

Review of Donald MacKenzie's *An engine, not a camera: how financial models shape the markets*. Cambridge (MA): MIT Press, 2006, 377 pp.

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This is an important book which has received a lot of attention from various corners. That attention is well deserved. *An engine, not a camera*, written by eminent sociologist Donald MacKenzie, is a compelling and accessible story about the links between science and reality, theory and practice, in the setting of financial markets. He focuses on the performativity of finance theory: how the theory has profoundly influenced, shaped, and constructed the practice of financial markets. The book is the culmination of a number of papers authored and co-authored by MacKenzie on this subject. The performativity of economics, an idea coined by Michel Callon, entails that economics performs, shapes, and formats the economy rather than merely observes how the economy or a particular economic process functions. Given the number of citations and references, *An engine, not a camera* appears to present a strong case for the performativity thesis.

In taking financial economics and financial markets as his case in point MacKenzie has chosen well. The insight that academic theory has deeply influenced the practice of financial markets is not new by any means. Peter Bernstein makes that claim in his 1992 book *Capital ideas: the improbable origins of modern Wall Street*. Prominent finance scholars such as Stephen Ross and Merton Miller have done so as well. But MacKenzie's approach is interesting in at least two regards. First, using sociological concepts, methods, and tools, he provides a plausible explanation of how exactly the performative effect has come about. Second, and this is where his self-professed main interest lies, he explores how far up the performative effect reaches, to the point where the question arises whether the theory has created its own reality. That would present an important challenge to traditional ideas about the relation of theory and practice.

In the first chapter we are introduced to MacKenzie's methodological approach: an extensive number of interviews, narratives, and other

existing literature. Chapter 1 also provides an introduction of the performativity concept, grounding it specifically in actor network theory (ANT) and the work of Callon, and Bruno Latour, and the Edinburgh ‘strong programme’ in the sociology of scientific knowledge (SSK). MacKenzie distinguishes various types of performativity going from weak to strong. Generic performativity implies that an aspect (model, theory, data) of economics is used in an economic process: theory is used as a tool or instrument. Effective performativity involves practical, difference-making use of such an aspect: theory acts as an engine of change. The strongest variety is Barnesian performativity: the practice is shaped along the lines of the theory/model. Connected to Barnesian performativity is the concept of counterperformativity. Here the practice develops contrary to what the theory or model posits. In the latter two, theory operates as a constitutive mechanism. Many have considered Barnesian performativity as a form of self-fulfilling prophecy. That is not the case. Unlike self-fulfilling prophecies which imply falsehood, performativity is a priori neutral with regard to truth attribution.

Chapters 2 to 5 set the table. MacKenzie presents a nice sketch of the rise to prominence of financial economics through the main theoretical breakthroughs of the 1950s and 1960s: the Modigliani-Miller propositions, Markowitz’s portfolio theory, the capital asset pricing model of Sharpe and others, and the efficient market idea, chiefly inspired by Samuelson and Fama. The social setting is described: the initial controversy within the finance community and the resistance of practitioners to buy into the new theory. And later on, the questions about the empirical validity of the theories and the realisticness of the assumptions are dealt with. In particular, the treatment of assumptions regarding distributions of returns, in chapter 4, is compelling. MacKenzie’s background in applied mathematics shows here. The development of option pricing theory, the crown jewel of finance, is described in chapter 5; again in a fine and eminently readable way.

However well these first five chapters are written, there is not really much news in them. That changes in chapter 6. The story turns to how in the early 1970s option pricing theory, in particular the Black-Scholes-Merton model, made its way into the practice of the derivatives markets and the subsequent thriving of those markets enabled by the model. But that journey from theory to practice has by no means been straightforward and impersonal. On a sociological note, MacKenzie emphasizes the substantial involvement of individuals (“bodies”) in this

process. For instance, many members of the University of Chicago faculty were involved in efforts to legitimize derivatives trading and the setting up of the Chicago derivatives exchanges in particular. And Fischer Black himself sold sheets with option prices to traders. This entangled process of theory and people led to a situation where the practice started resembling the theory more and more. Initially, the Black-Scholes prices did not match that well with the actual prices in the market, but the fit improved over time. Moreover, stringent assumptions in the model, such as the absence of transaction costs and the possibility of unlimited short selling, became less unrealistic as the derivatives markets flourished.

But then, enter chapter 7, something happened which would defy much of the established theory on financial markets: the 1987 crash. MacKenzie discusses the challenges that event posed to the paradigm of efficient markets, in particular with regard to rational expectations and information processing. But that debate has been conducted extensively by others. Where it gets interesting is with the observation that, after the crash, the empirical fit of derivatives prices with the original Black-Scholes-Merton model deteriorated. "While it could reasonably be said of this technosystem [i.e., derivatives markets before the 1987 crash] that it performed theory [...] what is now [after the crash] performed is no longer classic option pricing theory" (MacKenzie 2006, 201-202).

What happened was that empirical option prices started to exhibit a volatility skew. Contrary to the assumption made by Black, Scholes, and Merton, the expected standard deviation of asset returns implied by the option prices was no longer constant between various options on the same asset. MacKenzie traces the emergence of the volatility skew to an awareness of a form of systemic risk in financial markets. Contrary to the theoretical assumptions, there do exist various limits and constraints in the market, for instance imposed by regulation, or for risk management purposes, or caused by liquidity issues. Skew, or "smile", then is the mechanism built-in by the market to deal with the shortcomings of the theory employed. The emergence of skew constitutes a counterperformative move: practice develops in a direction diverging from the model that is supposed to describe that practice accurately.

In chapter 8, MacKenzie presents his take on the failure of long term capital management (LTCM) as an illustration of the points he made before. LTCM was a high profile and initially spectacularly successful

money management operation, headed by some of the biggest names from Wall Street but also with the prominent involvement of eminent academics such as Nobel laureates Robert C. Merton and Myron Scholes. Its blow-out in 1998 presented a major shock to the financial system, prompting government action and a concerted cleanup effort. The use of theory in practice and the subsequent frictions between model and reality, the entanglement of theories and models with actual individuals, the importance of culture and social setting, they all come along. MacKenzie appears to have dual purposes here. On the one hand, he wants to show the relevance of social and sociological aspects, visible for instance in the run-on-the-bank situation that arose. On the other hand, he provides a striking example of a changing relation between model and reality, which fits nicely with the performativity concept.

MacKenzie also offers a contribution of his own with regard to the demise of LTCM. Besides greed, blind faith in models, overleverage, and the systemic chain reactions that unfolded, imitation played a role in his opinion. This entails that market players copy each other's strategies resulting in what MacKenzie labels a "superportfolio". That is not one of his most convincing suggestions, I think. It sounds a bit like saying that there are more buyers than sellers as an "explanation" for when the market goes up. Because, by definition, for every buyer there has to be a seller implying that there are never more buyers than sellers and vice versa. Likewise, for the positions taken by LTCM and its fellow funds there had to be counterparties.¹

The true philosophical beef of this book resides in its last chapter: 'Models and markets'. Finance has never been a uniquely academic endeavour, but there is a tension between the theoretical and the practical. This ambivalence ultimately boils down to the particular goals of modelling: modelling to obtain tools to use in practice or modelling as an academic activity with the goal of improving knowledge. Or from a different point of view: plausible, analytically tractable models resulting in good abstractions versus realisticness. But the reality is that it is not either/or; rather "the boundary that separated academic financial economics and practical activity was very porous" (MacKenzie 2006, 249). That applies to data, concepts, tools, and people.

¹ This also becomes evident in the current debt crisis. In 2006 Goldman Sachs decided to take the opposite side of many of its competitors in the CDO market. That netted them some handsome profits but it did not isolate Goldman from the systemic fallout of the crisis.

That brings us back to the performativity issue. MacKenzie argues convincingly that finance theory has become incorporated in the infrastructure of the financial markets in three ways. First technically, as evidenced by the use of models in trading software not only in trading and investing but also in regulation, market organization, and risk management. Second linguistically, as can be seen in the use of originally theoretical terminology, such as “beta” and “volatility”, becoming standard jargon. Third legitimatizing: (financial) economists actively helped in the advent and development of certain markets, when options and securities trading was still very much seen as shady speculation and not unlike pure gambling. Thus, “finance theory’s incorporation into market infrastructure was consequential” (MacKenzie 2006, 252).

So far then the case has been made for generic and effective performativity. What about the Barnesian variety and counter-performativity? MacKenzie is cautioning that these two may be very hard to prove, but he does attempt to make the case with regard to the Black-Scholes-Merton model of option pricing. And, despite his caution, both notions do apply, he asserts. Originally, empirical option prices and market conditions started resembling those postulated by the model. That could be regarded as “simply a consequence of the discovery of the right way to price options” (MacKenzie 2006, 258). But there is a reason to doubt that statement and rather consider this as a case of Barnesian performativity. That reason is the appearance of skew after the 1987 crash leading to a counterperformative move. The emergence of skew tells us one of two things, according to MacKenzie: “if Black-Scholes is the “right” way to price options, then the market has been wrong since 1987; on the other hand, if a pronounced volatility skew in options is “correct”, then the market was wrong before 1987”. The latter is more plausible, as a case of rational learning, and that makes the Black-Scholes model not “a “true” discovery of what was already there” (MacKenzie 2006, 258-259).

This argument of a “false” or “inaccurate” model having such a profound effect on practice has been widely picked up by philosophers of economics and sociologists, in particular those active in the social studies of finance (SSF) program. But some caution is in order here. Is the model indeed false because the volatility pattern implied by empirical option prices differs from the assumption in the model? I don’t think so. Option pricing theory states that the price of a derivative

depends on the variability, or volatility, of the underlying object. It is not a theory which claims to predict, explain, or understand that variability. Constant volatility is an assumption in the model; an unrealistic assumption that is. Black, Scholes, and Merton were well aware of this, even in their seminal papers: “the valuation formula assumes that the variance rate of the return on the optioned asset is constant. But the variance of return on an option is certainly not constant” (Black and Scholes 1973), and “the expected return is not directly observable” (Merton 1973), and therefore volatility is also not observable. So, rather than the model being false, it is one of the assumptions that fails.²

In connection to this, there also appears to be a misconception about the nature of the phenomenon of volatility. Being the standard deviation of returns over a certain period, the one true correct volatility number can only be determined *ex post*. That means that the unambiguously correct price of a derivative can only be ascertained after the contract has expired. What is entered when calculating the price of a current option is an estimate of volatility and what can be inferred from empirical option prices is the market consensus about those estimates. If one adheres to some form of randomness in the returns on assets, it should become evident how difficult making those estimates is. And there is no reason why the process of estimating cannot change, like it did after the 1987 crash. In fact, Fischer Black refused to postulate or accept any model of volatility because he considered this impossible (Mehrling 2005).

Financial economics is characterized by a positivist methodology; a rigorously quantitative and formalistic approach dominates. But it is only a positivist veil because the phenomena that it deals with are still very much social, contingent, and contextual. The relation between theory and practice is not like it is in physics or chemistry, even when the style of modelling may look alike. Many in economics talk about inexact laws, tendencies, stylized facts, good abstractions and the like. Labelling theories right and wrong then becomes a complicated matter.³ Yet, it appears that MacKenzie’s Barnesian and counterperformativity

² That of course brings this issue close to one of the most debated items in (philosophy of) economics: Milton Friedman’s (1953) article: The methodology of positive economics.

³ Emanuel Derman, co-author with Fischer Black of a number of papers and a former colleague of Black at Goldman Sachs, has made a comparable point with regard to option pricing theory.

hinges exactly on dishing out such tags. That is even more surprising given the supposed neutrality of the performativity thesis with regard to truth; a neutrality which appears to be one of the main attractions of the concept.

MacKenzie's stepping in the positivist trap that finance presents, highlights another important aspect of this book. On the one hand, it is a supreme effort to cross the boundaries of disciplines, in this case finance and sociology. But, on the other hand, it also shows how difficult, perhaps impossible, it is to get it exactly right. Be that as it may, MacKenzie has still been able to drive home the relevance of sociology to financial markets. And while he ultimately cannot deliver a knock-out punch with his case for Barnesian performativity—his self-professed main interest—he does deliver a persuasive, and to some extent novel, account of how knowledge travels from theory to practice (and back again) and the consequences thereof.

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