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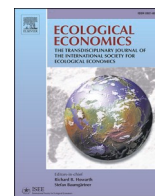
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ANALYSIS

Determinants of fossil fuel divestment in European pension funds

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ABSTRACT

Divestment from fossil fuel companies could help align financial flows with climate targets and reduce the related risk exposure of investors. Yet, investors reach different conclusions whether to divest. In this article, we derive hypotheses for financial and non-financial divestment motives to explore the determinants of divestment. Using a newly compiled data set on the 1000 largest European pension funds, we find that 129, or 13%, of these funds, representing USD 2.6 trillion in assets under management (33%), have divested from fossil fuels. Most of these funds ($n = 75$, AUM = USD 2.1 trillion) have committed to divesting from coal only, while some have committed to divest from all fossil fuels ($n = 16$, AUM = USD 109 billion). We find that divestment is more likely among larger and publicly owned pension funds. Among privately owned pension funds, we find that open funds competing for clients are more likely to divest compared with company funds restricted to employees. Hence, we identify size, ownership and market competition as key determinants for divestment decisions. Furthermore, we find weaker evidence for sectoral differences (e.g., higher likelihood in financial sector), albeit independent of carbon intensities, and a positive effect of climate policy stringency.

1. Introduction

Runaway climate change imposes risks on the financial system, to which long-term investors like pension funds are exposed (Battiston et al., 2017). In response, the financial system is starting to consider climate risks amid widespread beliefs among investors that these risks carry implications for their portfolios (Krueger et al., 2020). Besides physical climate risks, which are affecting all sectors of the economy, the fossil fuel sector is particularly exposed to the risk of stranded assets. Fossil fuel assets can lose market value and become stranded as a consequence of ambitious climate policy (Fulton et al., 2020) or rapid cost decreases in low-carbon technologies, which dampen demand for fossil fuels (van der Ploeg and Rezai, 2020). For example, it is estimated that limiting global warming to 1.5 degrees above pre-industrial levels would more than halve the value of fossil fuel reserves and decrease the stock market value of the fossil fuel industry by some 80% (Edenhofer et al., 2020).

Investors use various risk-mitigation strategies, such as changing

their capital allocations and engaging with the management of companies that they invest in, as well as indirect measures, such as the public stigmatisation of a company's image (Kölbel et al., 2020). A common form of changing capital allocation is to withdraw funds from companies in the fossil fuel industry, often termed fossil fuel divestment. If made public, fossil fuel divestment decisions also can elicit indirect effects, such as stigmatisation and a change of market norms more generally. The fossil fuel divestment movement started at US universities, with students demanding that their universities divest their endowments of coal (Bergman, 2018), then quickly expanded to other investor groups. As of 2020, fossil fuel divestment is growing quickly: Over 1200 investors managing approximately US \$14 trillion have announced plans to divest, including many large institutional investors (Boermans and Galema, 2019; Fossil Free, 2020).¹ One of the reasons for the widespread fossil fuel divestment is the association of high-carbon assets with financial risk, as opposed to purely ethical concerns (Beer, 2016; Hunt et al., 2016).

Long-term institutional investors, such as pension funds, are

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¹ Contrary to earlier divestment movements, such as the call to withdraw from tobacco firms, which only 80 out of about 1000 funds and organisations implemented after a decade-long campaign (Ansar et al., 2013)

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particularly exposed to climate risks due to their investment horizons, diversified international portfolios (including disproportionately heavy fossil fuel exposure) and largely passively managed portfolios, which complicate the incorporation of sophisticated risk-mitigation strategies. For example, [Battiston et al. \(2017\)](#) find that, in Europe, pension funds have one of the highest relative exposure to fossil-fuels among financial actors (7% of equity portfolio) with only governments and non-financial actors having a higher exposure. Thus, these investors are particularly exposed to emerging policies in response to climate change, sometimes termed the ‘inevitable policy response’ ([PRI Principles for Responsible Investment, 2019](#)). Moreover, in line with expert and legal opinions, some pension funds view managing climate risks as part of their fiduciary duties, meaning that they need to take climate risks into account to make investment decisions that are in the best financial interest of their clients ([TFCD, 2017](#); [Weber and Hösli, 2019](#)). Divestment from high-carbon investments is a straightforward way to reduce such risks and several studies have demonstrated that portfolio performance does not suffer from such fossil fuel divestment ([Boermans and Galema, 2019](#); [Hunt and Weber, 2019](#); [Trinks et al., 2018](#)).

Yet, pension fund managers reach very different conclusions with respect to climate risk and adequate risk-mitigation strategies ([Rempel and Gupta, 2020](#)), and only a part of the market decides to divest from fossil fuels. This heterogeneity is surprising, considering that knowledge of climate risks (including inherent uncertainty) is public information, and that funds are, in principle, exposed to a comparable extent, given their largely passive asset allocation ([Krueger et al., 2020](#)). Revealing the reasons for this heterogeneity may help in understanding long-term capital markets, as well as in designing financial policies that align with climate change mitigation accordingly. In this paper, we use the case of European pension funds as a prominent type of long-term institutional investor to examine what factors affect the likelihood of fossil fuel divestment. We formulate the research question: **What factors affect the likelihood of a large European pension fund publicly announcing a fossil fuel divestment strategy?** We chose Europe because it is the second-largest pension fund market in the world and by far the most active one in terms of fossil fuel divestment. We assembled a novel data set covering fossil fuel divestment statements among the 1000 largest European pension funds from 2008 to 2020 for our analysis.

This paper makes two main contributions. Firstly, we use the economic and business literature on sustainable finance, climate risk, responsible investing and corporate behaviour to identify possible motives for fossil fuel divestment. We thereby link the broader literature to fossil fuel divestment explicitly with the ambition to provide hypotheses to explain the heterogeneity among pension funds in their consideration and implementation of fossil fuel divestment. Secondly, we analyse a novel data set that covers all publicly available fossil fuel divestment statements from the largest 1000 European pension funds to understand this heterogeneity and to make a first step towards linking it empirically to underlying motives. The remainder of this paper is structured as follows. In section 2, we provide the background on fossil fuel divestment and pension funds, to derive hypotheses on the reasons for divestment that are presented in section 3. We then evaluate these hypotheses empirically using data on European pension funds. Section 4 describes the case-selection strategy, data compilation and empirical approach. Section 5 presents the results, both descriptively and regarding the identification of divestment drivers. Finally, Section 6 offers a discussion, including policy implications.

2. Background and literature

Fossil fuel divestment encompasses a broad range of actions. Common among all definitions is that the investor explicitly decides to exclude companies involved in the fossil fuel industry from their investment universe. However, commitments vary substantially regarding scope. Some investors simply exclude fossil fuel companies from future

investments, while others remove their investment capital from fossil fuel companies altogether (i.e., divest in the literal sense). In addition, investors define fossil fuel companies differently. For example, some choose to exclude the largest fossil fuel companies based on reserves, others exclude companies with business plans that are incompatible with the Paris Agreement, while some exclude companies based on a revenue percentage derived from coal only ([Harrison, 2018](#)). Finally, some investors opt to invest freed-up funds in so-called ‘climate-positive’ companies, a strategy sometimes called divest-invest. In addition to these variations in scope, investors sometimes formulate divestments conditional on other interventions (e.g., direct engagement) turning out to be unsuccessful ([Rempel and Gupta, 2020](#)). In this paper, we examine **unconditional public divestment statements** because these are clearly defined and trackable. We analyse these statements individually and categorise them according to their scope (see [Fig. 1](#) below).

The literature on fossil fuel divestment, and divestment more generally, can be divided into three streams: analyses of divestment movements from a sociological perspective; analyses of divestment impacts from an economic and political perspective; and (to a much smaller extent) analyses of divestment motives from a business perspective. First, the literature on movement description is largely qualitative and comparative. For example, a review of 28 peer-reviewed papers on the apartheid divestment campaign distils key components and compares these to fossil fuel divestment using news reports and websites as sources. The authors conclude that instead of focusing on state and business actors, the fossil fuel divestment movement targeted investors mainly through public pressure and symbolic political actions ([Ayling and Gunningham, 2017](#); [Hunt et al., 2016](#)). As a consequence, the fossil fuel divestment movement was characterised as a ‘novel form of private-investor-targeted climate change governance’ ([Ayling and Gunningham, 2017](#)).

Second, extant literature discusses a variety of possible divestment impacts, such as triggering climate and political action via debate, weakening the fossil fuel industry politically or reducing fossil fuel exploration by making access to capital more difficult ([Bergman, 2018](#); [Braungardt et al., 2019](#)).² The empirical literature on fossil fuel divestment covers the impact on the divesting investor (e.g., portfolio returns) and the impact on the divested firm (e.g., profits or share prices). Comparing hypothetical US stock market portfolios over the period 1927–2016, [Trinks et al. \(2018\)](#) analysed whether different hypothetical implementations of fossil fuel divestment affect portfolio returns. They found no significant difference in variance or performance between unconstrained and divested portfolios ([Trinks et al., 2018](#)), a finding that is confirmed for Dutch pension funds ([Boermans and Galema, 2019](#)). Following a similar methodology with six divestment strategies, [Hunt and Weber](#) analysed the Canadian stock market during the 2011–2015 period and found higher risk-adjusted returns for divested portfolios (consistently higher returns and ambiguous results on variance) and, unsurprisingly, lower carbon intensities in divested portfolios ([Hunt and Weber, 2019](#)). Regarding the impact on divested firms, the literature finds evidence of reduced capital flows to oil and gas companies across 33 countries from 2000 to 2015 as divestment pledges increased ([Cojoianu et al., 2019](#)). Using an event study methodology, [Dordi and Weber](#) analysed abnormal stock returns from 200 large coal, gas and oil companies after prominent divestments. They found a negative short-term effect on share prices following divestment ([Dordi and Weber, 2019](#)), which has been confirmed in a broader sample for at least 24 months ([Rohleder et al., 2020](#)). In constrained debt markets, such effects are particularly likely to occur ([Ansar et al., 2013](#)). However, the overall evidence on direct effects remains limited, and the duration of potential effects remains unclear ([Köbel et al., 2020](#)).

Third, to the best of our knowledge, divestment motives have yet to

² [Braungardt et al. \(2019\)](#) offer an extensive overview of possible impact channels and critiques.

be analysed, but insights from the literature on pension funds and socially responsible investment more broadly may be transferable. Analysing 44 Dutch pension funds from 2009 to 2017, [Boermans and Galema \(2019\)](#) found that pension funds, which deviate from the market benchmark (actively managed portfolios), demonstrated lower carbon exposures, thereby providing evidence of fossil fuel divestment. This effect is larger for pension funds that measure and report their carbon footprints ([Boermans and Galema, 2019](#)). However, beyond these two factors, there is no analysis of divestment motives. Related research found that more economic (financial performance) and human resource (size) slack, higher leverage (i.e., more debt financed), lower media coverage and a better ESG rating positively impact the likelihood of launching a socially responsible (SR) fund ([Peillex and Ureche-Rangau, 2016](#)). Finally, a survey among 281 pension funds and regulatory authorities in 15 European countries revealed that around 50% of responding pension funds 'engage with' SR funds ([Sievänen et al., 2013](#)). They also found an increasing likelihood for SR investment if the fund is located in Scandinavia or the UK, if the fund is publicly owned, if the fund offers defined-benefit or statutory pensions and if the fund is large (in terms of assets, staff or beneficiaries) ([Sievänen et al., 2013](#)). The relationship regarding size is non-linear, with both small and large funds more likely to embrace SR investments – the proposed mechanism being that small pension funds are close to their customers while large ones face increased public scrutiny ([Sievänen et al., 2013](#)).

To sum up, the impact from fossil fuel divestment on portfolio performance is inconclusive, with no evidence of worse performance due to divestment. However, evidence is emerging that divested firms may be affected negatively through lower share prices and capital inflows in the short and medium term. Finally, internal carbon reporting seems to increase the likelihood of divestment. Regarding implementation of SR strategies more generally, the literature indicates that slack, media coverage, country of origin, public ownership, pension schemes and size all play a role. Analysing these factors in the context of fossil fuel divestment helps to understand which funds move first in aligning financial flows with climate targets. On the one hand, this furthers our understanding of capital market reactions' to the emerging threat of climate change. On the other hand, this understanding can help policymakers to identify areas where regulatory involvement could be required.

3. Fossil fuel divestment motives

We used the literature on climate risk consideration – augmented with the reasons for socially responsible investment, as discussed above – to classify fossil fuel divestment decision motives into two categories: financial and non-financial. We propose to analyse the puzzle of heterogeneous pension fund responses to climate risks through the lens of these motives and structure our hypotheses accordingly. [Table A.11](#) in the appendix provides a detailed overview of the operationalisation and empirical strategy used to approach each hypothesis.

3.1. Financial motives

Growing evidence indicates that climate risks at times are mispriced in the market. For example, stock markets insufficiently price in information on long-term drought trends ([Hong et al., 2019](#)), and fund managers may suffer from a salience bias and overreact to climate disasters if they are based in the disaster area ([Alok et al., 2020](#)). Evidence on the firm level is less clear, with some research pointing to an adverse effect from extremely high temperatures on firm revenues ([Pankratz et al., 2019](#)), while other research suggests zero effect from abnormally

high temperatures on sales or productivity in the US ([Addoum et al., 2020](#)). Thus, from an investor's perspective, it could make sense to divest strategically to correct for mispriced information or specific exposures, and recent survey evidence among institutional investors shows that they do ([Krueger et al., 2020](#)).³

The ability to implement such strategies may differ depending on fund size. First, according to the slack resource theory, larger funds with more human and financial slack (e.g., expertise and budget for research teams) may be more likely to implement divestment strategies. Indeed, increased slack was found to impact the creation of SR funds positively ([Peillex and Ureche-Rangau, 2016](#)). While making a divestment decision itself may not require substantial resources, the preparation of such a decision (analysing the relevance of climate change for the fund, bringing the issue to the investment board, etc.) requires resources just as the implementation is resource intensive.⁴ Oftentimes, divestment is also used as part of a broader climate strategy to achieve investor impact, which requires resources ([Kölbel et al., 2020](#)).

Second, research has shown that greater media coverage of sustainability topics for a particular company raises the likelihood of stakeholder sanctions ([Kölbel et al., 2017](#)). This effect is conditional on the outreach of the media outlet covering the story. While we cannot measure media coverage directly, we used the outreach condition. Specifically, we utilised the fact that large media outlets mainly cover large funds – which leads us to expect that larger funds face greater reputational risks. Previous research has confirmed that large funds are often the focus of public attention ([Sievänen et al., 2013](#)). Media outlets might criticize funds both for taking climate action and for not doing so, but overall Europe has seen a large shift of attention towards the need for climate action, and many parties across the spectrum agree that it is an important issue (note the broadly-agreed decisions to phase out coal e.g., in Germany or the United Kingdom). Hence, media outlets are more likely to point negatively to funds that do not engage with climate risk.

Based on these two mechanisms that point in the same direction, we therefore hypothesize that size has an effect on fossil fuel divestment.⁵

H1. Fossil fuel divestment is more likely with larger funds.

Besides investment and reputational risks, new market opportunities may play a role as well. Funds can use fossil fuel divestment to differentiate themselves strategically on the market to investors/beneficiaries and attract new clients. The demand for sustainable investment has grown massively over the past few years, and the financial sector has responded with a broad set of innovations that try to tie sustainability criteria to investment products ([Connaker and Madsbjerg, 2019](#)). Growing literature has been making the case that investors increasingly consider non-financial motives when making investment decisions. For

³ Note however that survey respondents generally perceive divestment as an inferior strategy to address climate risk compared to corporate engagement or risk management.

⁴ E.g., the Government Pension Fund of Norway explains in this context ([Norges Bank, 2017](#)): "Data related to the levels of granularity required to facilitate the operational analysis and implementation of the [fossil fuel divestment] criterion is a particular challenge. There is a lack of centralized, or even company reported information, of the various levels required for analysis. Where a company does report related information, this is frequently at an aggregated level, which means deriving representative values is challenging. As such, we engaged multiple, reputable data sources and vendors to assist us in this analysis." In some instances, it even required direct dialogue with companies that potentially fall under the threshold: "In certain cases, it does not exist as public information and as such communication with the company provides the best and only source of relevant current and forward looking information."

⁵ We cannot link the empirical analysis directly to the underlying risk-exposure arguments (i.e., investment-strategic and reputational risk). Measuring those arguments would require more qualitative data on the internal processes in pension funds, which we discuss in the conclusion.

example, data from a Dutch open fund suggests that investors are willing to pay higher management fees and accept lower returns for socially responsible funds (Riedl and Smeets, 2017). Put differently, investors seem to value sustainability financially, i.e., they are prepared to pay for increased sustainability (Hartzmark and Sussman, 2019). Thus, considering that investors let non-financial considerations influence their investment decisions, we expect (at least some) pension funds competing for clients to adapt to these demands and use fossil fuel divestment as a strategic marketing instrument. In contrast, pension funds that only serve beneficiaries who are legally obliged to contribute (e.g., by law or by their work contract) need not bother marketing to or attracting clients. Thus, we propose:

H2. Fossil fuel divestment is more likely for pension funds that must compete for clients.

3.2. Non-financial motives

Investment funds operate in a broader societal environment, which they consider in their decision-making. Reputational concerns often are cited as a motive for fossil fuel divestment (Ansar et al., 2013; Ayling and Gunningham, 2017). Beyond concerns about financial repercussions from reputational damage, reputational concerns can be non-financial if fund managers' personal preferences change. It has been shown that such concerns affect investment decisions (Hong and Kostovetsky, 2012). We argue that managers' preferences are influenced by the company or industry culture of the beneficiaries they serve. Path dependencies in individual careers may be particularly important, and we expect to see a lower likelihood of fossil fuel divestment from funds serving high-emission industries. Conversely, we expect to see a higher likelihood of fossil fuel divestment in companies and industries with solid environmental performances. A similar pattern would occur if – independent of fund managers' personal preferences – the pension fund beneficiaries working in low-carbon/environmental friendly companies and sectors are expected to have strong pro-social preferences to mitigate climate change, and fund managers aim to maximize beneficiary welfare (within the flexibility given by their fiduciary duty in a legal sense) by choosing to divest (compare (Hart and Zingales, 2017)). While it is hard to measure proxies for these different channels (manager preferences, beneficiary preferences), they suggest an effect in the same direction, so we propose a third hypothesis regarding carbon intensity and environmental performance:

H3. Fossil fuel divestment is more likely from funds related to companies and sectors with low carbon intensity and/or solid environmental performance.

In addition to sectoral differences, publicly owned funds may face particularly high ethical demands from the public. First, literature has shown that state-owned enterprises often are expected to act based on higher standards regarding sustainability and responsibility compared with private counterparts (Christiansen, 2013). Second, publicly owned funds may attract and choose managers with preferences tilted towards societal and long-term goals (Steffen et al., 2020). Third, publicly owned funds may have an increased incentive to consider demands beyond the regulatory minimum to avoid being challenged politically (e.g., by a referendum on the investment policy) – a factor particularly in play within smaller funds (e.g., municipalities), in which democratic pressures can be applied and organised more easily. Finally, the literature also found a positive impact from public ownership on pension funds' engagement with SR; thus, an effect on divestment may be observed as well (Sievänen et al., 2013). In this vein, we propose:

H4. Fossil fuel divestment from publicly owned funds is more likely than from privately owned funds.

Finally, the literature on corporate behaviour suggests that investors rely on a 'social licence to operate' just like any other company. This

'licence' describes the notion that a company avoids actions that society deems unacceptable, even if such actions are permitted by law (Gunningham et al., 2004). More precisely, companies 'assume that any hazards and harms that their enterprise engenders, even if not clearly illegal today, will sooner or later be subject to public censure, government action and legal liability' (Gunningham et al., 2004). Some companies are more likely to be bound by a social licence than others, and the literature proposes three criteria that increase the likelihood of such a licence being important: long time horizons; heavy exposure to global markets; and a wide range of stakeholders (Dare et al., 2014). Institutional investors fulfil the first two criteria, while the third one differs depending on the type of investor. Thus, investors may need to adapt their investment strategies beyond what is legally required to maintain their social licence, as a deteriorating social licence can become problematic for investors if they rely on deposits. For example, it has been shown that banks that financed the disputed Dakota Access Pipeline subsequently lost deposits as depositors responded to bad press (Homanen, 2018). Similarly, investors are facing more and more public scrutiny concerning the climate and other environmental issues. Further, even without concerns about losing their social licence, fund managers could react to pro-social preferences of a majority of beneficiaries and divest to maximize beneficiary welfare (see section 3.2 above). Thus, we hypothesize that investors respond to societal preferences in the country where they are based.

H5. Fossil fuel divestment is more likely if a fund is based in a country with strong societal preferences towards mitigating climate change.

Finally, besides financial and non-financial motives, legal obligations to divest also can exist for certain investors. However, despite emerging regulations on climate-risk disclosure and further transparency requirements, no European countries have passed explicit divestment regulations (Steffen, 2021). We discuss the relevance of transparency regulation in the discussion.

4. Method

4.1. Case selection

This study focuses on pension funds for four key reasons. First, pension funds are among the largest institutional investors in developed countries (Chan-Lau, 2005), with significant assets that are broadly diversified across sectors and regions. They manage funds with global exposure, making systemic risks, such as climate risks, more relevant. In the same vein, their size also makes their investment decisions disproportionately more important for climate change mitigation efforts. Second, pension funds invest long-term and, therefore, also are exposed to risks that materialise over longer periods, such as climate risks (Krueger et al., 2020). Third, pension funds are (presumably for the above reasons) a key player in the fossil fuel divestment movement and account for approximately one-third of the AUM covered by fossil fuel divestment (DivestInvest, 2020). Thus, pension funds are among the forerunners in the divestment movement and provide an interesting case through which to investigate drivers. Fourth, pension funds are legally bound to fiduciary duties, which likely also nudge them early on to consider climate risk and mitigation strategies, such as fossil fuel divestment (McCarthy et al., 2016).

We chose the European market for our analysis because of its empirical relevance. According to data from divest-invest, European investors manage 87% of AUM under a fossil fuel divestment strategy. Europe is also the second-largest pension fund market after the US (OECD, 2019). Finally, pension funds operate in a regulated setting (cf. fiduciary duties above). Legislation on green or sustainable finance is a particularly pronounced phenomenon in Europe, accounting for almost three-quarters (98 of 134) of all low-carbon financial policies in OECD countries as of 2019 (Steffen, 2021). Thus, Europe is by far the most relevant region for (pension fund) fossil fuel divestment.

4.2. Data and empirical approach

We analysed the 1000 largest European pension funds by AUM as reported by Investment & Pensions Europe (IPE), a monthly publication for institutional investors and pension funds. IPE data include the pension fund's name, country of origin and AUM as of 2019.⁶ The pension funds in our sample report a total of USD 7.7 trillion in AUM. Germany, the Netherlands, Switzerland and the UK account for the largest number of pension funds (cf. Fig. 3). When considering AUM, Denmark, Norway and Sweden join the group of most important countries in the sample (cf. Fig. 3). We used this data set on pension fund size and location as our starting point to compile a new data set, which includes the time and scope of fossil fuel divestment statements (see Appendix A for data collection).⁷ In total, we found 129 pension funds that divested from fossil fuels (12.9%). We assumed that all divestment decisions were made on the group level, i.e., regional or national subsidiary pension funds ($n = 102$) divest if the global or holding pension fund has made a divestment decision. We identified subsidiaries by comparing fund names and consistently defined the largest branch as the parent company (unless a clear parent company exists). Counting group-level decisions, we found that 82 of 898 pension funds divested (9.1%). For a subset of divestment decisions, a detailed description of asset classes considered for divestment is publicly available; 100% of them explicitly include equity, and 50% explicitly include fixed income (see Table A.7 in the appendix for methodological details).

To investigate our hypotheses, we further classified pension funds according to their beneficiaries (see Appendix A). Publicly owned pension funds are government pension funds or those of state-owned enterprises (e.g., national railways). They are either national, regional (e.g., beneficiaries are public workers from a sub-national region)⁸ or municipal (e.g., beneficiaries are city or city-owned utility employees). Privately owned pension funds comprise the remainder of our sample. We distinguished between sectoral, company and open funds. Sectoral funds restrict beneficiaries to employees in one or several sectors, company funds restrict beneficiaries to employees of a specific company and open funds are generally open to the public (i.e., both individuals and small and medium-size companies). Banks or insurance firms often manage open funds. To complete our data set, we used data on climate policy from the Climate Change Performance Index (CCPI), published by Germanwatch (an NGO), covering 2010 to 2019 (Burck et al., 2019). We used the subcategory 'climate policy', which is an annual score by country between 0 and 20 determined by experts based on an evaluation of the most important policies in place to lower greenhouse gas emissions. We used this index as a proxy for societal preferences because in democracies, societal preference for climate action should correlate with policy on the matter, so an empirical corollary of the hypothesis would link the likelihood of divestment to the climate policy stringency in a country. Finally, we used data on GDP per capita from the World Bank as a control.

The dependent variable for our analysis is a binary variable indicating whether a pension fund issued a public divestment statement between 2008 and 2020. The analysis is cross-sectional, using averages

over the years for independent variables.⁹ We ran logistic regressions to estimate the likelihood of a pension fund's fossil fuel divestment. Following Eq. (1), the logistic regression calculates the likelihood $p(\text{div})$ of a fund having issued a publicly available divestment statement from fossil fuels or a subset thereof (e.g., coal). X is the fund-specific and country-specific covariate matrix across n funds and k parameters, β is a $k \times 1$ vector of the parameters estimate and ε is the error term ($n \times 1$). Note that we omit fixed effects from this notation to improve readability. The inclusion of fixed effects is described in each regression setup.

$$p(\text{div}) = \frac{1}{1 + e^{-(X\beta + \varepsilon)}} \quad (1)$$

For better coefficient comparison, we standardised the variables AUM, climate change policy, GDP per capita, emission intensities and environmental ratings by dividing them by two standard deviations, as established in the literature (Gelman, 2008). We excluded subsidiaries in all specifications because divestment decisions typically are taken at the group level and reflect conditions at the parent company, rather than at the subsidiary. We included the five pension funds from international organisations in the descriptive results, but they were dropped from the regression analysis because none of them divested. Table A.3 in the appendix provides the summary statistics and Table A.4 (excl. subsidiaries) shows that correlations between covariates are generally low, with the exception of the positive correlation between GDP and climate policy, which is to be expected as richer countries implement more ambitious climate policies.

5. Results

We start by reporting descriptive results over time, by type of divestment, size, country and fund type. Overall, 129 of the 1000 largest European pension funds have issued a divestment statement (13%), accounting for approximately USD 2.6 trillion AUM, and representing 33% of all AUM. To put this figure in context, MSCI (see footnote 14) lists 328 companies globally with ties to thermal coal. Together, the 269 of these companies for which market capitalization data is available, are valued at USD 4.5 trillion. Fig. 1 shows the dynamics over time and the divestment types used, and Table A.1 in the appendix provides an overview of the 10 largest divested pension funds. The earliest fossil fuel divestment statement dates from 2014; thus, fossil fuel divestment is a relatively recent phenomenon. However, in 2015, we observed a spike in divestment statements in terms of both the number of pension funds and their AUM. In 2015 alone, the year of the Paris Agreement, 43 of the largest European pension funds managing more than USD 1.5 trillion issued divestment statements. In subsequent years, there was a steady increase of around 20 pension funds or USD 200 billion AUM each year. It is unclear whether this trend levelled off in 2020, as we covered divestment statements up until September 2020.

By September 2020, 75 pension funds had announced divestment from companies engaged in coal only, with 24 including tar sands, two covering the entire oil industry and 16 pledged to divest from all fossil fuels, including gas. In addition, 12 pension funds committed only to a target (e.g., investing only in companies with Paris-compatible business models). Both in terms of numbers (58%) and AUM (80%), the vast majority of pension funds committed to divesting only from coal. In practical terms, most pension funds ($n = 77$) mentioned a threshold in their divestment statements (e.g., divestment from companies that derive more than 30% of their revenue from coal), and 11 committed only to prospective divestments (i.e., no future investments).

⁶ Cf. <https://www.ipe.com/>. A cross-check with data from Willis Tower Watson (<https://www.thinkingaheadinstitute.org/research-papers/the-worlds-largest-pension-funds-2019/>) confirms that all European pension funds listed among the 300 world's largest pension funds are in our sample.

⁷ Note that we always consider the latest available scope of divestment. Some, albeit few, pension funds increase their divestment scope over time. For example, the Church of Sweden started divesting from fossil fuel companies after its archbishop convened a conference on climate change in 2008. They completed their divestment and communicated it publicly in 2014, which we record as the year of divestment (no earlier public statement).

⁸ Note that some regional public worker funds also allow private beneficiaries (e.g., Labourfonds in South Tirol, which allows SMEs). We classify funds as publicly owned as long as this is a minority only.

⁹ Averages depend on data availability and cover the maximum possible time: CCPI 2010–2018 average, GDP per capita 2008–2019 average. Climate change policy data is unavailable for Andorra and Kosovo, where we use the average of the surrounding countries' policy scores. Data for Iceland is unavailable in 2018.

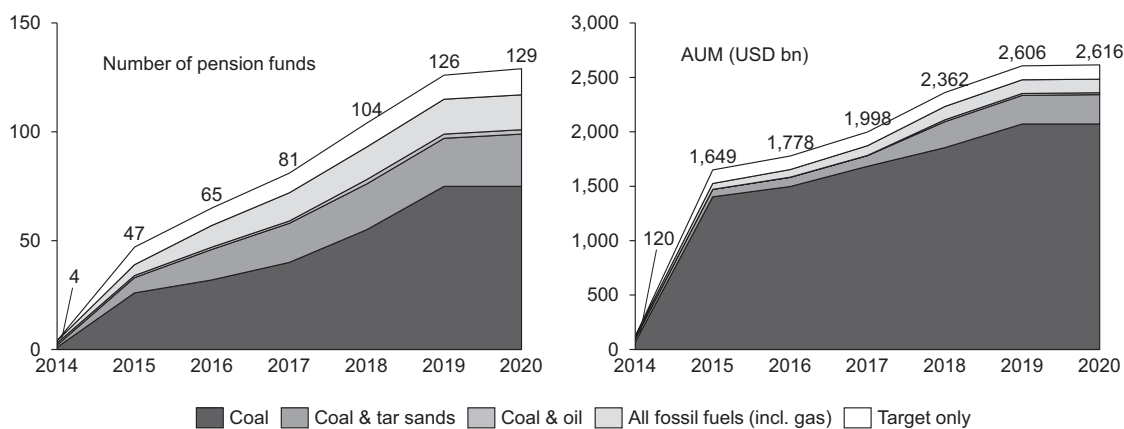


Fig. 1. Fossil fuel divestment over time according to divestment scope. Reading guide: The second layer from the bottom shows all pension funds, which divested from coal and tar sands. The following layer on top shows all pension funds, which divested from coal, tar sands and oil.

Divested pension funds' sizes vary substantially. For example, the Norwegian Government Pension Fund – the largest pension fund in Europe – accounts for 12% of total AUM alone and is more than four times as large as the second-largest divested fund (PFZW, a Dutch care and welfare sector fund). Fig. 2 provides the distribution of fund sizes along divestment types. First, funds that divest from fossil fuels are larger compared with the rest (see also *t*-tests reported in Table A.5 in the appendix). On average, divested funds manage USD 20 billion (median USD 2.9 billion), compared with USD 6 billion for the rest (median USD 2.4 billion). Differences in mean ($p < 0.01$) and median ($p < 0.01$) are statistically significant. Second, these differences are explained by funds that divest from coal only, whereas the other categories are not statistically different from the rest. However, it should be noted that varying sample sizes could drive this effect. Third, the variance in fund sizes is substantially larger with divested funds compared with the rest (std. dev. 86 vs. 17). Fig. 2 shows that funds above USD 10 billion remain common among those that divested from coal or coal and tar sands/oil, but are almost non-existent among the rest.

Fig. 3 provides a regional perspective, indicating that the top five European countries (United Kingdom, Switzerland, Germany, Netherlands, Italy) account for 768, or 77% of all pension funds in our sample, totalling USD 4.8 trillion in AUM (62%). While these countries represent a large share of the total sample, their divestment activity is below the average. In none of the top five countries is more than 10% of the funds divested, representing no more than 23% of the AUM in any of these markets. Switzerland is close to the upper boundary of this range (10% of funds, 22% of AUM), as is the Netherlands with respect to AUM (23%). Italy, in contrast, shows very low divestment rates (4% of funds, 1% of AUM). Moreover, Fig. 3 reveals that Scandinavian countries (Denmark, Finland, Norway and Sweden) show higher divestment activity. In these four countries, at least 25% of their pension funds have issued divestment statements, and in each country, they represent at least 44% of the total AUM, as high as 96% in the case of Norway. This finding is in line with previous findings on pension funds' SR engagement in the Nordic region (Sievänen et al., 2013). Thus, substantial variance exists between countries, which can be used to investigate drivers in further analysis.

To complete the descriptive results, Fig. 4 shows the differences across fund types. We observed a clear rank order among private funds with increasing divestment from company pension funds to industry pension funds to open funds. Together, these private pension funds account for about 80% of all pension funds in our sample and about 60% of AUM. Divestment among publicly owned funds (15% of funds, 48% of AUM) is more prevalent compared with the average of privately owned funds (12% of funds, 24% of AUM, $p < 0.01$ see Table A.5 in the appendix). Note that publicly owned funds include international ($n = 5$),

national ($n = 74$), regional ($n = 103$) and municipal funds ($n = 41$). Among the privately owned funds, open funds stand out with a higher divestment share (count) compared with publicly owned funds. A closer look into publicly owned funds reveals that municipal funds divest more often than regional or national pension funds (27% compared with 11% and 15%, respectively). Moreover, we found that none of the international organisation pension funds¹⁰ has issued a divestment statement.

We move on to discuss the regression results concerning our hypotheses on financial motives (Table 1) and non-financial motives (Table 2).

H1 Fund size (financial motive): Specifications (1) to (4) offer different tests of H1, and all fail to reject the hypothesis. The results indicate that larger pension funds are significantly more likely to issue a fossil fuels divestment statement. However, we found an indication of a curvilinear relationship in Specification (2), similar to what has been found previously for responsible investments among pension funds (Sievänen et al., 2013). Dividing the sample into five equal brackets along the size quintiles, we found that the last quintile (i.e., the 200 largest European pension funds) is significantly more likely ($p < 0.01$) to divest compared with the first quintile (Specification 3). All the other quintiles do not differ significantly from the first quintile. Moreover, Specification (4) in Table 1 confirms that the largest funds are, indeed, significantly more likely to divest, also when compared with the rest of the sample (as opposed to the first quintile). The 100 largest pension funds are roughly four times more likely to divest compared with the rest ($p < 0.01$). To sum up, these results point to a greater likelihood of divestment among the very largest pension funds compared with the rest.

H2 Client competition (financial motive): We next operationalise H2 by examining the likelihood of divesting from fossil fuels in open funds, the only fund type competing for clients, compared with the rest in Specifications (5) to (7). Across specifications, we cannot reject the hypothesis. Compared with the full sample in Specification (5), we found open funds to be roughly twice as likely to issue a divestment statement ($p < 0.01$) – an effect that becomes more substantial when restricting the sample to privately owned funds and comparing open funds to company funds in Specification (6). Because open funds compete most for clients, one might expect a higher likelihood to divest in countries with stricter climate change policies. We test this in Table A.6 in the appendix and find weak evidence to the contrary, that is, the likelihood for open funds to divest is slightly higher if they are based in countries with less strict climate change policy. While this

¹⁰ European Patent Office, CERN, EUROCONTROL, Bank for International Settlements, European Central Bank (descending order in AUM).

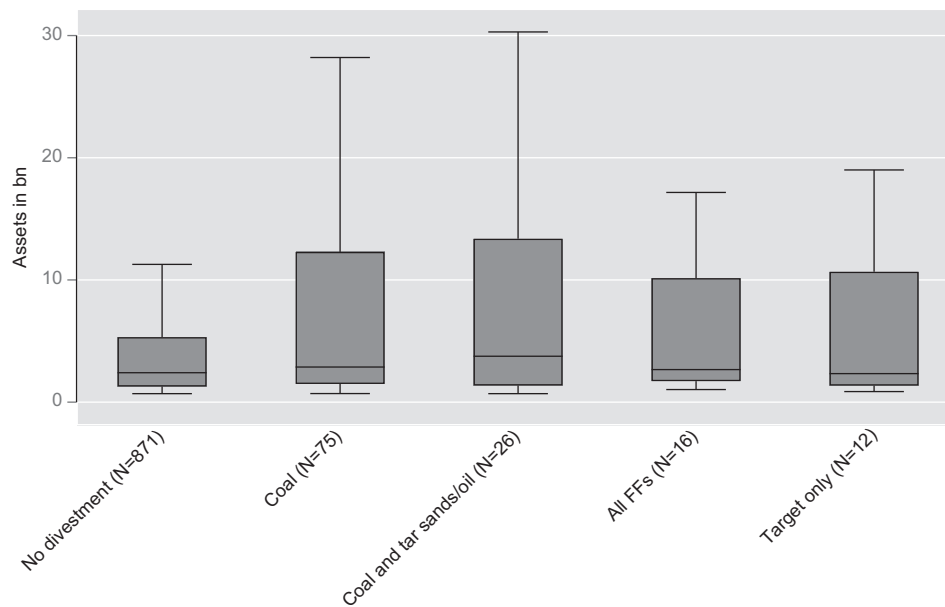


Fig. 2. AUM distribution according to divestment type. The lines show the median, boxplots the 25th and 75th percentiles, and whiskers the percentiles plus/minus 1.5 times the interquartile range. Values outside whiskers are not shown.

result needs to be read with caution, [Table A.6](#) confirms the robustness of the general finding that open funds are more likely to divest. Finally, Specification (7) shows that open funds are equally likely to divest, as are publicly owned funds. However, compared with publicly owned funds, privately owned company funds are significantly less likely to divest ($p < 0.01$). These funds are exposed the least to competition for clients (among privately owned funds), as their current and former workforces comprise their beneficiaries by definition. Overall, we found a coherent pattern of higher divestment likelihood in the presence of higher competition for clients.

H3 Carbon intensity (non-financial motive): [Table 2](#) provides a more granular picture of corporate and industry funds by examining sector differences in Specification (1). Compared with manufacturing, the largest sector, which serves as a baseline, we observed a higher likelihood of divesting in Agriculture, Forestry and Fishery ($n = 4$); Education ($n = 7$); Financial and Insurance Activities ($n = 49$); and Other Service Activities ($n = 6$), including, for example, churches. While three of these sectors have fewer than 10 entries in our database, the Finance and Insurance sector seems to divest more frequently than the rest in a rather robust manner, accounting for 36% (9 of 25) of divested company or industry pension funds and 90% (9 of 10) of divested company pension funds. These industries differ in terms of their carbon intensity, but fossil fuel divestment is independent of industry carbon intensity, as shown in Specification (2). Further regressions in [Table A.2](#) in the appendix show that carbon intensity on the fund level exerts no effect on the likelihood of divesting either, and neither do environmental performance measures. Thus, while industry patterns do exist, in our case, we can reject H3, that fossil fuel divestment depends on carbon intensity or the environmental performance. However, we should note that these models' explanatory power is rather low due to the low overall propensity of divestment among privately owned corporate pension funds (10 of 363, or less than 3%).

H4 Public ownership (non-financial motive): Specifications (3) to (5) in [Table 2](#) investigated H4 that publicly owned funds are more likely to divest compared with privately owned funds. The results in Specification (3) show that privately owned funds are about half as likely to divest compared with publicly owned funds; thus, we cannot reject H4. Taking a further look at differences within publicly owned funds, we found that national and regional funds are both less likely ($p < 0.05$) to divest compared with municipal funds (Specification 4). In comparing

publicly owned funds by category to privately owned funds (Specification 5), we found that national publicly owned funds are no more likely to divest than privately owned funds. However, regional funds are more than twice as likely to divest ($p < 0.05$), and municipal funds are more than eight times as likely to divest ($p < 0.01$). These results point to a rank order among publicly owned funds, where more local funds are more likely to divest – perhaps due to larger democratic influence from beneficiaries on the local level. The rather small number of municipal funds in our sample calls for further investigation as well.

H5 National climate preferences/policy (non-financial motive): Finally, we turn to the evidence on country-level climate policy stringency in Specification (6). We failed to reject H5, but due to the omission of country fixed effects (as we use country-level variance), these models' explanatory power is rather low. [Table A.4](#) in the appendix shows that there may be an issue of multicollinearity in this specification, hence the standard errors may be too large and the results should be interpreted with caution. Given this caveat, we found that pension funds in countries with more stringent climate policies are somewhat more likely to divest ($p < 0.1$). While these findings need to be investigated further (see discussion), they may indicate that climate policy is a reliable proxy for societal opinion on climate change to which pension funds respond, or that pension funds directly respond to climate change policy.

Across these regressions, we observed significant country fixed effects, which point to persistent country differences. We also found that compared with the baseline of UK pension funds, which is the most common location, pension funds based in Denmark, France and Sweden are more likely to divest from fossil fuels ($p < 0.01$). The results on Denmark and Sweden correspond partly with previous survey evidence that Scandinavian and UK pension funds are more likely to 'engage with responsible investment' ([Sievänen et al., 2013](#)). The effect in France may be due to its ambitious low-carbon financial policies, such as a climate risk disclosure mandate for large insurance companies and pension funds (Article 173 of the Energy Transitions Law 2015); however, the country-level variation in our data does not allow for analysing the individual effect from such policies (see discussion below). Finally, one concern with reported results may be that the model is overspecified when including fixed effects due to the large number of countries in our sample. We alleviate this concern by showing that the reported results are consistent in specifications without country fixed effects ([Tables A.8 and A.9](#) in the appendix). Additionally, we show that the results hold

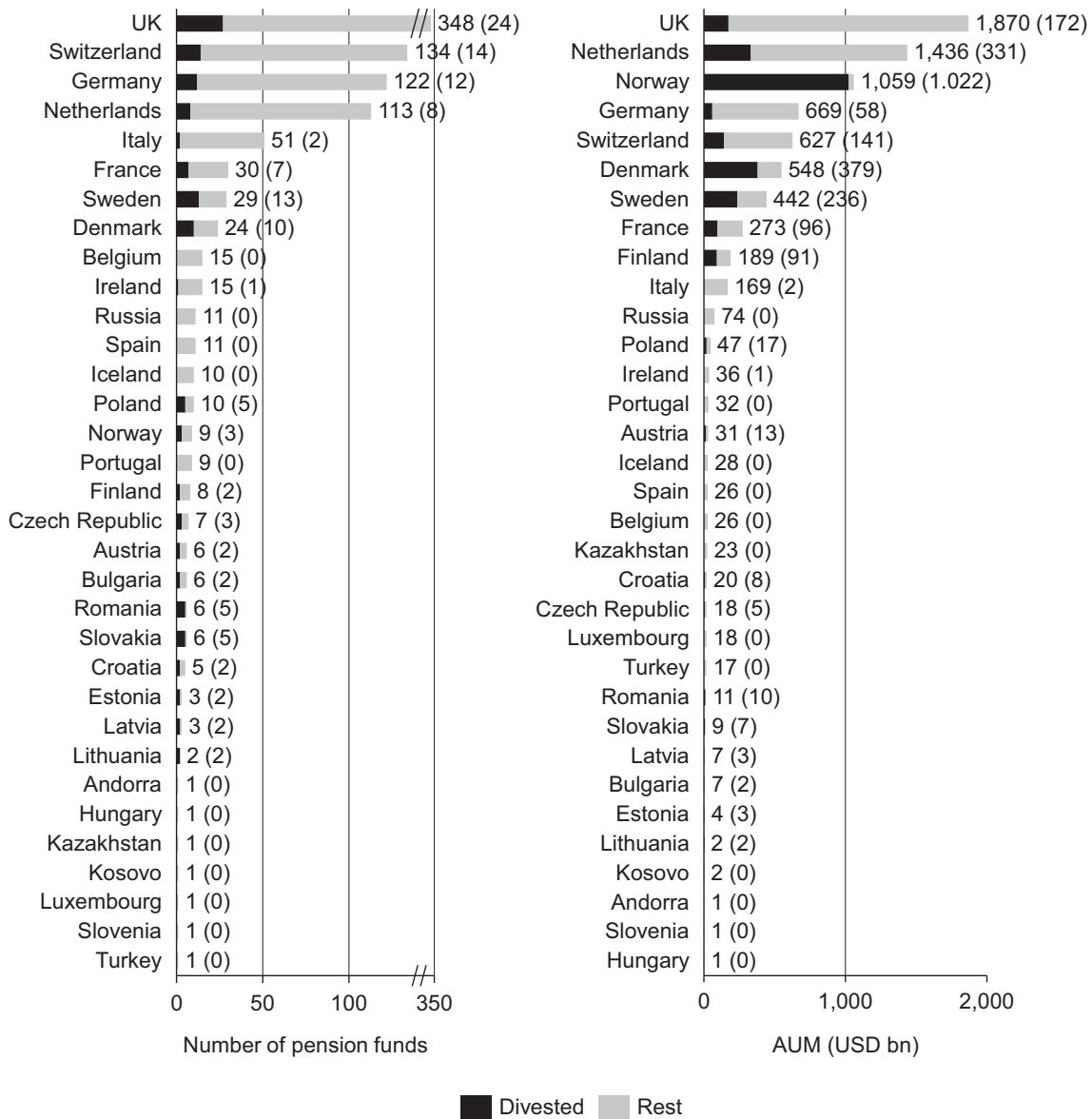


Fig. 3. Fossil fuel divestment by country. Left: number of pension funds (divested in brackets). Right: AUM of pension funds (divested in brackets).

when restricting the sample to the culturally and socially more homogeneous subsample of Scandinavia (Table A.10 in the appendix).

6. Discussion and implications

In this paper, we derived hypotheses concerning fossil fuel divestment motives and systematically tested them on a sample of the 1000 largest European pension funds using publicly available divestment statements. Overall, we found a clear upward trend in fossil fuel divestment among a small number of pension funds (13%), representing a substantial share of total AUM (33%). The scope of divestment deserves more attention as most pension funds limit the coverage of their decision (e.g., coal only), while others limit the applicability of their decision (e.g., equities only). We found large funds, publicly owned funds (particularly municipal funds), and funds that compete for clients (open funds) to be more likely to issue a fossil fuels divestment statement. Concerning privately owned funds that do not need to compete for clients, we found that company pension funds rarely commit to fossil fuels divestment. In fact, these types of funds almost exclusively commit to divest if they are in the finance and insurance industry. However, a note of caution on the implementation of these commitments is

necessary; of the seven group level divestment decisions in the finance and insurance industry, three are among the top 60 banks involved in fossil fuels as categorized by civil society organisations (RAN et al., 2021). More broadly, of 38 company and open funds that publicly committed to divest, nine of them remain in the top 60 “banking on fossil fuels” league tables with HSBC, Deutsche Bank and BNP Paribas among the top 20 - the latter two committed to divest from coal, the former from coal and tar sands (RAN et al., 2021). Despite these commitments, all three banks also remain among the top 60 banks financing the 30 largest coal mining and coal power companies. Part of this discrepancy may be explained by the long-term nature of fossil fuel investments and the relatively recent divestment decisions (2017–2019 for the three banks in question); however, the issue illustrates the need for public scrutiny concerning the implementation of commitments. Furthermore, we found tentative evidence of a positive effect from stringent climate policy on the likelihood of issuing a fossil fuels divestment statement, with some countries (Denmark, France and Sweden) featuring a particularly high number of divesting pension funds.

Accordingly, we can establish first links between the heterogeneity in pension funds’ divestment decisions and underlying financial and

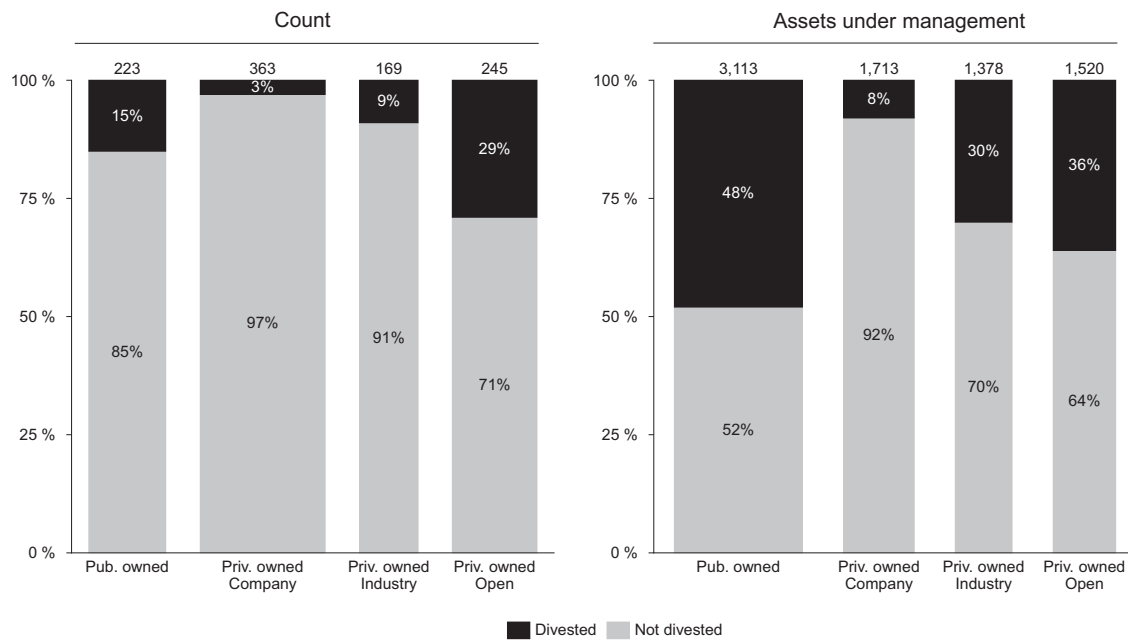


Fig. 4. Divestment across type of pension fund. Bar widths represent number of funds (left) and AUM in USD billion (right). Totals are indicated on top of the bars.

Table 1
Logistic regressions on financial motives.

Variables	(1) FF divest	(2) FF divest	(3) FF divest	(4) FF divest	(5) FF divest	(6) FF divest	(7) FF divest
Log AUM	4.397** (1.221)						
AUM		5.158*** (2.657)					
AUM ²		0.901** (0.0376)					
Rank 1–200			7.328*** (3.847)				
Rank 201–400			2.475 (1.453)				
Rank 401–600			2.135 (1.230)				
Rank 601–800			2.261 (1.286)				
Rank 801–1000			Ref.				
Top 100				4.348*** (1.501)			
Open fund					2.244*** (0.649)	6.432*** (2.945)	1.097 (0.359)
Industry fund						2.634* (1.381)	0.468* (0.202)
Company fund						Ref.	0.156*** (0.0657)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fund type fixed effects	Yes	Yes	Yes	Yes	No	No	No
Observations	811	811	811	811	815	610	815
Pseudo R2	0.242	0.212	0.228	0.215	0.120	0.182	0.166

Displayed coefficients are odds ratios, constants not shown, subsidiaries excluded. AUM and AUM squared in (2) are standardised (see 4.2). Reference categories: (3) Rank 801–1000; (6) Company fund; (7) Publicly owned fund. Subsamples: (6) includes the only privately owned funds.

Standard errors in parentheses

*** $p < 0.01$.

** $p < 0.05$.

* $p < 0.1$

non-financial motives. Funds that one would expect to be the most exposed to changing societal preferences – i.e., funds that must compete for clients – show the highest tendency to divest. The precise reasons for the low tendency to divest among company pension funds (outside the

financial and insurance industry) require further investigation; potentially, limited management capacity or poor governance play a role (Ebbinghaus and Wiss, 2013). Possibly, the higher tendency to commit to fossil fuel divestment in the financial and insurance industry is

Table 2
Logistic regressions on non-financial motives.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
	FF divest	FF divest	FF divest	FF divest	FF divest	FF divest
Agriculture, Forestry and Fishing	55.48** (92.90)					
Electricity, Gas, Steam and Air Conditioning Supply	5.558 (7.391)					
Information and Communication	3.296 (4.347)					
Financial and Insurance Activities	25.13*** (22.17)					
Education	33.82*** (46.10)					
Human Health and Social Work Activities	4.182 (4.165)					
Other Service Activities	37.49*** (45.23)					
Manufacturing	Ref.					
Industry emissions		0.391 (0.535)				
Private ownership			0.435*** (0.120)		Ref.	
National fund				0.0729** (0.0871)	1.185 (0.519)	
Regional fund				0.302** (0.152)	2.527** (1.054)	
Municipal fund				Ref.	8.545*** (3.909)	
Climate change policy						1.942* (0.682)
GDP						1.259 (0.308)
Country FE	Yes	Yes	Yes	Yes	Yes	No
Fund type FE	No	No	No	No	No	Yes
Observations	267	227	815	173	815	893
Pseudo R2	0.287	0.0772	0.123	0.170	0.145	0.0966

Displayed coefficients are odds ratios, constants not shown, subsidiaries excluded. Reference categories: (1) Manufacturing; (4) Municipal fund; (5) Privately owned fund. Subsamples: (1) includes only corporate and industry funds; (4) includes only publicly owned funds.

Standard errors in parentheses.

*** $p < 0.01$.

** $p < 0.05$.

* $p < 0.1$.

because the management in this industry deals with climate-related financial risks in their daily business, or pension fund governance is more stringent (given that fund management is part of the core business for many of the companies). The fact that particularly open funds with need to reflect beneficiary preferences (including potential pro-social preferences for climate change mitigation) show a much higher tendency to divest, raises the question whether other fund categories (especially company funds outside the financial industry) appropriately reflect beneficiary preferences w.r.t. climate change mitigation.

Our findings bear a number of implications for policymakers. To start, there could be a case for regulatory intervention to ensure that fund management aligns with beneficiary preferences across all types of pension funds. The evidence that funds more exposed to beneficiary preferences (e.g., open funds) or democratic control (e.g., municipal funds) are more likely to divest could indicate that managing funds in accordance with beneficiary preferences may help to consider climate risks more adequately. To ensure that beneficiary preferences are fully taken into account in other fund categories as well, financial regulation could require pension funds to survey beneficiary preferences w.r.t. climate, similar to plans to make the inquiry about a client's sustainability preferences mandatory for financial advisors (European Commission, 2021). Going further, policymakers could also require the disclosure of whether and how these preferences are considered in the overall investment strategy. This would leave room for pension fund managers to implement adequate investment strategies (that may not always include or be limited to divestment). Generally, regulatory

requirements on the disclosure of climate change risks and opportunities have gained momentum since the Paris Agreement in 2015, but major European countries miss such regulation to date (Steffen, 2021).

For policymakers who explicitly aim to foster fossil fuel divestment as an instrument to align financial flows with climate targets, our analysis offers further insights: First, there is ample room to increase divestment among publicly owned funds. Public pension funds are often large and comprise roughly 40% of AUM among the largest 1000 European pension funds. However, even in this sample of particularly large pension funds, only 15% of publicly owned funds divested by 2020. Policymakers can guide publicly owned pension funds' investment policies through direct fiat, the appointment of managers and other methods. In the spirit of ratcheting up ambition, policymakers also could commit to extending publicly owned funds' divestment scope beyond coal only (and request further efforts to make their portfolios climate-compatible), which might encourage other types of pension funds to follow suit.

Second, there might be a role for policymakers to foster knowledge exchange and data sharing on climate-related risks and opportunities for pension funds and institutional investors more broadly. Our analysis revealed a greater tendency to divest among very large funds (which are assumed to have more resources to analyse climate-related matters) and among funds tied to the financial and insurance industry (an industry that deals with climate risks and opportunities as part of its daily business). By extension, there may still be a lack of awareness and expertise around fossil fuel divestment among smaller funds and those tied to

other industries. Governments strategically could foster information exchange on the matter, beyond the level that profit-seeking funds (or their industry bodies) alone would do.

Third, policymakers may be able to leverage cross-country spillovers strategically. Disclosure requirements and information exchange policies are often enacted at the national level, but many pension funds (and their asset managers) operate internationally. Thus, if a given pension fund falls under a disclosure requirement, its asset managers need to provide this information, although located in a different country. Therefore, regulation can ripple across borders due to the financial system's interconnectedness. In some cases, concerned asset managers may even extend regulatory compliance beyond the assets managed for a single pension fund (i.e., client) requesting it because of economies of scale. Well-connected markets, such as Europe, in which regulatory frameworks on climate disclosure are growing, could be especially fertile ground for such spillover effects.

7. Conclusion

In sum, the analysis of European pension funds shows that the heterogeneity in divestment strategies can be explained to a significant extent by observable pension fund characteristics such as size, ownership, and type of beneficiary. We also illustrate that several hypotheses derived from financial and non-financial motives are in line with the fossil fuel divestment decisions. While the empirical link between the different divestment motives and subsequent divestment decisions cannot be firmly established with observational data, this study makes a first step towards linking motives and actions for this important group of institutional investors. Future research can build on these findings, for

Appendix A. Data collection

A.1. Divestment statements

First, we matched divest-invest data (Harrison, 2018) – which, to the best of our knowledge, are the most comprehensive fund-specific fossil fuel divestment data – to our sample. As such, we identified 73 funds that are listed as having divested from fossil fuels.¹¹ Second, we searched each pension fund's website for mentions of fossil fuel divestment. Only 48 funds, or 4.8% of our sample, do not maintain an online presence (i.e., a specific pension fund website or a section dedicated to the fund on another site, e.g., the parent company). We searched these websites for the terms 'fossil fuels', 'coal' and 'divestment' to find references to fossil fuel divestment. For websites in languages other than English, German or French, we used Google Translate and identified an additional 26 pension funds divested from fossil fuels. Third, we used Factiva, one of the most comprehensive news search portals, to find press reports of fossil fuel divestment.¹² We conducted a full-text search for newspaper articles and news wires in English from January 2008 to July 2020 using the following search string: '[name near20 [divest\$9 near20 [coal or fossil fuels]]]'. This search string yielded articles that mention the fund's name within 20 words of the word string 'divest', which also must be no more than 20 words away from either 'coal' or 'fossil fuels'. We searched for the pension fund's name in its original language. For funds with special characters, we checked the website identified in the second step for an abbreviation or an English name to use. If both were unavailable, we used a website (or email) word string without special characters. For company pension funds, we also conducted additional searches using the company names provided in Orbis¹³ without legal form abbreviations (e.g., 'Ltd.') and common company abbreviations. For sectoral pension funds, we also conducted searches with the full IPE name and with abbreviations. We also used occupational classifications (e.g., 'doctor') if abbreviations were unavailable and identified an additional 19 pension funds divested from fossil fuels during this step. Finally, we conducted a Google search in August-September 2020 using the same search terms as in the previous step and identified another 11 pension funds that issued divestment statements.

A.2. Pension fund covariates

We defined six beneficiary categories, from which three concern publicly owned funds and three relate to privately owned funds. We used the descriptions of the pension funds from the respective websites and additional online searches in case of ambiguity to determine beneficiary categories.

We matched company funds ($n = 363$) to MSCI data to obtain carbon intensity (Scope 1 + 2 in tons per USD million sales) and the company's environmental performance (component of ESG rating).¹⁴ Finally, for sectoral and company funds ($n = 532$), we used the Level 1 NACE Rev. 2

instance by focussing on single motives and analysing to which extent precisely they have been decisive (e.g., through case studies). In addition, future research should also evaluate the role of fossil fuel divestments in climate strategies at pension funds more generally, as well as extend the scope to other institutional investors or geographies. Finally, it is important to keep in mind that fossil fuel divestment decisions are only one element among many other ones that are required to align investment with the goals of the Paris Agreement. However, a potentially important one, as the widespread use among European pension funds suggests.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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¹¹ Divest-invest is mainly based on funds' self-reporting. Hence, their coverage is most likely incomplete.

¹² <https://professional.dowjones.com/factiva/>

¹³ <https://www.bvdinfo.com/en-gb/our-products/data/international/orbis>

¹⁴ Reproduced by permission of MSCI ESG Research LLC (c) 2017 MSCI ESG Research LLC All rights reserved. The ESG data contained herein is the property of MSCI ESG Research LLC (ESG). ESG, its affiliates and information providers make no warranties with respect to any such data. The ESG data contained herein is used under licence and may not be further used, distributed or disseminated without the express written consent of ESG.

classification (21 sectors in total) to assign an economic sector to each pension fund. The allocation follows a two-step process. First, we used all sectoral classifications provided in Orbis for company funds. For the remaining company funds and the sectoral funds, we manually researched the field of activity and assigned a corresponding NACE sector. Wherever these choices were not self-evident, they were discussed among the co-authors.

Appendix B. Tables and figures

Table A.1

Overview of the 10 largest European pension funds with fossil fuel divestment (* denotes public funds).

Rank	Name	Country	AUM (USD bn)	Year divested	Fund type	Divestment type
1	Norway Government Pension Fund Global	Norway	945	2015	National*	Coal
3	Pensioenfonds Zorg en Welzijn (PFZW)	Netherlands	225	2015	Industry	Coal
4	Arbejdsmarkedets Tillaegspension (ATP)	Denmark	137	2019	National*	Coal
5	Alecta Pensionsförsäkring	Sweden	85	2017	Open	Coal
10	PFA Pension	Denmark	77	2015	Open	Target only
11	Danica Pension	Denmark	76	2018	Open	Coal and tar sands
12	Kommunal Landspensjonskasse (KLP)	Norway	68	2014	Regional*	Coal
18	Pensioenfonds van de Metalektro (PME)	Netherlands	50	2018	Industry	Coal
20	Lloyds Banking Group	UK	50	2018	Company	Coal
21	Ilmarinen	Finland	46	2016	Open	Coal

Table A.2

Logistic regressions on privately owned company funds. Displayed coefficients are odds ratios, constants not shown, subsidiaries excluded.

Variables	(1)	(2)	(3)
	FF divest	FF divest	FF divest
Carbon intensity	0.585 (0.726)		
Env score		0.568 (0.418)	
Env score quartile			0.956 (0.348)
Country FE	Yes	Yes	Yes
Observations	250	253	253
Pseudo R2	0.0693	0.0729	0.0649

Standard errors in parentheses.

Table A.3

Summary statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
Divestment (binary, 1 = yes)	1000	0.1	0.3	0	1
Ccpolicy (cont.)	1000	12.6	2.5	2.2	15.4
Ownership (binary, 1 = private)	1000	0.8	0.4	0	1
Public: international	1000	0	0.1	0	1
Public: national	1000	0.1	0.3	0	1
Public: regional	1000	0.1	0.3	0	1
Public: municipal	1000	0	0.2	0	1
Private: company	1000	0.4	0.5	0	1
Private: industry	1000	0.2	0.4	0	1
Private: open	1000	0.2	0.4	0	1
Carb. Intensity by sect. (cont.)	298	0.2	0.5	0	3
Asset value (cont.)	1000	7.724e+09	3.527e+10	6.940e+08	9.447e+11
GDP (cont.)	1000	48,185.1	17,173.4	7723.4	109,953.4

Table A.4

Correlation matrix.

Variables	(1)	(2)	(3)	(4)	(5)
(1) divestment	1.000				
(2) ccpolicy	0.068	1.000			
(3) ownership	-0.106	-0.141	1.000		
(4) asset_value	0.187	0.042	-0.089	1.000	
(5) gdp	0.081	0.430	-0.113	0.080	1.000

Table A.5
Two-sided t-tests.

	N rest (1)	N divested (2)	Mean 1	Mean 2	Diff	St Err	t value	p value
AUM	871	129	0.084	0.286	-0.202	0.047	-4.35	0
Open fund	871	129	0.2	0.55	-0.351	0.039	-8.95	0
Company emission int.	313	10	0.196	0.098	0.098	0.161	0.6	0.543
Sector emission int.	288	10	0.245	0.095	0.15	0.161	0.95	0.35
Privately-owned	871	129	0.782	0.744	0.037	0.04	0.95	0.338
Climate change policy	871	129	2.542	2.42	0.121	0.047	2.6	0.01

Table A.6
Relationship between open funds and climate change policy.***

Variables	(1)	(2)	(3)
	FF divest	FF divest	FF divest
Open fund	127.4** (276.5)	3.265** (1.670)	1.874* (0.671)
Climate change policy	5.881** (4.208)		
Interaction term	0.231* (0.185)		
Country FE	No	Yes	Yes
Observations	898	225	590
Pseudo R2	0.0412	0.233	0.0476

Specification (1) includes an interaction term, specification (2) for funds located in countries with climate change policy index below or at 80th percentile, specification (3) above. The percentile cut is the most equal sample division in 5-percentile steps. Displayed coefficients are odds ratios, constants not shown, subsidiaries excluded.

Standard errors in parentheses

*** p < 0.01.

** p < 0.05.

* p < 0.1

Table A.7

Excerpts from publicly available divestment statements regarding the asset coverage of the statement for 18 divested pension funds.

Rank	Pension fund	Country	Year	Asset coverage	Equities	Fixed inc.
1	Norway Gov. Pension Fund	Norway	2015	The guidelines cover investments in the Fund's equity and fixed-income portfolios	Yes	Yes
4	Arbejdsmarkedets Tillægspension (ATP)	Denmark	2019	Private equity funds and credit funds: Covers investments in funds that, based on a pre-agreed framework, invests in or lends money to a number of funds. ATP cannot select the investments itself once the agreement has been concluded. In future, ATP has therefore chosen to require that new funds should not include companies that extract fossil fuels. For contractual reasons, ATP cannot publish the names of its credit portfolio, but can only provide information about the overall investments	Yes	Yes
5	Alecta Pensionsförsäkring	Sweden	2017	A clear decision-making process for investments: Sustainability is an important criterion in Alecta's decisionmaking process for investments. The process is applied for all equity and credit investments, which account for around 75% of our total assets. This is complicated, and therefore we have developed a method to analyse the overall equity portfolio and not just the energy and supply sectors	Yes	Yes
10	PFA Pension	Denmark	2015	While incorporating the Paris Agreement into the investment process, PFA has given priority to focusing on PFA's listed shares and bonds since different types of carbon data have been available. PFA has divested seven companies as they failed to meet the company's climate requirements, while another seven companies have been subjected to stricter supervision.	Yes	Yes
18	Pensioenfonds van de Metalektro (PME)	Netherlands	2018	Pensioenfonds van de Metalektro, The Hague, Netherlands, divested its holdings in coal companies.	Yes	No
32	Fjärde AP-fonden (AP4)	Sweden	2018	Climate Convention and the Paris Agreement. AP4 therefore divested its holdings in these companies in 2018	Yes	No
72	BPL (Landbouw)	Netherlands	2018	Since 2016, we have cleaned up our equity portfolio. We no longer invest in companies that comply least with our ESG standards.	Yes	No
120	Caisse de prévoyance de l'Etat de Genève (CPEG)	Switzerland	2018	Keen to know the climate impact of its investments, CPEG conducted a study to calculate the carbon footprint of its equity and corporate bond portfolios.	Yes	Yes
447	Svenska Handelsbanken AB	Sweden	2015	The scope of this report is Handelsbanken's actively and passively managed equity and fixed income funds.	Yes	Yes
507	Nest Sammelstiftung	Switzerland	2016	In each sector, such as housing, transport or energy, companies are compared to each other on their utility to society. "It becomes clear that fossil fuels, coal, oil and so on, they have no chance compared to renewables so they are excluded." Nest applies the same approach to its fixed income portfolio of corporate and sovereign bonds. For private equity and infrastructure, in the absence of public	Yes	Yes

(continued on next page)

Table A.7 (continued)

Rank	Pension fund	Country	Year	Asset coverage	Equities	Fixed inc.
552	Erste	Croatia	2016	information and ratings, Nest defines investible sub-sectors while excluding some subs-sectors. As a result, its entire infrastructure portfolio consists of renewable energy and energy efficiency projects.	Yes	unclear
589	Swedbank AB	Sweden	2019	All actively and discretionarily managed mutual funds and portfolios of Erste Asset Management are subject to this commitment. Institutional funds and special funds as well as externally managed sub-funds held as part of a fund's assets are exempt from this commitment. At the client's explicit request, we may deviate from complying with this guideline for cases of individual portfolio management. Third-party mandates where Erste Asset Management is not involved in the management of the fund or the definition of the investment strategy and only acts as custodian manager are also exempt.	Yes	Yes
615	Hackney Pension Fund (LGPS)	UK	2018	We reduce our exposure to coal in both investments and financing, we continue to encourage portfolio companies and corporate clients to improve their climate management as well as measure and disclose the carbon footprint of investment portfolios and we work to minimize our operational environmental impact and our carbon emissions.	Yes	No
637	Stiftung Abendrot	Switzerland	2016	These new changes to our equity portfolio represent a significant step towards achieving this target and reflect our long term ambition to move away from fossilfuel investments.	Yes	Unclear
643	Lambeth Pension Fund (LGPS)	UK	2018	We pursue a risk-conscious investment policy and only invest in assets that we understand and that are in line with our investment policy [...]. In the area of securities, we invest exclusively in companies that, according to an independent environmental and social analysis, are among the best in their industry. We do not invest in critical industries. (translated from German)	Yes	Unclear
769	City of London Pension Fund (LGPS)	UK	2017	Secondly, pensions committee has unanimously agreed in principle to sell down its remaining global equities investments and reinvest the proceeds as soon as a suitable alternative becomes available within the London Pension Collective Investment Vehicle framework (the collective pensions body for London councils). Several suitable alternatives have been identified, and we will lobby the London CIV to include them or similar funds within its framework.	Yes	Unclear
835	University of Cambridge	UK	2016	Where such investments are already in place and identified, and where opportunities for engagement and reform of the company or project are not possible or do not exist, the Authority will make all reasonable efforts to divest provided that this will result in no material financial detriment (either through increased costs or increased investment risk).	Yes	No
838	Assicurazioni Generali SpA	Italy	2018	The Council has now agreed to extend this commitment such that any change to the current position – of no direct equity investment in the fossil fuel sector – must be referred back to the Council.	Yes	Yes
				Generali will dispose of equity investments and gradually eliminate bond investments by bringing them to maturity or considering the possibility of divesting them before maturity		

Table A.8

Replication of Table 1 without country fixed effects.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	FF divest	FF divest	FF divest	FF divest	FF divest	FF divest	FF divest
Log AUM	5.384*** (1.318)						
AUM		10.51*** (5.596)					
AUM ²		0.856*** (0.0358)					
Rank 1–200			10.80*** (5.480)				
Rank 201–400			2.802* (1.600)				
Rank 401–600			2.672* (1.492)				
Rank 601–800			2.430 (1.351)				
Top 100				5.693*** (1.697)			
Open fund					2.345*** (0.579)	7.157*** (2.933)	1.145 (0.318)
Industry fund						3.071** (1.435)	0.495** (0.177)
Company fund							0.160*** (0.0654)
GDP p.c.	1.405 (0.333)	1.470* (0.335)	1.454 (0.335)	1.454 (0.331)	1.692** (0.363)	1.350 (0.371)	1.522** (0.324)

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Table A.8 (continued)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	FF divest	FF divest	FF divest	FF divest	FF divest	FF divest	FF divest
Country fixed effects	No	No	No	No	No	No	No
Fund type fixed effects	Yes	Yes	Yes	Yes	No	No	No
Observations	893	893	893	893	898	677	898
Pseudo R2	0.184	0.140	0.165	0.146	0.0304	0.0852	0.0771

Displayed coefficients are odds ratios, constants not shown, subsidiaries excluded.

Standard errors in parentheses

*** $p < 0.01$.

** $p < 0.05$.

* $p < 0.1$

Table A.9

Replication of Table 2 without country fixed effects.

Variables	(1)	(2)	(3)	(4)	(5)
	FF divest	FF divest	FF divest	FF divest	FF divest
Agriculture, Forestry and Fishing	33.75** (46.38)				
Electricity, Gas, Steam and Air Conditioning Supply	5.529 (6.983)				
Information and Communication	3.619 (4.520)				
Financial and Insurance Activities	16.77*** (13.90)				
Education	58.48*** (61.51)				
Human Health and Social Work Activities	5.701* (5.333)				
Other Service Activities	45.74*** (51.67)				
Industry emissions		0.454 (0.566)			
Private ownership			0.500*** (0.122)		
National fund				0.435* (0.216)	1.964* (0.733)
Regional fund				0.301** (0.146)	1.389 (0.493)
Municipal fund					4.466*** (1.716)
GDP p.c.	2.159 (1.203)	1.453 (1.240)	1.575** (0.349)	1.993** (0.687)	1.615** (0.362)
Country FE	No	No	No	No	No
Fund type FE	No	No	No	No	No
Observations	313	257	898	216	898
Pseudo R2	0.206	0.0111	0.0242	0.0520	0.0364

Specification (6) is omitted because it uses country-level variance and is reported without country fixed effects in Table 2 in the main text already. Displayed coefficients are odds ratios, constants not shown, subsidiaries excluded.

Standard errors in parentheses.

*** $p < 0.01$.

** $p < 0.05$.

* $p < 0.1$

Table A.10

Replication of Table 1 with Scandinavia subsample (Denmark, Finland, Norway, Sweden).

Variables	(1)	(2)	(4)	(5)	(7)
	FF divest	FF divest	FF divest	FF divest	FF divest
Log AUM	6.510*** (4.621)				
AUM		12.85* (18.17)			
AUM ²		0.919 (0.499)			
Top 100			5.161** (3.953)		
Open fund				2.817* (1.743)	1.837 (1.353)
Industry fund					0.934

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Table A.10 (continued)

Variables	(1)	(2)	(4)	(5)	(7)
	FF divest	FF divest	FF divest	FF divest	FF divest
Country fixed effects	Yes	Yes	Yes	Yes	(0.782) Yes
Fund type fixed effects	Yes	Yes	Yes	No	No
Observations	51	51	51	65	54
Pseudo R2	0.193	0.214	0.127	0.0431	0.0433

Specifications are numbered identically to Table 1 to facilitate comparison. Specifications (3) and (6) are omitted because AUM size buckets and privately-owned only subsample do not make sense for the limited sample of Scandinavia. Displayed coefficients are odds ratios, constants not shown, subsidiaries excluded.

Standard errors in parentheses.

*** p < 0.01.

** p < 0.05.

* p < 0.1

Table A.11

Hypotheses and empirical approach overview.

#	Hypothesis	Operationalisations (empirical specification)
1	Fossil fuel divestment is more likely for larger funds	<ul style="list-style-type: none"> • Descriptive comparison (Fig. 2 and Table A.5) • Logistic regression with continuous AUM as independent variable (Table 1, specifications 1–2) • Logistic regression with AUM size buckets (Table 1, specifications 3–4) • Robustness checks (Tables A.8 & A.10)
2	Fossil fuel divestment is more likely for pension funds that must compete for clients	<ul style="list-style-type: none"> • Descriptive comparison (Fig. 4 and Table A.5) • Logistic regression with open fund binary independent variable (Table 1, specification 5) • Logistic regression with open funds compared to other privately-owned funds (Table 1, specification 6) • Logistic regression with open funds compared to publicly-owned funds (Table 1, specification 7) • Robustness checks (Tables A.8 & A.10)
3	Fossil fuel divestment is more likely from funds related to companies and sectors with low carbon intensity and/or solid environmental performance	<ul style="list-style-type: none"> • Logistic regression with industry classification independent variable (Table 2, specification 1) • Logistic regression with continuous industry carbon intensity as independent variable (Table 2, specification 1) • Robustness checks (Table A.9)
4	Fossil fuel divestment from publicly owned funds is more likely than from privately owned funds	<ul style="list-style-type: none"> • Descriptive comparison (Fig. 4 and Table A.5) • Logistic regressions with binary private ownership independent variable (Table 2, specification 3) • Logistic regressions with fund type independent variable among publicly-owned funds only (Table 2, specification 4) • Logistic regression with fund type independent variable compared to privately-owned funds (Table 2, specification 5) • Robustness checks (Table A.9)
5	Fossil fuel divestment is more likely if a fund is based in a country with strong societal preferences towards mitigating climate change	<ul style="list-style-type: none"> • Descriptive comparison (Fig. 3) • Logistic regression with continuous climate policy independent variable (Table 2, specification 6) • Country fixed effects interpretation in logistic regressions (not reported separately, p-values indicated in main text) • Robustness checks (Table A.9)

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