A market for weather risk?
Worlds in conflicts and compromising.

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Abstract: In this paper we study the development of the market for weather derivatives in Europe. We show that weather derivatives conceived as financial products by their promoters have difficulties finding end-users. We describe the attempts of market promoters using a framework drawn from economic sociology, namely the theory provided by Boltanski and Thevenot's Economy of Worth. We derive some conclusions about the potential future of the market.

In his visionary conception of modern society, Ulrich Beck (1990, 1992, 2006) proposes to theorize modern societies as "societies of risk" and to explore the new paradigm thus created. The notion of risk can accordingly be considered as a new epistemological and political space for analyzing changes in contemporary capitalist societies (Calas, 1999; Douglas and Wildavsky, 1982; Ewald, 1991; Mandel, 1996). Although the social processes involved in the interpretation and definition of risks have been studied in many areas (for example, Lane and Quack, 1999, Gephart, 2001), they have been very little investigated on financial markets.

To at least partially fill in this gap, we propose to focus in this paper on the European market for weather derivatives. Our main empirical interest is to understand why this market remains extremely thin, despite several attempts to develop it and repeated announcements of coming growth. Following Huault and Rainelli (2007), we argue that the shape of the market that results from their efforts can best be understood by taking full account of the specific features of weather derivatives. Combining meteorology and finance, weather derivatives contracts are exchanged in Europe on the basis of over-the-counter markets and remain little standardized. More fundamentally, they involve various categories of actors belonging to the worlds of meteorology, industry, agriculture, financial markets, insurance and banking companies. These different actors have distinct risk cultures. While traders from financial markets heavily rely on the financial theory of risk in the way they design weather derivatives

contracts, insurance companies are more used to actuarial computing. As regards non-financial industries, they very much perceive weather risk as a kind of operational risk.

Our thesis is that the main task of weather derivatives market promoters is to rally the various categories of actors around a unique conception of weather risk. We therefore propose to analyze the heterogeneity of risk cultures, typical of the market, using Boltanski and Thevenot's theory (1991/2006). Our main argument is that the various categories of actors evolve in different worlds and that the problem of market participants can be understood as one of finding a compromise between worlds in conflicts.

Our paper evidences here is the relative failure of such an attempt. It provides some insight into the causes of this. When a financial innovation involves actors from very different worlds, it might be very difficult for the market promoters to find the compromise that would rally everybody around a common vision of risk. This suggests that there may be a limit to the marketization of new risks.

The remainder of this paper is divided into four parts. The first part presents "Economies of worth" as a conceptual matrix, to focus on different categories of actors evolving in different worlds and analyze the way they find an agreement. Against mainstream economic theory assumptions, and the idea that actors compete in a perfect and universal market on the basis of optimising rationality, this theoretical framework emphasizes complex operations of cultural adjustments and evaluation, to face economic uncertainty (Eulriet, 2008). The second part presents our research method based on a longitudinal qualitative study of the emerging activity of weather derivatives from 1997 to 2007. Our approach focuses on how French actors took part in the development of the market. The third part consists of a presentation of our case study and of an analysis of our main results. The fourth, and last part, draws the principal conclusions of the research.

1- **"Economies of worth" as a conceptual matrix**

In their book, *On Justification. Economies of Worth*, Luc Boltanski and Laurent Thevenot (1991/2006) focus upon the general question of *agreement*. They underline modes of *equivalence*, of *qualification*, of *adjustment* and of *justification*, by which actors produce

agreements and coordinate their actions. They answer this question by taking full account of the imperative to justify, a necessary condition to coordinate human behavior.

Common worlds

In order for actors to reach agreement, the quality of things must have been defined, in a way that is consistent with the *principles of worth* invoked. The "worth is the way in which one expresses, embodies, understands, or represents other people" (2006 : 132). This leads to examine assemblages, including both persons and things that can be coherent ; what the authors call *worlds.* These latter constitute bodies of rules that make it possible to build a harmonious *polity*, and shared competence required of persons in order for agreement to be possible. The order in a world can be described via categories defining subjects (*the list of subjects*), objects (*the list of objects*), qualifiers (*state of worthiness*), and relations designed by verbs (*natural relations* among beings). *Higher common principle*, principle of coordination that characterizes a world, is a convention for establishing *equivalence* among beings. This convention stabilizes and generalizes a form of association. People tend to make the higher common principle explicit only as a last resort in the process of justification.

Drawing both on fieldwork observations of disputes and critiques, and on a reading of the classical literature in political philosophy, the authors distinguish a plurality of forms of evaluation or "grammar of worth" (Lamont and Thevenot, 2000 : 5) : 1/ inspiration expressed in creativity, spontaneity and originality 2/ domestic trustworthiness expressed in tradition and hierarchy, 3/ market performance, 4/ industry efficiency, 5/ renown based on fame and 6/ civic solidarity,. These last four worlds[1], kinds of ideal models of situations and relations, are explicitly depicted by Boltanski and Thevenot (1991/2006), as follows.

The Market World. A person acting normally in this world, has not only to rely on the objectivity of the good to reach agreement on a transaction, but also on its independence with respect to the various actors engaged in the transaction. Competition is the higher common principle and the circulation of goods and persons is free in a space that has no limits. "The *Market World* is thus populated with individuals seeking to satisfy desires ;

[1] We describe more precisely the worlds that are directly linked to the main object of our research.

they are in turn clients, competitors, buyers and sellers, entering into relations with one another as businessmen" (2006 : 198). Actors are detached from one another, have no personal relationships, and they take any opportunity to engage in a transaction. This latter supposes that the good is detached enough to allow the play of competition with others. "This distance has to produce indifference with regard to all the qualities that are foreign to those of buyer or seller in the persons with whom one is dealing" (2006: 202).

The Industrial World. The higher common principle refers here to efficiency, to performance of beings and to their productivity. Action is a task of production. The harmony of this world is expressed in the organization of a system, that is to say, in a structure in which things can be predictable. Test in this kind of organization supposes to check that things function as was predicted and that the solution to a problem is realistic. "Once the decision is made, the arrangement set up, the project launched, the mechanism started, its proper operation can be judged by an evaluation of its performance on the basis of the effects produced" (2006 : 261).

The World of Fame. It is opinion that establishes equivalence, and the worth of each being depends on the opinion of others. Persons have a common desire to be recognized and to be considered. The aim is to attract attention, to convince other people, to obtain respect from them, "to earn or win" their support. (2006 : 180) ; finally to capture the attention of the public. The peak moments are those during which some images become visible, for example during a presentation that places actors "in the spotlight under the gaze of others". Beings achieve worth only if the presentation is made visible, in a transparent space where it can be looked at and compared. In the *World of Fame*, what is obvious is what is known, on the contrary what is unknown is debatable.

The Civic World. In this world, beings all belong to a collective that includes and transcends them. They escape from division, and access to worth, because they are naturally political. They have a taste for what is common, what unites them. Judgement is the expression of the general will that may be manifested through the achievement of awareness, or by a collective reflection, or in the form of mobilization around a cause (2006 : 192). The general will is expressed by law. The polity comes apart when it yields to the particular. "Whatever dilutes, splinters or restrains is unworthy" (2006 : 193).

Worlds in conflict and search for an agreement

However, these worlds are no closed systems. One of the important dimension of *Economies of worth* resides in the following question: How are relations between different worlds established ? The answer to this question is that unlike objects, human beings can navigate in situations arising from different worlds. This leads to tensions, since the principles of justice invoked are not mechanically compatible. For example, from the point of view of the *Market World*, the *Industrial World* can be criticized for its rigidities. The critique of the restraining effect of bureaucratic rules is particularly explicit (2006: 268). On the contrary, the *Market World* will be criticized for the ambiguity of the product sold. The tensions are particularly pregnant when it is time to make a deal and agree on a fair price. Sometimes, reference is made to the low degree of usefulness of a product if one considers its price.

All these tensions between different worlds that generate *disputes* have to be solved if the action is to take its normal course. The reduction of tensions and disaccords can be realized through *compromising* but also through other figures of agreement, such as *arrangements* and *relativization*.

The *compromise* represents the keystone of the *Economies of Growth* model. It is an agreement for the common good. In a compromise, people agree to suspend a clash – a dispute involving more than one world, without settling it through recourse to a test in just one of the worlds in presence (2006 : 277). The situation, say Boltanski and Thevenot, remains composite, but a clash is avoided. One way of establishing a compromise and to strenghthen it, is to place objects composed of elements stemming from different worlds at the service of the general interest to give them their own identity without refering to a particular world. To work out a compromise consists also to reach the consensus, as regard the adequate term, “finding a formulation acceptable to all”.

In a denunciation, a compromise is often reduced to a private arrangement that only benefits the people involved. In this sense, the *arrangement* is a very contingent and local agreement. It is fragile and refers to a form of relativization. It is a sort of association oriented toward private interests. “A private arrangement is a contingent agreement between two parties that refers to their mutual satisfaction rather than to a general good (*you do this which is good for me ; I do that, which is good for you*) (2006 : 336)”. The term *private* is used to

focus on the absence of any general interest. The arrangement escapes from any kind of justification in relation to a polity.

The analysis of the way people stop supporting a private arrangement leads Boltanski and Thevenot to identify another way of exiting from a dispute. It is a flight from justification, what they call *relativization*. To escape from a clash, people may agree that nothing really matters. Disagreement is not important if nothing matters. “In relativization, the reality test is abandoned in favor of a return to the circumstances (…). The relief that relativization brings depends precisely on the pacification that is procured by a return to relaxed situations in which the question of agreement is suspended”. (2006 : 339). Finally, the situation is considered as purely local and with no consequences. Relativization is a way to escape testing and examination. But this very contingent situation leads to instability. No common measure exists and the polity falls apart.

In the rest of this paper, we use the *Economies of worth* model as a matrix, to focus on different worlds in conflict on the market for weather risk, *i.e* different representations of weather risk. We also analyze the way actors try to reach an agreement, *i.e* the attempts to overcome conflicts between worlds.

2- Methods

Our research is based on an in-depth qualitative study of the development of the market for weather risk from 1996 to 2008.

Our objective is to understand the intentions and beliefs of the actors, their representation of the market, their arguments and their own interpretation. Hence, we retain the methodological position consisting of studying justifications in disputes, without “assuming the privilege of a bird’s eye view” (Boltanski and Thevenot, 2006 : 349). Besides, inductive logic remains rather dominant and can be assimilated to a naturalistic inquiry (Lincoln and Guba, 1985 ; Strauss and Corbin, 1994).

Data Collection

Our approach focuses on how European actors took part in the development of the market and on their perceptions of weather risk. In a first stage, our objective was to offer a precise

description of the emergence and development of the market, in order to improve our understanding of our object. In a second stage, we tried to put forward the views and types of arguments the agents used when debating.

To reach these objectives, the multiple sources of empirical evidence we used, can be divided into four main categories (Ravasi and Schultz, 2006 : 438). Although it covers a 12-year period of development, our direct observation in the field lasted two years.

Semi-structured interviews. We conducted a total of 20 interviews. Our sampling logic moved from purposeful to theoretical (Locke, 2001; Ravesi an Schultz, 2006 : 438). We initially interviewed people who could provide useful and general information on the market, its growth, its functioning, its main stakeholders and its operating routines. Our aim was also to identify key persons for subsequent interviews. Later, we theoretically selected our informants on the basis of our main research questions and interests. That is why we focused our attention not only on promoters of the market, but also on potential end-users, in order to deepen our understanding of disputes and agreements on this market. We selected interviewees so as to maximise the variety of profiles and heterogeneity of perspectives (Jacobides, 2005 : 471). Respondents are traders and promoters in banks and re-assurance companies (Merill Lynch, Swiss Re, Paris Re, Scor, Metnext, Powernext), end-users in companies stemming from different industries (tourism, textile, energy, agriculture), legal experts and economists in Paris and in London. More precisely, 10 interviews were conducted with promoters of the market, 3 with experts and 7 with end-users. Interviews were semi-structured and focused upon five main questions areas : 1/ The goal of the market for the interviewee, 2/ His/her representation of the market, of its different stakeholders, of cultures of risk ; 3/ His/her opinion as regard weather risk management ; 4/ The most important events s/he remembers as regard the development of the market ; 5/ The most significant or innovative products s/he used to manage weather risk ; 6/ The actions undertaken to deal with emerging problems and attempts to overcome conflicts.

Interviews lasted between one and two and half an hour, most of them were tape-recorded and transcribed. Whenever this was not possible, we took precise field notes. All the interviews involved the two researchers of the study, so as to minimize interviewer bias.

Archival materials. Many categories of archival information such as the studies of Deutsche Bank, the *Société française de statistique*, the *Association française des*

*trésoriers d'entreprises (*AFTE), the Weather Risk Management Association (WRMA)[2], were consulted. These materials were used to confirm the main events on the market, to give details not available from interviews and also to provide textual accounts of debates and discussions. We also studied information, texts and discourses stemming from promoters' websites such as WRMA and Metnext.

Press articles. To review press articles, we used the database Factiva, that provides business news collected from 14000 sources. In total, 250 articles were analyzed, beginning with research on the key-words : "weather risk" and "weather derivatives". Besides, we also analyzed systematically the articles from the professional magazine *Environmental Finance*. The database included issues of this magazine published from 1999 to 2008. 198 articles about "weather risk" were reviewed. Through these documents, we were not only able to reconstitute events, but also to focus on the representations and discourses of different actors as regards the market for weather risk.

Annual reports. We carefully analyzed annual reports of potential end-users from 2006 to 2007. Our aim was to assess how these actors take weather risk into account in their external communication, and to better understand their vision and their logics as regard weather risk management.

Finally, we also attended one professional seminar in March 2008, aiming at promoting the market. It was a very good opportunity to observe the arguments put forward by promoters and the way they justify the legitimacy of the market and their actions. This allowed also informal conversations with promoters (not counted as interviews).

Table 1 : Main sources

Sources	Objectives
Interviews	First stage : - Obtaining general information on the market - Becoming familiar with the context - Identifying actors for subsequent interviews Second stage - Exploring perceptions, representations and arguments of actors and how they try to reach an agreement.
Archival materials and websites	Confirming main events on the market

[2] The goal of WRMA, or Weather Risk Management Association is to serve the weather risk industry by providing forums of discussion and information

	Giving textual accounts of debates and discussions
Press articles (Factiva database and *Environmental Finance*)	Reconstituting main steps of development of the market to construct a chronology Focusing on representations and discourses of actors
Annual reports	Assessing how firms take weather risk management into account in their communication

Data Analysis

Following Miles and Huberman (1994) and Yin (1989), we arranged the data into a condensed, chronological account in order to produce a "facts database" of the development of the market. In a second stage, we tried to capture the “justificatory accounts” of the different actors (Greenwood and Suddaby, 2006: 32) and particularly of promoters trying to push the *Market World*.

We first conducted a primary analysis of these accounts, first identifying sentences and words commonly used by actors to justify their activity. Using knowledge of the financial sphere, we identified an initial set of narratives, reviewed them carefully and interpreted the data using what we knew about the subject based on documents, press articles and interviews (Berg, 2004; Greenwood and Suddaby, 2006). We were then able to analyze diverse cultures of risk, different kinds of justification stemming from diverse actors, and different attempts to find an agreement on this particular market. More precisely and in relation with our research interest, we focused on four main themes: 1/ the absence of growth of the market 2/ the existence of different *worlds, i.e.* the different views and logics of actors as regard weather risk management, 3/ the emergence of *disputes*, *i.e.* of debates and discussions regarding the usefulness of weather derivatives 4/ the search for an agreement by promoters *i.e* the different attempts to overcome conflicts between worlds.

As the research progressed, we sought to verify the emerging categories by using other data sources, in particular, professional press articles and annual reports. These data were collected after we had found the emerging themes from interviews and archival materials. It was then possible to verify the main actors of the market and their specific vocabulary. Based on this analysis, we observed that certain types of questions are more particularly put forward by certain types of actors.

3. Case study

The market for weather derivatives is usually considered to be born in 1997, with three noticeable transactions involving the firms Koch Industries, Enron and Willis[3]. The principle of weather derivatives is to use weather variables such as temperatures or precipitations, as a basis for risk indices, allowing for the transfer of weather risk from a risk seller to a risk taker. For example, in a typical temperature transaction, if weather is too warm – e.g., the average temperature over a defined period exceeds a pre- agreed threshold-, the buyer is entitled to receive a payment from the seller, on the extent to which the average temperature exceeds the threshold[4]. Weather risk can be expressed in terms of temperatures, precipitation, snowfall, wind or any other measurable variable. The amount of payment received by the buyer is determined according to his sensitivity to adverse change in weather. It is of interest to notice that risk can be transferred in the form of index-based insurances as well as through derivative transactions. In this paper we will focus on derivatives transactions, rather than insurances, because the former are at the core of the efforts of promoters to develop a financial market around weather risk. The advantage of using derivatives is that more stakeholders are allowed to participate, thus increasing the chances for liquidity to develop on the market, a key condition for a financial market to work efficiently[5].

Although promoters insist on significant growth of the weather derivatives market over the recent past years, the market remains noticeably thin and seems to encounter various difficulties in taking off. In this case study we present some market data. We then analyse the various approaches of weather risk borne by would-be participant of the market and relate them to the worlds described by Boltanski and Thevenot. Identifying conflicts between worlds around the notion of weather risk, we finally study the way market participants attempt to overcome these conflicts, and the problems weather derivatives promoters are faced with in their effort to develop the market.

3.1 The market for weather derivatives

The market for weather derivatives began with a few private transactions involving a transfer of weather risk between private counterparties. It then developed along the two lines usually followed by financial innovations. First, a market for standardized contracts was

[3] WRMA Website
[4] WRMA Website.
[5] For more on the intricate question of the difference in legal qualification between insurance and derivatives, see Huault & Rainelli (2007).

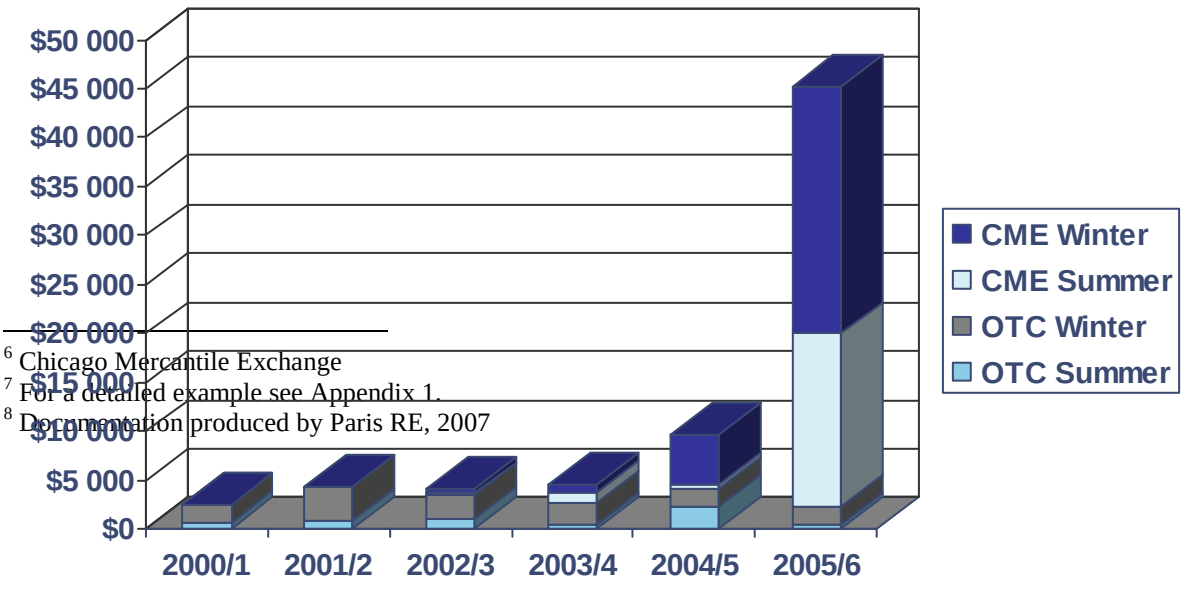
created on the CME[6] in 1999. Euronext attempted to launch a similar market on London's LIFFE in 2001, meeting however no success: the weather contracts had to be withdrawn from the market in 2003, due to a lack in transactions. A timid attempt to give it a second chance is reflected by the creation in May 2007 of MetNext, a Euronext-Nyse and Meteo France joint venture, which aim is to provide weather indices that could be used in tailoring weather derivatives.

The European market for weather derivatives then developed according to the second line often followed by financial innovations and today only involves customized contracts exchanged on an over the counter (OTC) basis.

Weather derivatives are rather simple financial instruments and come into the guise or futures, swaps and options. Contracts over temperature dominate the market. The total number of contracts (futures and options on futures) offered on the CME amounts to 27. 18 are based on weather data in US cities, 9 on weather data in European cities, such as Rome Barcelona, Essen, Paris or London[7]. Being customized, contracts exchanged on the over the counter European market can take various forms. Paris Re for example describes a double trigger option to hedge French vineyard exposure to frost and excess rainfall. The option will trigger if one or both of the two weather indexes involved exceed a pre-agreed threshold, offering the wine producer a payout, computed as a linear function of both indices.[8]

The evolution of the market has been measured by a yearly survey conducted by Price Waterhouse Coopers for the WRMA (Weather Risk Management Association), the industry association, since 2001. The last available data are summarized in the following chart.

Chart 1. Total Notional Value of weather risk contracts: 2000/1-2005/6 (in millions of U.S. dollars)



[6] Chicago Mercantile Exchange
[7] For a detailed example see Appendix 1.
[8] Documentation produced by Paris RE, 2007

The total value of trades reported in the 2005/6 survey is $45.2 billion, compared to $9.7 billion in the 2004/5 survey, with the CME experiencing significant increases in both the number of trades and the value of those trades. The survey also shows that High Degree Days[9] remains the most common type of trade. The increase on the standardized market was somewhat offset by declines in the OTC market, which remains very thin. With slightly over $2.5 billion dollars, the OTC weather derivatives market represent almost nothing of the $ 414,290 billion of total notional amount of OTC derivatives exchanged worldwide in 2006[10]. The number of OTC trades reported by survey participants was 2,180 in the 2005/2006s survey, as opposed to 4,057 the year before.

We should also note that the WRMA website does not communicate any figures for years 2006/2007, a sign that could reasonably be interpreted as meaning decrease for the market over the very last years.

Two further remarks might be added to the brief description of the market just provided. The first one is related to the fact that although futures are traded on weather, there exists no spot market for this very specific "commodity". Weather can not be exchanged in itself; the market for weather derivatives is therefore what financial theory calls incomplete. This induces a greater uncertainty on the price of weather derivatives, since the traditional methodology of arbitrage, which involves using the derivatives as a hedge for the spot, can not be used. The theoretical value of futures or option contracts remains thus somewhat problematic.

Secondly, the extension of the financial theory of risk to the management of weather risk is not straightforward. Orthodox theory, as set by the famous work of Modigliani and Miller, poses that risk such as interest rate risk and foreign exchange risk should not be

[9] HDD (Heating Degree day) contracts are based on the number of temperature degrees within a given period below 18,33° C
[10] Source BIS statistics

hedged by firms themselves, since shareholders can offset these risks with no cost by diversifying their portfolios. However, various theoretical and empirical researches have given grounds to the observed empirical fact that firms do manage their foreign exchange and interest rate risk. Some authors at least partly justify the practice by considerations related to the cost of financial distress or the need to smooth the evolution of earnings to remain powerful in the face of competitors. As weather risk is in some cases directly linked to the very operations of some firms, the idea that they might hedge what can be considered as part of their business risk is problematic in the point of view of financial theory. Shareholders might be willing to take that risk and add it to their portfolio for diversification purposes. They might not see favourably firms transferring this risk to financial intermediaries. Some weather market participants thus advocate that only those firms which are exposed to weather risk but not in their core activities, hedge for that risk[11].

Now that we have a better view of what the market for weather derivatives looks like, let us turn to the representations of actual and potential market participants as regards weather risk and the way it ought to be managed.

3.2 Different representations of weather risk

Weather is an old concern of humanity and one of the interests of our case study is to show how the proposal to manage weather risk through financial markets impacts with pre existing representations of various market participants as regards weather risk and the way it can or must be managed.

What « the market » ought to be: the view of promoters

The WRMA (Weather Risk Management Association) was founded in 1999 by leading participants in the weather market as the "*industry association for the weather risk management business*". Its website provides an accurate source of information to understand what it is exactly that promoters of a market for weather risk are fostering. In the chapter devoted to the history of the market, the WRMA website editor notes that the idea of

[11] Marteau *et al,* 2004

transferring weather risk had been the subject of insurance as well as power supply or gas utility management considerations for some time. He however observes that prior to 1997, and contrary to the current situation, none of these early initiatives "*developed into a market*". We hence learn that the whished-for market is one that "*manages risk in ways compatible with both financial and insurance markets*" and "*comprises a primary and secondary market in weather risk*". It does so by providing index based risk transfer per measurable weather variables (temperature, precipitation, …) and transferring risk on the basis or aggregate measures (e.g. total precipitation in a period, total degree days in a period), frequency of incidence (e.g. days with maximum temperature less than 32ºF in a period) or adverse event (e.g. rainfall greater than 0.50 cm on the day of finals at Wimbledon). The risk traders on this market manage risk "*dynamically according to disciplines adapted from commodity and financial trading*". There is a "*constellation of market makers and market participants*" which "*offers the weather market greater depth, breadth and financial security than ever*". Particularly emphasized is the fact that the place of energy traders, which were at the core of the market at its beginning, has "*now be taken by insurers, banks and hedge funds and by trading on exchanges, pre-eminently on the Chicago Mercantile Exchange", and that "its numbers include several of the strongest financial institutions on the globe*".

For weather risk to be successfully exchanged according to the traditional feature of a financial risk, depth of the market is crucial. It is depth that provides liquidity, a necessary feature for a financial market to remain attractive and develop. The existence of a secondary market of weather risk in addition to the primary market is a key condition to foster liquidity. The variety of participants in the market is another one:

> "*Emerging from a period in which the market was dominated by energy business, the market is spreading to encompass a variety of sectors, including agriculture, construction, transportation and entertainment. In the last three years the exchange trading of weather risk, often in conjunction with commodity and energy risk, has mushroomed and has attained a level of critical mass on the CME. The weather market has emerged as an important contributor to the management of risk in a wide variety of businesses and areas of government responsibility*". (WRMA website)

According to the view of market promoters, turning the idea of weather risk transfer into a market clearly amounts to framing weather risk into a financial risk. In other words, into a risk that can be dealt with using financial technologies and will seem of interest to financial institutions. Elsewhere on the website weather risk trading is presented as "*an attractive business opportunity because weather essentially is uncorrelated with secular or systemic risk in general financial markets and provides an opportunity for diversification for traders*". This argument is typically targeted for financiers who, since Markowitz's proposed his famous portfolio theory, have diversification as their first commandment. Following the same vein, weather is presented as a risk that "*can be traded in ways that are common to trading generally*", the argument being articulated in the vocabulary that is familiar to financiers: "weather *has volatility*[12]*, the tails of weather risk may move differently from at-the-money positions, correlations between weather in different areas converge and diverge, etc" (…) portfolios of weather risk can be managed by most of the approaches used in managing portfolios of security and commodity risk: including ratio tests, Greek parameters and Value at Risk measures*".

Firms and weather risk

Although according to promoters, weather derivatives offer features of interest for various industries, the view of industrial firms in Europe reveals by and large indifference to the concept. A recent study conducted in France, Belgium and Luxembourg in 2006 on 53 companies chosen for the intensity of their risk management activities (Bertrand, 2007) shows that 47% of the enterprises from the sample considered weather risk to have a negligible impact on their economic performances. Only 21% of the firms studied have attempted to assess precisely this impact. One and only one out of the 53 had put in place a weather risk management strategy involving however no financial instruments, while two others said they might consider doing so.

The difficulty of appreciating the exact impact of weather risk on sales is one of the primary reasons mentioned by companies for not developing any interest in weather derivatives. Vivarte, a textile group, reckons having been contacted by its reinsurance

[12] The emphasis on the volatility of weather is one of the prime argument of promoters, as can be seen for example, in the presentation made by Didier Marteau for AON, in Paris in March 2008, in the book from the same author (Marteau *et al.*, 2004) or on the WRMA and MetNext Websites.

company regarding the possibility of using weather derivatives. They declined, on the basis of rather ambivalent considerations on their exposure to weather risk. Although weather conditions are at the top of the day-to-day consideration of the local shops, the precise risk seems too difficult to measure:

> *"They are so many other factors, such as the economic conditions, which are more important than weather. OK, weather is important on a day to day basis, but, in and all, bad weather does not last the whole season, and we catch up a bad week through a better one"*. (General Manager)

Beyond limited impact on results, other reasons often offered by companies to explain why they do not hedge against weather risk using derivatives are the price of hedging which they generally consider to be too expensive. For example, in 2003, the ski manufacturer Rossignol said the company was unable to find any "*economically sound solution to externalize weather risk*" on the market. Compagnie des Alpes, a French ski lift operator, terminated its weather derivatives contract two years in advance, on the ground that the premium was too expensive for the protection it offered.

For the firms that are most conscious of their exposure to weather risk, operational management of weather risk and activity diversification are deemed to be good alternative to the use of derivatives. They seem closer to the core competencies of the firm and far less expensive. "We *will come to weather derivatives if the market develops*" says Philippe Huet from EDF, a company which weather exposure is particularly obvious (….) "*We look at the available physical resources before considering to resort to some insurance contract* (…) *We rather use the agreements we have with some of our customers, be they industrial or individuals, which allows us to stop providing energy if we need to*". The Compagnie des Alpes, which early reckoned its exposure to high temperature during winter, has first adapted its ski resorts. Eric Guilpart, its spokesman says:

> "*Thanks to the work we do on the trails in winter but also in summer, skiers can enjoy their favourite sport on snow layers no thicker as 10 cm, where 70 cm were necessary a few years ago. We have reoriented some trails, so that the sun will not melt the snow too rapidly (…) Our shareholders use to ask us questions about the way we managed*

weather risks: our geographical as well as activity diversification has reassured them".

Electrabel, a Belgian provider of electricity has no activity on the market which it deems not important for its activities at present. Were the climate to change rather drastically, for example as experts of global warming forecast, then the people in Vivarte think they will adapt by managing their textile collections differently.

A discrepancy between two worlds

Overall, weather risk appears to be apprehended in a different manner by promoters of a market for weather derivatives and industrial firms. But these differences in views would remain unproblematic, were it not for promoters of the market, who want to change the situation and rally other actors and especially industrial firms around their conception. A market for weather derivatives can only develop if there are, facing financial institutions, who act as direct or intermediary risk takers, people who seek risk protection. The need for counterparties is also a need for variety, since risk will be more easily shared if some industries need to hedge say against hot weather, while others fear cold weather. Convincing industrial firms is thus a crucial issue to promoters of the market. It is in this effort, and in the difficulties it meets that we can best recognize a situation that has been described at length by Boltanski and Thevenot. The need to convince other parties makes it necessary for promoters of the market to engage in justification efforts. The arguments developed by industrial firms confronted to that offer also provide extremely relevant information. Overall, what we face is a discrepancy between the views of two categories of actors on a same object, weather risk; we feel we can usefully characterize this discrepancy as a conflict between two worlds. The problem of promoters of a weather risk market is to succeed in drawing weather risk into the *Market World*. The crucial point here, as Boltanski and Thevenot underlines in their description of the *Market World*, is for weather derivatives to be objectively defined and as independent as possible of the personal characteristic of the buyer and seller. This conditions liquidity, eg the ability to resale the derivatives on a secondary market, which is crucial to the development of a financial market. On the other hand, companies tend to frame weather risk in close relation with their specific business and define its relevance to them in terms of operational considerations. When they do it at all, they tend to manage weather risk resorting

to tools closely linked to their "savoir faire" and view proposals from the financial companies as too expensive, or "not sound". This can be related to Boltanski and Thevenot description of the *Industrial World*, where "action is a task of production" and the higher common principle refers to efficiency, performance and productivity. The kind of solution thus designed by industrial firm foster firm specific responses to weather risks which are at odds with the minimum standardization required to develop a financial market for weather risk management instruments, with a secondary as well as a primary segment, both sufficiently liquid and deep for the market to remain attractive.

But although we can identify a conflict between the *Market World* and the *Industrial World* with respect to weather risk management, no dispute in Boltanski and Thevenot's sense really arise. What we see is an attempt of market promoters to frame weather risk management in a sense that would make the high common principle of the *Market World* eventually prevail. What they meet is mainly indifference. They resent this lack of success and mainly account for it by accusing industrial companies of lacking appropriate risk culture or in other words, evidencing culture backwardation.

> « *Firms are used to hedge against interest risk or foreign exchange risk. They use sophisticated instruments to do so, and in the same time, they do nothing against weather risk, which is of foremost importance. This difference in approaches is truly surprising. (…) How long will it take before firms realize that weather risk exists, and that it must be assessed and hedged* ? (Re-insurer)
>
> « *To be able to manage the risk, you need first to assess it. Assess…I think 99% of the firms simply do not assess it. They would say, oh, yes, we have weather risk* (…) (Re-insurer)
>
> *"I was told : you are crazy. Only Americans do this kind of things, it will never work in France"*. (Weather index provider)
>
> "*It is like asking people who have their habits…you know an old couple, 50 years of marriage, to change their habits of Sunday morning. Not to go to mass, or not to go shopping"* (Metnext)
>
> " *One learns at school, one is used to manage risk…interest rate risk for example. You learn at school and you know how to do it. You have models that are operational, you are used to it…and suddenly, there is a new risk, weather risk. And it bothers*

everybody. Except that weather risk can sink a firm. Except that weather risk, is often more important than …many other risks. (Metnext)

This type of arguments very often put forward by our interviewees, reflect their difficulty in entering into actual disputes, the reaching of an agreement being much more of an issue for promoters of the market than for industrial firms. Lamenting about culture backwardation of industrial firms is however not the only solution left to promoters. In what follows, we examine how they try to involve other worlds than the market and *Industrial World*s into the debate and how they face the demand of the *Industrial World* as regards weather risk management. We attempt to characterize the situation in the terms of *compromising* but also arrangements and *relativization* proposed by Boltanski and Thevenot.

3.3 Attempting to overcome the conflict between worlds

In an attempt to respond to what they perceive to be the need of industrial firms, promoters of the weather derivatives market enter into imaginative designs for the type of product they propose. Several of our interviewees, give the following description of "products of the future".

*"I think this is very interesting to develop linked products, for example on carbon and wind and gas that link the variables together. I find it extremely interesting. I think the product must not be considered alone. It has to be seen using a global approach, I think that is this direction which is the most promising "(*Expert)

In the same vein, an often mentioned selling argument can be found for example in the documentation provided by a re insurer:

"*As for product example, large travel agencies could buy bad weather protection which will pay out a % of travel arrangement package for every rainy day within the vacation period. A rainy day will be defined as 4 or more of consecutive rainy hours between 10:00 and 18:00 hour, a rainy hour implying 2 or more millimetres of rainfall during the 1 hour. This could allow the travel agency to sell a marketing package to its client, hedging them from bad weather by using itself a weather derivative."* This selling argument has practical implications as the example of Michelin's marketing campaign for winter tyres shows. From

the 1st November to the 20th December 2005, through its "mild winter guarantee", Michelin offered the buyers of four winter tyres a €50 credit, receivable only if the average temperature of the area they lived in remained over 7°C during the winter.

What we see in these examples is the attempt by promoters to overcome the lack of interest of firms by proposing finely tuned weather derivatives that would closely match the specific exposure or strategy of the targeted firm. This can be interpreted as extreme adaptation of weather derivatives promoters to the needs of industrial firms, or in our theoretical framework as an attempt to reach *agreements* between the *Market World* of promoters and the *Industrial World* of the firms they try to involve in the market. Such agreements can be characterized as a "*private arrangement*", in Boltanski and Thevenot's sense: they remain local, contingent and difficult to generalize. The *Industrial World* with its need for specificity, and operational efficiency seems to be the one which dictate the term of the agreements against the interest of the *Market World*: the weather derivatives thus generated could difficultly be exchanged on an anonymous secondary financial market, the chances of finding counterparty with opposite specific needs being unlikely. Overall, the efforts to develop financial product that would mirror marketing products used by industrial firms to attract customers, emphasize the effort of promoters to enter in the *Industrial World* of their would-be clients. To a great extent, this is done at the cost of abandoning the objective of creating a liquid financial market for weather derivatives.

To advance the development of the market, promoters of weather derivatives also resort to arguments borrowed from two other worlds, alien to both the industrial and the *Market World*, namely the *World of Fame* and the *Civic World*.

Most of our interviewees belonging to the promoters' category seem to put their faith in the interest showed by the press for weather derivatives and in the potential positive impact on the general public debate about climate change on the development of the market.

> *« The press is very fond of the topic. They deadly want to make reports on it. I am literally harassed by the main TV channels about it" (Re-insurer)*
>
> *« I think it is important to say that weather derivatives are extremely sexy products. People love to talk about them. They could talk about them during hours"(Weather index provider)*

« There are many people like you, who come to visit us at the moment. We see many students. Many do dissertations on the weather derivatives market, they are looking for information or for the names of some informants"(Metnext)

"*Well, the price of energies is increasing and the climate is becoming more and more erratic. Actors' awareness is increasing consequently. Some people have begun to realize that climate could have an impact on their results. And thus that something had to be done, that something could be done. Some actors that were not present on the market have begun to come to it."* (Re-insurer)

« *Truly, with what happens in the world as regards climate, weather derivatives are certainly trendy. Everybody speaks of them. Look, I brought you this, the magazine Challenge of this morning. See "hot and cold (coup de chaud et coup de froid) », firms tell what they have to go through. For example Go Sport, who underwent a terrible month of April due to weather conditions"* (Weather index provider)

« *…Awareness is increasing everywhere. Especially in firms. But also at individual level and at government level. At all levels, awareness increases as regards the enormous impact of meteorology on economy. Look at the rights to pollute, the Grenelle de l'environnement*[13]*, which is getting prepared. Everything hinges on environment and climate change. And firms are readier and readier to take that step* » (Metnext)

« It is perhaps optimistic, but one feels that this context, you see, climate change, the need to adapt, all this creates a real buzz around, you know, weather risk. » (Expert)

Drawing from Boltanski and Thevenot, we can interpret these elements of justification as attempts to rise above the conflict between the industrial and *Market World*s by using arguments of both the *World of Fame*, and the *Civic World*, in order to promote the relevance of weather derivatives. In the *World of Fame*, the aim is to attract attention, to capture the attention of the public, a situation that promoters of the market seem to deem attainable in the case of weather derivatives, due to the interest they raise among journalists. It is thus of importance to strike deals which will come "in the spotlight", and promoters of the market often complain on the lack of publicity that industrial firms are ready to give to the few deals they strike. The fact that EDF has refused to publicize a deal made with the courtier Gras

[13] A French government initiative to make all stakeholders contribute to the definition of a policy for environment protection.

Savoye to hedge its aerial installations from storm risk over the period 2003-2008 has been strongly resented by market promoters. Commenting on EDF's refusal to be cited in the press release published by CDC Ixis over the issuance of a CatBond following this operation, Jean Carle, at the time head of weather derivatives at Meteo France, states:

"*There are a lot of firms who contact us. Surprisingly however, almost all of them have us sign confidentiality agreements, or ask us not to communicate over their interest*[14]."

The higher common principle of the *Civic World* can conversely be perceived in the mobilization of arguments related to global warming. The idea that the problem will hit everybody and necessitates widespread awareness can be linked to the fact that in the *Civic World*, "*beings all belong to a collective that includes and transcends them*". Promoters seem to put their faith, at least partly to the notion that *"the general will may be manifested through the achievement of awareness, or by a collective reflection, or in the form of mobilization around a cause"* (Boltanski and Thevenot, 2006 : 192).

The *Civic World* is finally mobilized, however differently, in one of the peak moments of the market often quoted by promoters. A particularly striking deal on the weather derivatives market seem to have been the deal signed by Axa re, now Paris Re ,and the World Food Program, the former replying on an call for tender of the latter in 2006. The idea was to help Ethiopia hedge the risk of drought affecting its crops.

> "*What we have done is the first charity oriented weather derivative; we dealt with the World Food Program. The idea was to cover all Ethiopia, the totality of the crops in Ethiopia, to avoid famine. In case of famine, we would have sent money to Ethiopia, to provide help. The product was to look at all the climatic zones in Ethiopia, then construct an index based on the quantity of rain in each zone, which of course is correlated with crop yields all over the country. The contract is very, very complex. There are about 30 or 35 weather stations, the contract is really complex. And then according to the index, we pay or we don't pay. The money is sent to the WFP, before the end of the crop, before the beginning of the famine. This is preventive aid instead of emergency aid*." (Re-insurer)

[14] It must also be acknowledged that this argument can also be used to hide the thinness of the market and pretend it is larger than is actually the case.

The higher common principle of the *Civic World*, that is general interest, is clearly put forward in favour of this deal:

"(…) *disaster occurs, the media step in, people die in direct live on TV, and the money flows all at once. But emergency help is five times as expensive as preventive help (…) and less efficient. (…) The best way is to strike a deal, a weather derivative deal that allows money to arrive on time."* (Re-insurer)

What we observe in these examples is how promoters see the interest of general public opinion for weather changes, with its potential impact on rich as well as poor countries, as a potential driver for the market they attempt to develop. Their attempt to use higher common principles from worlds alien to the industrial and *Market World* can be interpreted as an attempt to transcend the conflict between these two worlds and seems to be based on the vague hope that this might make the principles of the *Market World* eventually prevail, which of course, remains the ultimate goal of market promoters. The kind of situation produced however instead of paving the way for the building of a compromise, seem rather to create what Boltanski and Thevenot call composite setups, which in the *Economies of Worth*, precede and sometimes trigger the disputes[15].

For example, the interest of the press is interpreted as producing negative outcomes by some of our interviewees. It glosses over the topic, which they feel contradicts and harms the seriousness required to design sound financial deals. They fear that the publicity given to weather derivatives might deprive these instruments of the touch of seriousness other financial products display and will eventually keep them from successfully entering the rational and highly technical world of finance. An even clearer illustration is given by the Axa Re –World Food Program deal which odd and somewhat awkward use of the principles of the *Civic World* into the *Market World* is resented by one of its main actor and promoter as follows:

"Of course there was a question about: « it is possible to use a financial product to develop aid and relief, while, in the same time, in a way, enriching the financial risk takers?".

[15] Composite setups are situations where people are made uncomfortable because they bring together things from different worlds in a very ambiguous manner. Different solutions seem equally likely and there is strong uncertainty over the state of mind of the people involved and over the worlds they refer to.

But (...) overall, we have had little negative comments, none from the journalists anyway." (Re-insurer)

If our interpretation of some of these situations as composite setups in Boltanski and Thevenot's sense is correct, then they will probably provide not help very much in overcoming the conflict between the industrial and *Market World*. Rather, they will call for clarification in one of the world they involve. Can it be the *Market World*? One could of course hope that the interest of the press will trigger the interest of would-be clients from the *Industrial World*, thus offsetting the negative effect described above. However, this has not been the case until now. The potential driving effect of the World Food Program deal seems even more dubious. The agreement remains highly contingent and local. It was signed as a response to a tender offer from the WFP. Although other such deals might see the light, they will remain private arrangements and are likely to reflect very much the demands from the tendering International Organizations. It is difficult to see how they could significantly foster the financial market for more usual weather derivatives. Lastly, the idea that weather derivatives are going to provide a significant solution to issues produced by global warming seems a little abusive. Market promoters themselves tend to exhibit agnosticism as regards their own use of the argument. Many of them underline moreover that too much of global warming might not foster the trade of weather derivatives, which like all financial instrument require opposite anticipations to make sense. They insist on the fact that weather derivatives will win more from increased weather volatility due to climate change than from global warming itself.

Overall, what we show is that market promoters are currently forced to enter into various strategies to overcome the conflict between the *Market World* they want weather derivatives to be framed in and the *Industrial World*. Their attempts to construct agreements with the *Industrial World* lead them to strike finely tuned contracts, matching the operational specificities of the firms they deal with. This results in their endorsing the world of their would-be clients, thus at least temporarily abandoning their initial objective of creating a liquid financial market for weather derivatives. Resorting to the higher common principles of the fame or *Civic World* has not proven of a great help up to now. It seems to have created composite setups in Boltanski's and Thevenot sense, which call for clarification in one of the world involved. It is difficult to see how such processes could significantly foster the

development of a market for weather derivatives. The marketization of weather risk finally can be said to be fraught with difficulties.

Conclusion

Using the framework proposed by Boltanski and Thevenot, we observe that weather risk is not apprehended by all market participants in the same way. We document the various efforts made by the promoters to rally industrial firm to their conception and promote the market by different means. Practically however, what they face seems to be low demand, which they tend to overcome by offering extremely fine tuned products, adapted to the very particular needs of the customer they target. Although the customizing of financial products is quite natural on OTC financial markets, we believe that in the case of weather derivatives, this extreme adaptation to customer's needs provides far reaching insights into the general question of risk marketization. In his detailed descriptions of various auctions market, Smith (1989) proposes to explain the market structures he observes by seeing them as answers to the ambiguities market actors have to alleviate to be able to do transactions. Following this thesis, we advocate the interpretation of our observations of the market we study can be greatly enhanced by taking into account the problem of ambiguities confronting market participants, which, in the case of weather derivatives, stem from the specific features of weather risk. From one firm to another, weather risk is associated with weather events related to different variables, which include, besides temperature, rainfall, snow, wind, sunlight, storms and all possible combinations of those. These weather events can be extremely localized, both in space and time. For example, the impact of a risk of lack of snow for a given ski-lift operator will vary greatly from one spot to another, one week to another depending on which are holydays weeks, and might also combine with additional weather variables such as wind or sun. As a result, ambiguities are strong on the measurement of weather risk, and also on its potential impact on would-be risk sellers' operations. Therefore industrial firms respond either by choosing to ignore weather risk, on the ground its impact is too difficult to measure, or by demanding products that closely match what they perceive to be their operations at risk. Promoters are then forced to adapt and offer products fitted to the specific industry of the buyer, the type of weather variables that impact its operations, the time of the year when

weather risk is considered and the very precise *locus* at risk. While the first reaction of industrial firms to perceived ambiguities, which consist in just ignoring the problem, is of course not favourable to the development of a weather derivatives market, the second one does not prevent such a development, provided the market offers tailor-made products to customers. However, the theory of Boltanski and Thevenot helps us see that such a market will very difficultly match the type of markets targeted by current weather derivatives market promoters; it will very difficultly take the shape of a financial market. The reason why this is so is because the answers given by market participants to the ambiguities they perceive on weather risk are in contradiction with the very principles of the *Market World*. The products exchanged, instead of being independent with respect to the actors involved in the transaction, are closely related to the operations of the risk sellers, who act as buyers of the contracts. Due to the need to finely adjust to the demand of customers and the lack of liquidity of the resulting contracts, competition between promoters is somewhat restrained and can not develop on a wide geographical space. Transactions involve personalized relationship, and the sought-for distance of the *Market World* is not easily attained. Overall, our analysis shows that the contradiction between the observed market structure and the principles of the *Market World* might be difficult to overcome. As a result, the possibility of developing a successful financial market for weather derivatives could remain remote. The observed thinness, lack of standardization and absence of liquidity of the market despite several attempts over the last 12 years do not appear to be temporary problems.

In summary, according to Boltanski and Thevenot's paradigm, we observe that, in contradiction to the higher common principle of the *Market World*, the weather derivatives exchanged on the European OTC market is far from resembling the anonymous, liquid and fast developing market its promoters targeted. We interpret this result as a consequence of the specificity of weather risk, which appears difficult to disembedd from the *Industrial World* and therefore not quite cut out for marketization. More generally, when a financial innovation involves actors from very different worlds, it might prove extremely difficult for the market promoters to find the necessary compromise that would rally everybody around a common vision of risk. This suggests that there may be a limit to the extension of the financial theory to the objectification (LiPuma and Lee, 2005) and marketization of new risks. It can be expected that attempts at having CAT-bonds, risks of attack or rights to pollute exchanged in financial markets could also meet difficulties. According to Beck (1990: 61), risks might be seen as "the interminable needs sought by economists", because needs that are open to

interpretation can be proliferated endlessly (Beck, 1992, 2006). In this paper, we show that the interpretation provided by the financial theory of risk might have more limited applicability than is generally acknowledged.

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