Predicting the Unpredictable: Value-at-Risk, Performativity, and the Politics of Financial Uncertainty

Abstract:
Starting from an observation about the high-profile predictive failures of Value-at-Risk (VaR), an internationally instituted financial risk model, this article has attempted to make sense of its continued use by analyzing its productive, rather than predictive, power. This line of inquiry leads me to identify VaR's (counter)performative effects and the way in which it produces banks as authoritative, responsible managers of an uncertain financial future. Viewing financial markets through the lens of Keynesian uncertainty and model performativity helps explain VaR's failures by revealing VaR to be an inherently limited and potentially destabilizing practice. Its use participates in the construction of a financial system that is only temporarily stable and controllable. At the same time, VaR is an important source of authority for banks vis-à-vis regulators and the public because it represents the future as statistically calculable and expert prediction as the optimal, objective mode of preparing for that future. This, in turn, makes less thinkable other responses to uncertainty – ones that might be better suited to contend with the possibility of devastating losses unforeseeable – and perhaps produced by – the widespread use of VaR.

Keywords: uncertainty, risk, performativity, Value-at-Risk, Basel Accords, financial models, financial regulation

Introduction

Hedge fund manager David Einhorn characterizes the Value-at-Risk (VaR) approach to measuring financial risk as “an airbag that works all the time, except when you have a car accident” (2008: 12). Since VaR’s formal institutionalization in the 1996 Basel Accord, several disastrous accidents have occurred in global financial traffic, but VaR is still used by investment firms and regulators to foresee and protect against large-scale losses. The persistent use of this method of modeling financial risk, despite widely publicized failures to predict catastrophic financial losses, is puzzling. When a model fails to fulfill its intended function – in this case, predicting the largest possible loss on a portfolio of investments – we might expect to see it substantially revised or perhaps abandoned altogether. And yet, VaR has endured throughout several financial crises, including ones in which its use was directly implicated as a contributing factor. In this article I analyze VaR modeling not as an apolitical technology that risk managers use to make money and guard against loss, but as an authoritative practice that structures financial markets operating in a context of both calculable risk and incalculable Keynesian uncertainty.

The 2008 global financial crisis has drawn both public and academic attention to the microstructures of the international financial system. Investment practices, financial instruments, risk management strategies, credit ratings, and domestic and international approaches to banking regulation have all fallen under heightened scrutiny, revealing the inadequacy of macro-level approaches to fully account for the workings – and failures – of global capital markets. This study contributes to this project by analyzing how the widespread use of a financial risk model is both constitutive of international financial practices and a politically consequential response to uncertainty.

In Section I, I introduce the Value-at-Risk method of measuring financial risk and sketch out the puzzle its continued use presents. This methodology underlies a group of risk models widely used by the risk managers of banks, brokerage firms, hedge funds, mutual funds, and clearing houses to assess the probability of loss on a portfolio of financial assets. The VaR of the portfolio is the smallest number such that the probability of a loss exceeding that amount falls outside a given confidence interval.[1] VaR is widely used throughout the financial system and has been internationally institutionalized by the Basel Committee on Banking Supervision (BCBS) as the preferred measure of market risk used to determine capital requirements. However, VaR's ability to accurately predict future financial losses has a poor empirical track record and the model has visibly failed to account for losses incurred in the 1997 Asian financial crisis, the 1998 Russian financial crisis, and most recently, the subprime mortgage crisis originating in the U.S. Nonetheless, VaR methodology has remained at the core of banks' risk management strategies and international regulations.

In Section II, I argue we can make sense of this puzzle if we understand VaR not as an approximately accurate measure of an objective reality, but rather as a conventional, contestable practice that is itself implicated in the workings of financial markets. I introduce two concepts – Keynesian uncertainty and Barnesian performativity – that explain both the limitations of risk modeling and why it is political. In an environment of both quantifiable risk and Keynesian uncertainty, risk modelers' claims to objectivity and accuracy are contestable. Far from neutrally describing market dynamics, the practical use of risk models constructs markets, making economic processes sometimes conform to and other times diverge from the model. I argue that the performative effects of risk modeling push us to examine its productive power – the practices and interpretations it makes possible and precludes.

In the second half of the paper I draw on documents from international regulatory bodies, financial participants, and commentators to identify how the use of VaR enables particular financial and regulatory practices, while rendering others less authoritative. In Section III, I focus on VaR's performative and counterperformative effects. I argue that the use of VaR may result in losses consistent with VaR predictions by producing authoritative meanings of "risk" and "value," which, when acted on, produce convergent investment strategies that limit volatility. However, this performative effect is temporary and fragile, often yielding to counter-performative effects in which the widespread use of VaR fuels financial market volatility and unpredictability by creating incentives for excessive and undisclosed risk-taking and even for manipulating the model itself.

In Section IV, I consider how, despite VaR's complicity in financial collapse, it has allowed investment banks to satisfy calls for greater banking regulation while simultaneously making uncertain financial practices seem tractable and manageable. By privileging prediction and control as modes of preparing for future financial events, reliance on VaR simultaneously makes it more difficult to acknowledge uncertainty and to respond to it in alternative ways. I contend that responding to uncertainty primarily through probabilistic risk management does not guarantee the prevention of – and may even contribute to – financial crises, the costs of which are incurred not just by banks but by the public.

I. The rise – and puzzling failure to fall – of VaR

The VaR model is a compelling case for demonstrating the political power of financial models for three reasons. First, although, as I shall argue, VaR operates under conditions of both risk and uncertainty, it models future financial losses statistically, as if they were governed solely by risk. Second, VaR exemplifies the performative qualities that are both a response to and productive of unmanageable uncertainty in financial markets. And finally, as the following history sketches out, the authoritative meanings of "value" and "risk" that VaR helps constitute are acted on financially and politically.

VaR was developed by the commercial and investment bank J.P. Morgan in response to high interest rate volatility and unforeseen losses in the late 1980s. As financial markets became increasingly globalized, the bank wanted to be able to apply the concepts of value and risk to portfolios of assets that were denominated in different currencies and subject to different interest rates. This would allow them to measure the riskiness of the portfolio as a whole and "manage" it through quantitative limits and off-setting investments, or hedges (Guldimann, 2000: 56). A group of mathematically trained risk managers in the operations research department developed the VaR methodology over the course of three years, settling on an approach based on three main components: position data (the components of a portfolio of financial assets); the risk factors associated with those components (interest rates, exchange rates, equity and commodity prices) and their associated volatilities; and measurement parameters (the holding period over which the value of the investments could change, the historical period over which risk factors are measured, and the confidence interval) (Basel Committee on Banking Supervision, 1995a: 6). The model produces a statistical distribution of a portfolio's probable future losses and gains and generates a single, easily understood number: the maximum possible loss on a portfolio likely to occur a given percent of the time. That number can then be compared with the maximum amount of risk the bank is willing to take on and off-setting positions and trades can be made accordingly.

By 1990, the methodology and mechanics for risk reporting were well established within J.P. Morgan, which Til Guldimann attributes to the clarity of the VaR output, citing the fact that

Marcus Meier, the head of international trading, would request a daily one-page report showing aggregate risks and forward it on to J.P. Morgan chair and CEO Dennis Weatherstone just after trading closed at 4:15pm (2000: 57). In 1994, J.P. Morgan decided to publish the VaR methodology for free, citing a desire for transparency and standardized risk measurement across the financial industry (J.P. Morgan/Reuters, 1996: 1), as well as a desire to avoid what the then-leader of the bank's risk committee referred to as "the consequential risks" of selling the system as a definitive way of controlling financial risk (Guldimann, 2000: 58). A project team, which later became an independent group called RiskMetrics, published their VaR datasets and methodology online as a simple spreadsheet into which any user could enter positions and calculate their VaR. Although other banks were using similar approaches to estimate market risk, they converged around the RiskMetrics approach. Guldimann cites the disclosure of major risk management accidents, the industry's engagement with academically trained quants, and the relative ease of the model as fueling its rapid diffusion throughout the financial industry (ibid: 58). Glyn A. Holton writes that the "timing for the release of RiskMetrics was excellent, as it came during a period of publicized financial losses" which created "a flurry of interest" in VaR (2003: 19).

This method of measuring risk was also quickly endorsed by regulatory bodies eager to rein in excessive financial risk-taking and impose transparency and shareholder accountability on the rapidly growing derivatives trade. In 1993, the G-30 commissioned a consultative group of bankers, financiers, and academics, led by J.P. Morgan CEO Dennis Weatherstone, to produce a report on derivatives. The G-30 report concluded that derivatives were no less predictable than other financial products and included a recommendation that investment banks use VaR daily to calculate the market risk of their derivatives positions and compare it to predetermined risk limits to prevent unexpected financial losses (Global Derivatives Study Group, 1993: 10).

Although the G-30 study intentionally eschewed regulatory implications, the Basel Committee on Banking Supervision (BCBS), a group of central bankers and regulators from the G-10 states, explicitly linked VaR to financial regulation. In 1988, the BCBS had responded to public concerns about the effects of developing countries' debt crises on capital markets and the moral hazard of investment banks' trades in increasingly complex financial instruments by setting capital adequacy requirements – an amount of capital the international supervisory authority saw as advisable for banks to have on hand as a cushion for future financial shocks. The 1988 Basel Accord was primarily concerned with losses that result from counterparties being unable or unwilling to fulfill contractual obligations (credit risk). But by the early 1990s, it was apparent that extreme swings in asset prices (market risk) posed an equal, if not greater, threat to financial institutions' solvency. Needing a way to tie capital requirements to the market risk of a bank's total investments, the BCBS readily took up VaR for consideration. As Philippe Jorion writes, "central bankers implicitly recognized that risk management models in use by major banks are far more advanced than anything they could propose" (1997a: 41).

In 1996, an amendment to the 1988 Basel Accord was adopted to require banks to hold enough capital to be able to meet market risks, calculated according to either a standardized methodology or a bank's own VaR model. This gave banks the option of adjusting the data and parameters used to calculate their maximum probable losses. The amendment was framed in explicitly regulatory terms: "Introducing the discipline that capital requirements impose is seen as an important further step in strengthening the soundness and stability of the international banking system and of financial markets generally" (BCBS, 1996a: 1). The amendment specified that measures of market risk would then be used to assign a capital charge to banks, on top of the capital requirements in the original 1988 Basel Accord (ibid.: 6). Like the original Accord, the 1996 Market Risk Amendment depended on domestic enforcement and, crucially, industry consent for its efficacy (ibid.: 7).

In accordance with the 1996 Amendment – and in particular the provision that allowed banks to develop their own internal VaR risk models – VaR methodology diffused throughout the financial industry in the late 1990s, often in conjunction with other proprietary risk management techniques. VaR was used by (among others) Standard & Poor's, Moody's, Long Term Capital Management, and over 60 international commercial banks, including the ten largest U.S. banks (Pérignon and Smith, 2010: 363).[2] It has remained the Basel Committee's recommended method of internally modeling market risk to assign capital charges throughout both the 2004 and 2010-11 renegotiations of the Basel Accords (Basel II and III), though the latter document adds leverage ratios to risk-based capital requirements and implements stricter VaR requirements (BCBS, 2006: 191-203; BCBS, 2011: 3; Haldane, 2012: 19). Following the 2008 financial crisis, in which commercial banks' losses were significantly higher than the minimum capital holdings required under Basel II, the BCBS revisited their standards for calculating market risk, imposing an additional requirement on banks to include a "stressed value-at-risk calculation" that takes into account a one-year observation period in which "significant losses" were sustained, in addition to calculating VaR based on the most recent one-year observation period (BCBS, 2009: 1). Banks are also now required to justify to the relevant supervisory authority any variables they use in pricing assets but leave out of their VaR calculations, in order to account for the possibility that banks would intentionally omit factors to make their risk burden appear smaller (ibid: 3). These reforms are anticipated to double or triple the capital that international banks would have to keep to protect against market risks (Gopalakrishna, 2013: 1). Nonetheless, they remain anchored in the same basic VaR methodology popularized by J.P. Morgan twenty years ago. Similarly, one of the centerpieces of post-crisis financial regulation in the United States and endorsed by the BIS – the requirement that over-the-counter derivatives be cleared through central counterparties – continues to rely heavily on historical VaR in its calculation of the amount of collateral banks are required to post (Cameron, 2011).

The history of VaR's initial diffusion is relatively straightforward, but explaining its continued authority as a response to financial uncertainty is puzzling given that VaR falls well short of predictive accuracy. Its history is remarkable for the lack of organized interests opposing banks' and regulators' preference for VaR. While banks did have to persuade the BCBS to permit them to choose their own model parameters, the methodology itself was never seriously disputed. The uncontested use of the model might be relatively unproblematic were it performing a purely descriptive function, but its poor predictive track record makes its continued use harder to explain. Systematic econometric tests of banks' VaR predictions against historical price and volatility data show that forecast losses bear little resemblance to what actually happened, particularly when a distribution based on historical data is used. For example, in their analysis of 60 banks' VaR numbers compared with data about the ensuing trading volatilities, Christophe Pérignon and Daniel R. Smith find that there is "at best a weak relationship" between VaR predictions about the maximum likely loss and subsequent trading prices (2010: 372). Nor did banks' forecasts of losses improve with time. They ultimately conclude that, "bank VaR computed using Historical Simulation helps little in forecasting the volatility of future trading revenues […]" (ibid: 376).

VaR's shortcomings have not been confined to econometric analyses: VaR has been implicated in high-profile financial disasters, such as the collapse of Long Term Capital Management (LTCM) in 1998 (Litzenberger and Modest, 2010: 77-78). VaR was the main approach the firm used to calculate market risk, but it was unable to account for unforeseen financial crises in Asia and Russia and the financial losses sustained by the firm as a result, leading to the firm's collapse (Dunbar, 2000: 140-147). More recently, VaR models prominently failed to account for losses on super-senior tranches of risk in collateralized debt obligations. For example, the investment bank UBS's VaR-based risk models had predicted that these securities would not lose more than 2% of their value, which was $50 billion by early 2007 (Tett, 2008: 138, 206). However, super-senior risk accounted for two-thirds of UBS's losses, or $12.5 billion dollars in 2007 – well in excess of the predicted 2% figure (Baker-Said and Logutenkova, 2008; Tett, 2009: 210). As Gillian Tett observes, the bank's VaR models had not foreseen the possibility of a highly correlated wave of mortgage defaults and the collapse of a market for even the ostensibly safest classes of assets, rendering their predictions spectacularly inaccurate (2009: 230).

Within the financial world, the explosive growth in financial exchanges is widely taken as evidence of statistical modeling's successful predictions (Millo and MacKenzie, 2009: 238). However, the repeated failures of VaR to foresee large-scale financial losses suggests the diffusion of VaR owes much more to its conventional status as a means of (ostensibly) standardizing risk measurements across a complex, closely integrated global financial system than to the success of its predictions. As Millo and MacKenzie argue in the case of the Black-Scholes-Merton option pricing model, ease of communication, compatibility with other model-based approaches, and institutionalization in regulatory instruments explain its widespread use despite demonstrated shortcomings (2009: 639). Similar factors can account for VaR's persistence in risk management. Specifically, in the case of VaR, most sources emphasize the simplicity of the model's output, as well as the ease of adopting RiskMetric's well-publicized methodology and data (Jorion, 1997a: 21; Nocera, 2009). Additionally, the inclusion of VaR in the Basel Accord goes a long way to explaining the international adoption of the approach. But neither of these factors operates at the level of economic logic. The continued use and perceived authority of VaR cannot be explained with reference to its empirical accuracy, and this suggests that its use and effects have a specifically political dimension. In what follows, I contend that we can understand VaR's shortcomings, as well as its use, by viewing it as an authoritative response to Keynesian uncertainty with performative and counterperformative effects. Moreover, viewing risk modeling as an authoritative practice allows us to see how it produces particular political consequences.

II. Productive, not predictive, power: why VaR is political

I contend that practices are political when they are contestable and when doing things differently would empower different groups of actors. In this section I introduce three theoretical concepts that motivate my analysis of Value-at-Risk as a political practice: uncertainty, model performativity, and productive power. Viewing international finance through the lens of Keynesian uncertainty helps explain VaR's shortcomings. It also reveals that risk models are inherently limited in their ability to anticipate the probability and magnitude of financial losses and are therefore contestable as the dominant method of preparing for future financial events. The concept of performativity requires us to view financial models as active participants in, rather than neutral representations of, financial systems. If VaR accurately approximated an objective reality, the measures of financial "risk" and "value" produced by the model would be more difficult to contest. However, understanding risk modelers as constructing the world they purport to describe opens their claims of responsible risk management to critique and contestation. Acknowledging the performativity of financial models pushes us to consider their role in constituting and perpetuating particular practices, while making others less thinkable. I argue that the concept of productive power is a useful analytical tool for understanding the political consequences of the use of VaR to model risk.

A. Uncertainty

In IR, uncertainty, risk, and ambiguity are sometimes used interchangeably to refer to situations in which outcomes are unknown (e.g., Rathbun, 2007). My argument about the inherent limitations of probabilistic risk modeling relies on a specific conception of uncertainty, as distinguished from risk, most influentially articulated by John Maynard Keynes and taken up today by heterodox and post-Keynesian economists. Keynes powerfully and elegantly defined uncertainty in terms of future events about which we cannot make probabilistic predictions:

> By ‘uncertain’ knowledge, let me explain, I do not mean merely to distinguish what is known for certain from what is only probable. The game of roulette is not subject, in this sense, to uncertainty […] The sense in which I am using the term is that in which the prospect of a European war is uncertain, or the price of copper and the rate of interest twenty years hence, or the obsolescence of a new invention […] About these matters there is no scientific basis on which to form any calculable probability whatever. (1937: 214)

Whereas risk refers to decision-making in an environment of known probability of loss or gain, uncertainty refers to situations in which the probable distribution of outcomes itself is unknown (Abdelal, Blyth and Parsons, 2010: 12; Katzenstein and Nelson, 2013: 1102).[3] Uncertainty characterizes outcomes in non-deterministic open systems, in which prediction is impossible not because of epistemological limitations on the part of the observer but because the structure of the system is such that its behavior is not amenable to prediction (Latsis, de Larquier and Bessis, 2010: 546; Berger, 2009: 2). That is, the system does not automatically tend toward stable equilibria (non-ergodicity), nor are events and outcomes in the system distributed according to a knowable pattern. When either estimating the probability of a given event or representing the set of future events is impossible, probabilistic models like VaR fail to capture the full range of empirical phenomena under consideration (Kregel and Nasica, 2011: 281).

There is good reason to think that outcomes in economic systems are at least partially uncertain. Keynes was one of the first economists to explicitly characterize financial markets as governed by uncertainty, referring to “the extreme precariousness of the basis of knowledge on which our estimates of prospective yield have to be made” (2007: 149). Contemporary international financial markets appear, in extreme cases, equally resistant to probabilistic prediction, as evidenced by the failure of financial models to account for losses more than twenty standard deviations from the predicted mean three times since 1987 alone.[4] The 2008 financial crisis is a stark example of neglected uncertainty in financial markets, given that credit rating agencies underestimated default rates for collateralized debt obligations derived from mortgage-backed securities by 20,155% on average (Nelson and Katzenstein, 2014: 17; Silver, 2012: 29). That such unpredicted events are repeatedly found in financial markets in which there is an abundance of information offers further evidence for the inadequacy of risk-based models to capture the totality of the financial system.[5] When objectively valid probabilities of gains and losses do not exist, the use of probabilistic models should be understood not as means of eliminating uncertainty through the quantitative mastery of a calculable system, but rather as a contingent, and inherently limited, response to uncertainty.

The ex post inaccuracy of VaR’s predictions of volatility compared to historical data provides evidence for thinking that this risk model, in particular, operates in a world of

Keynesian uncertainty. Pérignon and Smith conclude their econometric analysis of VaR's accuracy by acknowledging a "disconnect between Historical Simulation-based VaR and future volatility" (2010: 376). If financial markets are, in some respects, non-ergodic and therefore characterized by uncertainty in addition to risk, this is what we would expect to see. Indeed, Paul Davidson argues that probabilistic forecasting models are only accurate when the distribution of possible outcomes does not vary over time: "If, however, the economic future is nonergodic […] these forecasts can persistently differ from the time average which will be generated as the future unfolds and becomes historical fact" (1982-1983: 186).

Why is historical data such a poor predictor of future outcomes in financial markets? Several mechanisms produce the uncertainty that limits the predictive accuracy of financial models. According to Benoit Mandelbrot and Nassim Nicholas Taleb, stock price movements and other financial data sets are characterized by non-normal distributions and may have infinite variance (2010: 48-53). Most risk models are based on a distribution with a known variance (Gaussian, lognormal, or historical), but if price movements do not follow a knowable distribution, then models of future outcomes – like VaR – that rely on estimated mean and standard deviation are of limited utility.[6] Aaron Brown, a prominent financial trader and risk manager, likewise attributes the financial system's incalculability to the complexity of highly integrated markets, in which risks in one sector are hedged and bundled with positions in another, leading to highly complex correlations and new kinds of financial instruments to the point where the predictive validity of any historical precedents for price movements breaks down (2004).[7]

That financial markets are constituted by human actors also fuels their incalculability. David Tuckett associates the uncertainty of financial markets with the unpredictability of emotional responses to financial gains and losses. He observes that these affective responses are difficult to model because behaviors like obsessively checking daily stock price movements despite their known inability to predict future patterns diverge from what actors with expectations consistent with rationalist models would do and lead financial traders to act in non-uniform ways (2011: 23, 51). Quantitative analyst Emanuel Derman also attributes uncertainty to the irreducibly agentic and social aspects of financial markets, contending that “we cannot know how the value of a security will change through time because we don’t know how the future will affect the promises made by its sellers. Value is determined by people, and people change their minds” (2011: 149). This affective component of uncertainty was part of what caused losses on super-senior CDO risk to far exceed VaR predictions. The model not only failed to anticipate widespread mortgage defaults, it also neglected the possibility that no one would want to buy even highly rated debt due to investors’ irrational fears (Tett, 2009: 230).

Although financial experts are operating in a world of both uncertainty and fully calculable risk – and are often aware of this – their response is nonetheless to attempt to statistically model future outcomes, claiming to have segregated manageable risk from incalculable uncertainty, or disregarding the latter entirely. Keynes observed this tendency to respond to uncertainty with probabilistic calculation, writing that “the necessity for action and for decision compels us as practical men to do our best to overlook this awkward fact and to behave exactly as we should if we had behind us a good Benthamite calculation of a series of prospective advantages and disadvantages, each multiplied by its appropriate probability, waiting to be summed” (1937: 24). Descriptively, Keynes’s assessment remains apt; VaR is one among many attempts to confront uncertainty in financial markets through practices that probabilistically model future outcomes.[8] Risk modeling allows investment banks to value investments and make trades in the face of Keynesian uncertainty.

In her analysis of how collateral is documented in Japanese derivatives trading, Annelise Riles refers to the practice of acting as if collateral posted to cover future credit risks belongs to the counterparty as a "placeholder" – a cognitive strategy for dealing with unknowable future outcomes which she describes as "a kind of knowledge that is consciously false and for this very reason irrefutable […]a tool for practical intervention" (2010: 802). Risk modelers' use of VaR is best understood not as an epistemological commitment that future unknowns are fully knowable, but rather as this kind of "placeholder." In responding to criticisms of VaR, many risk modelers acknowledge its limitations, but contend that there is nothing else to be done about the truly uncertain. Jorion, for example, writes, "Practically speaking, there is no way to provide an estimate of the absolute worst outcome" (1997b). Similarly, Gregg Berman, co-founder of RiskMetrics, contends that not being able to account for losses that are predicted to occur less than 1% of the time is no reason not to use VaR, since such losses cannot be predicted in any case: "If you say that all risk is unknowable, you don't have the basis of any sort of a bet or a trade. […] To not use VaR is to say that I won't care about the 99 percent, in which case you won't have a business" (qtd. in Nocera, 2009). Treating uncertainty as risk allows risk modelers to proceed by cognitively bracketing the consideration of losses that cannot be accurately modeled. While this is understandable, I will argue that excessive reliance on VaR, especially on the part of the bank managers, regulators, and the public who may be less familiar with the limitations of VaR is more problematic.

B. Model performativity

According to Marieke de Goede, modeling risk may have in fact perpetuated uncertainty by introducing further, less-than-fully calculable complexity into financial markets. In discussing international financial markets after the collapse of the Bretton Woods system of fixed exchange rates, she writes, “The response to increased uncertainty has been increasingly complex strategies of risk management, insurance, hedging, and speculation. Paradoxically, these increasingly complex financial strategies have fueled uncertainty and volatility rather than dispelled them” (2005: 50).

The idea that risk management itself affects the very outcomes it purports to model points to another, more insidious source of uncertainty. The concepts of “reflexivity” and “performativity” refer to the idea that economic models are not detached descriptions of objective, determinable economic processes but are themselves implicated in creating and altering the economy they purport to describe. The phenomenon of reflexivity has most notably been addressed in sociology (MacKenzie, Muniesa and Siu, 2007; Giddens, 1990: 35-36) and philosophy of science (Buck, 1963: 361-362; Martin, 1977: 81-97), but it can also be found in IR. For example, Alexander Wendt’s claim that “anarchy is what states make of it” refers to the idea that states acting under an assumption of anarchy will create a world that is indeed anarchic, but only contingently so (1992: 395). Reflexivity is a source of uncertainty because it generates contingent outcomes at odds with the idea of objective or knowable probabilities.

Financial investor George Soros regards reflexivity as inherent to economic life. Soros argues that participants’ views of the economy are always partial and distorted and that these skewed views influence the economy because they lead to “inappropriate” actions (2009a). In situations characterized by reflexivity, there is significant slippage between intentions and actions and between actions and outcomes. Because economic actors manipulate their environment according to the (partial) knowledge they possess, knowledge can no longer be understood as an objective description of a world external to the economic actor (ibid.). Instead, knowledge and the world are implicated in a relationship Soros refers to as a "reflexive feedback loop," where necessarily distorted and partial knowledge is acted on in such as a way as to instantiate the misperceptions, resulting not in convergence toward an equilibrium but rather to dynamic disequilibrium. This slippage is why reflexivity is one source of uncertainty (Soros, 2008: 29; 31). Soros characterizes financial markets, in particular, as reflexive, arguing that instead of neutrally reflecting an underlying reality, financial markets construct and change the fundamentals they are supposed to reflect (2009b; 2008: 51ff). According to such an understanding, crises and bubbles are not random deviations from equilibrium caused by exogenous shocks, but are rather a product of the disconnect between financial actors' expectations and the reality those expectations are enacting (ibid.). An important implication of this view is the impossibility of generating firm predictions about future outcomes because the act of formulating those predictions alters the very dynamics the model attempts to capture (Soros, 2008: 19).

Closely related to the idea of reflexivity is an ontological conception of financial markets – and the economy as a whole – as undergoing constant reconstruction and performance. Daniel Breslau writes that the economy only comes into being once a multitude of transactions are "recorded, abstracted from everyday experience, quantified, and then reassembled into a whole that seems to have a life of its own." (2003: 380). The idea that financial models construct the world of finance is memorably captured by Donald MacKenzie (paraphrasing Milton Friedman), who argues that financial models are "engines, not cameras" (2008).

MacKenzie uses the idea of performativity to argue that not only are theories and models engines of change in economic processes, but that the use of models causes practices to be altered such that their conformity with the model is changed. MacKenzie distinguishes between *Barnesian performativity*,[9] in which economic processes are changed such that they better correspond to the model, and *counterperformativity*, in which economic processes undermine the accuracy of the model (2008: 19). For example, MacKenzie finds that as the Black-Scholes-Merton options pricing model was used to identify under- or over-priced options relative to their theoretical values, options prices converged on these theoretical values as discrepancies were eliminated via arbitrage (ibid: 164). In contrast to this performative effect, MacKenzie notes that models which assume that price movements are stochastic can become counterperformative if large numbers of economic actors base their decisions on these models, undermining the assumption of randomness on which such models depend (ibid: 260).

Another mechanism through which models can produce counterperformative effects that is important to my analysis of VaR is what Akos Rona-Tas and Stephanie Hiss refer to as "gaming the system." In their analysis of the declining validity of FICO scores, they attribute the disconnect between estimated and actual default rates to incentives for borrowers to improve their credit scores through practices that alter the variables used to calculate their score (such as getting added to the credit card of a stranger with better credit) without necessarily improving their creditworthiness (Rona-Tas and Hiss, 2010: 138-140). VaR, as we shall see, has both performative and counterperformative effects, facilitating stability in which financial losses are confined to those predicted by the model in the short run, while ultimately producing a highly correlated, fragile system of leveraged investments that is vulnerable to losses far in excess of VaR numbers.

C. Productive power

Understanding VaR as a performative model operating in – and contributing to – a world of Keynesian uncertainty allows us to see two things: First, responding to uncertainty via probabilistic modeling is a political practice – one that is contestable because of its inherent limitations and, as I will argue in Section IV, empowers banks to have more discretion over their risk-taking than they would otherwise. Of course, if the financial future were fully predictable and risk models completely detached from market dynamics, political questions would still be present. In a world governed solely by risk, questions of distribution and fairness would remain, but they could be made based on confident estimates of future outcomes. In a world governed by both risk and uncertainty, the sites of politics include not just how resources are to be distributed, but also how we know what those resources will be. Even in a world of pure risk, the negotiation between banks and regulators over how much discretion banks should have concerning their risk models would be political. But in a world characterized also by uncertainty, the very practice of using probabilistic models to guard against large-scale losses is also political.

Second, the performative effects of VaR push us to consider what practices its use makes possible and precludes. Adopting a performative perspective on financial models helps explain their inability to accurately foresee future events, but it also shifts the question from one of representational accuracy to a consideration of the "constitutive and formative engagement of knowledge with the world" (Pickering, 1994: 417). Risk models play a powerful role in interpreting and constructing the world they purport to measure and describe, and as such, should not be understood as politically neutral technologies. As de Goede writes, although financial actors often assume economic outcomes to exist independently of their analysis, a performative understanding of markets considers instead "the manifest political consequences of adopting one mode of representation over another" (2005: 8). Mark Blyth similarly argues for the political power of financial ideas, like market integration and transparency, whose global authority cannot be explained in purely functional terms, observing that both the financial industry and states "have used these ideas to defend and extend the current regime *despite* the volatility and asymmetric distributions it produces" (2003: 239).

Many IPE scholars have recognized the political consequences of increasingly integrated global financial markets, even or especially when they are generally understood as apolitical. For example Jonathan Kirshner introduces his book on the politics of financial policies by observing that, as economic explanations for financial practices "become more modest and ambiguous, the demand for a political explanation must increase" (2002: 19). However, in IR, financial politics are often understood in state-centric terms (e.g., Bernhard et al., 2002; Frieden 1991; Lake, 2009). As Kirshner goes on to argue, "Even though states have lost considerable power and autonomy to market forces in the past few years, the world is still a world of states, actors with strong preferences and the power to advance their interests" (2002: 20). While states and domestic interests within states do retain a great deal of influence over economic policy , understanding the politics and power of practices of modeling financial risk requires a conception of power that goes beyond IR's usual focus on states as the primary locus of political power and organized interests as the main drivers of political economy.

Risk modelers and managers wield considerable power that cannot be reduced to state interests. As Breslau writes, economic experts help constitute and perform the economy itself: "The economy […] is in fact visible only through the mediation of economic experts." (Breslau, 2003: 388). A growing body of studies has documented the political power and governance authority of private actors in international economics (Tsingou, 2006; Underhill and Zhang, 2008; Büthe and Mattli, 2011; McKeen-Edwards and Porter, 2013). Frank Partnoy, for example, reveals that credit rating agencies are not external observers of financial markets, but help to construct them, facilitating global capital mobility and leading financial instruments to be assembled to maximize ratings, rather than value (2007; see also Sinclair, 2005: 53). Tim Büthe and Walter Mattli identify the shift from domestic financial regulation to global private rule-making as a highly consequential political trend, noting that although "the language accompanying these processes is technical; the essence of global rule-making […] is political" (2011: 12).

Analyzing the non-state, non-coercive power exercised by financial experts and their models demands moving beyond the interest-based models that characterize many studies of international political economy and considering instead the broader political effects of this authority. Investment banks are undeniably powerful actors in the global political economy, and their interests are not irrelevant to the story of VaR; they underlie the push for internal risk models. But banks' material power and interests constitute a poor explanation for the continued use of VaR, given its repeated failures. For this reason, I contend that the practice of modeling itself should also be understood as powerful, insofar as it makes other practices possible and empowers banks vis-à-vis regulators and the public. The authority of VaR was in fact partially constitutive of the power of investment banks to stave off stricter regulation because it allowed them to claim to be limiting and planning for future losses.

In order to understand the politics of VaR, I use the concept of productive power, which Michael Barnett and Raymond Duvall define as referring to "the constitution of all social subjects with various social powers through systems of knowledge and discursive practices" (2005: 55). Productive power differs from more traditional conceptions of power in that it inheres not in actors' material capabilities, but rather in the relationships between them. Productive power shapes not only how social actors understand and conduct themselves, but also how particular systems of practice are constructed as meaningful and authoritative. In what follows, I consider how the use of VaR shaped risk modelers' and traders' understanding of their actions, but focus primarily on how its use produced unforeseen systemic effects. In broad terms, I argue that the perceived knowledge of financial experts and the practice of modeling risk using VaR helps constitute the political power of private investment banks over public actors.

As an analytical tool, productive power focuses on the conditions of possibility for, rather than coercive limits on, social practices. Michel Foucault writes that "power would be a fragile thing if its only function were to repress, if it worked only though the mode of censorship, exclusion, blockage, and repression […]If, on the contrary, power is strong this is because, as we are beginning to realise, it produces effects […] at the level of knowledge" (1980: 59). This conceptualization of power suggests that a study of VaR's political consequences must be attentive to two dynamics of power. First, with respect to the enabling effect of power, one must consider what effective interpretations of financial markets and the future VaR produces and how these, in Clarissa Hayward's words, "define fields of possibility of social action" (2008: 30). But so too must one consider what meanings and practices are foreclosed by models' claims to objective evaluation of the financial system. This latter line of inquiry, in particular, has important implications for democratic politics. To the extent that financial modelers' authority to define risk (or more precisely, to represent uncertainty as risk) is unrivalled, alternative understandings of the financial system and alternative possibilities for contending with Keynesian uncertainty are marginalized.

III. The production of temporary stability and long-run volatility: VaR's (counter)performative effects

Having made the case for *why* we should understand the use of VaR as political, I now turn to the question of *how* it is political by examining the practices its use facilitates and inhibits. To do this, I first specify and trace out the performative and counterperformative effects of VaR modeling, explaining how its use produces a system of highly correlated investments in which losses are limited to those foreseen by the model. However, the fragility of this system makes it more crisis-prone and ultimately more volatile and unpredictable, with losses far in excess of VaR predictions. After tracing out these effects, I turn to a discussion of the implications of these (counter)performative effects for authority and power in an uncertain financial system.

VaR's performative and counterperformative effects are a product of its "nearly universal" use by investment banks (Kuritzkes and Schuermann, 2010: 113) and by many hedge funds (Dunbar, 2000: 203). In the short run, the widespread use of VaR exhibits Barnesian performativity: financial losses largely conform to VaR predictions. The institutionalization of a common method of measuring risk in banks' risk management divisions causes investment strategies to converge, producing temporary stability, with few unexpected losses, in financial markets. Specifically, tying VaR to limits on risk-taking that traders are not allowed to breach creates incentives for traders to take on investments with a low probability of very large losses. VaR is only concerned with the maximum loss at a given confidence level; a 99% VaR, for example, says nothing about the size of losses that are expected to occur less than 1% of the time. Therefore traders have an incentive to look for investments with a very low probability of loss, regardless of the magnitude of that loss. This makes it significantly more likely that firms will take what the industry refers to as "asymmetric positions" – positions with small gains and rare but huge losses.

The tendency for VaR to produce similar, and therefore highly correlated, investment strategies is well documented, and the effects of this correlation are highly consequential. Stan Jonas, the managing director of the European investment bank Société Générale/FIMAT, observes that given sufficiently widespread use of VaR, the financial system comes to be defined by the model, closing the presumed separation between objective valuations of risk and the financial practices being modeled. His comments at a 1998 roundtable on VaR are worth quoting at some length: "[A]fter a given period of time, everybody has pretty similar trades. After 10 successful years, everybody is doing the Thai baht carry trade. […] The statistics show that it's a risk-free trade. After eight years, it's an immutable fact –Thailand doesn't devalue. What results then is that people have portfolios that are diversified in virtually the identical fashion" (*Derivatives Strategy*, 1998).

Jonas's analysis of VaR's effects on the global financial system provides a striking illustration of the way in which VaR creates apparently "immutable facts" in its image. With everyone calculating the market risk of common investments similarly, it is unlikely that the asset price will exhibit unexpected volatility, helping to ensure the accuracy of the VaR estimate of losses, and shoring up its apparent capacity to effectively manage risk.

This stability, however, is exceptionally fragile because it is not the result of objective risk calculations, but rather an artifact of highly correlated investments. When subjected to an unexpected shock, correlation does not produce stability, but rather unforeseen volatility. This is because when one firm's risk limits are breached, other firms' are likely to be as well. Firms then have two options: to hold more offsetting capital or to cut the unacceptably risky positions.

When banks are highly leveraged, increasing capital allocations may be impossible, so cutting positions is likely. But with everyone attempting to reduce the same trading positions at the same time, there is insufficient liquidity in the market. As Jonas goes on to describe: "Under a VAR approach […] everybody tries to shrink the size of their aggregate portfolio. […] Then you can see that if everybody has a similar portfolio, everybody can't shrink their portfolio at once, because, in this world, the major fallacy of diversification is that somebody else has to be outside of the ostensibly diversified system to hold the risk" (*Derivatives Strategy,* 1998). The widespread use of VaR reduces the variation in estimates of value that investment banks and hedge funds profit from.

G. Gopalakrishna, of the Indian Federal Reserve Bank argues that this correlational effect is ultimately counterperformative, intensifying the sharp and unpredictable price changes that VaR purports to manage:

> The herd mentality that is so typical of the financial industry means that market sensitive risk management systems, such as VaR, actually make markets less stable and more prone to crisis. This is because financial institutions may have to sell assets in the affected classes when markets become volatile in order to keep within the VaR limits set by senior management; this depresses market prices even further and increases the volatility and correlation of the risk factors of these assets. This in turn might cause another set of financial institutions to exceed their VaR limits, forcing them to reduce their exposure by selling still more of the same assets – perpetuating a vicious cycle. (2013: 3)

As a result, the use of VAR acts as an endogenous source of market instability and unpredictability: When widespread use of VaR changes the behavior it purports to model objectively – when its use becomes endogenous to the system it claims to model – it fuels the unpredictability of the financial system as a whole. Moreover, this volatility magnifies the potential for crisis. As Robert Litzenberger, former Chief Risk Officer at Goldman Sachs, describes:

> [W]hen volatilities rise and there are some trading losses, VARs would be higher and tolerances for risk would likely be lower. For an individual firm, it would appear reasonable to reduce trading positions; however, if everybody were to act similarly it would put pressure on their common trading positions […] If many arbitrage traders have similar trades and the aggregate position sizes are very large, it is like dry grass building up and just needs a match to ignite it. (qtd. in Dunbar, 2000: 203; 205)

Taleb argues that it is precisely this element of reflexivity – which cannot be captured by a statistical model that assumes a separation between its use and the world – that makes unreflective uses of, and over-reliance on, VaR a questionable strategy (*Derivatives Strategy*, 1997).

This counterperformative effect is not merely a theoretical possibility; it helps explain the collapse of the hedge fund Long Term Capital Management (LTCM) in August 1998 when Russia unexpectedly restructured its debt, triggering a wave of VaR breaches. Although LTCM was not itself heavily invested in Russian securities, its core strategy of taking advantage of small differences in government bond prices depended on the assumption that, via arbitrage, prices on similar bonds would ultimately converge. However, when Russia defaulted on its domestic debt, investors rushed to cut their positions in Russian bonds, and the bond values that LTCM was betting would converge diverged in an unprecedented fashion, turning LTCM's anticipated profits into a $551 million loss on one day alone (Dunbar, 2000: 205). By the end of August, LTCM's losses were more than 14 standard deviations away from VaR predictions, "something that occurs once in several billion times the life of the universe" (Kolman, 1999). Industry-wide reliance on the same risk model had produced events that diverged dramatically from the model's predictions.

The production of correlation is not the only way the use of VaR may destabilize financial markets. While Gopalakrishna's "vicious cycle" is an emergent consequence of attempting to model risk, the dominance of VaR also provides incentives for intentional changes in investment behavior that make unforeseen losses more likely. At work is the mechanism identified by Rona-Tas and Hiss, who contend that consumer credit rating models lead borrowers to behave in ways that improve their credit score while leaving their financial situation unaltered, making estimates of credit risk less accurate (2013). Similarly, VaR encourages practices that keep predicted losses low but do not necessarily make a portfolio less risky.

Jorion acknowledges this effect on investment behavior in his discussion of the limits of VaR, observing: "If a risk manager imposes a VAR system to penalize traders for the risks they are incurring, traders may have an incentive to 'game' their VAR. In other words, they could move into markets or securities that appear to have low risk for the wrong reasons. For instance, currency traders in 1994 could have taken large positions in the Mexican Peso, which had low historical volatility but high devaluation risk" (1997b). More recent examples of the kind of low-probability high-magnitude investments that VaR incentivizes are the mortgage-backed securities and credit default swaps that played an infamous role in the 2008 financial crisis. Although the risk of default, and therefore financial loss on these investments, was interpreted as very low at the height of the U.S. housing bubble, the magnitude of the losses, particularly in a highly correlated investment market, was devastating. As Einhorn writes, "the risk models said [these securities] had trivial VaR, because the possibility of credit loss was calculated to be beyond the VaR threshold. […] In the current crisis, it has turned out that the unlucky outcome was far more likely than the backtested models predicted" (2008: 12). VaR did not just fail to foresee losses in excess of its predictions; it contributed to investment practices that made such losses more likely by incentivizing banks to take on positions with potentially huge losses outside the VaR confidence interval. As Jonas observed of risk-taking prior to the Asian financial crisis, “the prevalence and apparent statistical comfort that VAR gave people probably increased the size and the risk of the exposure that banks were willing to take ex-ante” (*Derivatives Strategy*, 1998).

A further counterperformative effect was at work in the subprime mortgage meltdown: a false sense of security. As early as 2000, Guldimann had warned, in reference to VaR, that, “the danger is that we get lulled into complacency by the illusion of assured liquidity” (2000: 58). Nocera’s description of the financial sector prior to the collapse of the housing bubble bears out Guldimann’s warning: “[W]ith easy profits being made and risk having been transformed into mathematical conceit, the real meaning of risk had been forgotten. Instead of scrutinizing VaR for signs of impending trouble, [banks] took comfort in a number and doubled down, putting more money at risk in the expectation of bigger gains” (2009). Indeed, when asked why their VaR models so dramatically underestimated the losses on super-senior CDO risk, UBS’s chief financial officer, Marco Suter explicitly cited the bank’s risk management models, commenting that, “Sometimes people start to fall in love with models, and they forget to look at notional values” (Baker-Said and Logutenkova, 2008). This confidence in having controlled future losses caused traders to disregard what was excluded from the model – the multimillion dollar potential losses that were in the tail outside of the 99% confidence interval with which VaR is concerned, as well as the fundamental uncertainties inherent in the system. As Richard Hoppe writes, “believing a spuriously precise estimate of risk is worse than admitting the irreducible unreliability of one’s estimate. False certainty is more dangerous than acknowledged ignorance” (1998: 50).

Rather than neutrally calculating objective probabilities of financial losses, VaR changed the very patterns of financial behavior it claimed to be measuring. The claim to be able to accurately account for future losses is, as we might expect in a world of uncertainty, at least partially illusory. And the illusion of control provided by VaR did not just affect how regulators saw the financial industry; it also changed how traders and risk managers acted, leading them to take on more risk than they might have otherwise have. By creating a perception of control, VaR made investors over-confident in their ability to foresee and manage financial losses.

A final mechanism through which VaR produces counterperformative effects involves the methodology's sensitivity to parameter and distribution choices. Because the 1996 Amendment allows banks to use their own, internally determined models to calculate their market risk, some scholars have suggested that "banks may be inclined to underestimate their VaR in order to reduce their market risk charge […] or to decrease the quality of its risk management system" (Pérignon and Smith, 2010: 363). In 2013, these concerns were borne out by a U.S. Senate Subcommittee investigation of JPMorgan Chase's derivatives trade. Among other findings, the report detailed that the investment bank – the largest financial holding company in the US and the largest derivatives dealer in the world – had intentionally manipulated their VaR model in order make their investments appear less risky and therefore subject to a lower capital charge: "Bank documents, emails, and recorded telephone conversations are clear that a key motivation for developing the new VaR model was to produce lower VaR and Risk Weighted Asset (RWA) results […] in order to lessen the bank's capital requirements under the upcoming Basel III rules" (United States Senate, 2013: 171). The investigation found that the bank had responded to a series of risk limit breaches not by changing their investment strategy, but by changing their risk model to make their greatest possible loss appear smaller than under the previous model. In fact, the new model immediately reduced JP Morgan's VaR by 50%, from $132 million to $66 million (ibid.: 180). Although media and congressional investigations ultimately uncovered the bank's self-serving manipulation of their risk model, it went unnoticed by regulatory agencies for several months (Kopecki and Hopkins, 2013), drastically misrepresenting possible losses to investors, regulators, policymakers – and, as the Senate report notes, "the taxpaying public who, when banks lose big, may be required to finance multi-billion-dollar bailouts" (United States Senate, 2013: 1).

The same model that, as I will argue, legitimized investment banks' claim to responsible self-regulation also made the financial system more vulnerable to crisis, changed financial behavior in unpredictable ways, and enabled the systematic misrepresentation of multimillion-dollar financial losses. These effects go well beyond objective apolitical calculation. They suggest that risk modeling is in fact an important site of power in the international financial system and that this power allows financial actors to maintain a substantial amount of authority irreducible to their technical proficiency. In the following section, I turn to the implications of these (counter)performative effects for power and authority in global finance.

IV. The political implications of VaR's (counter)performativity

VaR does not always, or even usually, fail, nor does it always produce devastating counterperformative effects. During normal times, and partially in virtue of its Barnesian performativity, portfolio losses conform to VaR predictions. To analyze VaR as performative is not to say that any arbitrary risk model could have had the same effects. If VaR had routinely and systematically produced financial losses, its users would soon have been outcompeted and the model abandoned. Indeed, VaR's authority, particularly in convincing the BCBS to allow banks to use internal risk models to calculate capital adequacy ratios, can be partially explained by its successful use by investment banks in the early 1990s. But in light of its well-publicized failures, it is worth considering what other sources of authority underlie the practice of risk modeling. In this section, I argue that even as reliance on VaR exacerbates market volatility, it also undergirds banks' authoritative claim to responsibly manage risk, a claim which limited the regulation of banks by the BCBS. To make sense of this tension, I then analyze how the authoritative status of VaR both immunizes private expertise from public scrutiny and precludes alternative responses to uncertainty.

A. VaR as an authoritative practice

Although VaR was designed by J.P. Morgan as a way to *measure* risk, its users quickly claimed to be able to *manage* risk – to foresee and limit future losses and to stake their claim to expertise on this ability. RiskMetrics carefully cautioned users of their methodology that, "no amount of sophisticated analytics will replace experience and professional judgment in managing risks. RiskMetrics is nothing more than a high-quality tool for the professional risk manager involved in the financial markets and is not a guarantee of specific results." (J.P. Morgan/Reuters, 1996: 1). But the distinction between tool of measurement and technology of control was quickly elided, and a 1997 textbook on VaR is prefaced with a discussion of the model's contribution to "controlling" risk (Jorion, 1997a: x).

VaR did not allow for risk management on its own, but rather in conjunction with other financial practices, most notably capital requirements and firms' own risk limits and systems of allocating capital among traders. These latter practices, however, require a way to measure probable future losses prior to imposing limits on the risk or calculating a risk-weighted capital adequacy ratio. Without the ability to measure risk, there would be no way to limit risk-taking, make off-setting investments, or tie capital requirements to market risk. For example, Dunbar describes how LTCM's use of VaR shifted from measurement to control through the use of risk limits: "From its initial use as a passive radar system, the risk managers transformed VAR into an active tool intended to replace the stop-loss limit" (2000: 147). Even after LTCM's collapse, VaR's use as a technology that allowed banks to authoritatively claim to control and limit future losses was reproduced throughout the financial industry.

The centrality of claims of control has historically been central to the legitimation of financial practices. De Goede writes that in the earlier 20th century claims to be able to measure risk are precisely what separated legitimate financial speculation from illegitimate gambling: "Speculation came to be regarded as a technical and economically logical response to objectively existing business risks, which made possible the silencing of political critiques of the financial exchanges through the discursive, albeit unstable, separation of gambling from finance" (2004: 204). The claim to be able to measure risk using VaR and therefore predict future price movements similarly allowed the financial industry to claim that practices like derivatives trading were controllable and controlled, depoliticizing them and strengthening the case for limited outside regulation.

B. Limiting international regulation

The availability of an ostensibly objective model of maximum possible losses resulting from price volatility made it possible for the BCBS to link capital requirements to market risk. But allowing banks to develop their own specific VaR models grants banks a great deal of autonomy in terms of determining their own capital requirements. While central banks and public regulators were the principal participants in earlier Basel negotiations, the financial industry played a very active – and successful – role in defending its interests in the market risk negotiations in the early 1990s.[10] In April 1995, the BCBS developed a proposal for calculating capital charges based on market risk and solicited comments from central bankers and investment banks (BCBS, 1995a). The proposal was endorsed by the G-10 central bank governors (BCBS, 1996a), but while private banks generally acceded to the need to account for market risk, they strongly advocated they be allowed to use their own, internal models to calculate VaR, rather than a standardized approach. A BCBS summary of industry comments concludes: "[A] strong common theme among the responses was the argument that proprietary risk management models developed by some of the more sophisticated banks produce far more accurate measures of market risk and that there would be costly overlaps if those banks were required to calculate their market risks in two different ways" (BCBS, 1995b: 2).

This corresponds with the financial industry's comments at the time. For example, David Palmer, Associate Director of Trading Risk at the British investment bank NatWest Markets, wrote in 1995 that "most people in the industry welcome the Basel Market Risk proposals because they introduce the concept of banks using their own VAR models to calculate capital charges" (Richardson, 1995-6).

In response to strong insistence by banks that they be allowed to develop their own specific risk models, as an alternative (rather than a supplement) to the standardized risk measurement framework originally proposed, the BCBS ultimately permitted considerable bank discretion in determining model parameters, finding studies of internal risk models to be, in their words, "sufficiently reassuring for it to envisage the use of internal models to measure market risks" (BCBS, 1995a: 2). The final version of the Amendment gave banks the choice between using a standardized risk model or using their own internal VaR models, subject to a series of quantitative and qualitative standards and the approval of the bank's home country supervisory authority (BCBS, 1996b: 40).[11] The 1996 Amendment is careful to specify that "no particular *type of model* is prescribed" and that banks are free to choose their own parameters and distribution (including "variance-covariance matrices, historical simulations, or Monte Carlo simulations") for calculating their maximum possible losses (ibid.: 46).

Having an easily understood, quantitative model at hand that claimed to accurately capture the risks incurred by trade in complex financial instruments allowed the financial industry to legitimate its resistance to stricter international regulation. Regulators' turn toward VaR as a method for measuring risk was itself a result of its widespread use in the financial industry the Basel Committee sought to rein in. As Dunbar writes, "As regulators became aware of OTC derivatives in the early 1990s, the leading banks could point to VAR and Raroc as signs of their responsibility in controlling this expanding business. […] The regulators, in particular the Basel Committee, took the bait, and signalled that they would permit the use of 'internal models' in allocating capital for a derivatives business" (2000: 140). The result of this perception of effective technical risk management was that, in Blyth's words, "the biggest banks would be able to regulate themselves" (2003: 249).

Were VaR doing nothing more than measuring objective probabilities of future financial losses (however incompletely) this degree of self-regulation might not be particularly problematic. However, VaR's counterperformative effects can produce a world in which the pattern of financial losses diverges sharply from the model's predictions. The use of VaR influences and interacts with financial behavior in ways that may heighten the vulnerability of the financial system – and the public – to the very crises that VaR was designed to foresee and prevent. For this reason, I turn now to a consideration of the alternative conceptions of and responses to the possibility of crisis that are marginalized by relying on VaR.

C. The depoliticization of uncertainty

VaR's authority may seem difficult to reconcile with its predictive failures and its contribution to the uncertainty and volatility that make such failures more likely. Viewing risk modeling not as a technical practice with accurate predictive power, but rather as a political practice with productive power helps makes sense of this tension. The concept of productive power pushes us to consider not only the practices VaR makes possible but also the other side of this coin -- those it renders unthinkable. I argue that VaR precludes alternative ways of responding to uncertainty by depoliticizing both the financial future and risk modeling as a practice. Because the model systematically fails to acknowledge uncertainty, those who depend on VaR for preventing destructive financial losses are blinded to the possibility of much larger losses than those predicted by the model – and to Keynesian uncertainty itself. Moreover, VaR's authority and dominance in financial governance narrows the field of contestation about how to respond to uncertainty by privileging experts and predictive models as the primary response to the possibility of financial crisis. Alternative responses to uncertainty, such as subjective judgment and systemic financial regulation, are crowded out, leaving few tools with which to face the unpredictable, besides inevitably limited attempts at control.

There are two reasons that VaR makes acknowledging uncertainty *qua* uncertainty difficult. First, its assumption that historical data are a reasonably accurate predictor of future outcomes obscures the possibility of unprecedented and unpredictable deviations from historical trends. Kolman argues that this is one reason LTCM was left vulnerable to ultimately devastating unanticipated losses: "the past is a poor guide to the future. In July 1998, Russia defaulted on its domestic debt but not on its foreign debt. Because an event of that nature had never occurred, a model would assign it a probability of zero. […] Even perfect data would not have helped them because the past is simply not adequate to predict the future" (1999). Because, as we have seen, VaR creates the illusion of control over future losses, actors may not even consider the possibility of unpredictable events. .

Taleb argues that a predictive model will always be an inadequate way to anticipate future crises; historical data are inherently problematic because the experience of crises causes people to alter their behavior in ways not captured by the model's assumptions: "the casual quantitative inference in use in VAR (which consists of estimating parameters from past frequencies) is too incomplete a method […] there is no 'canned,' standard way to explore stressful events – they never look alike because humans adjust" (1997). For example, Taleb notes that in response to an unanticipated financial crisis, risk modelers will "fatten the tails" of the underlying distribution of future losses, that is, add the possibility of higher losses than previously predicted into their model. But this in turn changes investment behavior and the price movements that the model is attempting to capture. Because of these performative effects, Taleb writes that "an after-the-fact adaptation to the stressful events that happened is dangerously naïve […] there is a tautological link between the harm of the events and their unpredictability, since harm comes from surprise" (ibid.). Updating or modifying risk models in response to unpredicted financial crisis is thus both self-defeating, insofar as the model remains problematically based on historical data, and ineffective as a response to events that are, by definition, not amenable to probabilistic prediction. Moreover, using past events, even updated ones, as the basis for prediction continues to make losses that are fundamentally uncertain – and by definition unprecedented – unthinkable.

A second way the use of VaR blinds financial actors to the problem of Keynesian uncertainty is that it causes them to disregard the potentially devastating losses that are outside the confidence interval with which bank managers and regulators are concerned.[12] As hedge fund president David Einhorn writes, “A risk manager’s job is to worry about whether the bank is putting itself at risk in the unusual times – or, in statistical terms, in the tails of distribution. Yet, VaR ignores what happens in the tails […] This, in my view, makes VaR relatively […] potentially catastrophic when its use creates a false sense of security among senior managers and watchdogs” (2008: 11-12). Financial actors and regulators ignore the losses in the neglected tails of the distribution at their peril. An empirical test of a variety of VaR measures against historic price data found that losses outside of the confidence interval were typically 30 to 40 percent larger than VaR models predicted, leading Darryl Hendricks to conclude that “value-at-risk measures – even at the 99th percentile – do not ‘bound’ possible losses” (1996: 56).

Those inside the financial industry are, as we have seen, not unaware of these limitations of VaR. As financial trader and risk manager Aaron Brown writes, VaR “is not the worst-case loss: in fact, we expect to lose more than VaR two or three times a year” (2008: 20). However, the VaR numbers that are disclosed to investors, regulators, and the public convey no information about possible losses that fall outside the predictions of the model. Because VaR enjoys an exceptionally privileged place in public evaluations of financial risk, it tends to crowd out other, non-probabilistic methods of anticipating crisis, leaving banks – and the citizens who are asked to bail them out – unprepared for losses that VaR cannot predict. Bluford Putnam, former head of Cdc Investment Management Corporationwrites that excessive reliance on VaR causes those who see only VaR numbers to ignore macroeconomic dynamics and events excluded from the model, producing a dangerously false sense of security:

> If one uses only historical price data of U.S. short-term debt securities, VAR will tell you there is very little risk in the U.S. interest rate market, since the historical standard deviation of the price series had been heading lower and lower as the Federal Reserve held short-term interest rates fixed. Of course in February 1994, fixed-income markets blew up. […] Value-at-risk calculation based solely on the recent history of the price series, by construction, will never see a storm coming,

> and worse, the message that will be sent is that life is getting increasingly less risky – until the storm hits and it is too late. (*Derivatives Strategy,* 1998)

The problem is not that VaR is unable to predict the unpredictable – an unfair critique – but rather that it makes the unpredictable unimagined. That is, it causes non-expert audiences for VaR predictions, in particular, to disregard uncertainty precisely because it cannot be captured by a probabilistic model.

For all its counterperformative effects and limitations, the dominance of probabilistic calculation as a response to Keynesian uncertainty would be less politically consequential if there were no other possible ways to confront unknown unknowns. But this is not the case: VaR is one possible response to uncertainty, not a necessary one. However, because of the considerable power of VaR and of the financial actors whose authority derives, in part, from its use, other practices and sensibilities are marginalized or even rendered unthinkable. As Blyth concludes in his analysis of the dominance of transparency in discussions of international financial regulation: "Representing the current system as the 'only way' to organize capital flows ensures that the financial sector itself becomes largely immune from criticism and protected against calls for more fundamental reforms" (2003: 253). Like transparency, risk modeling is represented as an optimal, unproblematic way to prepare for adverse future events.

While a full elaboration of alternatives to risk modeling is beyond the scope of this article, two practices bear mention as both substantively distinct from VaR and marginalized by its dominance. First, in terms of banks' preparations for future outcomes, subjective judgment has historically been the main alternative to quantitative calculation. As Peter Bernstein writes, the history of risk is marked by "a persistent tension between those who assert that the best decisions are based on quantification and numbers, determined by the patterns of the past, and those who base their decisions on more subjective degrees of belief about the uncertain future"

(1998: 6). VaR, and other model-based approaches to financial practice and governance, such as the capital asset pricing model, largely supplanted subjective judgment in latter half of the twentieth century. In his defense of a greater role for judgment in financial markets, Amar Bhidé explains how the move to quantification has worked to exclude case-by-case evaluations in modern finance, writing that statistical models are "utterly at odds with a decentralized, innovative economy where different individuals make different choices, depending on how they interpret the world around them and the facts that they uniquely observe" (2010: 103). One need not endorse the full-scale replacement of statistical modeling by judgment to recognize that the latter is diminished when VaR is represented as the best way to foresee financial losses.

At the level of regulation, the post-crisis turn towards macroprudential regulation (MPR) has been proposed as an alternative to the excessive reliance placed on standardized risk models and capital requirements (e.g., Borio, 2009; Persaud, 2009; Gauthier, Lehar, and Souissi, 2010; Hanson, Kashyap, and Stein, 2011). In contrast to pre-crisis regulation, such as Basel II, that focused primarily on protecting individual banks, MPR regards risk as endogenous to the financial system as a whole and works specifically to counter the herding behavior produced by excessive reliance on standardized risk models (Baker, 2014: 30). Serious consideration of MPR during the 1990s was largely precluded by the BCBS's focus on VaR-linked capital requirements, leading Baker to characterize MPR as "relatively unpopular and very much on the sidelines" prior to the crisis (2013: 112). As Borio wrote in 2009, "a decade ago, the term was barely used. And it would have been hard for supervisors to recognize that their tasks involved a significant macroprudential dimension, let alone that it would have been desirable to strengthen it" (32). Even today, this alternative to VaR reveals the dominance of quantitative models as a response to financial uncertainty. While MPR adds other tools, in addition to VaR, to the arsenal of anticipating future outcomes, it remains model-based and has been criticized for some of the same technocratic and depoliticizing tendencies I attribute to VaR (Baker, 2014: 34-37).

The dominance of VaR over responses such as these can be seen clearly in the BCBS's 1996 response to the limitations of VaR. The BCBS made clear that even VaR approaches that met the 1996 Amendment's standards did not fully capture the range and magnitude of potential future losses, regarding the model as a "a valuable starting point" for measuring the riskiness of a bank's portfolio (BCBS, 1996a: 4). They observed that, "Market price movements often display patterns (such as 'fat tails') that differ from the statistical simplifications used in modelling (such as the assumption of a 'normal distribution'); The past is not always a good approximation of the future (for example volatilities and correlations can change abruptly); [and] Models cannot adequately capture event risk arising from exceptional market circumstances" (ibid.: 4-5). In response, the Committee required that banks' VaR numbers be multiplied by three (an apparently arbitrary number) to account for greater than predicted losses. While the BCBS's identification of VaR's limitations was astute, their solution – that maximum predicted losses be multiplied by three – does little to move beyond prediction as a response to uncertainty, as it remains firmly grounded in the results of a probabilistic model.[13] Brown bluntly argues that the multiplication factor is a wholly inadequate way of preparing for losses in excess of VaR. The idea that multiplying VaR by three is a good representation of the largest possible loss is, in Brown's words, "a terrible assumption on both theoretical and empirical grounds" (2008: 20). The BCBS also specified that banks would be issued an additional charge for poor performance of their models, as measured against historical data, further reinforcing the centrality of probabilistic prediction to their approach to devastating financial losses (BCBS, 1996b: 47).

VaR's status as an objective practice used by financial experts lies at the heart of its authority and of BCBS's willingness to use it as the basis for linking capital requirements to market risk. However, rather than ensuring its neutrality, VaR's claim to objectivity and technicality is itself an act of political power. As Theodore Porter observes, claims to objectivity are often intended to depoliticize decisions in order to remove them from the realm of contestation. He writes, "A decision made by the numbers (or by explicit rules of some other sort) has at least the appearance of being fair and impersonal. […] Quantification is a way of making decisions without seeming to decide" (1995: 8). But this act of "making decisions without seeming to decide" is no less powerful for having been depoliticized – and may even be more so, insofar as the workings of power are obscured by its having been placed outside the scope of politics. To the extent that VaR is perceived as an approximately accurate, detached representation of market processes, it is unlikely to be seen as a political practice – one that is contestable because it is necessarily unable to foresee devastating losses and one that serves to legitimate banks' claim to authority and responsibility.

The depoliticization of risk models narrows the field of popular deliberation and contestation about how to respond to Keynesian uncertainty by privileging experts and their predictive models as the only (or at least best) response to the possibility of financial crisis and an uncertain future. Uncertainty, however, is an irreducibly political problem: one that cannot be solved or dissolved through technical management. As Sanjay Reddy writes, "[C]onceptions of uncertainty in terms of 'risk' or potentially calculable probabilities divert attention from the truly radical and irreducible nature of our ignorance about the future world, which makes of it in turn an irreducibly political space" (1996: 242). In treating uncertainty as measurable and manageable by technical experts, VaR makes other political responses to uncertainty more difficult to implement. Alternative forms of financial regulation, such as limitations on the size of the financial industry relative to a domestic economy,[14] can be marginalized from the public debate when banks can make an authoritative claim to self-regulation. More generally, the perception that future financial losses can be accurately foreseen means that it is harder to imagine and persuasively advocate for societal practices and sensibilities, beyond financial regulation, that might better equip the world for unforeseeable financial events.

The global financial crisis dramatically revealed that large-scale private sector losses, many times in excess of banks' predictions and capital reserves, have profound effects on the real economy and ordinary citizens' well-being. That the consequences of financial risk modeling are not confined to the financial industry makes its depoliticization – the fact that it is taken for granted, especially by those who poorly understand it, as the best or only way to contend with an uncertain future – highly consequential. To the extent that banks were held responsible for unpredicted losses and the financial crisis, they tended to be blamed for failing to measure and manage risk responsibly, implying that the response should be one of building better predictive models and adhering to them. But acknowledging that financial systems are characterized by a level of uncertainty that exceeds probabilistic modeling calls for a different political sensibility, one not driven solely by attempts at prediction and control. When uncertainty is understood precisely as that which cannot be neither predicted nor dissolved, and when crises are understood as endogenous to the system itself, the focus can and should expand beyond building better risk models to building a society with the flexibility, resources, and political will to weather unforeseeable financial shocks.

Conclusion

Starting from an observation about Value-at-Risk's high-profile predictive failures, this article has attempted to make sense of its continued use by analyzing its productive, rather than predictive, power. This line of inquiry has led me to identify VaR's (counter)performative effects and the way in which it produces banks as authoritative, responsible managers of an uncertain financial future. Viewing financial markets through the lens of Keynesian uncertainty and model performativity helps explain VaR's failures by revealing VaR to be an inherently limited and potentially destabilizing practice. Its use participates in the construction of a financial system that is only temporarily stable and controllable. At the same time, VaR is an important source of authority for banks vis-à-vis regulators because it represents the future as statistically calculable and expert prediction as the optimal, objective mode of preparing for that future. This, in turn, makes less thinkable responses to uncertainty that might be better suited to the possibility of devastating losses unforeseeable – and perhaps produced – by the widespread use of VaR.

My goal in this article is not to advocate specific financial regulatory reforms. Rather, by revealing the political consequences of attempts to manage risk and by acknowledging the non-necessity of responses to uncertainty which claim to be dictated by objective calculations, I hope to create space for alternative or additional ways to acknowledge, act in, and respond to a world of risk, uncertainty, and reflexivity. This should not be interpreted as an argument against professional skill in financial markets. In economic policy, economists, statisticians, and financial analysts have an important role to play in analyzing, informing, and creating well-informed policy. Rather, this article should be read as a call for critical inquiry into the nature and scope of expert authority in global finance to better identify the conditions under which that authority should be seen as legitimate and decisive. Nor should the claim that the financial system exceeds our capacity to fully predict and control be mistaken for political quietism in the face of unknown unknowns. Precisely the opposite; by recognizing the limitations of what we can capture probabilistically, we open up space for deliberation about how to proceed in the face of irreducible uncertainty.

NOTES

[1] For example, if a bank says the daily VaR of its portfolio is $40 million at the 99% confidence level, that means there is a 1 in 100 chance that a loss greater than $40 million will occur.
[2] Büthe and Mattli note the effects of the Basel Committee's recommendations extend well beyond the regulators that participated in setting them: "Numerous public regulators who had no voice in setting these capital adequacy standards thus ended up adopting them" (2011: 22).
[3] My position in this article is not that markets "really are" governed by uncertainty rather than risk, but that is that it is analytically useful to view them as partially characterized by Keynesian uncertainty as this helps us see the way in which calculative tools like VaR construct them in contingent ways. I do not think risk and uncertainty are mutually exclusive, though I do think that the islands of predictability that do emerge in markets are not inherently so, but exist as social accomplishments.
[4] Mandelbrot and Taleb point to the 1987 stock market crash, the 1992 crisis in the EU exchange rate mechanism, and the 2007-8 financial crisis as events that, according to extant risk models, should only happen one in a googol (one, followed by a hundred zeros) times (2010: 51).
[5] While these extreme cases fall outside the scope of what the models claim to be able to predict, the magnitude of losses speaks powerfully to why we should be concerned with the limitations of risk modeling.
[6] VaR models can also be based on a Monte Carlo simulation which generates a distribution of possible outcomes by running multiple random hypothetical trials. In this case, financial gains and losses are assumed to be stochastic and thus amenable to probabilistic analysis, in contrast to the non-ergodic view of the financial system that underlies contemporary understandings of Keynesian uncertainty (Holton, 2003: 193-198).
[7] Brown nonetheless defends VaR in a subsequent article, though he acknowledges its limitations, noting that "A 99% one-day VaR has to operate for about three years before you can trust it. A 99.97% one-year VaR, which some people use for economic capital, requires 26,000 years for the same level of confidence. That makes deep tail VaR a matter of faith and assumptions, not something you can observe with reasonable statistical certainty over a moderate time interval" (2008: 20).
[8] Other examples of financial models that incorporate statistical methods include the capital asset pricing modeland the Black-Scholes-Merton option pricing formula.
[9] Although MacKenzie uses the term "Barnesian performativity" to distinguish this phenomenon from a more general sense of performativity, in which economic theories are used in economic practice, in this paper "performativity" refers exclusively to MacKenzie's Barnesian variety, in which the practical use of models make economic processes more like their theoretical depiction.

For an example of how MacKenzie’s other forms of performativity can also be mobilized in IPE see Henriksen (2013).

[10] NatWest Associate Director for Trading Risk David Palmersaid of negotiations, “Throughout the process of preparing the new rules, the Basel Committee have shown their willingness to listen to the industry's comments and take action based upon them” (Richardson, 1995/6).

[11]The qualitative standards for internal risk-models are: an independent risk management unit within the bank; back-testing of the model; senior management involvement in risk management; that the model be used in conjunction with the bank’s trading and risk exposure limits; regular stress-testing; and independent external review of the model (BCBS, 1996b: 41-42). Quantitative standards include that the VaR be computed daily; a one-tailed 99% confidence interval be used; the historical observation period of past price data be at least a year; data sets be updated every three months; and the model capture the non-linear price movements of options (BCBS, 1996b: 44-47).

[12] One method that does attempt to account for the magnitude of losses in the extreme tails of the VaR distribution is expected shortfall or conditional VaR, which approximates the expected loss during a given period, conditional on that loss being greater than the *X*th percentile of the loss distribution (Hull, 2007).

[13] Richardson writes, “In theory, the multiplication factor compensates for many of the nonquantifiable factors that can influence the estimation of risk such as flawed distribution assumptions, the inadequacy of past events as a guide to future ones, extreme market movements, and other factors that may limit the accuracy of a VAR approach but its ability to accomplish this seems doubtful” (1995/6).

[14] For one detailed proposal for alternative forms of financial regulation see: *The Warwick Commission on International Financial Reform: In Praise of Level Playing Fields* (2009). The introduction of leverage-based regulation in the Basel III framework represents another such shift. Nonetheless, as Andrew Haldane observes, risk-weighted capital ratios are still favored over leverage ratios in the current framework (2012: 19-20).

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