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Firm climate investment: a glass half-full

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Prachi Srivastava,[1] Nicholas Bloom,[2] Philip Bunn,[3] Paul Mizen,[4] Gregory Thwaites[5] and Ivan Yotzov[6]

Abstract

We analyse the importance of climate-related investment using a large economy-wide survey of UK firms. Over half of firms expect climate change to have a positive impact on their investment in the medium term, with around a quarter expecting a large impact of over 10%. Around two thirds of these investments are expected to be in addition to normal capital expenditure, with some firms investing less elsewhere. Climate investments are expected mainly in switching to green energy sources and improving energy efficiency, and firms expect to finance these mainly using internal cash reserves. Climate investment will be driven by larger firms as well as those in more energy-intensive sectors. Although firms are expecting to invest more resources in adapting to climate change, under reasonable assumptions, these investments are still not sufficient to meet the estimated targets implied by the UK Net Zero Pathway.

Key words: Firm data, Decision Maker Panel, climate change, investment.

JEL classification: C83, D22, D25, D84.

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1 Introduction

Climate change can affect the macroeconomy through a number of channels (Angeli et al., 2022). Physical impacts (e.g. extreme weather events, rising temperatures) can lead to disruptions in both output and inflation. Likewise, the transition to a low-carbon economy can impact activity through policy changes, preferences, and technology. In 2019, the UK's Climate Change Act set a goal to reach net-zero emissions by 2050 to comply with the Paris Agreement goal of limiting global warming. This implies that the amount of CO_2 produced is less than the amount removed and would require balancing low emissions (investments in green technology) and removing emissions (e.g. forestation). In the UK, greenhouse gas (GHG) emissions have fallen by 40% since 1990 due to the introduction of several policies focusing on the green transition.[1] Most recently, the 2023 Autumn Statement introduced a Connections Action Plan, which is expected to boost capital expenditure by £47-96 billion between 2023/25 and 2033/34.[2] Alongside mitigation policies, the green transition will require large investment from firms. However, very little is known about the scale of the investment that firms are undertaking and their importance for understanding trends in aggregate business investment.

In this paper, we analyse climate-related investment of UK firms using the Decision Maker Panel (DMP) survey. We outline four key findings. First, firms in the DMP expect to increase climate-related investment over the next three years, and this will likely provide a boost to aggregate capital expenditure. Second, these expectations are driven by larger firms and those in energy-intensive sectors. Third, the main areas of climate investment are expected to be switching to green energy sources and energy-efficiency improvements. Finally, firms expect to finance climate investment primarily through internal cash reserves as opposed to bank borrowing or bond/equity issuance.

We first consider overall green investment expectations. Over 50% of firms expect a positive impact of climate change on their investment, with around a quarter expecting a large impact of over 10% of total investment. In contrast, only around one-third of firms reported a positive impact of climate change on investment over the past three years. By assigning quantitative values to these qualitative responses,

[1] https://www.greenmatch.co.uk/blog/2021/02/renewable-path-to-net-zero-emissions

[2] https://www.gov.uk/government/publications/electricity-networks-connections-action-plan

we estimate that climate-related investment accounted for 2.5% of firms' capital expenditure over the past three years, and this is expected to rise to 5.5% over the next three years. Based on the latest data on business investment available from the Office for National Statistics, this would imply around £13 billion in climate-related investment per year over the next three years. While not insignificant, these expectations are below the estimates from the Climate Change Committee's Balanced Net Zero Pathway, which requires green investments of around £20-22 billion per year (Committee et al., 2020).[3]

For some firms, these climate-related investments will represent additional spending, but others will invest less elsewhere instead. Firms in the DMP are asked about the share of climate-related capital expenditure they expect will be offset by lower spending elsewhere. Firms vary in the degree of offsetting, but up to 90% of firms expect at least some of their climate-related investment to be in addition to normal investments. Taking account of this, our estimates imply that aggregate investment will be around 3.1% (or £7.5 billion per year) higher over the next three years than it otherwise would have been.

Although the results suggest climate change will boost total investment in the UK, we do not measure the impact on aggregate economic activity. Climate change can affect aggregate output through multiple channels beyond investment, including consumption, trade, productivity, and labour supply. Existing cross-country studies have found strong evidence that climate change (most commonly measured with temperature shocks) has a negative effect on economic activity, on average (see Dell et al., 2012; Burke et al., 2015, 2024; Acevedo et al., 2020; Bilal and Känzig, 2024). However, these studies have also shown that the effects are often non-linear and vary significantly across countries, depending on geography and development status.[4] In contrast, our project is specifically focused on firm climate investment, the character-

[3]The Net Zero Pathway is a projection for total capital investment, not only business investment. The pathway requires total climate investments around £35-40 billion per year in 2025. These projections are reported in real 2019 £ values. As business investment is around 56% of total UK investment (in 2023), we estimate that this corresponds to around £20-22 billion of required climate investment from firms.

[4]Dell et al. (2012) find that higher temperature has a negative impact on GDP growth, but only in poor countries (defined using GDP per capita levels). Acevedo et al. (2020) find that higher temperature lowers output for the median emerging market and low-income country, whereas the effect is weakly positive for the median advanced economy. Bilal and Känzig (2024) also find large negative effects of *global* temperature shocks on real GDP, but the effects vary across regions of the world.

istics of firms making these investments, and covers both the impact of physical risks as well as climate-related policies.

We next analyse heterogeneity of climate investment expectations across several dimensions. We find that larger firms and those with higher energy intensity in production expect higher climate-related investment. The relationship with energy intensity is significantly stronger in 2023 compared with 2021, suggesting the recent energy price shock may have boosted green investment intentions. We also consider the expected sources of climate-related investment. Firms expect the two main sources of climate-related investment over the next three years to be switching to green energy sources and energy efficiency improvements. These investments are expected by 81% and 74% of firms, respectively. Meanwhile, investments in R&D into green technologies and adaptation to physical impacts of climate change are planned by around 20% of firms. Finally, climate-related investments are expected to be financed primarily using internal cash reserves, whereas only around a quarter of businesses expect to use bank borrowing. Bank borrowing is a less common source of funding for climate-related investment compared to normal capital expenditure. Firms which expect to finance climate investment using bank borrowing tend to be smaller, less productive, and less cash-rich.

We contribute to a rapidly growing literature which studies how climate change affects firm behaviour, broadly defined. A number of recent studies have used survey data to understand green investment among firms, as well as any constraints to financing such spending. These include the ECB's Survey on the Access to Finance of Enterprises (Ferrando et al., 2023), the European Investment Bank Investment Survey (Bank, 2023), and the EBRD (Kalantzis et al., 2022). Siedschlag and Yan (2021) use data from Ireland and Hrovatin et al. (2016) use data from Slovenia to study the firm-level and industry-level factors which explain green investment by firms. Hensel et al. (2024) show that carbon price increases are associated with higher realised and expected firm prices using survey data from France. Norris-Keiller and Van Reenen (2024) use data from the World Management Survey to show that well-managed firms have more accurate perceptions of climate risks and are more likely to adopt climate adaptation measures in response to perceptions. Grover and Kahn (2024) provide a survey of the literature on firm responses to climate change, and highlight how differ-

ent characteristics (e.g. size, management) can affect adaptive capacity. We add to this work using a large economy-wide survey of UK firms.[5]

The current paper also contributes to research on the impact of financing conditions for green investments.[6] Accetturo et al. (2022), for example, find that credit availability is associated with more green investments among Italian firms. De Haas and Popov (2023) use industry-level and firm-level data show that stock markets spur green investment. Kaldorf and Shi (2024) use firm-level data from 28 countries to show that credit constraints are associated with lower emissions reductions in response to carbon tax increases. Aghion et al. (2024) argue that financial constraints can slow down the green transition, because green innovation is disproportionately driven by younger firms which are more credit constrained. In the UK, we find that firms plan to finance green investment mainly using internal cash reserves. Higher expected borrowing rates are associated with lower expected climate investment, and financially constrained firms are more likely to cite climate investments as too expensive or having too low a return to justify the expenditure.

Finally, the paper contributes to the literature which measures climate change uncertainty and analyses the effects on investment behaviour. In recent years, a number of studies have created measures of climate uncertainty using text-based methods (e.g. Noailly et al., 2022; Basaglia et al., 2021; Bua et al., 2022; Huang and Sun, Huang and Sun). Although a common finding is that higher uncertainty tends to depress investment among firms, Basaglia et al. (2021) note that positive effects are also possible, depending on the nature of the climate uncertainty. In the DMP, firms are asked directly about climate change as a source of uncertainty for their business. We find strong positive correlations between our measures of uncertainty and expected climate investment among firms.

The remainder of the paper is organised as follows: Section 2 describes the firm-level dataset. Section 3 presents the main results on climate investment, Section 4 presents the main findings on climate-related uncertainty, and Section 5 concludes.

[5] Related research has also analysed the impact of green investments on firm performance (e.g. Siedschlag and Yan (2023))

[6] See Giglio et al. (2021) for a review of this literature.

2 The Decision Maker Panel (DMP) Dataset

The Decision Maker Panel is a large and representative online survey of Financial Directors and Chief Financial Officers in UK businesses.[7] It is similar in style to the Survey of Business Uncertainty run in the United States by the Federal Reserve Bank of Atlanta (Altig et al., 2022). The survey asks about recent developments and expectations for the year ahead in sales, prices, employment, and investment. An important advantage of the DMP survey relative to many other business surveys is the quantitative nature of the data it collects.

The DMP collects, on average, 2,500 responses a month and samples around 4% of UK private sector employment. That makes it one of the largest monthly business surveys in Europe. Figure A1 shows the monthly response rate since the beginning of 2018. The survey has a rotating three-panel structure – each member is randomised at entry into one of the three panels (A, B, or C). Each panel is given one-third of the questions in any given month, so within each quarter, all firms rotate through all questions. This helps to keep the survey short for respondents whilst yielding a regular monthly flow of data.[8] As well as the regular questions on sales, prices, employment, and investment, the DMP survey also includes ad-hoc special questions about topical policy issues. The special questions have focused on multiple topics, including tax policy changes, the impact of higher interest rates, changing working arrangements, as well as the impact of climate change.

Between August and October 2023, firms in the DMP were asked a series of questions regarding the impact of climate change (both physical risks and climate-related policies) on their investment behaviour and about climate change as a source of uncertainty for their business. The main questions were:

1. How has climate change affected your capital expenditure over the past three years? And how do you expect climate change to affect your capital expenditure over the next three years?

2. How much of climate-related capital expenditure will be offset by lower capital spending elsewhere?

[7] https://decisionmakerpanel.co.uk/

[8] The median time for completing the survey is around seven minutes.

3. What are the most important sources of climate-related capital expenditure (e.g. energy efficiency, switching to green energy, etc.)?
4. How do you expect to finance climate-related capital expenditure over the next three years?
5. How important is climate change as a source of uncertainty for your business?

Screenshots of all the questions above with the precise wording are shown in Figure A2.[9] Over the three months, the survey received 2,108 firm responses. In addition, the questions on expected climate investments and climate uncertainty were asked in 2021, which allows us to compare how these responses have changed across DMP firms over the past two years. In the analysis, the results are weighted by industry and employment shares. The main findings are similar when using investment weights instead (see Figure A5 and the discussion in Section 3.1 for details).

3 Main Results

3.1 Magnitude of climate-related investment

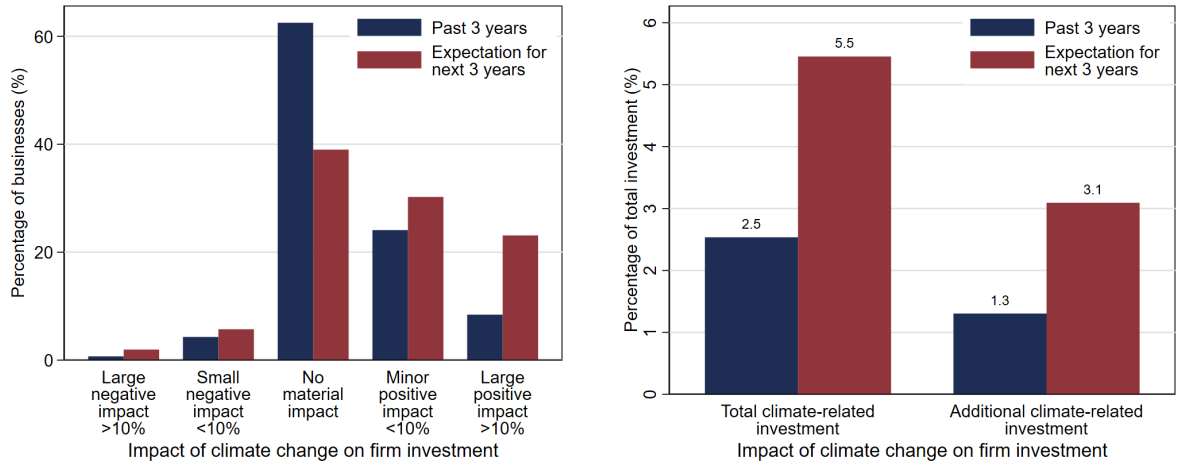
In Figure 1, we present the main results on the amount of climate-related investments firms have realised over the past three years and their expectations for the next three. Over the past three years, 32% of firms reported that climate change had a positive impact on their capital expenditure; 63% reported no material impact, and around 5% reported a negative impact (Panel A, navy bars). However, firms also expect a significant increase in their climate-related investment going forward. Over the next three years, 53% of firms expect a positive impact, whereas only 39% expect no impact, and 8% expect a negative impact (maroon bars).

To perform further analysis using these responses, we assign quantitative values to each of these categories. Specifically, we assign values of +20 to 'large positive

[9] In addition to the questions focusing on climate investment, firms were asked an optional text-based question about the main ways they expect climate change to affect their business over the medium term. 681 firms responded (out of 2,108), a 32% response rate. A summary of these text responses is provided in Figure A3. Multiple different factors were mentioned by firms (Panel B), including higher costs, physical impacts from high temperatures and flood risks, and the impact of regulations and government policies. Climate uncertainty is strongly correlated with the likelihood of leaving a comment. However, higher realised/expected climate investments are not correlated with a higher likelihood of leaving a comment.

Figure 1: Overall realised and expected firm climate investments

(a) Realised and expected climate investment (b) Total and additional climate investments



Notes: The results in Panels A and B are based on responses to the questions: "How have factors related to climate change affected the capital expenditure of your business over the past three years? And how do you expect them to affect your capital expenditure over the next three years?" and "Please estimate how much of your climate change-related capital expenditure over the next three years will be offset by lower capital spending less elsewhere in your business?" The estimates for total climate investment in Panel B are based on assigning values of -20%, -5%, 0%, +5%, and +20% to the respective categories from Panel A. The estimates on additional climate-related investment are based on assigning qualitative values to the catergorical responses (see Figure A7), based on the midpoint of the ranges.

impact'; +5 to 'minor positive impact'; 0 to 'no material impact'; -5 to 'minor negative impact'; and -20 to 'large negative impact'. Having converted the categorical responses to numerical values, we estimate that climate change accounted for around 2.5% of aggregate capital expenditure over the past three years and is expected to account for 5.5% over the next three years (Figure 1, Panel B).

To get an approximate monetary value for these investments, we use the annual business investment data published by the Office for National Statistics (ONS).[10] In 2023 (the last full year of available data), business investment was around £241 billion.[11] Based on this figure, and our estimates from Figure 1, climate-related investment accounted for around £6 billion per year over the past three years, and this is expected to increase to £13 billion per year over the next three years.

The precise aggregate estimates are sensitive to the numerical values assigned to each of the qualitative categories, in particular, the 'large positive impact' and

[10] https://www.ons.gov.uk/economy/grossdomesticproductgdp/datasets/businessinvestmentbyasset

[11] This is based on the seasonally adjusted chained-value measure of business investment, where the reference year is 2019.

'large negative impact'. The survey wording specifies these as corresponding to a positive/negative impact 'greater than 10%', respectively. In Figure A4 we show estimates for aggregate realised and expected climate investment for different values of these two categories, ranging from ±10% to ±50% impact. It is worth pointing out that in order to approach the £18-22 billion per year of business investment estimated for the Balanced Net Zero Pathway would require us to assume a value of around ±33% to these categories.

On average, different weighting schemes all suggest around 6% expected climate investment over the next three years. Our baseline methodology uses industry employment weights, also adjusting for firm size within industries. DMP statistics are usually weighted in this manner. Employment is a much smoother variable than capital expenditure, and using employment weights allows us to match to the official business register by firm size as well as industry. However, this approach may understate the investment impacts, as smaller industries in terms of employees (e.g. utilities, mining and quarrying) tend to have relatively high investment shares. In Figure A5 we compare our main estimates to those calculated using alternative weighting schemes. These vary from 5.5% expected climate investment (baseline employment weighting) to 6.2% for weighting based on industry-level business investment data from the ONS.[12] If, instead, we use the actual reported level of capital expenditure by firms in the DMP to construct weights, we obtain a very similar estimate of 6.1%.[13] In monetary terms, the different weights imply a range of climate investment between £13.3 billion to £14.9 billion per year over the next three years. Thus, although the precise estimate depends on the weighting used, the results are still below the target implied by the UK Net Zero Pathway.

Finally, we can compare how climate investment expectations have changed compared with 2021, the last time this question was asked. Note that because the questions ask about expectations over a three-year horizon, there is an overlap of only two years between the answers in 2021 and 2023. In aggregate, expected climate investment has increased from 3.4% in 2021 to 5.5% in 2023 (without the effects of any

[12] One limitation of using investment data from the ONS to construct the weights is that we are not able to adjust for investment shares *within* industries, for example by firm size. As an alternative, we adjust for small/large firms within industry by employment, as in our baseline weights.

[13] Capital expenditure is a very lumpy measure, so we use the three-year average capital expenditure for each firm to construct weights.

offset), with increases in every sector except real estate (Figure A6).[14]

Additional climate investment A key question is how much of the expected climate investment will be additional to existing capital expenditure, versus how much will be offset by lower investment elsewhere. In 2023, firms in the DMP were also asked to estimate these shares. Figure A7 presents the results from this question. 90% of firms expect at least some of the climate-related investments to be additional to normal capital spending, with 20% of firms expecting it to be fully new capital expenditure. Only around 10% of firms expect their climate spending to be fully offset by lower spending elsewhere.

Following the same approach as before, we convert these categorical answers to numerical values. To each of the categories, we assign the midpoint of the range of percentages. In other words, we assign 80% to '61-99%', 50% to '40-60%', and 20% to '1-39%'. Using these firm-level responses together with the expectations from Figure 1, Panel A, we estimate that aggregate investment will be around 3.1% (or £7.5 billion per year) higher, on average, than it would have been over the next three years due to additional climate spending (Figure 1, Panel B). Similarly, aggregate investment is estimated to have been around 1.3% (or £3 billion per year) higher over the past three years due to additional climate investments.

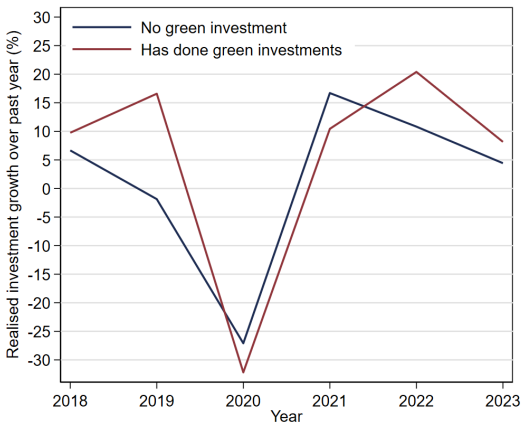
It is important to put these numbers in the context of *total* realised and expected capital expenditure growth among firms in the DMP. These are reported in Figure A8. Annual capital expenditure over the past three years was volatile and affected by the Covid-19 pandemic but slowed during 2023. For the period between 2022Q4 and 2023Q4, firms reported annual investment growth of 0%. Expected investment growth has also slowed over the past two years; for the period between 2023Q4 and 2024q4 firms expect their capital expenditure to decrease by around 1.3%, although these series are volatile, as shown in the figure. In general, capital expenditure growth is now similar to the rates seen in the pre-pandemic, post-Brexit referendum period.

We can furthermore analyse trends in total realised and expected investment

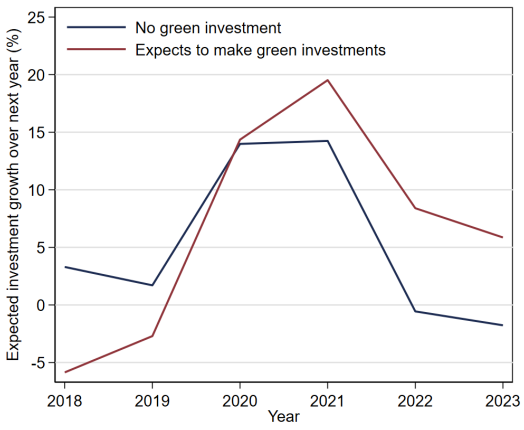
[14]We are also able to assess forecast accuracy of firms with respect to their climate-related investment by comparing expectations in 2021 with realised values in 2023 for the firms which responded in both sets of climate questions. There are 722 firms which responded both in 2021 and 2023. Of these, 25% report they have invested less than expected in 2021, 59% have invested as much as expected, and 16% have invested more than expected. Note again that this comparison is over a two-year horizon, whereas the questions ask about expectations and realisations over three years.

Figure 2: Realised and expected total investment growth and climate investment

(a) Realised total investment growth



(b) Expected total investment growth



Notes: Panel A shows annual total capital expenditure growth depending on whether firms report any climate-related investments over past three years. Panel B shows expected year-ahead total capital expenditure growth by whether firms expect any climate-related investments over next three years.

growth depending on whether firms report to have done/expect to make any climate-related investment. This is one way to check whether their responses are consistent across the two sets of questions. Figure 2 presents these results. Indeed, for both realised (Panel A) and expected (Panel B) total investment growth, firms which make green investments have experienced a higher growth rate over the past few years. Over the past three years (Panel A), on average, total investment *growth* among firms making climate-related investments has been around 3.3 percentage points higher compared with firms which have made no green investments (12.6% versus 9.3%). In *level* terms, this translates to capital expenditure being around 6.6 percentage points higher, on average, over the three-year period. In comparison, firms which report a positive impact on climate investment over the past three years estimate five percentage point *additional* climate investment.

We can perform a similar calculation for expected total and climate-related investment. Looking ahead, expected total investment growth for the year ahead is 7.7 percentage points higher for the firms which expect to make climate-related investment, based on data from 2023 (5.9% versus -1.8%). This is very close to the additional climate investment estimated by these firms, which is around 7.5 percentage points over the next three years. Unfortunately, the DMP does not collect expectations for total capital expenditure beyond the one-year horizon, so it is not possible

to compare expectations further ahead. Nevertheless, the similarity in these numbers for climate and total capital expenditure give us some confidence in the consistency of firm reporting and expectations.[15] Overall, the results from this section suggest that climate change will have a positive impact on firm capital expenditure over the medium term, with increases expected to be broad based across the economy.

3.2 Which firms make green investments?

We explore how climate investments vary with a number of firm-level and industry-level characteristics.

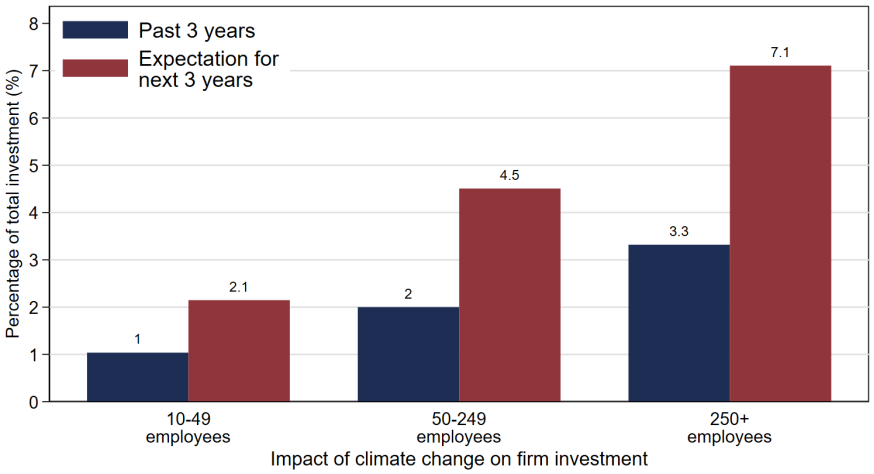
Firm size Realised and expected climate investments increase with firm size (Figure 3). Large firms (250+ employees) expect climate change to account for 7.1% of total capital expenditure over the next three years, whereas smaller firms (10-49 employees) only expect climate investments of around 2.1%, on average. Similarly, over the past three years, climate-related investments have accounted for 3.3% of total investment for the largest firms, whereas this number is only 1% for the smallest firms. Medium-sized (50-249 employees) firms report climate investments in between those of the largest and smallest firms.

Energy intensity Another important determinant of climate-related investment is likely to be energy intensity. Firms with higher energy costs in production or which emit more greenhouse gases (GHG) will need to make the largest adjustments over the medium term. In addition, the energy price shock in 2022 potentially accelerated this process.[16] To test this hypothesis, we use two complementary measures of energy intensity: the first is a measure of energy costs calculated at the SIC2 level using ONS Supply and Use Tables. Specifically, this measures intermediate consumption of energy (i.e. electricity; gas; petroleum) as a share of total intermediate consumption including labour compensation. The second measure is total greenhouse gas emissions at the SIC2 level, also calculated using ONS data. In this section, we report the results using only industry energy costs. The results using GHG emissions are very

[15] Still, we acknowledge that there may be other factors beyond climate investment which could be contributing to the differences in total capital expenditure growth between the two groups. The exercise in Figure 2 is only meant to provide a simple cross-check between the two sets of data.

[16] A recent paper by Fetzer et al. (2024) analyses how UK firms adapted to the 2022 energy price shock along a number of dimensions. They find firms (particularly larger firms) increased capital spending following the shock. They also find energy intensity is positively related with changes to more energy-efficient building equipment.

Figure 3: Realised and expected climate investment by firm size



Notes: The results are based on responses to the questions: "How have factors related to climate change affected the capital expenditure of your business over the past three years? And how do you expect them to affect your capital expenditure over the next three years?"

similar.[17]

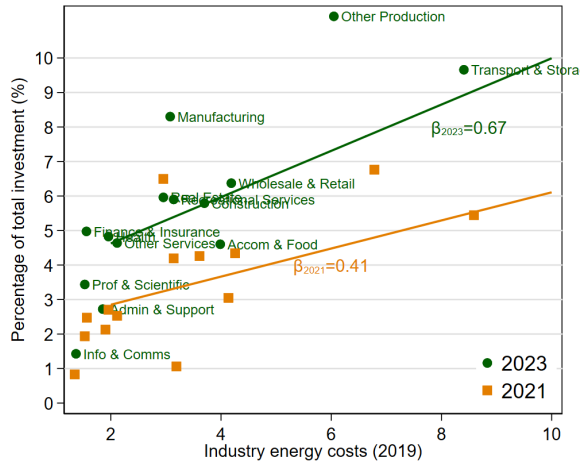
Figure 4, Panel A presents a scatter plot of energy intensity (captured using industry energy costs) and expected climate investment, separately for 2021 and 2023. The green scatter plot shows a strong positive correlation in the most recent data. The slope coefficient of around 0.67 also suggests a very large quantitative relationship: moving from the 25th to the 75th percentile of energy intensity increases expected climate investment by more than 40%, from 4.3% to 6%. Furthermore, Panel A shows that the relationship between energy intensity and expected climate investment is much stronger now in 2023 compared with 2021. The slope in 2021 is around 0.4, and further regression analysis confirms the difference between these coefficients is statistically significant (see Table 1). Given that results from 2021 were reported before the major energy shock in 2022, these results are consistent with the energy price shock accelerating the transition toward climate investment, and particularly driven by firms with higher energy intensity.[18] This is further illustrated in Figure 4, Panel B, which shows that firms with higher energy intensity are more likely to select 'switching to green energy' as a source of climate-related investment over the

[17] See, for example, Figure A9, which shows a strong positive correlation between industry-level greenhouse gas emissions and expected climate investment.

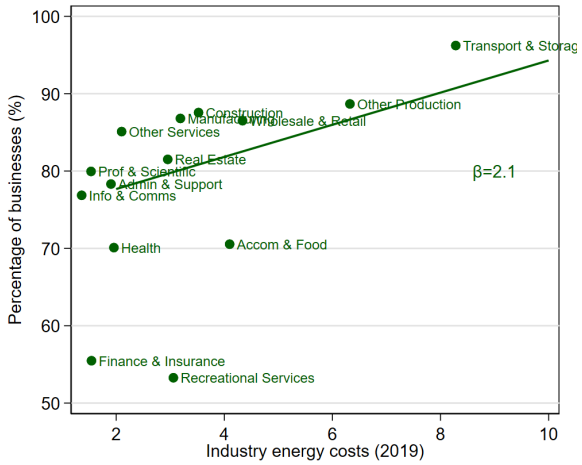
[18] This result is consistent with recent evidence from an LSE-CBI survey of UK firms (Oliveira-Cunha et al., 2024). The authors find that for 40% of firms, the recent energy crisis either accelerated environmental sustainability actions, or prompted one-off or continued changes.

Figure 4: Climate investment: Heterogeneity by energy intensity

(a) Energy intensity and expected climate investment: 2021 vs. 2023



(b) Energy intensity and investment in green energy



Notes: "Industry energy costs" are measured as the intermediate consumption of energy (i.e. electricity; gas; petroleum) as a share of total intermediate consumption including labour compensation, at the SIC2 level, based on Supply and Use Tables from 2019 published by the ONS. In Panel A, the coefficient estimates are based on a simple (weighted) linear regression of energy costs interacted with a dummy for 2021 vs. 2023, with no fixed effects or additional controls.

next three years. The relationship between energy costs and climate investment is also consistent with free-text comments left by firms, where higher costs (primarily due to energy costs) is the most commonly cited factor on how climate change is expected to affect businesses (Figure A3).

In Table 1, we further explore the heterogeneities of expected climate investment across firms in the sample. Across all seven columns, the dependent variable is the expected climate investment over the next three years, as a percentage of total investment.[19] Realised climate investment and firm size (measured by number of employees) are both robustly positively correlated with expected climate investment. The positive correlation with firm size is consistent with Figure 3. Likewise, the positive correlation with realised investment suggests there is no 'mean-reversion' in climate spending; rather, firms which have made more investments in the past continue to expect the same in the future. Being a listed firm is negatively correlated with expected climate investments (Column 1), but the relationship is not statistically significant.

[19] In Table A1, we perform a similar analysis using *realised* climate investment over the past three years as the dependent variable. Larger firms and those with higher energy costs have made more climate investments in the past. Furthermore, we find a positive and statistically significant correlation between climate investment expectations in 2021 and what firms reported now in 2023 (Column 6).

However, there are only around 35 listed firms in the regression sample, so we are cautious not to over-interpret the results.

(Table 1)

In Columns 2-5 we test the correlation between expected climate investment and a number of variables, in addition to the ones discussed above. We find that expected climate investment is positively correlated with expected year-ahead total investment growth (Column 2) as well as with firm profit margins, estimated using official firm accounts data (Column 4). In contrast, firms which expect a higher interest rate on their own borrowing over the next year, expect to make fewer climate expenditures (Column 5). This is consistent with evidence that higher interest rates since 2021 are lowering total firm investment in the DMP.[20] In contrast, we find no significant correlation between firm labour productivity (estimated using firm accounts) and climate spending. However, as we will show in the next sub-section, labour productivity is significantly correlated with some of the types of climate investments firms expect to make.

In Column 6, we add industry energy costs as a regressor, estimated using ONS Supply and Use Tables. For this specification, we have excluded industry fixed effects, as they are highly correlated with the measure of energy costs. The result suggests a strong and highly significant relationship: firms with higher energy costs expect to make more climate investments over the next three years. Finally, in Column 7 we pool expected climate investment responses from 2021 and 2023. As suggested by Panel A of Figure 4, the effect of industry energy costs is positive and highly significant in both years, and the magnitude of the coefficients is noticeably larger in 2023. The last row of the table shows that the difference between the coefficients for 2021 and 2023 is statistically significant at the 10% level.

In Table 2, we analyse the determinants of *additional* climate investment. The dependent variable across all columns is the percentage of climate spending firms expect to be in addition to normal capital expenditure, as opposed to offset by lower spending elsewhere. This question was only asked for the subset of firms which expected positive climate investment, hence the sample is smaller in this table.

[20] See Shah et al. (2024) for further evidence on the impact of higher interest rates on firms.

(Table 2)

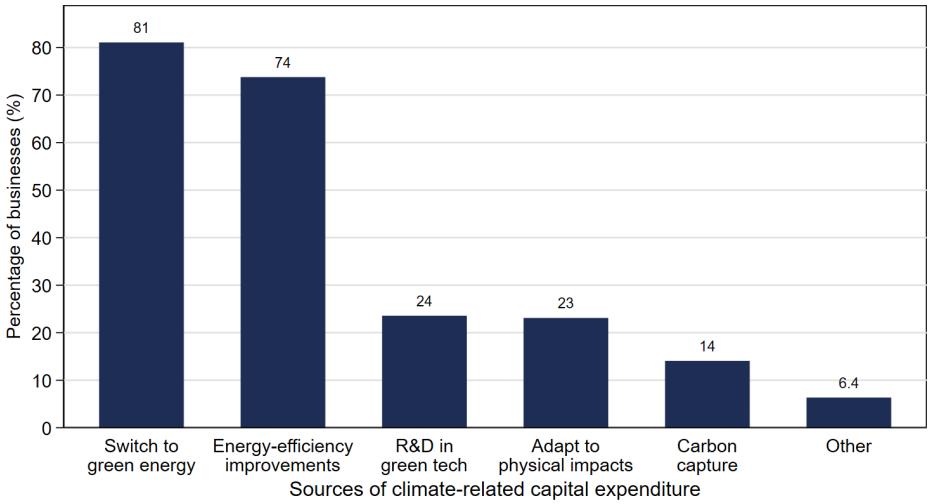
We find that across all specifications, there is a positive relationship between expected climate investment and the share of this which is expected to be additional. This is encouraging, and suggests larger investments in climate change will not be offset by a larger share, and thus would add more to total investment by firms. We also find that more profitable firms expect more of their climate investments to be additional (Column 3). Meanwhile, Column 4 shows more indebted firms (measured by debt/assets in firm accounts) expect more of their climate investments to be offset by lower spending elsewhere. This would be the case if firms with more debt have a harder time accessing financing. Indeed, in Column 5 we find that financially constrained firms expect significantly less of their climate spending to be additional. The indicator for financial constraints is based on questions asked in the DMP regarding (1) the availability of internal finance, (2) the availability of external finance, and (3) and the cost of external finance as constraints for firm investments. These results suggest higher firm indebtedness and financial constraints may affect the impact of climate-related investment on aggregate business investment, as higher shares of capital expenditure would be offset.

Overall, this section uncovers a number of heterogeneities in the expected climate investment among firms. As well as firm size and energy costs, firm profitability and borrowing rates appear to be important determinants for the amount of climate capital expenditure over the medium term. In the next sections, we analyse in more detail the specific types of climate investment as well as the sources of financing firms expect to use.

3.3 Sources of climate investment

In addition to the overall expected climate investment over the next three years, in 2023, the DMP survey asked about the sources of climate-related investment firms expect to make. Firms are asked to select from: (i) energy-efficiency improvements, (ii) switching to greener energy sources, (iii) carbon capture, (iv) R&D in new green technologies, (v) adaptation to physical impacts, and (vi) other. Figure 5 reports the main results from this question. Note that firms are allowed to select multiple sources of investment; therefore, the percentages do not add up to 100. Indeed, only 25% of

Figure 5: Sources of climate-related capital expenditure



Notes: The results in this figure are based on 913 responses to the question: "Which of the following do you expect to be important sources of climate-related capital expenditure for your business over the next three years?" This question was only asked to firms which expect climate change to have a positive impact on their capital expenditure over the next three years. Firms are allowed to select more than one option.

firms selected just one source of climate-related investment, and 33% of firms selected three or more sources of investment.

The most common source of climate-related capital expenditure is switching to green sources of energy. This was reported by 81% of businesses which expect a positive impact of climate change on their capital expenditure.[21] Switching to green energy sources includes investments in solar panels, electric vehicles, or installing electric furnaces. There is nevertheless some sectoral heterogeneity in green energy investments: 96% of businesses in the Transport & Storage sector expect to make such investments over the medium term, likely related to switching to electric vehicles. Meanwhile, only around 53% of firms in Finance and Insurance and Recreational Services expect to move to green energy sources. As we show in Figure 4 Panel B, energy intensity in production is also a strong predictor of the likelihood of making investments toward green energy.

The second most common source of climate-related investment is energy efficiency improvements. This captures changes such as improving insulation, changing

[21] Switching to green energy sources was also commonly mentioned in free-text comments left by firms (see Figure A3). For example, one respondent wrote that, "we have had a policy to purchase electric vehicles where possible for several years. this is anticipated to be continued."

LED light bulbs, or reducing heat loss in production, but importantly without changing the energy source. 74% of firms expected to make energy efficiency improvements over the medium term. Such improvements were most widely reported in the Accommodation and Food and Recreational Services sectors, where over 90% of firms selected this source. In contrast, only 41% of businesses in Other Production (which includes agriculture, mining, and utilities sectors) expect to make energy efficiency improvements over the next three years.[22]

In Table 3, we explore the heterogeneity in these expected sources of climate investment using a similar set of variables as used in Tables 1 and 2. Specifically, we estimate linear probability models where the dependent variable is an indicator for whether a given type of climate investment was selected. Since firms were allowed to select multiple factors, we control for the number of additional factors selected in each specification. In other words, a firm which has selected three sources overall, the variable would take the value of two.

(Table 3)

There are two interesting takeaways from this table. First, firms which report higher climate investments over the past three years are less likely to expect investments in green energy sources (Column 1) and energy efficiency improvements (Column 2). At the same time, past climate investments are positively correlated with carbon capture. This suggests these firms may have already undertaken green energy and energy efficiency investments, and no longer need to do so going forward. Second, we find that, in contrast to the null effects on the magnitude of climate investments, firm labour productivity is significantly correlated with the expected sources of climate investment. Specifically, high-productivity firms are less likely to make investments in energy efficiency improvements, but are more likely to make investments in carbon capture technologies over the next three years. The results from this table are correlations, and not necessarily causal. However, the implications of climate investments for productivity growth is an important area for future study.[23]

[22] Energy-efficiency improvements were also discussed in around 15% of comments left by firms (Figure A3). For example, one respondent stated that, "climate change is driving climate related 'sustainability' policies. led lighting is being installed across our retail network and electric vehicles and charging points invested in."

[23] Note that the results in Table 3 are based only on the sub-sample of firms which expect to make

3.4 Climate investment financing

Figure 6, Panel A presents the main ways firms expect to finance climate investments over the next three years (maroon bars). Around 87% of firms expect to use internal cash reserves; the next most common option is bank borrowing, selected by 27% of firms. Note that firms were allowed to select more than one option, therefore the percentages do not add up to 100. Bank borrowing, in particular, was a more common source of financing for large firms: 29% of firms with 250+ employees selected this option, compared with only 17% of firms with 10-49 employees. Starting in November 2023, firms were also asked about the typical sources of financing for their overall capital expenditure, not just climate-related investments. Panel A also reports these numbers (blue bars). Internal cash reserves are again the most common source of financing, indicated by 84% of firms. However, bank borrowing is a more common source of financing for total investments (around 42% of businesses), compared with climate-related investment. There are several reasons why bank borrowing may be a less frequent source of finance for climate investments. First, firms which intend to make climate investment may find it more difficult to obtain financing for climate-related capital expenditure relative to other investments. Furthermore, if firms are expecting to make relatively small climate-related investments, they may be able to finance those with internal cash, rather than needing to apply for external financing.

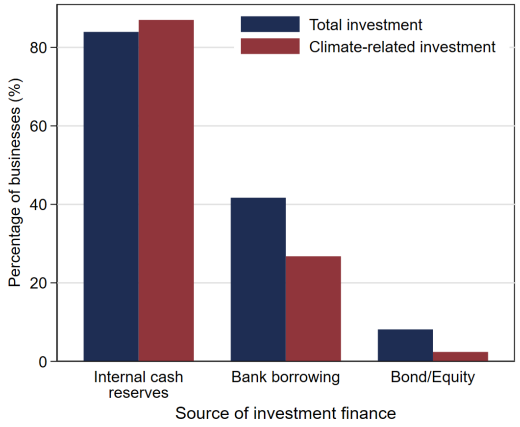
In Table 4 we analyse in more detail the determinants of the different sources of climate financing. The dependent variables in each column are indicators for whether firms expect to use cash, borrowing, or bond/equity to finance climate spending. As before, we control for the number of additional sources of finance selected in each specification. It should be noted that this question was only asked for firms which expected to make some positive climate investments over the next three years.

There are several interesting patterns emerging from this table. First, firms which expect to make larger climate investments are less likely to use cash financing (Column 1). Bulkier investments are likely to require some form of external financing, which emphasises the importance of making such financing opportunities readily available to firms. Nevertheless, we find that larger, more productivity, and cash-rich

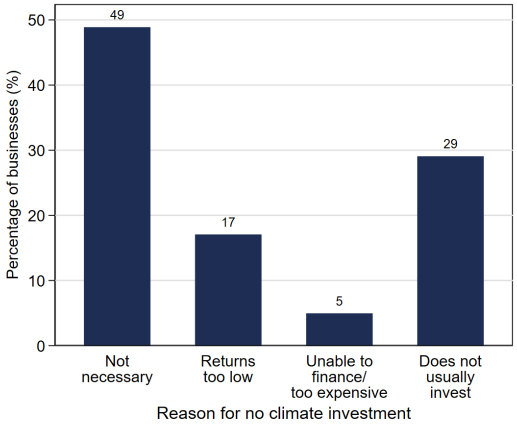
some positive climate investment over the next three years. An alternative specification which assigns zeros to the dependent variables for firm which expect no impact or negative impact of climate change on investment yields similar results.

Figure 6: Climate finance and reasons for no climate investment

(a) Ways of financing climate and total investments



(b) Reasons for no climate investment



Notes: Panel A is based on responses to the questions: "How do you expect to finance your climate change-related capital expenditure over the next three years?" and "How do does your business typically finance its capital expenditure?" Panel B is based on 1,195 responses to the question: "Which of the following best explains why you do not expect to make any additional capital expenditure related to climate change over the next three years?"

(measured by cash/assets in firm accounts) firms are more likely to rely on internal cash reserves for climate investments (Column 1). In contrast, smaller, less productive, and cash-poor firms are more likely to use bank borrowing for climate investments (Column 2). We do not find any strong correlates with bond/equity financing, but note that this source was very rare, and only selected by around 2% of respondents.

(Table 4)

Finally, firms which expected no climate-related investment (or a negative impact) over the next three years were asked a follow-up question about the reasons why no such investments were planned. Firms could select one of four answers: (i) no climate investment necessary; (ii) returns from climate investments too low; (iii) unable to finance/finance is too expensive; or (iv) firm does not typically make climate investments. In total, 1,195 firms answered this question. Figure 6, Panel B summarises the main results. The majority of firms reported either that climate investments were not necessary (49%) or that they do not usually invest (29%). Only 5% of firms report that they would like to make climate-related investments but cannot afford to do so. These were predominantly small firms with less than 50 employees, who in any case

account for a small share of overall investment (Figure A11). Finally, around 17% of firms reported that they found the returns to climate-related investments too low.

(Table 5)

In Table 5 we explore the determinants of the reasons for no climate investment in more detail, using a similar set of covariates as before. The dependent variable across all columns is an indicator taking a value of one if a firm reports they cannot afford to make climate investments, or the returns are too low. Thus, the reference category is firms which do not typically make capital investments and those which do not think climate investments are necessary. A number of interesting correlations appear from this table. Firms with higher debt, lower profitability, and lower labour productivity are all more likely to report climate investments are too expensive or have too low a return. Financially constrained firms are also significantly more likely to cite these reasons for why they are not making climate investments. The coefficient in Column 5 suggests being financially constrained increases the likelihood by 0.1 percentage points, or around 50% from the mean, a quantitatively meaningful effect. Finally, in Column 6 we also show that higher energy costs are associated with a higher likelihood of finding climate investment too expensive or the returns too low.

4 Climate-related uncertainty

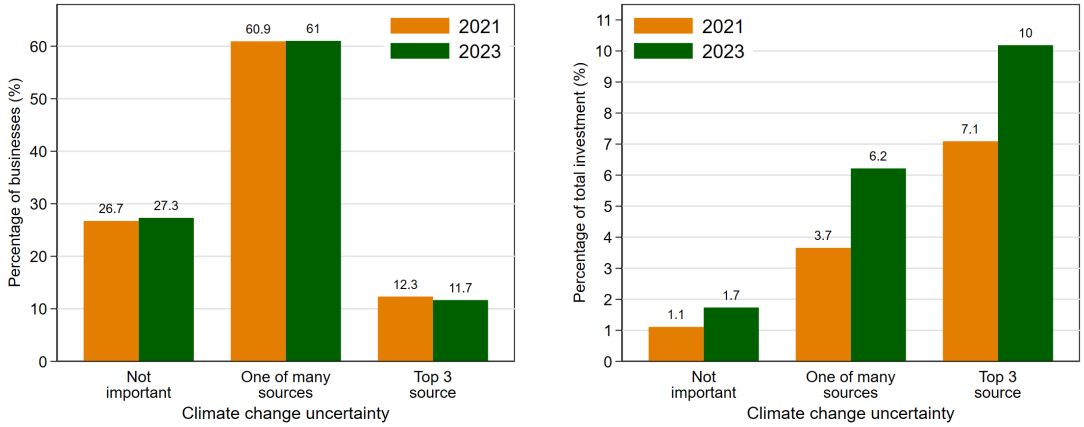
In addition to questions about climate investments, firms in the DMP survey were asked about climate change as a source of uncertainty for their business. Importantly, when asked about climate uncertainty, firms were asked to consider both the physical risks and climate-related policies.[24] This question was asked in both 2021 and 2023. On average, climate uncertainty has remained remarkably stable over the past two years (Figure 7, Panel A). The majority (around 60%) consider climate change as one of many sources, whereas around 12% of businesses consider it a top 3 source of uncertainty.

[24]The policy impact was a common way firms expected climate change to affect their business, cited in around 20% of comments (Figure A3). For example, one respondent stated that, "government mandated or led emissions reductions initiatives will mean we need to install more energy efficient infrastructure eg led lighting."

Figure 7: Climate-related uncertainty

(a) Climate change as a source of uncertainty

(b) Climate uncertainty and expected climate investment



Notes: Climate change as a source of uncertainty is based on the question: "How important is climate change – both the effects of physical risks and climate-related polices – as a source of uncertainty for your business?" This question was asked both in 2021 and 2023.

Although the results from Panel A suggest uncertainty has not changed much, there is some heterogeneity in these numbers at the industry level (Figure A10): more firms in Other Production and Wholesale and Retail consider climate change a top 3 source of uncertainty in 2023 versus 2021. Meanwhile, the shares have decreased in the Transport & Storage and Real Estate sectors. Higher energy intensity (both industry energy costs and GHG emissions) is positively associated with higher climate uncertainty.

Climate uncertainty is important insofar as it affects firms' climate investment plans. In Figure 7, Panel B we consider the relationship between these two variables, again separating the results for 2021 and 2023. In both years, climate uncertainty has had a strong positive impact on expected climate investment. This relationship has strengthened in 2023; firms which consider climate a top 3 source of uncertainty in 2023 expect climate-related investments of around 10% over the next three years, compared with 7% when asked in 2021. Therefore, although the level of climate uncertainty has remained unchanged, uncertainty is now associated with higher climate investment across all categories.

The positive relationship between climate uncertainty and expected climate investment may appear at odds with the conventional wisdom that uncertainty is associated with 'wait-and-see' dynamics and lower investment (e.g. Bernanke, 1983;

Bloom, 2009). Fuchs et al. (2024) also show higher climate uncertainty (measured in financial markets) is associated with lower decarbonisation investment. However, past research has highlighted that positive effects of uncertainty are also possible. For example, Bar-Ilan and Strange (1996) show that when there are lags in investment realisations, higher uncertainty may have a positive effect on investment.[25] In the context of climate uncertainty, Basaglia et al. (2021) also note that positive effects are possible, depending on the source of the uncertainty shock.[26]

5 Conclusions

The transition to a green economy will require large investments by firms. These will be needed in numerous areas, including transitioning to green energy sources, adapting to the physical impacts of climate change, and R&D in new technologies. However, data on the magnitudes of these investments expected by firms are still scarce. It is also not well-known how businesses expect to finance these investments, and whether there are specific constraints which may affect how much they can invest. This paper presents new findings from a large survey of UK businesses on firms' climate investment, the types of investment, and expected sources of financing. Firms expect their climate-related capital expenditure to increase over the next three years relative to investments over the past three years. This investment will be driven primarily by larger firms and those with high energy input costs. Although firms expect to finance these expenditures mainly using internal cash reserves, financial constraints (e.g. cost and availability of financing) as well as expected interest rates are shown to be important predictors of climate investment intentions. Overall, despite higher expectations over the medium term, climate-related investments remain lower than the targets estimated by the Climate Change Committee's Balanced Net Zero Pathway.

[25] See Bloom (2014) for a further discussion on the effects of uncertainty on investment behaviour.

[26] However, it is also possible that the measure of climate uncertainty is conflating a first-moment effect (firm exposure to climate change) as well as a second-moment effect (increased variability of expected outcomes regarding climate change). This would be another explanation for the positive relationship with expected climate investment.

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6 Tables

Table 1: Determinants of expected climate investment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:	Expected climate investment						
Sample:	2023						2021/2023
Realised climate investment	0.735***	0.720***	0.755***	0.730***	0.691***	0.748***	
	(0.039)	(0.043)	(0.043)	(0.044)	(0.064)	(0.039)	
ln(Employment)	0.737***	0.681***	0.629***	0.575***	0.496***	0.756***	0.738***
	(0.117)	(0.127)	(0.130)	(0.135)	(0.163)	(0.112)	(0.093)
=1 Listed	-1.661						
	(1.077)						
Expected total investment growth		0.005**					
		(0.002)					
ln(Labour Productivity)			-0.001				
			(0.224)				
Profit margin				0.026**			
				(0.013)			
Expected year-ahead borrowing rate					-0.176*		
					(0.095)		
Industry energy costs						0.435***	
						(0.091)	
Industry energy costs X 2021							0.308***
							(0.091)
Industry energy costs X 2023							0.562***
							(0.100)
Constant	-0.367	0.063	0.396	0.464	1.848*	-1.773***	-1.003**
	(0.491)	(0.568)	(1.109)	(0.629)	(1.020)	(0.503)	(0.449)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	No	No
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.303	0.295	0.316	0.312	0.287	0.296	0.036
Observations	2,098	1,628	1,444	1,354	818	2,094	3,996
Mean of Dependent Variable	3.894	4.389	4.872	4.970	4.169	3.904	3.412
Test coefficients equal (p-value)							0.056

Notes: The dependent variable in all columns is the expected climate investment, as a percentage of total firm investment. The coefficients are estimated using OLS. Robust standard errors are reported in parentheses, stars indicate *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 2: Determinants expected additional climate investment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:	Percentage additional expected climate investment						
Sample:	2023						
Expected climate investment	0.399***	0.454***	0.373**	0.405***	0.395**	0.269	0.389**
	(0.154)	(0.174)	(0.177)	(0.154)	(0.166)	(0.237)	(0.152)
ln(Employment)	1.189	0.299	0.055	1.429*	1.705**	0.973	1.336*
	(0.766)	(0.861)	(0.934)	(0.753)	(0.824)	(1.123)	(0.724)
=1 Listed	8.830						
	(8.142)						
ln(Labour Productivity)		2.584					
		(1.686)					
Profit margin			0.228**				
			(0.102)				
Debt/Assets Ratio				-0.105**			
				(0.052)			
=1 Financially Constrained					-13.715***		
					(3.026)		
Expected year-ahead borrowing rate						0.052	
						(0.602)	
Industry energy costs							0.709
							(0.519)
Constant	43.278***	38.591***	48.870***	44.421***	52.024***	45.699***	40.631***
	(3.895)	(8.636)	(5.126)	(3.940)	(4.842)	(7.477)	(4.048)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	No
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.027	0.029	0.032	0.031	0.055	0.048	0.015
Observations	907	701	662	899	760	388	907
Mean of Dependent Variable	53.241	55.492	56.073	53.337	53.184	53.351	53.241

Notes: The dependent variable across all columns is the percentage of climate spending firms expect to be in addition to normal capital expenditure, as opposed to offset by lower spending elsewhere. The regressions are based only on the sub-sample of firms which expect to make some positive climate investments over the next three years. The coefficients are estimated using OLS. Robust standard errors are reported in parentheses, stars indicate *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 3: Determinants of different sources of climate investment

Dependent variable:	(1) =1 Switch to green energy	(2) =1 Energy efficiency	(3) =1 R&D in green tech	(4) =1 Carbon capture	(5) =1 Adapt to physical impacts
Sample:			2023		
Expected climate investment	0.002	-0.001	-0.000	-0.002	-0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Realised climate investment	-0.004*	-0.005*	0.003	0.004*	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
ln(Employment)	0.013	0.013	-0.008	-0.012	0.003
	(0.010)	(0.011)	(0.009)	(0.008)	(0.008)
=1 Listed	0.060	-0.080	0.137	-0.114*	0.024
	(0.063)	(0.083)	(0.094)	(0.060)	(0.095)
ln(Labour Productivity)	-0.024	-0.066***	0.017	0.049***	-0.010
	(0.021)	(0.021)	(0.017)	(0.016)	(0.017)
Number of other factors selected	0.172***	0.200***	0.215***	0.183***	0.194***
	(0.015)	(0.016)	(0.013)	(0.015)	(0.014)
Constant	0.623***	0.730***	-0.087	-0.198**	-0.008
	(0.105)	(0.108)	(0.083)	(0.080)	(0.082)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
R^2	0.226	0.233	0.332	0.306	0.261
Mean of dependent variable	0.790	0.720	0.197	0.140	0.191
Observations	701	701	701	701	701

Notes: The regressions are based only on the sub-sample of firms which expect to make some positive climate investments over the next three years. The coefficients are estimated using OLS. Robust standard errors are reported in parentheses, stars indicate *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 4: Determinants of sources of climate finance

Dependent variable:	(1) =1 Climate Finance Cash	(2) =1 Climate Finance Borrowing	(3) =1 Climate Finance Bond/Equity
Sample:		2023	
Expected climate investment	-0.005***	0.003	0.001
	(0.002)	(0.002)	(0.001)
ln(Employment)	0.022**	-0.030***	0.001
	(0.010)	(0.010)	(0.005)
=1 Listed	-0.039	0.054	0.061
	(0.086)	(0.061)	(0.074)
ln(Labour Productivity)	0.071***	-0.049**	0.002
	(0.022)	(0.021)	(0.015)
Profit margin	-0.000	0.001	-0.000
	(0.001)	(0.001)	(0.001)
Cash/Assets Ratio	0.004***	-0.004***	0.000
	(0.001)	(0.001)	(0.000)
Number of other sources selected	0.169***	0.592***	0.079***
	(0.024)	(0.036)	(0.028)
Constant	0.433***	0.503***	-0.017
	(0.110)	(0.111)	(0.067)
Industry fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
R^2	0.117	0.437	0.091
Mean of dependent variable	0.861	0.250	0.022
Observations	641	641	641

Notes: The regressions in Columns 1-3 are based only on the sub-sample of firms which expect to make some positive climate investments over the next three years. The coefficients are estimated using OLS. Robust standard errors are reported in parentheses, stars indicate *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 5: Reasons for no climate investments

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:	=1 Climate investment too expensive/returns too low					
Sample:	2023					
ln(Employment)	0.002	0.002	0.017*	-0.001	0.004	0.002
	(0.007)	(0.008)	(0.009)	(0.009)	(0.008)	(0.008)
Debt/Assets Ratio		0.001*				
		(0.001)				
Profit margin			-0.003***			
			(0.001)			
ln(Labour Productivity)				-0.046***		
				(0.015)		
=1 Financially Constrained					0.103***	
					(0.024)	
Industry energy costs						0.023***
						(0.007)
Constant	0.183***	0.168***	0.139***	0.383***	0.113***	0.121***
	(0.030)	(0.031)	(0.040)	(0.076)	(0.035)	(0.035)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	No
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.042	0.046	0.061	0.053	0.064	0.010
Mean of dependent variable	0.191	0.191	0.182	0.192	0.194	0.190
Observations	1,191	1,185	692	743	1,016	1,187

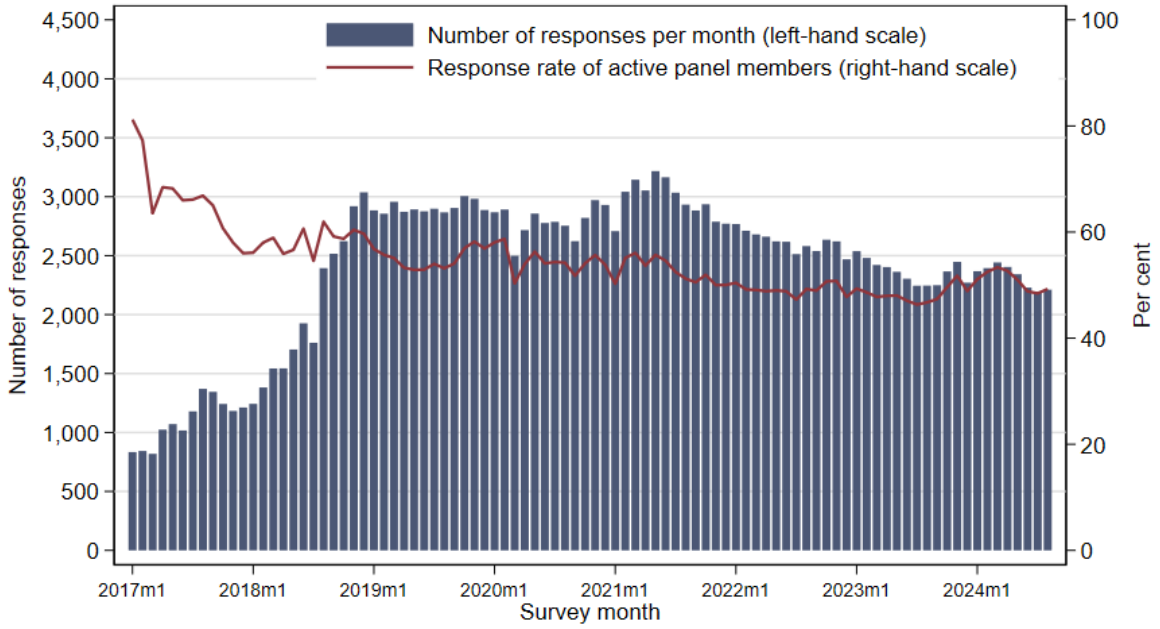
Notes: The results in Columns 1-6 are based on the sub-sample of firms which expect no impact of climate change on their investment (or a negative impact) over the next three years. The coefficients are estimated using OLS. Robust standard errors are reported in parentheses, stars indicate *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Appendix
Firm climate investment: A glass half-full

September 2024

A Figures

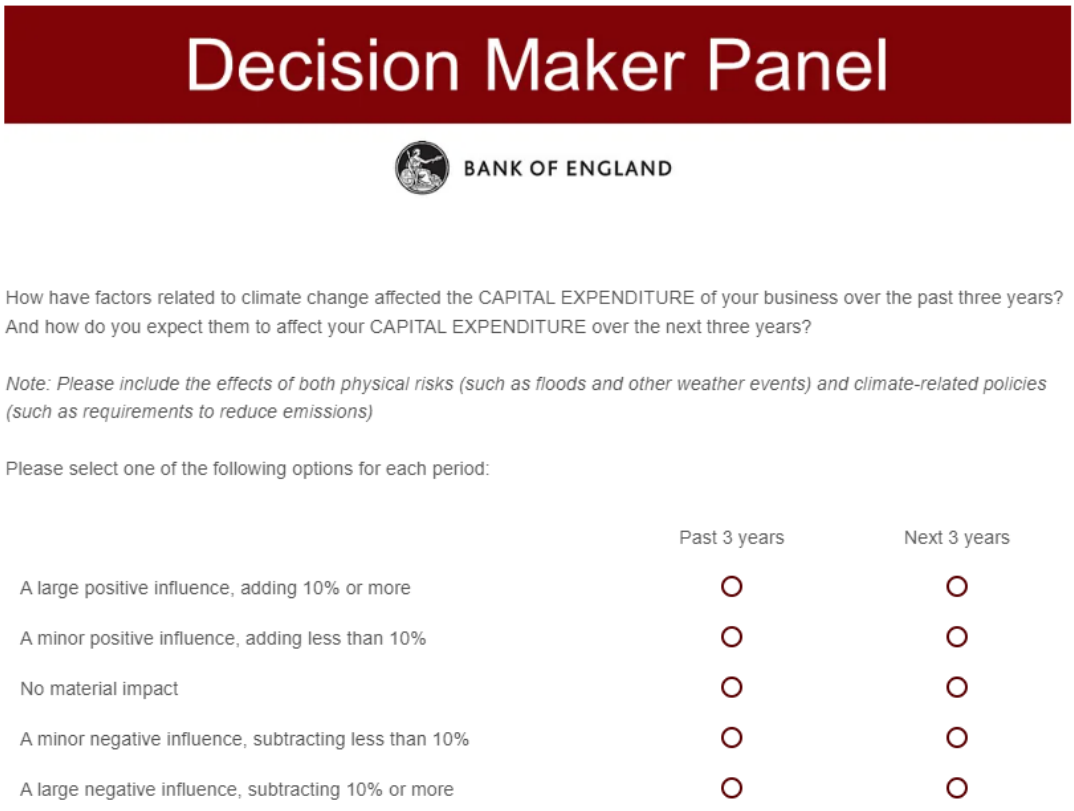
Figure A1: DMP response rate



Notes: The response rate of active panel members is calculated as the percentage of panel members who had completed at least one survey over the last 12 months who responded to the survey in a given month.

Figure A2: Main climate investment questions in the Decision Maker Panel

(a) Realised and expected impact of climate change on investment



(b) Share of climate investment expected to be additional

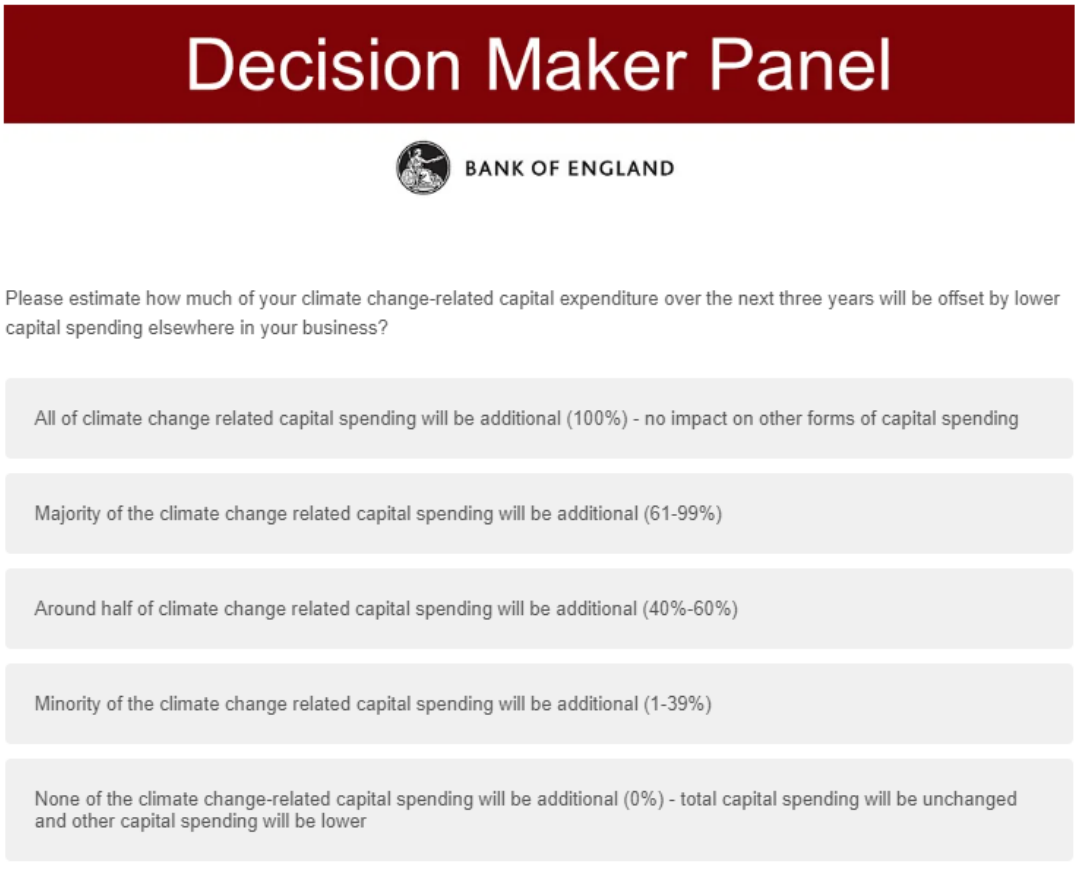
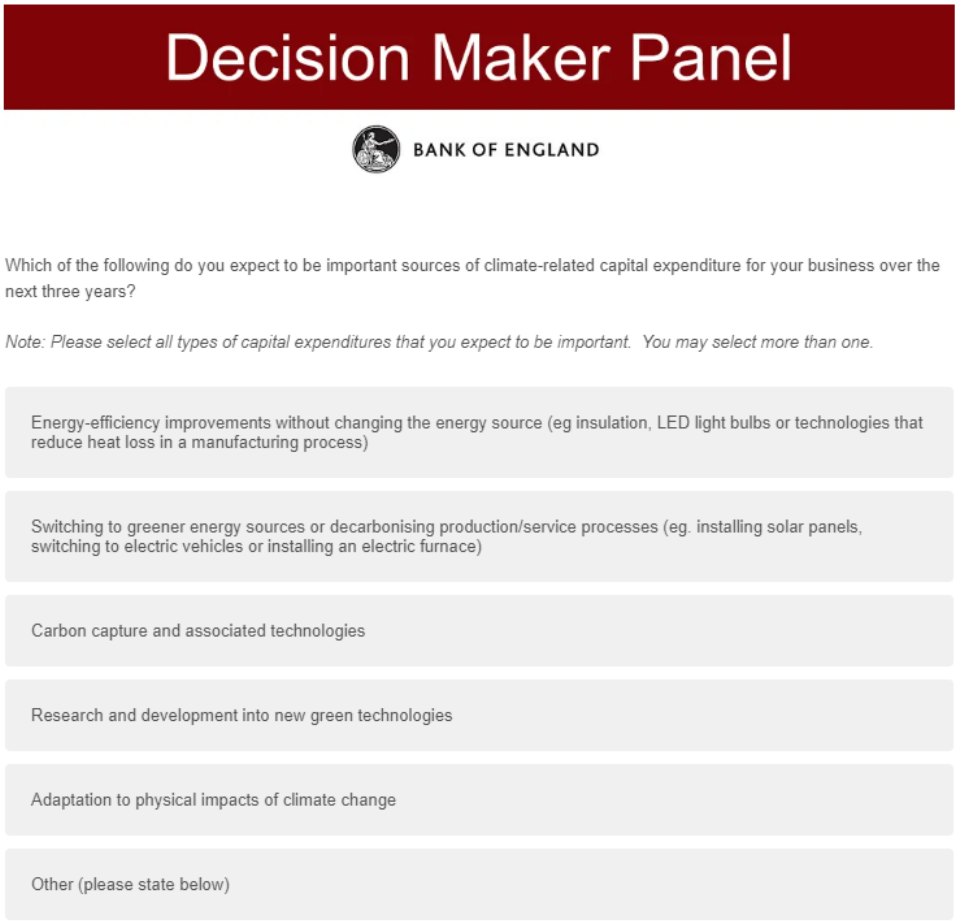


Figure A2: Main climate investment questions in the Decision Maker Panel (continued)

(c) Types of climate-related investment



(d) Sources of climate investment financing

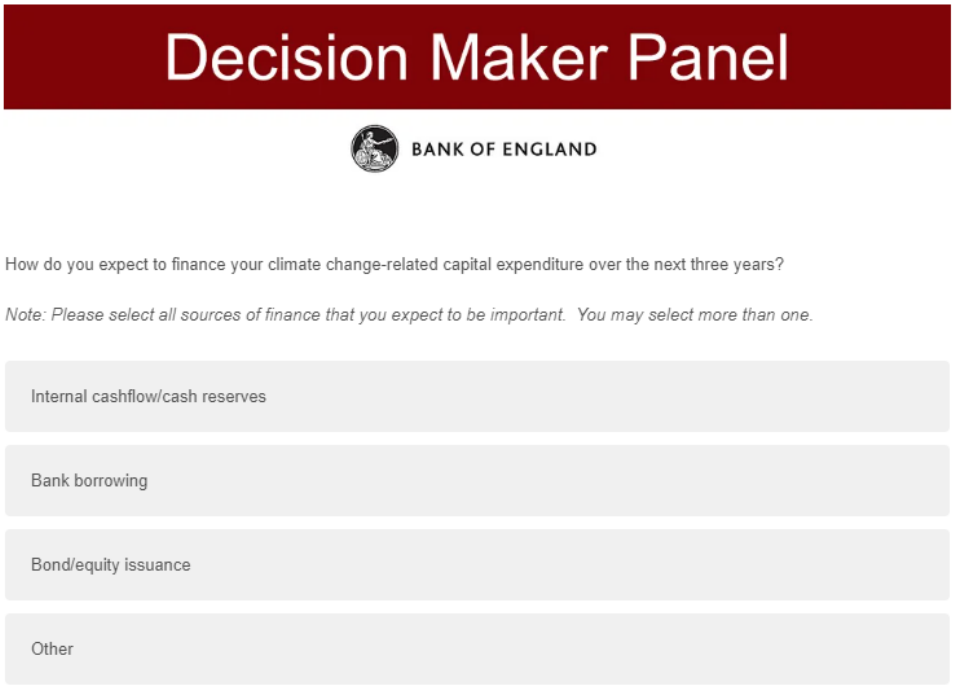


Figure A2: Main climate investment questions in the Decision Maker Panel (continued)

(e) Climate change as a source of uncertainty

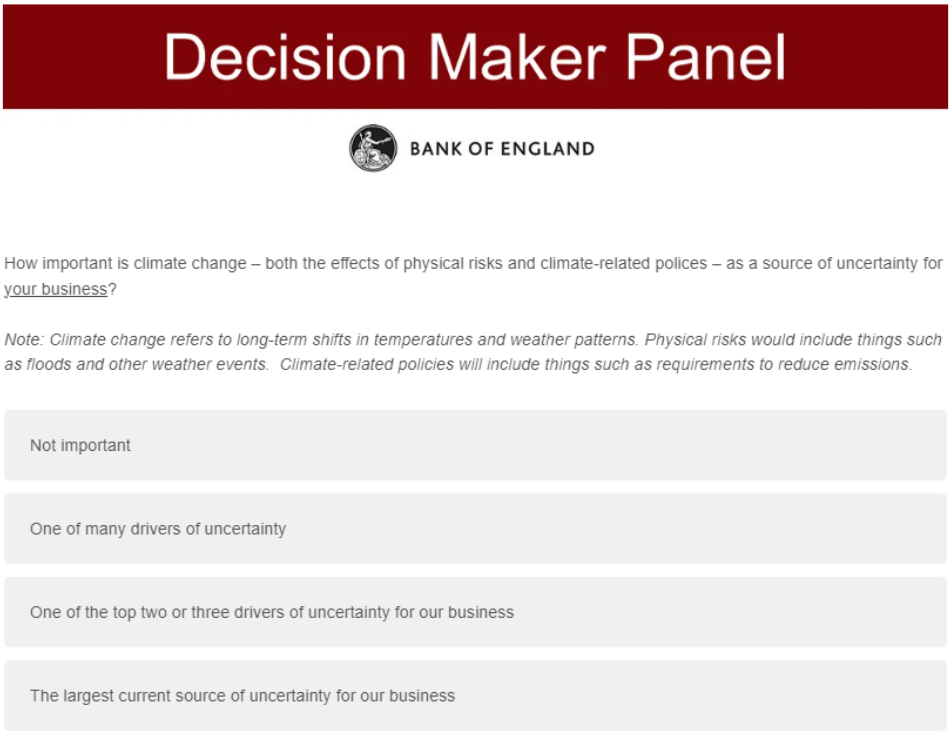
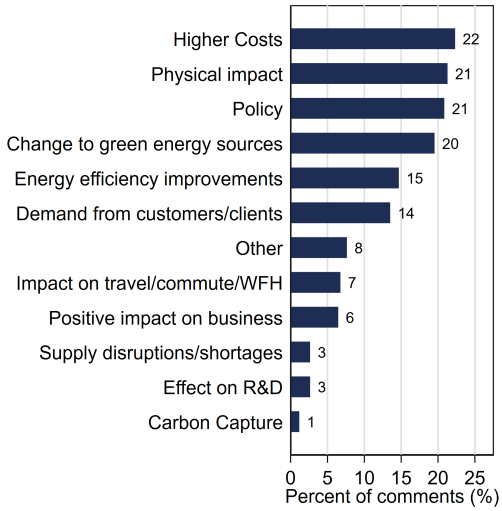


Figure A3: Effect of climate change on firms

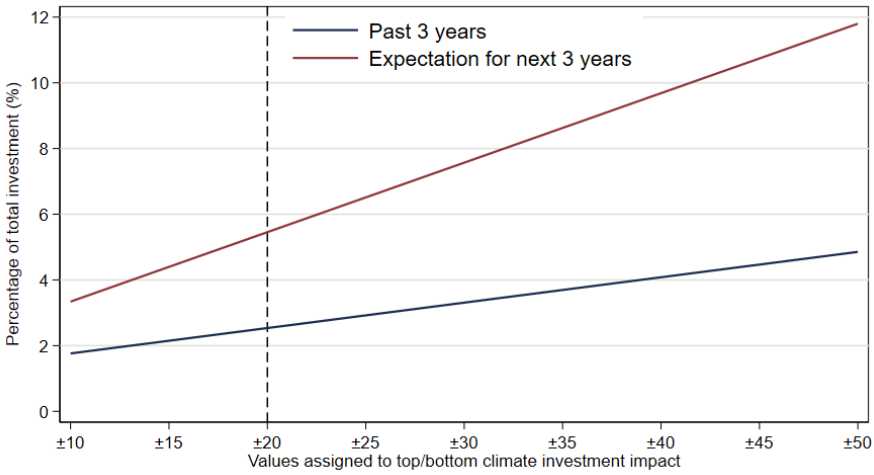
(a) Word cloud of most common terms

(b) Distribution by category



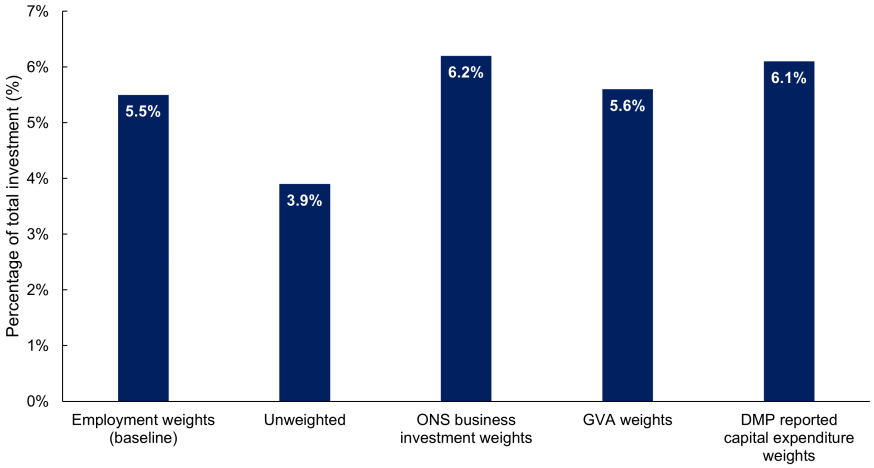
Notes: The results in Panels A and B are based on 681 responses to the question: "In your own words, what are the main ways that you expect climate change to affect your business over the next three years?" This question was optional and was asked between August and October 2023. The categories in Panel B are manually constructed. Comments can be assigned to more than one category, so the percentages do not sum to 100.

Figure A4: Realised and expected climate investment estimates: Sensitivity to alternative top/bottom coding assumptions



Notes: This figure presents estimates of realised and expected climate investment in 2023 for alternative assumptions on the 'large positive impact' and 'large negative impact' categories, as presented in Figure 1. The vertical dashed line corresponds to ±20%, which is the value assigned in our empirical analysis.

Figure A5: Expected climate investment estimates: Sensitivity to alternative weighting



Notes: This figure presents estimates of expected climate investment in 2023 for alternative weighting schemes. 'Employment weights' refers to the baseline industry employment weights, also adjusting for small/large firms within industry. 'Unweighted' refers to a simple average across all firms. 'ONS business investment' weights are based on 2023 business investment shares by industry using ONS data, also adjusting for small/large firms within industry by employment. 'GVA weights' are based on 2023 gross value added shares by industry using ONS data, also adjusting for small/large firms within industry by employment. 'DMP reported capital expenditure' weights are based on the three-year average reported capital expenditure data for each firm, capped at the 90th percentile to control for outliers.

Figure A6: Expected climate-related capital expenditure: 2021 vs 2023

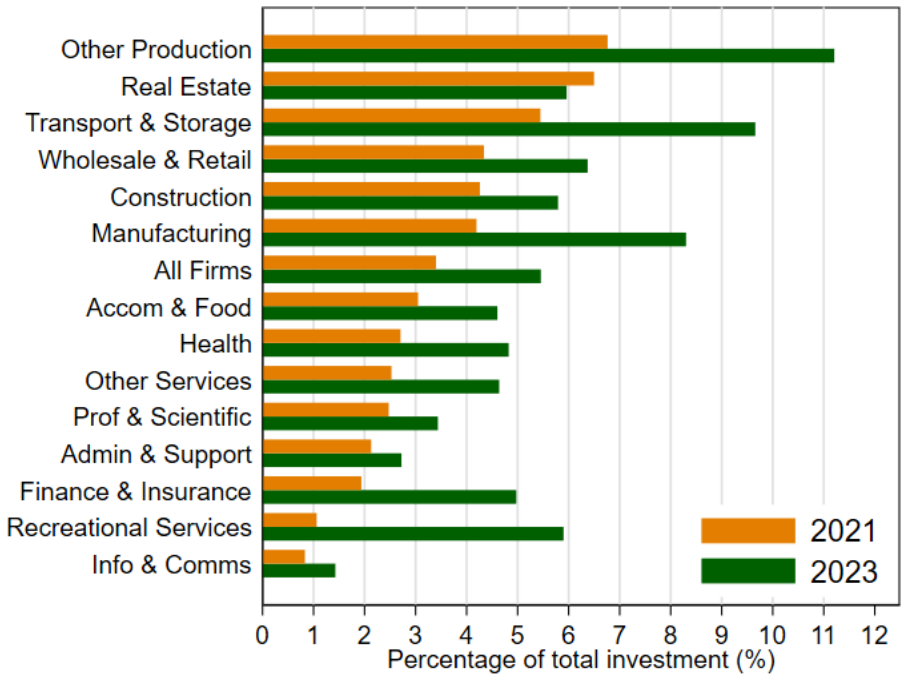
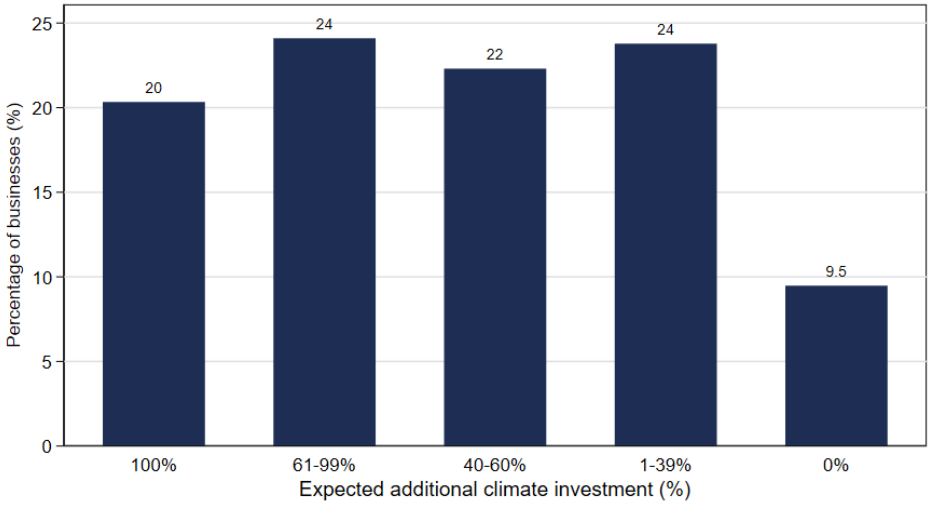
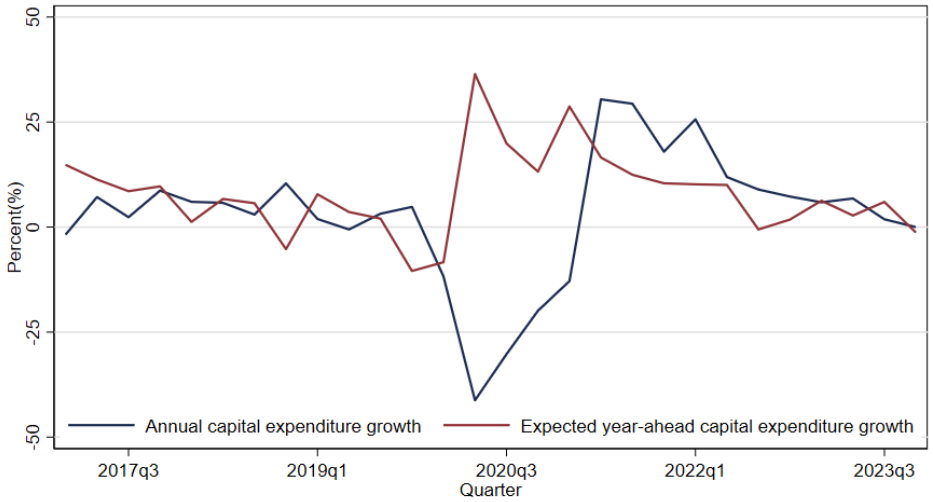


Figure A7: Share of expected climate investments expected to be additional



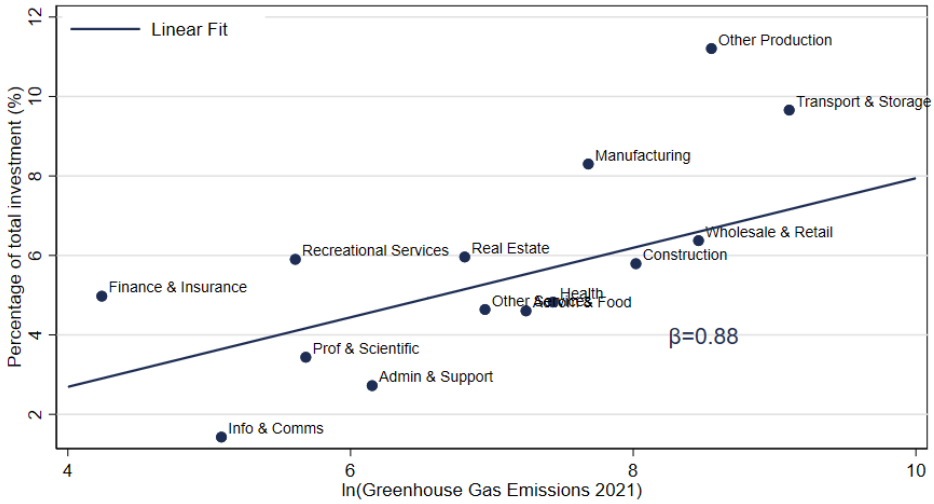
Note: This figure is based on 913 responses to the question: "Please estimate how much of your climate change-related capital expenditure over the next three years will be offset by lower capital spending less elsewhere in your business?" This question was only asked to firms which expect a positive impact of climate change on their capital expenditure over the next three years.

Figure A8: Realised and expected total capital expenditure growth



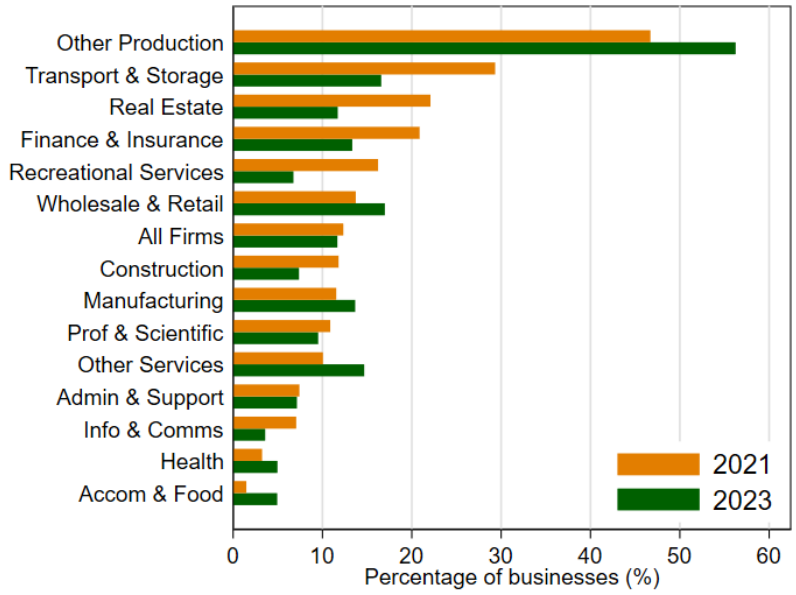
Notes: The figure shows annual total capital expenditure growth and expected year-ahead total capital expenditure growth at the quarterly frequency. The horizontal axis are the reference periods for the questions on capital expenditure.

Figure A9: Expected climate investments and greenhouse gas emissions



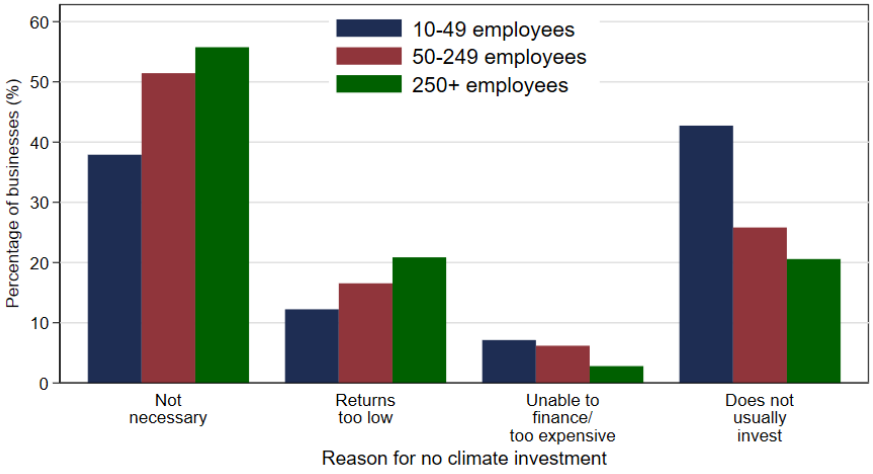
Notes: This figure shows the relationship between expected climate investment and industry-level greenhouse gas (GHG) emissions, based on data from the Office for National Statistics.

Figure A10: Climate-related uncertainty by industry: 2021 vs. 2023



Notes: This figure is based on responses to the question: "How important is climate change – both the effects of physical risks and climate-related polices – as a source of uncertainty for your business?" This question was asked both in 2021 and 2023. The figure shows the percentage of businesses which report climate change as either the largest or a 'top 3' source of uncertainty by industry.

Figure A11: Reasons for no climate related investment: Heterogeneity by firm size



Notes: This figure is based on responses to the question: "Which of the following best explains why you do not expect to make any additional capital expenditure related to climate change over the next three years?" This question was only asked to firms which expect climate change to have no impact or a negative impact on their capital expenditure over the next three years.

B Tables

Table A1: Determinants of realised climate investment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:	Realised climate investment past three years						
Sample:	2023						
ln(Employment)	0.348***	0.284***	0.243**	0.272***	0.245*	0.128	0.384***
	(0.088)	(0.097)	(0.097)	(0.099)	(0.128)	(0.153)	(0.083)
=1 Listed	-0.625						
	(0.825)						
Annual total investment growth		-0.000					
		(0.002)					
ln(Labour Productivity)			0.123				
			(0.208)				
Profit margin				0.006			
				(0.012)			
Current borrowing rate					-0.020		
					(0.070)		
Expected climate investment 2021						0.204***	
						(0.045)	
Industry energy costs							0.157**
							(0.068)
Constant	0.436	0.988**	0.606	0.904*	1.095	0.969	-0.166
	(0.372)	(0.448)	(1.047)	(0.504)	(0.812)	(0.694)	(0.390)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	No
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.027	0.026	0.026	0.030	0.033	0.085	0.013
Observations	2,098	1,582	1,444	1,354	818	722	2,094
Mean of Dependent Variable	1.821	2.190	2.188	2.201	1.980	2.140	1.834

Notes: The coefficients are estimated using OLS. Robust standard errors are reported in parentheses, stars indicate *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.