

Financial Markets and Climate News: Evidence of Short-Termism?

John (Charlie) Walsh, Senior Sophister
Andrew O’Riordan, Senior Sophister

In another paper which stresses the idea that we have only twelve years remaining to avert climate disaster, Charlie Walsh and Andrew O’Riordan investigate whether or not investors are myopic in their assessments of the cost of climate change. The research includes an impressive event study analysis and contributes some incredibly interesting findings to both the research of short-termism in financial markets and the wider discourse around climate change. Walsh and O’Riordan suggest that investors are indeed hyperbolically discounting the future costs of climate change, illustrating this by showing that energy companies do not experience any abnormal returns beyond the market rate when disquieting information such as that contained within the IPCC report “Global Warming of 1.5°C” is published.

I. Introduction

Climate change is one of the most significant challenges facing humanity in generations. Whilst debate rages amongst the public and politicians, the message from the scientific community has been clear for many years. In their latest report, the IPCC indicated that we have until 2030 to make the necessary changes to prevent average global warming

of over 1.5°C above pre-industrialised times, the failure of which will have severe consequences. They have estimated that this will require over \$13 trillion of investment (IPCC, 2018). However, this investment is required now to prevent costs that will not be fully realised for generations. Given the long-term nature of such investment, it is potentially exposed to a market inefficiency known as short-termism. This is a well-documented phenomenon whereby expected cashflows accruing at distant time horizons are irrationally discounted more highly than expected cashflows in the nearer future (Miles, 1993). This could lead to an underestimation of the potential future costs of climate change, or of the potential future benefits of swift action. Ultimately, this could lead businesses to underinvest in positive NPV projects that would make them more sustainable and lessen the future effects of climate change.

This paper aims to investigate whether investors display short-termism in their assessment of climate change. We do this by analysing the response of energy company stock returns to climate news. We use the market model to estimate the average abnormal return on all the stocks listed on the S&P 500 Energy index on the day of and the days surrounding the release of the IPCC special report entitled “Global Warming of 1.5°C .” If markets are efficient, any abnormal returns can be attributed to new information. Assuming there were no other news events impacting energy stocks in the period analysed, we can attribute any abnormal returns to the release of the IPCC report. A finding of no average abnormal returns on the day of the report’s release would support the hypothesis that investors are excessively discounting the future costs of climate change.

II. Climate Risks and the IPCC

There are two important questions for this analysis. Firstly, does climate change impact the value of companies? Secondly, does the IPCC report contain information on climate change pertinent to investors? If the answer to either of these questions is no then we would not expect to see a response in stock markets to the release of the IPCC report.

Tackling the first question, climate change is a real threat to not only the human population but also to economic activity. For example, Tropical Storm Barry, which made landfall in the Gulf of Mexico on the

13th of July of 2019 (Adams, 2019), forced companies such as Chevron, Royal Dutch Shell and BP to evacuate non-essential personnel (Cunningham, 2019). The storm resulted in oil production shuttering for up to three days (Adams, 2019). These extreme weather events are only going to intensify, as has been recently evidenced by the Amazonian and Australian wildfires. Meanwhile, rising sea levels will destroy many companies' premises, whilst rising temperatures and changing climates could make large portions of land nonarable.

To tackle the second question we must understand what the IPCC is. The Intergovernmental Panel on Climate Change (IPCC) was formed in 1988 to "provide policymakers with regular scientific assessments on climate change" (IPCC, 2019). The IPCC determines the state of knowledge on climate change, assessing thousands of research papers and amalgamating them into a consensus view of climate change knowledge. Assessment reports are released approximately every 6 or 7 years, with special reports addressing particular issues released in the interim. We analyse the stock market response to the special report entitled "Global Warming of 1.5°C", released on October 8th, 2018. The report outlined the potential impact of global temperatures rising 1.5°C higher than pre-industrial times. Consequences highlighted include increased likelihood of flooding in some countries and droughts in others, an increase in tropical storms, and forced migration due to changing landscapes. Most importantly it outlined the major difference in the climate damage caused by 1.5°C vs 2°C of global warming. A stark example of this is that under 1.5°C of warming, there will be a sea-ice free Arctic summer once every century, under 2°C this increases to once every ten years (IPCC, 2018).

Some critics may argue that the contents of the report were not news to investors, so the information was already priced into markets and so we should not see a reaction in stock prices. In response to this, we have a number of remarks. Whilst the IPCC does not conduct its own research, its impact on the state of climate change knowledge is undeniable (Hulme & Mahony, 2010). The report in question contains over 6000 references and tens of thousands of comments (Cole, 2018). They are summarizing knowledge that is not available to the everyday public, either through scientific literacy boundaries or large access fees for research papers. The IPCC is renowned for its impact on general climate change knowledge, policy decisions and climate change discourse (Hulme &

Mahony 2010), and in 2007 won the Nobel Peace Prize for their efforts to accumulate and disseminate greater knowledge about man-made climate change. Moreover, the scientists who compiled the report said the difference caused by just half a degree came as a “revelation” (Watts, 2018). If this was a surprise to the expert compilers of the report, then it will likely have been news to investors and the general public.

III. Short-termism

If markets are efficient and investors are rational, we would expect to see a stock market reaction to the release of the IPCC report. However, humans are not rational agents. We often use cognitive rules of thumb in our decision making, which make us susceptible to systematic bias (Kahneman, 2011). The most relevant biases for this paper are those that cause short-termism, also known as myopia. This is the result of excessive discounting of long-term events above and beyond rational discounting levels. A rational individual will discount a future event accounting for the risk-free rate and the specific risk premium. However, the short-term individual will additionally discount for his own time preference. This is usually explained by a present bias, or a desire for immediate gratification. This excessive discounting of long-term events is well documented in the literature (Loewenstein & Thaler, 1989) and can lead to time inconsistent preferences. This leads to the rejection of actions with long term benefits that the individual feels desirable, over and above the usual effects of discounting (Sterman, 2011).

Whilst there is significant evidence of time inconsistent preferences at the individual level, the question is whether it extends to the aggregate level – i.e. do financial markets as a whole display short-termism? There have been a number of papers demonstrating that they do. Miles (1993) found excessive discounting above the rational level of 10% per annum. Davies et al. (2014) found no significant evidence of excessive discounting in the subperiod 1985-1994 but found a significant result of between 5% and 10% excessive discounting per annum in the period 1995-2004, indicating that the myopic tendencies of markets have worsened over time.

If markets display myopic tendencies, the obvious question to ask is what is causing them? At the individual level, time inconsistent prefer-

ences are explained by an internal preference for immediate gratification. There is evidence for this at the neurological level whereby functional magnetic resonance imaging of the brain have indicated that two separate systems are involved for decisions with an immediate reward and those with a time delay (McClure et al., 2004). However, in financial markets there could be additional factors making investors favour short-term returns at the expense of long-term ones. First is the rise in high-frequency trading in the stock market, whereby investors hold shares for a tenth of a millisecond, courtesy of high-tech trading computers (Davies et al., 2004). Since the algorithms that run these machines search for arbitrage opportunities and hold positions for such a small amount of time, long term sustainability doesn't come into their trading decisions. Moreover, the reward structures of institutional investors often directly encourage short-termism, as short-term performance is easier to measure than long-term performance.

The reasons above are the standard explanations of short-termism in financial markets. However we believe that in the context of considering climate change, there are additional reasons why investors would excessively discount its future costs. Firstly, many institutional investors are bound by fiduciary duty, whereby they have a duty of prudence and loyalty to their beneficiaries, on whose behalf they invest. Courts have often interpreted the duty of prudence to mean investing in the conventional way. Woods (2009) argues that this encourages fiduciaries to stick with the status quo, discouraging investment innovation by institutions. This precludes the consideration of climate change in investment strategies to the extent that it is unconventional practice.

Another explanation is investors and the public don't fully understand the complex dynamics of climate change and thus don't grasp the severity of its costs, even when they are clearly put to us. For example, Egan and Mullin (2012) conducted a survey of public opinion on climate change under a variety of weather conditions. They found that for every 3.5°F that local temperatures rose above normal, Americans became a percentage point more likely to agree that there is "solid evidence" that the earth is getting warmer. These climate change misconceptions are seen even amongst highly educated individuals (Sterman & Sweeney, 2007). If investors don't fully understand the implications of climate news, they will underestimate the scale of the future costs of climate

change and the scale of the benefits from swift action. Overall, this is an argument that on top of excessively discounting the future costs of climate change, investors don't understand, and thus underestimate those very same costs. This is in a sense a double shot whereby the true costs are underestimated, and those underestimated costs are discounted at an excessively high rate.

Most previous research has seen the cost of short-termism as the opportunity cost of foregone investment, since positive NPV investment projects with a long-term maturity, when appropriately discounted for both risk and time preference of investors, will often be rejected (Miles, 1993). However, in the context of ignoring the future costs of climate change, the implications of short-termism could be far more severe, namely preventing the businesses investment necessary to tackle climate change. This, combined with the extra susceptibility of climate costs to short-termism outlined above, makes this an extremely relevant issue and one that we must find solutions for.

IV. Data

We choose to study the response of energy company stock returns to the release of the IPCC report. These companies are the most likely to be affected by the contents of the reports and as such, should see the largest response in their share price. Specifically, we analyse those listed on the S&P 500 energy index, totalling 27 firms. We obtained their daily adjusted close prices from Yahoo Finance for all days inclusive 9th October 2017 to 10th October 2018, which we convert to daily returns. Additionally, we use the daily market return levels from the Kenneth R. French data library.

V. Empirical Methodology and Results

We want to measure the impact of the IPCC report's release on the returns of the sample energy companies. To do this we utilise the event study methodology which has become the standard method of measuring security price reaction to an announcement or event. This methodology uses the market model:

$$R_{it} = \underbrace{\alpha_i + \beta_i R_{mt}}_{\text{Expected return}} + \underbrace{\varepsilon_{it}}_{\text{Abnormal return}}$$

where R_{it} is the return of company i at time t ; R_{mt} is the market return at time t ; α_i is a constant term for each company i ; β_i is the sensitivity of the stock's return to the market return; and ε_{it} is the error term. This model separates out the return of a stock into the normal/expected return caused by economy wide factors ($\alpha_i + \beta_i R_{mt}$) and abnormal/excess returns caused by new firm specific information (ε_{it}), such as the IPCC report release. Assuming markets are efficient, we can attribute any abnormal returns (ε_{it}) to the release of new information relevant to the firm.

The first step of an event study is to identify the estimation window, over which we estimate the above market model parameters (α_i , β_i) for each firm. It is standard in the literature to estimate these parameters using a years' worth of data prior to the event date of study. Second, we must identify the event window, over which we analyse the stock market reaction to the report. We choose ± 2 days around the report's release date. This short event window is necessary due to the crucial assumption that no other news events relevant to the sample companies occurred over the event period. The longer the event window, the less confidence we can have in this assumption. We redefine time in our event window relative to the report's release and label it s . As such $s = -2$ is 2 days before the report's release and $s = 0$ is the day of the report's release.

We estimate the parameters of this market model (α_i , β_i) for each firm using the daily stock and market return data over the estimation period. We then use these estimates to generate a predicted return for each sampled firm on each day of the event window, using the actual market return on each of these days. These predicted returns represent the expected/normal returns of the firm caused by economy wide factors. By subtracting the predicted return from the actual stock return on a day, we get the abnormal returns for that day. Assuming markets are efficient, and that the IPCC report was the only relevant event over the event period,

we can attribute these abnormal returns to the release of the IPCC report. The average abnormal return in period s (AAR_s) for all energy firms in our sample is given by

$$AAR_s = \sum_{i=1}^N \frac{AR_{is}}{N_s}$$

where AR_{is} is the abnormal return of firm i in period s , and N is the number of firms in our sample. Figure 1 plots out the path of average abnormal returns over our event window. Our primary interest is in the average abnormal returns on the day of the report's release (AAR_0).

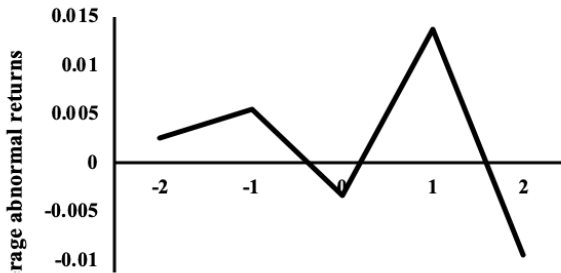


Figure 1. Average abnormal returns for all sampled energy stocks across a four-day event window around the release of the IPCC report

Looking at *Figure 1* we see that there is a small negative effect on returns, however this is not statistically significantly different from zero. It is possible that the effect was simply dulled due to early leakage of information or that markets took some time to properly assimilate the information. As such, we also calculate the cumulative average abnormal return (CAAR) over the entire event window (± 2 days around the report's release date):

$$CAAR = \sum_{s=-2}^2 AAR_s$$

Table 1 shows that cumulative average returns over the event period were

actually positive (although statistically insignificant), thus providing no evidence that the report had any negative impact on returns over our event period. As such, there is no evidence that the returns of energy companies showed any reaction to the release of the IPCC report, either on the day of its release nor over a 5-day event window surrounding its release.

Table 1. Average and Cumulative average abnormal returns

AAR_0	-0.00337 (-0.0023165)
CAAR	0.00857 (-0.1660499)

Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

VI. Discussion

These results provide evidence that financial markets display short-termism in their processing of climate change information. In this paper we have outlined many reasons why an efficient market should respond to climate change information, and why the IPCC reports constitute pertinent information to investors. Despite this, we see no reaction in the returns of energy companies to the report. We believe this is due to excessive discounting of the future costs of climate change i.e. short-termism.

Some may argue that investors are in fact rationally discounting but since the costs of climate change occur so far into the future, they simply have a minimal present value. Wagner and Weitzman (2015) have addressed this criticism. They note that there is currently a 10% probability of global warming of over 6°C, which would have catastrophic implications for life on this planet. This would incur near infinite costs. With the potential for near infinite costs, the argument that this has been appropriately discounted to minimal present value is unconvincing no matter what time horizon such events occur on.

These findings have significant implications for the fight against climate change. It has been estimated that we only have until 2030 to make the necessary investment of \$13 trillion to prevent global warming of over 1.5°C (IPCC, 2018). With over 35% of all energy-related carbon dioxide and methane emissions worldwide since 1965 being attributable to the top 20 fossil fuel companies, much of this investment must come from businesses (Heede, 2019). Investors play a key role in mobilizing businesses to tackle climate change, and by extension, an equally large role in preventing them doing so. Davies et al. (2014) showed that if investors discount future returns excessively, a manager, looking to maximise the value of a firm, will prioritise short-term cash-flows over long term ones. This leads to companies prioritising dividend pay-outs over long-term investment in sustainable technologies and business practices. Thus, investors displaying short-termism with respect to climate change are directly worsening its effects by impeding the necessary investment in sustainable solutions.

VII. Conclusion

This paper adds to the literature on short-termism and to the literature on market inefficiencies more generally. Our research is unique in that we focus our analysis on the consequences of short-termism on the fight against climate change. Our empirical analysis has provided evidence that markets are myopic in the processing of climate change information. This is significant as this inefficiency could seriously impede the allocation of resources toward climate action that is currently needed on an exceptionally wide scale. We encourage further research on methods to mitigate short-termism and maximise investor consideration of climate issues in their investment strategies.

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