Inflation and the Carbon Premium

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Abstract: This paper explores the link between inflation and the carbon premium of U.S. listed companies. Prior evidence has established that investors demand a return premium for stocks of companies with higher (direct and indirect) carbon emissions. We find new evidence that this carbon premium is higher in the presence of energy price inflation. For values of energy CPI equal to the sample mean, a one-standard deviation change in direct emissions is associated with a 2 percentage-point higher annual return premium, and this return premium increases by 44% when aggregate energy prices are higher by one standard deviation of their in-sample distribution.

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1. Introduction

A growing number of studies has found that a widespread and significant carbon premium has emerged, especially following the landmark Paris Climate Agreement of 2015. This carbon premium is generally interpreted as reflecting the compensation that investors increasingly demand for their exposure to carbon transition risk or their stronger preferences for green stocks. In the post-COVID years, however, there has been a backlash against the sustainable investment movement and ESG-related funds have seen interest by investors wane, with significant outflows from these funds in recent years.[1] Some commentators have even suggested that ESG was a fad that had run its course.[2]

This backlash has coincided with a return of inflation, as global economic activity has surged following the COVID lockdowns. There were multiple causes to this resurgence of inflation, one of which being the rise in energy prices following the Russian invasion of Ukraine. As a direct consequence of this energy price shock, profits of brown energy companies have reached record levels in 2022,[3] and the oil and gas industry has responded by postponing any planned decarbonization.[4] In contrast, the valuation of renewable energy companies (Ørsted, Enel) has declined, partly as a result of the expected rise in interest rates to combat inflation. A natural question, therefore, is whether the fading interest in ESG may be due to inflation. Is the revived interest in brown companies driven by the energy price shock? If so, then this interest could be short-lived, and could, in turn, vanish when energy prices revert to mean.

In this paper we undertake the first systematic analysis of how inflation impacts carbon transition risk by looking at how inflation is associated with the carbon premium in the cross-section of listed U.S. companies over the period 2005-2022. We distinguish between core inflation, as measured by changes in the core consumer price index (core CPI), and energy price inflation (the energy component of the CPI). One plausible hypothesis is that inflation, by boosting valuation of brown companies, negatively impacts the carbon premium. An alternative hypothesis is that energy price inflation, by raising the energy costs of brown companies, reduces their valuation, and thereby positively impacts the carbon premium. A third hypothesis is that the higher interest rates that inevitably follow the rise of inflation reduce the growth rate of green firms, increase their discount rates, and lower their valuation. As some

[1] Brooke Masters and Patrick Temple-West "The real impact of the ESG backlash," *Financial Times*, 4 December 2023.
[2] See for example Aswath Damodaran, "ESG is beyond redemption: may it RIP," *Financial Times* October 23, 2023.
[3] Oliver Milman 'Monster profits' for energy giants reveal a self-destructive fossil fuel resurgence, *The Guardian*, 9 February 2023
[4] Myles McCormick, Jamie Smyth and Amanda Chu "Oil executives talk down rapid shift to green energy as profits boom," *Financial Times*, 27 March 2024

have argued, a fourth hypothesis is that inflation raises the development costs of green companies and lowers their capital expenditures.[5] Our analysis sheds light on which of these hypotheses is more plausible.

A common observation is that stocks provide a hedge against inflation. For example, Fama (1981) has argued that earnings rise with inflation, so that stock returns are negatively correlated with inflation. More recent evidence, however, paints a more nuanced picture. Fang, Liu, and Roussanov (2022), for example, while confirming the negative relation between core inflation and stock returns, also find that stock returns are positively related with energy-price inflation. Following Fang, Liu, and Roussanov (2022), we also distinguish between core and energy-price inflation, as these are likely to have different effects on carbon-transition risk. However, the question we address is different from the macroeconomics and asset pricing literature that is concerned with the pricing and hedging of inflation risk. The question we focus on is the effect of price rises on the carbon premium, defined as the risk compensation associated with carbon-transition risk exposure proxied by the level of carbon emissions.

The standard carbon premium regression model estimates the relation between expected returns and lagged carbon emissions, controlling for key company characteristics, together with industry-time (or firm) fixed effects (see Bolton and Kacperczyk, 2021). To measure the effects of inflation on the carbon premium, we add to this specification an interaction term between carbon emissions and inflation. If the coefficient of this interaction term is positive and significant then we conclude that inflation increases the carbon premium, and if the coefficient is negative then we conclude that brown company stocks are a hedge against inflation. We look at both direct and indirect emissions, distinguishing between four different emission categories, scope 1, scope 2, upstream scope 3, and downstream scope 3 (we have comprehensive data for these latter emissions only over part of our sample period). As for our inflation variables, we consider both the core CPI and the energy component of the CPI. Note that in our main specification we interact the (demeaned) level of emissions with the price level. That is, we focus on the effects of price-level shocks (rather than inflation shocks per se) because shocks to the price level are more persistent and have a long-term impact on cash-flows.

[5] See Rachel Millard and Mari Novik "European utilities cut renewable targets as high costs and low power prices bite," *Financial Times* 19 May 2024

Our key finding is that energy price significantly increases the carbon premium, after controlling for firm characteristics, industry-time, and firm fixed effects. When energy CPI is at the sample average, a one-standard deviation change in direct emissions (scope 1 and 2 emissions) is associated with a 2.05 percentage point higher annual return premium (the carbon premium). And when energy CPI is higher by one standard deviation, the return premium increases by 44% to 2.97%. We find a similar effect of energy price on the carbon premium associated with indirect emissions (scope 3 upstream and downstream emissions). Thus, when looking at within-sector variations in carbon emissions across firms, we find that energy price inflation, far from dampening firm-level carbon transition risk exposures, actually exacerbates them. In contrast, we find no significant effect of general (or core) inflation on the carbon premium.[6]

These findings confirm the hypothesis that positive energy price shocks increase carbon-transition risk, on average. The more a company is exposed to carbon-transition risk through its emissions the more the carbon premium is affected by energy price shocks. Companies with higher emissions are obviously more dependent on fossil fuels, and therefore are more exposed to energy price shocks. Thus, the surge in energy prices following the invasion of Ukraine by Russia, far from being a bell toll for ESG, has worsened carbon-transition risk for brown companies. This effect has been overshadowed by the attention given to the rise in profits of fossil fuel energy companies. Any energy price increase, however, is a cost increase for fossil-fuel dependent companies, which exposes them to greater carbon-transition risk.

We further examine the positive relationship between energy price inflation and the carbon premium by exploring several alternative specifications. First, we find that the cross-sectional results are not due to differential responses of companies with different carbon footprint to surprises in earnings announcements. Second, we find that the conditional carbon premium cannot be explained by shocks to oil supply, monetary surprises, U.S. dollar exchange rate, and inflation innovations. Third, we show that the relationship between energy price inflation and the carbon premium is robust when we split our sample into before and after COVID subsamples. This latter finding suggests that our results are not driven by possible weakening climate concerns post COVID, as some have suggested (see e.g., Baker, Egan, and Sarkar, 2022). This interpretation is further supported by our finding that there is no significant difference in coefficients of the interaction term before and after the Paris Climate

[6] There is a positive impact, but it is not economically or statistically significant.

Agreement of 2015. Moreover, more directly, we show that the main effect cannot be explained by investors' flows into U.S. sustainable funds, both across all asset categories and their stock subset.

Finally, we explore what are the likely economic forces underlying the effect of energy price inflation on the carbon premium. Two natural alternative explanations are first, that higher energy prices are associated with lower cash-flows for companies with high exposures to fossil fuel energy price shocks, and second that higher energy prices are associated with higher discount rates. Our findings are consistent with the latter explanation. Indeed, we find that companies with higher emissions are on average associated with higher energy price betas, which suggests that capital markets price these companies at discount rates in response to an energy price shock. We further find that companies with higher scope 1 emissions generate lower sales and invest less in periods of high energy price inflation. The results for indirect emissions are less conclusive. Finally, we find that higher emissions (both direct and indirect) predict higher future profitability twelve months forward (but not in three months forward) when energy price inflation is higher. Following Novy-Marx (2013), when we combine this latter finding with our earlier result that firms with higher emissions are also associated with higher expected returns (following a positive energy price shock), we conclude that brown firms are, in effect, seen by investors as a form of growth stock.

Related literature. This paper contributes mainly to the growing literature on the asset-pricing implications of carbon-transition risk (e.g., Bolton and Kacperczyk, 2021; 2023; Bolton, Halem, Kacperczyk, 2022; Sautner et al., 2023; and Aswani, Raghunandan, and Rajgopal, 2023). Compared to the earlier studies, we show evidence that energy price inflation can exacerbate carbon premium for an average brown company. To our knowledge, this is the first paper to undertake such an analysis.

Our study also contributes to the literature on the asset-pricing implications of inflation, particularly the energy component of inflation. Most of the studies in this literature focus on aggregate, market-level returns and bond prices (for more details, see the recent survey by Cieślak and Pflueger, 2023). The literature on stock returns is somewhat small, especially taking the cross-section of returns. Here, Chen, Roll, and Ross (1986) were the first to study the unconditional inflation premium in stock returns. Boons, Duarte, de Roon, and Szymanowska (2020) stress the importance of estimating inflation betas conditionally by estimating it across various industry sectors. Fang, Liu, and Roussanov (2022) study the impact of inflation risk on returns across various broadly defined asset classes and point out to significant differences between the core inflation and energy inflation. Our study makes three significant contributions here. First, we focus on the inflation effects in the cross-section of

individual companies. More importantly, our study examines the interaction between core/energy prices and carbon-transition risk, thereby blending the insights from the two independently studied streams of literature. On the methodology side, our specification allows us to absorb a significantly richer variation in the data, potentially reflecting other confounding time-varying macroeconomic confounders, by utilizing both industry-time and firm fixed effects, none of which are feasible in the context of using aggregate or industry-level data.

Finally, we also contribute to the literature on the economic mechanisms driving the carbon premium/greenium, which typically distinguishes between risk-based (Bolton and Kacperczyk, 2021; 2023), and preference-based explanations (Pastor, Stambaugh, and Taylor, 2022; Zerbib, 2022). Our finding that the carbon premium increases in times of energy price inflation suggest that risk-based explanations are more consistent with the evidence. Moreover, this result is not a simple reflection of monetary shocks or supply effects in the energy markets.

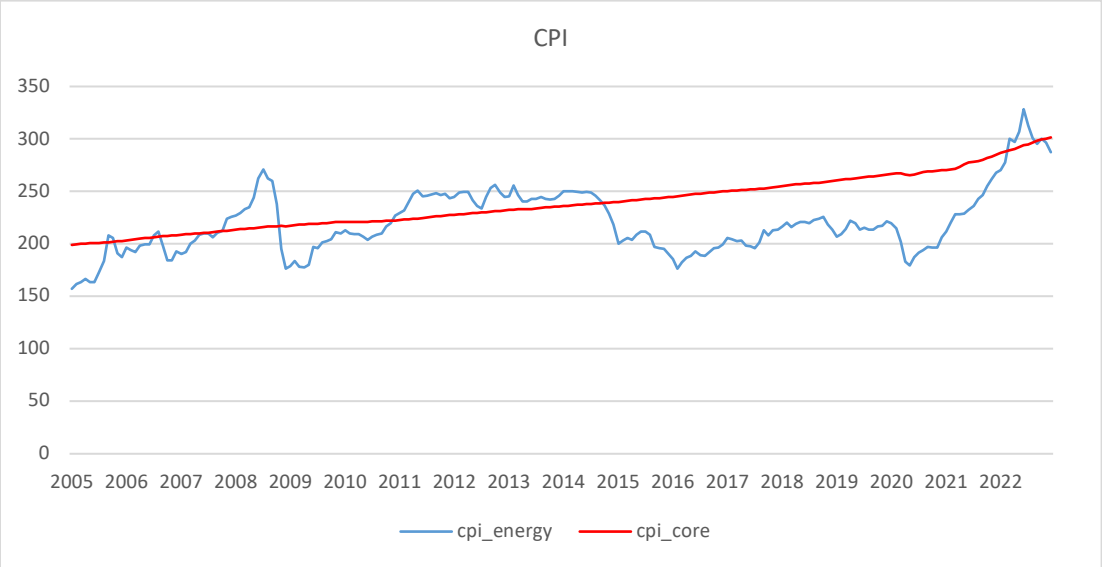
The remainder of the paper is organized as follows. Section 2 describes the data and our empirical model. Section 3 discusses the main cross-sectional results. Section 4 discusses how these results change over time. Section 5 analyses corporate responses of brown companies to inflation shocks. Section 6 concludes.

2. Data and Panel Regression Specification

We combine two data sets for listed companies in the U.S., one by S&P Global Trucost, which provides annual data on firm-level carbon and other greenhouse gas emissions, and the other by Compustat, which assembles data on stock returns and corporate balance sheets. We follow the same matching procedure as in Cenedese, Han, and Kacperczyk (2023). We further add inflation data from the U.S. Bureau of Labor Statistics (BLS), which includes the time series for the CPI, Core CPI, and the components of CPI (in particular, energy, and its subcomponents). For our robustness analysis we also add data on monetary policy news shocks from Acosta (2023),[7] and data on oil supply news shocks from Kanzig (2021). As in other asset pricing studies, we remove observations of companies whose stock prices are below $1. The overall number of unique firms in our sample is 2898 and the total number of observations in the main sample is 227,310.

[7] These data are constructed following the methodology of Nakamura and Steinsson (2018).

Figure 1 displays the core and energy CPI time series over our sample period, from 2005 to 2022. Core inflation has been close to flat until the end of the COVID lockdown periods, when it started to accelerate as economic activity rapidly recovered in response to pent-up demand. Energy price inflation has fluctuated more over our sample period, with a major positive shock following the Russian invasion of Ukraine.



We also report summary statistics on CPI price variables in Panel A of Table 1. Panel A is divided into two subpanels, the first one covering the full sample, and the second one covering only the sample for the period 2017-2022, during which we also have data on corporate downstream scope 3 emissions. The most noteworthy statistics are the relatively high volatility in energy CPI, which is 0.3175 over the full sample, and commodity price CPI (0.5294), compared with a volatility for core CPI of 0.2475 over the same sample period.[8] It is also worth noting the high dispersion in the level of direct (scope 1) and indirect (scope 2 and scope 3) carbon emissions across firms.

Panel B of Table 1 reports summary statistics for stock returns and the firm characteristics we use for our control variables. The dependent variable in most our cross-sectional regressions is monthly stock returns $RET_{i,t}$, the monthly return of a primary share of an individual stock i in month t. To calculate returns, we follow the approach outlined in Chaieb et al. (2021), with some necessary adjustments. We focus on securities categorized as common or ordinary shares (*tpci* = *'0'*) in Compustat. Total return indexes are created by combining variables such as prices (*prccm*), adjustment factors (*ajexdm*),

[8] CPI price levels are divided by 100.

quotation units (*qunit*), and total return factors (*trfm*). We apply -30% delisting returns when delisting is performance related (based on the delisting reasons *dlrsn)*, following Shumway (1997).

The control variables we use in our cross-sectional regressions are defined as follows: 1) $LOGSIZE_{i,t}$ is the natural logarithm of firm *i*'s market capitalization at the end of month *t*. Market capitalization is computed as a product of number of shares outstanding and stock prices (*prccm*) and the shares outstanding reported on the last trading day of the month (*cshom*). 2) $LOGMB_{i,t}$, is the natural logarithm of the price-to-book ratios. We define the book value of common equity, that is, as a difference between the book value of stockholder's equity, adjusted for tax effects, and the book value of preferred stock.[9] To construct the book value per share, we follow Asness and Frazzini (2013), and adjust book value for corporate actions between fiscal year-end and the date of portfolio formation. To construct price-to-book ratios we divide current price by book value per share. 3) $LEVERAGE_{i,t}$, is the firm's book leverage; 4) $MOM_{i,t}$ is the return momentum taken to be the buy-and-hold return of the most recent 12 months of stock *i*, leading up to and including month *t-1*; 5) $INVEST/A_{i,t}$ is the ratio of the firm's capital expenditures divided by the book value of its assets; 6) $LOGPPE_{i,t}$ is the natural logarithm of the firm's property, plant, and equipment; 7) $VOLAT_{i,t}$ is the standard deviation of returns based on the past 12 months of monthly returns; 8) $AGE_{i,t}$ is given by the number of years the firm has been in operation as of year *t*;[10] 9) $SALESGR_{i,t}$ is the annual growth rate in firm sales; and, 10) $ROE_{i,t}$ is the ratio of firm i's net yearly income divided by the value of its equity. To mitigate the impact of outliers, we winsorize *LEVERAGE, MOM, INVEST/A, VOLAT, SALESGR*, and *ROE* at the 2.5% level. Over our sample period the average firm's monthly stock return is 1.07%, with a standard deviation of 12.67%. The magnitudes and distributions of other firm-level controls are consistent with other studies using U.S. data.

3. Cross-Sectional Results

Our cross-sectional analysis relates the level of companies' direct and indirect emissions to their corresponding stock returns, conditional on the states of U.S. inflation. This translates to the model in which firm-level emissions measures are interacted with aggregate measures of inflation. As in Bolton and Kacperczyk (2021; 2023), the level of corporate emissions reflects in broad terms the exposure of the company to carbon-transition risk when inflation is at its sample average. The higher are the company's emissions, the further it must travel to reach net zero emissions, and the bumpier

[9] See Bali et al. (2016), page 178.

[10] In our regressions, we use the transformation of the variable 1/(1+firmage), to control for the skewness of the distribution in the raw variable.

the journey is likely to be. The interaction term between emissions and inflation captures exposure to some of these bumps. In particular, the higher are the company's emissions, the higher is its reliance on fossil fuels, and therefore the higher is its exposure to energy price (and commodity price) inflation. If the company is a net seller of fossil fuel energy, then a rise in energy price inflation is expected to boost its bottom line, whereas if it is a net buyer of fossil fuels, energy price inflation ought to hurt its earnings. One of the touted benefits of renewable energy is indeed that the supply of this energy following installation of the equipment is not affected by swings in energy and commodity prices.

To operationalize this intuition, we estimate the following cross-sectional regression model:

$$RET_{i,t} = a_0 + a_1(TOT\ Emissions)_{i,t-1} + a_2(TOT\ Emissions)_{i,t-1} * (Inflation)_t + a_3 Controls_{i,t-1} + \mu_{j,t} + \mu_i + \varepsilon_{i,t} \quad (1)$$

where $RET_{i,t}$ measures the stock return of company *i* in month *t*, *TOT Emissions* is a generic term for respectively the level of the firm's scope 1 emissions (*LOGS1TOT)*, scope 2 emissions (*LOGS2TOT)*, and upstream (*LOGS3UTOT*) and downstream scope 3 emissions (*LOGS3DTOT)*, all measured in log scale, and *Inflation* is a generic term for the various inflation measures (CPI and CPI changes) we consider in turn. The vector of firm-level controls is the same as in Bolton and Kacperczyk (2023) and is listed in Table 1.[11] We also include industry-time fixed effects ($\mu_{j,t}$) and firm fixed effects (μ_i) to account for time-varying industry-level unobservables, [12] and time-invariant firm-level unobservables. The former ones are particularly useful to account for many time-varying macroeconomic effects, both aggregate and sectoral. Including industry-fixed effects is also important in transition risk regressions due to significant cross-industry differences in emissions, as indicated by Bolton and Kacperczyk (2023). The latter fixed effects allow us to absorb any firm-specific effects possibly correlated with firm emissions. We double cluster standard errors at the firm and year levels, which allows us to account for any cross-firm correlation in the residuals as well as capture the fact that some control variables, and emissions, are measured at an annual frequency. Our main coefficient of interest is a_2.

What are the effects of inflation on the carbon premium? How are stock returns of companies that are exposed to carbon transition risk affected by price inflation? Typically, stocks are considered to be

[11] We center both the emissions and inflation variables to facilitate the interpretation of the regressions' level effects.

[12] Throughout our analysis we consider a granular classification of 361 Trucost industries, but the results are also robust to using coarser, 77-industry GICS-6 classification.

hedges against inflation, so that expected stock returns may be unaffected, or even be lower in the face of higher inflation (Modigliani and Cohn, 1979; Fama, 1981; Flannery and Protopapadakis, 2002; and Stock and Watson, 2003). This is true irrespective of whether firms have high carbon emissions or not. On that basis, one would expect that the coefficient of the interaction term, a_2, to be insignificant, or possibly negative, if stocks of companies with high emissions offer a better hedge against core price inflation. On the other hand, Fang, Liu, and Roussanov (2022) have shown that energy price inflation is considerably more volatile than core inflation and that it is positively related with excess returns on various risky portfolios of assets. Now, companies with high emissions are disproportionately exposed to energy and commodity price shocks. To the extent that higher energy price inflation imposes higher costs on companies with high emissions, one would therefore expect that the coefficient of the interaction term to be positive and significant. And if higher energy price inflation boosts revenues of net suppliers of fossil fuel energy, then one would expect the coefficient a_2 to be negative and significant.

3.1 Inflation and the Carbon Premium

We begin our analysis by exploring the effects of energy price inflation on the carbon premium, as reflected by the coefficient a_2 of the interaction of energy price inflation (*Energy CPI*) and carbon emissions. We report the results of our regression in Table 2. Columns 1 and 2 show the results for direct scope 1 emissions (*LOGS1TOT*). The first column includes industry-time fixed effects, and the second column further includes firm fixed effects. Columns 3 and 4 report the results for indirect scope 2 emissions (*LOGS2TOT*); columns 5 and 6 for upstream indirect emissions (*LOGS3UTOT*); and columns 7 and 8 for downstream indirect emissions (*LOGS3DTOT*). Consistent with the findings in Bolton and Kacperczyk (2021), we find a positive and statistically significant effect of carbon emissions on stock returns, for all four categories of emissions, which indicates that there is a positive carbon premium for an average firm when *Energy CPI* is at its mean value. As for our interaction coefficient of interest, we find that it is consistently positive and statistically significant for all four categories of emissions, whether we add industry-time fixed effects or firm fixed effects (we obtain slightly stronger statistical significance when we add firm fixed effects). Remarkably, the effects are strongest for companies with greater downstream Scope 3 emissions, which suggests that the energy-price risk is highest for end products that have a high carbon footprint.

The effect of energy price inflation on the carbon premium is also economically significant: A one-standard-deviation increase in the energy price index leads to an increase in the scope 1 carbon

premium by roughly 44%. The numbers for the scope 2, upstream scope 3, and downstream scope 3 emissions premia are 41%, 28%, and 136%, respectively. In terms of the effect of emissions on stock returns this implies that a (within) one-standard-deviation increase of scope 1 emissions is associated with a 2.86 percentage-point increase in next month's annualized returns. Again, similar numbers for the other categories of emissions are 2.87, 4.97, and 5.21. Overall, these findings suggest that energy-price shocks worsen the carbon transition risk of companies. That is to be expected based on a straightforward economic analysis. To be sure, swings in energy prices affect the bottom line of companies with greater fossil fuel energy dependence more, so that investors should be expected to seek greater compensation for holding these companies when there is a greater energy price inflation.

To better understand the source of energy-price inflation we further break down the energy price index into its two subcomponents, an energy commodities and energy services component, and include them jointly in the regression model (1). We report the results of the regression model in terms of these two energy sub-components in Table 3 for the specification with both industry*time and firm fixed effects as well as the same control variables as in Table 2. All coefficients of the control variables have been omitted for brevity here and in subsequent tables. The coefficient of the interaction variables is positive and highly significant for the commodities component for all four categories of emissions. On the other hand, the effect of services for scope1, scope 2, and upstream scope 3 emissions is much weaker and statistically insignificant. At the same time, both commodities and services contribute roughly the same to the effect of scope 3 downstream emissions and are both statistically significant.

Next, we explore the relative effects of core inflation and energy price inflation on the carbon premium. As we highlighted above, it is unclear a priori what the effects of core inflation on the carbon premium are likely to be, as they depend on whether stocks of companies with high carbon emissions offer better (or worse) inflation hedges than other stocks. There is no obvious economic reason why brown stocks should offer a better inflation hedge than green stocks. We evaluate this empirically by including jointly energy and core price index in the model (1).

Table 4 report the results for each of the four types of emissions for the specification with both industry*time and firm fixed effects. The effects of energy price index remain positive and significant as before. Remarkably, the coefficient of the interaction term with core CPI while positive is statistically insignificant, and economically much smaller, for all four categories of emissions. These findings suggest that the carbon premium is not sensitive to the component of core CPI unexplained

by energy prices, and that brown stocks are not significantly different from green stocks as inflation hedges. However, when it comes to the energy price component, brown firms are more exposed to this price risk than green firms, so that investors demand a greater risk compensation for holding brown stocks when energy price is high. These results broadly resonate with the findings in Fang et al. (2022) who also underscore the relatively more important role of energy prices in asset pricing.

Bolton and Kacperczyk (2021) found that the carbon premium is mirrored in corporate valuations: Companies with higher emissions other things equal have lower market to book ratios. How is this valuation discount affected by energy price inflation? We explore this question next by looking at the interaction effect for the regression specification, where the dependent variable is firms' market-to-book ratio (*MB*), winsorized at the 2.5% level. Our specification here follows Hong and Kacperczyk (2009) and includes previously used momentum and volatility measures, as well as contemporaneous values of both *ROE* and *SALESGR*, along with their values one year and two years into the future. We report the results in Table 5. The four columns of Table 5 are for each type of emissions for the specification that includes both industry*time and firm fixed effects. The results go in the expected direction, with energy price inflation negatively affecting the valuation of brown stocks, in most cases in a statistically significant way. However, the effects on the book-to-market ratio are weaker than the effects on returns, especially for the effects measured at the average energy price levels, as reflected in the estimates of the coefficients of the emission levels. We interpret these findings as reflecting the fact that energy price shocks are somewhat transitory, given that energy price inflation is a mean-reverting process.

We have estimated several additional models to help better understand of our main findings. First, we assess whether our results might be due to unexpected earnings news differentially affecting brown and green stocks in different inflation regimes. To this end, we re-estimate the model in (1) by netting out returns around earnings announcement dates, defined as the one-day and three-day return around quarterly earnings announcements. The results in Table 6 indicate a negligible change relative to our baseline model in Table 4. Second, we explore whether the effect of energy price inflation can be explained by the energy inflation rate. To this end, we expand the model in (1) with a set of additional interaction terms between respective emission types and the annual rate of energy price changes. We present the results in Table A1 of the Appendix. We find that the effect of energy price cannot be explained by changes in the price; moreover, the unexplained component of the energy price is economically and statistically insignificant. Our interpretation of these results is that energy price levels are more important for the carbon premium than the rate of change *per se*, likely because the energy

price, rather than its change, is the key driver of profitability. Third, we examine whether our main effect is due to expected or unexpected components of energy price inflation. To this end, we expand our model with the measure of energy inflation innovations interacted with the respective measures of emissions. We report the results in Table A2 of the Appendix. We find that the expected component of energy price is a stronger predictor of the carbon premium: interaction terms between energy prices and emissions are all positive and significant, whereas the equivalent interaction terms with energy inflation innovations are positive but all statistically insignificant. Fourth, our baseline results are based on seasonally adjusted energy CPI series. We further assess the robustness of our findings to using unadjusted series. Our results, presented in Table A3 of the Appendix indicate that the results are not particularly sensitive to one or the other specification. Finally, we assess the importance of sample selection bias related to the discrete shift in coverage of companies by Trucost. Notably, Trucost has adjusted the universe of companies with estimated or reported carbon emissions by a significant margin in 2016. To establish whether the shift is not affecting our results we estimated our main regression on a sample of companies that had at least one year of emissions data in any year between 2005 and 2015. The results of this estimation, reported in Table A4 of the Appendix, indicate no material difference in the effect we document for the entire sample. Hence, we conclude that our main results cannot be solely explained by differences in the time-series composition of our sample.

3.2 The Carbon Premium, Demand Shocks, Monetary Policy, and Exchange Rates

Our analysis above inevitably raises questions about the specific macroeconomic drivers of our effects. In this section, we consider three possible channels: the role of oil supply shocks, the role of U.S. dollar as the primary mode of commodity pricing, and the implications of inflation for monetary policy and its effects on asset prices. Energy prices are affected by changes in the supply and demand for fossil fuel, and it is helpful to try and separate supply-driven from demand-driven inflation forces. In Table 7, Panel A, we present results from our regression model (1), expanded by the inclusion of an interaction effect between firm-level emissions and oil supply shocks, as defined in Kanzig (2021). As can be seen, the estimates of our main interaction term with energy prices remain positive and highly significant. At the same time, the effect of oil supply shocks is negative, as one would expect, but significantly weaker, both statistically and economically. These findings suggest that the effects of energy price inflation are more likely driven by demand rather than supply factors and are consistent with the common narrative of demand shocks affecting energy prices (see e.g., Kilian, 2009; and Cheng, and Xiong, 2014).

We further consider the role of monetary policy shocks in driving the effects of energy and core CPI shocks on the carbon premium. It is reasonable to expect that the stock return effects we document could be a reflection of (expected) changes in monetary policy in response to inflation. This is especially because firms with different carbon footprint tend to exhibit different sensitivities to interest rate changes. To separate pure cash-flow effects of inflation from effects driven by changing discount rates due to changes in interest rates and monetary policy stance, we expand the model in equation (1) to include the level of short-term Fed funds rate (*RF*) and the monetary policy (Fed funds) shock (*FF shock*) from Nakamura and Steinsson (2018), both interacted with firm-level emissions. Our results, in Table 7, Panel B and Panel C, suggest that the observed changes in carbon premium due to energy price shocks are not driven solely by changes in interest rates or monetary policy shocks. In fact, we observe that our main coefficients remain positive and significant, whether we control for the level of interest rates or monetary policy shocks. If anything, the direct effects of monetary shocks are weaker and statistically insignificant.

Finally, we examine the sensitivity of our results to fluctuations in U.S. dollar exchange rates. Various commodities may be traded using different currencies as a mode of exchange, but corporate profits of U.S. companies are reported in U.S. dollars. Thus, changes in the exchange rate may differentially affect the values and stock prices of energy-sensitive companies. We measure the U.S. dollar exchange rate, *Dollar index*, by using the exchange rate basket that measures exchange rates aggregated across several markets. To measure the impact of the index on the inflation premium, we expand the model in equation (1) to include *Dollar index* interacted with firm-level emissions. Results, reported in Panel D of Table 7, indicate that carbon premium increases on average with higher values of *Dollar index*. This is particularly true for scope 2 and upstream scope 3 emissions. However, this effect cannot explain the role of energy CPI in pricing carbon-sensitive companies. Most of the coefficients of the interaction terms between *Energy CPI* and measure of emissions remain nearly the same relative to the baseline model.

4. The Effects of Inflation over Time

In this section we explore how the impact of energy price on the carbon premium has evolved over time. In particular, we ask two questions: (1) to what extent are the price effects attributable to changing investor preferences for green stocks, possibly as a result of strengthening climate policy response, and (2) are the effects mostly driven by the recent large price shocks due to Covid and the war in Ukraine?

To address the first question, we look at the impact of energy prices before and after the Paris Climate Agreement of 2015. Several studies have argued that the Paris Climate Agreement has ushered in a new era of climate policy, which has led investors to reprice carbon transition risk. The effect of the Paris Climate Agreement shock on the carbon premium has been documented in Bolton and Kacperczyk (2021), among others. However, it is not known whether the same shock might amplify the carbon premium conditional on the state of energy prices. We explore this question by expanding our model (1) with an additional interaction effect capturing the periods pre- vs. post-Paris. We define an indicator variable, *Paris*, that takes the value one for the period 2016-2022 and zero for the period 2005-2015. We focus on the triple interaction term between energy prices, firm-level emissions, and the *Paris* indicator. The results are reported in Panel A of Table 8. Interestingly, we do not find that the Paris shock has significantly affected of the link between energy prices, emissions, and stock prices. While the interaction effect is positive, it is small both in terms of its statistical and economic significance. Hence, we conclude that the energy forces we observe are not merely a reflection of changing preferences and perceptions of climate risk by investors but are rather a reflection of changing fundamentals driven by changing energy prices.

With respect to the second question, we repeat our analysis of Table 4 by restricting our sample to observations prior to the Covid crisis. Concretely, we retain observations from 2005 until 2020.06 to allow for some delay in changing fundamentals around the onset of the global pandemic. We report the results of the analysis in Panel B of Table 8. A few notable findings emerge. First, the carbon premium measured for average energy prices remains positive and statistically significant for all four measures of emissions. More specifically, we find that the interaction effects between respective emissions and energy prices are positive, statistically and economically significant. Thus, our results are not solely driven by the extreme inflation shock post 2020.06, but also obtain for changes in energy prices in the earlier sample period. Moreover, in light of the fact that the magnitudes of both effects in Table 4 and 8 are quite similar we conclude that the carbon premium is similarly affected by inflation in the pre- and post-Covid periods. This last result is quite provoking given the common belief that climate risk has become less of an issue to U.S. investors in recent times (e.g., Baker, Egan, and Sarkar, 2022). Our interpretation is that such shift in beliefs is not the primary driver of carbon premium; rather, it is fundamentals that are responsible for changing asset prices.

In our final test, we look at the role of demand forces for sustainability-driven mutual funds. These forces could be correlated with the interaction effect between emissions and inflation levels and at the same time future stock returns. Specifically, we obtain monthly data from Morningstar on aggregate

net flows (*Tot Flow*) into U.S. sustainability mutual funds and ETFs and their asset-level subcategories. In the cross-sectional tests, we focus on flows to U.S. stocks (*Stock Flow*). We also measure the respective growth rates of the two flow variables. Next, we expand our model in (1) to include another interaction term between the respective flow variables and alternating measures of emissions. We report the results from estimating this model in Table 9. Our results indicate that controlling for the flow variables does not reduce much of the variation we capture in our main effects between energy prices and emissions. Our results remain similar to those we document before. Moreover, the interaction variables between the flow variables and all emission levels are positive but statistically insignificant.

5. Corporate Responses to Inflation

How is exposure to energy price risk related to carbon emissions, and how are companies' decisions affected by this exposure? We explore these questions in this section and begin by exploring the link between energy price and carbon emissions. Following Duarte (2013) and others we take energy price betas, which capture how stock returns are affected by energy price innovations, to be our measure of energy price risk. Because our earlier results point towards an important role of the expected component of energy inflation, we construct an equivalent measure of beta based on the expected energy price.[13] Specifically, we decompose total inflation into its expected part and an unexpected inflation shock. The inflation shock is estimated using a VAR system as in Fang et al. (2022):

$$Y_t = a + AY_{t-1} + \varepsilon_t \tag{2}$$

where, Y_t includes the vector of headline, core, food, and energy inflation, plus the risk-free rate, and the price-dividend ratio of the aggregate stock market portfolio. The first elements of ε_t for the inflation variables are extracted as the inflation shocks. Then, for each stock, using a 60-month rolling window of data, we estimate a time-series regression model as follows:

$$R_t = a + \beta * Inflation_t + \mu_t \tag{3}$$

where, R_t is stock excess return, and $Inflation_t$ is a variable indicating expected inflation. The coefficient of *Inflation* is our beta measure, henceforth referred to as the *Energy Expected Beta*. We have

[13] In another, unreported test, we have estimated our models with the beta based on the unexpected energy inflation component. These estimates are unrelated to the levels of firm emissions.

also considered alternative measures of betas, with different windows or measures of expected inflation, with similar results, as below.

Next, we examine the link between *Energy Expected Beta* and the levels of corporate emissions, direct and indirect. Panel A of Table 10 reports our main findings. As can be seen, the higher are corporate emissions, the higher is the firm's exposure to expected energy price risk. This is true for direct (scope 1) emissions (as seen in column 1), and indirect (scope 2 and upstream scope 3) emissions (as shown in columns 2 and 3). For all three emission variables the coefficients are positive and statistically significant. As for downstream scope 3 emissions, the coefficient is also positive, but it is not statistically significant. The latter result may be due to the fact that we have a shorter time-series for downstream scope 3 emissions, even though we note that for other levels of emissions the results hold even for the restricted sample. Overall, these findings provide further insight on the association between energy price inflation and the carbon premium. To the extent that companies with higher emissions are more exposed to energy price risk, we should expect their carbon premia to be positively affected by energy price inflation.

In Panel B of Table 10 we explore how corporate profitability, measured by the return on equity (*ROE*), is affected by energy price changes, by linking *ROE* to the interaction variable between carbon emissions and the *Energy CPI*. In the odd-numbered columns, we report the effects on next quarter *ROE*, and in the even-numbered columns we report the results for next year's *ROE*. Overall, we find that short-term (next quarter) profitability is not significantly affected by shocks in the *Energy CPI*, except for the effect on scope 2 emissions, which is borderline statistically significant. This result suggests that electricity prices are not immediately and fully responding to changes in fossil fuel energy prices, so that cost shocks to firms' electricity consumption are somewhat dampened. In turn, we find a strong and positive effect of the *Energy CPI* interacted with emissions on next year's *ROE*. For all measures of emissions, the effect is positive, and it is highly statistically significant for all except for downstream scope 3 emissions. This latter result is consistent with the view that brown companies can extract rents through rising energy prices. More profitable companies also command higher expected returns, consistent with them having more sensitive growth prospects (see Novy-Marx, 2013).

In Panels C, D, and E of Table 10 we look at how firms' operations are affected by energy price shocks, again both in the short and longer run. We begin with the total level of sales (*LOGSALES*) in Panel C. Our main finding here is that sales of companies with high scope 1 emissions are negatively related to energy prices in the short run. As can be seen in column 1, the coefficient of the interaction

term between *LOGS1TOT* and the *Energy CPI* is negative and significant. However, the effect becomes insignificant in the long horizon. Moreover, firms' exposure to energy price shocks through indirect emissions does not seem to significantly relate to their sales, both in the short-term and the long-term. Notably, the challenge with interpreting the sales data is that quantities of products sold may move in the opposite direction to the products' prices and thus the dollar value of sales may be unaffected even if buyers and sellers internalize the price changes.

Panel D of Table 10 reports the results for corporate debt outcomes, measured by the logarithm of the total value of debt outstanding, *LOGDEBT*. Overall, we find that companies with a greater exposure to energy price inflation risk, as reflected by the interaction term between corporate emissions and the *Energy CPI*, tend to have less debt in the short term. This is true for scope 1, 2, and upstream scope 3 emissions. The coefficient of the interaction term is negative and statistically significant for these three categories of emissions. We obtain an insignificant coefficient for downstream scope 3 emissions, which, again, may be due to the fact that we have a much shorter time-series for this category. At the same time, the effect becomes significantly weaker in the longer horizon. Overall, these results suggest that companies with greater exposure to energy price risk adjust their debt policy following a new shock, but in the long run tend to return to their target capital structure (as predicted by the dynamic risk-management and debt policy theories of Bolton, Chen, and Wang, 2013, and Bolton, Wang, and Yang, 2021).

Finally, Panel E reports the results for corporate investment policy in terms of firms' level of capital expenditure. We find that companies with higher exposure to energy price shocks through their scope 1 emissions tend to invest less in the short run, but not in the long run. Moreover, exposure to energy price shocks through their indirect emissions does not seem to affect corporate capital expenditures, both in the short and in the long run.

Overall, the results from this section suggest that the effect of energy price inflation on the carbon premium is multifaceted and manifests itself both in terms of its effect on systematic energy beta risk as well as its effect on firm profitability and firm debt. The profitability force is stronger in the long run and the debt effect is more pronounced in the short run. Altogether, these forces lead to a higher carbon premium in stock returns.

6. Conclusion

Our analysis of how inflation affects the carbon premium has revealed one robust finding, namely that energy price inflation significantly increases the carbon premium. Energy price inflation isn't a bonus for brown firms. On the contrary, it is a source of greater risk, which investors demand compensation for. This finding is even more striking when contrasted with the effects of core CPI, which does not significantly affect expected returns of brown firms. We have measured the effects of energy price on the carbon premium by estimating the coefficient of an interaction term between carbon emissions and energy price inflation. We have found that this coefficient is positive and significant for all four categories of emissions.

There has been considerable discussion of a backlash in sustainable investing in recent years; of an end of ESG, that recent outflows from ESG funds seem to indicate. Yet, this prophecy may well be premature, if one takes account the context of rising energy prices in recent years. This energy price inflation may have filled the coffers of oil & gas majors, but most other brown companies have seen their carbon premia rise, reflecting a demand for greater risk compensation from investors facing higher carbon transition risks.

Importantly, we also find that the relationship between energy price and the carbon premium is broadly similar before and after COVID, suggesting that the higher carbon premia of brown firms in response to energy price shocks has not been affected by changing investor preferences post COVID.

There are two alternative broad explanations for the positive effect of energy prices on the carbon premium, a cash-flow, and a discount rate shock explanation. Our findings are generally consistent with the latter, as we found that brown companies are associated with higher energy price betas and higher long-term profitability, so that brown firms inherit similar risk pricing characteristics as growth stocks.

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Table 1: Summary statistics

This table reports summary statistics (mean, standard deviation, minimum, median, and maximum) of the main variables. CPI data series include core and energy components, and sub-categories in energy index (energy commodities and services). *Energy inflation* is annual growth rate of energy CPI, and innovation of energy inflation (*Energy innovation*) is calculated using ARIMA or VAR model. *Oil supply shock* is defined as in Kanzig (2021); *Monetary shock* is defined in Acosta (2023). *Dollar index* is a U.S. dollar exchange rate index. Carbon emissions are the natural logarithm of scope 1, 2, 3 upstream/downstream total emissions. *Tot flow growth* is the growth rate of fund flows into U.S. ESG funds. *Stock flow growth* is the corresponding value for equity investments of such funds. The sample period is 2005.01-2022.12. Panel A1 reports statistics for full sample. Panel A2 shows information on the same variables for a subsample of observations with non-missing downstream emissions. Panel B summarizes information on firm-level variables that enter our regression models. *RET* is the monthly stock return; *LOGSIZE* is the natural logarithm of a firm's market capitalization; *LOGMB* is the natural logarithm of market cap divided by book value; *LEVERAGE* is the ratio of debt to book value of assets; *MOM* is the average stock returns over the previous year; *INVEST/A* is capital expenditures divided by the book value of its assets; *LOGPPE* is the natural logarithm of the property, plant, and equipment; *VOLAT* is the standard deviation of returns based on the past 12 monthly returns; *ROE* is the ratio of net yearly income divided by the value of equity; *AGE* is a standardized measure of firm age; *SALESGR* is the annual growth rate in firm sales.

VARIABLES	Mean	p50	SD	Min	Max
Panel A1: Full sample					
Energy CPI	2.253	2.172	0.317	1.764	3.283
Commodities	2.560	2.427	0.529	1.634	4.225
Energy services	2.062	2.031	0.183	1.783	2.672
Core CPI	2.515	2.543	0.248	2.032	3.003
Energy inflation	0.049	0.043	0.137	-0.326	0.346
Energy innovation	0.000	0.002	0.028	-0.158	0.086
Oil supply shock	0.002	-0.055	0.661	-2.896	1.827
Monetary shock	-0.001	0.000	0.021	-0.200	0.096
Dollar index	91.268	93.230	8.720	71.800	112.120
Tot flow growth	0.553	0.300	1.133	-2.870	4.150
Stock flow growth	0.391	0.140	1.100	-5.070	4.820
LOGS1TOT	10.159	10.160	3.062	-4.605	19.506
LOGS2TOT	10.240	10.448	2.502	-1.946	17.165
LOGS3UTOT	12.144	12.374	2.347	-0.941	19.031
Panel A2: Sample with non-missing LOGS3DTOT					
Energy CPI	2.157	2.150	0.176	1.793	2.681
Commodities	2.344	2.366	0.304	1.658	3.174
Energy services	2.071	2.038	0.074	1.991	2.294
Core CPI	2.642	2.640	0.091	2.505	2.852
Energy inflation	0.048	0.051	0.115	-0.203	0.287
Energy innovation	0.001	0.004	0.023	-0.072	0.045
Oil supply shock	-0.001	-0.079	0.634	-1.794	1.567
Monetary shock	0.002	0.000	0.013	-0.033	0.061
Dollar index	95.003	95.130	2.978	89.130	101.120
Tot flow growth	1.157	0.780	1.146	-0.320	4.150
Stock flow growth	0.902	0.690	1.081	-0.960	4.820
LOGS1TOT	9.352	9.430	3.039	-2.431	18.569
LOGS2TOT	9.578	9.806	2.572	-1.946	16.727
LOGS3UTOT	11.494	11.643	2.430	-0.941	18.897
LOGS3DTOT	10.761	11.139	3.881	-5.880	20.875

Panel B: Control Variables					
VARIABLES	Mean	p50	SD	Min	Max
RET(%)	1.071	0.926	12.668	-83.480	1625.053
LOGSIZE	8.169	8.169	1.715	-0.288	14.885
LOGMB	1.021	0.944	0.948	-3.762	7.808
LEVERAGE	0.233	0.213	0.181	0.000	0.822
MOM	0.145	0.099	0.411	-0.552	1.454
INVEST/A	0.038	0.025	0.043	0.000	0.244
LOGPPE	5.985	6.047	2.255	-4.962	12.467
VOLAT	0.100	0.086	0.054	0.030	0.274
AGE	-0.029	-0.020	0.036	-1.000	-0.004
SALESGR	0.089	0.054	0.206	-0.339	0.831
ROE	0.112	0.117	0.206	-0.401	0.581

Table 2: Carbon Emissions and Stock Returns: Energy CPI

The sample period is 2005.01-2022.12. The dependent variable is *RET*. The main independent variables are carbon emission levels and interaction terms with *Energy CPI*. All variables are defined in Table 1 and Table 2. We report the results of the pooled regression with standard errors double clustered at the firm and year levels. All regressions include Trucost industry*time fixed effects. In columns (2), (4), (6), and (8), we additionally include firm-fixed effect. ***1% significance; **5% significance; *10% significance.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Dependent Variable: RET							
LOGS1TOT	0.144**	0.335***						
	(0.062)	(0.110)						
LOGS2TOT			0.175**	0.361***				
			(0.078)	(0.110)				
LOGS3UTOT					0.316**	1.164***		
					(0.111)	(0.274)		
LOGS3DTOT							0.077	0.217**
							(0.060)	(0.082)
LOGS1TOT*Energy CPI	0.352**	0.460**						
	(0.176)	(0.170)						
LOGS2TOT* Energy CPI			0.329*	0.466**				
			(0.179)	(0.172)				
LOGS3UTOT* Energy CPI					0.425*	0.619***		
					(0.236)	(0.220)		
LOGS3DTOT* Energy CPI							0.856***	0.931***
							(0.170)	(0.243)
LOGSIZE	-0.253***	-3.924***	-0.289***	-3.925***	-0.372***	-4.269***	-0.202**	-6.779**
	(0.052)	(0.610)	(0.062)	(0.613)	(0.084)	(0.648)	(0.084)	(1.578)
LOGMB	-0.002	-0.252*	0.017	-0.259*	0.033	-0.184	-0.023	-0.327
	(0.105)	(0.138)	(0.099)	(0.140)	(0.097)	(0.137)	(0.185)	(0.249)
LEVERAGE	-0.151	0.032	-0.187	0.035	-0.292	-0.173	-0.001	1.195
	(0.266)	(0.650)	(0.269)	(0.639)	(0.273)	(0.651)	(0.389)	(1.783)
MOM	0.153	0.316	0.161	0.319	0.172	0.421	-0.068	0.695
	(0.262)	(0.407)	(0.262)	(0.408)	(0.258)	(0.424)	(0.183)	(0.666)
INVEST/A	-0.829	-1.265	-0.788	-0.981	-0.069	-0.382	0.791	-3.523
	(1.140)	(1.941)	(1.135)	(1.968)	(1.312)	(2.041)	(1.924)	(3.036)
LOGPPE	0.106**	0.143	0.095**	0.113	0.049	-0.039	0.131	0.183
	(0.042)	(0.139)	(0.042)	(0.137)	(0.041)	(0.119)	(0.068)	(0.185)
VOLAT	3.458	1.553	3.374	1.601	3.573	1.264	5.813	-0.484
	(5.578)	(1.925)	(5.545)	(1.927)	(5.503)	(1.840)	(8.946)	(1.730)
AGE	1.629	-0.003	1.600	-0.009	1.465	-0.027	0.655	4.264
	(1.640)	(1.469)	(1.668)	(1.476)	(1.644)	(1.494)	(2.770)	(2.037)
Firm FE	No	Yes	No	Yes	No	Yes	No	Yes
Industry * Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	227,329	227,310	227,197	227,178	227,329	227,310	105,990	105,983
R-squared	0.404	0.427	0.404	0.427	0.404	0.428	0.371	0.406

Table 3: Carbon Emissions and Stock Returns: Energy (Commodities and Services)

The sample period is 2005.01-2022.12. The dependent variable is *RET*. The main independent variables are carbon emission levels and interaction terms with energy CPI subcategory (commodities and services). The vector of controls includes those in Table 2. All variables are defined in Table 1 and Table 2. We report the results of the pooled regression with standard errors double clustered at the firm and year levels. All regressions include firm and Trucost industry*time fixed effects. ***1% significance; **5% significance; *10% significance.

	(1)	(2)	(3)	(4)
VARIABLES	Dependent Variable: RET			
LOGS1TOT	0.338***			
	(0.111)			
LOGS2TOT		0.361***		
		(0.110)		
LOGS3UTOT			1.168***	
			(0.276)	
LOGS3DTOT				0.222**
				(0.080)
LOGS1TOT*Commodities CPI	0.243**			
	(0.113)			
LOGS2TOT* Commodities CPI		0.226**		
		(0.112)		
LOGS3UTOT* Commodities CPI			0.343**	
			(0.173)	
LOGS3DTOT* Commodities CPI				0.332***
				(0.093)
LOGS1TOT*Services CPI	0.122			
	(0.208)			
LOGS2TOT* Services CPI		0.202		
		(0.200)		
LOGS3UTOT* Services CPI			0.108	
			(0.287)	
LOGS3DTOT* Services CPI				1.207***
				(0.298)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry * Time FE	Yes	Yes	Yes	Yes
Observations	227,310	227,178	227,310	105,983
R-squared	0.427	0.427	0.428	0.406

Table 4: Carbon Emissions and Stock Returns: Energy and Core CPI

The sample period is 2005.01-2022.12. The dependent variable is *RET*. The main independent variables are carbon emission levels and interaction terms with *Energy CPI* and *Core CPI*. The vector of controls includes those in Table 2. All variables are defined in Table 1 and Table 2. We report the results of the pooled regression with standard errors double clustered at the firm and year levels. All regressions include firm and Trucost industry*time fixed effects. ***1% significance; **5% significance; *10% significance.

	(1)	(2)	(3)	(4)
VARIABLES	Dependent Variable: RET			
LOGS1TOT	0.329***			
	(0.112)			
LOGS2TOT		0.364***		
		(0.105)		
LOGS3UTOT			1.157***	
			(0.274)	
LOGS3DTOT				0.219**
				(0.079)
LOGS1TOT*Energy CPI	0.414**			
	(0.175)			
LOGS2TOT*Energy CPI		0.395**		
		(0.181)		
LOGS3UTOT*Energy CPI			0.535**	
			(0.248)	
LOGS3DTOT*Energy CPI				0.823***
				(0.250)
LOGS1TOT*Core CPI	0.152			
	(0.219)			
LOGS2TOT*Core CPI		0.241		
		(0.207)		
LOGS3UTOT*Core CPI			0.277	
			(0.308)	
LOGS3DTOT*Core CPI				0.435
				(0.555)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry*time FE	Yes	Yes	Yes	Yes
Observations	227,310	227,178	227,310	105,983
R-squared	0.427	0.427	0.428	0.406

Table 5: Carbon Emissions and Market-to-Book Ratio

The sample period is 2005.01-2022.12. The dependent variable is *MB*, the market-to-book ratio winsorized at 2.5%. The main independent variables are carbon emission levels and interaction terms with *Energy CPI*. The vector of controls includes those in Table 2. All variables are defined in Table 1 and Table 2. We report the results of the pooled regression with standard errors double clustered at the firm and year levels. All regressions include firm and Trucost industry*time fixed effects. ***1% significance; **5% significance; *10% significance.

	(1)	(2)	(3)	(4)
VARIABLES	Dependent Variable: MB			
LOGS1TOT	-0.005			
	(0.054)			
LOGS2TOT		-0.054		
		(0.046)		
LOGS3UTOT			-0.290**	
			(0.142)	
LOGS3DTOT				-0.025
				(0.023)
LOGS1TOT*Energy CPI	-0.107*			
	(0.062)			
LOGS2TOT*Energy CPI		-0.126**		
		(0.055)		
LOGS3UTOT*Energy CPI			-0.186**	
			(0.069)	
LOGS3DTOT*Energy CPI				-0.082
				(0.066)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry*time FE	Yes	Yes	Yes	Yes
Observations	131,706	131,599	131,706	58,597
R-squared	0.903	0.903	0.903	0.948

Table 6: Carbon Emissions and Stock Returns: Excluding Earnings Announcement Returns

The sample period is 2005.01-2022.12. The dependent variable is the difference between stock return and returns around earnings announcement days. The main independent variables are carbon emission levels and interaction terms with energy CPI. Panel A reports the monthly return excluding one-day earnings announcement return, Panel B reports the monthly return excluding three-day earnings announcement return. The vector of controls includes those in Table 2. All variables are defined in Table 1 and Table 2. We report the results of the pooled regression with standard errors double clustered at the firm and year levels. All regressions include firm and Trucost industry*time fixed effects. ***1% significance; **5% significance; *10% significance.

Panel A: Excluding 1-Day Earnings Announcement Return

	(1)	(2)	(3)	(4)
VARIABLES	Dependent Variable: RET – ANNRET(1)			
LOGS1TOT	0.309***			
	(0.107)			
LOGS2TOT		0.352***		
		(0.105)		
LOGS3UTOT			1.076***	
			(0.264)	
LOGS3DTOT				0.202**
				(0.079)
LOGS1TOT*Energy CPI	0.447**			
	(0.173)			
LOGS2TOT*Energy CPI		0.443**		
		(0.175)		
LOGS3UTOT*Energy CPI			0.593**	
			(0.222)	
LOGS3DTOT*Energy CPI				0.926***
				(0.235)
Observations	227,310	227,178	227,310	105,983
R-squared	0.430	0.430	0.431	0.407

Panel B: Excluding 3-Day Earnings Announcement Return

	(1)	(2)	(3)	(4)
VARIABLES	Dependent Variable: RET – ANNRET(3)			
LOGS1TOT	0.291***			
	(0.105)			
LOGS2TOT		0.342***		
		(0.104)		
LOGS3UTOT			1.041***	
			(0.267)	
LOGS3DTOT				0.212***
				(0.077)
LOGS1TOT*Energy CPI	0.442**			
	(0.174)			
LOGS2TOT*Energy CPI		0.445**		
		(0.176)		
LOGS3UTOT*Energy CPI			0.592**	
			(0.223)	
LOGS3DTOT*Energy CPI				0.915***
				(0.211)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry * Time FE	Yes	Yes	Yes	Yes
Observations	227,310	227,178	227,310	105,983
R-squared	0.423	0.423	0.424	0.401

Table 7: Carbon Emissions and Stock Returns: Oil Supply and Monetary Policy

The sample period is 2005.01-2022.12. The dependent variable is *RET*. The main independent variables are carbon emission levels and interaction terms with *Energy CPI*, *Oil Supply Shock* (Panel A), Fed fund interest rate (Panel B), monetary policy news shock (Panel C), and U.S. dollar exchange rate index (Panel D). The vector of controls includes those in Table 2. All variables are defined in Table 1 and Table 2. We report the results of the pooled regression with standard errors double clustered at the firm and year levels. All regressions include firm and Trucost industry*time fixed effects. ***1% significance; **5% significance; *10% significance.

Panel A: Oil supply news shock

	(1)	(2)	(3)	(4)
VARIABLES	Dependent Variable: RET			
LOGS1TOT	0.337***			
	(0.109)			
LOGS2TOT		0.362***		
		(0.110)		
LOGS3UTOT			1.166***	
			(0.273)	
LOGS3DTOT				0.217**
				(0.081)
LOGS1TOT*Energy CPI	0.469**			
	(0.179)			
LOGS2TOT*Energy CPI		0.476**		
		(0.180)		
LOGS3UTOT*Energy CPI			0.628***	
			(0.231)	
LOGS3DTOT*Energy CPI				0.974***
				(0.248)
LOGS1TOT*Oil Supply Shock	-0.082			
	(0.065)			
LOGS2TOT*Oil Supply Shock		-0.085		
		(0.067)		
LOGS3UTOT*Oil Supply Shock			-0.088	
			(0.088)	
LOGS3DTOT*Oil Supply Shock				-0.102**
				(0.039)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry*time FE	Yes	Yes	Yes	Yes
Observations	227,310	227,178	227,310	105,983
R-squared	0.427	0.427	0.428	0.406

Panel B: Interest rate

	(1)	(2)	(3)	(4)
VARIABLES	Dependent Variable: RET			
LOGS1TOT	0.337***			
	(0.110)			
LOGS2TOT		0.363***		
		(0.110)		
LOGS3UTOT			1.157***	
			(0.272)	
LOGS3DTOT				0.225**
				(0.081)
LOGS1TOT*Energy CPI	0.461**			
	(0.173)			
LOGS2TOT*Energy CPI		0.466**		
		(0.175)		
LOGS3UTOT*Energy CPI			0.618***	
			(0.223)	
LOGS3DTOT*Energy CPI				0.945***
				(0.169)
LOGS1TOT*RF	0.389			
	(0.366)			
LOGS2TOT*RF		0.353		
		(0.386)		
LOGS3UTOT*RF			0.448	
			(0.462)	
LOGS3DTOT* RF				-0.535*
				(0.291)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry*time FE	Yes	Yes	Yes	Yes
Observations	227,310	227,178	227,310	105,983
R-squared	0.427	0.427	0.428	0.406

Panel C: Monetary policy news shock

	(1)	(2)	(3)	(4)
VARIABLES	Dependent Variable: RET			
LOGS1TOT	0.335***			
	(0.110)			
LOGS2TOT		0.361***		
		(0.110)		
LOGS3UTOT			1.164***	
			(0.274)	
LOGS3DTOT				0.216**
				(0.083)
LOGS1TOT*Energy CPI	0.460**			
	(0.170)			
LOGS2TOT*Energy CPI		0.466**		
		(0.170)		
LOGS3UTOT*Energy CPI			0.619***	
			(0.218)	
LOGS3DTOT*Energy CPI				0.920***
				(0.251)
LOGS1TOT*FF shock	0.407			
	(1.175)			
LOGS2TOT* FF shock		0.714		
		(1.122)		
LOGS3UTOT*FF shock			1.039	
			(1.425)	
LOGS3DTOT*FF shock				1.676
				(1.436)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry*time FE	Yes	Yes	Yes	Yes
Observations	227,310	227,178	227,310	105,983
R-squared	0.427	0.427	0.428	0.406

Panel D: U.S. dollar exchange rate

	(1)	(2)	(3)	(4)
VARIABLES	Dependent Variable: RET			
LOGS1TOT	0.328***			
	(0.106)			
LOGS2TOT		0.364***		
		(0.107)		
LOGS3UTOT			1.156***	
			(0.267)	
LOGS3DTOT				0.209**
				(0.088)
LOGS1TOT*Energy CPI	0.422**			
	(0.188)			
LOGS2TOT*Energy CPI		0.429**		
		(0.194)		
LOGS3UTOT*Energy CPI			0.555**	
			(0.250)	
LOGS3DTOT*Energy CPI				0.977***
				(0.250)
LOGS1TOT*Dollar index	0.008			
	(0.005)			
LOGS2TOT*Dollar index		0.008*		
		(0.004)		
LOGS3UTOT*Dollar index			0.012*	
			(0.006)	
LOGS3DTOT*Dollar index				0.020
				(0.011)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry*time FE	Yes	Yes	Yes	Yes
Observations	227,310	227,178	227,310	105,983
R-squared	0.427	0.427	0.428	0.406

Table 8: Carbon Emissions and Stock Returns: the Paris Agreement and COVID

The sample period is 2005.01-2022.12. The dependent variable is RET. The main independent variables are carbon emission levels and interaction terms with energy CPI, and an indicator variable Paris (Panel A). In Panel B, we show the pre-COVID sample analysis. The vector of controls includes those in Table 2. All variables are defined in Table 1 and Table 2. We report the results of the pooled regression with standard errors double clustered at the firm and year levels. All regressions include firm and Trucost industry*time fixed effects. ***1% significance; **5% significance; *10% significance.

Panel A: Paris Agreement

	(1)	(2)	(3)
VARIABLES	Dependent Variable: RET		
LOGS1TOT	0.283**		
	(0.132)		
LOGS2TOT		0.299**	
		(0.124)	
LOGS3UTOT			1.081***
			(0.323)
LOGS1TOT*Energy CPI	0.198		
	(0.248)		
LOGS2TOT*Energy CPI		0.213	
		(0.231)	
LOGS3UTOT*Energy CPI			0.363
			(0.360)
Paris*LOGS1TOT	0.065		
	(0.085)		
Paris*LOGS2TOT		0.093	
		(0.081)	
Paris*LOGS3UTOT			0.102
			(0.126)
Paris*LOGS1TOT*Energy CPI	0.306		
	(0.324)		
Paris*LOGS2TOT*Energy CPI		0.300	
		(0.317)	
Paris*LOGS3UTOT*Energy CPI			0.292
			(0.444)
Controls	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Industry*time FE	Yes	Yes	Yes
Observations	227,310	227,178	227,310
R-squared	0.427	0.427	0.428

Panel B: Pre-COVID crisis

	(1)	(2)	(3)	(4)
VARIABLES	Dependent Variable: RET			
LOGS1TOT	0.401***			
	(0.129)			
LOGS2TOT		0.374***		
		(0.117)		
LOGS3UTOT			1.309***	
			(0.388)	
LOGS3DTOT				0.196**
				(0.085)
LOGS1TOT*Energy CPI	0.365*			
	(0.191)			
LOGS2TOT*Energy CPI		0.367**		
		(0.176)		
LOGS3UTOT*Energy CPI			0.597**	
			(0.275)	
LOGS3DTOT*Energy CPI				0.652**
				(0.237)
LOGS1TOT*Core CPI	0.244			
	(0.298)			
LOGS2TOT*Core CPI		0.331		
		(0.295)		
LOGS3UTOT*Core CPI			0.534	
			(0.415)	
LOGS3DTOT*Core CPI				-0.136
				(0.888)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry*time FE	Yes	Yes	Yes	Yes
Observations	163,858	163,726	163,858	69,454
R-squared	0.474	0.474	0.474	0.455

Table 9: Carbon Emissions and Stock Returns: ESG Fund Flows

The sample period is 2005.01-2022.12. The dependent variable is *RET*. The main independent variables are carbon emission levels and interaction terms with *Energy CPI*, growth rate of *Tot flow growth* (Panel A) and *Stock flow growth* (Panel B), and also the net asset flow in dollar value, *Dollar flow*, (Panel C). The vector of controls includes those in Table 2. All variables are defined in Table 1 and Table 2. We report the results of the pooled regression with standard errors double clustered at the firm and year levels. All regressions include firm and Trucost industry*time fixed effects. ***1% significance; **5% significance; *10% significance.

Panel A: Total ESG Fund Flow Growth Rate

	(1)	(2)	(3)	(4)
VARIABLES	Dependent Variable: RET			
LOGS1TOT	0.334**			
	(0.120)			
LOGS2TOT		0.362***		
		(0.106)		
LOGS3UTOT			1.163***	
			(0.280)	
LOGS3DTOT				0.215**
				(0.085)
LOGS1TOT*Energy CPI	0.466**			
	(0.182)			
LOGS2TOT*Energy CPI		0.481**		
		(0.181)		
LOGS3UTOT*Energy CPI			0.630**	
			(0.231)	
LOGS3DTOT*Energy CPI				0.906***
				(0.287)
LOGS1TOT*Tot flow growth	0.005			
	(0.058)			
LOGS2TOT*Tot flow growth		0.013		
		(0.056)		
LOGS3UTOT*Tot flow growth			0.009	
			(0.064)	
LOGS3DTOT*Tot flow growth				-0.031
				(0.036)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry*time FE	Yes	Yes	Yes	Yes
Observations	227,310	227,178	227,310	105,983
R-squared	0.427	0.427	0.428	0.406

Panel B: Stock ESG Fund Flow Growth Rate

	(1)	(2)	(3)	(4)
VARIABLES	Dependent Variable: RET			
LOGS1TOT	0.333***			
	(0.116)			
LOGS2TOT		0.363***		
		(0.106)		
LOGS3UTOT			1.163***	
			(0.276)	
LOGS3DTOT				0.216**
				(0.083)
LOGS1TOT*Energy CPI	0.472**			
	(0.178)			
LOGS2TOT*Energy CPI		0.484**		
		(0.180)		
LOGS3UTOT*Energy CPI			0.634**	
			(0.230)	
LOGS3DTOT*Energy CPI				0.916***
				(0.279)
LOGS1TOT*Stock flow growth	0.014			
	(0.055)			
LOGS2TOT*Stock flow growth		0.020		
		(0.054)		
LOGS3UTOT*Stock flow growth			0.017	
			(0.065)	
LOGS3DTOT*Stock flow growth				-0.020
				(0.035)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry*time FE	Yes	Yes	Yes	Yes
Observations	227,310	227,178	227,310	105,983
R-squared	0.427	0.427	0.428	0.406

Panel C: Stock ESG Fund Flow Dollar Value

	(1)	(2)	(3)	(4)
VARIABLES	Dependent Variable: RET			
LOGS1TOT	0.329***			
	(0.119)			
LOGS2TOT		0.363***		
		(0.105)		
LOGS3UTOT			1.159***	
			(0.278)	
LOGS3DTOT				0.216**
				(0.082)
LOGS1TOT*Energy CPI	0.481**			
	(0.171)			
LOGS2TOT*Energy CPI		0.492**		
		(0.174)		
LOGS3UTOT*Energy CPI			0.645***	
			(0.222)	
LOGS3DTOT*Energy CPI				0.941***
				(0.251)
LOGS1TOT*Dollar flow	0.027			
	(0.054)			
LOGS2TOT*Dollar flow		0.033		
		(0.054)		
LOGS3UTOT*Dollar flow			0.032	
			(0.061)	
LOGS3DTOT*Dollar flow				-0.009
				(0.028)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry*time FE	Yes	Yes	Yes	Yes
Observations	227,310	227,178	227,310	105,983
R-squared	0.427	0.427	0.428	0.406

Table 10: Carbon Emissions and Firm Fundamentals

The sample period is 2005.01-2022.12. The dependent variables are *Energy Expected Beta*, *ROE*, *LOGSALES*, *DEBT*, and *CAPEX*. The main independent variables are carbon emission levels and interaction terms with *Energy CPI*. The vector of controls includes those in Table 2. All variables are defined in Table 1 and Table 2. We report the results of the pooled regression with standard errors double clustered at the firm and year levels. All regressions include firm and Trucost industry*time fixed effects. ***1% significance; **5% significance; *10% significance.

Panel A: Energy Beta

	(1)	(2)	(3)	(4)
VARIABLES	Dependent Variable: Energy Expected Beta			
LOGS1TOT	0.037**			
	(0.018)			
LOGS2TOT		0.042**		
		(0.019)		
LOGS3UTOT			0.067**	
			(0.031)	
LOGS3DTOT				0.020
				(0.014)
Controls	Yes	Yes	Yes	Yes
Industry*time FE	Yes	Yes	Yes	Yes
Observations	216,095	216,210	216,342	100,903
R-squared	0.208	0.209	0.209	0.190

Panel B: ROE

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	ROE(t+3)	ROE(t+12)	ROE(t+3)	ROE(t+12)	ROE(t+3)	ROE(t+12)	ROE(t+3)	ROE(t+12)
LOGS1TOT	-0.049	0.664**						
	(0.093)	(0.234)						
LOGS2TOT			0.032	0.738***				
			(0.090)	(0.200)				
LOGS3UTOT					0.182	4.178***		
					(0.292)	(0.626)		
LOGS3DTOT							-0.041	0.353
							(0.102)	(0.220)
LOGS1TOT*Energy CPI	0.069	0.523**						
	(0.070)	(0.224)						
LOGS2TOT*Energy CPI			0.145**	0.651***				
			(0.073)	(0.181)				
LOGS3UTOT*Energy CPI					0.137	0.875***		
					(0.081)	(0.237)		
LOGS3DTOT*Energy CPI							-0.071	0.194
							(0.105)	(0.197)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry*time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	212,885	189,149	212,753	189,017	212,885	189,149	100,689	99,150
R-squared	0.896	0.784	0.896	0.784	0.896	0.786	0.912	0.812

Panel C: Log Sales

VARIABLES	SALES(t+3)	SALES(t+12)	SALES(t+3)	SALES(t+12)	SALES(t+3)	SALES(t+12)	SALES(t+3)	SALES(t+12)
LOGS1TOT	0.220***	0.083***						
	(0.024)	(0.021)						
LOGS2TOT			0.247***	0.093***				
			(0.035)	(0.023)				
LOGS3UTOT					0.765***	0.331***		
					(0.020)	(0.084)		
LOGS3DTOT							0.081***	0.017*
							(0.014)	(0.010)
LOGS1TOT*Energy CPI	-0.016*	-0.004						
	(0.008)	(0.013)						
LOGS2TOT*Energy CPI			-0.012	-0.006				
			(0.008)	(0.012)				
LOGS3UTOT*Energy CPI					-0.002	0.004		
					(0.004)	(0.013)		
LOGS3DTOT*Energy CPI							0.007	0.001
							(0.005)	(0.010)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry*time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	221,549	196,446	221,417	196,314	221,549	196,446	105,577	103,853
R-squared	0.986	0.985	0.986	0.985	0.994	0.987	0.983	0.986

Panel D: Log Debt

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Debt(t+3)	Debt(t+12)	Debt(t+3)	Debt(t+12)	Debt(t+3)	Debt(t+12)	Debt(t+3)	Debt(t+12)
LOGS1TOT	2.318***	5.864***						
	(0.345)	(1.170)						
LOGS2TOT			3.018***	7.006***				
			(0.453)	(1.125)				
LOGS3UTOT					10.781***	29.241***		
					(1.280)	(3.397)		
LOGS3DTOT							0.557	1.538**
							(0.317)	(0.542)
LOGS1TOT*Energy CPI	-0.746***	-1.071						
	(0.227)	(1.592)						
LOGS2TOT*Energy CPI			-0.645***	-1.972				
			(0.203)	(1.464)				
LOGS3UTOT*Energy CPI					-0.569**	-1.915		
					(0.286)	(1.780)		
LOGS3DTOT*Energy CPI							-0.594	-1.600
							(0.891)	(1.647)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry*time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	200,716	175,137	200,584	175,005	200,716	175,137	93,825	91,655
R-squared	0.981	0.950	0.981	0.950	0.982	0.951	0.982	0.957

Panel E: CAPEX

VARIABLES	Capex(t+3)	Capex(t+12)	Capex(t+3)	Capex(t+12)	Capex(t+3)	Capex(t+12)	Capex(t+3)	Capex(t+12)
LOGS1TOT	0.017***	0.051***						
	(0.003)	(0.007)						
LOGS2TOT			0.024***	0.069***				
			(0.004)	(0.011)				
LOGS3UTOT					0.064***	0.201***		
					(0.010)	(0.026)		
LOGS3DTOT							0.007***	0.014***
							(0.002)	(0.005)
LOGS1TOT*Energy CPI	-0.006**	-0.008						
	(0.003)	(0.007)						
LOGS2TOT*Energy CPI			-0.005	-0.005				
			(0.003)	(0.006)				
LOGS3UTOT*Energy CPI					-0.003	-0.004		
					(0.004)	(0.009)		
LOGS3DTOT*Energy CPI							0.003	0.007
							(0.006)	(0.009)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry*time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	217,567	192,538	217,435	192,406	217,567	192,538	103,570	101,676
R-squared	0.986	0.970	0.986	0.970	0.987	0.970	0.985	0.965

Appendix Tables

Table A1: Carbon Emissions and Stock Returns: Energy Inflation

The sample period is 2005.01-2022.12. The dependent variable is *RET*. The main independent variables are carbon emission levels and interaction terms with Energy CPI and energy price inflation. The vector of controls includes those in Table 2. All variables are defined in Table 1 and Table 2. We report the results of the pooled regression with standard errors double clustered at the firm and year levels. All regressions include firm and Trucost industry*time fixed effects. ***1% significance; **5% significance; *10% significance.

	(1)	(2)	(3)	(4)
VARIABLES	Dependent Variable: RET			
LOGS1TOT	0.332***			
	(0.111)			
LOGS2TOT		0.362***		
		(0.112)		
LOGS3UTOT			1.154***	
			(0.274)	
LOGS3DTOT				0.213**
				(0.084)
LOGS1TOT*Energy_Inflation	0.377			
	(0.322)			
LOGS2TOT*Energy_Inflation		0.360		
		(0.351)		
LOGS3UTOT*Energy_Inflation			0.430	
			(0.433)	
LOGS3DTOT*Energy_Inflation				-0.456
				(0.533)
LOGS1TOT*Energy CPI	0.347**			
	(0.146)			
LOGS2TOT*Energy CPI		0.358**		
		(0.140)		
LOGS3UTOT*Energy CPI			0.491***	
			(0.164)	
LOGS3DTOT*Energy CPI				1.180**
				(0.509)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry*time FE	Yes	Yes	Yes	Yes
Observations	227,310	227,178	227,310	105,983
R-squared	0.427	0.427	0.428	0.406

Table A2: Carbon Emissions and Stock Returns: Energy Inflation Shock

The sample period is 2005.01-2022.12. The dependent variable is *RET*. The main independent variables are carbon emission levels and interaction terms with energy CPI and energy inflation shock. The vector of controls includes those in Table 2.All variables are defined in Table 1 and Table 2. We report the results of the pooled regression with standard errors double clustered at the firm and year levels. All regressions include firm and Trucost industry*time fixed effects. ***1% significance; **5% significance; *10% significance.

	(1)	(2)	(3)	(4)
VARIABLES	Dependent Variable: RET			
LOGS1TOT	0.334***			
	(0.110)			
LOGS2TOT		0.361***		
		(0.110)		
LOGS3UTOT			1.162***	
			(0.275)	
LOGS3DTOT				0.217**
				(0.082)
LOGS1TOT*Energy inflation shock	1.014			
	(0.772)			
LOGS2TOT* Energy inflation shock		0.823		
		(0.835)		
LOGS3UTOT* Energy inflation shock			1.256	
			(1.158)	
LOGS3DTOT* Energy inflation shock				1.129
				(1.075)
LOGS1TOT*Energy CPI	0.453**			
	(0.167)			
LOGS2TOT*Energy CPI		0.460***		
		(0.169)		
LOGS3UTOT*Energy CPI			0.609***	
			(0.218)	
LOGS3DTOT*Energy CPI				0.899***
				(0.244)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry*time FE	Yes	Yes	Yes	Yes
Observations	227,310	227,178	227,310	105,983
R-squared	0.427	0.427	0.428	0.406

Table A3: Carbon Emissions and Stock Returns: Legacy Sample

The sample period is 2005.01-2022.12. The (legacy) sample includes all companies with information on emissions in any period before 2016. The dependent variable is *RET*. The main independent variables are carbon emission levels and interaction terms with CPI energy. The vector of controls includes those in Table 2. All variables are defined in Table 1 and Table 2. We report the results of the pooled regression with standard errors double clustered at the firm and year levels. All regressions include firm and Trucost industry*time fixed effects. ***1% significance; **5% significance; *10% significance.

	(1)	(2)	(3)	(4)
VARIABLES	Dependent Variable: RET			
LOGS1TOT	0.165*			
	(0.097)			
LOGS2TOT		0.136*		
		(0.073)		
LOGS3UTOT			0.798*	
			(0.438)	
LOGS3DTOT				0.201**
				(0.083)
LOGS1TOT*Energy CPI	0.229**			
	(0.095)			
LOGS2TOT*Energy CPI		0.242**		
		(0.099)		
LOGS3UTOT*Energy CPI			0.458***	
			(0.147)	
LOGS3DTOT*Energy CPI				0.418**
				(0.157)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry*time FE	Yes	Yes	Yes	Yes
Observations	134,263	134,131	134,263	36,978
R-squared	0.546	0.546	0.546	0.559

Table A4: Carbon Emissions and Stock Returns: Unadjusted CPI Energy

The sample period is 2005.01-2022.12. The dependent variable is *RET*. The main independent variables are carbon emission levels and interaction terms with unadjusted CPI energy. The vector of controls includes those in Table 2. All variables are defined in Table 1 and Table 2. We report the results of the pooled regression with standard errors double clustered at the firm and year levels. All regressions include firm and Trucost industry*time fixed effects. ***1% significance; **5% significance; *10% significance.

	(1)	(2)	(3)	(4)
VARIABLES	Dependent Variable: RET			
LOGS1TOT	0.336***			
	(0.108)			
LOGS2TOT		0.361***		
		(0.109)		
LOGS3UTOT			1.162***	
			(0.275)	
LOGS3DTOT				0.217**
				(0.086)
LOGS1TOT*Unadj_CPI_energy	0.423**			
	(0.171)			
LOGS2TOT*Unadj_CPI_energy		0.431**		
		(0.171)		
LOGS3UTOT*Unadj_CPI_energy			0.565**	
			(0.220)	
LOGS3DTOT*Unadj_CPI_energy				0.976***
				(0.121)
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Industry*time FE	Yes	Yes	Yes	Yes
Observations	227,310	227,178	227,310	105,983
R-squared	0.427	0.427	0.428	0.406