When Markets are Poison

Learning about Climate Policy from the Financial Crisis

THE CORNER HOUSE

"[T]he forms of social practice that gave rise to the new kinds of calculability, and that calculation attempted to format, also continually rendered the world more mobile, uncertain, and incalculable."

Timothy Mitchell
Rule of Experts: Egypt, Technopolitics, Modernity[1]

Around the world, progressive groups have been quick to associate the unfolding financial crisis with concurrent crises of climate, food, energy, health care and militarism. Hailing the apparent breakdown of the neoliberal experiment, they have called for the building of integrated popular movements for greater "democratic control over financial and economic institutions"[2] – a "new paradigm" that:

> "puts the financial system at the service of a new international democratic system based on the satisfaction of human rights, decent work, food sovereignty, respect for the environment, cultural diversity, the social and solidarity economy and a new concept of wealth."[3]

"The most obvious crises we face collectively today are all linked and the solutions to them must be linked as well," goes one manifesto. "Properly targeted and used," the financial crisis "could open the door to the quantitative and qualitative leap we must make."[4] "The financial crisis of 2008," insists another:

> "presents the best opportunity in over a century to simultaneously reform money systems and create additional mediums of exchange and financing mechanisms to accelerate the shift from the fossil-fuel/nuclear-Industrial Era to the greener information-rich Solar Age."[5]

"[T]he current situation of crisis is also an opportunity," agrees still another, proposing "food sovereignty" as a slogan under which to agitate against deregulation and the "ferocious offensive of capital and of transnational corporations to take over land and natural assets" and to speculate in food futures contracts.[6] "The two crises of our times — economic recession and global warming — should be tackled together," urges yet another. "The trillions of dollars earmarked for economic recovery can be spent to fight climate change."[7]

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There are close parallels between the rampant financial innovations behind the current financial crisis and the innovations feeding carbon trading.

Carbon markets are the dominant official response to climate change – despite being part of the neoliberalism and financialisation now being questioned worldwide.

Progressives, of course, are not the only ones being spurred by current crises to reorganise. Despite having been caught off guard by financial meltdown, governments and business elites are attempting to free up credit with a bewildering variety of their own responses. While ordinary citizens take to the streets to demand help for ordinary families, governments have deposited billions of dollars into the accounts of large banks.[8] Financial institutions have been nationalised, interest rates cut to near zero, ratings agency reforms promoted, and proposals made to set up clearing houses for credit derivatives or curb them sharply. Plans are being discussed to institute "a new national Keynesianism along Sarkozyan lines," invest in vast tracts of land in the global South, and tackle global warming and economic reversals simultaneously through "Green New Deals"[9] or investments in geoengineering, agrofuels and synthetic biology. In the meantime, financial institutions are planning new waves of securitisation, while the interests of Wall Street and the richest one per cent of the US population are being defended at the highest levels of the Barack Obama government through figures such as Treasury Secretary Timothy Geithner and Lawrence Summers, Director of the White House's National Economic Council.[10]

Somewhere near the centre of this confused post-meltdown global landscape lie the carbon markets set up under the Kyoto Protocol, the European Union Emissions Trading Scheme (EU ETS), the Chicago Climate Exchange and many other initiatives. Although they form part of a 35-year-old pattern of neoliberalism and financialisation that is now being called into deep question, carbon markets remain the dominant official response to climate change worldwide.

After roughly doubling in size each year from 2005 through 2008, they are set for a further explosive expansion in the US under the Obama administration, as elsewhere. While the carbon trade's current volume of over US$100 billion[11] cannot yet compare to the half-quadrillion dollar-plus nominal value that the overall financial derivatives markets reached in 2007, it is being heralded as the "world's biggest commodity market" and prospectively "the world's biggest market overall,"[12] with "volumes comparable to credit derivatives inside of a decade."[13] As a welcome new "asset class", with a low correlation to many others and many arbitrage opportunities, carbon has proved a magnet for hedge funds, energy traders, private equity funds and large global investment banks such as Barclays, Citigroup, Goldman Sachs, Credit Suisse, BNP Paribas and Merrill Lynch as well as index providers and European exchange-traded commodity sponsors.[14]

The largest carbon markets are those created and maintained by government regulation and supported by a consensus of the middle-class environmentalist movement in industrialised countries (which tends to see them as "better than doing nothing about climate" or "the only show in town") as well as, more recently, by many ruling elites in the South. Yet carbon markets' nature and their links to financialisation are still little discussed among social movements and intellectuals preoccupied with more traditional terrains of corporate control, privatisation, trade, globalisation, inequality and so forth, and carbon trading has not normally been placed by political economists in the same analytical basket as other issues concerning power, ownership and redistribution.

Carbon markets thus pose a challenge to progressive movements seeking a common response to the financial crisis and to official failures to address climate change. This briefing paper suggests concrete ways of holding both within the same strategic vision by proposing parallels between the rampant financial innovations that have contributed

to the current crisis and the innovations feeding carbon trading. Relying on groundwork laid by Karl Marx and economic historian Karl Polanyi, it also calls on recent advances in the social studies of finance as well as the insights of both financial and carbon market practitioners and grassroots communities on the receiving end of the new trade arrangements.

The first section of the paper proposes that the enormous growth in the derivatives markets since the 1970s constitutes a wave of commodification of certainty/uncertainty countered by a Polanyian "counter-movement" of societal self-defence.[15] New commensuration practices transforming this "fictitious commodity" into a target for expanded investment – practices that were developed by "quants", financial institutions and regulators – helped make possible a huge expansion, then a catastrophic collapse, of credit; in the process, they created a vast if temporary opportunities for profit-taking by financial firms. After reviewing some of the basics of carbon markets, a second section explores some parallels between carbon and uncertainty markets:

- Both markets have seen the construction of similar abstract commodities, largely by centralised corps of "quants" and traders.
- Embedded in neoclassical economics and its over-ambitious institutions of calculation, both markets heighten systemic dangers, necessitating movements of societal self-protection.
- Both markets involve regressive redistribution and the destruction of crucial knowledge.
- Both are vulnerable to bubbles and crashes.
- Both erode notions of transparency and conflict of interest.
- Both call into question the assumption that all imaginable markets can be successfully regulated.

A concluding section draws some of the threads together in reiterating the value of considering the two new markets together.

The enormous growth in the derivatives markets constituted a new wave of commodification of certainty/uncertainty.

I. Uncertainty Markets

"We built a system that was much more dangerous than anyone thought."

Simon Johnson
former IMF Chief Economist
November 2008[16]

Taking as inspiration economic historian Karl Polanyi's treatment of the "fictitious commodities" land and labour, this section looks at the political dynamics and attempts at regulation following on from the formation of a related "fictitious commodity": the cluster of phenomena referred to by such terms as security and risk, certainty and uncertainty, safety and danger, and determinacy and indeterminacy. Like the commodification of land and labour, it will argue, the "framing" (to borrow sociologist Michel Callon's[17] term) of a wide range of uncertainties as commodities leads to "overflows" and a dynamic of resistance, retrenchment and more or less fumbling attempts at societal self-defence that Polanyi called the "double movement".

Land is a useful first point of comparison. Polanyi famously remarked that the sweeping commodification of land was among the

To preserve food supplies, soils and forests, every society commodifying land limits how far it can be exchanged or accumulated, what it can be used for and where, and how it is to be used and by whom.

Commodifying security and risk, certainty and uncertainty, safety and danger needs to be limited if it is not to prove fatal to society.

"weirdest undertakings of our ancestors." Making land exchangeable, or "liquid", enabled mobilisation of capital and played a key role in the industrial revolution. To the extent that land was dissociated from "habitation . . . physical safety . . . landscape and the seasons . . . organisations of kinship, neighborhood, craft and creed . . . tribe and temple, village, guild and church" and, through enclosure, re-embedded[18] in overseas trade, banking, new legislation and juridical procedures, new moral theories, speculation, surveying and calculating techniques, and so forth, it was "abstracted" into real estate – just as, in a related way, commodifying diverse human activities helped engender an abstract "labour" capable of being used as a measurement of value. The word "land" itself, like "labour", became largely a commercial term of art, its new sense difficult to recognise for practitioners of a different moral economy.

Yet unless commodification had been checked and hedged about, Polanyi insisted, it would have resulted in the "demolition of society". Any mechanism that in the extreme case could result in *any* land being bought and accumulated in *any* amount by *anybody* with enough cash, and then used for *any* purpose and exchanged *for* anything *with* anybody *in* any amount, had built-in tendencies to destroy the knowledge and institutions of stewardship ensuring sustainable food, shelter and other necessities of survival. Land cannot be "consumed" but has to be productively reused and renewed. To treat it otherwise, to adopt contemporary financial jargon, is to build up "systemic risk".

The early 20th century economist John Maynard Keynes cautioned against finance's "fetish of liquidity" that "there is no such thing as liquidity of investment for the community as a whole;"[19] his point applies to land and knowledge of land as much as to business and knowledge of business. Only if landholders do not constantly exchange their lands for other lands in obedience to price movements or "efficiency" considerations, or constantly exchange the peoples that belong to the land for others, or for none, can food supplies be ensured, along with the preservation of soils and forests. To make the use of land fully dependent on the market mechanism would be, in Polyani's words, "to subordinate the substance of society itself to the laws of the market," with fatal results.[20] Whatever may be said in the economics classroom, every society commodifying land learns to limit how far land can be exchanged or accumulated, what it can be used for and where (for example, through zoning laws, laws prohibiting conversion of agricultural land, green belt provisions and various taboos), and how it is to be used and by whom.

Commodifying security and risk, certainty and uncertainty, or indeterminacy, safety and danger, presents similar challenges. Before the 1970s, perhaps the most important examples of the commodification of uncertainty were insurance and gambling. Traditional insurers commodified uncertainty by, in effect, accepting bets that their policyholders wouldn't die or their houses burn down over the next, say, 10 years. They supplied liquidity to an uncertainty market by taking the other side of transactions that supplied "safety equivalents" to exposed businesses and individuals. Traditional gambling or lottery establishments also attached prices to the unknown outcomes of future events. They provided liquidity to an uncertainty market that they themselves helped create by taking the other side of a range of transactions designed to tempt clients into speculating.

Both traditional insurance and traditional gambling, however, tended to limit their commodification of uncertainty to artificially-landscaped,

highly-constrained environments where it could not unduly threaten either corporate profits or overall social welfare. Traditional insurance, for example, typically commodified uncertainty only where it could attach calculable, independent probabilities to the possible outcomes. It did not allow 20-year olds to transfer their life insurance policies to pensioners. It recruited state law enforcement to help prevent or deter policyholders from activating payouts by killing themselves or burning down their own houses – that is, it stopped them from treating lives and homes as if they were fully commensurable with monetary payouts.[21]

Traditional gambling, too, was confined to highly-manicured landscapes. Casinos emphasised games (roulette, slots, blackjack) whose odds were independent and could be precisely calculated, placed limits on amounts staked, deployed state-of-the-art surveillance technology, frowned on customers betting other people's money without their knowledge, and generally did their best to ensure that, in the long term, the house always won (which could mean banning bettors who could calculate better than the house could).[22] In addition, casinos, like traditional gambling generally, were hemmed in by legal, geographical and moral restrictions aimed at discouraging vulnerable punters from addictively gambling their possessions and lives away – limitations parallel to those placed throughout the world on the commodification of land, food and labour to help shield households, livelihoods and nations from catastrophe.[23] As Keynes said, casinos "should be inaccessible and expensive". Outside the arenas of traditional insurance and gambling, uncertainties were generally seen as too complex, varied, context-specific, and, often, of too high potential impact to admit of thoroughgoing commodification.

On occasion, uncertainties were commodified in other ways. Thirteenth-century monks,[24] 17th-century Japanese rice farmers,[25] 16th-century Dutch herring fishers[26] and 20th-century Iowa corn farmers[27] all hedged against losses due to price drops at harvest time. At a relatively low cost, farmers, somewhat like insurance policyholders, could ensure that the price they got for their harvests did not fall below a specified level no matter what happened. They contracted with merchants to sell their grain at a certain price at a certain date, thus paying the "price of a price". If the market price fell below that level by the time the date rolled around, the farmers would not only have a safe market, but would win out financially. Even if the market price rose above that level, they would still have a safe market, although they would be at a disadvantage relative to the buyer. And even that disadvantage could be cancelled out. Farmers could hedge by contracting to buy an equal amount of grain at the same price that they had promised to sell it for, then allowing the two contracts to cancel each other out. The farmers could then sell on the rising open market.[28]

Such markets could also be used for profiteering. The ancient Greek philosopher-mathematician Thales of Miletus, foreseeing a bumper olive harvest, is said to have paid local producers a small deposit in return for the right (or "option") to have first use of their olive presses after the crop was brought in. When Thales' prediction turned out to be right, he made a fortune by charging growers large sums to use their own presses. Had the harvest failed and demand for the presses fallen to zero, all that Thales stood to lose was his deposit.

Again, however, before the 1970s, such markets were either, as with farmers' hedges, embedded in a "safety-first" or insurance framework of practices (ensuring survival, minimising losses, preparing for the worst) or hemmed in by law or marked out as hazardous, and were

Traditional insurance and gambling limit their commodification of uncertainty to highly-constrained environments where it does not threaten corporate profits or overall social welfare.

limited in size. In the 17th century Amsterdam Bourse, officials frowned upon forward contracts and short-selling (in which traders gamble on a price fall, borrowing securities, selling them and then buying them back and returning them after they lose value).[29] In Britain, options such as those pioneered by Thales were banned, as a form of gambling, in the 18th and 19th centuries, and also in France from 1806 and in many US states in the 19th century.[30] In the US, until the late 1970s, derivatives trading was considered gambling unless "a futures contract could be settled by physical delivery of the underlying commodity, for example grain."[31] Investors were not allowed to buy securities entirely on credit, and short-selling was constrained by law.[32]

Post-1970s Shifts

Recently, uncertainty and indeterminacy have been swiftly and recklessly commodified on an unprecedented scale by means of derivatives.

After the 1970s, all that changed. Uncertainty and indeterminacy were commodified on a scale, at a speed, and with a half-conscious recklessness that bear comparison with those associated with the commodification of land in early modern Europe or the rest of the world at any other time.

The background to the transformation is closely tied up with developments in postwar politics and economic policy. Before the 1970s, exchange rates had been set by governments and protected by controls on the flows of capital between countries. Under the Bretton Woods agreements concluded at the close of the Second World War, "foreign exchange risk was borne by the public sector."[33]

But then several things happened. As chronic deficits took hold, the US abandoned its commitment to redeem debts in gold, allowing its deficits to swell endlessly while surpluses built up in other countries' reserves, fuelling credit expansion. With the collapse of the Bretton Woods agreements under the pressure of increasing international capital flows, industrialised-country states withdrew from the task of "securing the present to the future"[34] using fixed exchange rates, stable interest rates, commodity price stabilisation and the like. The 1980s and 1990s, for example, saw the biggest exchange-rate swings between the major currencies since the Second World War.[35] Stock market indices and world real interest rates also increased in volatility during this period.[36] "For many corporations doing business globally," these were difficulties that "could not be handled or offset by the conventional forms of insurance (such as hedging)", nor by the intervention of any single government:

> "[T]he problematic and uncontrollable consequence of outsourcing was that exogenous events beyond their control or corporate intelligence, such as a steep shift in cross-currency rates due to the election of a socialist-leaning president, could seriously harm or destroy the profitability of an enterprise."[37]

It became harder to handle the dangers of business partners defaulting, and banks that held the credit risk on loans and mortgages wanted to reduce their vulnerability to global economic contagion during recessions.

Other uncertainties emerged as well. For example, energy privatisation and re-regulation in the US added to weather-related risks for power utilities when they found themselves having to cope with new uncertainties about demand volumes as well as about fluctuation in prices and margins.[38]

The main vehicle the private sector used to handle such uncertainties in a globalised environment was derivatives – versions of the hedges used by Thales or Iowa corn farmers, who paid a price for keeping the price of something else where they wanted it to be. Thus a "future" is a tradeable agreement to buy or sell something at a specified price and date. An "option" confers the right but not the obligation to buy or sell something at an agreed price and date in return for a small down payment. A "swap" is an agreement to exchange assets (such as different currencies) at a specified price and date. Derivatives allow investors to bet, like Thales, on price movements without owning the relevant asset. Some derivatives are also used to separate out and sell "risks" to others. For example, a bank can try to sell off the risk that the people who have borrowed money from it will go bankrupt.

On the surface, such derivatives might seem merely to be an expanded version of traditional insurance.[39] Interest rate options were a privatised "insurance" solution to the interest rate uncertainties opened up by liberalisation. Weather derivatives were a privatised response to the price uncertainties utilities found themselves exposed to in the wake of deregulation. Credit derivatives could be used to lay off and manage exposure to supplier default, and so on.

But the new derivatives involved social transformations undreamed of by conventional insurers. New ranges of uncertainties had to be commodified, and the resulting markets needed to be liquid, with interested parties able to buy and sell securities as their needs demanded.[40] Capital and credit controls were challenged as "inefficient", a block to the growth of the liquidity that traders assembling diversified international portfolios needed if they were to provide a privatised solution to privatised uncertainty. Default risk was detached from loans so that it could be bought and sold separately. Price uncertainties were separated from their underlying assets and from the political aspects of commerce, repackaged, made commensurable with new things, mathematised, "liquified" and sent through commodity circuits.

Disembedded from local contexts, uncertainties were simplified and re-differentiated along various numerical scales to help create products that could be claimed to be tailored to the degree of risk-averseness of every investor. Re-complicated through the advanced mathematics of finance, they were re-embedded in neoclassical economic theory, neoliberal policy, portfolio and pricing theory, private financial institutions, and economistic "risk management" methodologies that would allow them to be passed from hand to hand in a centralised international system.

Through commensuration, a floating pool of abstract "risk" began to circulate globally, disregarding former borders between national and international capital markets and subject to little regulation. An unprecedented range of unknowns "became 'things' like commodities – tradeable at any moment at the right price" across the world.[41] Just as objectified, abstracted "land" and "labour" had emerged with the early modern European transformation of agriculture and gathering, so an objectified, abstracted, commodified "risk" emerged as a new reality as well as a new term of economic and financial art.[42]

One concrete example is the 1993 invention, at financial services firm J.P. Morgan, of an early credit derivative deal, involving a credit line that Morgan and Barclays Bank had extended to the oil company Exxon in the wake of the Exxon Valdez oil spill off Alaska. To maintain good corporate relations with Exxon, J. P. Morgan wanted to keep the loan on its own books rather than sell it. The problem was that the loan

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produced little profit while requiring a lot of capital reserve, limiting the amount of lending the firm could undertake elsewhere. The solution was to try to separate out from the loan the danger that Exxon would not pay off the interest or principal and then sell on that danger to someone else. In this case, the willing buyer was the European Bank for Reconstruction and Development. By commensurating, quantifying and comparing the uncertainties connected with all such loans using a technique called "value at risk", which purported to specify with a "95 per cent probability" the maximum possible losses incurred by a set of positions, J. P. Morgan could then try to work out which assets were producing good returns relative to the uncertainties and allocate its capital reserve accordingly, supposedly making its use more "efficient".[43]

In 1997, J. P. Morgan took a further step by transferring many of the default uncertainties of $9.7 billion worth of loans to 307 companies to a shell company, or special purpose vehicle, (SPV) that it had set up. These uncertainties were divided up into two tranches using quantitative techniques and the principle of diversification. Investors in the bottom, riskier tranche, who would be the first to lose their investment if the companies started to default, received a return over six times that of investors in the top, more secure or "senior" tranche, who would be tapped only if losses exceeded the entire sum of investments in the bottom tranche. Yet even the senior tranche's returns were attractive in view of the top triple-A credit rating it was awarded by Moody's credit ratings agency.

Because the 307 companies were so reputable and diversified, J. P. Morgan thought it unnecessary to offload more than $700 million worth of their loan uncertainties to other parties. The remaining, "super-senior" tranche of uncertainties, considered insignificant, were taken on by American International Group (AIG) for a small fee. Later on, banks eagerly packaged the default uncertainties connected with mortgages and consumer debt in a similar way, although there existed much less data on how such defaults might correlate than on how corporate defaults correlated, raising the question of just how secure investments in "super-senior" tranches of the relevant instruments would be.

It was part of the "added value" of the uncertainty products emerging from the new assembly lines that they distanced their buyers from the original firms and houses and their contexts of ownership. Mass-produced derivatives had to be valued by abstract models based on numerical data, not on non-replicable personal judgements. What counted as trust was progressively disentangled from one context (for example, the "thick" sets of information and varied noncalculative, often artisanal or personalised social practices that had previously defined it) and re-embedded in another (for example, the innovative commensuration methodologies deployed by transnational financiers and quantitative specialists and the networks of mutual back-scratching that issued in the spectrally "thin" codes of credit ratings).[44] To adapt a phrase of Mervyn King, Governor of the Bank of England, "My word is my bond" was transformed, through commodification, into "my word is my collateralised debt obligation squared."[45]

The names or credit histories of the companies or homeowners whose debt was being packaged were likely to be hidden, and value chains became so long that few could guess how, say, defaults in the housing market might affect the cash flows of investors. The domesticated, transparent wagers taken by the bank managers of yesteryear on modest mortgages of local residents of their acquaintance gave way to – for example – gambles taken by Norwegian municipal investors on

tens of millions of dollars of doubly-repackaged collateralised debt obligations built on Detroit or Los Angeles mortgages, priced by mathematical models, and assembled through software routines executed in London. The drive to produce a liquid, commodified "risk" also encouraged neglect of the significance of falling mortgage underwriting standards or of extreme events or unexpected correlations.

To treat this distancing and mathematisation as if it were a remediable "defect" of the increased commodification of uncertainty is to miss the point. Ignorance, as much as expertise, was built into commodity production – a pattern that was to become equally prominent in carbon trading.

Ignorance created by distancing and mathematisation is key to the mass-production of uncertainty commodities.

The Bigger Picture

Many of the complex, interlinked components and accompaniments of the expanded and extended commodification of uncertainties became evident only gradually in the 1990s and 2000s. Disentangling, re-embedding and "thingifying" uncertainties facilitated speculation and new, large-scale forms of gambling that, by being commensurated with insurance operations, transformed them. The enormous expansion of credit that the new commodification facilitated, while providing large short-term profits for lenders, helped take ordinary people's indebtedness (caused in part by downwards pressures on real wages) to new levels.[46] Fees for inventing or brokering uncertainty products also ballooned, spurring further innovation. Finance became increasingly dominant in society, helping further to marginalise enterprises with low returns but high long-term social value, including much traditional manufacture.

Speculation

Like other financial innovations, the derivatives that at first appeared merely to be new forms of insurance quickly began to "succumb to rampant speculation, as investors tr[ied] to exploit them".[47] At a time of growing doubts about returns from traditional industrial investment and falling interest rates that made government bonds less attractive, a liberalised capital market helped make (for example) floating, fluctuating, post-Bretton Woods exchange rates not only "an object of fear (a risk that must be hedged)" but also "an object of enormous potential profit (an incentive to speculation)."[48] Whereas in the 1970s, most currency exchange was for financing international purchases of goods and services, by the 2000s the figure was less than 0.1 per cent;[49] the rest comprised a new, gigantic form of gambling. Similarly, only a relatively tiny number of credit default swaps were undertaken to match an underlying position in bonds; most were speculative.

Over the past two decades, finance became increasingly dominant in society, devaluing enterprises with low returns but high long-term social value.

The same derivatives that promised to help investors reduce uncertainty could also be used to amplify it or to create big new gambles.[50] For example, derivatives investors could buy exposure to movements in the value of oil cheaply without having to lay out any money for oil themselves, or to movements in the value of a company without trading shares in the company themselves. Instead of stockpiling a million barrels of oil in anticipation of a shortage, speculators could buy an oil derivative that gave exposure to the price movement on 25 million barrels. They got leverage and could both hedge and speculate more cheaply – and without having to fear anti-speculation regulations.

Liberalised capital markets turned fluctuating exchange rates into an incentive for speculation and profit-making.

It is misleading to describe the new financial practices as "casino capitalism" – they were so hazardous that no casino could have followed them and stayed in business.

Credit default swaps enabled money-makers to bet on the solvency of companies even if they had no connection with them.

With the technique called delta-hedging, it became possible to make money by betting on the volatility of stock prices, whether they went up or down or whether investors had a stake in them or not; with the instrument called credit default swaps, it became possible to make money by betting on the solvency of companies with which investors had no other connection. Bonds were re-engineered into structured notes which repaid their holders not on fixed dates but on uncertain dates – for example, dates when the Nikkei, Japan's stock exchange index, rose, or when US interest rates fell, or when the Utah Jazz basketball team won 100 games. Interest rate swaps were transformed into barely-comprehensible instruments that greatly increased profits if wagers came off, even if they led to skyrocketing losses if they did not. Derivatives based on sub-prime mortgage cash flows stimulated huge investor demand partly because they were high-risk and thus potentially high-profit.

As anthropologists Edward LiPuma and Benjamin Lee write, the new abstract financial commodities:

> "provided a new avenue and opportunity for absorbing the over-accumulation of capital of the metropole, giving birth to institutions . . . that specialized in managing what 'the street' would call 'speculative capital.'"[51]

They were, financial analyst Nassir Sabir states, simply "the functional form that speculative capital assumes in the market",[52] it being "faux historicism" to liken them to futures in ancient Greece or 16th century Japan. [53] One result was a treadmill encouraging still further speculation:

> "the speculative use of derivatives increases both the quantity and velocity of capital . . . corporations doing business transnationally employ derivatives to offset . . . volatility; the provision of sufficient market liquidity requires the participation of speculative capital which tends to amplify volatility; the amplification of volatility both increases the need . . . to hedge . . . and the profit opportunities for speculatively driven capital."[54]

Gambling and Insurance

The bets made in the new derivatives markets were different in kind from those laid in the comparatively tame, predictable and controlled gambling environments of Las Vegas or Atlantic City (*see below*). Many of the new financial practices today misleadingly pilloried as "casino capitalism"[55] were in fact so hazardous that no casino could have got away with them and stayed in business.[56] Yet they were allowed to spread globally, paradoxically gaining a legal and moral imprimateur that had always been denied to the less dangerous activity of traditional gambling. All in all, the nominal value of markets in derivatives including futures and options on interest rates, currencies and commodities, credit default swaps and so on grew from virtually zero in 1970 to nearly US$100 trillion in 2000 and $680 trillion in 2008, many times the economic value of global output.[57]

If it is unhelpful to criticise derivatives markets using casino analogies, it is just as anachronistic to defend them – as many financial writers still do – by claiming that they simply provide liquidity for improved insurance, in effect allocating security more efficiently. As John Meriwether, the legendary trader associated with the ill-fated firm Long Term Capital Management, put it, while insurance policies are not supposed to affect the likelihood of the events insured against:

> "[I]n financial markets this is not true. The more people write financial insurance, the more likely it is that disaster will happen because the people who know you have sold the insurance can make it happen."[58]

Overall, the aim of today's derivatives is so far removed from the safety-first "peasant goal" of minimising the risk of losing money through a declining exogenous market that it might be said to lie at the other end of the prudential spectrum entirely – a fact that becomes particularly obvious when financialisation's role in creating asset price bubbles and crashes is considered. The new finance created, increased or concentrated risks as much as controlling, decreasing or spreading them.

The example of American International Group (AIG) is emblematic. AIG continued to call itself an insurance company when, in the 1990s, it began to insure not only houses but also the mortgages on those houses by issuing derivatives, selling billions of dollars in guarantees against the default of tranches of super-senior debt in collateralised debt obligations (CDOs) manufactured by banks such as Merrill Lynch. But in fact, by attempting to apply what financial journalist Matthew Philips calls "traditional insurance methods to the credit default swap market", AIG was venturing into a jungle far from the manicured turf on which insurance usually operates:

> "There is no correlation between traditional insurance events; if your neighbor gets into a car wreck, it doesn't necessarily increase your risk of getting into one. But with bonds, it's a different story: when one defaults, it starts a chain reaction that increases the risk of others going bust. Investors get skittish, worrying that the issues plaguing one big player will affect another. So they start to bail, the markets freak out and lenders pull back credit."[59]

Specialised bond insurers such as MBIA and Ambac made the same mistake, helping firms such as Union Bank of Switzerland (UBS) pile up tens of billions of dollars of CDO notes on their books without having to report any risk whatsoever.[60]

The scale of derivatives transactions, in addition, entailed that if traders' poorly-understood bets went wrong, they and those who had become dependent on them, unlike prudential farmers, stood to lose everything. Attempts to "offset" the dangers, moreover, often involved additional questionable gambles. Thus in 1998 Long Term Capital Management wound up losing money on both legs of a hedge that tried to balance bets that emerging market bonds would increase in value against bets that US Treasury bonds would go down.[61] The stock in trade of "hedge" funds is a long way from what the prudential farmer of yesteryear would have understood as a hedge – that is, an insurance policy against losing the costs of production. As Nicholas Hildyard of The Corner House explains, hedge fund clients:

> "are after 'alpha' – the higher-than-market returns that (supposedly) come from active management; they are 'alpha hunters for hire'. Their target is returns – typically 15-20 per cent – that are uncorrelated to movements in the market. This is achieved by betting not only on the price of assets going up but also on them going down. The hedging undertaken by hedge funds is [not simply to preserve] the value of the initial portfolio."[62]

This type of hedging became widespread in banking as well, with the divide becoming increasingly blurred between traditional "long-only" investors, who bet on stocks going up, and more adventurous "long/

New financial practices were allowed to spread globally, gaining the legal and moral approval denied to the less dangerous activity of traditional gambling.

The new finance created, increased and concentrated risks rather than controlling, decreasing or spreading them.

It is now difficult to define a hedge fund, distinguish it from an unregulated bank, or draw a distinction between "traditional" and "alternative" investment management.

short" investors, who also bet on stocks going down by borrowing them, selling them, and then hoping to be able to buy them back later at a lower price.[63]

Today it is difficult even to define a hedge fund, distinguish it from an unregulated bank, or draw a sharp line between "traditional" and "alternative" investment management.[64] Insurance has been transformed by being commensurated with gambling, which itself has been expanded and transformed far beyond its customary boundaries. Derivatives have fused "in a single instrument the objectification of various types of risk, the almost extraordinary leveraging of those risks, and the possibility of being used for both hedging and speculation".[65] In sum, it is misleading to class the new derivatives with more conventionally-embedded risk commodities associated with traditional insurance and traditional gambling.

Credit Expansion

As the J.P. Morgan case suggests, the derivatives revolution involved what billionaire speculator George Soros called "ever more sophisticated means of credit creation".[66] Credit risk, after having been made into asset-backed securities, became far more liquid. Abstracting, "thingifying" and commodifying uncertainties allowed them to be packaged up and moved off balance sheets, notably to investors who were "not subject to supervision and persuasion by the regulatory authorities"[67] or to insurers with lighter capital reserve requirements. Investment banks using abstract modelling of uncertainties and structured investment vehicles that enabled them to park uncertainties off their balance sheets became able to flout the spirit if not the letter of international banking guidelines set out in the Basel Accord implemented in 1992, which required them to keep reserves equivalent to 8 per cent of the value of their assets. In 1996 the US Federal Reserve approved derivative techniques for use in reducing banks' capital reserve requirements. "For the first time in history," financial journalist Gillian Tett relates, "banks would be able to make loans without carrying all, or perhaps even any, of the risk involved themselves," allowing them to make more loans, "as they wouldn't need to take losses if those loans defaulted."[68]

Investment banks flouted international banking guidelines by using abstract models of uncertainties, which they tried to park off their balance sheets in structured investment vehicles.

As calculation began to supplant collateral as a means for handling uncertainty, and correlation was conflated with diversification, leverage expanded enormously. Securitised debt made possible an explosion in lending for mortgages, cars and individual consumption: lenders went wild because they thought they could sell off any risk they accrued to manufacturers of collateralised debt obligations or credit default swaps, which had become all the rage among investors.[69] In novelist Margaret Atwood's pithy summation, financiers:

> "peddled mortgages to people who could not possibly pay the monthly rates and then put this snake-oil debt into cardboard boxes with impressive labels on them and sold them to institutions and hedge funds that thought they were worth something."[70]

Allowing such practices appealed to governments in both the US and the UK as a "technical fix" for potential popular discontent over stagnant incomes for most of the population amid worsening maldistribution of wealth and the growth in power of a class of super-rich.[71] The value of securitisation issues grew more than five times in the US, Europe, Australia and Japan in the decade to 2006 alone. In 2005, US

households raised $4.75 trillion against the value of their homes, compared with only $106 billion ten years earlier. Two-thirds went to personal consumption, home improvements and credit card debt, helping maintain (over)production of export consumer goods by countries such as China. In the US, the lack of a public health care system and the driving down of wages added to pressures to draw on the new sources of credit. The new wave of money also helped finance dubious infrastructure projects in the global South,[72] and helped give credence to the notion that the private sector – traditionally inferior to the state as a mobiliser of finance – could take over social roles from which the state had withdrawn.[73] The fact that the income in question was hypothetical, basing itself on, as well as feeding, a housing bubble, was no disincentive against banks' attempts to make massive short-term returns.

Financialisation

Because derivatives are separated from ownership of the underlying assets, they are able, as political economists Dick Bryan and Michael Rafferty explain, to "blend" attributes of multiple asset forms in new ways as relations are established between present and future prices. Convertible bonds, for example, break down the distinction between debt and equity, just as the seminal Wall Street development known as portfolio theory, first mooted in the 1950s, had attempted formally to commensurate risk and profit, while the junk bond market of the 1980s had assumed that jacking up the interest paid on bonds below investment grade should be able to compensate investors for the likelihood of any losses resulting from bankruptcies. Bryan and Rafferty paint a picture of a:

> "huge market process in which all different forms (and temporalities) of capital are priced against (commensurated with) each other. By this process of commensuration, rates of return on different assets can be directly measured and, in a competitive capitalist environment, there follows a requirement of each asset, across space and time, to deliver a competitive return."[74]

Like the "shareholder value" movement, that process of commensuration exacerbated finance's traditional tendency[75] to flatten and scramble diverse and distinctive attributes by making them fungible, to crack apart aggregations of previously incommensurate enterprises, to divorce ownership from creative use and to devalue businesses with lower returns but higher long-term social value. The high rates of return associated with successful speculation in uncertainty and with the new possibilities for credit extension were entrancing and addictive for top executives in the financial sector (and some others), who were able to reap enormous bonuses on the back of the new commodity production line. Because no financial innovation could be kept secret for long, bonus hunger added to pressures to develop ever-new uncertainty products. That made investment in what is sometimes termed the "real economy" seem all the more passé. The growing imbalance between finance and other sectors, in addition, resulted in what historian Robin Blackburn calls:

> "the cancellation of promises made to employees . . . the erosion of small capital holdings by large and unscrupulous money managers and the swallowing of shoals of tiny fish by a shark-like financial services industry."[76]

Top executives in the financial sector found addictive the high rates of return associated with speculation in uncertainty and with new possibilities for credit extension.

Securitised debt made possible an explosion in lending for mortgages, cars and individual consumption.

Mechanics of Commodification

One reason why it is hard to understand the implications of uncertainty markets stems from the ways in which many proponents and critics present them.

Outsiders have found it difficult to get to grips with the political economy of the new uncertainty markets not only because of the complexity and arcane structure of derivatives, but also because of the ways they are presented to the public both by proponents and, often, by critics. Apologists for the new markets (like apologists for the European enclosures of the 18th and 19th centuries, say, or apologists for industrial agriculture), have always tried, especially when talking to relative outsiders, to characterise the new arrangements mainly as an "efficient", politically-neutral, technical rearrangement of pre-existing materials.

For example, a 1999 JP Morgan *Guide to Credit Derivatives* discourses complacently about how credit derivatives "allow even the most illiquid credit exposures to be transferred to the most efficient holders of that risk" by "separating specific aspects of credit risk from other risks."[77] This "unbundling", elaborated Alan Greenspan, Chair of the US Federal Reserve:

> "improves the ability of the market to engender a set of product and asset prices far more calibrated to the value preferences of consumers . . . and enable entrepreneurs to finely allocate real capital facilities to produce those goods and services most valued by consumers, a process that has undoubtedly improved national productivity growth and standards of living."[78]

Such glib statements were based on a tacit inference nearly identical to one that later came to underpin carbon trading:

> (1) If the feat of disentangling, isolating and quantifying a new range of uncertainties could be accomplished, it would help maximise efficiency;[79]

therefore,

> (2) It must be the case that this feat can be (or already has been) accomplished.[80]

Apologists for the new markets characterise them as an "efficient", politically-neutral, technical rearrangement of pre-existing materials.

Some commentators still assume even today that the disentangling process was unproblematic. Writes one journalist from *The Economist*:

> "In the end, this financial crisis has been like every other; banks lent too much money during a property boom and now (together with the unfortunate taxpayers) they are paying the penalty."[81]

In such simplistic, boilerplate accounts, recent events become an illustration of the "same old same old" cycle of a bubble fed by excessive credit followed by a crash. Once again, the story goes, greed and love of risk-taking have got out of control. Financiers have yet again been unable to resist the temptation to take advantage of their capacity to make huge wagers just by hiring people who can formulate contracts. On this view, the technical-fix solution is simple: regulate and constrain the bankers. Critics further to the left aren't always much more helpful, sometimes attributing the crisis simply to the "internal dynamics of capitalism", discouraging inquiry into its novel features and accepting at face value financiers' narratives of the inexorable march of financial technology.

A more constructive approach would pay closer attention to the sociological details of how the new uncertainty markets were cobbled together. The inference from (1) to (2) above, after all, is invalid – which is why no one ever articulated it out loud. Far from being unproblematic, the task of trying to disentangle and "objectify" various uncertainties involved continual hard work and hustle in the service of a

goal the possibility of whose achievement was always in doubt.

Instead of viewing the unprecedented new uncertainty markets as emerging "naturally" from greed or the unstoppable, independent progress of financial technology, a deterministic force that steamed off on the wrong track because regulators were asleep at the switch, and remediable by waking them up, a less lazy approach would explain the new markets' roots in painstaking, innovative, contingent political and technical work by a variety of interested actors, including regulators themselves. Polanyi's famous dictum "*laissez faire* was planned; planning was not" holds as good for the finance of the turn of the 21st century as it did for the labour and land markets of the turn of the 19th. The details of this planning – or, perhaps more accurately, of this *bricolage* – need to be investigated and understood before a coherent response to the havoc it has created can be formulated. Three relevant topics are sketched below:

- How financial derivatives were disembedded from customary restrictions on gambling and re-embedded in new financial and academic networks;
- How the institutions required for the new markets were built up; and
- How the assembly lines and supply chains for the new financial commodities were constructed.

Attributing the financial crisis to the "internal dynamics of capitalism" can discourage inquiry into its novel features and give credence to claims that the new financial innovations were inevitable.

Removing Taboos on Gambling

One aspect of the process of market construction was the removal of stigmata against gambling. This has been as crucial to commensuration in modern finance as it was to the commensuration required for, say, the emergence of significant global food prices several centuries ago. As sociologist of science Donald MacKenzie has described, this legal and moral disentanglement took tough political organising to achieve – even if not necessarily always carried out in full awareness of the eventual outcome.

The new uncertainty markets resulted from hard political work carried out by interested actors – including regulators.

For instance, in order to help build up a narrative according to which speculating in derivatives would not be gambling but rather a natural outgrowth of an endogenous demand for liquidity and "efficiency", early US derivative *bricoleur* Leo Melamed, a Chicago trader, paid economist Milton Friedman $5,000 to write a paper supporting a currency futures market that he could then use in lobbying Washington to give the green light to his project of setting up a new Exchange.[82] The Chicago Board of Trade hired still other economists to come up with a "public interest" case for introducing options[83] for use in lobbying the Securities and Exchange Commission (SEC).[84] According to one knowledgeable observer, it was the Black-Scholes option pricing equation (a "quant" invention discussed below) that really got the new Chicago Board of Trade's Options Exchange off the ground:

> "[Black-Scholes] gave a lot of legitimacy to the whole notion of hedging and efficient pricing, whereas we were faced in the late 60s-early 70s with the issue of gambling. That issue fell away, and I think Black-Scholes made it fall away. It wasn't speculation or gambling, it was efficient pricing . . . I never heard the word 'gambling' again in relation to stock options traded on the . . . Exchange."[85]

This work needs to be investigated and understood before formulating a coherent response to the havoc it has created.

Helping further to disembed the new gambling from previous social controls – and re-embed it in economic theory and neoliberally-inclined institutions operating globally – were the fusion of retail and investment

banking,[86] the erosion and 1999 repeal of the Glass-Steagall Act in the US, which had been passed four years after the Great Crash of 1929,[87] and the de-mutualisation of building societies in the UK in the 1980s and 1990s.[88]

Partly motivated by the need to counter London's efforts to poach financial business from New York by offering a less-regulated environment, the repeal of Glass-Steagall enabled commercial banks to use their deposits as collateral for globalised gambling, commensurating them with the wall of money being created and augmented by the growing "shadow banking system" and blurring the distinction between investment banks, commercial banks and insurance companies. To stay competitive, investment banks – many of which had eagerly purchased various mortgage companies[89] – then had to create "a lot of additional risk to make a lot of money on the back of nothing – that is, borrowed or leveraged money – because they didn't have deposits."[90]

Pooling, recombining and concealing assets bearing different kinds of risk and uncertainty, further commensurating them with various "hedge" investments, blurring different credit lines, and setting up special purpose vehicles all also helped the disembedding process. So did regulatory decisions to allow banks to take securitised loans (used to raise finance to make more loans) off their balance sheets, to permit banks backed by taxpayers to lend to hedge funds, and to give hedge funds tax exemptions and allow them to use tax havens. Mutual fund managers could get around prohibitions on gambling on currency fluctuations simply by buying structured notes whose payoffs were linked to the performance of a particular currency pair.

Financial innovation went hand in hand with the expansion of funds and exchanges.

Institutional Growth and Transformation

In broad institutional terms, the "modern machinery of speculation"[91] was constructed through the mushrooming of private-sector financial organisations, including sell-side institutions, such as brokerages and banks, and buy-side institutions, such as alpha-hungry hedge funds and pension funds. Also playing a role were mutual funds, index funds, insurance companies, private equity firms, stockbrokers, venture capitalists, capital management firms, endowment funds and family trust funds, together with various new trading floors. "Expanding institutional investment and widening financial innovation have stimulated one another."[92]

While governments learned to restrict the conduct of monetary policy to the management of short-term interest rates, the number of Wall Street firms trading in foreign exchange climbed from 11 in 1971 to 200 today, and the ratio of foreign exchange to world trade began its ascent from 2:1 in 1973 toward the 1995 figure of 70:1. In 1972, the International Monetary Market opened. On 23 April 1973, the Chicago Board Options Exchange traded its first 911 contracts; by 2007 its volume of contracts would reach almost 1 trillion. In 1974, the US abolished restrictions on international capital movements, trailing in the wake of Canada, Germany and Switzerland. The UK followed suit in 1979, Japan in 1980, France and Italy in 1990, and Spain and Portugal in 1992. In 1976, trade in commodity options was made legal in the US. The first index fund had already started up in 1971, at Wells Fargo.

In 1982, as business was beginning to increase its efforts to protect itself against interest rate swings as well as other uncertainties, trading in futures on the Standard & Poor's 500 Index got under way, and trading in options a year later. Between 1970 and 1980, international

equity and bond purchases between the US and the rest of the world tripled; by 1993 they would multiply 45 times. By the mid-1990s, cross-border ownership of tradeable securities amounted to about US$2.5 trillion.

As the role increased of "financial motives, financial markets, financial actors and financial institutions in the operation of the domestic and international economies,"[93] finance began to penetrate "all commercial relations to an unprecedented direct extent"[94] and "permeate everyday life"[95] as never before. By the late 1990s, finance, insurance and real estate had come to account for a greater share of US corporate profits than either manufacturing or services,[96] and by 2007 the profits of US financial companies stood at 41 per cent of total corporate profits, after tax, compared with less than 5 per cent in 1982.[97]

As profits from non-financial activities declined, even the most venerable non-financial companies opened financial divisions. By 2003, for instance, 42 per cent of General Electric's profits were generated by its GE Capital division, and by 2004, 80 per cent of General Motors' income came from the GM Acceptance Corporation.[98] Facing dwindling returns from investment in industry and losing big customers to other credit suppliers, banks increasingly learned to rely on non-interest income, whose ratio to bank profits rose in the US from 25 per cent in 1980 to 41 per cent in 2005, in Spain from 15 to 33, in Germany from 20 to 34, and in France from 23 per cent in 1990 to 62 per cent in 2005.[99] Meanwhile, hedge funds increased in number from 3,000 in 1996 to 8,900 in 2006, with their assets growing more than 10 times.[100] Private equity funds and sovereign wealth funds also ballooned in s e and influence.[101]

Taking on a "life and evolutionary trajectory of its own," derivatives trading smudged and eventually almost obliterated the distinction between insurance, "portfolio capital" and "speculative capital". By 2008, the conventional assumption that regulation should focus on commercial banks, as the financial institutions most crucial to the so-called "real economy", was in deep question:

> "it was becoming increasingly hard to state which institutions were 'core' to the system, and which were not . . . The shadow banking world in London and New York had swelled to such a monstrous size that the regulated and unregulated spheres were deeply entwined, on both sides of the Atlantic."[102]

Brokers, hedge funds and special investment vehicles controlled US$8 trillion in assets, compared with $10 trillion on the balance sheets of banks. Shadow banks and brokers were so closely connected with commercial banks that they were not only "'too big to fail'; they were also too interconnected to ignore."[103]

At the same time, businesses and governments were commensurated as seldom before into a single class of economic actors engaged in a unified effort to deliver returns, "agents subject to the same structures of opportunity and decision."[104] "Chinese walls" between research and banking within investment firms were also breached: "What used to be a conflict [of interest] is now a synergy," was the famous judgement of Jack Grubman of Salomon Smith Barney as early as 2000.[105]

The growing complexity and obscurity of financial technologies encouraged regulators to opt for what US Federal Reserve Chair Alan Greenspan euphemistically referred to as "private regulation." It was not only that shadow banks and certain derivatives tended to lie for long periods outside regulators' ken, or that banks were allowed to become investors in and beneficiaries of the same projects they were

Finance came to account for a greater share of US corporate profits than manufacturing or services and to permeate everyday life as never before.

"What used to be a conflict [of interest] is now a synergy."

Jack Grubman
Salomon Smith Barney
2000

Regulators colluded in uncontrolled credit expansion by falling in with the uncertainty computations of market participants.

The concept of conflict of interest became obsolete at the highest levels of government: top US Treasury appointees came from derivatives-trading institutions – and were fiercely critical of most regulation.

Instead of limiting innovation in uncertainty commodities, regulators celebrated its growth and lamented the public's financial illiteracy.

advising on. Checks and balances themselves became commodified in the sense of becoming entwined with the models and the ways of thinking they encouraged. According to lawyer and financial analyst Frank Partnoy, instead of ruling whether or not financial companies should be allowed to buy and sell certain securities, regulators began deferring as early as the 1970s to credit-ratings agencies, such as Moody's, Standard & Poor's and Fitch, by passing regulations that depended on their findings.[106] The agencies' fees, which came from the companies whose offerings were being rated, mushroomed, giving the agencies powerful incentives to award nicely commensurate AAA ratings to billions of dollars of stupendously heterogeneous and often dubious securities.[107] By 2005, Moody's was drawing nearly half of its revenues from the structured finance sector.

The regulator/rating agency nexus linked itself even more tightly to private financial firms in 2004, when Moody's and Standard & Poor's (and thus the regulators who relied on their findings) began to rate collateralised debt obligations using a type of mathematical formula that financial firms themselves used in the production of derivatives;[108] Basel banking rules already allowed banks to use their own models to calculate risk and judge how much capital to set aside.[109]

By falling in with the uncertainty computations of market participants themselves, in other words, regulators colluded in uncontrolled credit expansion. Unwilling or unequipped to challenge this tide of commodification, even acute critics such as John Eatwell and Lance Taylor could only recommend meekly that regulatory authorities, who they assumed were fated always to be "running several paces behind the market" and to lack "significant expertise", be:

> ". . . in constant dialogue with the firms they supervise, providing guidance and building a compliance culture. A good relationship with supervised firms, with a continuous flow of information and mutual advice, will be far more efficient than adversarial policing. . . . In today's fast-changing financial markets it is essential that the regulator be 'close to the market'."[110]

The concept of conflict of interest slipped into obsolescence at the highest levels of government as well. Although officials such as the US Secretary of the Treasury had always been likely to come from, and return to, Wall Street, it became less and less acceptable to raise questions about conflicts of interest among the new generation of top appointees such as Robert Rubin and Hank Paulson, both of whom came from derivatives-trading institutions and were fiercely critical of most regulation.[111] Rather than reining in innovation in uncertainty commodities, regulators celebrated the financial sector's growth, merely taking time out occassionally to lament punters' supposed financial illiteracy.

By the late 1990s, bringing the over-the-counter derivative market under any official oversight at all was considered out of the question. Just as President Bill Clinton was about to leave the White House, Congress passed the Commodity Futures Modernisation Act 2000, which both exempted derivatives from oversight under state gaming laws as well as from reserve requirements and excluded certain swaps from being considered securities under the rules of the Securities and Exchange Commission. Later on, Hank Paulson, one of Wall Street's highest-paid executives, was instrumental as Treasury Secretary in a decision to abandon restrictions on leverage that benefited his old firm, Goldman Sachs.

Nor did regulation keep up when mortgage banks and brokers, a few years later, began to dominate the primary mortgage market, and

there was little official monitoring of the swelling housing bubble. Internationally, the World Trade Organisation (WTO), which was a factor in the revocation of Glass-Steagall,[112] would not allow countries to break their commitments to deregulate derivatives even after the financial crisis broke.[113] In the US, the sole exception to deregulation had been onion futures, which farmers had insisted that Washington ban in 1958 after speculators had cornered the market.[114]

Quantism

At the level of the "factory floor" within the burgeoning financial institutions, the new uncertainty commodities were manufactured in large part by "quants" – quantitative experts, often with a science or mathematics background – acting in conjunction with new computing, information and communication technologies, as well as traders and management.

Starting in the 1970s, an "arms race" to develop new financial techniques for commodifying uncertainty spurred innovators competing for profits to ever-new heights, and by the 1990s terms such as "financial product" and "financial products division" were enjoying an unprecedented vogue. The relevant mode of "production" was what might be called "quantism": the material and social processes of isolating, laying claim to, objectifying, simplifying, abstracting, quantifying, commensurating, pricing and re-aggregating masses of unknowns by which derivatives were manufactured and financial uncertainty commodified. Computers and top mathematical talent were given free rein in greatly expanded efforts to break down, reframe, mathematise, diversify across, appropriate and charge rent for the future. Between 1998 and 2007, the number of quantitative-based equity funds relying principally on computer programmes increased from around 130 to about 800, as mechanical computation multiplied in importance across the financial world.[115]

Key to these processes was, roughly speaking, the "mystification of uncertainty or contingency as if it were measurable as probability":[116] such "commodified thinking" (to adapt the phrase of options trader Nassim Nicholas Taleb)[117] was essential to making a wide new range of unknowns market-friendly. Starting from the efficient market hypothesis, which in one of its forms claims that asset prices are always and everywhere correct, and that any price movement must be generated by external events, quantism promised a picture of the entire possible future distribution of returns from any asset. That seemed to give traders the means to slice, dice, buy and sell different parts of it.[118] What economist Frank Knight had dichotomised in the 1920s as risk and uncertainty[119] tended to be run together, as were what philosopher and historian Ian Hacking later called "looping" and "non-looping" phenomena[120] and the "fat-tailed" and "thin-tailed" distributions described in statistics.[121] This sort of oversimplification in the service of mass production (which was later to become a necessary feature of carbon trading as well) paradoxically led to enormous complexity due to the resistance of the uncertainties involved to being mathematically framed in a way that facilitated market liquidity.

If quants found their efforts conditioned by economic dogma and the imperatives of the financial institutions that employed them, the institutions, for their part, could not have grown in the way they did without quantism. For example, the Black-Scholes equation, published in 1973, facilitated the expansion of a market in options by offering an academically-sanctioned way of calculating prices for uncertainty in

The new uncertainty commodities were manufactured largely by quantitative experts using new computing, information and communication technologies.

"Quantism" involves the material and social processes of isolating, laying claim to, objectifying, simplifying, abstracting, quantifying, commensurating, pricing and re-aggregating masses of unknowns.

Uncertainty was treated as if it could be measured like probability.

The models that made possible the mass production of uncertainty commodities were built partly out of market imperatives and neoliberal ideology.

such financial products quickly through reference sheets, calculators and computers, using heat diffusion equations as a model. The templates for Black-Scholes and other quantist commensuration devices date back even further, to portfolio theory and the capital asset pricing model developed in the 1960s, which provided a metric for price uncertainty by defining it as volatility relative to that of the entire market.

In another key development, one quant, David Li, devised a piece of mathematical machinery in 1999 that helped make the "mass production" of structured finance deals possible by offering a supposedly streamlined way of figuring out how corporate or mortgage defaults might correlate. Instead of speculating on the ways that the defaults of thousands of different companies or homeowners might affect each other, Li proposed, why not apply a generic formula that used a bell curve or normal distribution to map and determine the correlation on any given portfolio of assets? As financial journalist Sam Jones explains, in the same way that actuaries who studied the increased statistical likelihood of death among widowers:

> "could tell their employers the chances of Johnny Cash dying soon after June Carter without knowing anything about Cash other than the fact of his recent widowhood, so quants could tell their employers the effect one company defaulting might have on another doing the same – without knowing anything about the companies themselves."[122]

Not only was there now seemingly less need to study specific companies or interview debtors; there was also less need to avoid putting eggs in a single basket, since the exact odds of the basket being dropped could now supposedly be calculated. Again, mechanising the production of confidence had seemingly made the provision of credit vastly more cost-effective:

> "Banks could now build collateralised debt obligations out of subprime mortgage debt alone and get AAA ratings for them. The CDO market exploded. In 2000, the total number of CDOs issued were worth somewhere in the tens of billions of dollars. By 2007, two trillion dollars of CDO bonds had been issued. And with so many investors looking to put their money in debt, that debt became incredibly cheap, fuelling a massive boom in house prices and turbo-charging the world's economies."[123]

Confirms trader and consultant Pablo Triana:

> "Without the model-based confident assessments of traders, quants and rating agencies, the vast securitisation of less-than-salubrious credit and its spreading throughout the far corners of the financial universe might not have taken place . . . Pricing tools that purported to be able to summarize überly complex trades into one neat number . . . convinced bank executives and trading floor honchos that restraint would be a wasteful course of action."[124]

Whatever their academic sheen, quantist innovations such as those of Black, Scholes and Li were not self-actuating, disembodied collections of advanced mathematics arriving fully-formed from the academic ether with a network of high-end computers attached – "objective," if obscure, discoveries about an independently-existing, ahistorical "risk" waiting to be seized upon and "applied" (or misapplied) by canny or self-interested financial practitioners. Nowhere was there a single line dividing the models from the world to which they were applied. Nowhere did traders suddenly step from model to reality or expect to match the one to the other.

For one thing, the models that made mass production of uncertainty commodities possible were built partly out of market imperatives and neoliberal ideology (including equilibrium theory and the efficient markets hypothesis espoused at the University of Chicago), which went "all the way down" into the intimate details of their mathematics. The various numerals and Greek letters of the formulas had no more metaphysical or privileged an origin than did structured investment vehicles.

Moreover, the models did not provide a sudden illumination of a separate reality. Rather, they formed a part of reality and continually shaped it.[125] For example, the fact that traders' use of the Black-Scholes equation increased market volume and liquidity, making transactions easier, made more realistic the equation's initially unrealistic assumption that portfolios could be continuously revised without transaction costs. The efficient markets hypothesis became in some sense more plausible as it became easier for arbitrageurs to exploit (and thus supposedly eliminate) small price anomalies.[126] Up to the point of the 1987 crash, the Black-Scholes equation apparently helped determine prices,[127] as other models did afterwards. Models were also used to evaluate the trading results that determined executive pay, and were crucial to index trading.

On the negative side, unlike casino bosses who were generally able to construct a near-sterile environment in which the models crucial to sustained profitability worked, traders using Li's correlation model – referred to by bankers as the "combustion engine of the collateralised debt obligation world"[128] – found that their environment was constantly being contaminated by new uncertainties and dangers deriving from the model itself:

> "[T]he more that banks all relied on the Gaussian copula approach, the more they were creating a new form of correlation risk. Because everyone was using the same statistical method of devising their collateralised debt obligations to contain risk, in the event of economic conditions that defied that modelling, huge numbers of CDOs would suffer losses all at once."[129]

Similarly, "value at risk" methodologies, introduced around 1990 at J.P. Morgan as a way of simplifying uncertainty into a single number purporting to display on a day-to-day basis how much a bank could lose in an unfavourable scenario, were designed to prevent the accumulation of excessive uncertainty in individual trading positions. Yet the models forced swaths of traders to cut their losses together at a time it was unfavourable to do so, thus magnifying adverse market movements and correlating hitherto relatively uncorrelated markets, helping bring about events that the models had suggested could only happen once in millions of years.[130] Moreover, while trading away foreign exchange or interest rate risk might have seemed to make a portfolio safer, "you are in fact swapping everyday risk for the exceptional risk that the worst will happen and your insurer will fail".[131]

Another example of how efforts to "economise" on uncertainty led to unanticipated results is "ratings arbitrage" or "ratings shopping". No sooner had ratings agencies made public their risk models than banks began gaming them, running prototype products through the agency programmes to see what credit ratings they might be assigned. If the rating seemed too high or too low, the banks would tweak the commodity to get the maximum rating for the maximum uncertainty.

These kinds of "negative shaping" were hazardous not just because they created new uncertainties[132] but also because those uncertainties were not stabilisable or predictable through further modelling. This was

Because everyone used the same statistical method to devise their collateralised debt obligations, economic conditions that defied the modelling could cause huge numbers of CDOs to suffer losses at the same time.

Following the same models magnifed adverse market movements, correlated previously uncorrelated markets – and helped bring about the very events the models suggested could happen only once in millions of years.

The models commodifying uncertainty gave financial sector actors a false sense of confidence in buying and selling their products.

The efficient markets hypothesis did not grasp that financial systems are inherently unstable, do not tend toward equilibrium, and do not allocate resources optimally.

Because quantist formulas oversimplified and destabilised the future, some traders had pointed out from the outset that model-assisted commodification of uncertainty made crashes inevitable.

one reason why the science for constructing the assembly lines – as with all assembly lines – could not be used off-the-shelf, but had to be worked out largely on the ground.

True, Black-Scholes calculators were being marketed within six months of the publication of the two quants' original paper, and David Li's Gaussian copula was also quickly incorporated into computer programmes across the industry. But those traders who actually understood the models learned to compensate for their unworkability (and sometimes, wittingly or unwittingly, conceal it from technically-inexperienced higher-ups and from clients) by relying on the "dark twin"[133] of older "heuristics and tricks" and a vernacular understanding of possible scenarios that they had acquired through long, everyday practice.[134] Realising that quantist formulas for cultivating the future both oversimplified it and destabilised it in dangerous ways, brainy, experienced traders working close to the coal face pointed out from the beginning that while heavily model-driven commodification of uncertainty might temporarily expand profit opportunities, it ultimately made crashes inevitable.

Such trader-critics tended to be more concerned about the threat to profits and careers posed by "blowups" than with the fallout for society as a whole. Predictably, many hastened to use the failures of the models as money-making opportunities, thus ironically shoring up the dominance of the models by becoming trading partners of more gullible quantist true-believers.[135] But at the same time, like fellow financial practitioner John Maynard Keynes many decades earlier, many could not restrain themselves from taking to task what Polanyi might have called unfeasibly ambitious attempts to commodify uncertainty and security. What was particularly dangerous, the trader-critics insisted, was that the new models being used in the commodification of uncertainty gave financial sector actors a false sense of confidence when buying and selling their products.

Thus the trader and physicist J. P. Bouchaud of Capital Fund Management denigrated models that priced structured financial products involving sub-prime mortgage risk, accusing them of providing the "credit mongers of the financial industry" with ways "to smuggle their products worldwide."[136] The options trader Nassim Nicholas Taleb called for the abolishment of "value at risk" models because of their inability to handle the problem of "black swans" (unforeseeable events of high impact resistant to commensuration, although not to "safety-first" modes of social thinking):[137] "If you give a pilot an altimeter that is sometimes defective he will crash the plane. Give him nothing and he will look out the window".[138] George Cooper of Alignment Investors, together with other followers of the Keynesian economist Hyman Minsky, slated the efficient markets hypothesis underlying most quantist theory for failing to grasp that financial systems are inherently unstable, do not tend toward equilibrium, and do not lead toward an optimal allocation of resources. "Risk management based on the efficient market hypothesis is like the proverbial chocolate teapot; it works only while not in use,"[139] Cooper pointed out. Because it does not know what it claims to know, it will "increase confidence to inappropriate levels" and thus will itself add risks to the system.[140]

Along similar lines, the billionaire speculator George Soros mobilised arguments demonstrating that financial markets are vulnerable to positive feedback cycles and strong anti-equilibrium tendencies, noting that "uncertainties inherent in reflexivity", or the periodic tendency of investors' observations and biases to influence "economic fundamentals" in a disruptive way, cannot be ignored.[141] Derivatives veteran

Satyajit Das contributed satires on the logic that drives risk management toward the status of "pure entertainment," with quants pushed into the absurdity of pretending to be able to model every eventuality including road accidents involving bankers on bicycles.[142] Even mainstream manuals for financial practitioners pointed out that the increased leverage made possible by the new commodification of uncertainties tended both to expand bubbles and to deepen crashes when calls were made on reserve capital, turning classroom "efficient market" theories of equilibrium upside down:

> "When there is no leverage in the system . . . a higher price triggers selling and a lower price triggers buying. When there is enough leverage in the system then the reverse is true: higher prices trigger buying, to close losing positions; lower prices trigger selling . . . The unwinding of . . . losing positions exacerbates the price action, triggering yet more stop-losses."[143]

The models' self-defeating "negative shaping" tendencies were bound up with the scale, speed and tight integration of modern financial transactions that they helped make possible. Even the early "privatisation of foreign exchange risk … increased the scale and incidence of market risk enormously", economists John Eatwell and Lance Taylor noted, with new "externalities" that bore down on the whole system:

> "The new market linkages (domestic and international) created by the liberalisation widened the potential impact of failure by any one investor or firm. Contagion became possible on an international scale."[144]

By 1998, it was obvious that model-driven commodification of uncertainty had helped intertwine markets and investors so closely that they were behaving in ways not factored into the models.[145] In 2005, Timothy Geithner, then of the US Federal Reserve, quietly admitted that credit derivatives, if they made the system more stable in places, seemed to do so "at the price of making the system more unstable at the tail".[146] A couple of years later, hedge fund practitioner Richard Bookstaber elegantly summarised the instabilities inherent in the "tight coupling" and "interactive complexity" that resulted from the sweeping use of commensuration and the new financial engineering to enhance liquidity and leverage:

> "[I]n the instances where it really matters the liquidity that is supposed to justify the leverage will disappear with a resulting spiral into crisis."[147]

In vivid contrast to academic economist Kenneth Arrow, who envisaged a security for every condition in the world, with every uncertainty becoming a commodity that could be transferred to someone else,[148] Bookstaber insisted that "just because you can turn some cash flow into a tradeable asset doesn't mean you should . . . limitless trading possibilities might cause more harm than good."[149] Pointing out that "if risk management can fail in unanticipated ways, then adding more controls can't address the issue,"[150] Bookstaber envisaged a coarser, less "sophisticated", more resilient approach:

> "Rather than adding complexity and then trying to manage its consequences with regulation, we should rein in the sources of complexity at the outset . . . reduce the speed of market activity . . . reduce the amount of leverage that comes as a result of the liquidity."[151]

"Risk management based on the efficient market hypothesis is like the proverbial chocolate teapot: it works only while not in use."

George Cooper
The Origin of Financial Crises

Model-driven commodification of uncertainty intertwined markets and investors so closely that they began to behave in ways not factored into the models.

If risk management can fail in unanticipated ways, adding more of the same kind of controls can't address the issue.

Quantism helped maintain confidence in a detached "objective expertise" and generated a narrative of progress justifying attempts to maximise profits from industrial-scale cultivation of uncertainty.

Quantism cemented the position of Wall Street high earners, while concealing from customers the ways in which power, money and goods were being redistributed.

Even the quants and bank executives most eager to defend the formulas were typically only too happy to acknowledge, when questioned, that "a model is inherently wrong, because a model only looks backwards",[152] and to give at least lip service to more well-rounded or synoptic views of uncertainty. Fischer Black, one of the most famous of all quants, was well aware of "The Holes in Black-Scholes"[153] (as well as the limitations of "value at risk" methodology) and went so far as to point out ways traders could exploit them. Most experts knew that "in finance, statistical impossibilities are quite literally an everyday occurrence."[154] Portfolio theory, which attempted to commensurate uncertainty and profit by abstracting from concrete hazards associated with particular assets and focusing on standard deviations in price swings, ended up assigning one-in-a-septillion odds to large price fluctuations whose actual probability was measurable in percentage points.[155] Price shifts that a normal distribution predicted would occur once every 300,000 years in fact occurred 48 times in the 20th century alone.[156] Even the best models, admitted Emanuel Derman, another prominent quant, could do no more than make clear "exactly what has been swept out of view" and allow you to "think clearly about what you may have overlooked".

If finance continued to rely on such models as the "combustion engines" of accumulation, therefore, it was not because no one saw the pollution they gave off or failed to spot their tendency to break down or get into motorway pileups. More plausibly, it was because, beset by irresistible competitive pressures to maintain or ramp up production of uncertainty commodities, quants, traders, bankers and politicians found themselves unable to answer their own question, "What is the alternative?"[157] Whatever promised "productivity", however temporary, had to be treated as, in principle, perfectible. Among quants, journalists and the interested public alike, obligatory admissions that models were "inherently wrong" were typically interpreted as implying that they were "approximately right", or, in line with Milton Friedman's famous doctrine of positive economics, "heuristically useful".[158] The word "model" itself implied that progress was being made in the taming of an ahistorical uncertainty.

Even after it became clear how financial innovation had contributed to the crisis, pundits, continuing to be misled by the fact-like appearance of prices and markets when seen through the lens of the efficient markets hypothesis, often insisted that this must be because the models had failed the "reality test" – as if there existed an economic or trading reality separable from the modellers and their doings, or as if some as yet undiscovered algorithm could make the commodification-friendly mathematics of standard bell curves "compatible" with the occurrence of unlikely events of extreme impact, or as if there existed such a thing as a metaphysically "fundamental" price underlying all the herd movements and irrational exuberance.[159] The same failure of imagination has afflicted many theorists of regulation, who continue to claim that the systemic uncertainties brought about by the new financial instruments are a result of "mispricing".[160]

This was perhaps quantism's deeper function: to maintain confidence in a detached "objective expertise" concerned with overcoming risk and to generate a narrative of progress that justified and excused attempts to maximise profits from an industrial-scale cultivation of uncertainty. In this respect, the false yet reassuring precision afforded by financial models deriving from 19th century physics was a positive advantage. In addition to preserving the mystified theory/practice distinction so important to modern forms of power and class warfare,[161]

Commodifying Uncertainties, Commodifying Land: The Role of Technical Expertise

If the mathematical models used as the "combustion engines" of the commodification of uncertainty were so destructive, and undermined their own plausibility so thoroughly, what accounts for their influence? Some clues might be provided by comparing attempts at the wholesale commodification of uncertainties with attempts at the thoroughgoing commodification of land undertaken by the modern forest industry.

Modern wood product manufacture tends to rely on "framing" large tracts of land for maximum, relatively short-term, commercial production of uniform timber or pulpwood. Land is surveyed, examples of desirable species tagged, their "fit" with existing machinery assessed, and return per hectare of various varieties estimated. Stands are thinned and biodiversity and human habitation that is "extraneous" to the varieties selected is reduced or eliminated. Ultimately, serried, factory-friendly monocrops of species can be planted, perhaps followed by rows of clones or even trees engineered to be genetically identical.[163] "Wood" becomes a standardised, fungible, mobile product.

State and market actors working through such processes often understand that they are drastically simplifying the landscape both in "theory" and in "reality". What they "see" when they look at the original landscape is largely a substrate for the maximal or optimal growth of the particular species appropriate for the machines available. Following through on this vision results in an even more reduced "reality". Relationships centring on the land that are extraneous to maximum wood production are disentangled and separated out from it in the name of efficiency.

Many wood industrialists may well understand, following reflections such as those of options trade Nassim Nicholas Taleb or hedge fund practitioner Richard Bookstaber, that, far from applying a "theory of sustainable maximal wood production" which, if false, will automatically and benignly correct itself through iterated encounters with distinct biological or social realities, they are in fact stoking the likelihood of long-term systemic "blowups" resulting from soil depletion, pest infestations, disease, genetic erosion, farmer revolt, catastrophic fire, and other social and environmental consequences of extreme simplification.[164] As in the world of credit derivatives, overreaching attempts to maximise the system's productivity by continuing to seek small gains at the margin – "picking up pennies in front of a steamroller"[165] is one phrase used to describe securities trading – threaten to crash it altogether if things go wrong.

Whether or not they grasp this, however, wood industrialists have incentives, when encountering precursors of crisis, merely to add technical fixes to the original package, and then additional technical fixes that attempt to fix the problems brought on by the fixes, and so on, often setting in motion new dynamics of crisis.

The inevitability of a reckoning, unpredictable in its timing and damaging depending partly on how much land has been staked on the experiment and how extreme the simplification procedures deployed, does not entail that they are acting unreasonably given their interests and the imperatives of the markets in which they are operating.

The point is to cash in just as the bubble is about to burst and to take "as much as possible of the credit when things go right, and as little as possible of the blame when things go wrong".[166] As financial analyst John Kay points out, "most people in large organisations are not really interested in minimizing risk."[167]

Like quants and the bankers that depended on them, wood industrialists and the foresters they work with find themselves subject to a social context and an incentive structure in which they are typically unable to answer their own question: What is the alternative to oversimplification? A narrative of progress through forestry expertise helps them defend their position both before and after crisis hits.

quantism was likely also to have served partly as a political coordination and prestige device that helped cement the position of the academically-trained faction of the Wall Street high salariat and their revenue-seeking superiors, while concealing from customers the way power, money and goods were being redistributed.[162] If the models undermined themselves, and the projected vast pool of future income from (say) indefinitely rising house prices turned out to be a mirage, that was no obstacle to using the mass production made possible by the models to make high returns off fees and payments in the short term. As Martin Wolf of the *Financial Times* observes, in a highly-leveraged, limited-liability business, it is perfectly rational for managers holding options to countenance or help create the conditions for catastrophe as long as their institutions can enjoy periods of high returns, are not in danger of losing more than their equity stake, or are "too big to fail."[168] The boost in finance for export industries or infrastructure development,

moreover, however short-lived, had impacts which were just as real, in terms of reinforced concrete, displaced communities and ecological destruction, as finance derived from any other source. In recasting the future in a way that made new accumulation possible at the cost of degrading the basic conditions for livelihood, in other words, quantism was a mode of production like many others (*see* Box, "Commodifying Uncertainties, Commodifying Land: The Role of Technical Expertise", p.25).

The growth of uncertainty markets was accompanied by the invention of carbon markets.

II. Carbon Markets

"What, exactly, are we trading in?"

Environmental Data Services Report
July 2004[169]

The growth of uncertainty markets from the 1970s onwards was accompanied by another equally sweeping movement of commodification: the invention of pollution markets and, ultimately, carbon markets.[170] As financialisation gained momentum, governments and financial and energy interests facing potential popular unrest due to a deepening climate crisis were encouraged to turn to quants for help in developing a "commodity" or neoliberal solution to global warming, just as some of the same interests had earlier sought a commodity solution to new commercial uncertainties.

NGOs, governments and business encouraged traders, economists and quants to develop a neoliberal, "commodity" solution to global warming.

A landmark date was December 1997, when the Bill Clinton regime in Washington, citing the precedent of a US programme to trade sulphur dioxide, successfully pressed for the United Nations' Kyoto Protocol to become a set of global pollution trading instruments. The then US Vice-President, Al Gore, who carried the US ultimatum to Kyoto, became a carbon market actor himself; his Generation Investment Company has become the largest shareholder in Camco, holder of one of the world's largest carbon asset portfolios. In the 2000s, Europe picked up the initiative to become the host of what is today the world's largest carbon market, the EU Emissions Trading Scheme (EU ETS). Today, the project of building a single, liquid global carbon market worth many trillions of dollars – backed by the UN, national governments, economists, environmentalists and many in the business sector – is the main official approach to the climate crisis worldwide.

Building a single, liquid global carbon market worth many trillions of dollars is the main official approach to the climate crisis worldwide.

Significantly, some of the same *bricoleurs* and theorists have helped create both the financial derivatives markets and the carbon markets. One example is Richard Sandor, a US economist and trader who was one of the originators of interest rate derivatives in the 1970s and who later made a fortune during the boom years of the 1980s at Drexel Burnham Lambert, the firm of the junk-bond innovator Michael Milken.[171] Sandor also collaborated with Howard Sosin,[172] who subsequently helped set up and head the financial products division that ultimately laid the American International Group (AIG) low to the point of having to be bailed out by US taxpayers to the tune of $152 billion.[173] (AIG has used some of the payouts to lobby for a US carbon trading system, hoping to gain from new insurance opportunities thrown up by the market.[174]) Encouraged by a Washington environmental organisation, Sandor helped develop the idea of pollution trading in the 1980s and 1990s, building on a theoretical foundation laid down by academic neoclassical economists such as Ronald Coase and John Dales. In the 2000s, with philanthropic handouts, Sandor set up the Chicago Climate

Exchange, which today commands a small but growing segment of the carbon markets, and eventually was named as an "environmental hero" by *Time* magazine.

Other prominent figures in the derivatives markets quickly followed Sandor into the "ecosystems services" financial sector to manage funds, advise on matters such as the "measurement and monetisation of land use carbon credits," and perform other roles.[175] For example, Graham Cooper, who edited *Risk* magazine in the 1990s partly as a conference-for-profit operation serving the derivatives markets, soliciting articles from quants such as Fischer Black and Emanuel Derman, moved into a similar role in the carbon markets as publisher of *Environmental Finance* and *Carbon Finance* magazines and organiser of industry events.

Even more significant was Ken Newcombe, a former executive at the World Bank, which is now promoting financial products such as weather derivatives to countries in the global South. Newcombe helped set up the global carbon market at the Bank's Prototype Carbon Fund beginning in the late 1990s, influencing UN regulatory decisions and helping put the Bank into a position to make money from attempts to compensate for the climatic damage caused by the fossil fuel-intensive developments that it itself was underwriting in the global South.[176] As the market began to take off, Newcombe moved on to Climate Change Capital, a City of London boutique merchant bank, then headed up the North American carbon trading desk at Goldman Sachs before becoming CEO at the new carbon trading firm, C-Quest Capital. In addition, many of the same institutions that have been most active in financial derivatives are also moving to dominate carbon (*see* Box below: "Wall Street Moves into Carbon").

Some of the same theorists and practitioners responsible for the new derivatives markets have also helped create the carbon markets.

Carbon markets trade abstract commodities characterised by suppression of unknowns, contested quantifications, and lack of transparency.

Wall Street Moves into Carbon

Among the financial institutions that have set up desks to speculate in carbon commodities are Goldman Sachs, Deutsche Bank, Morgan Stanley, Barclays Capital, BNP Paribas Fortis, Rabobank, Sumitomo, Kommunalkredit, Merrill Lynch (now owned by Bank of America) and Cantor Fitzgerald (*see* Table 1, pp.50-51, and Table 2, p.53).

JP Morgan Chase has meanwhile snapped up the carbon offset firm Climate Care, while Credit Suisse has acquired a stake in the troubled carbon consultancy and accumulator EcoSecurities.

Goldman Sachs, which has spent millions of dollars lobbying for a US carbon trading scheme,[177] has announced plans to buy Constellation Energy's carbon trading business and is part owner of the Chicago Climate Exchange and of Blue Source, an offset producer.[178]

As with derivatives, a host of specialised new institutions have also been set up that deal in the new pollution commodities, with names like Sindicatum Carbon Capital, NatSource Asset Management, New Carbon Finance, Carbon Capital Markets, Trading Emissions plc, South Pole Carbon Asset Management, Natixis Environnement & Infrastructures, Noble Carbon, ICECAP, and so forth.

By 2008, there were about 80 carbon investment funds set up to finance offset projects or buy carbon credits, managing nearly $13 billion; most are oriented more toward speculation than toward helping companies comply with regulated carbon caps.[179]

Trading companies are also active, including Vitol, a major energy-market speculator; Enron, too, was keen on the Kyoto carbon market before the firm's spectacular collapse, and some ex-Enron staff have moved over to the carbon business. In addition, industrial companies such as steel giant Arcelor Mittal have at various points opened departments specifically to seek profits in the carbon trade, just as companies such as General Electric opened finance divisions in the 1990s.

Hedge funds are also benefiting – and in line with the philosophy of "going short" as well as "going long", some of the smart ones are hoping to make more money off the carbon market's failure than they ever could have made from its successes. In June 2009, Anthony Limbrick, chief investment officer of the hedge fund Pure Capital, noted that:

> "[w]e think there's a 30 percent chance the [carbon] market collapses . . . That could create a 'fat tail' (a very rare event with major consequences) for us to make money."[180]

How can industrialised countries eliminate their dependence on fossil fuels? Carbon markets fatally abstract from this question.

To be marketable, the climate commodity must be given qualities that prevent it from being an effective part of a climate change solution.

Carbon markets isolate and objectify a new product that is difficult to define – a commodification of climate benefits/ disbenefits constructed as discrete, quantifiable and commensurable.

The remainder of this paper will use parallels with the new uncertainty markets to explore further the political economy of carbon markets. An introductory section will lay out the basic steps through which the new carbon products are created. The two components of carbon markets – cap and trade, and offsets – will then be considered separately in order to detail the similarities between uncertainty and carbon markets.

These similarities are numerous. Like the uncertainty markets, carbon markets (which may someday rival them in size) produce highly abstract commodities, partly through quantist procedures characterised by suppression of unknowns, contested quantifications and lack of transparency. Like uncertainty markets, they pursue a strategy of "cost-effectiveness" so single-mindedly, and with so little attention to various less benign consequences of commensuration, that they end up interfering with the goal – in this case, curbing global warming – that was to be attained cost-effectively. In isolating divisible, comparable, accounting-friendly "emissions reductions" as the climate solution – the quantitative framework carbon markets require – they fatally abstract from the question of how those reductions might be made in a way that makes possible a historical progression away from fossil fuels; to be a commodity at all, the climate commodity must be given qualities that prevent it from being an effective part of a climate change solution. Like uncertainty markets, too, carbon markets have quickly become dominated by speculators eager to profit from a new asset class. Like uncertainty markets, they involve regressive redistribution and the destruction of crucial knowledge. Eroding notions of conflict of interest, carbon markets, like uncertainty markets, reveal the weaknesses of the dogma that all imaginable markets must be regulatable. Encouraging the accumulation of "toxic" assets similar to that which occurred in the uncertainty markets, they are vulnerable to bubbles and crashes that have particularly grave implications in view of the fact that, in the words of British Climate Camp activists, "nature doesn't do bailouts". Like uncertainty markets, carbon markets face contradictions, "overflows" and movements of societal self-protection owing to the ways that they "disembed" various survival goods and relations from one context and "re-embed" them dangerously in another.

Building a New Commodity: The Basics

Like financial derivatives markets, carbon markets isolate and objectify a new product that is, in many ways, difficult to define. One rough way of characterising the product is to say that it is a commodification of climate benefits/disbenefits, which – due to the formal requirements of markets – must necessarily be constructed as discrete, quantifiable and commensurable. Governments decide supply levels, rendering the commodity more or less economically scarce, and either sell it or, more usually, give it away to large industrial polluters. Trade in the commodity then supposedly makes climate change mitigation maximally cost-effective. Another way of conceptualising the product is to say that it is the result of the state enclosure, commodification and apportionment of the earth's carbon-cycling capacity, or ability to keep its climate stable.[181] Governments decide, whether on climatological or political grounds, how much of the world's physical, chemical and biological ability to regulate its own climate should be "propertised" and privatised and then given away or sold at any particular moment, and to

whom; the market then (regressively) distributes that capacity according to cost-effectiveness. Still another way of conceiving of the commodity would be as universally fungible greenhouse gas pollution rights backed by an implicit government guarantee that an optimal "climatically safe" amount of total rights in circulation can be, in principle, both specified and mandated.

A more fine-grained and accurate picture of the commodity would break down how it is constructed (*see* Box: "Constructing a Climate Commodity"). In the crucial first stage, climate crisis mitigation is translated into measurable, divisible greenhouse-gas "emissions reductions". Second, a large class of equivalent, tradeable reductions is constructed by abstracting away from place, technology, history and greenhouse gas type. That is, a reduction of a certain number of molecules achieved in one place by one technology is set as climatically "equivalent" to a reduction of an equal number of molecules in another place by another technology, regardless of the different roles the two equal acts of reduction might play in the historical transition away from fossil fuels. (It is often repeated that "the atmosphere doesn't care where or how reductions are made, as long as they are made.")

Constructing a Climate Commodity

Step 1
The goal of overcoming fossil fuel dependence by entrenching a new historical pathway is changed into the goal of placing progressive numerical limits on emissions (*cap*).

Step 2
A large pool of "equivalent" emissions reductions is created through regulatory means by abstracting from place, technology, history and gas, making a liquid market and various cost savings possible (*cap and trade*).

Step 3
Further tradeable emissions reductions "equivalents" are invented through special compensatory projects, usually in regions not covered by any cap, and added to the commodity pool for additional liquidity and corporate cost savings (*offsets*).

Step 4
Project bundling, securitisation, financial regulation, "programmatic Clean Development Mechanism"[183] and so forth provide further help in making "reductions/offsets" into a speculative asset class.

In other words, just as the *bricoleurs* who assembled credit derivatives markets took it on faith that separating out various credit uncertainties from loans and injecting them into commodity circuits was mainly merely a technical challenge, so carbon market architects assume without argument that "climate benefit" units can be unproblematically separated out from the historical pathways and political and social movements involved in a transition away from fossil fuels. In this way, an individuated, tradeable commodity (a "thingified" climate benefit/disbenefit) is created whose "efficient" allocation via pollution rights trading can become a coherent, apolitical programme for action ("cap and trade"), and whose status as asset, grant or financial instrument can be engineered to fit various accounting standards.[182]

In a third step, the scope for cost-effectiveness is expanded by creating another class of divisible, measurable, thing-like climate-benefit units or "reduction equivalents" called "offsets". These are pooled together with "reductions", enabling wealthy industries and states to delay reducing their own emissions still further, in the name of cost-effectiveness. Such offsets are manufactured by special projects that are claimed to result in less greenhouse gases accumulating in the atmosphere than would be the case in the absence of carbon finance, such as tree plantations (which are supposed to absorb carbon dioxide emissions) or fuel switches, wind farms and hydroelectric dams (which are argued to reduce or displace fossil energy). In theory, "project-based" credits, no matter what their origin, are to be fungible with the emissions allowances distributed in the North.

Indeed, in a sort of attempted commensuration-by-fiat, Articles 3 and 12 of the Kyoto Protocol stipulate, without argument, that these offset credits are *identical* with emissions reductions, thus legislating into existence a new, abstract, nonsituated, omnibus category of

The carbon commodity can also be seen as resulting from state and private sector enclosure, commodification and apportionment of the earth's carbon-cycling capacity – its ability to keep its climate stable.

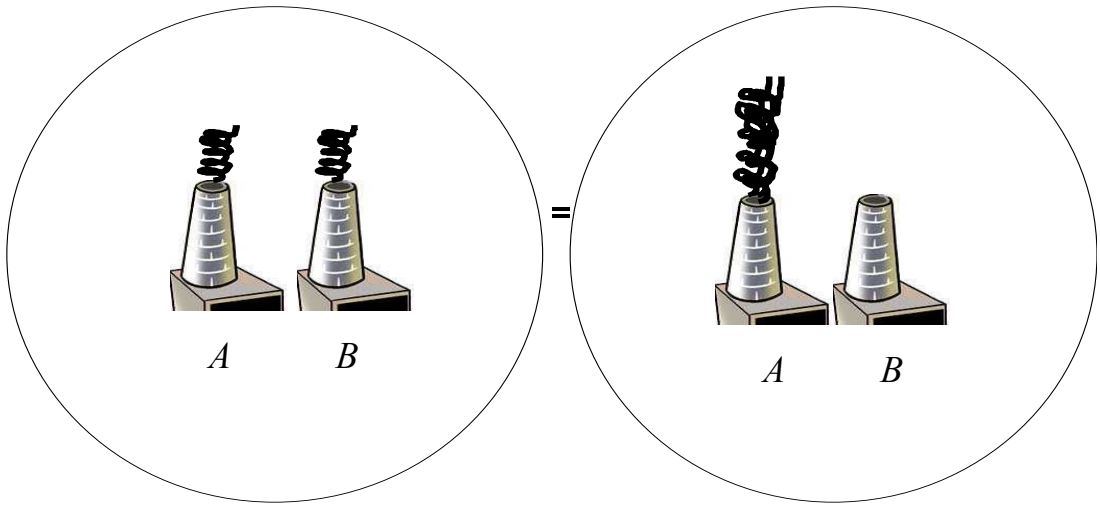


Figure 1

reductions/offsets. In its scale and nature, this attempt at commensuration, like that which resulted in the new category of "risk" associated with contemporary financial markets, is no less momentous than the feats of embedding and disembedding that conjured up the historically-specific social reality of abstract labour whose emergence Marx described. Yet most governments, environmentalists and business executives have accepted it without question or comment, perhaps not even grasping what has happened.[184]

One further indication of the confusion that reigns about the nature of the new commodities is a simmering controversy over whether they themselves are derivatives, or are merely raw materials out of which derivatives can be constructed.[185] The type ofcommensuration specifically connected with the "cap and trade" component of the commodity-construction process is depicted in Figure 1 above, and that associated with offsets in Figure 3 (p.40). It will be useful to consider these two components in detail, one by one.

Cap and Trade

The emissions "cap" that does the "environmental" work of cap and trade is imposed by government regulation – whether based on climate science or on horse-trading – and is represented by the circles of Figure 1 above. One way of achieving the cap is to dictate limits to how much each industrial installation covered by the scheme (schem-atically represented by A and B) is allowed to pollute. If the overall cap on a sector's emissions is 100 tonnes annually, for example, the government might require A and B to limit their emissions to 50 tonnes a year each.

The "trade" of cap and trade promises to make achieving the overall cap cheaper for both A and B, and thus, so the theory goes, for society as a whole. Suppose, for example, that before the cap represented by either circle in Figure 1 was imposed, A and B each produced 100 tonnes of pollution a year. Suppose further that it is expensive for A to reduce its emissions to 50 tonnes but cheap for B

to do so. Suppose, in fact, that it is cheaper for B to reduce its emissions to zero than it is for A to reduce its emissions even by half. In that case, the better economic choice is to allow B to make A's reductions for A. Installation A can be allowed to continue pollution as usual provided that it pays installation B to reduce B's emissions to zero. Assuming that the price that B charges for the necessary pollution permits is more than B's cost of reducing emissions to zero, yet less than A's cost of reducing emissions to 50 tonnes, B makes money from the deal at the same time that A saves money. Both come out ahead – yet the same environmental goal of limiting overall pollution to 100 tonnes a year is met. Whatever the size of the circle that government regulation draws, the cost of keeping pollution within that circle will be lowered by emissions trading.

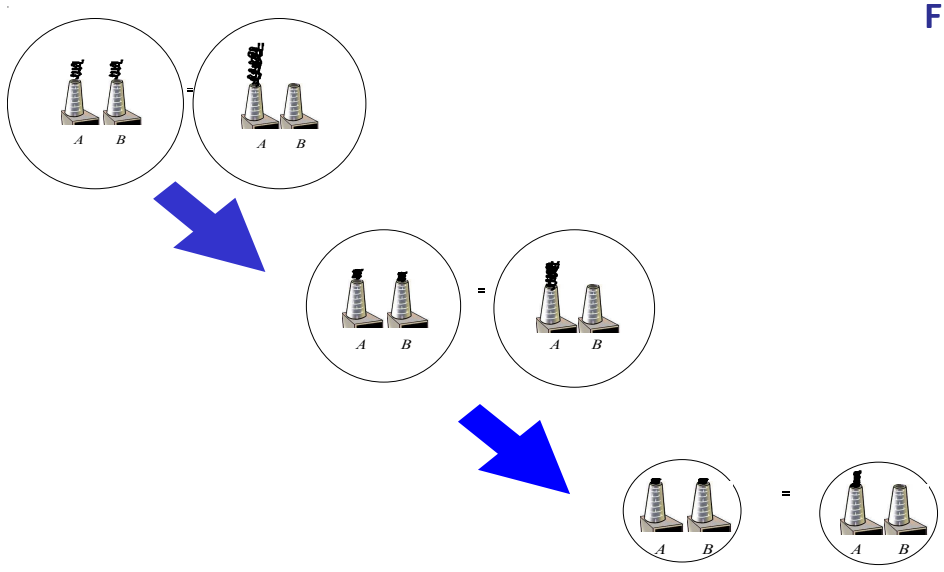
Governments will thus be able to ratchet down the emissions cap (that is, draw smaller and smaller circles) each year, as in the hypothetical case represented in Figure 2 below, believing that they are doing so in the cheapest way possible.

Numbers as Distraction

This programme of commodity formation has a number of immediate political and climatic blowbacks. First, it at once disembeds the climate debate from the challenge of initiating a new historical pathway to overcome current dependence on fossil fuels. Instead, it conceptualises action on climate change in terms of numerical greenhouse gas emissions reduction targets. Only by rewriting the policy goal in this way can climate benefits and disbenefits be made into quantifiable "things", opening them up to the possibility of exchange. Only by identifying climate benefit with short-term emissions reductions, for example, can an emissions cut in one place become climatically "equivalent" to, and thus exchangeable with, a cut of the same magnitude elsewhere. Only in this way can an emissions cut owing to one technology become climatically "equivalent" to an emissions cut that relies on another, or an emissions cut that is part of a package that brings about one set of social effects become climatically equivalent to a cut associated with another.

By themselves, numerical emissions targets tell us nothing about how to overcome dependence on fossil fuels or to address the root causes of forest loss.

Figure 2



Nowhere in the debates over emissions targets is it mentioned that most unmined coal, oil and gas must stay in the ground.

Industrialised societies locked in to fossil fuels need to turn to structurally different, non-fossil energy, transport, agricultural and consumption regimes within a few decades.

Similarly, only through emissions permit banking can an emissions cut at one time become climatically equivalent to a cut achieved at another. It is such equivalences that enable a market to select for the emissions reductions (and, *ipso facto*, the climate benefits) that can be achieved most cheaply.

By identifying the climate solution with discrete, exchangeable "emissions reductions" (a move that not only provides the quantitative framework needed for "cost-effectiveness" claims but also is looked upon by political elites as a way of "depoliticising" climate action), and then multiplying the number of "equivalent" reductions, market architects abstract from the question of how those reductions are made. This distances carbon markets from the climate problem in the same way that historical labour markets, in inventing abstract labour, disconnected from and modified the significance of various concrete useful human activities of livelihood, or land markets encouraged concrete processes of abstraction from the question of how land is used.

The issue matters because at the most fundamental level, the climate solution revolves around initiating a new historical pathway that leads away from dependence on fossil fuels – by far the major contributor to human-caused climate change. Once taken out of the ground and burned, coal, oil and gas add to the carbon burden cycling between the atmosphere and the oceans, soil, rock and vegetation. This transfer is, on human time scales, irrevocable: once mined and burned, fossil carbon cannot be locked away safely underground again in the form of new deposits of coal, oil or gas, or in the form of carbonate rock, for millions of years. The transfer is also unsustainable: there is simply not enough "space" in above-ground biological and geological systems to park safely the huge mass of carbon that is coming out of the ground without carbon dioxide building up catastrophically in both the air and the oceans. As biologist Tim Flannery puts it:

> "There is so much carbon buried in the world's coal seams [alone] that, should it find its way back to the surface, it would make the planet hostile to life as we know it".[186]

Most unmined coal, oil and gas, in other words, is going to have to stay in the ground.

Accordingly, industrialised societies currently "locked in"[187] to fossil fuels need instead to "lock in" structurally different non-fossil energy, transport, agricultural and consumption regimes within, at most, a few decades. Infrastructure, trade, even community structure will have to be reorganised, and state support shifted from fossil-fuelled development toward popular movements constructing or defending low-carbon means of livelihood and social life. Whatever the nature of the social, economic and political change this implies,[188] it will be all-encompassing and based on large-scale political mobilisation and historically-informed analysis of how structural social and technological transformations actually take place. Because the changes required are structural, the phenomenon of path dependence[189] assumes great importance, meaning that the first steps must be undertaken immediately to minimise future dangers and costs alike,[190] particularly in industrialised countries.

It follows that short-term actions can be assessed for their climatic effectiveness only by determining the part they play in a longer-term shift away from reliance on fossil fuels. Cutting one hundred million tonnes of emissions through routine efficiency improvements that leave a fossil-fuelled infrastructure as it is will have long-term emissions (and

climatic) consequences very different from cutting one hundred million tonnes through investment in renewable technologies with a high potential for wide adoption, or through initiating radically different ways of organising food production, energy generation or transport.[191] Installing a few low-cost, add-on technical fixes to sunset industries powered by fossil fuels will have different long-term emissions effects from undertaking an integral step toward a society fundamentally more conducive to climatic stability, even if both notch up identical short-term emissions cuts. In short, it matters not only how much emissions are cut but also how they are cut.

Cap and trade necessarily gives short shrift to this reality. By disembedding climate action from future history and present struggles against fossil fuel use and embedding it in neoclassical economic theory, trade treaties, property law, risk management and so forth, cap and trade puts prices in place of other reasons for comprehensive social action organised around survival, and puts variation in cost in place of context-dependent diversity of type of incentive. "What is the best way to tackle climate change?" asked Matthew Whittell of Climate Exchange plc rhetorically in July 2008. "If we have a global carbon price, the market sorts it out."[192]

The equivalence illustrated in Figure 1 (p.30), for example, pays no attention to what kind of industries A and B are. The "A" industries – the big carbon permit buyers – are likely to be the companies most locked into fossil fuel use and therefore also the ones where change is most necessary and most urgent. Major electricity generators, to take one example, are among the world's most important producers of greenhouse gases and a prime target for early action on climate change. They tend to have billions of dollars tied up in nonconvertible fossil fuel plants whose lifetime is measured in decades; culturally speaking, too, they are generally determined to ride the fossil wave until the very end, regardless of their status as "sunset" industries. Yet cap and trade is designed in a way that gives such industries further incentives for delaying structural change, not only because it gives them the alternative of buying or being given bankable pollution permits, but also because it cannot predict prices 40 years in the future.[193]

Similarly, cap and trade is designed to treat emissions-reduction measures as equal, regardless of whether they are likely to contribute to unquantifiable but important positive global synergisms.[194] If any given method can reduce emissions by a certain amount over the short term, it is irrelevant whether it leads to radically-lessened dependence on fossil fuels in the long run. Treating "technology neutrality" as a virtue, cap and trade directs ingenuity toward positing measurable "equivalences" between emissions of different types in different places and times, not toward fostering targeted innovations that can initiate or sustain a long-term historical trajectory away from fossil fuels (the effectiveness of which is less easy to measure). Indeed, once the carbon commodity has been defined, to weigh different long-range social and technological trajectories or to evaluate and "backcast" from distant goals is already to threaten the efficiency imperative.

Of course, cap and trade does also give incentives to "B" industries – including those that may be dirty now but have the advantage of being less structurally addicted to fossil fuels – to hasten development of lower-carbon ways of doing business, and to independent businesses to develop new low-carbon technologies to sell to the "A"s. The aggregate effect, however, is likely to be delay, together with a reduction in the types of social or technological innovation that are needed. Entre-

The first steps to a different energy dependence must be undertaken immediately to minimise future dangers and costs.

The climatic effectiveness of short-term actions can be assessed only by looking at their contribution to a longer-term shift away from fossil fuels.

***It matters not only* how much *emissions are cut but also* how.**

Cap and trade is designed in a way that gives polluting industries incentives to delay making structural change.

preneurs tempted to take advantage of the new market will concentrate on realising the cheapest opportunities for emissions reductions first, regardless of whether they lead to long-term structural change away from fossil fuels. Concludes emissions trading expert David Driesen:

> "[L]owering cost does not increase incentives for valuable innovation . . . There is a tradeoff between maximizing cost reduction and maximizing technological development likely to significantly increase global capacity to address global warming."[195]

To use a term made familiar by the financial crisis, "systemic risk" escalates when incentives for structural change in polluting sectors are blocked through over-reliance on price incentives.

Examples from the Past

The US's pioneering cap and trade system for achieving cost savings in reducing sulphur dioxide – which was the main model for the Kyoto Protocol and subsequent carbon trading systems – offers some empirical illustration of the point. According to staff of the Environmental Protection Agency, speaking in their personal capacity:

> "the few and relatively minor experiments in emissions trading in our country have produced virtually no technological innovation, much less the kind of innovation necessary to power our economy on renewable resources rather than fossil fuels."[196]

In the long term, regulation can cut more pollution if there are no trading provisions.

The sulphur dioxide trade may or may not have saved money in attaining limited reduction goals, but in any case it did not foster technological innovation of the type that would be relevant to the climate crisis.[197]

Los Angeles's Regional Clean Air Incentives Market, to cite another example, appears to have sidelined developments in fuel cells, low-emitting burners and turbines that had previously been subsidised by a percentage of car registration fees; the failure of at least one emerging method of reducing nitrogen oxides to break into the market can be attributed to the "spatial flexibility" provided by trading, which allowed emitters to ignore innovative but still expensive technology options.[198] Innovations under the "bubbles" of early US pollution trading programmes also tended merely to be rearrangements of conventional technologies rather than the invention, development or commercialisation of technologies likely to be useful for achieving longer-term social or environmental objectives.[199]

Straight regulatory approaches, whether national or international in scope, appear to have had far greater success. Examples include Germany's sulphur dioxide programme, which, without trading provisions, has been able to make deeper cuts in power plant emissions than the US did;[200] US regulations that have succeeded in banning or limiting other pollutants without trading or even much concern with cost;[201] and the Montreal Protocol, which has enforced limits on chloroflourocarbon (CFC) production, again without trading. Driesen concludes that "targeted regulatory programmes encourage renewable energy development better than global emissions trading programmes."[202]

Even from the standpoint of interests that focus on the narrowest conceptions of technical innovation, embedding climate action in price theory is counterproductive, since carbon prices are unlikely to be able to "deliver the escape velocity required to get investment in technological innovation into orbit, in time," particularly in the absence of a "significant increase in publicly funded research and development for clean energy technology and changes to innovation policies."[203] In contexts

in which increasing returns are significant, leaving research and development of critical technologies largely to private firms incentivised by price cannot guarantee, in the words of economist W. Brian Arthur, that the "fittest technology in the long run sense will be the one that survives."[204] Shell International, for example, cites economic considerations to justify its decision to move out of solar and wind power and into agrofuels, and carbon capture and sequestration[205] – that is, from technologies rated relatively highly in terms of their long-term impacts and potential to supplant fossil fuels to technologies rated much lower.[206]

From a point of view according to which not only technical fixes but broader structural social change is crucial to the phasing out of fossil fuels, this "imperialism of prices" is fatal. As Tariq Banuri and Hans Opschoor note, while prices may be:

> "quite effective for introducing changes on the margin . . . there is little evidence of price incentives inducing a fundamental transformation in the economy or society."[207]

"The oil price shocks of the 1970s didn't wean us off oil, so why should we believe that a high carbon price will wean us off carbon?" asks Jim Watson of the Energy Study Group at Sussex University.[208] In reality, the dislodging of path-dependent systems, as climate experts Gwyn Prins and Steve Rayner observe, "is usually initiated by quite unexpected factors resistant to being accounted for in advance".[209] Structural change, or even just the development of major new technologies, requires above all public investment, public planning and regulation.

The retort that prices could become incentives for step changes if they were both higher and more predictable ignores two realities. The first is that prices cannot be predicted over the relevant investment horizons. The second is that there is no evidence for the assumption that an ideal "Goldilocks" range of carbon prices can be found that are high enough to select for "the necessary fundamental overhaul of energy systems"[210] in the absence of dedicated public investment programmes, redirected research and development and the like, yet not so high that they irreparably damage the profits of the crucial corporations that the system is designed to accommodate. Whenever prices threaten to rise to a level that threatens established technological systems, pollution trading systems are altered or abandoned.

In California, for example, the price of permits to emit particulate matter approaches half a million dollars per kilogramme – a price high enough, it would seem, to constitute a serious clean-up incentive for fossil fuel-dependent electricity generators. But because power generation is still "locked in" to particulate-emitting technologies, individual corporations and their state benefactors simply seek ways around the market. Hence a proposal to create a "reserve" of permits valued at hundreds of millions of dollars to give out free of charge to the offending corporations[211] – in effect invalidating the entire rationale of the trading system.

The Waxman-Markey Act[212] that passed the US House of Representatives in June 2009 is also advertised as being based on the idea that carbon prices incentivise structural change, but at the same time is larded with provisions ensuring that they will not rise high enough to constitute a threat to fossil fuel dependence. Similarly, under the EU Emissions Trading Scheme (EU ETS), the penalty for a factory's emitting more than its carbon permits cover is just 100 euros (US$150)(it was previously only 40 euros), far short of what would incentivise even the beginnings of a shift away from fossil fuels, much less structural change in the consumption of energy.

When prices threaten to rise far enough to threaten vested interests, pollution trading systems are usually altered or abandoned.

US legislation presumes that carbon prices provide an incentive for structural change – but it also ensures that prices will not rise high enough to threaten fossil fuel dependence.

Cap and trade demands a centralised and powerful state apparatus for measurement and enforcement.

The measurements needed to underpin carbon trading – or even to detect compliance with Kyoto reduction targets – are not being made, making the carbon commodity a fiction even in its own terms.

Carbon permits are a lucrative asset; corporations lobby governments to get allocated as many as possible, taking advantage of the unlikelihood of proper measurement.

Wrong Incentives, Wrong Outcomes

The record of the EU ETS reveals still further blowbacks associated with overreliance on price incentives. In the scheme's first phase, the largest industrial greenhouse gas emitters in Europe were granted more rights to emit greenhouse gases than they needed to cover their current emissions. The result was the carbon market's first big price crash in April 2007.

Playing some part in this embarrassment were measurement and verification failures involving, among other things, falsified corporate emissions histories. Such monitoring and enforcement limitations are likely to continue. Cap and trade demands a far more sensitive, centralised and powerful state apparatus for measurement and enforcement than is needed for conventional regulation. Tens of thousands of sources need to be monitored, and the margins for error required to keep a market on an even keel are far more stringent than the margins of error required to check whether a regulatory or investment programme is on track.[213] Even in most industrialised countries, the emissions measurements needed to underpin trading, or even to detect compliance with Kyoto targets, are not being made, rendering the existing carbon emissions commodity largely fictitious even in its own terms. In addition, as climate change expert Steve Rayner points out, the "underdeveloped monitoring and accounting systems" that cap and trade relies on "inevitably leave plenty of wiggle room for unscrupulous speculators to work the system, amassing fortunes while achieving nothing for the atmosphere."[214]

Just as significant to this first crash, however, was the rent-seeking that is endemic to carbon markets, and that gives them special vulnerability to regulatory capture. Corporations, aware that the grants of carbon permits they are being allocated are a lucrative asset (the Kyoto Protocol, the EU ETS, and all other cap and trade systems including the Waxman-Markey arrangements, are overwhelmingly "polluter earns" arrangements: the lion's share of pollution rights is simply given away free to the biggest emitters) simply lobby governments for as much as they can get, taking advantage of inadequate emissions verification requirements.

Under the EU ETS, accepted accounting procedures meant that electricity generators such as RWE, CEZ and Scottish Power were then able to pass on to consumers the nominal "opportunity cost" of withholding their free carbon assets from the market. It is estimated that in five European countries, windfall profits for power generators from cap and trade will reach US$112 billion by 2012.[215] Much of this free money is being ploughed back into long-term fossil fuel investments, further locking in global warming. Environmental groups' attempts to reduce the damage done by the EU ETS by insisting on permit auctioning, or at least stricter limits on the gift of excess pollution rights to Europe's worst greenhouse offenders, have proved no match for industrial lobbies,[216] who have not hesitated to deploy lawsuits and diplomatic pressure to resist official attempts to tighten caps.

To the limited extent that caps are nominally being tightened, moreover, "holes" are being punched in them to admit a flood of carbon credits from outside the EU (one effect of the multi-stage commodity formation process is that "offset" credits become mixed with emissions allowances, *see* p.40ff), in effect loosening emissions regulation.

The current financial crash, in addition, has once again left many corporations with a surplus of free pollution assets, since allocations

were decided at a time of rosier economic predictions. Ironically, some of these are now being sold off to keep fossil fuel-dependent firms afloat. With prices dropping along with emissions, cap and trade works against the possibility of locking in energy-use changes brought about by recession.

As the EU ETS expands to cover new gases and sectors in future phases, fossil-intensive industries are likely to be provided with still more escape clauses, and the disconnection between carbon prices and action on climate change is likely to widen with the rise in the trade in derivative products as opposed to simple brokered exchanges of allowances between polluting firms. According to Deutsche Bank commodities market analysts, any minimal shortfall in carbon permits that might appear through 2020 can be met via existing fossil-fired installations; even if circumstances change, the most that could happen would be that some new gas-fired plant gets built ahead of a coal-fired plant.[217] Renewable energy gains no benefits from the EU ETS; one utility that does happen to have undertaken a (highly unusual) long-term programme of disinvestment in fossil fuel generation explicitly states that the EU ETS has not affected its decision.[218] Geopolitical considerations are likely to prove an additional reason for sustaining coal capacity in Western Europe, given fears about Russian dominance of the gas markets. According to Citigroup research, the main winners from the EU ETS have been, in order, hedge funds and energy traders; coal and nuclear generators; and all generation-based utilities, with consumers the biggest losers. Profits have increased, but no policy goals have been achieved.[219]

Indeed, far from complementing the investment, public planning and regulation required for structural change, cap and trade systems tend to work against and drain resources from them. For example, the UK government admits that it is because large-scale energy producers "are covered by the EU Emissions Trading Scheme" that official renewables strategy has no provisions for setting large-scale energy production on a different technological path.[220] A leaked document suggests, in addition, that one reason that the British government is reluctant to pursue renewable energy targets is that they would threaten EU ETS carbon prices and the survival of the London financial district's growing carbon trading industry.[221] The European Commission, meanwhile, discourages EU member states from making investments in emissions reductions much more than 0.5 per cent of gross domestic product.[222]

Actually-existing cap and trade systems are "polluter earns" arrangements: most pollution rights are given away free to the biggest emitters.

Cap and trade undermines effective actions on climate change.

The main winners from the EU's Emissions Trading Scheme have been hedge funds and energy traders; coal and nuclear generators; and all generation-based utilities – among the biggest losers have been consumers.

Abstracting from Place

In addition to abstracting from the question of *how* reductions are made, cap and trade is also designed to abstract from the question of *where* they are made. Commensuration of place is built into its design; redistributing pollution around the landscape to "maximise cost-effectiveness" is part of its structure. In line with carbon trading's (mis) identification of climate solutions with emissions reductions, this commensuration is typically justified by chemistry: "carbon is carbon, wherever it enters the atmosphere".

The experience of the US with previous pollution trading schemes again discloses one of the "costs" of this "cost-effectiveness": since the industries most firmly locked into fossil fuel exploitation or use, and most likely to be carbon permit buyers, tend disproportionately to affect poorer and disadvantaged communities, cap and trade strengthens environmental racism and other forms of discrimination.[223] Lower-income communities are far more likely than others to play host to the "A"

industries of Figure 1 (p.30). Although national sulphur dioxide emissions from power plants decreased by 10 per cent from 1995 to 2003 under US sulphur dioxide trading, more than half of the US's dirtiest power plants increased their annual soot-forming SO_2 emissions over the period. As a result, "communities living in the shadows and downwind of these polluting power plants are actually breathing dirtier air."[224] Cap and trade's built-in insensitivity to the different ecological effects that pollution can have in different biomes creates additional environmental and social problems.

Numbers for the Market's Sake

Cap and trade also detaches climate policy from the global warming problem by preventing it from taking proper account of climatological uncertainties and indeterminacies. The sum of fungible greenhouse gas pollution rights that governments create and distribute as the basis for a carbon market are implied to approach, in principle if not in practice, an economically optimal, "climatically safe" level of overall greenhouse gas pollution. That presupposes an ability to estimate how much space exists in the interlinked above-ground system of oceans, surface rock, soils, vegetation, and air in which carbon from underground fossil sources might be "safely" dumped.[225]

This estimate, however, depends both on what kind of world is considered tolerable and what the likely physical response will be of that above-ground system to the increasing load of fossil carbon with which it has to cope. No non-political answer can be found to the first question, and no probabilistic answer can be found to the second due to the many unknowns, indeterminacies, nonlinearities, unknowables and feedbacks of the climate system.[226] For example, current debates about whether and how to keep temperature rises within 2 degrees centigrade (or 4 degrees centigrade, or any other particular range) are complicated by ineradicable deficiencies in knowledge about both the conditions that would bring about a 2 or 4 degree rise and the effects on human civilisation of such a rise, as well as political disputes about whether such effects would be acceptable or not.

Climatology and politics alike therefore militate against a climate commodity's being either specifiable or quantifiable, much less divisible into the sort of tradeable elements that become the object of rent-seeking. Nevertheless, the pressure to create a market, combined with ingrained habits of linear thinking, have resulted in continuing quantist efforts to measure what would be a "safe" concentration of carbon dioxide in the atmosphere, as well as to conduct cost-benefit analyses (CBAs) that commensurate climate damage with economic gains and losses from taking climate action. This pressure is felt not only by politicians but also by climate scientists themselves.[227]

As the Harvard economist Martin Weitzman has recently written in a rebuke to former World Bank economist Nicholas Stern, it is "understandable . . . to want climate-change CBA to be restricted to dealing only with modest damages by disregarding nightmare scenarios (as being 'too speculative' or 'not based on hard science')." But the consequences, Weitzman cautions, include a dangerously degraded conception of the climate problem itself. In a critique of the commensuration process inherent in multi-equation, computerised Integrated Assessment Models (IAMs), which aggregate economic growth with simple climate dynamics to analyse the economic impacts of global warming, he suggests that:

The British government seems reluctant to pursue renewable energy targets that might threaten carbon prices and the growing carbon trading industry.

Cap and trade strengthens environmental racism.

> "the climate-change economist can help most by not presenting a cost-benefit estimate for what is inherently a fat-tailed situation with potentially unlimited downside exposure as if it is accurate and objective – and perhaps not even presenting the analysis as if it is an approximation to something that is accurate and objective – but instead by stressing somewhat more openly the fact that such an estimate might conceivably be arbitrarily inaccurate depending upon what is subjectively assumed about the high-temperature damages function along with assumptions about the fatness of the tails and/or where they have been cut off. Even just acknowledging more openly the incredible magnitude of the deep structural uncertainties that are involved in climate-change analysis – and explaining better to policy makers that the artificial crispness conveyed by conventional IAM-based CBAs here is especially and unusually misleading compared with more-ordinary non-climate-change CBA situations – might go a long way towards elevating the level of public discourse concerning what to do about global warming. All of this is naturally unsatisfying and not what economists are used to doing, but . . . we may be deluding ourselves and others with misplaced concreteness if we think that we are able to deliver anything much more precise than this with even the biggest and most-detailed climate-change IAMs as currently constructed and deployed."[228]

The Kyoto Protocol and EU Emissions Trading Scheme enshrine imperial claims on the world's carbon-cycling capacity.

The parallels with the new uncertainty markets are clear: such words might have come out of the mouths of trader-critics of the Black-Scholes option-pricing equation or of other manifestations of Wall Street quantism. The project of finding a "cost-effective way of addressing global warming" through carbon trading becomes incoherent insofar as creating the market framework necessary to make sense of the notion of cost-effectiveness entails losing touch with what is supposedly being costed.

Cap and trade's notion of "cost effectiveness" is based on an unscientific understanding of uncertainty.

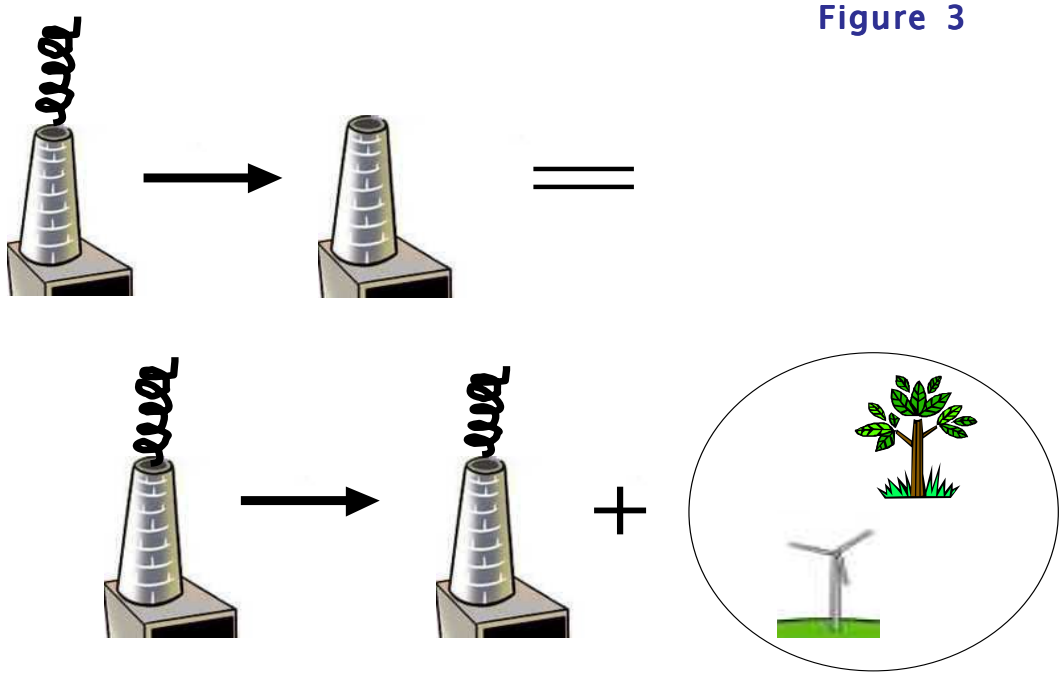
A Muddled Politics

While disconnecting climate policy from, and undermining scientific understanding of, global warming, cap and trade also gives rise to distribution problems that could flare into destructive international political conflict. This is due to the privatisation, enclosure, or "primitive accumulation" of the earth's carbon-cycling capacity that is a precondition for carbon trading.

Regardless of how this capacity is estimated or assessed, the industrial North, through the EU Emissions Trading Scheme, has already staked a claim to more than its share of what was heretofore an unclaimed global good. If it is stipulated, in accordance with current scientific thinking, that human societies have to cut their use of this capacity by 80 per cent within a few decades, and thus that the nominal "size" of the capacity is 20 per cent of what is currently being used, then it follows that Europe, in the first phase of the EU Emissions Trading Scheme, appropriated approximately 34 per cent of the world's carbon dump, far out of proportion to Europe's relative population. Assuming even a very low carbon price, this translates into the unilateral creation and acquisition of assets worth many billions of dollars annually.[229] As noted above, much of this wealth has already gone into the pockets of large electricity generators in Northern industrialised countries.

Remarkably, such structural biases toward the short-term interests of heavy-polluting industry and the wealthy are frequently cited by governments, economists, environmentalists and commentators as among

Figure 3



Offsets were devised partly to channel some financial benefit to Southern countries.

the political virtues of cap and trade.[230] Without trading, it is suggested, the worst-polluting corporations would force governments not to impose any caps at all. With trading, it is argued, the corporations most dependent on fossil fuels will be motivated to call off their lobbying dogs, making some caps possible, even if the trading component of cap and trade discourages immediate steps toward a long-term transition away from fossil fuels. In addition, it is pointed out, transforming the Kyoto Protocol into a trade treaty setting up a new market was necessary for getting the US to initial the Protocol in 1997 – even though it later pulled out of an agreement that was not, furthermore, crafted in a way that addressed global warming in the first place.

The ubiquity of such pro-bribery arguments in North America and Europe suggests the extraordinary extent to which fossil fuel bias and a commodified political imagination have been "naturalised" in the climate change debate in industrialised societies.

Offsets

Carbon offsets constitute a further development of the climate commodity, reinforcing the climatic, political and social "blowbacks" of cap and trade while adding new ones, disconnecting carbon markets still further from the climate problem and storing up market valuation problems for the future. In the Kyoto market, offsets were devised partly as a compromise between, on the one hand, wealthy industries' and states' desire for an additional source of pollution rights to enable them to buy time before reducing their own emissions and, on the other, the desire of Southern state negotiators for some financial benefit from the international climate regime. Outside the Kyoto framework, they serve a mix of purposes, including compliance with emissions laws, public relations, educational tool and modern-day indulgence.[231]

Like cap and trade and financial derivatives trading, offset trading

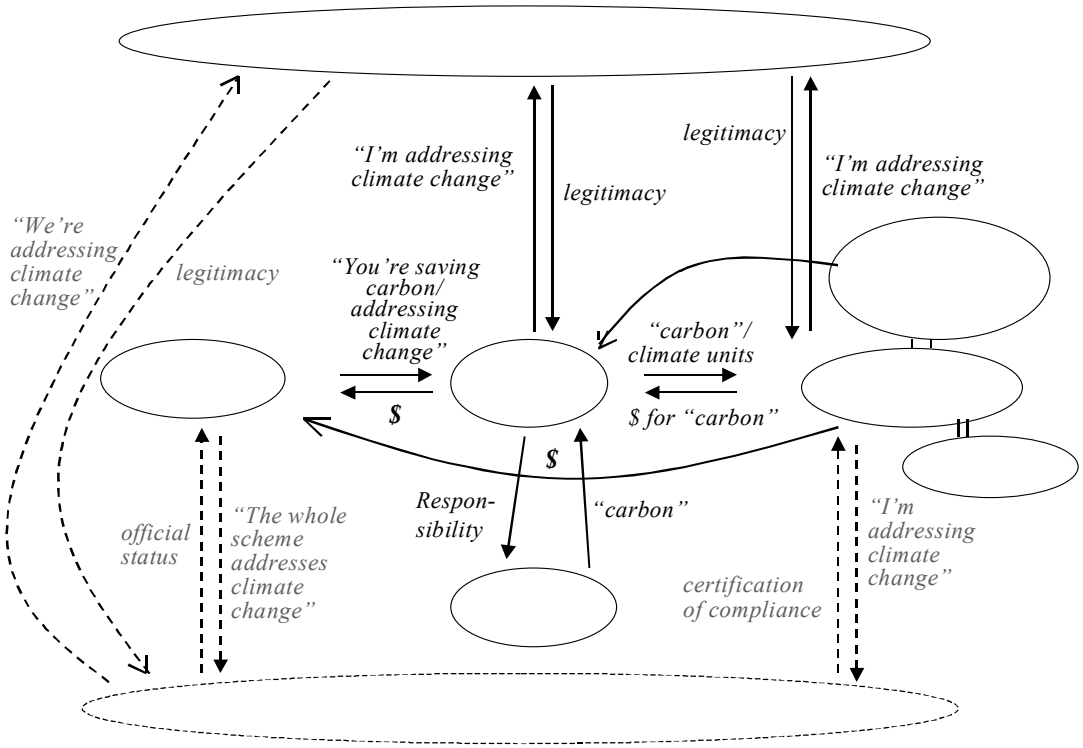
relies on the creation of new equivalences (Figure 3 above). In this case the principal equivalence is between emissions reductions and purportedly "carbon-saving" projects. Instead of cutting their greenhouse gas pollution (top arrow), industries, nations or individuals finance a mixed, ingenious range of schemes elsewhere (bottom right) that are cheaper to implement. Examples include carbon sequestration schemes such as plantations or ocean-fertilisation projects as well as dams, wind farms, fuel switches, efficiency schemes, fly-ash or coal-ash reprocessing programmes and other projects that can be argued to result in less greenhouse gas being released to the atmosphere than would otherwise be the case.

As with financial derivatives, these new equivalences give rise to commodities that can then be used in speculation. For instance, as commodities that are "the same and yet not the same", the Kyoto Protocol offsets known as Certified Emissions Reductions (CERs) are often swapped or arbitraged with the greenhouse gas pollution rights granted by European governments to corporations (EUAs or European Union Allowances). Despite the recent economic downturn and low carbon prices, carbon market trading volumes have continued to rise as compliance buyers look to benefit from low permit prices, permit accumulators look to make money from rising prices, and hedge funds look to make money from permit price volatility. The new equivalences created by carbon offset trading also take their place in a much wider context of exchanges – Figure 4 below gives a sketch of some of the interactions – that lies beyond the scope of this paper.

Just as cap and trade commodifies the earth's carbon-cycling capacity before parcelling it out to polluting industries in industrialised countries, so too many offsets tend to commodify land, water, air, genes and community futures in new ways in order to "expand" that global capacity to allow more use of fossil fuels. Although many offsets are

Offsets commodify land, water, air, genes and community futures in ways that allow the rich to use more fossil fuels.

Figure 4



constructed in industrialised countries including the US, most sites for this new form of commodification within the Kyoto market are in the global South, particularly countries such as China, India, Korea and Brazil. That means that carbon trading under Kyoto affects less-industrialised countries not only indirectly, through any hastening effect cap and trade has on climate change, but also directly, by encouraging the development of "offset" projects designed to license continued emissions by industrialised countries.

Offset Quantism and Its Contradictions

One example of a corporation that uses offsets to maintain its fossil fuel dependence is the German-based energy firm RWE, which plans to meet its pollution targets under the EU ETS not by cutting its emissions significantly at home, but rather by investing in UN-backed offset projects destroying nitrous oxide (a powerful greenhouse gas) at factories in Egypt and South Korea and HFC-23 (an even more powerful climate-forcing gas) at chemical plants in China. RWE is also exploring the possibility of buying carbon credits from projects that would capture and burn methane (yet another harmful greenhouse gas) from landfills and coal mines in China and Russia.[232]

Offsets reinforce a fossil-dependent industrial path in the South as well as the North.

Such "industrial gas" or "gas destruction" projects become a spectacularly "cost-effective" way of "addressing climate change" – in spite of the fact that they do nothing to address the fossil fuel question – because of the equivalences set up by climate market architects among various greenhouse gases. In the 1990s, the Intergovernmental Panel on Climate Change (IPCC) devised a new abstraction called "global warming potential" that commensurates nitrous oxide (N_2O), HFC-23, methane and other greenhouse gases according to how they compare to carbon dioxide in their climate impact. [233] The assumption was that the climatic impact of an action can be measured solely by the numbers of carbon dioxide (or, now, "carbon dioxide equivalent") molecules it releases. Nitrous oxide was stipulated to be 298 times more powerful than carbon dioxide over a 100-year time horizon, HFC-2 14,800 times;[234] there were different figures for 25- and 50-year horizons.

There is no such thing as scientific carbon offset accounting.

Commensurating all these gases required gross simplifications and abstractions: they vary in their effects along so many different axes and time scales, and some of their effects and interactions are still so disputed, that to say that one is exactly *x* times as dangerous as another is to subscribe to a linearised travesty of how climate systems work. Reflecting this arbitrariness, the IPCC significantly revised, between 2001 and 2007, many of the conversion factors used to aggregate the gases. The 100-year factor for HFC-23, for instance, was increased by over 23 per cent, enabling at a keystroke the production of millions of tonnes more carbon credits. Such acts of commensuration, again, bolstered market liquidity at the cost of reducing a problem of historical trajectory to one of measurement of chemicals: gas-destruction offsets both help delay shifts from fossil fuel-oriented production among credit buyers and fail to contribute toward non-fossil historical pathways in their Southern host countries.[235]

As the example suggests, quants play as much a role in the production of commodities for the carbon offset markets as they do in the production of commodities for the financial derivatives trade. But their efforts go far beyond simply commensurating different greenhouse gases. More importantly, for every offset project, carbon consultants must identify a unique storyline describing a hypothetical world without the project,

and then assign a number to the greenhouse gas emissions associated with that world. They then subtract from this number the amount of emissions associated with the real world that contains the project to derive the number of carbon credits that the project can sell. Hence just as financial quants attempt to disaggregate different kinds of uncertainty from their contexts, carbon quants must disentangle carbon offset projects from an imaginary "baseline" to show that the projects are "additional" and how many credits they generate. In so doing they are compelled to engage in similarly creative efforts to domesticate, simplify and quantify unknowns. Carbon quants must present the counterfactual without-project scenario not as indeterminate and dependent on political choice but as measurable, singular, determinate and a matter for economic and technical prediction. The offset market's requirement for a single number, in other words, amounts to a methodological assumption that "no other world is possible."

This assumption, as Kevin Anderson, Director of the UK's Tyndall Centre for Climate Change Research, observes, is a "meaningless concept in a complex system." As Anderson explains, the counterfactual "baseline" against which the purported emissions savings of a carbon offset project must be measured must be calculated over 100 years to correspond with the approximate residence time of carbon dioxide in the atmosphere. For example, a wind farm in India may claim to be generating carbon credits because it is saving, over a century, fossil fuels over and above what would have been saved without the project:

> "[B]ut the wind turbines will give access to electricity that gives access to a television that gives access to adverts that sell small scooters, and then some entrepreneur sets up a small petrol depot for the small scooters, and another entrepreneur buys some wagons instead of using oxen, and the whole thing builds up over the next 20 or 30 years . . . If you can imagine Marconi and the Wright brothers getting together to discuss whether in 2009, EasyJet and the internet would be facilitating each other through internet booking, that's the level of . . . certainty you'd have to have over that period. You cannot have that. Society is inherently complex."[236]

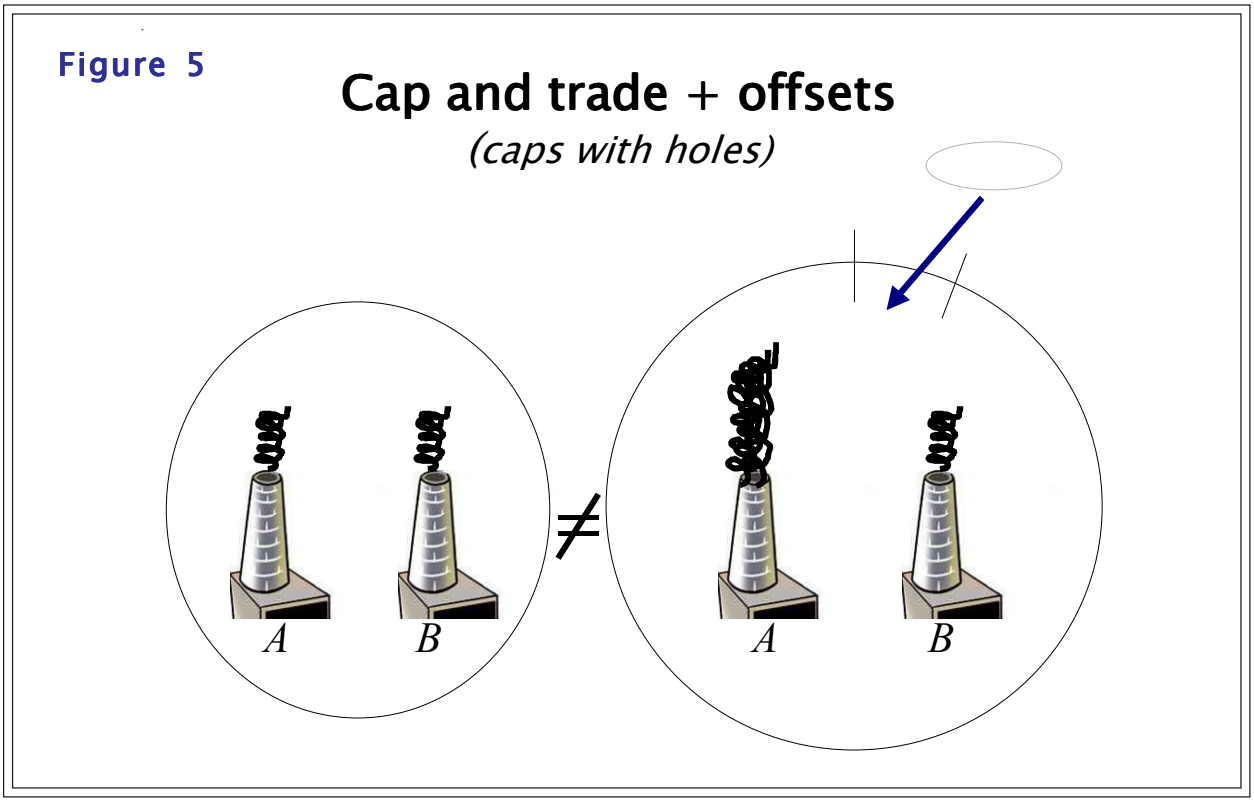
In the long term, there can be no proof that a wind farm that claims to be displacing (rather than simply supplementing or even increasing) overall fossil fuel use is actually doing so. Even the question whether a project goes beyond business as usual in saving carbon, as carbon trader Mark C. Trexler and colleagues noted years ago, has "no technically 'correct' answer."[237] Project baselines "cannot be measured," admits another expert.[238] As Dan Welch of *Ethical Consumer* sums it up, "[o]ffsets are an imaginary commodity created by deducting what you hope happens from what you guess would have happened."[239]

One of the sources of the complexity that defeats any attempt to calculate offsets are offset projects themselves. First, like cap and trade, offsets are designed in a way that helps entrench or even increase dependence on fossil fuels in the industrialised North. While each separate offset project will have such climate-damaging effects, those effects are literally incalculable. Overall, the European Union has proposed that member states be allowed to use offset credits to meet more than half of their modest emission reduction targets in the period 2008-2020.[240] Under the Waxman-Markey Act, meanwhile, US emissions would not dip below 2005 levels until 2026, thanks to billions of tonnes of offset credits bought in from abroad.[241] In effect, then, offsets open holes in the "caps" announced by industrialised country

Offsets make climate change worse – although how much they do so cannot be measured.

Most carbon offset credits are generated by projects that strengthen industrial and fossil fuel interests.

Figure 5



governments (Figure 5). In California, offsets planned under a regional trading programme would help make possible 21 new planned fossil-fuelled generating plants – all to be located in poorer, predominantly non-white communities – while usurping funding that could go instead to energy efficiency investments, renewables and energy refit programmes that would make large numbers of green jobs possible for underprivileged communities.[242]

Second, offsets also tend to reinforce a fossil-dependent industrial path in the South, further exacerbating climate change – and exacerbating it, moreover, in ways that cannot be predicted or calculated in discrete tradeable units. While offsets have been defended by European governments as a way of helping to finance the South's efforts to embark on a "greener" development path, and as a stimulus to Northern exporters to develop innovative renewable energy technologies, most Kyoto Protocol carbon offset credits are generated not by renewable energy but by projects that strengthen established industrial interests, including fossil fuel interests. Indeed, many financial-sector and compliance buyers alike have gravitated toward that segment of the carbon offset market in which carbon credits are ostensibly easiest to calculate given the premises of commodity construction – HFC and N_2O projects, coal mine methane, landfill gas, and so forth.[243] These are precisely the projects that would appear to make the least contribution to the systemic social and infrastructure transformation needed for phasing out fossil fuels. As of December 2008, three-quarters of Kyoto offset credits issued were manufactured by large firms making minor technical adjustments at a few industrial installations to eliminate HFCs and N_2O (*see* Box: "Carbon Offsets in Practice", p.47). No credits came from the development of solar or tidal power.[244]

It can be argued that by 2020, the proportion of credits from HFC and N_2O projects is expected to decline to one quarter (although increasing tenfold in absolute terms). But this is not because of any trend toward projects that verifiably curb the flow of fossil carbon out of the

ground, but through a growth in, for example, credits from hydropower projects (over 19 per cent), most of which were planned or under construction before carbon finance was even considered;[245] landfill gas burning projects (8 per cent); fuel switches (7 per cent) and schemes to burn off methane seeping from coal mines (5 per cent). Credits from solar and tidal power will remain negligible, and although wind power credits will rise to 8 per cent of the total, the degree to which wind displaces, rather than simply adds to, fossil energy, is disputed, as are the other benefits of giant industrial wind farms.[246]

Offset projects undertaken outside the Kyoto framework have a profile that in some ways is even more supportive of expanded fossil fuel use: offsets being sold on the voluntary market include credits generated by using carbon dioxide to pump out the remaining sticky oil at the bottom of nearly-exhausted wells, and there is strong lobbying to allow coal-burning power plants to generate further pollution rights by capturing carbon dioxide out of their stacks, liquefying it and pumping the strongly alkaline product into underground "toxic waste dumps".[247]

It is sometimes claimed that once the market has picked "low-hanging fruit" from the offset orchard, it will seek out more difficult, expensive and useful schemes that actually work to hasten the transition away from fossil fuels. This, however, is to misunderstand the structure of the incentive that offset trading provides to innovators, which is not to develop climate solutions, but rather to find or invent new "emissions reduction equivalents" that can be used in manufacturing substantial blocks of cheap carbon credits for sale. The last decade has seen proposals for carbon offsets ranging from rearranging traffic signals to seeding the oceans with urea to stimulate algal growth to not riding elevators; in the words of one carbon banker, "we will not run out of cheap CDM [Clean Development Mechanism] options any time soon."[248]

One of the most important examples of such emerging "cheap options" is REDD – "Reducing Emissions from Deforestation and Forest Degradation". In the run-up to the December 2009 UN Copenhagen climate negotiations (at which parties aim to agree a framework to mitigate climate change after 2012 when the first commitment period of the Kyoto Protocol ends), Wall Street firms, large Washington nature conservation organisations, carbon consultants, foresters, economists, scientists and government officials from several countries are engaged in an assiduous lobbying campaign ultimately aimed at getting UN rules revised to allow the creation of billions of tonnes of cheap REDD pollution licences. Like mortgage providers feeding the collateralised debt obligation production line by amassing prospective homebuyers' signatures on repayment contracts, carbon consultants seeking to give flesh to the new equation "forest conservation = fossil-fuel emissions reductions" have been fanning out in rural areas of countries such as Indonesia and Papua New Guinea looking for prospective "stakeholders" to endorse carbon credit-producing forestry projects. A number of scandals have already resulted.[249]

Ironically, meanwhile, it remains fairly openly acknowledged that there are insuperable obstacles to REDD offset accounting. Indeed, biotic carbon offsets confront quants with a raft of additional measurement impossibilities on top of those common to all offsets.[250] Many of these relate to the complexity of biological interactions and to the differences between, on the one hand, carbon cycling among oceans, soils, surface rock, air and vegetation and, on the other, carbon transferred from fossil deposits to the surface.[251] Although many of the measurement

Wall Street firms, large US nature conservation organisations, carbon consultants, foresters, economists, scientists and government officials are trying to create billions of tonnes of cheap pollution licences from forest conservation projects.

Carbon offset projects create incentives not to enforce emissions-related environmental laws – the greater the "baseline" emissions, the greater the offset payoffs.

"I guess in many ways it's akin to sub-prime. You keep layering on crap until you say, 'We can't do this anymore.'"

Marc Stuart
EcoSecurities

"The carbon market doesn't care about sustainable development. All it cares about is the carbon price."

Jack Cogen
Natsource

impossibilities were aired early on,[252] contributing to corporate reluctance to undertake plantation offset projects under the UN system, market imperatives are continuing to trump science – perhaps not surprisingly, given the prospect of billions of tonnes of biotic-based carbon credits from not only REDD but also agrofuels and biochar (charcoal created from biomass).[253]

The offset market's incentive structure is thus parallel to that of derivatives markets in that it drives innovators continuously to seek new yet impossible ways of pricing the future in ways that tip the system toward crisis rather than ensuring sustainability. "I guess in many ways it's akin to sub-prime," Marc Stuart of the offset consulting and trading firm EcoSecurities confessed to *The Wall Street Journal* in 2008 in the wake of his firm's first stock crash. "You keep layering on crap until you say, 'We can't do this anymore.'"[254]

The Kyoto offset market's structural bias entrenching the use of fossil fuels is reinforced by the reality that the companies best equipped to gain regulatory permission to sell carbon credits are well-capitalised, often fossil-dependent corporations with government connections and the ability to hire carbon consultants and accountants. In many ways, in fact, their profile is similar to that of industrial credit buyers. While industrial buyers include, unsurprisingly, such large-scale corporate greenhouse gas producers as Shell, BHP-Billiton, EDF, Endesa, Mitsubishi, Cargill, Nippon Steel, ABN Amro and Chevron, major carbon credit sellers include corporations that share the same fossil orientation, such as South Africa's Sasol, India's Tata Group, ITC, Birla, Reliance and Jindal, Korea's Hu-Chems Fine Chemical and so forth.[255] Such well-financed companies use the carbon offset market not as a way of propelling their countries away from fossil dependence, but generally as a means for topping up finance for environmentally-damaging projects to which they are already committed and which are more often than not in sunset industry sectors. As a top official at the Asian Development Bank, which itself has attempted to use the carbon market as a slush fund to prop up its portfolio,[256] admits:

> "When the CDM [Clean Development Mechanism] was introduced 10 years ago, there was much expectation from the developing countries that it would provide the necessary upfront financial and technical support for new sustainable development projects that would reduce greenhouse gas emissions. Today . . . it is mostly functioning to provide additional cash flow to projects that are already able to move forward with its [sic] own financing."[257]

Carbon credit investors in the financial sector, who today dominate the buy side (*see* Table 1, pp.50-51, and Table 2, p.53), have also repeatedly been explicit that offset economics does not select for a transition away from fossil fuels. Historically, such buyers have focused on large blocks of low-cost, easy-to-obtain pollution licences, being reluctant to involve themselves in projects involving long-term sustainability considerations and local sensitivities. "We look at the market price. We don't look at any particular technology," explains Louis Redshaw of the Emissions Trading Department of Barclays Capital.[258] "The carbon market doesn't care about sustainable development," confirms Jack Cogen of Natsource. "All it cares about is the carbon price."[259]

Unsurprisingly, community-based carbon-saving or renewable energy projects have found it difficult to tap into the carbon market while maintaining the quality of their work.[260] As one veteran renewables activist and specialist in Africa put it:

Carbon Offsets in Practice

The global offset trade is well represented by a project undertaken by the French chemical company, Rhodia, at an adipic acid plant it owns in South Korea.

Keen to benefit from the Kyoto market, Rhodia invested US$15 million in equipment that destroys nitrous oxide. Because N_2O is a greenhouse gas stipulated to be 298 times more dangerous than carbon dioxide, and because Rhodia owns a plant located in the global South, it can generate 298 tonnes of carbon credits just by burning one tonne of the compound, thus enabling production of $1 billion in UN-approved carbon credits for sale to polluting industries in industrialised countries.

The trade does not reduce overall greenhouse gases, because customers typically buy Rhodia's credits so that they can continue to invest in fossil fuels.

Nor does it help Korea decarbonise: at best, it is irrelevant; at worst, it encourages the country to build more dirty industries so that it can make money cleaning up later, as has already happened with the HFC-23 trade.[263] Rhodia already makes 35 times more money selling carbon credits than it does from the adipic acid market.

Nor does the trade incentivise green technological innovation. The technology Rhodia uses dates from the 1970s.[264]

The example suggests some of the ways in which the notion that offsets are "cost-effective" ways of reducing emissions – like the notion that using exotic derivatives is an "efficient" way of allocating risk – is incoherent. Buyers of credits from such projects pay a disproportionate amount of money for an insubstantial, fiddly change. Overall, buyers of UN carbon credits have paid 4.7 billion euros (US$ 9.4 billion) for permits from industrial gas projects costing less than 100 million euros (US$ 150 million) to produce.[265]

More generally, in attempting to create "efficiencies" in one place through commensuration, offsetting creates "inefficiencies" elsewhere in the form of transaction costs – costs that proliferate when one technical fix after another is resorted to in order to try to paper over accounting impossibilities. In the case of offsets, as in the case of cap and trade, the effort to reach a goal cost-effectively results in the goal itself becoming lost, and with it the very point of cost-effectiveness.

> "When the company for which I worked for 10 years got into carbon trading, I became increasingly distraught. It was no longer about 'sustainable development', it was about tonnes of CO_2 on make-believe spread sheets".[261]

A third source of complexity defeating any attempt to calculate offset credits is the act of attempted calculation itself. In a parallel with reflexivity in the financial markets (that is, the periodic tendency of investors' observations and biases to influence "economic fundamentals" in a disruptive way), offset accounting, like certain aspects of financial engineering, undermines its own stability. For one thing, baseline accounting procedures set up perverse incentives for credit seekers (including host governments, credit buyers and consultant validators seeking future contracts) not only to postulate but also to bring about "business as usual" scenarios that are the highest-emitting possible, in order to make the proposed projects appear to be saving as much carbon as possible.[262]

For example, in many countries hosting Kyoto Protocol offset projects, the Kyoto market is creating incentives for emissions-related environmental laws not to be enforced, since the greater the "baseline" emissions, the greater the payoffs that can be derived from carbon projects.[266] This trend also blurs the distinction between price incentives and legal codes, tending to commensurate "cost-effectiveness" and legality by normalising the expectation that certain laws will be obeyed only if it becomes possible to earn carbon credits by doing so. Logically (yet impracticably), all this should necessitate incessant recalculation of the baseline and continual alteration in the number of credits calculated; unlike traditional insurers, carbon traders or regulators cannot police "gaming" in order to guarantee a benign fit between market actors and the mathematics.

Another aspect of reflexivity in offset markets derives from the fact that offset accounting methodology's built-in suppression of

Carbon offset accounting, like certain aspects of financial engineering, undermines its own stability.

unknowns entails suppression of alternative political approaches to climate change and the climate-friendly knowledge that is often associated with them (*see* Box: "Destroying the Future", p.48). Carbon offset accounting unavoidably frames the political question of what would have happened without carbon projects as matter of quantist technical prediction in a deterministic system, while at the same time framing project proponents non-deterministically, as free decision-makers whose carbon initiatives "make a difference".

Among the first observers to call attention to the alternative-suppressing aspects of this methodology were social activists in Minas Gerais, Brazil, critical of the attempt of a local charcoal and pig iron company, Plantar, to get carbon credits for the environmentally-destructive eucalyptus plantations it had established on occupied land. Of the carbon accounting deployed by the company, the activists observed:

> "The argument that producing pig iron from charcoal is less bad than producing it from coal is a sinister strategy . . . What we really need are investments in clean energies that at the same time contribute to the cultural, social and economic well-being of local populations."[267]

In a later letter to Kyoto regulators, the activists, after insisting that "the claim that without carbon credits Plantar . . . would have switched to coal as an energy source is absurd," went on to characterise the accounting procedure as a "threat":

> "It is comparable to loggers demanding money, otherwise they will cut down trees . . . [the Clean Development Mechanism] should not be allowed to be used by the tree plantation industry to help finance its unsustainable practices."[268]

For the activists, carbon accounting's suppression of knowledge of the plurality of choices amounted to an attempt to block popular pathways

Destroying the Future

The destruction of knowledge that stems from carbon offset accounting often plays out in a brutely physical way. One example comes from the Bhilangana river in Uttaranchal, India, near the village of Sarona.

There, Swasti Power Engineering Ltd. is benefiting from Kyoto carbon market money in its development of a 22.5 megawatt run-of the-river hydroelectric project that would devastate local farmers' finely-tuned (and extremely low-carbon) customary terraced irrigation system that provides them with rice, wheat, mustard, fruits and vegetables even when rainfall is irregular.

Sarona residents were never consulted and first learned about the project only in 2003, when construction machines arrived. An official survey conducted ten years earlier had reported no villages near the project.

Older women in the village led the first actions of opposition. In March 2005, 120 villagers were jailed for four days, and another 79 arrested in July. In November 2006, at least 29 people were arrested and forced to sign a document that they would cease resistance.

In police raids since, people have had their clothes torn off and been beaten, and women in the village have been assaulted, dragged by their hair and tortured.[269]

In the mountainous river valleys of Uttaranchal, some 146 such dam projects are proposed or underway, and hundreds of hydroelectric schemes elsewhere in China, Brazil and elsewhere are also seeking carbon finance. Many are likely, as at Sarona, to contribute to the undermining of existing knowledge of low-carbon approaches to livelihood that are certain to be increasingly important to a fossil-free future.

The effects of thousands of offset projects of every kind on the knowledge and technology useful in a greenhouse world remain unknown to a wider public or even to environmentalists with a special interest in climate.[270] It is impossible for market calculations of carbon supposedly gained and lost to take account of the extent to which such projects undermine the raw materials for climate solutions; or, for that matter, for them to take account of the other "opportunity costs" generated by the carbon markets, including the literally incalculable climatic impacts of the markets' disincentivizing of structural change in the industrial North.

In the words of hedge fund practitioner Richard Bookstaber on the financial markets, such costs constitute "externalities for the entire . . . system that are hard to measure but dominate their apparent value."[271]

to an alternative future. The more the methodology was applied, the more deleterious climate effects would follow – and the less convincing the calculations of carbon savings would become.

Consequences of the Contradictions

The problems arising from offset trading's dependence on an unfeasible methodology play out in a number of ways. First, the fact that there can be no firm basis for offset accounting opens the way for unresolvable conflicts over estimates of carbon credits. Just as different investment banks calculate different prices for the same collateralised debt obligation tranche because they use different models of correlation,[272] different offset experts, regulators and environmentalists offer different estimates of the number of carbon credits, if any, that a project should be allowed to generate, if any.

One 2007 study concluded, for example, that most of the several hundred hydropower projects in the Kyoto offset pipeline in China were well advanced before carbon finance could have become a factor in their construction, meaning that they should not be allowed to produce any pollution licences at all.[273] Another investigation of projects in India, similarly, found that one third of the sample was not "additional."[274] A third investigation elicited admissions from managers of carbon finance-supported projects in Bulgaria and Britain that their schemes, too, would have been instituted with or without carbon money.[275] A fourth showed that carbon credit revenue amounted to a very small part of the projected internal rate of return for 546 of the first 803 CDM projects.[276] Richard Sandor, the derivatives trader who set up the Chicago Climate Exchange, told the *Wall Street Journal* in October 2008 that whether it is carbon finance or some other factor that results in his contractors making the emissions savings they use to claim carbon credits is "not my business. I'm running a for-profit company."[277] There is evidence that offset producers and traders themselves sometimes present different claims about "additionality" at different times, depending on to whom they are talking. According to one prominent carbon banker, project proponents "tell their financial backers that the projects are going to make lots of money" at the same time they claim to regulators "that they wouldn't be financially viable" without carbon finance.[278]

A second consequence of offsets' reliance on an unworkable, self-invalidating calculation methodology is that it undermines the possibility of effective regulation. Regulators' power to block projects that cannot establish that they are "additional" was supposed to produce two climate benefits: first, the emissions reduction required of the legally "capped" entity that would have bought the blocked carbon credits; and second, the benefit produced by the carbon-saving project itself, which is shown not to need carbon finance. If, however, "additionality" consists merely in more or less implausible storytelling, and regulators at the UN and elsewhere are forced to fall back on aesthetic, political or pseudo-scientific criteria in deciding whether to approve or disapprove projects, then regulators' power to enforce climate benefit becomes largely illusory. As Lambert Schneider of Germany's Öko-Institut (for Applied Ecology) notes, "If you are a good storyteller you get your project approved. If you are not a good storyteller you don't get your project through."[279] From the point of view of climatic effectiveness, distinguishing between fraudulent and non-fraudulent calculations becomes impossible, rendering any attempt at offset regulation ultimately pointless.[280]

As long as the appearance of regulation is maintained, the impossibility of standards is a commercial boon for credit buyers and sellers alike.

Untenable quantist methodology creates a carbon asset valuation problem like that of sub-prime mortgage-based securities.

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Table 1

Buyers of Kyoto market carbon

TYPE OF PROJECT	AVERAGE SIZE (tonnes of CO_2 "reductions" by 2020)	FINANCIAL SECTOR BUYERS	OTHER BUYERS
HFCs	50 million	Barclays, Bear Stearns (JP Morgan Chase), BHP Billiton Marketing, BNP Paribas Fortis, British Gas Trading, Climate Change Capital, Comercio Internacional Proserdi, Deutsche Bank, EcoSecurities, EDF Trading, Goldman Sachs, IBRD, ICECAP, MIT Carbon Fund, IXIS, JBIC, JMD Greenhouse Gas Reduction, Marubeni, Mitsui, Morgan Stanley, NATIXIS, Natsource, Noble Carbon, Oz Carbon Trading, Rabobank, Sumitomo Bank, Trading Emissions, Zeroemissions Carbon Trust	Aalborg Portland, Azuliber, Carbon Compliance Acquisition 5, Cementerie Aldo Barbetti, Cementos Portland Valderrivas, CEPSA, CER Investments 1, Chubu Electric, Chugoku Electric, Daioh Construction, Danish Ministry of Climate and Energy, DONG, Electrabel, Endesa, ENEL, ERG, Fortum, Gas Natural SDG, Government of Canada, Government of Sweden, Hidroelectrica del Cantabrico, Iberdrola, IFJ Korea, Iride Mercato, Italcementi, Italian Ministry of Environment, Ineos Fluor, JGC, J-Power, KfW, Kyushu Electric, Maersk, Mitsubishi, Nippon Steel, Nordjysk Elhandel, Nuon, Repsol, RWE, Sempra Energy Europe, Shandong Dongyue Chemical, Shell Trading, Shikoku Electric, Solvay Fluor, Statkraft, Tohoku Electric, Tokyo Electric, Union Fenosa, VROM
N_2O	9 million	Ecoinvest Carbon, EcoSecurities, BNP Paribas Fortis, Goldman Sachs, Kommunalkredit, Marubeni, MGM Carbon Portfolio, MIT Carbon Fund, Mitsui, N.serve, NATIXIS, Natsource, Noble Carbon, ORBEO, Sindicatum Carbon Capital, Vitol	Johnson Matthey, Mitsubishi, Rhodia Energy, RWE, Toyo Engineering
Coal bed/ mine methane	5 million	Arreon Carbon UK, BNP Paribas Fortis CAMCO, Climate Change Capital, Credit Suisse, Eco-Carbone, EcoSecurities, EDF Trading, Energy Systems International, Equity Environmental Assets, European Carbon Fund, IBRD,	CEZ, Choguku Electric, JGC, MTM Capital Partners, NEDO, Pear Carbon Offset Initiatives (individual carbon offsets), RWE, STEAG, Tokyo Electric, Toyota

credits from large-volume sources*

TYPE OF PROJECT	AVERAGE SIZE (tonnes of CO_2 "reductions" by 2020)	FINANCIAL SECTOR BUYERS	OTHER BUYERS
Coal bed/ mine methane (continued)		ICECAP, IXIS, Japan Carbon Finance, Kommunalkredit, Lehman Brothers, Marubeni, Merrill Lynch, MGM Carbon Portfolio, Mitsui, NATIXIS, Natsource, Noble Carbon, ORBEO, Renaissance Carbon Investment, Sindicatum Carbon Capital, Trading Emissions, Vitol	
PFCs and SF6	3 million	33 Asset Management, Arreon Carbon UK, Climate Change Capital, EcoSecurities, MGM Carbon Portfolio, South Pole Carbon Asset Management, Swiss Re	–
Wind	1 million	BNP Paribas Fortis, BP Gas Marketing, CAF, Cambridge Funds Investment, CAMCO, Cantor Fitzgerald Europe, Carbon Asset Management Sweden, Carbon Capital Markets, CarbonNeutral Company, Carbon Resource Management, Climate Change Capital, Climate Change Investment, Credit Suisse, Daiwa Securities, Deutsche Bank, Ecoinvest Carbon, EcoSecurities, EDF Trading, Essent Energy Trading, European Carbon Fund, First Carbon Fund, Fortis, Grey K Environmental, Goldman Sachs, IBRD, ICECAP, IXIS, J. Aron, Japan Carbon Finance, JBIC, Kommunalkredit, Marubeni, Merrill Lynch, MGM Carbon Portfolio, Mitsui, NATIXIS, OneCarbon, Pacific Consultants International, Rabobank, Renaissance Carbon Investment, Spanish Carbon Fund, Standard Bank, Sumitomo Bank, Trading Emissions, Vitol, World Carbon Credit Investment	Cargill, CERUPT, CEZ, Chubu Electric, Chugoku Electric, Converging World, Danish Ministry of Climate and Energy, Econergy, Electrabel, Endesa, ENEL, Enerfin Enervento, Eurus Energy, Finland Ministry for Foreign Affairs, Fortum, Gamesa, Gaz de France, Government of Canada, Iberdrola, Inversiones Celco, BIC, KfW, Kyushu Electric, Lafarge, Mitsubishi, NEDO, Ricoh, RWE, Scottish and Southern Energy, Shell Trading, Shikoku Electric, Sojitz, Statoil, Swedish Energy Agency, Swiss Re, Tohoku Electric, Tokyo Electric, Voestalpine, VROM

* as of September 2009 (where information is available)

Source: UNEP Risoe Centre CDM/JI Pipeline Analysis and Database, 1 September 2009, www.cdmpipeline.org

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Offsets abstract from the climate problem twice over – they reinforce cap and trade's false equivalence between reducing some emissions and addressing the root causes of global warming; and they set up another false equivalence between "compensatory" carbon-saving schemes and emissions reductions at source.

As long as the appearance of regulation is maintained, however, the impossibility of standards becomes a commercial boon for both credit buyers and credit sellers, since it becomes relatively easy for skilful and well-paid carbon accountants whose work is largely shielded from public scrutiny or independent professional challenge[281] to fabricate huge numbers of pollution rights for sale to Northern fossil fuel polluters, who are only too happy not to enquire too closely into their origin. That makes corporate self-restraint no more likely in the offset markets than it was in the collateralised debt obligations market.

A third effect of an untenable quantist methodology is that it stores up an asset valuation problem similar to that of sub-prime mortgage-based securities before the 2007-08 financial crash. For several years, this has been a concern even for some market actors. "We don't want an Enron scandal where excess credits are issued without the actual reductions taking place," fretted one executive of Det Norske Veritas, one of the "big four" private agencies licensed by the UN to validate and verify carbon credits, in 2006; two years later, in December 2008, the UN suspended his company from verifying Kyoto offsets after an investigation revealed irregularities in its auditing procedures.[282] By 2009, policy analyst Michelle Chan was calling the attention of the US Congress to the dangers of a "sub-prime carbon" bubble followed by a collapse due to rapid devaluation.[283]

The danger of a catastrophic loss of confidence in the value of offsets is heightened by two further factors affecting their acceptance by the public. First, by market design, the net carbon emissions effect of a successful offset project cannot be more than zero, as long as its credits are used to license emissions elsewhere (although small margins of error are sometimes included in the calculations). It follows that even if calculations of carbon savings were verifiable in principle, calculation errors on the optimistic side would be likely to render the project not only unhelpful, but also positively damaging to climatic stability.

Second, even if offsets worked according to design and the carbon "balancing" associated with them was verifiable, those savings would at most serve the purpose of being "equivalent" to emissions reductions elsewhere. But since reducing emissions is not the same as addressing the climate problem, even those offsets that had some net benefits would be subject to the same problems of abstraction from place, technology and time that afflict cap and trade proper.

Offsets, in other words, abstract from the climate problem twice over: once by reinforcing cap and trade's false equivalence between numerical emissions reductions and the institution of a historical pathway away from fossil fuels, and then again by setting up another false equivalence between "compensatory" carbon-saving schemes and emissions reductions. This "double distance" from the climate problem suggests the high likelihood of an eventual collapse in confidence in the commodity.

Structural Ignorance and Conflict of Interest

Complex combinations of awareness and denial regarding such contradictions are as pervasive in the carbon trading world as they are in the financial world. For example, market proponents who admit that "measuring or even defining savings that are additional to those that would have occurred in the absence of emissions credits" is an "impossibility"[284] often reverse the judgement a few paragraphs or pages later. As in the financial markets, confusion regarding issues such as probability,

error bars and uncertainty is intermittently criticised yet on the whole nurtured: panellists at conferences on carbon trading who admit in the corridors that it is impossible to show the additionality of nearly any project often chastise colleagues for saying so in public.[285]

Carbon traders, like derivatives traders, are also capable of organising a political consensus to ignore unfavourable findings. For example, in 2008, the US General Accounting Office (GAO) concluded that "it is impossible to know with certainty whether any given offset is additional,"[286] just as it had concluded in 1994 that derivatives trading methodologies were creating systemic risks that could issue in disaster. In 1994, the International Swaps and Derivatives Association, in "one of the most startling triumphs for a Wall Street lobbying campaign in the twentieth century,"[287] succeeded in getting the US Congress to set aside the GAO's concerns, with the help of former US Federal Reserve Chair Alan Greenspan and the Wall Street businessmen, such as Robert Rubin, who had joined Bill Clinton's government two years earlier. Whether the International Emissions Trading Association needed to play an equally dynamic role in persuading Congress to ignore the GAO's concerns about offset accounting 14 years later is doubtful, but one alliance or another was clearly mobilised in 2008-09 to ensure that the US retains the option, under the Waxman-Markey Act, of importing billions of tonnes of carbon credits from abroad.

As in the uncertainty markets, such patterns of denial and repression are intertwined with widespread erosion of the concept of conflict of interest and ubiquitous moral hazard.

- Criteria used to gauge the effectiveness of climate mitigation policy are largely formulated or influenced by private carbon consultants, big permit buyers, bankers and fund managers. Barclays Capital, a

Criteria to gauge the effectiveness of climate mitigation policies are formulated or influenced by private carbon consultants, big permit buyers, bankers and fund managers.

Table 2

Top 20 Kyoto market carbon credit buyers*

Buyers (sector)	Number of projects
EcoSecurities (carbon finance, brokerage and consulting)	293
Carbon Asset Management Sweden (carbon finance)	159
EDF Trading (carbon finance)	103
Mitsubishi (technology)	100
AgCert (carbon finance)	96
RWE (utilities)	93
Vitol (oil trading)	82
Carbon Resource Management (carbon finance)	70
Cargill International (agribusiness)	69
Camco (carbon finance)	68
Trading Emissions (carbon finance)	66
MGM Carbon Portfolio (carbon finance)	63
Kommunalkredit (banking)	63
Marubeni (carbon finance)	60
ENEL (utilities)	60
Agrinergy (carbon finance)	50
Climate Change Capital (carbon finance)	49
Danish Ministry of Climate and Energy	47
Energy Systems International (carbon finance)	44
IBRD (banking)	43

* as of September 2009

Source: UNEP Risoe Centre CDM/JI Pipeline Analysis and Database 1 September 2009, www.cdmpipeline.org

The complicated types of ignorance created by carbon markets are not just the result of denial motivated by institutional and financial interests; as such, they cannot be addressed merely through regulation against conflict of interest.

With its offset calculations, diversity of credits, monitoring and legal requirements, and acronyms, carbon trading rivals the trade in financial derivatives in its obscurity.

major investor in the carbon markets, boasts openly that "two of our team are members of the Methodology Panel to the Clean Development Mechanism (CDM) Executive Board", part of the UN carbon market's regulatory body,[288] of which Lex de Jonge, head of the carbon offset purchase programme of the Dutch government, is the chair.[289] One principal of a carbon asset management firm, who is also a member of the UN's CDM methodology panel, noted at an industry meeting in London in October 2008, "I helped set the rules; now my firm plays by those rules."[290] European Commission coordinator for carbon markets and energy policy Peter Zapfel, a disciple of US economist-advocates of pollution trading and an instrumental figure in convincing European bureaucrats and governments to commit themselves to carbon trading,[291] has urged "cross-fertilisation between regulators and regulated".[292] "I don't see us as police," the chair of the CDM Executive Board confirmed in 2007.[293] In the UK, the Secretariat of the All-Parliamentary Committee on Climate Change is hosted by a private carbon offset firm, The Carbon Neutral Company.

- Like credit ratings firms in the financial markets, private sector carbon auditors approved by the UN have a strong interest in gaining future contracts from the companies that hire them; unsurprisingly, they wave through an overwhelming majority of projects under review.[294] Sir Nicholas Stern, the ex-World Bank economist and author of the British government's Stern Report on Climate Change, has meanwhile championed the initiative of his private firm, IDEACarbon, to set up a carbon credit ratings agency, which many would argue would inevitably be subject to the same type of conflict of interest.[295]

- Within the insular, tightly-knit professional climate mitigation community, experts are constantly passing through revolving doors between private carbon trading consultancies, government, UN regulatory agencies, the World Bank, environmental organisations, official panels, trade associations and energy corporations. James Cameron, an environmental lawyer who helped negotiate the Kyoto Protocol, now benefits from the market he helped create in his position as Vice Chair of Climate Change Capital, a boutique merchant bank that recruited as staff members Kate Hampton, former climate chief at Friends of the Earth International, and Jon Sohn, formerly of World Resources Institute. Hampton was then seconded in 2005 by Climate Change Capital to the UK's Department for Environment, Food and Rural Affairs (DEFRA) as a senior policy adviser during the UK's G8 summit (which focused on global climate change) and EU Presidency. Climate Change Capital's Vice President for Carbon Finance, Paul Bodnar, took charge of climate change finance at the US State Department in 2009. Henry Derwent, a former director of international climate change at DEFRA, who was responsible for domestic and European climate change policies, is now president and chief executive of the International Emissions Trading Association, the industry alliance.

- In the unregulated "voluntary" markets for carbon credits, where buyers seek credits for reasons other than legal compliance, Alan Greenspan and Robert Rubin's concept of "private regulation" is even more deeply entrenched. Laurent Segalen, formerly a carbon trading manager at the failed Lehman Brothers investment bank, expressed a wide consensus when he affirmed that "traders should be the ones designing and determining the standards."[296]

- The World Bank, as mentioned above (p.27), benefits from financing fossil fuel development at the same time as it profits from running carbon funds that are claimed to be able to help clean up the resulting mess.[297]

As in the finance sector, however, the erosion of the concept of conflict of interest is less a cause of the carbon market's problems than a symptom of broader trends. The complicated types of ignorance created by the carbon markets are more than just a matter of denial motivated by institutional and financial interest, and cannot be addressed simply through regulation against conflict of interest.

For example, with its reams of offset calculations, diversity of credits, daunting monitoring and legal requirements, and crowd of acronyms, carbon trading often rivals the trade in new financial instruments such as collateralised debt obligations (CDOs) in its stupendous obscurity. In addition, there is direct overlap. With spot prices for carbon permits varying daily, the overwhelming majority of carbon trades today take place in the world of carbon swaps, options, forwards and futures, further distancing commodities from projects.[298] Carbon options have been used since 2005, and there are now swaps between Clean Development Mechanism credits and EU allowances, allowing more liquidity and larger positions. Proposals to securitise carbon credits (as a new "asset class") have been made at least since 2007,[299] and offset consulting and trading firm EcoSecurities invented a CDO-type instrument for carbon in 2008.[300] A "Capital Protected Forestry Carbon Credit Note", a "Discount Certificate on CO_2" and other exotic instruments have also been developed.

The complexity of such instruments and transactions, like that associated with the products traded on uncertainty markets, functions politically to hide hazards not only from the public but also from many market players themselves.[301] Just as financial-sector quantism had difficulties in grasping the potential large impacts of various unknowns on price movements, taking account of the on-the-ground realities of mortgage holders in low-income neighbourhoods of US cities, or giving weight to well-tried "commons" conceptions of "safety first", carbon-sector quantism tends to block contact either with climatic uncertainties or the social or biophysical realities of specific carbon offset projects.

In both cases, second-order ignorance exacerbates the dangers: isolated by background and by their location in financial districts, quants tend not to be aware that they are not aware. In 2008, for example, Richard Sandor of the Chicago Climate Exchange was quoted approvingly in *The New Yorker* magazine endorsing schemes to commodify native forests in the global South for use as marketable sinks for industrial carbon dioxide:

> "They are slashing and burning and cutting the forests of the world. It may be a quarter of global warming and we can get the rate to two per cent simply by inventing a preservation credit and making that forest have value in other ways. Who loses when we do that?"[302]

Although the neocolonialist misconceptions about forest destruction and forest politics that this confident statement exemplifies have been thoroughly discredited in thousands of scholarly publications over the last two to three decades,[303] and the implications are often drawn for carbon accounting, quantist mentality is necessarily resistant to assimilating them. Ignorance has become structural in ways that not even critics of finance such as John Maynard Keynes, R. H. Tawney and John Kenneth Galbraith might have foreseen.[304]

The complexity of both carbon and uncertainty markets hides their hazards from many market players and from the general public.

Isolated by their background and location in financial districts, quants tend not to be aware that they are not aware.

Middle-class green advocacy of carbon markets also obscures their dangers.

Can carbon markets be regulated? Even after a decade of carbon trading failures, this question is too politically incorrect to be asked in public.

Carbon markets' dangers have been further concealed by middle-class environmentalist advocacy of the Kyoto Protocol and EU ETS since the late 1990s. Professionally committed to defending and reforming officially-sanctioned mechanisms that promised globally-coordinated action on climate change action, members of the Climate Action Network (CAN), the major group of environmentalist campaigners on global warming worldwide, ridiculed research on the political economy of carbon markets as "ideological claptrap" for many years, strenuously denying even that carbon markets involved asset creation.[305] In 2007, a joint statement from CAN, the World Wide Fund for Nature (WWF), Friends of the Earth Europe and Greenpeace claimed that the "existence of the EU Emissions Trading Scheme is a tremendously important achievement for European climate change policy."[306] As late as October 2008, Stefan Singer, a senior European climate officer with WWF, which continues to back carbon markets, was quoted at a carbon trading panel fretting that "it was never the intention [of the EU ETS] to create profits," prompting Louis Redshaw of Barclays Capital to remind him gently: "it's inevitable if you institute a trading system."[307]

Middle-class green advocacy of carbon markets has obscured the dangers in another way as well. Nervous about, for example, "unsustainability" or "nonadditionality" in carbon projects, professionalised environmentalists have joined together with business and UN bureaucracies troubled by carbon bubbles and "carbon cowboys" (to cite the headline of a *Financial Times* series)[308] in promoting new regulatory and certification measures of many kinds. Environmentally speaking, the resulting complicated efforts to distinguish (for example) "gourmet" or "gold standard" carbon from "sub-prime" carbon have accomplished little more than help hide the underlying nonequivalences between reductions and offsets and between trading emissions rights and undertaking political action to address fossil fuel dependence. But such contortions have been highly successful in another respect. They have kept alive the appearance of regulatability, allowing an environmentally harmful global trade to go on.

Even after a decade of carbon trading failures, the question of whether the carbon markets are regulatable or not remains almost too politically incorrect to be raised in public. In many circles, the notion that any type of uncertainty or climate benefit whatsoever can be safely and thoroughly commodified (like the notion that any type of uncertainty whatsoever can be safely and thoroughly commodified) remains dogma. Rather than questioning whether effective regulation of carbon markets is possible, the British state is – as discussed above – even intervening to attempt to ensure the stability of carbon prices in a way that directly undermines investment in low-carbon infrastructure.

Governments and environmentalists alike have on the whole failed to recognise that carbon markets – in which there is no viable commodity and in which scarcity is created principally by lobby-vulnerable legislators – is even more likely than the new uncertainty markets were to outrun any good intentions entertained by their inventors and reformers. They have thus collaborated in storing up a problem of asset valuation that is likely to end in another crash perhaps even before one or another climate catastrophe strikes, particularly if a speculative carbon bubble encourages further headlong development of unverifiable carbon assets.

III. Conclusion

The markets in uncertainty and carbon developed during the last decades of the 20th century created rich new possibilities for accumulation against a background of growing worldwide inequality and disappointing returns on traditional investment. Formulating new practices elaborating an ideology of universal calculability exemplified by the efficient markets hypothesis and by linear views of the relationship among atmospheric change, geochemical cycles and social systems, the markets' architects, although facing different pressures, sought to enhance the cost-effectiveness of both finance and climate action through intensive efforts to commodify two of the furthest, least tangible and most recalcitrant reaches of the infrastructure of human existence. Predictably, both new markets quickly became playgrounds for speculative investment, multiplying the dangers involved.

As various types of uncertainty were isolated, recontextualised, quantified, sliced, diced and circulated, a new finance emerged out of the rearrangement and fusion of banking, gambling and insurance. Credit expanded enormously, multiplying leverage, creating unprecedented opportunities and pressures to lend and blowing asset bubbles up to huge sizes. Questions of what debt is for, how much leverage is necessary, and whether unlimited liquidity is always and everywhere a good thing, became passé. Similarly, as global warming solutions became identified with reductions in an abstract quantity of tradeable emission rights, emissions reductions were swapped and pooled with offsets manufactured through quantitative techniques. As the resulting amalgam was sliced, diced, bought and sold, a new "climate change mitigation" problem emerged, disembedded from history, politics and fossil fuels and embedded in neoclassical economics. Again, the question of what the new market was for got lost amid ever more ambitious attempts to maintain and extend it.

Yet the ambitious new trading projects soon came to grief even in their own terms. The extreme abstraction needed for commodity formation in each case wound up exacerbating, even engendering, systemic crises that threatened the social order. The unchecked pursuit of liquidity in the uncertainty markets led in the end to a financial stampede for the exits and a drying up of liquidity. The imperative to take positions "against every possible state of nature" entailed losing touch with vernacular, safety-first conceptions of livelihood in favour of an ill-fated, cascading "technical-fix" approach to unknowns. Meanwhile, uninformed attempts to implement a "market solution" for global warming, in abstracting from how emissions reductions are made, entrenched fossil fuel infrastructure, undercut the political mobilisation needed for a climate solution and engendered social dislocations of diverse kinds and wide geographical reach.

As a result, both markets have provoked strong, if diverse and confused, movements of societal self-defence. This pattern of action and reaction constitutes a chapter in the political history of commodification as significant in some ways as that describing the movements to commodify land and labour analysed by Karl Polanyi. In each case, these movements of self-defence have been, roughly speaking, a mixture of two elements. In finance, the establishment response has been largely a technical fix focused on bailing out dysfunctional financial institutions "too big to fail" and encouraging regulators to oversee more and better commodification of uncertainties. Also significant, however, are proposals being pressed both inside and outside government to scale

The markets in uncertainty and carbon created new possibilities for accumulation against a background of growing worldwide inequality and disappointing returns on traditional investment.

Comparative study of the financial and carbon markets can inform constructive responses to a new era of turbulence.

back the commodification of uncertainty in one or another respect and reconsider the role and governance of finance in society while switching resources toward ensuring the vitality of the basket of incommensurables on which ordinary people rely for their livelihoods.

In the case of climate change, the response has been similar. On the one hand are technical-fix proposals demanding that governments expand carbon markets worldwide in the interests of enhanced liquidity while regulators and certifiers oversee better calculation of carbon commodities. On the other are movements to call off or limit the attempt to commodify the earth's carbon-cycling capacity and instead mobilise politically for a fair transition away from fossil fuel dependence.[309]

How can progressive forces best contribute to such movements? What sort of alliances can be fashioned among, say, ordinary victims of the financial crash, movements for new financial and tax regimes, environmental justice movements battling fossil fuel extraction and pollution, health activists, campaigners for alternative energy and transport, grassroots resisters of carbon offset projects in the South, movements for food sovereignty, and a Northern public frustrated at the largesse being lavished by their governments and the United Nations climate apparatus on the creation of yet another dysfunctional speculative market? The answers are not yet clear, but in trying to place the new uncertainty and carbon markets within a broader history of commodification, this paper has tried to suggest that comparative study of the financial and carbon markets can inform constructive responses to a new era of turbulence. Financial crisis, climate crisis: each can perhaps help teach what needs to be avoided when contending with the other.

Notes

1. Timothy Mitchell, *Rule of Experts: Egypt, Technopolitics, Modernity*, University of California Press, 2002, p.118.
2. *See*, for example, the Beijing Declaration of 15 October 2008: http://focusweb.org/the-global-economic-crisis-an-historic-opportunity-for-transformation.html?Itemid=92.
3. "Let's Put Finance in Its Place!", call for the signature of NGOs, trade unions and social movements, final draft, Belem, 1 February 2009, http://www.choike.org/campaigns/camp.php?5
4. Susan George, "Transforming the Global Economy: Solutions for a Sustainable World", Schumacher Lecture, 6 October 2008, http://www.tni.org/detail_page.phtml?&act_id=18736&menu=13e.
5. Hazel Henderson, "Reforming Global Finance: Re-Designing Money Systems to Reduce Greenhouse Gas Emissions and Accelerate the Growing Green Economy", presentation to the Green Economy Initiative Conference, United Nations Environment Programme, Geneva, 1 December 2008, http://www.ethicalmarkets.com/?p=1119.
6. "Declaration of Maputo", 5th International Conference of La Via Campesina, Maputo, Mozambique, 19-22 October 2008, http://www.worldproutassembly.org/archives/2008/11/declaration_of_4.html.
7. Martin Khor, "Spend the Trillions on Climate", Third World Network, December 15, 2008, http://banglapraxis.wordpress.com/2008/12/15/spend-the-trillions-on-climate/.
8. *See*, for example, Ben Hall, "French Strikers Protest at Reforms and Aid to Banks", *Financial Times*, 30 January 2008; Stephen Gandel, "America's Broken Banks", *Time*, 9 February 2009.
9. Ramesh Jura, "And Now a New Green Deal?", Inter Press Service, 12 December 2008.
10. Lawrence Summers received about US$5.2 million in 2008-09 in compensation from hedge fund D.E. Shaw, and also received hundreds of thousands of dollars in speaking fees from major financial institutions (John D. McKinnon and T. W. Farnham, "Hedge Fund Paid Summers $5.2 Million in Past Year", *Wall Street Journal*, 5 April 2009, p.A3).
11. Andrei Marcu, "Risks and Opportunities in Global Carbon Markets", Carbon Markets 2008 Conference, London, 8-10 October 2008; Marc Gunther, "Cooking up Carbon Credits", *Fortune*, August 2008.
12. James Kanter, "Carbon Trading: Where Greed is Green," *International Herald Tribune*, 20 June 2007; Fiona Harvey, "Carbon Trading Set to Dominate Commodities", *Financial Times*, 26 June 2008.
13. James Kanter, "In London's Financial World, Carbon Trading Is the New Big Thing", *New York Times,* 6 July 2007.
14. Murray Coleman, "Second Carbon Exchange-Traded Product Makes It to Market", *Index Universe*, 15 December 2008.
    Carbon prices have crashed in tandem with the financial crash, partly as a result of expected economic slowdown, but carbon commodities remain of interest to traders and investors looking for diversified portfolios.
15. Karl Polanyi, *The Great Transformation*, Beacon Press, 2001 [1944].
16. "'Everyone Needs to Rethink Everything': Reflections from the IMF's Former Chief Economist", interview with Simon Johnson, *Multinational Monitor*, Vol. 29, No. 3, November/December 2008, pp. 39-43, p.42.
17. Michel Callon (ed), *The Laws of the Markets*, Blackwell, 1998.
18. The famous riposte of French sociologist Michel Callon to economic historian Karl Polanyi is that rather than becoming "disembedded" from society, "the economy is embedded in economics". This insight has been brilliantly elaborated by the political scientist and scholar of modern Egypt, Timothy Mitchell, who argues that instead of being a creation of the 18th or early 19th century, "the economy" only emerged in the 1930s and 1940s, "reflecting the collapse of a colonial organisation of power, knowledge and exchange, and the rise of the national state as producer of statistical knowledge and custodian of the economic." *See* Timothy Mitchell, *Rule of Experts: Egypt, Techno-Politics, Modernity,* University of California Press, 2002, p.246. This paper attempts to extend the Polanyian notion of embedding along Callonian lines.
19. J. M. Keynes, "Speculation, Cyclicality and the Euthanasia of the Rentier", *in* Ismail

Erturk, Julie Froud, Sukhdev Johal, Adam Leaver and Karel Williams (eds), *Financialisation At Work: Key Texts and Commentary,* Routledge, 2008, pp.73-81.

20. Karl Polanyi, *The Great Transformation*, Beacon Press, 2001 [1944], p. 76.
21. As sociologist of money Viviana Zelizer documents, life insurance was widely frowned upon for moral reasons in earlier eras – a type of restriction that prefigured its contemporary "embedding" in the legal apparatus preventing insurance fraud. *See* Viviana Zelizer *Morals and Markets: The Development of Life Insurance in the United States*, Transaction, 1983.
22. Options trader Nassim Nicholas Taleb astutely points out that no matter how much social landscaping they do, casinos still cannot prevent black swans from popping up in the form of, say, disgruntled employees trying to blow up the building – often with financial results far greater than any of those that their elabourate "risk management" systems are designed to protect against. *See* Nassim Nicholas Taleb, *The Black Swan*, Random House, 2007, pp.126-32.
23. In a sense, of course, traditional commercial banking also involved "gambling" through its provision of mortgages and business loans. But this "gambling", if it can be called that at all, was even more heavily conditioned. Mortgages and loans were typically extended only in the context of face-to-face contact with clients, access to a range of "local knowledge" about their status, heavy collateral requirements and legal recourse to repossession.
24. Adrian R. Bell, Chris Brooks and Paul Dryburgh, "Interest Rates and Efficiency in Medieval Wool Forward Contracts", *Journal of Banking & Finance,* Vol. 31, No. 2, 2007, pp.361-380, http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VCY4KGG1PN-1&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=8c824d3be7235cec53bc5c8273458a90.
25. J. D. Agarwal and A. Agarwal, "Savings Concept in Derivative Instruments", Paper presented to the 7th International Conference of International Society for Intercommunication of New Ideas, "Frontiers in Finance", 23 August 2003, http://nt2.fas.nus.edu.sg/ecs/res/seminar-papers/22%20Sep%2003.pdf ,and Shigeyuki Hamori, Naoko Hamori and David A. Anderson, "An Empirical Analysis of the Efficiency of the Osaka Rice Market During Japan's Tokugawa Era", *Journal of Futures Markets*, Vol. 21, No. 9, pp.861-874.
26. Marc Levinson, *Guide to Financial Markets*, Financial Times/Profile Books, 2005, p.167.
27. "Farmers Teach Wall Street Futures", Wesels Living History Farm, http://www.livinghistoryfarm.org/farminginthe50s/money_12.html.
28. In a hypothetical example, a corn farmer seeks to ensure that the price she gets for her harvest will not fall below a specified price. When she plants the corn in the spring, the price is, say, $3 a bushel. But the harvest will not take place until October – by which time the price may have fallen. To guarantee her costs of production, the farmer enters into 10 contracts, each of which commits her to sell 5,000 bushels of corn to the local grain dealer on a specified date in October at a strike price of, say, $3.20 a bushel – the grain dealer gambling on the market price rising higher than this and thus on his being able to buy the corn cheap but sell on at the market price. If the market price of corn falls below $3.20, however, the farmer is "in the money", since she has a guaranteed buyer at a strike price that is above the market price. If, on the other hand, the market price rises above the strike price, she is in danger of losing out. But because derivative contracts establish an obligation to the trade rather than to a person, she can always liquidate her own position should the price of corn start to rise in, say, July. She does this by buying another 10 contracts – but this time the contracts are to *buy* grain in October at the price she had agreed to sell in her first 10 contracts – the two sets of contacts cancelling themselves out. While she might lose some money on this, her aim – to ensure that she will receive a specific price for her crop – will still be achieved, since she can sell her crop on the rising open market in October. Meanwhile, the grain dealer adopts the opposite strategy, offsetting his contracts should the market price look like falling. Options work in a similar manner – the main difference being that the purchaser of the option does not have to exercise the right to buy or sell and stands to lose only the premium they pay for the option right should they let their option expire.
29. Edward Stringham, "The Extralegal Development of Securities Trading in Seventeenth Century Amsterdam", *The Quarterly Review of Economics and Finance*, Vol. 42, 2003, pp.321-344, http://www.sjsu.edu/stringham/docs/Stringham.2003.QREF.Amsterdam.pdf.
30. Donald MacKenzie, "An Equation and its Worlds: Bricolage, Exemplars, Disunity and Performativity in Financial Economics", *Social Studies of Science*, Vol. 33, No. 6 (2003), pp.831–868, p.836.
31. Donald MacKenzie, *An Engine, Not a Camera: How Financial Models Shape Markets*, Massachusetts Institute of Technology Press, 2006, p.144.
    When first proposed, in the late 1960s, the idea of an options exchange idea faced considerable hostility from established traders and officials at the US Securities and Exchange Commission, the then chairman comparing options to "marijuana and Thalidomide".
32. Ibid., p.142.
33. John Eatwell and Lance Taylor, *Global Finance at Risk*, Polity Press, 2000.
34. Dick Bryan and Michael Rafferty, "Financial Derivatives and the Theory of Money", *Economy and Society*, Vol. 36, No. 1, 2007, pp.134-158, p.140.
35. Jeffrey Frankel and Nouriel Roubini, "The Role of Industrial Country Policies in Emerging Market Crises", NBER Working Paper 8634 (2001), p.6.
36. Robert Wade, "Choking the South: World Finance and Underdevelopment", *New Left Review*, No. 38, March-April 2006.
37. Edward LiPuma and Benjamin Lee, *Financial Derivatives and the Globalisation of Risk*, Duke University Press, 2004, pp.20-21.
38. Michael Pryke, "Geomoney: An Option on Frost, Going Long on Clouds", *Geoforum*, Vol. 38 (2007), pp.576-588, p.583.
39. That is, dealers of both collect premiums for promising to make payouts if certain things happen. For example, customers can buy a call option on a stock that gives them the right to buy the stock at $50 per share in one month's time. Instead of immediately paying $50 and receiving a share of the stock, they might pay $0.70 today for this right. If the stock increases in price to $75 in a month's time, they can exercise the option and sell the stock in the open market, locking in a profit.
40. Edward LiPuma and Benjamin Lee, *Financial Derivatives and the Globalisation of Risk*, Duke University Press, 2004, p.21.
41. Alfred Steinherr, *Derivatives: The Wild Beast of Finance*,Wiley, 1998, p.101, quoted in Edward LiPuma and Benjamin Lee, *Financial Derivatives and the Globalisation of Risk*, Duke University Press, 2004, p.81.
42. Although many economists refer to this development simply as the "privatisation of risk," this paper attempts to avoid what has become an indiscriminate use of the R-word in favour of another inadequate shorthand, "uncertainty". This is in the hope that using a less familiar word – and one which, since Frank Knight, has often been contrasted with "risk" – may help problematise a concept the scale of whose metamorphosis over the past 35 years has often been underappreciated.
43. Gillian Tett, *Fool's Gold: How Unrestrained Greed Corrupted a Dream, Shattered Global Markets and Unleashed a Catastrophe*, Little, Brown, 2009, pp.54-8.
44. Costas Lapavitsas, "Information and Trust as Aspects of Credit", *Economy and Society* Vol. 36, 2007, p.416.
45. Martin Wolf, "Perilous Incentives," *Financial Times*, 26 June 2009.
46. Many people became indebted not just because reputable institutions encouraged them to pay for purchases on credit, but also because they had few alternatives given progressively lower wages. *See* Costas Lapavitsas, "The Financial Crisis Of 2007-8: Why And What Next?", presentation at "A coherent civil society response to the financial crisis", 28 October 2008, London, seminar organised by Bretton Woods Project, http://www.engagemedia.org/Members/zoe/videos/costas.mp4/view, at 8:26. *See also* seminar report: http://www.brettonwoodsproject.org/art.shtml?x=562842#backgroundpprs.
47. "Giving Credit Where It Is Due", *The Economist*, 8 November 2008.
48. John Eatwell and Lance Taylor, *Global Finance at Risk*, Polity Press, 2000, p.54.
49. Keith Hart, *Money in an Age of Inequality,* Texere, 2001, pp.161-2.
50. Gillian Tett, *Fool's Gold: How Unrestrained Greed Corrupted a Dream, Shattered Global Markets and Unleashed a Catastrophe*, Little, Brown, 2009, p.14.
51. Edward LiPuma and Benjamin Lee, *Financial Derivatives and the Globalisation of Risk*, Duke University Press, 2004, p.21.
52. Nasser Saber, "Speculative Capital: The Upper Hand", *Institutional Investor's Alpha*, July/August 2007, http://www.alphamagazine.com/article.aspx?articleID=1396902.
53. Ibid.
54. Edward LiPuma and Benjamin Lee, *Financial Derivatives and the Globalisation of Risk*, Duke University Press, 2004, pp.21-22, 38.
55. *See*, for example, Transnational Institute, Casino Crash website: http://casinocrash.org.
56. Attributing the current financial crisis to the

"casino economy" in fact legitimates the new uncertainty markets by suggesting that they can be regulated in the way that casinos are regulated. *See also* Rebecca Cassidy, "'Casino Capitalism' and the Financial Crisis", *Anthropology Today*, Vol. 25, No. 4, August 2009, pp.10-13.

57. Bank of International Settlements, *Quarterly Review*, December 2008, statistical annex, p. A103.

    The actual value these derivatives would have brought if sold in 2007, rather than their theoretical value when trades come due in the future, is much less, but still estimated as approximately equivalent to the entire economic output of the United States (Bank of International Settlements, *Triennial Central Bank Survey of Foreign Exchange and Derivatives Market Activity in 2007 – Final results*, p. 3; International Monetary Fund, *World Economic Outlook*, October 2007).

58. Quoted in Richard Bookstaber, *A Demon of Our Own Design: Markets, Hedge Funds and the Perils of Financial Innovation*, Wiley, 2007, p.112.

59. Matthew Philips, "The Monster that Ate Wall Street," *Newsweek*, 6 October 2008:

    "For example, Lehman Brothers had itself made more than $700 billion worth of swaps, and many of them were backed by AIG. And when mortgage-backed securities started going bad, AIG had to make good on billions of dollars of credit default swaps. Soon it became clear it wasn't going to be able to cover its losses . . . The reason the federal government stepped in and bailed out AIG was that the insurer was something of a last backstop in the CDS market. While banks and hedge funds were playing both sides of the CDS business—buying and trading them and thus offsetting whatever losses they took—AIG was simply providing the swaps and holding onto them. Had it been allowed to default, everyone who'd bought a CDS contract from the company would have suffered huge losses in the value of the insurance contracts they had purchased, causing them their own credit problems."

    See also Tim Rayment, "Joseph Cassano: The Man with the Trillion-Dollar Price on his Head,", London *Sunday Times*, 17 May 2009.

60. Gillian Tett, *Fool's Gold: How Unrestrained Greed Corrupted a Dream, Shattered Global Markets and Unleashed a Catastrophe*, Little, Brown, 2009, pp.149-50, 160-63.

61. Charles Kindleberger and Robert Aliber, *Manias, Panics and Crashes: A History of Financial Crises*, Fifth Edition, Wiley, 2005, p.100.

62. Nicholas Hildyard, "A (Crumbling) Wall of Money: Financial Bricolage, Derivatives and Power", *Corner House Briefing 39*, The Corner House, October 2008, http://www.thecornerhouse.org.uk/pdf/briefing/39wallmoney.pdf.

63. Edward Robinson, "Empire of the Quants", *Bloomberg Markets*, February 2007, pp.37-46.

64. Richard Bookstaber, *A Demon of Our Own Design: Markets, Hedge Funds and the Perils of Financial Innovation*, Wiley, 2007, pp.233 ff.

65. Edward LiPuma and Benjamin Lee, *Financial Derivatives and the Globalisation of Risk*, Duke University Press, 2004, pp.21-22.

66. Nasser Saber, "Speculative Capital: The Upper Hand", *Institutional Investor's Alpha*, July/August 2007, p.41, http://www.alphamagazine.com/article.aspx?articleID=1396902.

67. George Soros, *The New Paradigm for Financial Markets: The Credit Crisis of 2008 and What It Means*, Public Affairs, 2008, p.115.

68. Gillian Tett, *Fool's Gold: How Unrestrained Greed Corrupted a Dream, Shattered Global Markets and Unleashed a Catastrophe*, Little, Brown, 2009, p.56.

69. Ibid., p.145.

70. Margaret Atwood, *Payback: Debt and the Shadow Side of Wealth*, Bloomsbury, 2009, p.8.

71. Ben Funnell, "Debt is Capitalism's Dirty Little Secret", *Financial Times*, 30 June 2009.

72. Nicholas Hildyard, "A (Crumbling) Wall of Money: Financial Bricolage, Derivatives and Power", *Corner House Briefing 39*, The Corner House, October 2008, http://www.thecornerhouse.org.uk/pdf/briefing/39wallmoney.pdf.

73. George Soros, *The New Paradigm for Financial Markets: The Credit Crisis of 2008 and What It Means*, Public Affairs, 2008, p.91.

74. Dick Bryan and Michael Rafferty, "Financial Derivatives and the Theory of Money", *Economy and Society*, Vol. 36, No. 1, 2007, pp.134-158, p.35.

75. R. H. Tawney, "Against the Rentier and Financier", *in* Ismail Erturk, Julie Froud, Sukhdev Johal, Adam Leaver and Karel Williams (eds), *Financialisation At Work: Key Texts and Commentary,* Routledge, 2008, p.57.

76. Robin Blackburn, "Finance and the Fourth Dimension", *New Left Review* 39, May/June 2006, pp.39-70, http://www.newleftreview.org/?view=2616

77. Gillian Tett, *Fool's Gold: How Unrestrained Greed Corrupted a Dream, Shattered Global Markets and Unleashed a Catastrophe*, Little, Brown, 2009, p.81.

78. Ibid., p. 8.

79. There was an additional advantage to the process of isolation and differentiation of uncertainties, the International Monetary Fund insisted, using words that later took on an ironic cast: "Dispersion of credit risk by banks to a broader and more diverse set of investors, rather than warehousing such risk on their balance sheets, has helped to make the banking and overall financial system more resilient" (Ibid., p.179).

80. Thus the familiar joke about economists: A physicist, a chemist and an economist are stranded on a desert island. They have a can of beans. The physicist says, "let us build a catapult and break it open." The chemist says, "let us build a fire and heat it up until it breaks open (and the beans will even be cooked)." But the economist says, "no, no, no, you are making things too difficult. Let us assume that we have a can opener."

81. "First Draft of History", *The Economist* 27 June 2009, p.103.

82. Donald MacKenzie, *An Engine, Not a Camera: How Financial Models Shape Markets*, Massachusetts Institute of Technology Press, 2006, p.148.

83. Ibid., p. 149.

84. Even when the International Monetary Market was finally set up, Chicago trade Leo Melamed had to act as "a one-man enforcer" to get his associates to use it. It "takes planning, calculation, arm-twisting, and tenacity to get a market up and going," Melamed admitted. "Even when it's chugging along, it has to be cracked and pushed" (Ibid., p.173). As elsewhere, fields for *Homo economicus* to play on have to be constructed by beings belonging to another species. Compare Carol M. Rose, "Property as Storytelling: Perspectives from Game Theory, Narrative Theory, Feminist Theory", *Yale Journal of Law and the Humanities*, Vol. 2, No.1, 1990, pp.37-58. *See also* Carol M. Rose, *Property and Persuasion, Essays on the History, Theory and Rhetoric of Ownership*, Westview, 1994, http://www.law.yale.edu/documents/pdf/Property_and_Persuasion_Carol_M_Rose.pdf.

85. Donald Mackenzie, "Is Economics Performative? Option Theory and the Construction of Derivatives Markets", paper presented to the annual meeting of the History of Economics Society, Tacoma, WA, 25 June 2005, p.18.

86. One example was the merger of Citibank with Travelers Bank – which had earlier encompassed the broker Salomon Brothers – to produce Citigroup; another was Morgan Stanley's acquisition of Dean Witter.

87: The 1933 Glass-Steagall Act included banking reforms designed to control speculation, such as separating investment banking and commercial banking firms, and prohibiting banks from owning, underwriting or dealing in corporate stock and corporate bonds, particularly that of other financial companies.

88: The first building society was set up in England in 1774 and in Scotland in 1810; by 1910, there were 1,723 of them in the UK. They had flourished as a means of enabling working and middle-class people (mainly men) to save money to buy their own home; by the 1920s, building societies were the UK's main mortgage lenders. Similar to mutuals, thrifts, cooperatives, people's banks or community banks, building societies are essentially owned by their customers rather than third-party shareholders. Any profits tend to be either distributed to their customers or reinvested. Building societies are barred, however, from high-risk banking activities such as derivatives trading and are obliged to use their retail deposits to fund at last half of their new loans. The 1986 Building Soceity Act, introduced by Margaret Thatcher's government as part of the liberalisation of banking and financial services more generally, enabled building societies to turn themselves into public limited companies owned by third-party shareholders – to demutualise. Although only 10 of the 89 societies that existed in 1992 did so, they represented 70 per cent of the sector's assets, and soon became big, aggressive lenders. By 2008, however, all of them had been either taken over themselves or nationalised.

89. The top US mortgage originators responsible for nearly three-quarters of the subprime morgages issued in 2005-07 – most of which are now bankrupt – were mostly either owned or heavily financed by the US's largest banks, including Citigroup, Goldman Sachs, Wells Fargo, JPMorgan and Bank of America. *See* Edward Luce, "Biggest Subprime Lenders Spent $370m to Ward off Legislation", *Financial Times*, 6 May 2009, p.1; see also Gillian Tett, *Fool's Gold: How Unrestrained Greed Corrupted a Dream, Shattered Global Markets and Unleashed a Catastrophe*, Little, Brown, 2009, p.143.

90. "Interview with Nomi Prins", *Multinational Monitor*, Vol. 29, No. 3, November/December 2008, p.50. *See also* George Soros, *The New Paradigm for Financial Markets: The Credit Crisis of 2008 and What It Means*, Public Affairs, 2008, p.115.
91. John Eatwell and Lance Taylor, *Global Finance at Risk*, Polity Press, 2000, p.2.
92. Ibid., p.183.
93. Gerald A. Epstein (ed), *Financialisation and the World Economy*, Edward Elgar, 2005, p.3. http://www.peri.umass.edu/fileadmin/pdf/programs/globalization/financialization/chapter1.pdf.
94. Ben Fine, "Looking at the Crisis through Marx: Or Is It the Other Way about?", ms., 2008.
95. Robin Blackburn, "Finance and the Fourth Dimension", *New Left Review* 39, May/June 2006, pp.39-70, http://www.newleftreview.org/?view=2616.
96. Greta Krippner, "Accumulation and the Profits of Finance", *in* Ismail Erturk, Julie Froud, Sukhdev Johal, Adam Leaver and Karel Williams (eds), *Financialisation At Work: Key Texts and Commentary,* Routledge, 2008, p.195.
97. Martin Wolf, "Why It Is so Hard to Keep the Financial Sector Caged", *Financial Times*, 6 February 2008.
98. Robin Blackburn, "Finance and the Fourth Dimension", *New Left Review* 39, May/June 2006, pp.39-70, http://www.newleftreview.org/?view=2616.
99. Greta Krippner, "Accumulation and the Profits of Finance", *in* Ismail Erturk, Julie Froud, Sukhdev Johal, Adam Leaver and Karel Williams (eds), *Financialisation At Work: Key Texts and Commentary,* Routledge, 2008, p.195.
100. Ismail Erturk, Julie Froud, Sukhdev Johal, Adam Leaver and Karel Williams (eds), "Introduction", *Financialisation At Work: Key Texts and Commentary,* Routledge, 2008, p.12.
101. Kavaljit Singh, "Taking it Private: The Global Consequences of Private Equity", *Corner House Briefing 37*, The Corner House, October 2008, http://www.thecornerhouse.org.uk/pdf/briefing/37privateequity.pdf; Kavaljit Singh, "Sovereign Wealth Funds: Some Frequently-Asked Questions", *Corner House Briefing 38*, The Corner House, October 2008, http://www.thecornerhouse.org.uk/pdf/briefing/38SWFFAQs.pdf.
102. Gillian Tett, *Fool's Gold: How Unrestrained Greed Corrupted a Dream, Shattered Global Markets and Unleashed a Catastrophe*, Little, Brown, 2009, p.263.
103. Ibid.
104. Randy Martin, "The Financialisation of Everyday Life" *in* Ismail Erturk, Julie Froud, Sukhdev Johal, Adam Leaver and Karel Williams (eds), *Financialisation At Work: Key Texts and Commentary,* Routledge, 2008, p.252.
105. Quoted in Richard Swedberg, "Conflicts of Interest in the US Brokerage Industry", *in* Karen Knorr Cetina and Alex Preda, *The Sociology of Financial Markets,* Blackwell, 2005, pp.187-203, p.189.
106. Frank Partnoy, *Infectious Greed: How Deceit and Risk Corrupted the Financial Markets*, Times Books, 2003, pp.387-88, p.66. These findings, to make things worse, often depended on models that were hand-me-down versions of those used by the agencies' clients. *See also* George Soros, *The New Paradigm for Financial Markets: The Credit Crisis of 2008 and What It Means*, Public Affairs, 2008, pp.116-7.
107. Frank Partnoy, *Infectious Greed: How Deceit and Risk Corrupted the Financial Markets*, Times Books, 2003, p.119.
    One 2006 internal email from Standard & Poor's stated that "Rating agencies continue to create and [sic] even bigger monster — the CDO [collateralised debt obligation] market. Let's hope we are all wealthy and retired by the time this house of cards falters" (Bloomberg, "Moody's, S&P Employees Doubted Ratings, E-Mails Say", 22 October 2008).
108. Sam Jones, "Of Couples and Copulas", *Financial Times Weekend*, 25/26 April 2009, p.35.
109. Gillian Tett, *Fool's Gold: How Unrestrained Greed Corrupted a Dream, Shattered Global Markets and Unleashed a Catastrophe*, Little, Brown, 2009, p.162.
110. John Eatwell and Lance Taylor, *Global Finance at Risk*, Polity Press, 2000, p.191.
111. Robert Rubin was the US Treasury Secretary during the first (1993-1997) and second (1997-2001) Clinton administrations. Before his appointment, he had worked at Goldman Sachs for 26 years; after 2001, he worked with Citigroup. Hank Paulson was the Chair and Chief Executive Officer of Goldman Sachs before being appointed by George W Bush, Jr in 2006 as US Treasury Secretary.
112. The provisions of the WTO's General Agreement on Trade in Services (GATS) in general, and of GATS' Financial Services Agreement in particular, lock in a country's removal of domestic barriers to the movement of finance capital (ie. deregulation) and restrict subsequent government regulation of financial services. The US had committed itself in 1994 under GATS to remove such barriers; US financial interests therefore pushed for the Glass-Steagall Act to be revoked, arguing that the country needed to comply with its international undertakings.
113. For information on how ongoing WTO negotiations are continuing to push for countries to deregulate their financial services still further, *see* "End WTO Deregulation of Finance", Somo, 8 June, 2009, http://www.ourworldisnotforsale.org/en/report/end-wto-deregulation-finance-owinfs-financial-services-brief-1.
114. Justin Fox, *The Myth of the Rational Market,* Harper Business, 2009, pp.194-95.
115. Pablo Triana, *Lecturing Birds on Flying: Can Mathematical Theories Destroy the Financial Markets?* Wiley, 2009, p.84.
116. Stephen Gudeman, *Economy's Tension: The Dialectics of Community and Market*, Berghahn, 2008, p.141.
117. Nassim Nicholas Taleb, *The Black Swan: The Impact of the Highly Improbable*, Random House, 2007.
118. George Cooper, *The Origin of Financial Crises: Central Banks, Credit Bubbles and the Efficient Market Fallacy*, Harriman House, 2008, p.28.
119. Frank Knight, *Risk, Uncertainty and Profit*, Houghton Mifflin, 1921.
120. Ian Hacking, "The Looping Effect of Human Kinds" *in* Dan Sperber, David Premack and Ann James Premack (eds), *Causal Cognition: An Interdisciplinary Approach*, Oxford University Press, 1995, pp.351-383.
121. Whereas in "thin-tailed", "normal" or "bell curve" distributions, which are often used in financial models encouraging mass production of derivatives, deviant events are rare, in "fat-tailed" distributions the magnitude and frequency of deviant events are harder to foresee.
122. Sam Jones, "Of Couples and Copulas", *Financial Times Weekend*, 25/26 April 2009, p.35.
123. Ibid.
124. Pablo Triana, *Lecturing Birds on Flying: Can Mathematical Theories Destroy the Financial Markets?* Wiley, 2009, p.99.
125. *See* Donald MacKenzie, Fabian Muniesa and Lucia Siu (eds) *Do Economists Make Markets? On the Performativity of Economics*, Princeton, 2008; Donald MacKenzie, *Material Markets: How Economic Agents are Constructed*, Oxford University Press, 2009.
126. Donald MacKenzie, "Fear in the Markets", *London Review of Books*, 13 April 2000.
127. Donald MacKenzie, "An Equation and its Worlds: Bricolage, Exemplars, Disunity and Performativity in Financial Economics", *Social Studies of Science*, Vol. 33, No. 6 (2003), pp.831–868, p.836.
128. Gillian Tett, *Fool's Gold: How Unrestrained Greed Corrupted a Dream, Shattered Global Markets and Unleashed a Catastrophe*, Little, Brown, 2009, p.121.
129. Ibid.
130. Donald MacKenzie, "Fear in the Markets", *London Review of Books*, 13 April 2000;

    Boris Holzer and Yuval Millo, "From Risks to Second-Order Dangers in Financial Markets: Unintended Consequences of Risk-Management Systems", *New Political Economy*, Vol. 10, No. 2, 2005;

    Gillian Tett, "Volatility Wrecks Financial World's Value at Risk Models", *Financial Times*, 12 October 2007;

    Robin Blackburn, "The Subprime Crisis", *New Left Review*, No. 50, March/April 2008, pp.63-106, pp.89-90.
121. "In Plato's Cave", *The Economist*, Vol. 390, No. 8615, 24-30 January 2009, p.S14.
132. *See also* Donald MacKenzie, "Fear in the Markets", *London Review of Books*, 13 April 2000.
133. James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*, New Haven: Yale University Press, 1999, p.331.
134. Espen Gaarder Haug and Nassim Nicholas Taleb, "Why We Have Never Used the Black-Scholes-Merton Option Pricing Formula", 5th version, 26 February 2009, available on the Internet at http://ssrn.com/abstract=1012075. *See also* Pablo Triana, *Lecturing Birds on Flying: Can Mathematical Theories Destroy the Financial Markets?* Wiley, 2009, pp.199-201, 224-25.
135. Gillian Tett, *Fool's Gold: How Unrestrained Greed Corrupted a Dream, Shattered Global Markets and Unleashed a Catastrophe*, Little, Brown, 2009, p.155.
136. Jean-Philippe Bouchaud, "Economics Needs a Scientific Revolution", *Nature*, Vol. 455, 2008, p.1181.

137. "Value-at-Risk", Taleb and fellow trader Pablo Triana claim, "was to blame for the crisis": "When you see a quantitative "expert", shout for help, call for his disgrace, make him accountable. Do not let him hide behind the diffusion of responsibility. Ask for the drastic overhaul of business schools . . . Ask for the Nobel prize in economics to be withdrawn from the authors of these theories . . . Remove Value-at-Risk books from the shelves – quickly. Do not be afraid for your reputation. Please act now. Do not just walk by" (*Financial Times*, 7 December 2008).

138. Quoted in Pablo Triana, *Lecturing Birds on Flying: Can Mathematical Theories Destroy the Financial Markets?* Wiley, 2009, p.147.

See also Gillian Tett, *Fool's Gold: How Unrestrained Greed Corrupted a Dream, Shattered Global Markets and Unleashed a Catastrophe*, Little, Brown, 2009, p.39.

"It is inattention to the less quantifiable risks which leads to failure," note John Eatwell and Lance Taylor, *Global Finance at Risk*, Polity Press, 2000, pp.192-93.

139. George Cooper, *The Origin of Financial Crises: Central Banks, Credit Bubbles and the Efficient Market Fallacy*, Harriman House, 2008, p.147.

140. Ibid., pp.148-51.

141. George Soros, *The New Paradigm for Financial Markets: The Credit Crisis of 2008 and What It Means*, Public Affairs, 2008.

Echoing John Maynard Keynes, economists John Eatwell and Lance Taylor write that "prices in financial markets are determined by what average opinion believes average opinion believes those prices should be … The result is volatility and, given the worldwide interconnection of financial markets, contagion" (*Global Finance at Risk*, Polity Press, 2000, pp.208-09).

Thus, for example, in the 1920s, investment trusts bought stocks because they expected their price to go up, and because they bought them the price did go up, 32 per cent in the summer of 1929 alone (John Kenneth Galbraith, *Money: Whence It Came, Where it Went* Bantam, 1975, pp. 211-212).

Similarly, in the late 1970s, "the market price of gold was increasing because the market price of gold was increasing" (Charles Kindleberger and Robert Aliber, *Manias, Panics and Crashes: A History of Financial Crises*, Fifth Edition, Wiley, 2005, p.43).

From the point of view of prediction and calculation, the "distinguishing feature of reflexive processes is that they contain an element of uncertainty or indeterminacy" (George Soros, *The New Paradigm for Financial Markets: The Credit Crisis of 2008 and What It Means*, Public Affairs, 2008, p.71).

See also George Cooper, *The Origin of Financial Crises: Central Banks, Credit Bubbles and the Efficient Market Fallacy*, Harriman House, 2008.

142. Satyajit Das, *Traders, Guns and Money: Knowns and Unknowns in the Dazzling World of Derivatives*, Financial Times/Prentice Hall, 2006, p.177. Noted Columbia University economist Edmund Phelps: "The requirements for information … have gone beyond our abilities to gather it" (quoted in "In Plato's Cave", *The Economist*, Vol. 390, No. 8615, 24-30 January 2009, p.S14).

143. J. D. A. Wiseman, *Pricing Money: A Beginner's Guide to Money, Bonds, Futures and Swaps*, Wiley, 2001, p.101.

144. John Eatwell and Lance Taylor, *Global Finance at Risk*, Polity Press, 2000, p.188. *See also* Richard Bookstaber, *A Demon of Our Own Design: Markets, Hedge Funds and the Perils of Financial Innovation*, Wiley, 2007.

145. Gillian Tett, *Fool's Gold: How Unrestrained Greed Corrupted a Dream, Shattered Global Markets and Unleashed a Catastrophe*, Little, Brown, 2009, p.86.

146. Ibid., p. 185.

147. Richard Bookstaber, *A Demon of Our Own Design: Markets, Hedge Funds and the Perils of Financial Innovation*, Wiley, 2007, p.260

148. Gary Stix, "A Calculus of Risk", *Scientific American*, May 1998, p.97.

149. Richard Bookstaber, *A Demon of Our Own Design: Markets, Hedge Funds and the Perils of Financial Innovation*, Wiley, 2007, p.259.

150. Ibid., p.240.

151. Ibid., p.260.

152. This formulation, one of dozens, comes from Larry Fink of Blackrock, speaking on the *Financial Times* video "The Future of Capitalism: The New York Panel Part 1", 1 April 2009, available at http://www.ft.com/cms/3cf2381c-c064-11dd-9559-000077b07658.html. For more examples, *see* Pablo Triana, *Lecturing Birds on Flying: Can Mathematical Theories Destroy the Financial Markets?* Wiley, 2009.

153. "The Holes in Black-Scholes," *Risk*, Vol. 1, No. 4, 1988, pp.30-33; "How to Use the Holes in Black-Scholes", *Journal of Applied Corporate Finance*, Vol. 1, No. 4, 1989, pp.67-73.

154. George Cooper, *The Origin of Financial Crises: Central Banks, Credit Bubbles and the Efficient Market Fallacy*, Harriman House, 2008, p.11.

155. Benoit Mandelbrot, "A Multifractal Walk down Wall Street", *Scientific American*, February 1999, p.70.

156. "In Plato's Cave", *The Economist*, Vol. 390, No. 8615, 24-30 January 2009, p.13: "Now that the world has moved behond any of the scenarios modeled for collateralised debt obligations, investors' quantitative grasp of the payouts has fizzled into blank uncertainty."

157. Gillian Tett, *Fool's Gold: How Unrestrained Greed Corrupted a Dream, Shattered Global Markets and Unleashed a Catastrophe*, Little, Brown, 2009, p.154.

158. Milton Friedman, *Essays in Positive Economics*, University of Chicago Press, 1953.

159. The doctrine that there exists something called "price discovery" (in a sense distinguishable from price invention) is seldom questioned.

160. *See*, for example, Kern Alexander, Rahul Dhumale and John Eatwell, *Global Governance of Financial Systems: The International Regulation of Systemic Risk*, Oxford University Press, 2005, who claim that "systemic risk is a negative externality that imposes costs on society at large because financial firms fail to price into their speculative activities the full costs associated with their risky behavior" (p.24) and that the "health of the global financial system has been undermined by the mispricing of risk in financial markets" (p.32).

161. Timothy Mitchell, *Rule of Experts: Egypt, Technopolitics, Modernity*, University of California Press, 2002.

162. Pablo Triana, *Lecturing Birds on Flying: Can Mathematical Theories Destroy the Financial Markets?* Wiley, 2009, p.245.

163. James C. Scott's seminal *Seeing like a State,* Yale University Press, 1999, although it focuses on the "high modernism" of 20th-century states rather than on financial or other markets, is the crucial reference on simplification in the sense used here.

164. *See* Ricardo Carrere and Larry Lohmann, *Pulping the South: Industrial Tree Plantations and the World Paper Economy*, Zed Books, 1996.

165. Nassim Nicholas Taleb, *Fooled by Randomness: The Hidden Role of Chance in Life and in the Market***,** Penguin, 2007; John Kay, *The Long and the Short of It: Finance and Investment for Normally Intelligent People who are not in the Industry,* Erasmus Press, 2009.

Hedge fund managers who are happy to expose themselves to Taleb distributions, in which frequent small gains are punctuated by infrequent but catastrophically large losses, are analogues of the extraordinary fictitious farmers imagined by economist Ronald Coase (the grandfather of pollution trading) for whom it was a "matter of indifference" whether they were able to till the land and harvest crops or not, as long as they received the market price for the crops that could have been grown on the land. *See* Ronald Coase, *The Firm, the Market and the Law*, University of Chicago Press, 1990, p.140.

166. John Kay, *The Long and the Short of It: Finance and Investment for Normally Intelligent People who are not in the Industry,* Erasmus Press, 2009, p.xi.

167. Ibid.

168. Martin Wolf, "Reform of Regulation Has to Start by Altering Incentives", *Financial Times*, 24 June 2009. *See also* Lucian Bebchuk and Holger Spamann, "Regulating Bankers' Pay", *Harvard Law and Economics Discussion Pape*r No. 641, May 2009.

169. Editorial, *Environmental Data Services Report* 354, July 2004, p.3.

170. Larry Lohmann (ed), *Carbon Trading: A Critical Conversation on Climate Change, Privatisation and Power,* Dag Hammarskjold Foundation, 2006, http://www.thecornerhouse.org.uk/pdf/document/carbonDDlow.pdf.

171. Jeff Goodell, "Capital Pollution Solution?", *New York Times Magazine*, 30 July 2006.

172. Richard L. Sandor and Howard B. Sosin, "Inventive Activity in Futures Markets: A Case Study of the Development of the First Interest Rate Futures Market" *in* Manfred E. Streit (ed), *Futures Markets: Modeling, Managing and Monitoring Futures Trading*, Blackwell, 1983, pp.255-272.

173. Robert O'Harrow Jr. and Brady Dennis, "The Beautiful Machine", *Washington Post*, 29 December 2008. *See also* Michael Lewis, "The Man who Crashed the World," *Vanity Fair*, August 2009, http://www.vanityfair.com/politics/features/2009/08/aig200908.

174. "AIG Withdraws from US Climate Action

Partnership", *Dow Jones Newswire*, 6 Feburary 2009.

175. *See*, for instance, Terra Global Capital website, http://terraglobalcapital.com/About.htm.

176. Janet Redman, *World Bank: Climate Profiteer,* Institute for Policy Studies, April 2008, http://www.ips-dc.org/reports/world_bank_climate_profiteer.

177. Matt Taibbi, "The Great American Bubble Machine", *Rolling Stone*, Issue 1082-1083, 2009.

178. Goldman Sachs is also partnering with academic and non-government organisations such as Resources for the Future, Woods Hole Research Center, the Prince's Rainforest Project and World Resources Institute to "examine and further market-based solutions to environmental challenges". *See* http://www2.goldmansachs.com/citizenship/environment/center-for-environmental-markets/index.html.

179. Caisse des Depots, "Carbon Investment Funds: The Influx of Private Capital", November 2007, http://www.caissedesdepots.fr/IMG/pdf_07-11_Mission_Climat_Research_Report_12_Carbon_Investment_Funds-2.pdf.

180. "Hedge Fund Firm Pure Capital Targets Carbon, Food", Reuters India, 18 June 2009, http://in.reuters.com/article/fundsNews/idINLI57389320090618.

181. Larry Lohmann, "Marketing and Making Carbon Dumps: Commodification, Calculation and Counterfactuals in Climate Change Mitigation", *Science as Culture*, Vol. 14, No. 3, 2005, pp.203-235; Larry Lohmann (ed), *Carbon Trading: A Critical Conversation on Climate Change, Privatisation and Power,* Dag Hammarskjold Foundation, 2006, http://www.thecornerhouse.org.uk/pdf/document/carbonDDlow.pdf.

182. Donald MacKenzie, "Making Things the Same: Gases, Emission Rights and the Politics of Carbon Markets", *Accounting, Organisations and Society*, Vol. 34, Nos. 3-4, 2009, pp.440-455.

183. The Clean Development Mechanism (CDM) is an arrangement under the Kyoto Protocol allowing industrialised countries committed to reducing their greenhouse gas emissions to invest in projects that claim to reduce emissions in Southern countries instead of reducing emissions in their own countries. An approved CDM project certifies that the supposed emissions reductions would not occur without the investment or the incentive provided by the carbon credits that the project sells.

184. *See*, for example, "'Even at a Conceptual Stage Indigenous Peoples Should be Involved': Interview with Victoria Tauli-Corpuz", *REDD-Monitor*, January 2009, http://www.redd-monitor.org/2009/01/13/even-at-a-conceptual-stage-indigenous-peoples-should-be-involved-interview-with-victoria-tauli-corpuz/.

185. *See,* for example, Jonas Monast, Jon Anda and Jim Profeta, "US Carbon Market Design: Regulating Emission Allowances as Financial Instruments", Duke University Nicholas Institute for Environmental Policy Solutions Working Paper, February 2009; Michelle Chan, "Subprime Carbon? Rethinking the World's Largest New Derivatives Market", Friends of the Earth, 2009, http://www.foe.org/subprime-carbon-testimony.

186. Tim Flannery, "Monstrous Carbuncle", *London Review of Books*, Vol. 27, No. 1, 2005.

187. Gregory C. Unruh, "Understanding Carbon Lock-In", *Energy Policy*, Vol. 28, 2000, p.817.

188. *See*, for example, Leo Panitch and Colin Leys, *Coming to Terms with Nature*, Socialist Register, 2007.

189. W. Brian Arthur, *Increasing Returns and Path Dependence in the Economy*, University of Michigan Press, 1994.

190. Steffen Kalbekken and Nathan Rive, "Why Delaying Climate Action is a Gamble", Centre for International Climate and Environmental Research, 2005, http://www.stabilisation2005.com/30_Steffen_Kallbekken.pdf.

191. Larry Lohmann (ed), *Carbon Trading: A Critical Conversation on Climate Change, Privatisation and Power,* Dag Hammarskjold Foundation, 2006, pp.101-121, http://www.thecornerhouse.org.uk/pdf/document/carbonDDlow.pdf.

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193. Larry Lohmann (ed), *Carbon Trading: A Critical Conversation on Climate Change, Privatisation and Power,* Dag Hammarskjold Foundation, 2006, pp.114, http://www.thecornerhouse.org.uk/pdf/document/carbonDDlow.pdf.

194. Brett M. Frischmann and Mark A. Lemley, "Spillovers", *Columbia Law Review* Vol. 107, 2006, p.257.

195. David M. Driesen, "Sustainable Development and Market Liberalism's Shotgun Wedding: Emissions Trading under the Kyoto Protocol", *Indiana Law Journal*, Vol. 83, No. 1, 2008, pp.21-69, p.56 and "Linkage and Multilevel Governance", *Duke Journal of Comparative and International Law* Vol. 19, No. 3, 2009, pp.389-411, p.408. *See also* David A. Malueg, "Emissions Credit Trading and the Incentive to Adopt New Pollution Abatement Technology", *Journal of Environmental Economics and Management*, Vol. 16, 1989, p.52.

196. Laurie Williams and Allan Zabel, "Climate Change Legislation – Urgent Plea for Enactment of Carbon Fees and Ban on New Coal-Fired Power Plants without Carbon Sequestration", open letter, 4 May 2008, http://www.carbonfees.org/home/.

197. Margaret R. Taylor, Edward L. Rubin and David A. Hounshell., "Regulation as the Mother of Invention: The Case of SO2 Control", *Law and Policy*, Vol. 27, 2005, pp.348–78.

198. Curtis A. Moore, "Marketing Failure: The Experience with Air Pollution Trading in the United States", Health and Clean Air, 2003, http://www.healthandcleanair.org/emissions/marketing_failure.pdf, p.24.

199. Richard A. Liroff , *Reforming Air Pollution Regulation: The Toil and Trouble of EPA's Bubble*, Conservation Foundation, 1986, p.100.

200. Curtis A. Moore, "Marketing Failure: The Experience with Air Pollution Trading in the United States", Health and Clean Air, 2003, http://www.healthandcleanair.org/emissions/marketing_failure.pdf or www.acidrain.org/AN2-04.htm, pp.7-8.
In the EU's 27 countries, sulphur dioxide emissions declined 72 per cent between 1990 and 2007 as a result of conventional regulation and technology standards, whereas in the US, the Acid Rain Program, with its cap and trade system, was able to achieve only a 43 per cent reduction. *See* US Environmental Protection Agency, "Clean Air Markets", 2009, http://www.epa.gov/airmarkets/progress/interactivemapping.html

201. David M. Driesen, "Sustainable Development and Market Liberalism's Shotgun Wedding: Emissions Trading under the Kyoto Protocol", *Indiana Law Journal*, Vol. 83, No. 1, 2008, p.62.

202. Ibid., pp.56-58.
Short-term cost-effectiveness has been increasingly at a premium in the post-1970s era of financialisation and "shareholder value"; compare, for example, the account of the large US corporation in John Kenneth Galbraith, *The New Industrial Estate,* Penguin, 1968, with that of Thomas O'Boyle, *At Any Cost: Jack Welch, General Electric and the Pursuit of Profit*, Vintage, 1998.

203. Gwyn Prins and Steve Rayner, "Time to Ditch Kyoto", *Nature*, Vol. 449, pp.973–975, p.974. *See also* http://www.wired.com/politics/law/magazine/16-10/sl_rayner. *See also* Jeffrey Sachs, "Technological Keys to Climate Protection", *Scientific American*, March 2008; "Still Needed: A Climate Plan", *Scientific American*, July 2009.

204. W. Brian Arthur, *Increasing Returns and Path Dependence in the Economy*, University of Michigan Press, 1994, p.27.
It is a historical irony that just as carbon trading was beginning to establish itself as a theoretical approach, Arthur and other economists were assembling a body of theory that contested the assumption that historical accidents and starting points were unimportant to economic outcomes, merely delivering the economy, through a series of negative feedbacks, to its inevitable equilibrium (p.11). Starting points, positive feedbacks and multiple equilibria, Arthur argued, were not marginal or negligible economic phenomena, but often central. Nowhere is this more so than in responses to climate change, where "locking in" new social and technological patterns is widely agreed to be crucial to overcoming a previously "locked-in" fossil fuel dependence.

205. John Donovan, "Shell Dumps Wind, Solar and Hydro Power in Favour of Biofuels", *The Guardian*, 19 March 2009.

206. Mark Z. Jacobson, "Review of Solutions to Global Warming, Air Pollution, and Energy Security", *Energy and Environmental Science*, Vol. 2, 2009, pp.148 – 173.

207. Tariq Banuri and Hans Opschoor, "Climate Change and Sustainable Development", United Nations Department of Economic and Social Affairs Working Paper No. 56, ST/ESA/2007/DWP/56, October, New York: United Nations, p.22.

208. J. Lovell, "Carbon Price is Poor Weapon against Climate Change", Reuters, 24 September 2007. *See also* Nicholas Stern, *The Economics of Climate Change: The Stern Review*, Cambridge University Press, 2007. For a less conventional perspective, *see* Daniel Buck, "The Ecological Question: Can Capitalism Prevail?" *in* Leo Panitch and Colin Leys, *Coming to Terms with Nature*, Socialist Register, 2007, pp.60-71.

209. Gwyn Prins and Steve Rayner, "Time to Ditch Kyoto", *Nature*, Vol. 449, pp.973–975, p.974.

210. Jeffrey Sachs, "Technological Keys to Climate Protection", *Scientific American*, March 2008.

211. I am grateful to Jane Williams of California Communities against Toxics for this information.

212: The American Clean Energy and Security Act is known after its authors, Representatives Henry Waxman of California and Edward Markey of Massachusetts.

213. Larry Lohmann (ed), *Carbon Trading: A Critical Conversation on Climate Change, Privatisation and Power,* Dag Hammarskjold Foundation, 2006, pp. 94-101, 187-190, http://www.thecornerhouse.org.uk/pdf/document/carbonDDlow.pdf; Ruth Greenspan Bell, "Market Failure", *Environmental Forum*, March/April 2006, pp. 28–33, http://www.weathervane.rff .org/p.28.

214. "Steve Rayner: Take Climate Change Seriously", *Wired*, 16 October 2008, http://www.wired.com/politics/law/magazine/16-10/sl_rayner.

215. "Polluting EU Power Firms to Reap Billions of Euros in Windfall Profits: WWF", *Point Carbon*, 7 April 2008.

216. *See*, for example, Axel Michaelowa and Sonja Butzengeiger, "EU Emissions Trading: Navigating between Scylla and Charybdis", *Climate Policy*, Vol. 5, 2005, pp.3-5; Michael Grubb, Michael Azar, Christian Persoon and U. Martin, "Allowance Allocation in the European Emissions Trading Scheme: A Commentary", *Climate Policy*, Vol. 5, 2005, pp.132-33.

217. Deutsche Bank, "The Long and Short of it: Power Sector Key to EUA & CER Prices", *Carbon Emissions Commodities Report*, London, 5 May 2009.

218. Paul Conlon, ESB International, presentation at *Environmental Finance* conference, London, October 2008.

219. Daphne Wysham, "Carbon Market Fundamentalism", *Multinational Monitor*, Vol 29, No. 3, November/December 2008.

220. United Kingdom Department for Business, Enterprise and Regulatory Reform, *UK Renewable Energy Strategy: Consultation Document 2008. Executive Summary*, UK Stationery Office, 2008, pp.20-1.

221. "Leaked Note Reveals UK's Renewables Angst", *Environmental Data Service Europe Daily* 2373, 15 August 2007.

222. European Commission, Proposal for a Directive of the European Parliament and of the Countil amending Directive 2003/87/EC to as to Improve and Extend the Greenhouse Gas Emission Allowance Trading System of the Community, Brussels COM 2008, 16 provisional, 23 January 2008.

223. Richard Toshiyuki Drury, Michael E Belliveau, J. Scott Kuhn and Shirpa Bansal, "Pollution Trading and Environmental Injustice: Los Angeles' Failed Experiment in Air Quality Policy", *Duke Environmental Law and Policy Forum*, Vol. 45, 1999, http://www.law.duke.edu/shell/cite.pl?9+Duke+Envtl.+L.+&+Pol%27y+F.+231.

224. United States Public Interest Research Group, *Pollution on the Rise: Local Trends in Power Plant Pollution*, US PIRG, 2005.

225. Fossil carbon transferred above ground cannot be locked away safely underground in the form of new deposits of coal, oil or gas, or in the form of carbonate rock, for millions of years. For human purposes, therefore, any mining of fossil fuels constitutes a permanent transfer of carbon from a below-ground geological system to an above-ground system in which biotic, physical, chemical, atmospheric and surface-geological processes interact.

226. In an unstable climate system, for instance, runaway feedback effects triggered by obscure factors such as the reduced capacity of warming oceans to absorb carbon dioxide are capable of radically altering even such symbols of unchangeability as the Indian monsoons. In the past, climate change has often been characterised by deterministic but unpredictable (or "chaotic") events and processes of extreme impact. As with similar events in the financial markets, these render problematic reliance on probabilistic bell curves and conventional "risk management", which assume that individual variation averages out and no single event is capable of changing overall trends. The quantist imperative of carbon credit accounting (driven by, among other things, policy and economic theory) is to enlist scientists in helping to reduce these "monsters" to (or frame them as) probabilities. Demand is strong for tidy clusters of "likeliest scenarios" to feed into economic or political models, complete with "probabilities" of, say, a 2 or 5 degree C temperature rise by 2100. This is necessary for credit accounting involving future biotic sequestration (Larry Lohmann, "Marketing and Making Carbon Dumps: Commodification, Calculation and Counterfactuals in Climate Change Mitigation", *Science as Culture*, Vol. 14, No. 3, 2005, pp.203-235), but also for accounting for carbon outcomes more generally, and for cost–benefit analysis of action on climate change.

227. Larry Lohmann, "Toward a Different Debate in Environmental Accounting: The Cases of Carbon and Cost-Benefit", *Accounting, Organisations and Society* Vol. 34, Issues 3-4, April/May 2009, pp.499–534; Stephen H. Schneider, "What is 'Dangerous' Climate Change?", *Nature*, vol. 411, 2001), pp.17–19; A. Grubler and N. Nakicenovic, "Identifying Dangers in an Uncertain Climate", *Nature*, Vol. 412, 2001, p.15R;J. Lempert and M. E. Schlesinger, "Climate-Change Strategy Needs to be Robust", *Nature*, Vol. 412, 2001, p. 375; Daniel Sarewitz, *Frontiers of Illusion: Science, Technology and the Politics of Progress*, Temple University Press, 1996.

The crash-fuelling tension in the financial markets between the imperatives of commodity calculation and the "safety-first" need for a robust, reslient system capable of accommodating unknowables of potential large impact is paralleled at all levels of the carbon markets. When faced with uncertainties and ignorance, for instance, carbon accountants tend to hedge their calculations toward the "conservative" side by adding a more or less arbitrary margin of, say, 25 per cent, or by looking for commensurable "hedges". Because events and processes of extreme impact, however unexpected, could overwhelm almost any margin or "hedge" likely to be added, many small farmers and indigenous peoples, on the other hand, especially in the global South, tend where possible to value resilience and "safety first" practices over probabilistic calculations of gain and loss or arbitrary, numerical "safety margins" as ways of handling unknowns. *See*, for example, James C. Scott, *The Moral Economy of the Peasant,* Yale University Press, 1976;E. P. Thompson, *Customs in Common: Studies in Traditional Popular Culture,* New Press, 1990; John Berger, *Pig Earth,* Pantheon, 1979;cf. Samuel Popkin, *The Rational Peasant,* University of California Press, 1979.

228. Martin L. Weitzman, "On Modeling and Interpreting the Economics of Catastrophic Climate Change", *The Review of Economics and Statistics*, vol. 91, no. 1, 2009, pp.1-19, http://www.economics.harvard.edu/faculty/weitzman/files/REStat FINAL.pdf.

"Standard approaches to modeling the economics of climate change (even those that purport to treat risk by Monte Carlo simulations) very likely fail to account adequately for the implications of large impacts with small probabilities. From inductive experience alone, one cannot acquire sufficiently accurate information about the probabilities of extreme tail disasters to prevent the expected marginal utility of an extra unit of consumption from becoming infinite for any utility function with relative risk aversion everywhere bounded above zero. . . It is difficult to imagine what [temperature rises of 10 or 20 C] might mean for life on earth, but such high temperatures have not been seen for hundreds of millions of years and such a rate of change over a few centuries would be unprecedented even on a time scale of billions of years. Global average warming of 10 C- 20 C masks tremendous local and seasonal variation, which can be expected to produce temperature increases much greater than this at particular times in particular places. Because these hypothetical temperature changes would be geologically instantaneous, they would effectively destroy planet Earth as we know it. At a minimum such temperatures would trigger mass species extinctions and biosphere ecosystem disintegration matching or exceeding the immense planetary die-offs associated in Earth's history with a handful of previous geo-environmental mega-catastrophes. There exist some truly terrifying consequences of mean temperature increases of 10 C – 20 C, such as: disintegration of the Greenland and at least the Western part of the Antarctic ice sheets with dramatic raising of sea level by perhaps 30 meters or so, critically-important changes in ocean heat transport systems associated with thermohaline circulations, complete disruption of weather, moisture and precipitation patterns at every planetary scale, highly consequential geographic changes in freshwater availability, regional desertification – and so forth and so on … the more speculative and fuzzy are the tiny tail probabilities of extreme events, the less ignorable and the more serious is the impact on present discounted expected utility for a risk-averse agent."

229. Larry Lohmann, "Marketing and Making Carbon Dumps: Commodification, Calculation and Counterfactuals in Climate Change Mitigation", *Science as Culture*, Vol. 14, No. 3, 2005, p.207.

230. *See*, for example, Robert Hahn and Robert Stavins, "Trading in Greenhouse Permits: A Critical Examination of Design and Implementation Issues", *in* H. Lee (ed),

Shaping National Responses to Climate Change, Island Press, 1995, p.203.

231. Kevin Smith, *The Carbon Neutral Myth: Offset Indulgences for your Climate Sins,* Carbon Trade Watch, 2007.

232. Robin Lancaster, "Mitigating Circumstances", *Trading Carbon*, December 2007.

233. Donald MacKenzie, "Making Things the Same: Gases, Emission Rights and the Politics of Carbon Markets", *Accounting, Organisations and Society*, Vol. 34, Nos. 3-4, 2009, pp.440-455.

234. P. M. Forster, V. Ramaswamy et al., "Changes in Atmospheric Constituents and in Radiative Forcing" *in* S. Solomon, D. Qin, M. Manning et al. (eds) *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, 2007.

235. Additional problems with multi-gases are mentioned by Michael Wara, "Is the Global Carbon Market Working?", *Nature*, Vol. 445m, 2007, pp.595–596.

236. Kevin Anderson, testimony before the Parliamentary Environmental Audit Committee, 23 June 2009, http://www.parliamentlive.tv/Main/Player.aspx?meetingId=4388.

237. Mark C. Trexler, Derek J. Broekhoff and Laura H. Kosloff, "A Statistically Driven Approach to Offset-Based GHG Additionality Determinations: What Can We Learn?", *Sustainable Development and Policy Journal*, Vol. 6, 2006, p.30.

238. Carolyn Fischer, "Project-Based Mechanisms for Emissions Reductions: Balancing Trade-Offs with Baselines", *Energy Policy*, Vol. 33, No. 14, 2005, pp.1807–1823, p.1807. *See also:* Barbara Haya, *Failed Mechanism: How the CDM is Subsidizing Hydro Developers and Harming the Kyoto Protocol*, International Rivers, 2007, http://www.internationalrivers.org/files/Failed_Mechanism_3.pdf, p.9; Larry Lohmann (ed), *Carbon Trading: A Critical Conversation on Climate Change, Privatisation and Power,* Dag Hammarskjold Foundation, 2006, http://www.thecornerhouse.org.uk/pdf/document/carbonDDlow.pdf, pp.145-152; Larry Lohmann, "Toward a Different Debate in Environmental Accounting: The Cases of Carbon and Cost-Benefit", *Accounting, Organisations and Society* Vol. 34, Issues 3-4, April/May 2009, pp.499–534.

239. Dan Welch, "A Buyer' Guide to Offsets", *Ethical Consumer*, No. 106, 2007.

240. FERN, "Reducing Emissions or Playing with Numbers?", *EU Forest Watch*, March 2009, p. 1. http://www.fern.org/media/documents/document_4362_4368.pdf; Point Carbon, *CDM and JI Monitor* Vol. 6, No. 1, 9 January 2008; European Commission, "Emission Trading System", http://ec.europa.eu/environment/climat/emission/ets_post2012_en.htm and http://europa.eu/rapidpressReleasesAction.do?reference=MEMO/08796&format=HTML&aged=0&language=EN&guiLanguage=en.

241. International Rivers, "Waxman-Markey Bill: No Cuts Until 2026!", http://www.internationalrivers.org/node/4223.

242. Alex Padilla, Letter to Commissioner Timothy Simon, California Public Utilities Commission, 19 February 2008.

Branding carbon trading a "charade to continue business as usual", environmental justice groups in the state accordingly do not hesitate to affirm solidarity "with communities around the world in opposition to carbon trading and offset use and the continued overreliance on fossil fuels." *See* "The California Environmental Justice Movement's Declaration against the Use of Carbon Trading Schemes to Address Climate Change", http://www.ejmatters.org, 19 February 2008 and *Los Angeles Times*, 20 February 2008. Many California renewable energy developers are "critical of cap and trade, due to the volatility and uncertainty of carbon prices under cap and trade, which they point to as unreliable when it comes to planning, developing, and financing renewable energy projects" (Jose Carmona, The Verde Group, personal communication).

243. In a parallel with financial engineering, the more the drive to make everything calculable is indulged, the more that the more significant factors relating to systemic instability – in this case climatic instability – tend to be slighted.

244. United Nations Environment Programme Risoe Centre on Energy, Climate and Sustainable Development, *CDM Pipeline*, 1 December 2008, http://www.cdmpipeline.org/. *See also* Emily Boyd et al., "The Clean Development Mechanism: An Assessment of Current Practice and Future Approaches to Policy," *Working Paper No. 114*, Tyndall Centre for Climate Change Research, 2007.

245. *See*, for example, Barbara Haya, *Failed Mechanism: How the CDM is Subsidizing Hydro Developers and Harming the Kyoto Protocol*, International Rivers, 2007, http://www.internationalrivers.org/files/Failed_Mechanism_3.pdf, p.9.

246. Tamra Gilbertson, "The Offsets Market in India: Confronting Carbon Colonialism", Carbon Trade Watch, http://www.carbontradewatch.org/index.php?option=com_content&task=view&id=42&Itemid=45.

247. Energy companies are already strategising informally about how to manage resistance to geosequestration, and a new term, "NUMBY syndrome" – "Not Under My Back Yard" – has recently been coined.

248. Guy Turner, New Carbon Finance, speaking at a European Commission meeting Brussels, in June 2007.

The Clean Development Mechanism (CDM) is one of the "flexible mechanisms" in the Kyoto Protocol allowing industrialised countries to meet their reductions targets by purchasing emission reductions credits from elsewhere.

249. *See*, for example, "PNG Carbon Chief Suspended", *Point Carbon*, 1 July 2009, http://www.pointcarbon.com/news/1.1150782.

250. Larry Lohmann, "Democracy or Carbocracy? Intellectual Corruption and the Future of the Climate Debate", *Corner House Briefing 24,* The Corner House, October 2001, http://www.thecornerhouse.org.uk/pdf/briefing/24carboc.pdf, pp. 36-44; Larry Lohmann, "Toward a Different Debate in Environmental Accounting: The Cases of Carbon and Cost-Benefit", *Accounting, Organisations and Society* Vol. 34, Issues 3-4, April/May 2009, pp.499–534.

251. At first, forestry specialists imagined that they could measure precisely the amount of carbon a plantation project, say, was fixing, and therefore, the volume of pollution rights it could generate, simply by doing periodic measurements of tree growth, gas transfer in the canopy, and so forth. But it quickly became clear that quantifying the climatic impact of such projects would also necessitate investigating their effect on soils' carbon production both inside plantation boundaries and downstream, requiring the hiring of additional experts.

At the same time, sobering evidence emerged that error bars in such relatively simple matters as forest inventories and physical fluxes of carbon into and out of forests were so wide that they swamped the signal required for the establishment of a biotic carbon market. Unknowns concerning the response of soil biology and chemistry to global warming itself also became a significant consideration.

Moreover, in order to complete their calculations, accountants realised, they would have to monitor the effects of plantations on the human groups displaced or otherwise affected. For example, communities evicted by carbon plantations might clear forests elsewhere, migrate to cities where they might adopt lifestyles with a different carbon budget, and so on. Due to the persistence of greenhouse gases in the atmosphere, the activities of such groups would have to be monitored over a significant time period (between 42 and 150 years) whose length itself was a contested issue.

In formulating a counterfactual baseline for carbon production without the project, accountants would also have to venture into economic predictions about trade patterns involving commodities produced on forest lands, such as soy, as well as predictions about future currency exchange rates. Not surprisingly, as such difficulties mounted, the very concept of "project boundary" became increasingly disputed within the community of sequestration experts – and with it the concepts of "carbon offset project" itself and the status of the experts who attempted to frame it.

252. *See*, for example, Sten Nilsson, A. Shvidenko, V. Stolbovoi et al., "Full Carbon Account for Russia", Interim Report IR-00-021, IIASA, 22 August 2000; M. Jonas, S. Nilsson, M. Obersteiner et al., "Verification Times Underlying the Kyoto Protocol: Global Benchmark Calculations", Interim Report IR-99-062, http://www.iiasa.ac.at, IIASA, 1 December 1999; Sten Nilsson, "Carbon Accounting and the Kyoto Protocol", *Options*, Autumn 2000, p.FOR-4.

253. Biochar seeks to scale up a little-understood ancient Amazonian burning practice that sequestered carbon in the soil in a mineral form. It is suggested that biochar might also produce gas and oil substitutes. Agrofuels are fuels produced by agribusinesses from plants.

254. Jeffrey Ball, "Up In Smoke: Two Carbon-Market Millionaires Take a Hit as UN Clamps Down – EcoSecurities Sees Shares Slide 70 Per Cent", *Wall Street Journal*, 14 April 2008.

255. United Nations Environment Programme, *CDM Pipeline.*

256. Larry Lohmann (ed), *Carbon Trading: A Critical Conversation on Climate Change, Privatisation and Power,* Dag

Hammarskjold Foundation, 2006, http://www.thecornerhouse.org.uk/pdf/document/carbonDDlow.pdf, p.147.

257. Ursula Schäfer-Preuss, Speech, Asian Development Bank, 2008, http://www.adb.org/Documents/Speeches/2008/ms2008014.asp.

258. "Indians Make Cool £300m in Carbon Farce", *Sunday Times* (London), 22 April 2007.

259. Larry Lohmann (ed), *Carbon Trading: A Critical Conversation on Climate Change, Privatisation and Power,* Dag Hammarskjold Foundation, 2006, http://www.thecornerhouse.org.uk/pdf/document/carbonDDlow.pdf, p.115.

260. Ibid., pp.272-280.

261. Anonymous, personal communication. For a reaction among renewable energy developers in industrialised countries, *see*, for example, Solarenergie Forderverein Deutschland eV (2009) "Unterschriften gegen den Handel mit Emissionszertifikaten". http://www.sfv.de/lokal/mails/wvf/e_unters.htm.

262. Michael Wara, "Is the Global Carbon Market Working?", *Nature*, Vol. 445, 2007, pp.595–596.

263. Michael Wara, "Is the Global Carbon Market Working?", *Nature*, Vol. 445, 2007, pp.595–596.

264. Jeffrey Ball, "French Firm Cashes In Under UN Warming Program", *Wall Street Journal*, 23 July 2008.

265. Michael W. Wara and David G. Victor, "A Realistic Policy on International Carbon Offsets", Program on Energy and Sustainable Development Working Paper No. 74, 2008, available at http://iis-db.stanford.edu/pubs/22157/WP74_final_final.pdf. *See also* Michael Wara, "Is the Global Carbon Market Working?", *Nature*, Vol. 445, 2007, pp. 595–596, and "Measuring the Clean Development Mechanism's Performance and Potential", *UCLA Law Review*, Vol. 55, 2008, p.1759.

266. In August 2007, the CDM Executive Board published forms for the submission of applications for a new type of carbon project called programmatic CDM or "programmes of activities" (PoA). A PoA, it stated, could be additional and thus acceptable as CDM even if a law already existed that mandated the measures that the PoA would bring about, if that law was not being "enforced as envisaged but rather depend[ed] on the CDM to enforce it", or if the PoA would "lead to a greater level of enforcement of the existing mandatory policy/regulation than would otherwise be the case" (Christina Figueres, "The CDM and Sustainable Development", *Environmental Finance*, December 2007, pp.S50–S51).

    Oil companies have also applied for carbon credits for not flaring natural gas in Nigeria, a prohibition already mandated by the environmental laws of that country. Just as norms of commons regimes have historically been partly supplanted in many places by prices, so too now are legal safeguards (Larry Lohmann (ed), *Carbon Trading: A Critical Conversation on Climate Change, Privatisation and Power,* Dag Hammarskjold Foundation, 2006, http://www.thecornerhouse.org.uk/pdf/document/carbonDDlow.pdf, p.148).

267. FASE et al., "Open Letter to Executives and Investors in the Prototype Carbon Fund", Espirito Santo, Brazil, 23 May 2003.

268. A. P. L. Suptitz et al., "Open Letter to the Clean Development Mechanism Executive Board", Minas Gerais, Brazil, 7 June 2004.

    Recent moves by the World Bank and other UN agencies to open up native forests to carbon accounting are similarly viewed as providing an opening for governments to threaten to destroy their forests if they are not granted carbon credits. *See*, for example, *World Rainforest Movement Bulletin*, December 2008.

269. Tamra Gilbertson, "The Offsets Market in India: Confronting Carbon Colonialism", Carbon Trade Watch, http://www.carbontradewatch.org/index.php?option=com_content&task=view&id=42&Itemid=45.

270. Axel Michaelowa and Katharina Michaelowa, "Does Climate Policy Promote Development?", *Climatic Change*, Vol. 84, 2007, pp.1–4, p.4.

271. Richard Bookstaber, *A Demon of Our Own Design: Markets, Hedge Funds and the Perils of Financial Innovation*, Wiley, 2007, p.260.

272. Gillian Tett, *Fool's Gold: How Unrestrained Greed Corrupted a Dream, Shattered Global Markets and Unleashed a Catastrophe*, Little, Brown, 2009, p.117.

273. Barbara Haya, *Failed Mechanism: How the CDM is Subsidizing Hydro Developers and Harming the Kyoto Protocol*, International Rivers, 2007, http://www.internationalrivers.org/files/Failed_Mechanism_3.pdf, p.9.

274. Channel 4 (UK), "Dispatches: The Great Carbon Smokescreen", 16 July 2007.

275. Ibid. *See also*: Central and Eastern Europe Bankwatch (CEE), *An Analysis of Additionality: The Prototype Carbon Fund's Joint Implementation Project in the Czech Republic: Sixteen Small Hydropower Plants*, CEE, 2005; O. P. R. Van Vliet, A. P. C. Faaij and C. Dieperink, "Forestry Projects under the Clean Development Mechanism", *Climatic Change*, Vol. 61, Nos. 1–2. 2003, pp.123–156, p.154; Axel Michaelava, "Climate Strategies: Empirical Analysis of Performance of CDM Projects," *Climate Strategies*, 2009; Lambert Schneider, "Is the CDM Fulfilling its Environmental and Sustainable Developent Objectives? An Evaluation of the CDM and Options for Improvement", Öko-Institut (for WorldWide Fund for Nature) 5 November 2007, http://www.oeko.de/oekodoc/622/2007-162-en.pdf?PHPSESSID=94fo81oejnnguh4svdjp2u0ug0.

276. Lambert Schneider, ibid.

277. Jeffrey Ball, "Pollution Credits Let Dumps Double Dip: Landfills Find New Revenue in Trading System Meant to Curb Greenhouse Emissions", *Wall Street Journal*, 20 October 2008.

278. *Financial Times*, 16 February 2005.

279. Lambert Schneider, presentation at conference on Review of the EU ETS, Brussels, 15 June 2007.

280. All regulation currently proposed for carbon markets assumes without evidence or argument that this the distinction between fraud and non-fraud can be made and enforced. Under the Kyoto Protocol, this assumption forms the basis of the work of the Clean Development Mechanism Executive Board. In the US, it is the unexamined assumption of, for example, the Emissions Allowance Market Transparency Act (S. 2423) proposed by Senator Dianne Feinstein, the Waxman-Markey Act, and the Climate Market Auction Trust and Trade Emissions Reduction System (HR 6316) introduced by Congressman Lloyd Doggett.

281. Achim Brunnengräber, "The Political Economy of the Kyoto Protocol", *Socialist Register 2007*, pp.224-25.

282. Tom Young, "UN Suspends Top CDM Project Verifier over Lax Audit Allegations", *Business Green*, 1 December 2008.

283. Michelle Chan, "Subprime Carbon? Rethinking the World's Largest New Derivatives Market", Friends of the Earth, 2009, http://www.foe.org/subprime-carbon-testimony.

    Carbon market participants such as Axel Michaelowa have been pointing out for some time possible parallels with, for example, the tulip bulb crash of the 17th century. *See* Axel Michaelowa, "Avoiding the Carbon Hangover", *Carbon Trading*, December 2007, pp.32–34. *See also* Matt Taibbi, "The Great American Bubble Machine", *Rolling Stone*, Issue 1082-1083, 2009.

284. Michael Grubb, P. Vrolijk et al., *The Kyoto Protocol: A Guide and Assessment*, Royal Institute for International Affairs, 1999, p.138.

285. Barbara Haya, *Failed Mechanism: How the CDM is Subsidizing Hydro Developers and Harming the Kyoto Protocol*, International Rivers, 2007, http://www.internationalrivers.org/files/Failed_Mechanism_3.pdf, p.9.

286. United States General Accounting Office, "International Climate Change Programs: Lessons Learned from the European Union's Emissions Trading Scheme and the Kyoto Protocol's Clean Development Mechanism", GAO Report GAO-09-151, November 2008, p.39.

287. Gillian Tett, *Fool's Gold: How Unrestrained Greed Corrupted a Dream, Shattered Global Markets and Unleashed a Catastrophe*, Little, Brown, 2009, p.46.

288. Chris Leeds, "Carbon Markets and Carbon Trading: Greener and More Profitable", presentation, 13 June 2008.

289. "CDM Market in Good Shape: Official", *Point Carbon*, 2 April 2008.

290. "Carbon Finance 2008", *Environmental Finance* Conference, 8-9 October 2008.

291. Marcel Braun, "The Evolution of Emissions Trading in the European Union – the Role of Policy Networks, Knowledge and Policy Entrepreneurs", *Accounting, Organisations and Society*, Vol. 34, Nos. 3-4, 2009.

292. "Carbon Finance 2008", *Environmental Finance* Conference, 8-9 October 2008.

293. S. Nicholls, "Interview with Hans-Juergen Stehr", *Environmental Finance*, December 2007, p.S42.

294. Jeffrey Ball, "Up In Smoke: Two Carbon-Market Millionaires Take a Hit as UN Clamps Down – EcoSecurities Sees Shares Slide 70 Per Cent", *Wall Street Journal*, 14 April 2008.

295. Fiona Harvey, "Carbon Credit Ratings Agency is Launched", *Financial Times*, 25 June 2008.

296. Stien Reklev, "Cowboys or Cavalry?", *Trading Carbon*, December 2007, pp.27–28.

Similarly, the International Emissions Trading Association has argued in a letter to US Senators Dianne Feinstein and Olympia Snowe, who had introduced a carbon market governance bill, that "[t]he market itself recognizes the importance of integrity and exerts discipline on participants . . . Trading companies set their own trading limits to guard against excessive speculation. The market itself punishes firms that exceed responsible limits by downgrading credit ratings, lowering lines of credit or barring individuals or firms from trading" (IETA letter to Sens. Feinstein and Snowe, 4 March 2008, http://www.ieta.org/ieta/www/pages/getfile.php?docID=2938).

297. Janet Redman, *World Bank: Climate Profiteer,* Institute for Policy Studies, April 2008, http://www.ips-dc.org/reports/world_bank_climate_profiteer.

298. Steven Pavett of the European organisation FERN estimates that 64 to 99 per cent of carbon trading is derivative trading, opening the door to widespread speculation. Short selling is also widespread in carbon markets. For example, when the current financial crisis hit, many corporations sold their permits to raise capital, hoping to buy back a smaller number of permits later, perhaps at a lower price. This can lead to self-reinforcing collapses in prices. The Chicago Climate Futures Exchange, a subsidiary of the Chicago Climate Exchange, already offers a futures contract based on emissions allowances under the anticipated US federal cap and trade scheme. *See* Susanna Twidale, "Neil Eckert", *Trading Carbon*, February 2009, p.14.

299. Madeleine M. L. Tan and Ronald S. Borod, "Why Limit the Asset Class?", *International Securitisation and Finance Report*, Vol. 10, No. 16, 2007, http://www.brownrudnick.com/nr/pdf/articles/REPRINT_International_Securitisation_and_Strucutred_Finance_Report_Why_Limit_the_Asset_Class_-_Energy_Tan_907.pdf.

300. Robin Kwong, "New Products and Players in Carbon Credit Market", *Financial Times*, 27 April 2008.

301. Satyajit Das, *Traders, Guns and Money: Knowns and Unknowns in the Dazzling World of Derivatives*, Financial Times/Prentice Hall, 2006.

This obscurity is deepened by the fact that the trend in the carbon markets is to conduct most trading over the counter rather than through exchanges. About 70 per cent of European Union Allowances, for example, are traded over the counter (*Point Carbon*, "Carbon 2008: Post 2012 is Now", 11 March 2008).

302. Michael Specter, "Big Foot", *New Yorker*, 25 February 2008; cf. Larry Lohmann, "Carbon Trading, Climate Justice and the Production of Ignorance: Ten Examples", *Development*, Vol. 51, No. 3, pp.359–365.

303. For an introduction to this literature, *see*, for example, James Fairhead and Melissa Leach, "False Forest History, Complicit Social Analysis: Rethinking some West African Environmental Narratives", *World Development,* Vol. 23, No. 6, 1995, pp.1023-35; Michael Dove, "Theories of Swidden Agriculture and the Political Economy of Ignorance", *Agroforestry Systems* Vol. 1, 1983, pp.95-103.

304. *See* Ismail Erturk, Julie Froud, Sukhdev Johal, Adam Leaver and Karel Williams (eds), *Financialisation At Work: Key Texts and Commentary,* Routledge, 2008.

305. Larry Lohmann (ed), *Carbon Trading: A Critical Conversation on Climate Change, Privatisation and Power,* Dag Hammarskjold Foundation, 2006, http://www.thecornerhouse.org.uk/pdf/document/carbonDDlow.pdf, p.196.

306. CAN/WWF/FoE Europe/Greenpeace, "ECCP EU ETS Review Process: Written Comments", Brussels, 2007.

307. "Debating Carbon", *Trading Carbon*, October 2008, pp.26-33, p.28.

308. Fiona Harvey, "Beware the Carbon Offsetting Cowboys", *Financial Times*, 26 April 2007.

309. Larry Lohmann, "Regulatory Challenges for Financial and Carbon Markets", *Carbon and Climate Law Review* Vol. 3, No. 2, 2009, pp.161-71; "Climate as Investment," *Development and Change* (forthcoming).

a time when financial markets overshadowed the productive economy. Private equity was invariably behind the multi-billion buyout deals, and mergers and acquisitions that swept across the US and Europe, creating a new type of corporate conglomerate that is reshaping the way business is conducted. Insofar as it constitutes a new form of corporate ownership, private equity poses new challenges because it has a significant and distinctive influence on taxation policy, corporate governance, labour rights and public services, and thus deeply affects society, human rights and environment alike. These challenges are especially clear in Asia, since the financial crisis has diminished the scope for the huge deals in Europe and North America.

Sovereign Wealth Funds: Some Frequently Asked Questions

by Kavaljit Singh

Western politicians, business leaders and commentators seem paranoid about state-owned sovereign wealth funds (SWFs), particularly those from the Middle East and China. They fear that SWFs follow strategic political objectives – investing in Western companies and banks to secure control of strategically important industries such as telecommunications, energy and banking – rather than commercial interests. A protectionist backlash against sovereign wealth funds has emerged: the US, Canada, Australia and Germany have introduced substantial legislative changes to screen and restrict investments by SWFs and other state-owned entities.

Are such fears based on facts or assumptions? Is the "invasion of sovereign wealth funds" real? Do SWFs pose a direct threat to financial stability? Do they have hidden agendas? Are SWFs driven by political considerations? Are governments really using SWFs to pursue nefarious foreign policy objectives? Should anyone be afraid of sovereign wealth funds? Are SWFs providing long-term investments and stability to ailing businesses and economies?

This briefing paper examines these questions in order to understand the potential impact and implications of sovereign wealth funds in a rapidly-changing global political economy.

Climate as Investment

by Larry Lohmann

The climate crisis and the credit crisis have made the political issues surrounding investment and finance more critical than ever before. Proposals for Green New Deals aimed at tackling both global warming and global recession are streaming forth worldwide. Yet many such proposals are incoherent in that they overlook the need for an immediate start to a programme of phasing out both fossil fuels and purported fossil fuel substitutes such as nuclear power and industrial-scale agrofuels. They also tend to rely on Northern-biased conceptions of technology transfer and intellectual property that the climate crisis has helped make obsolete. To overcome these problems, future climate movements will have to focus increasingly on the democratisation of research, planning and finance.

Neoliberalism and the Calculable World: The Rise of Carbon Trading

by Larry Lohmann

Various neoliberal movements of recent decades have invented new possibilities of accumulation by creating new objects of calculation and intensified commodification. Such movements include the derivatives markets responsible for the financial crisis; global intellectual property rights regimes; carbon markets; and attempts to transform health, health care and even biological species into measurable, tradeable commodities. Generating both profits and crisis, the ambitious abstraction and commensuration that are vital to such schemes can never be completed; contradictions are inherent in attempts to so so.

Unregulatability in Financial and Carbon Markets

by Larry Lohmann

Can the financial derivatives markets be regulated? Can the carbon markets be regulated? Regulatory responses inspired by neoclassical economics, which assume that any problems can be handled by "internalising externalities", are unlikely to succeed. A more pragmatic approach looks to decommodification in both markets, and has attracted support across the political spectrum.

Regulation as Corruption in the Carbon Offset Markets: Cowboys and Choirboys United

by Larry Lohmann

"No matter what the market, it will always be possible to regulate it." Really? In the real world, this is not a useful principle for constructive social action. In markets that cannot distinguish between fraud and non-fraud, that undermine the rule of law, and that are based on conflict of interest, attempts at regulation can be worse than useless. "Governance" itself becomes part of corruption. The carbon offset market is one such market; the market for complex credit derivatives another. Both of them indicate the need for new, more nuanced and practical approaches to issues of corruption and regulation.

Carbon Trading, Climate Justice and the Production of Ignorance

by Larry Lohmann

The idea that global warming can be addressed by turning unpriced greenhouse gas pollution dumps into a tradable, ownable commodity has helped mobilise neoclassical economics and development planning in new projects of dispossession, speculation, rent-seeking and the redistribution of wealth from poor to rich and from the future to the present. A central aspect of this process has been the creation of new domains of ignorance. This article cites ten processes of ignorance-creation facilitated by the new carbon markets. It then asks what the quest for climate justice becomes if it is incorporated into a carbon market framework.