

Re-establishing What Went Wrong Before: The Greenspan Put as Macroeconomic Modellers' New Normal

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Almost a decade after his retirement Alan Greenspan remains the world's most immediately recognisable and highest profile central banker. This article reviews Greenspan's ostensible move away from efficient markets theorising as he has tried to come to terms with the patterns of 'euphoria' and 'fear' he believes explain the build-up to the global financial crisis. In truth, though, it looks much more like an attempt to rescue the reputation of his free market models in the face of an increasing number of sceptics. Greenspan's new memoir fails to acknowledge what, in effect, was the free put option the Federal Reserve provided to Wall Street traders under his leadership. Indeed, it goes as far as to promote a visualisation technique for how macroeconomic modellers should view the basic structure of the market environment which treats the now increasingly infamous 'Greenspan put' as an ostensibly formal component of asset prices. The style of policy-making that helped to stoke such extreme asset price inflation prior to the crisis is now embedded: (i) within the class of models that Greenspan has presented as the post-crisis antidote to efficient markets theorising; and (ii) within the recent historical data being used in the calibration tests of the models' efficacy. What macroeconomic modellers can see in the market environment when embracing the supposedly new reality of euphoria and fear is a manifestation of what the prior existence of the Greenspan put first brought into view.

Introduction

There is an unwritten rule amongst the community of ex-central bankers not to criticise the actions of the present incumbent. However, former five-time Chair of the US Federal Reserve, Alan Greenspan, has taken this one step further. He continues to find it next to impossible to criticise his own policy decisions in the years leading up to the biggest combined credit, mortgage and banking market

crisis in world financial history. His recent memoir – *The Map and the Territory* (Greenspan, 2013a) – suggests that he has spent most of the post-crisis period trying to discover not why his free market fundamentalist beliefs were mistaken so much as why traders might ‘misbehave’ in a way that occasionally prevents his market models from becoming true. The book is written through the selective lens of the true believer. An addendum chapter to his earlier account of his time in public life – *The Age of Turbulence* (Greenspan, 2008) – has been fleshed out in an attempt to repair the standing of his free market ideology. He wants to believe so much that the global financial crisis was a statistically freak event unsettling an otherwise smoothly functioning market order that this represents the outer limits of what his reflections on the subject can tell him. Any other answer destroys the probabilistic reasoning on which his market-based macroeconomic models are founded.

If the new memoir is purchased on the expectation of encountering a genuine *mea culpa* moment then the reader will be left disappointed. No such cathartic revelation is forthcoming. This leaves fundamentally untackled the question of whether Greenspan’s own policy decisions must shoulder some of the blame for nurturing trading conditions that made more probable the eventual implosion of asset prices. It is unlikely, however, that anyone would have felt moved to ask such a thing in the first phase of biographical accounts of Greenspan’s time at the helm of the Federal Open Market Committee (FOMC). Bob Woodward’s (2000) eulogy to ‘The Maestro’ was maybe the most emblematic of what in general were routinely deferential nods to his sure handling of interest rates. From the time of his third reappointment in 2000, though, an increasingly sceptical attitude has taken hold, whereby it is now more common to say that the US economy flourished in the 1990s in spite of his policies rather than because of them. The ‘Roaring Nineties’, to use Joseph Stiglitz’s (2004) apt phrase, are now considered to be both an effect of Greenspan failing to recognise the bubbles he was blowing and a masking agent for the troubles being stored up for later (e.g., Canterbury, 2006, p. 98; Calverley, 2011, p. 57).

Viewed through this latter lens, Greenspan’s fingerprints are likely to have been all over the global financial crisis. Revisionist histories of his tenure at the Fed have tended to depict him as Wall Street’s champion-in-chief (Geisst, 2004, p. 371). He had, of course, come to public life from Wall Street, and by his own admission probably never truly shed the assumption that what was good for it was good *per se* (Greenspan, 2008, p. 77). It is always difficult to know when the gentle encouragement of extra profit-taking for financial firms becomes the full-

on blowing of an asset bubble, especially when that point is passed through in real time. There can be little doubt in retrospect, though, that the wolf that Greenspan was particularly eager to keep from the door of the US economy was one which served as a portent of doom for asset prices. One might be tempted to ask whether Greenspan ever truly believed the headline conclusion of his own self-confessed efficient markets theorising: namely, that financial prices should always already have incorporated the implications of both present and future knowledge (see Malkiel, 1999, p. 203). At the very least, whenever prices began to slide during his tenure at the Fed the FOMC provided market participants with new information about its willingness to intervene to reverse the prevailing price trajectory. No analogous interventionist process was established when prices were going up.

This willingness to consistently give financial firms what they wanted has come to be known in the critical central banking literature as the 'Greenspan put', so closely was he personally associated with this style of policy-making. The article now proceeds in three stages, which together attempt to add deeper insight into the way that particular classes of macroeconomic models appear to provide financial firms with a substantial subsidy. Overall the attempt is to shed light on the potential for corruption by the Greenspan put of the probabilistic macroeconomic models on which policy continues to be based in the post-crisis world. In section one I outline the main features of the classic operation of the Greenspan put before then moving on to show how asymmetrically favourable treatment of asset price inflation has found its way into the visualisation techniques used by macroeconomic modellers to make sense of economic policy options. Section two shows that it is no longer necessary to act simply to promote Wall Street interests for those interests to continue to be embedded in monetary policy, whilst section three reveals the political stance which is embedded in the Greenspan put mark two. As the argument develops I make much of the idea of a visualisation technique. This is the basic image of the economy that needs to be imprinted in the theorist's mind if the modelling process is to prove plausible. However, in telling the theorist what there is of interest to be seen in the world it also places alternative accounts of economic dynamics fundamentally out of sight. The probabilistic visualisation technique that continues to dominate macroeconomic modelling has been harnessed most obviously to the promotion of a pro-market worldview.

The Greenspan Put Mark One

President Clinton is reputed to have asked Greenspan before nominating him in 2000 for his fourth term as Fed Chair whether he would like to retire at the peak of his powers (Hartcher, 2005, p. 76). This is how brightly his star shone before the evidence of bursting bubbles sparked a more critical tone amongst the commentating classes. The cult that surrounded him in the late 1990s revolved around his apparent ability to turn asset markets into an investors' free lunch. Everyone had reinvented themselves as an investor – or so it seemed – and he therefore found it easy to come across as everybody's friend. It was often said at this time that Wall Street only needed to lay its hands on the official chisel for Greenspan to very soon appear on Mount Rushmore (Grant, 2008, p. 107). But he was popular on Main Street too. He was invariably depicted as the man with the Midas touch, capable with one decision of making multiple nest eggs flourish in his wake. Holding down interest rates allowed stock markets to roar their approval with private pension funds growing rapidly in value and housing markets to do likewise with equity being released to finance additional consumption.

It remains noticeable in his recently published memoir that, even to this day, Greenspan's search for measures of the economy's health goes no further than comparing the level of stock prices to their historical trend (Greenspan, 2013a, p. 38). Everything you could possibly need to know about monetary policy success, it seems, can be seen in how well the stock market is faring. Wall Street firms were never under any illusion about the fact that they had one of their own pulling the levers of US monetary policy, and they acted accordingly to greatly expand both the scope and the scale of their activities (Brenner, 2002, p. 174). Financial markets became both wider and deeper on Greenspan's watch, but they also became much frothier as passive investment strategies increasingly gave way to a trading frenzy. This was macho finance with a vengeance. At the heart of the changing culture was the assumption that, whilst the FOMC was powerless to prevent individual trades from going wrong, it always stood ready to guarantee the vitality of the trading environment as a whole, thus lessening the likelihood that anyone would ever lose everything.

Trading firms consequently began to act on the expectation of the so-called Greenspan put. The old adage that actions speak louder than words has particular resonance within central banking communities, where it is only recently that attention has begun to be paid to the use of communication to shape private sector expectations more closely in line with the prevailing model of the

economy (Braun, 2014). The actions of the Greenspan Fed appear, under retrospective evaluation, to have followed a consistent pattern. Each plateau of accelerating asset prices was treated as if it was a de facto price floor, and interest rates were set to provide the greatest possible chance that the price floor would not be breached (Garnaut, 2009, p. 13). Exactly the same remedy was applied whatever the perceived problem within the economy, just as long as it had the desired effect on asset prices (Bonner and Wiggin, 2009, p. 189). As Barry Ritholtz (2009, p. 72) has written of Greenspan's approach: "To someone whose only tool is a hammer, pretty soon everything begins to look like a nail".

The Greenspan put has been described as "the intangible sense of safety" delivered by the expectation that the next asset-price plateau was only ever one Fed interest rate reduction away (Schiff, 2012, p. 60). It was never explicitly articulated as such but became an "implied promise" on which Wall Street firms believed they could rely (Zandi, 2009, p. 75). Search in either of his memoirs for the index item 'Greenspan put' and you will do so in vain. Yet Greenspan came to public prominence in the first place as a market watcher, and as Fed chair he provided all the right cues in both word and deed for successor generations of market watchers to convince themselves that a publicly-sponsored backstop had been introduced to cushion asset prices (Reinhart and Rogoff, 2009, p. 291). Whether this was ever the Fed's intention is beside the point, and so Greenspan's consistent denial that he was in the business of blowing bubbles counts for little. Trading firms had confidence that extra liquidity would always be on hand to boost flagging asset markets, and this confidence in itself became a primary driver of financial activity (Cohan, 2009, p. 122). What mattered most is that Wall Street believed that the Greenspan put had become an integral part of US monetary policy and adapted its trading strategies in line with that belief (Batra, 2005, p. 88).

Put options provide investors with the knowledge that there is a specified price for which an asset might always be redeemed. If the market price continues to rise there is no reason to exercise the put, because more gains can be made from selling the asset on the open market. If the intervening period has been marked by a downturn in price, though, the put helps the investor to avoid losses by requiring the counterparty to buy the asset at the pre-agreed higher price. Put options therefore come close to providing the investor with a one-way bet because they create a safe haven against falling prices. For this reason they often command quite a notable transaction fee. The unique feature of the Greenspan put is that trading firms were not required to pay a cent to benefit from the peace of mind it brought: the FOMC provided this psychological comfort for free.

What the options market charged a handsome commission for the FOMC provided without charge courtesy of its largesse with taxpayer money. The one-way bets materialising as a result were evidence of the existence of market-replacing subsidies (Bonner and Wiggin 2009: 252). Eyebrows might certainly be raised at this point, given that a self-confessed pro-market ideologue was in charge at the Fed (Western 2004: 150).

A bias was thus introduced into US monetary policy that saw preemptive strikes against falling asset prices but equally strategic non-intervention against rising prices. Upside prices were allowed to find their own level on the understanding that each new price plateau represented the workings of an efficient capital market. It was only downside prices that were met by clear and determined action at the Fed (Shiller, 2005, p. 40). The Greenspan put, then, was constantly reset to reflect the ever dizzying heights to which first the stock market and then the housing market were propelled. It was not just short-term asset prices but also trading firms' short-term interests that were consequently locked in by the FOMC's approach to monetary policy. However, the free insurance associated with the Greenspan put eventually pitted those firms' short-term and long-term interests against one another. The fact that they would not have to shoulder the full costs of inappropriate short-term risk-taking made them more likely to damage their long-term balance sheet health by taking on ever greater increments of risk in what proved to be a heady cocktail prior to the 2007 crash (Quiggin, 2010, p. 57). The 'irrational exuberance' against which Greenspan so famously railed in 1996 – but then very quickly learned to love (Fleckenstein and Sheehan, 2008, p. 49) – was consequently transformed under the influence of the Greenspan put into something approaching a rational exuberance (Ritholtz, 2009, p. 76).

There is a rather large irony, then, when Greenspan (2013b, p. 94) now wonders why pre-crisis markets were typified by the systematic underpricing of risk. A fairly simple answer exists to this question, and it focuses on his own actions. Any asset market investment undertaken in the absence of the Greenspan put would always be perceived to be more risky than when the put is believed to be firmly anchored within the structures of market pricing: this is the wholly predictable effect of a publicly sponsored trading subsidy. The FOMC's willingness to inject fresh liquidity every time a price plateau began to look in trouble changed the risk/return ratios to which traders socialised themselves. Those ratios moved decisively in the direction of facilitating enhanced speculative gambles. The Fed had been treating trading firms for so long as too-big-to-fail entities that it is not difficult to understand why they should have taken

to acting in such a way. The restraint that comes from knowing that losses must be fully internalised was all but eliminated (Iley and Lewis, 2013, p. 83).

This is the classic operation of the original Greenspan put, and it is already fairly extensively discussed by those who immerse themselves in the details of FOMC decision-making during his tenure. In the following section, however, I suggest that a second dimension must now be considered which compounds the original problem. Greenspan is now seeking to explain away the bubbles that his asymmetric monetary policy helped to create. In doing so, though, he relies on the probabilistic reasoning which, because it treats bubbles as being statistically supremely rare, makes it very difficult to see them for what they are until it is far too late to introduce an ameliorative policy. Moreover, this whole style of reasoning reads off its probabilities from recent historical data, and this has the effect of elevating the existence of the Greenspan put to a permanent feature of the policy-making environment. Every macroeconomic model that is calibrated in this way consequently struggles to see past the Greenspan put, because the selective datasets against which they are tested give the impression that it has always been there.

Methodologists of economics have become increasingly concerned that the calibration tests which seek to reveal the relationship between the model world and the real world do not really deserve to be thought of as genuine empirical tests (Boland, 1989, p. 133). The scope of the historical data used in calibration tests is deliberately restricted so that it exhibits features that it is pre-known the model can copy (Blaug, 2002, p. 33). Robustness and representativeness tests are strategically bypassed. Instead, selective trends are emphasised over what the historical data reveal as a whole, so that it can be shown that sometimes the real world conforms to the model world whilst conveniently forgetting about those instances in which it does not (Gregory and Smith, 1991, p. 297). The datasets on which calibration tests are based are therefore somewhat flimsy, to say the least (Bhidé, 2010, p. 119). The fact that they are almost always drawn from very recent experience, moreover, means that the data becomes doubly ineffective: readings from when the Greenspan put was in operation are only rarely balanced by readings from when it was not. In this way, asymmetric treatment of asset price inflation and deflation shows up within the ensuing probability distribution functions. When potential policy changes are run through the model world, then, they are not changes *to* the Greenspan put so much as changes that continue to take it *as a given*. This is a subtler manifestation of the Greenspan put than simply acting upon short-term Wall Street interests,

because it relates to how the economy is imagined in the minds of macroeconomic modellers. It is no less potent for that, though, and thus deserves examination in its own right.

The Greenspan Put Mark Two

In contrast to his previous public proclamations, Greenspan's new memoire at least now concedes that markets can foster bubbles and promotes the need for an explanation of how that possibility might arise. However, he only asks the question in the first place as a means of defending his life's work in the practice of economic forecasting through modelling. Two fundamentally different styles of reasoning are therefore placed in tension with one another. Greenspan's recognition that bubbles emerge as financial prices reach an overwhelmingly speculative phase suggests that each event in the history of the economy is unique and that it might only be understood in its own terms (Berry, 2013, p. 22). Bubbles might have very similar effects when the mess they leave behind has to be paid for using public money, but each one has its own particular trigger point. This, as heterodox economists have been saying for many years, is an account of a non-ergodic future of non-repetitive events rooted in historical reasoning (Davidson, 2006, p. 150). Yet the attempt to ensure that macroeconomic modelling remains a credible pursuit points in an altogether different direction. This is about isolating the pattern of historical repetition so that the future can be understood as a function of past events. It is to privilege accounts of an ergodic future in which historical reasoning has been supplanted by probabilistic reasoning (Collier, 2011, p. 58).

The dominance of probabilistic over historical reasoning is evident in Greenspan's insistence that bubbles should be thought of as off-the-scale events, where the relevant scale refers to the mathematical properties of a normal distribution. Market crashes are still to be conceptualised as statistically freak occurrences, but the realm of market possibilities, he says, should be expanded to include a new category of event: "back-to-back highly improbable economic outcomes" (Greenspan, 2013a, p. 151) that nonetheless "seem to occur with some regularity" (Greenspan, 2008, pp. 509-10). This appears to be about changing the visualisation technique through which the macroeconomic modeller seeks to render the market environment knowable, but by how much?

Historical reasoning suggests that any one event is just as difficult to predict as any other, but to embrace the radical ontological uncertainty contained within such a position is to denigrate the macroeconomic modeller's craft.

Rationally informed forecasters, Greenspan insists, must always be able to know more than can be claimed when every state of the world is treated as an $N=1$ state, which acts as a spur to bring previously off-the-scale events under the umbrella of probabilistic reasoning (Greenspan, 2013a, p. 43). What remains extremely rare in probabilistic terms, then, is being reconfigured as potentially repetitively-patterned in historical terms. The future consequently remains resolutely ergodic within Greenspan's new framework of thinking, and therefore economic forecasting and macroeconomic model-building are still plausible pursuits.

The issue here is one of visualisation technique (on which, see Clarke, 2012, p. 274). If models are to be constructed to offer insights into the likely economic effects of future policy paths, then a number of prior steps must first have been engaged. Primary amongst these is the decision – perhaps consciously reflected upon to assess its pros and cons, but in practice most often not – of how to render the economy predictable. The full complexities of modern economic life therefore have to be suppressed so that the economy can be reduced to a potentially patternable entity: the model-building process is always likely to be a non-starter in the absence of such patternability. The search for distinctive patterns, however, takes place not through extensive work on relevant historical data but in the mind's eye of the macroeconomic modeller. It is an act of the imagination in the first instance, one which enables the theorist to develop an idea of what might be seen in the economy and then to use this as an imprint of what should be considered to be real. A visualisation technique should thus be regarded as a leap of faith in terms of the content of its underlying abstraction, but it subsequently has practical effects through the way in which it templates all that might be usefully seen by the macroeconomic modeller.

Greenspan's new memoir thus allows the macroeconomics profession to cling tenaciously to the idea that economic events follow a knowable probability distribution, even if the shape of that distribution no longer adheres rigidly at all times to the bell curve of a normal distribution. The dominant visualisation technique is subjected to some minor readjustments, but wholesale challenges to how the mind's eye might imprint the idea of a functioning economy are never seriously entertained. The bell curve still reigns supreme. It continues to describe all but "extreme outcomes", we are told (Greenspan, 2013a, p. 150), although there is now an acknowledgement of a new need to understand what happens when the economy transcends such boundaries to enter some other type of circumstance. The unique historical conditions that prefigured the build-up to the global financial crisis thus appear to

be in danger of being overwritten by a focus on the statistical misbehaviour of the least typical aspects of probability distributions. Greenspan's (2013a, p. 44) new visualisation technique for the economy – if 'new' is an acceptable exaggeration for the purpose of exposition – is predicated on the necessity "to fully comprehend the size of so-called tail risk". The classic normal distribution allows for a so-called 'three-sigma event' to occur on only three occasions out of every thousand. All of the remaining events congregate within three standard deviations of the mean, where the mean acts as the generalised attractor for the distribution as a whole (Stewart, 2012, p. 302). Three-sigma events constitute the distribution's tail, but in modern-day financial markets they occur on the downside so much more frequently than a 0.3% chance that they are vastly more populated than the classic normal distribution suggests.

The call to investigate the properties of tail risk is supported by a number of the most authoritative orthodox macroeconomic modellers, who tend to see the crisis only as a failed inference of a normal probability distribution (see Keen, 2013, p. 228). Their models' performance changes once the range of possible inferences is expanded by adding exogenous shocks of sufficient magnitude and variability to significantly enlarge the downside tail: they become much more able after the fact to replicate the behaviour displayed by macroeconomic variables at the time of the crisis (McKibbin and Stoeckel, 2009, p. 582; Ireland, 2011, p. 33). The image of a temporary departure from normality is thus smuggled in through the back door, so that the discussion becomes not one of how the crisis was allowed to happen (this, of course, being a question based on historical reasoning) but how fat the tail is at the point where in retrospect it can be shown the crisis started (a question couched in terms of probabilistic reasoning). Greenspan has defended the continued relevance of visualisation techniques constructed on probabilistic reasoning by describing the fat-tail features of recent years as "downright obese" (2013a, p. 151) and even "morbidly obese" (2013b, p. 95).

Within this visualisation technique, the statistical misbehaviour of macroeconomic variables is thought to be identical to the misbehaviour of the economic agents populating the forecasters' models. That is, the models will continue to provide a useful representation of the economy just as long as people can be persuaded to act out the models' preferred relationships. This all sounds very circular, and Greenspan (2013a, p. 45) gives the game away in this respect by arguing that: "If people acted solely to maximise their own self-interest ... the actual outcomes of their risk taking would reflect random deviations from their long-term trend". In other words, the assumption of a normal distribution to

economic events is manifested through the prior assumption of an innate rationality to economic agency. Fat-tail characteristics arise in the first place, this suggests, only insofar as people follow something other than their own self-interest. Greenspan depicts an economic agent trapped between the twin perils of 'euphoria' and 'fear' to describe why self-interest is not preordained. However, it is still to be *preferred*, he says (Greenspan 2013a, p. 36), because models which disqualify alternative forms of conduct reveal the most pristine market conditions possible in a best-of-all-worlds scenario.

The distinguishing feature of Greenspan's concepts of euphoria and fear is that they are exogenous to the economy whose dynamics they are meant to describe. Their most obvious role is as a qualification to the probabilistic visualisation technique designed to immunise it from direct challenge. Euphoria and fear are external shocks triggered by misbehaving agents, rather than being reflections of the dominant form of socialisation through which people assess their economic options at any moment. The reader is told that they impose outcomes at odds with those of the Panglossian world of perfect human rationality but not what it is about the way in which the economy is being managed that leads to these behavioural trends in the first place. Greenspan is interested, after all, only in acknowledging that unusual moments produce equally unusual tail shapes in the macroeconomic modeller's probability distributions. He does not seem to care how his own role in influencing market participants' risk perceptions in turn influenced their overall mood. However, the free insurance of the Greenspan put was clearly instrumental to the euphoria that preceded the crash, and the fear that propelled the crash came about following recognition that even the Greenspan put was inadequate for restoring to health failed trading positions.

The Greenspan put is also the missing link in explaining the puzzle he identifies in the fact that the downside tail associated with the crash appears to be much fatter than the "barely discernible" upside tail of the preceding period (Greenspan, 2013a, p. 45). The apparent washing away of the statistical relevance of the euphoric stages arises from the resetting of the Greenspan put every time doubts arose about the viability of a new price plateau. The asymmetrical interest rate policy that the FOMC delivered in support of asset price inflation meant that price rises accrued incrementally, building on one another to make it progressively harder to beat the rolling mean increase in prices. This made it much more difficult for each individual time period increase to look special in statistical terms even at the very height of the bubble. The same is most definitely

not true, though, when the crash wiped out in one go the accumulated effects of a number of resettings of the Greenspan put. In moments like these the sudden reductions in price really do stand out statistically against the historical background of generally buoyant asset markets.

Once again there is more than a little irony contained here. Greenspan has reconfigured his basic visualisation technique for the economy only very marginally, from a normal distribution to a negatively fat-tailed normal distribution. It was the existence of the implicit put option offered free-of-charge to traders by Fed policy that made the normal distribution such an inappropriate means of forecasting the economy's likely trajectory in the first place, which is why orthodox macroeconomic models based on a probabilistic visualisation technique failed to spot the global financial crisis coming (Nesvetailova and Belli, 2013, p. 59). However, the shape of Greenspan's new negatively fat-tailed normal distribution does not seek to question the continued existence of an interest rate policy that displays the same bias towards supporting asset price inflation. Simply by trying to make the economic world knowable using his reconstituted probabilistic reasoning leaves fundamentally unresolved the issue of free insurance against downward pressure on asset prices. Very little has therefore changed in this respect, with perhaps one important exception. The defence of a probabilistic visualisation technique invokes supporting historical data that has the Greenspan put built into their very fabric. By relying on this data to say that the pre-crisis macroeconomic models may require some modification at the edges but remain essentially sound at their core, the Greenspan put becomes potentially locked in as the dominant tendency within monetary policy-making, even though Greenspan himself no longer oversees the process. At the very least, this is what is implied by the rapid recovery in asset prices whilst the rest of the economy continues to struggle to escape the fallout from the global financial crisis.

Rational Microfoundations and the Greenspan Put

It would be one thing were Greenspan's ideas to place him out on his own. However, his technique for visualising the market environment finds direct parallels in the work of those economists who were called upon to speak on behalf of their discipline at the height of the global financial crisis. This is not to say that all economists think likewise, but it is interesting to reflect for one moment on who was invited to answer the charge that the failure to foresee the crisis was evidence of the intellectual bankruptcy of modern-day macroeconomic

modelling. It was not, in general, those macroeconomists who might be seen to represent the cutting edge of the subject field today. Instead, it was those whose heyday might well be thought to be behind them, but who nonetheless continue to have the largest professional stake in defending a probabilistic visualisation technique for the economy. They have, like Greenspan, found themselves confronted with tricky questions about perceived failures of their method. Their response has hardly been convincing.

Robert Lucas, recipient of the Nobel Prize in Economics “for having developed and applied the hypothesis of rational expectations”, perhaps had more cause to reconsider than most (Nobel Committee, cited in Klein and Daza, 2013, p. 435). He had set the standard for saying that the knowledge held by market actors – mirroring, as it does, macroeconomic modellers’ probability distribution functions – had a far greater stabilising influence on the economy than anything that could be delivered by so-called government stabilisation policy (Lucas, 1976, p. 104). Lucas used his Presidential Address to the American Economic Association in 2003 to announce the complete victory of his rational expectations approach. The success of macroeconomists who had embraced his framework and its accompanying probabilistic visualisation technique, he argued, meant that “the central problem [of the subject field’s endeavour...] has been solved, for all practical purposes”, following the turn to a macroeconomic policy which assumes that governments are more failure-prone than markets (Lucas, 2003, p. 1). When challenged to defend this view in the aftermath of the crisis, he stated simply that: “The simulations [of rational expectations macroeconomics] were not presented as assurance that no crisis would occur, but as a forecast of what could be expected conditional on a crisis not occurring” (Lucas, 2009, p. 67). In other words, the underlying visualisation technique might be viewed as a reliable indicator when events continue to be clustered around the statistical mean, but anyone adopting it must remain silent on those regularly occurring three-sigma-plus events. This is either an admission that the whole venture of modern macroeconomics is doomed before it starts or an attempt to explain away the crisis as statistically irrelevant because it falls outside those states of the world that the models allow theorists to see in their mind’s eye. Given Lucas’s insistence that the successes of rational expectations macroeconomics mean that the only potential welfare gains left to exploit are those “from providing people with better incentives to work and to save” (Lucas, 2003, p. 1), one can only imagine that he was alluding to the latter. The former, it perhaps does not need to be said, would hardly justify all the accolades and awards he has received from his profession.

Lucas's defence is that nobody can reasonably be expected to see something that their visualisation technique tells them is so statistically unlikely that there is no reason why they would be able to know what it was even if they did see it. After all, the multiple-sigma characteristics of the global financial crisis make it not only a highly unlikely occurrence but also, to all intents and purposes, an impossible one. Yet orthodox macroeconomic modellers might still reasonably be expected to challenge the lens through which they observe market outcomes if a supposedly impossible event has just occurred in front of their eyes. Such events are only 'impossible', it should be noted, from within the framework of predictions rendered possible by the assumption of a normal distribution. Greenspan's move away from this assumption to one of a fat-tailed normal distribution appears at first glance to place some distance between him and Lucas.

Initial appearances, however, might prove to be deceptive. The assumption of a normal distribution, remember, acts most obviously as cover for the assumption of a model world populated only by fully rational individuals. Lucas, one presumes, is not in a position to give up on such a world, as his whole professional reputation rests on the integrity of the rational expectations framework. The Greenspan of the latest memoir also shows a marked reluctance to challenge this same core insight of orthodox macroeconomics, because any other stance would not allow him to understand moments of intensely low-probability outcomes as temporary aberrations of an otherwise smoothly functioning market system. Trying to learn more about the fear that propels multiple standard deviation events, he argues, "isn't to say that we should throw *Homo Economicus* out with his dirty bathwater" (Greenspan, 2013a, p. 9). Recognising the existence of negative fat tails within an overall normal distribution nonetheless leaves the characteristics of the non-tail features of the distribution fundamentally intact: the appropriateness of a probabilistic visualisation technique is not brought into question.

It is here that macroeconomics and microeconomics come into line. Once more, though, this is not to say that all macroeconomics consists of microfoundations based on a simple rationality postulate, because that is simply not the case. There are numerous examples in behavioural and experimental economics which can legitimately lay claim to being the new frontiers of the subject field and which explicitly reject all *homo economicus* constructions (Lerbinger, 2012, p. 278). Where microfoundations are used in the process of macroeconomic model-building, though, they remain resolutely fixed on a rationality postulate that is considered old hat elsewhere within the subject field. The methodological justification for doing so is that this renders the economy

imaginable, patternable and therefore knowable in a way that would not otherwise be possible (Weintraub, 1977, p. 17). Yet the one abiding weakness of probabilistic macroeconomic models is that they can see no other behaviour than that which is fully informed and has fully discounted all future risk in present actions. No form of conduct beyond this most extreme of special cases can be seen from within the models' restricted worldview, and therefore to safeguard the pristine nature of this class of model the pretence has to be upheld that other forms of conduct do not occur (Duarte, 2012, p. 218). A visualisation technique provides as much information about what one cannot allow oneself to see in the world as it does about what actually exists there to be seen. It trains the mind's eye only to be selectively sighted.

Greenspan and Lucas, unarguably two of the most important doyens of the pre-crisis macroeconomic orthodoxy, tell their readers nothing about why secular forms of economic reason might reduce solely to the behavioural characteristics of *homo economicus*. They raise that particular behavioural type to such an elevated status only because they want to do so. The impetus in this respect is provided by their prior desire to model the world as if it might be made to obey a really rather rudimentary market logic. On this point Lucas (cited in Snowdon and Vane, 1998, p. 135) has voiced his preference for "some kind of conservative, pro-market, pro-business, economic policies". In turn, Greenspan (2013a, p. 36) argues that: "Knowing what the human race could do if it were fully rational at least gives us the upper bounds of possible economic achievement". The contrast is thus drawn in ideologically-oriented fashion between a first-best solution when actual economic agents resemble those of macroeconomists' model world in acting out the presumed superior relationships captured by market logic and, at most, a second-best solution when they are prone to stray from this particular path.

This translates into the economic distinction between equilibrium and disequilibrium, where equilibrium is the imaginary territory in which *homo economicus* comes into his own. It is not a point in actual economic space that can be truly lived, but it is a characteristic of the mathematical space which enables the assumption of rational expectations to be formalised (Watson, 2014, p. 51). It can therefore be seen through a visualisation technique that asserts the innate rationality embedded within normal probability distributions, even if it might prove entirely invisible when any other visualisation technique is adopted. It also produces a series of political implications linked to the conditions under which rational expectations models have a solution (Clower, 1995, p. 317). According

to Thomas Sargent (2011, p. 9), who along with Lucas has been awarded the Nobel Prize in Economics for work in the rational expectations tradition, it delivers a “humbling message” to all policy-makers, because “the equilibrium concept can disable someone who proposes to improve outcomes”.

Where might the Greenspan put fit into such a perspective? It certainly improved outcomes for Wall Street firms whose interests are served by increasing asset prices, but at the same time its existence was never formally acknowledged by the Fed, so it is not as though it is an explicit proposal to engineer a particular outcome. Most intriguingly, though, it now appears as an integral part of the recent historical datasets that are plugged into macroeconomic models to ascertain how close to the desired position of equilibrium the economy is deemed to be. Indeed, the Greenspan put might now have become an element of the equilibrium condition to which modern macroeconomics pays such deference.

If true, this allows us to say some important things about the political content of the forecasting endeavour undertaken in the name of the rational expectations revolution. In interview Sargent has conceded: “When I came out of Berkeley and Harvard I had a really naive view of what the government could accomplish. It was my own fault, but I was very pro-intervention”. However, his subsequent decision to align himself with Lucas’s rational expectations perspective brought about a political conversion away from stabilisation policy: in his words, “I distanced myself from that” (cited in Sent, 2006, p. 55). Rational expectations macroeconomists pride themselves on having created a class of constrained optimisation models capable of taking the politics out of economic policy-making. Yet if those models are now corrupted by data that require the existence of the Greenspan put for ease of retrofitting to a normal distribution, this claim does not stand up. The most important models used for forecasting purposes today simply change the political character of monetary policy decisions rather than rendering them in any sense apolitical. Sargent’s (2011, p. 10) assertion that “[o]ur concept of equilibrium ties our hands” might be true insofar as it produces visualisation techniques that make it very difficult to see the merit in stabilisation policy. But if the concept of equilibrium now includes an adjustment for the Greenspan put it institutionalises a monetary policy bias towards asset price inflation. Hands are therefore tied in favour of expanding accumulated asset wealth at exactly the same time as they are tied against enhancing the regularity of employment.

The mismatch between what the normal distribution tells macroeconomists is and is not possible policy-wise comes through clearly in Lucas’s work. Whilst asset-holders continue to bask in the glow of the Greenspan

put even in the aftermath of the global financial crisis, Lucas (2003, p. 1) is adamant that “it is unrealistic to hope for [welfare] gains larger than a tenth of a percent from better countercyclical policies”. This is merely a tweaking of the Sargent-Wallace ‘policy ineffectiveness proposition’, which in turn took Lucas’s rational expectations approach as the starting point for arguing that “[t]here is no systematic rule that the [monetary policy-making] authority can follow that permits it to affect the unexpected part of the price level” (Sargent and Wallace, 1975, p. 249). In other words, active stabilisation policy might be positively harmful if economic agents learn that it can never succeed as planned but constantly have to factor into their expectations persistent government failure. At best, policy activity is wasted effort. As the willing embrace of post-crisis austerity reveals only too well, this approach continues to cast a long shadow over the way in which macroeconomic possibilities are constructed, even though the original Sargent-Wallace position has been shown to be merely a trick of the mathematics employed (Frydman and Phelps, 2013, p. 22). According to Greenspan (2013a, p. 302), “our broken political system” draws politicians into promising more than monetary policy-makers can accommodate in terms of social insurance, even as the bias built into monetary policy-makers’ macroeconomic models manifests itself as free investment insurance against downside price risk. The ostensibly apolitical nature of modern macroeconomic models masks only the political asymmetry of their operation in practice. And all of this follows from the decision to commit to a probabilistic visualisation technique for the economy as a whole.

Conclusion

Models are extremely important to the process of macroeconomic policy-making. It is only possible, of course, to see how relationships within a model will be affected by a new policy setting; the real world provides no analogous advance knowledge about the likely success of a change in policy. Models therefore have prescriptive content every bit as much as they have descriptive content. It consequently matters how they are constructed, because their basic inbuilt visualisation technique removes far more options from the ensuing political discussion than it places on the table. Whenever a particular class of macroeconomic model comes to dominate it limits what can be seen within the world. It acts as an overlay on the political imagination in order to enforce a specific way of viewing what exists beyond the model.

What, then, might be said from this perspective about Greenspan's post-crisis choice of macroeconomic model? To my mind the most instructive observation in either of Greenspan's memoirs comes in the very final words of *The Age of Turbulence*. It is not even clear if those words were ever really meant to be read, coming as they do in an elongated acknowledgements section. He admits in that passage that: "There are errors in this book". "I do not know where they are", he continues (Greenspan, 2008, p. 535). "If I did, they wouldn't be there. But with close to two hundred thousand words, my probabilistic mind tells me that some are wrong." Even though his more sceptical biographers now often describe it as 'classic Greenspan' to want to present suitably whitewashed accounts of history over and above what he said or did at the time, the important part of this admission from my perspective is not that the historical record might well be contested. It is that his whole approach to the world around him is conditioned by the lens of probability. What cannot be seen through this lens is to be treated, it seems, as fundamentally unseeable. At the very least, this is what is implied by the rather tortuous journey undertaken in *The Map and the Territory* to travel almost no intellectual distance at all. The lasting impression of this second memoir is that the world according to Greenspan is a world which might only be known through appeal to now slightly refined normal probability distributions. The limits of his self-proclaimed "change of perspective" remain confined by "statistical techniques whose roots lie in probability analysis" (Greenspan, 2013a, pp. 9, 55).

There is no great rethink here, then, and neither is the introspection oriented to anything more profound than allowing him to identify new ways of being able to say that he had been right in his decision-making all along. This has only been the pretext for expanding the existing class of models to make room for the systematic misbehaviour of agents who would benefit from mimicking the models' overt preferences for full rationality, not for questioning the whole modelling exercise. But what happens if overreliance on the models themselves now incentivises the type of conduct that orthodox macroeconomists have struggled even to recognise in the recent past? The implication of the foregoing analysis is that very serious consideration needs to be given to this possibility. If, as I have argued, the existence of the Greenspan put has been incorporated into the basic visualisation technique underpinning macroeconomic forecasting, the future is unlikely to look much different to the recent past. Greenspan (2013a, p. 53) seems to place great faith in the "repetitiveness of history", but appears to be unaware of his own culpability as history-maker in recent bubble episodes. With the Greenspan put also now part of the historical data that helps to calibrate

central bank models, more of the same looks to be on the way in terms of first the blowing and then the bursting of asset price bubbles.

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