Weather, finance and meteorology: forecasting and derivatives

Samuel Randalls

School of Geography, Earth and Environmental Sciences
University of Birmingham

SCR857@bham.ac.uk
SamRandalls@tesco.net

Extended Abstract

Since the 19th century forecasting has been one of the primary tasks of meteorology as well as one of the principal revenue earners. When we think about the weather it is often in terms of the weather forecast: what the weather *should* have been. For businesses, however, forecasts are of limited value. They can be used to make decisions about short-term production and consumption practices, but they can only reduce a company's exposure to the weather in a limited way. In the mid-1990s a group of thinkers at Enron came up with a product that would mitigate the economic risk of the weather to a company even further. Weather derivatives, as they became known, would allow an energy company, for example, to mitigate, or hedge, the cost of a warm winter when they sell less gas and hence earn less revenue. In effect they would be purchasing an insurance contract that would pay out compensation when a particular weather parameter was reached. Thus weather, or more technically weather data, has become commodified as a financial product that can be bought and sold. In Castree's (2003) schema this is the commodification of 'nature as information'.

This paper traces the history of this weather derivatives market using the limited printed material that is available and the material gleaned from interviews undertaken with most of the key players in the market. The history of weather derivatives is a story of a product that is trying to become an accepted part of business culture. The network of actors it involves expands across financial markets, innovative corporations, particular weather events and systemic changes in certain sectors. This process can be seen as both constrained and creative, both structured and an innovative becoming.

How did weather become a derivative in the US in 1997? Firstly it is important to recognize a systemic change that was occurring in the 1990s, namely, the convergence of the capital and the insurance markets. Until then insurance had largely been separate from the capital markets, but the two became increasingly intertwined, particularly in alternative risk transfer markets, as companies sought to insure themselves in the capital market and trade insurance-style products more freely (Considine, n.d.). For Considine (n.d.) weather derivatives are the logical extension of this process. This process is driven by the expansion of risk providers into new areas and the demand for new protection areas from those seeking protection (Banks and Bortniker, 2002).

Secondly, the insurance industry in 1997 was going through a cyclical phase of low premiums from the traditional underwriting industry, which meant that they were able to release a significant amount of risk capital to hedge weather risks (Considine, n.d.). The third factor was the strong El Niño event of 1997-1998. The anomalously warm weather in the northern US coupled with the fact that many energy companies are dependent on sales of gas and electricity to the large populations in this region left many companies with massively reduced profits.

Fourthly, this warm winter effect was enhanced by the deregulation of the electricity markets, a process ongoing since 1996. The rise of competitive regional wholesale markets brought about increased electricity trading and an understanding of the effect of the weather on both short-term demand and long-term supply (Clemmons, 2002). This increased the meteorological expertise within energy companies, the first step towards an increasing valuation of atmospheric knowledges.

Fifthly, energy companies were particularly keen to examine ways of mitigating this risk. The most important of these was Enron. For all its well-documented problems, Enron promoted innovation and a constant investigation of risks within its own business. In 1996 whilst investigating the revenue fluctuations from the gas pipeline sector, which during a warm winter pumps less gas through the pipes, a group at Enron decided they needed to manage this risk pro-actively. They generated an idea of creating financial tools built around an index that was familiar to every energy company, that of degree-days. Unlike many other financial products it was easy to create this index, because weather is independently measured. As people have different opinions on which way the weather index was going to go (warmer or colder) then a market was, in principle, possible. At first insurance companies were unimpressed so Enron decided to act as a risk capacity provider to start the market. In 1997, the first major deal took place between three US energy companies, which created sufficient publicity to persuade insurance companies into the market. The underlying issues about data and pricing were also being resolved.

This leads on to the sixth factor in the creation of the market. Meteorological data would be supplied from airport stations with good historical records such that with some de-trending it would be relatively straightforward to price a contract based on this data. The quality and nature of observational data required for the market will be discussed at more length later.

Finally, a weather market did not seem so unusual in the 1990s as it would have done in the 1970s, because of the rise of other environmental markets, particularly in air pollutants. The focus on atmospheric pollution and the global climate change debate put climate discourses at the centre of business attention. The fear of climate change spurred some companies into examining what effect it might have on their profits and operations. The El Niño event of 1997-1998 merely brought to the fore the potential effect that changing climate might have on their businesses.

The creation of the weather derivatives market thus involved a whole set of factors from the weather of 1997-1998, to the changes in financial markets, through to the specific contextual environment provided at companies such as Enron. The weather derivatives market has subsequently spread globally. In the UK, the first weather derivative deal was sold by Enron to Scottish Hydropower who, at that time, 1998, were taking part in a government pilot scheme for the privatization and deregulation of energy markets. Other European deals followed, first in Germany and the Netherlands, and then later in Scandinavia. A Japanese and Australian market has also developed, whilst the World Bank has also begun analyzing the potential use of weather derivatives in agricultural rural development schemes conducting a pilot study in India in 2003. In the US, the market became more open, particularly after the Chicago Mercantile Exchange (CME) started listing weather contracts in 1999, although not until 2001 did they acquire a market-maker to expand the market. The market has also diversified beyond energy into the leisure, retail and construction sectors, but it still retains the environment that the energy players have given to it.

Whilst the meteorological observation network was generally adequate to get the market going, companies were good at exploiting weaknesses. The meteorological offices have been used to renovating stations and moving thermometers with little notice and short overlap periods for the difference between the new and old instruments to be properly recognized. A classic example is that which occurred at Houston where certain energy companies extracted profit from the fact that they knew the thermometer had moved and other companies did not. The difference may be small (just 1°C), but this may affect whether a particular contract pays out or not. Thus the weather risk community has been active in trying to work with the meteorological station operators to attempt to make the stations more reliable.

The commodification of weather in weather derivatives is also having an effect on the employment of meteorological expertise and the value of meteorological labour. What was previously relatively unvalued daily average data for many locations has become a traded commodity. This has raised its value, a fact not lost upon the Meteorological Office in the UK (and others in Europe) that wishes to charge the weather derivatives users substantial sums of money for data. Whilst in the US meteorological data is cheap and historical datasets are widely available, European meteorological offices are prepared to charge substantial fees for data. This has restricted the ability of some players in the market, particularly those US companies that would be willing to trade European stations. This re-valuation of good observational, meteorological data has thus increased the stream of revenue for meteorological offices. Arguably if the weather derivatives community wants improvements in meteorological observation networks then they should pay for it. It must be remembered that the initial development of an observing network in the 19^{th} century using the telegraph system required money, which was provided by the Meteorological Councils at that time. Meteorology and economy have always been inter-linked.

In addition to this a host of companies have grown up offering software that will aid the prediction of next season's climate, as well as calculate the expected price for a particular contract. Weather derivatives have thus expanded the demand for meteorological expertise as well as increasing the jobs available for meteorologists. Weather derivatives, in the eyes of many people selling them, will replace some of the needs for forecasting, as there is little information in forecasts beyond 10 days and most weather derivative contracts are bought several months in advance. Forecasting, however, is not completely valueless. There is some short-term trading when particular outcomes look more or less likely and this is based upon whether one believes the forecast to be right or not, but for weather derivatives bought for a season in advance the only way to gain a trading advantage is to be able to predict the direction the temperature is likely to go in, either up or down. One weather product supplier claim to have predicted the last 3 cool winters in New York more accurately than the national weather service, because they do not just accept global warming. So different knowledges are becoming valued by the weather derivatives community, namely less short-term and more medium-term understandings of weather and climate.

Energy companies have for many years employed extensive meteorological expertise to help predict power prices and demand curves. Now this expertise has become even more valuable as knowledge that can be turned into profit. This is a further commodification of 'nature as information' (Castree, 2003); not just weather data itself, but information and knowledges about weather data. For one US-based energy company, the weather derivatives desk is not designed to hedge internal risk, but simply to make money out of the hope that their weather models and expertise are better than other companies. This has increased the exchange value of

meteorologists and also led to the fact that much of the cutting-edge climate research may now be carried out within a corporate rather than a national or academic environment. This has certain implications for meteorological science. Firstly those corporate climate models are not available publicly and secondly meteorological issues less relevant to corporate issues may become sidelined. This creates the potential for companies to claim atmospheric knowledge in advance of the public sphere, which may have implications for debates such as climate change. How would we react to models of climate change that are produced by the international meteorological experts based within energy companies?

Finally, weather derivatives have also led to attempts to privatize meteorological knowledges for profit. Two companies in the market have clashed over one company's attempts to patent their wind power indexes, which would force any company trying to sell wind derivatives to use and pay for their indexes. This privatization was contested and won by the other company, but nonetheless the issue highlights the ream of opportunities for profit that the creation of weather derivatives has opened up. Thus the commodification of weather in weather derivatives has also resulted in a more general commodification and privatization of meteorological knowledges that may have far-reaching consequences in the future.

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Short Biography

My general area of interest is in understanding weather-society relations. I am currently researching for a PhD at the University of Birmingham, UK, on 'Firms, finance and the weather: the UK weather derivatives market'. Prior to this I have a BA and MSc from the same university, my MSc dissertation examining the social, economic and technological factors involved in establishing meteorological science in the second half of the nineteenth century in the UK and it was entitled 'Illuminating the "Brocken Spectres" of Meteorology: 1860-1900'.