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# THE *VIRTUAL* BIOECONOMY: THE ‘FAILURE’ OF PERFORMATIVITY AND THE IMPLICATIONS FOR BIOECONOMICS

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This article considers how the bioeconomy – conceived as a market constituted by and constituting technologies derived from the biosciences – can be usefully considered as a virtual economy in that the representations and practices of economic activity differ significantly from one another. It does so through an analysis of the economic theories on spatial innovation processes (e.g. clusters) that have proved a popular approach in economic geography. The article contrasts the theory of performativity with that of virtualism in order to illustrate how the *failure* of economic performativity helps to explain economic practices rather than assuming that economic theories necessarily ‘work’ as implied by the theory of performativity. This has important implications for how we understand the bioeconomy because it means that we have to reconsider the production of biovalue.

Keywords: Bioeconomics; bioeconomy; biovalue; clusters; economic performativity; failed performativity; virtualism.

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## Introduction

In the social sciences there has been a growing interest in economies and markets that stretches beyond the confines of economics. The recent ‘economic turn’ in science and technology studies (STS) represents one example of this trend although it also seeks to move beyond current debates in fields critical of economics such as economic sociology. This STS agenda has been led by Michel Callon whose arguments about the *performativity* of economics (e.g. Callon, 1998a; 1998b; 1999; 2005; 2006; Callon, Méadel and Rabeharisoa, 2002; Callon and Muniesa, 2005) have proved especially popular. Other scholars such as Knorr Cetina and Preda (2001), MacKenzie (2003, 2004) and Mitchell (2005) have also produced work in this area, whilst recent events (e.g. the Said Business School workshops on *Does STS Mean Business?*) and publications (e.g. 2002 special issue in *Economy and Society* 31(2); Barry and Slater, 2005a) further highlight the particular academic interest in the relationship between technoscience and economics.

Broadly speaking such work considers the interrelations and interdependencies of technologies and economic theories, particularly how certain technologies (re)produce certain economic theories which in turn (re)produce

certain technologies. However, although the theories of Callon and others on the performativity of economics are now being widely applied, they have also encountered criticism from anthropologists like Daniel Miller (2002), who contends that the theory does not adequately address the question of *virtualism* in economics (see also Carrier, 1997; 1998; Miller, 1998; 2003; 2005). By this Miller means that economic theories produce abstractions of material practices which then come to assume greater importance than the practice itself (Miller, 1998).

This article seeks to engage in this debate between the theories of performativity and virtualism through an examination of the *bioeconomy*. To this end it seeks to explore the ‘virtuality’ of the bioeconomy in relation to the spatial innovation processes in the UK biotechnology industry. In particular, it will question the emphasis in policy, commercial and academic circles on the *biotech cluster* by arguing that they are virtual abstractions of place. As such the article not only contributes to theoretical developments in STS and economic sociology, but also to debates in economic geography on the relationship between space and innovation. Instead of arguing that economics necessarily ‘works’ as the theory of performativity contends, it draws on all three disciplines to examine how the *failure of economic performativity* contributes to our understanding of economies and markets by helping us to explain the making of the spaces of the virtual bioeconomy. Thus the central claim of this article is that we need to consider seriously how failure (to work) underlies economies and markets, science and technology, and how it is through this very failure that we learn, adapt and change. Dynamism can be seen as a consequence of this failure of things to work, meaning that as economies and markets, science and technology become more complex they fail more often and therefore change more often.

Such an approach is particularly relevant when considering the bioeconomy and the question of life as the centre of political (economic) calculation as argued by Foucault (1978) and others. To do so it is first necessary to clarify exactly what we mean by the concept of the bioeconomy – the central concern of this special issue. The more prosaic definition used by policy-makers like the European Commission (EC) and Organisation for Economic Co-operation and Development (OECD) does not really address the need for theoretical explication. For example, the OECD (2005: 9) defines the bioeconomy as ‘that part of economic activities which captures the latent value in biological processes and renewable bioresources to produce improved health and sustainable growth and development’. In turn, the European Commissioner for Science and Research, Janez Potocnik, defines it as involving ‘different sciences and technologies, different industries, and different policy areas (EC, 2005: 1). Academic literature has also had a longstanding interest in the economics of the biosciences covering work in innovation studies (see Senker, 2005 for a review), political economy (e.g. Loeppky, 1999) and economic geography (e.g. Audretsch and Stephan, 1996; Cooke, 2001), although such work does not address the issues raised by the concept of *bioeconomics*.

The more recent attempt to conceptualise the relationship between the biosciences and the economy in terms of *bioeconomics* draws a much clearer link between the co-production of the biosciences and the economy (e.g. Rajan,

2006). A number of scholars have argued that the search for *biovalue* concerns the alignment of vitality or well-being, as opposed to mortality, with economic processes (Lemke, 2001; Rose, 2001; Waldby, 2002; Rajan, 2006; Rabinow and Rose, 2006). Broadly speaking they argue that the geneticisation and individualisation of responsibility for health lead us to adopt a highly economic relationship with our own body (Novas and Rose, 2000; Lemke, 2005b). However, despite representing an interesting body of work, the bioeconomics concept, like that of performativity, does not address the possibility of failure. Furthermore, I will argue that bioeconomics (and consequently *biopolitics*) does not adequately address the failure to calculate life in its theoretical approach. Instead it is crucial to understand the bioeconomy from a different perspective that can account for such a failure. This I term the *logic of morbidity* – as opposed to vitality – in which the failure of health or well-being constitutes the bioeconomy.

I start this article with a discussion of the theoretical debate between performativity and virtualism highlighting how the similarities and then difference between these concepts impact on our understanding of economies and markets. In so doing I will address the relationship between economic representations and practices and how they can help to delineate between the theories. This then leads into the discussion of the virtuality of the bioeconomy, especially in relation to the analyses of spatial innovation processes characterised as biotech clusters, which draws on the theory of Michael Porter (1990) in his book *The Competitive Advantage of Nations* as well as the broader application of this theory in understanding such processes in the UK biotech sector. Next I discuss how the failure of performativity as a theory enables a new way to understand economies and markets and how the failure of economic performance can be seen as a necessary component of market making. Finally I consider how the concept of bioeconomics necessitates a similar consideration of failure.

## **Debates on Performativity and Virtualism** **Similarities between Performativity and Virtualism**

Although it is a relatively recent debate, there have been a number of exchanges between proponents of performativity and virtualism. In particular the paper by Daniel Miller (2002) in *Economy and Society* has been criticised (Holm, 2002), whilst it has also led to a later debate between Callon (2005) and Miller (2005) in which Miller sought to downplay the incompatibility of the theories. However, despite the sometimes vituperative exchanges, there are a number of similarities between the two theories that provide a useful starting point for this article.

Although Callon (2005: 13–17) may disagree with the very idea that performativity and virtualism share any ‘core assumptions’, there are at least two similarities between the theories according to Miller (2005: 3); ‘the performative nature of economic action’ and an ‘interest in materiality’.

The argument that economic theories are performative is not necessarily new since economists and others have addressed the problem of self-fulfilling prophecies in economics before (e.g. Frank, Gilovich and Regan, 1993; Fer-

raro, Pfeffer and Sutton, 2005). However, what is new about these theories is the specific focus on the relationship between the performative and the material world. The central similarity is therefore that economic models or theories are performed by economists (and 'economists at large' – Callon, 2005) through the use of economic technologies such as accountancy, intellectual property, computerised trading etc. (Barry and Slater, 2005b). In particular, Callon (1999) argues that actors need to be able to calculate to perform economic theories meaning they need tools to make the world calculable (Callon, 1998a; Barry and Slater, 2002). With virtualism there are similar concerns; Miller (1998; 2003) uses the example of auditing in the public services in the UK for 'best value' as one illustration. Here again there are specific tools that make the world calculable, although in this case Miller argues that they represent virtual abstractions that bear little relevance to economic practices.

In relation to materiality, Miller (2005) argues that it both makes and is made by people thereby playing a central role in the economy. Here it is possible to argue further that materiality affects different people in different ways because small shifts in material circumstances will affect them differently (e.g. materially poor individuals will suffer more from a small downward shift in wealth than will rich individuals) (Miller, 1998). According to Callon (2005: 4) materiality is a crucial component of action since he argues that action and the production of meaning of action 'takes place in hybrid collectivities'. Materiality is a central component of the socio-technical arrangements that Callon sees as central to *agencement*, or the distributed agency that is embedded in hybridities and collectivities (see also White and Bradshaw, 2004).

All this enables us to talk of the *Technological Economy* (Barry and Slater, 2002; 2005a; 2005b) because it positions technoscience in a co-determinative relationship with the economy in that technoscience enables certain economic activities which in turn enable specific forms of technoscience. Furthermore, according to Slater (2002: 235) this enables the theory of performativity to ask how calculativeness or the rationality of *homo economicus* is achieved rather than argue that calculation of such sort does not actually exist. This, of course, means that Callon has to posit that such a thing as rational calculation can and does exist in itself and through which people pursue their own interests or, more relevant to Callon's case, agencements pursue their interests. Thus we could argue that the means and ends of agencements are in fact the pursuit of specific, calculative interests that have not developed from anywhere, but are rather assumed to exist as part of the agencement. However, how this is so is unexplained.

## Differences between Performativity and Virtualism

In considering the differences between the two theories it is important to distinguish between representations and practices in the 'performative nature of economics'. It is crucial to do so because this distinction helps to separate the concept of 'performative' from that of 'performativity' where the latter is specifically developed by Callon especially in his argument that:

In reality this struggle between statements is a struggle between socio-technical *agencements*. It is not the environment that decides and selects the statements that will survive; it is the statements themselves that determine the environments required for their survival. (Callon, 2006: 28)

Here Callon does not seek to separate the representations (i.e. statements) from practices, but rather he argues that they are both components of the same process. One cannot exist without the other and both form part of the *agencement*. In an earlier paper Callon (2005: 3) claims that such agencements are composed of both agencies and socio-technical arrangements, which 'means assuming that agency is distributed and that concrete markets constitute collective calculative devices'. Thus he further argues that markets require such arrangements to shape 'calculative agencies' and that there are numerous actors involved in the construction of such markets (2005: 8).

In contrast, virtualism distinguishes between representations and practices by arguing that the former can consist of abstractions (i.e. virtual representations) of economic action that do not correspond to economic practices (Miller, 1998). This does not deny that socio-technical arrangements (or materiality) are important. In fact, Miller (2005: 4) states that he is 'concerned as much with how materiality makes people, as with what people make'. Rather, he is concerned with how certain discourses (or representations) have come to dominate the world and that '... we need a better discrimination between those cases where there is the power to actualise the model of the market and those where no such imperative exists or there is no such power' (2005: 11). In conclusion to this argument, Miller (2005: 11) stresses that '[i]n most cases economic activity is a failure of performance' in which the consequences of economic practices is the opposite of the intentions embodied in economic models or representations.

Performativity starts with the basic assumption that economic theories actually 'work' (see Holm, 2002: 15). This is a necessary position to take because Callon's (1998a: 2) original claim 'consists in maintaining that economics, ..., performs, shapes and formats the economy, rather than observing how it functions'. If economics does not 'work' then the economy is not performed, shaped or formatted in performative terms. However, the evidence for economic theories actually 'working' comes, in a circular fashion, from the existence of the economy which economics is supposed to perform, shape and format. Thus we can argue that performativity, by its very premise, is based on a normative claim about what markets (and economies) should consist of and what the application of economic theories will produce (see Fine, 2003). With virtualism there is no such assumption, but rather an acknowledgement that some things (e.g. auditing claims) may be meaningless (Miller, 2003), just as some things may not work and that these two can be related. Consequently Miller (2002: 224) argues that economics, as set out by Callon, is a 'moral and ideological system' that provides the 'normative conditions for exchange rather than a description of practice'.

As the above discussion illustrates, it is useful at this point to distinguish clearly between the 'performative nature of economic action' as Miller (2005)

describes it in the concept of virtualism and the performativity of economics as Callon (2006) argues. On the one hand the performativity argument is based on the claim that markets are all essentially the same (i.e. 'as a collective device for the evaluation of goods'), whilst there are also a 'diversity of possible forms of market organization' (Callon and Muniesa, 2005: 1245). This means that calculation can be achieved in a number of different ways and that markets are the collective device to achieve this calculation. However, this view has been criticised by Fine (2003: 479) for example for failing to 'move beyond description to explanation'. On the other hand, virtualism contends that calculation is not necessarily the central feature of economic practices. Rather there are numerous possible intentions, motivations and values that feature in economic practices, not all of which can be explained by the theory of virtualism and not that its proponents meant it to do so (see Miller, 1998: 211). However, the theory of performativity appears to be a totalising concept in that it aims to explain the market and economic activities in reference to hybridities (i.e. agencements) that could conceivably include everything.

The most problematic element in performativity is the argument that representations and practices are both elements in the same process because it means that we cannot refer to knowledge of the 'economic' as anything but claims about (and performance of) the 'economic'. In contrast it could be argued that at least one sense of value is produced through practice and not representation in that economic practices have to be performed repeatedly to ensure their continuing power and not because they are performative (see Graeber, 2001). This would mean that practices of exchange produce representations of calculation and not the other way round because value is produced through people agreeing with the claim rather than the claim being realised in practices. In one sense then, such representations end up naturalising practices – whether past, present or future – as sensible because they are the result of previous performance. This is necessary because practices and representations are always at one remove from each other since the 'performative nature of economics' can only refer to both past and future representations to justify current representations and practices, whereas current practices can only build on past practices.

### **The *Virtual Bioeconomy* and the Failure of Performativity Spaces of the Virtual Bioeconomy**

In this section I argue that the *bioeconomy*, as it has come increasingly to be known, can be seen as a virtual abstraction of economic practices even if the claims made about it are compared with the evidence used to support those claims (e.g. quantitative descriptions and analyses). This view is reinforced when considering the projects by the EC (2005) and OECD (2006) to define the 'bioeconomy' as both innovative and beneficial. For example, the OECD project entails a deliberate policy agenda that 'seek[s] to identify the necessary steps to realize the *potential gains* of what is called the bioeconomy' (OECD, 2006: 2, emphasis added). 'Benefit' and 'potential' are intertwined concepts

in this agenda, repeated numerous times throughout this policy literature, which essentialises and naturalises the claims made about its innovative potential. However, the virtualism of the bioeconomy is clearer when we consider its characterisation as a locally-bounded industry – i.e. the representation of it in terms of ‘biotech clusters’ (e.g. DTI, 1999a; 1999b) – and the benefit entrepreneurs are supposed to gain from such clusters. The rest of this section therefore outlines the underlying assumptions of cluster theory drawing on debates in economics and economic geography.

The ‘cluster’ argument represents the life sciences in terms of highly networked organisations and institutions that are located in specific regional or national geographies because of the inherent characteristics of those places; e.g. San Francisco, California and Boston, Massachusetts are often identified as iconic clusters. A number of European regions like Cambridgeshire and Oxfordshire have also sought to identify themselves as clusters. For example, one ‘viewpoint’ in the Oxfordshire Bioscience Network (OBN) ‘cluster report’ states that ‘We recognise the important role the network plays in the development of Oxford’s world class biotechnology cluster’ (OBN, 2002: 7).

In the same year The Oxford Trust produced a report titled *Oxford Networks* in which it more cautiously argued that ‘In Oxfordshire, there appears to be a clustering effect of bioscience and medical establishments occurring in a band running north to south through the county’ (Oxford Trust, 2002: 13).

This policy literature emphasises the local-boundedness of biotech clusters, which is repeated in the bioscience trade literature. For example, there are numerous articles and reports on old, new and emergent clusters and national sectors from around the world in publications like Genetic Engineering News (GEN) and European Biotechnology News (EBN). Throughout this policy and trade literature the characterisation of the bioeconomy can be seen as a representation of an industry that downplays the geographical diversity, specificity and distinctiveness of the sector and therefore produces a virtual abstraction in the form of the ‘cluster’.

The virtual abstraction of the ‘biotech cluster’ can be seen as originating in debates about biotechnology that have centred on the identification and definition of territorial innovation processes and in particular the spatial concentration of the biosciences. This debate has revolved around the cluster concept derived from the work of Michael Porter (1990) who initially conceived of clusters in functional terms (i.e. sectoral) before later expanding on his theory to include a spatial dimension (Porter, 2000; see Malmberg, 2003). Thus in *The Competitive Advantage of Nations*, Porter (1990: 149) argued that: ‘The reasons for clustering grow directly out of the determinants of national advantage and are a manifestation of their systemic character. One competitive industry helps to create another in a mutually reinforcing process’. Later however, he argues that:

A cluster is a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities. The geographic scope of clusters ranges from a region, a state, or even a single city to span nearby or neighboring countries (e.g., southern Germany and German-speaking

Switzerland). The geographic scope of a cluster relates to the distance over which informational, transactional, incentive, and other efficiencies occur. (Porter, 2000: 16)

As a business economist, Porter has produced an economic model that is both an explanation for the success of different industries, countries and regions as well as a performative theory because it suggests that the pursuit of particular strategies (i.e. clustering) will benefit industries, countries and regions. As such it is a particularly pertinent concept for discussing the performativity of economics, especially in relation to the failure of performativity because the theory has been subject of a number of criticisms (Malmberg, 2003; Martin and Sunley, 2003; Malmberg and Power, 2005).

Scholarly analyses of 'biotech clusters' are underpinned by an emphasis on the more general argument that innovation is a collective and systemic process that therefore entails proximity between innovative actors (see Fagerberg, 2005). Such claims are based on the argument that because innovation is collective it is dependent upon tacit knowledge and face-to-face contact, which, because it is difficult to exchange over distance, necessitates the concentration of the bioeconomy. Consequently a number of academics have argued that biotech innovation is determined by the location of specific actors such as 'star scientists' (Zucker, Darby and Brewer, 1998) or by knowledge spillovers (Audretsch and Stephan, 1996). However, in the performance of these theories there is a subtle shift in emphasis from viewing innovation as concentrated to viewing concentrations as innovative because such concentrations enable access to hard-to-transfer tacit knowledge.

Later discussions in economic geography proper gradually moved beyond the 'local-boundedness' (Phelps, 2004) and away from the earlier more economic arguments to show how the bioeconomy has a greater level of geographical specificity and particularity than represented by the biotech cluster concept, especially in terms of local-global interactions (e.g. Coenen, Moodysson and Asheim, 2004; Leibovitz, 2004; Cooke, 2004; Birch, n.d.; forthcoming).<sup>1</sup> There is also little support for the general notion that clusters are either characterised by more localised inter-linkages or encourage more localised interaction or collaboration (Malmberg, 2003; Malmberg and Power, 2005). In relation to the bioeconomy, firms in UK biotech clusters appear to be more tied into national and global knowledge networks, whether or not the particular knowledge they acquire is explicit or tacit. This is illustrated from data on the location of knowledge acquisition for these types of knowledge across a number of UK 'clusters' (see Birch, n.d.).

It is possible to speculate that although cluster theory is not performative in the strictest sense for the bioeconomy (i.e. biotech clusters are no more reliant on localised innovation), it can be viewed in another light. The description of biotech clusters provides the means to identify and constitute certain places as centres of the bioeconomy and thereby provide existing and emerging actors with an institutional identity (i.e. as a member of a cluster). Thus cluster theory is performative in the sense that it instigates institutional isomorphism through which actors can make sense of their world (see DiMaggio and Powell, 2004), whether or not their economic practices correspond to the representations of

the bioeconomy. However, this contrasts with the arguments made by Callon and others about economic performativity in ways which I will now discuss.

## **The Failure of Economic Performativity and the Making of the Economy**

Perhaps the most problematic issue with the theory of performativity is that it cannot fail as a theory in itself. It is always able to explain the way we perform economics (without explaining why) because it can always bring everything within its remit using concepts like *agencement* (Callon, 2005; 2006). Anything can form part of such agencements and no specific features are identified, which means that ultimately everything can be (and must be) used to explain the performativity of economics. As such it cannot explain why one thing is more important than another or how people understand one thing to be more important than another (see Graeber, 2001: 18). Consequently it would appear to be unable to incorporate learning (i.e. how people come to judge importance) into the theory even though we need to acknowledge that the 'collective hybridities' represented by agencements are continually changing (inspired by McKinnon, 2005). Furthermore this failure to incorporate learning is compounded by the assumption that economics 'works' without explaining what this means outside of the theory itself. It thus appears to be a largely self-referential theory. Thus virtualism and the emphasis on the performance of economics are more useful for understanding the bioeconomy.

Economic performativity is different from the performance of economics because the former proposes to explain the way we perform economics (i.e. calculation) without necessarily explaining why we perform economics (i.e. why do we calculate?). If we assume that the explanation results from sociotechnical agencements (i.e. the co-production of context and performance), we end up arguing that we perform economics because economics is performative (i.e. we calculate because calculation works). Such a position appears unsatisfactory. As Slater (2002: 245) argues, the concept of performativity proposed by Callon and others ends up relying on 'asserting what needs to be explained' and 'presuming effects from discourses'. However, if we argue that economics, whilst it can be performed, does not 'work' in and of itself, then we have to argue that the 'failure' of performativity is as important – if not more important – as the 'success' of performativity for providing the explanation for why we perform economics.

With virtualism there is a means to provide an explanation which can account for the failure of economic performativity in that the 'desire to perform and thereby create the idea and ideal of a market' is achieved with comparative rarity (Miller, 2005: 7). Such failure of performativity or even more simply failed performance is incompatible with Callon's arguments because he posits a 'generic' version of performativity that is therefore 'all-pervasive' (MacKenzie, 2004). In performativity everything can be seen as performance and therefore everything is performative, which means that nothing ever fails to perform and therefore nothing ever fails to be performative. In one sense then, Callon's per-

formativity can only explain that which exists, but it cannot explain that which attempted to exist and 'failed' to do so because it cannot study that which does not exist. Thus we could argue that the incompleteness of a contract, for example, enables it to function as White and Bradshaw (2004) do, but we would then not be acknowledging that if a contract is not actually 'functioning' (i.e. working) then there may be another explanation for this failure of performativity.

Virtualism enables us to consider what a failure to be performative might mean. Instead of assuming that the bioeconomy 'works', especially its spatial embedding in 'biotech clusters', it is more useful to consider how the bioeconomy can result from economic representations (e.g. clusters) and practices (e.g. clustering) that do not necessarily correspond to one another (i.e. the consequences are different from those claimed). In this sense we can argue that the 'biotech cluster' is a virtual abstraction that replaces the diversity and specificity of place with a representation that naturalises certain claims as absolute and therefore not subject to failure (i.e. that do not work). In fairness, performativity attempts to avoid this position by casting the concepts of 'entanglement' and 'disentanglement' as 'two sides of the same process' (Holm, 2002: 10), which virtualism does not separate (see Miller, 2002). However, this means that once again everything is deemed to be an element of the performativity process and therefore that it still cannot explain why we perform economics.

Virtualism provides a tool to at least attempt to answer the question of why certain things are brought within calculative markets and other things are not (see Graeber, 2001 for a discussion of non-calculative exchange). We could even argue that calculative markets, rather than being a means of disentanglement, are themselves merely an overflow from the rest of the social system that can "mop up" these overflowing externalities' (Miller, 2002: 221). More pertinent here is that such disentanglements could really be the production of virtual abstractions, which serves another role to that envisaged in performativity. The virtual abstraction (e.g. biotech cluster) does not need to represent a set of economic practices (e.g. clustering) for the representation of such practices to have an effect on economic practices; i.e. actors who adhere to these representations appear predictable and trustworthy and therefore benefit from 'failed' performativity (e.g. biotech firms in a cluster appear worthy of investment) (see Carrier, 1997; Ferraro, Pfeffer and Sutton, 2005). Thus the failure of economic performance can still produce economic practices in contrast to the claim that it is because economics 'works' that it is performative.

The reason that failure is so important in the performance of economics is that it enables the change and production of economies and markets. As already mentioned, the failure to perform economics does not hinder economic practices because in the pursuit of failed performance an actor appears sensible and therefore predictable. The representation of economic practices, such as the argument that the bioeconomy consists of 'biotech clusters', produces an expectation about the world that seeks to describe how the world works and therefore makes economic practices such as clustering prospectively and retrospectively sensible. For example, in their work on the 'sociology of technological expectations', Brown and Michael (2003: 6) argue that the tendency to 'fetishise' the 'soon to be' naturalises current practices

by representing them as the inevitable solution to particular future problems. However, the failure of performance also drives change and therefore innovation through adaptation in that where economic practices (e.g. clustering) do not ‘work’ it encourages different practices (e.g. global searching). Consequently new ways of doing are necessary and in turn necessitate new modes of exchange and new practices.

## **Bioeconomics: The Logic of Morbidity**

As the rationale for this special issue illustrates, there have been a number of attempts – some in passing, others not – to conceptualise the relationship between the biosciences and economy in biopolitical terms (e.g. Novas and Rose, 2000; Rose, 2001; Waldby, 2002; Lemke, 2005a; Rabinow and Rose, 2006; Rajan, 2006). The proliferation of research and debate around Foucault’s (1978: 139–45) concept of biopolitics has been considerable over the past few years. This is partially, at least, because the concept covers an array of interpretations from government policy through the definition of a particular epoch to a morality of society (see Larsen, 2003). Foucault (1978: 139) described two forms of ‘power over life’ – one centred on the individual body and the other on the population – both of which contributed to the expansion and development of the modern capitalist economy which: ‘...would not have been possible without the controlled insertion of bodies into the machinery of production and the adjustment of the phenomena of population to economic processes’ (1978: 141).

With the recent developments in the biosciences, touching as they do the genetic basis of life, the calculation of life at the scale of both the individual body and the wider population takes on a new meaning in relation to the modern economy (Rose, 2001; Rabinow and Rose, 2006; Rajan, 2006). Thus the production of health or vitality – what Waldby (2002) terms *biovalue* – has been constituted in terms of bioeconomics which ‘operates according to logics of vitality, not mortality’ (Rabinow and Rose, 2006: 211).

The central concern with the ‘calculation of life’ makes the issues raised earlier around economic performativity and virtualism pertinent to this debate. In particular, the question of how we calculate life is crucial. Several attempts to do so have highlighted the difference between calculations at the individual level such as treatment models based on quality-adjusted life-years (QALYs) and those at the population level such as Agamben’s (1998) arguments about *homer sacer* and societal exclusion. Such attempts reveal the central problem underlying the calculation of life: how do we place a value on life in either economic or moral terms? The continuing contestation and critique of intellectual property rights shows how problematic this is in economic terms, whilst the growth of debate in bioethics and medical ethics proves how difficult it is in moral terms. Thus it is understandable that the focus of bioeconomics has predominantly been on the expected benefits to health and vitality from new biotechnologies as evident in the concepts of the ‘political economy of hope’ and the ‘politics of potentiality’ (e.g. Novas and Rose, 2000; Ganchoff, 2004; Novas, 2006; Rajan, 2006), rather than on the valuation and calculation of life per se.

The central issue here is therefore whether and how health can constitute value in the bioeconomy. It is useful to consider a number of existing analyses that draw on the theory of biopolitics to do this; these include Waldby's (2002) concept of *biovalue* and Novas' (2006) *political economy of hope*, but could refer to others just as well. Biovalue is defined as the: '...yield of vitality produced by the biotechnical reformulation of living processes. Biotechnology tries to gain traction in living processes, to induce them to increase or change their productivity' (Waldby, 2002: 310).

As such it represents a 'surplus of fragmentary vitality' that is 'involved in the production of health' (Waldby, 2002: 310). From an economics perspective this does not make much sense because it implies that vitality (i.e. health) already exists and that it is the surplus of vitality (i.e. health) that is economically productive. Thus it is possible to argue that biovalue does not come from the production of health – as much because health does not already exist to be exploited but also because it is socially constituted (see Conrad and Gabe, 1999) – and rather it is the *failure* to perform or produce vitality that necessitates a turn to the abstraction of hope (e.g. Novas, 2006). Even from a sociological or anthropological perspective the alignment of value with health does not really fit either if we agree with the idea that economic exchange requires both similarity and difference (see Graeber, 2001: 15). Similarity is necessary because it facilitates the establishment of a fixed value (e.g. money) which enables the exchange of things with no fixed value (i.e. difference).

This means that 'biovalue' does not originate from the production of health or the 'yield of vitality' from modern biotechnologies. Instead the value of modern biotechnology can be seen as the failure of vitality with the attendant implications this has for the failure of biopolitical strategies themselves. It is the continual failure of such strategies that not only necessitates their continued application but also produces new individuals and populations that therefore require new strategies (see Larsen, 2003: 7). In bioeconomic terms this means that it is the failure of health or vitality that produces value because it provides the means of exchange in which there is a fixed value (i.e. health) and a corresponding unfixed value (i.e. ill-health). Thus there is little economic point to bioscience research that does not identify illness or morbidity because this provides the value from biotechnical treatments that seek to produce a fixed value in relation to the differences in our individual bodies (see Rose, 2001: 21). If we take this beyond the individual level, it is possible to argue that the bioeconomics of populations necessitates a high proportion of unhealthy members in order to produce national or group value from the biosciences; a reversal of eugenics perhaps, in which the unhealthiest populations produce the most economic value. This is what I see as the *logic of morbidity*.

## Conclusion

There is a definite scale issue in the conceptualisation of bioeconomics, one that Foucault highlights in his identification of an individual and population basis for biopolitics. Thus it is possible to argue that the global dimensions of

the bioeconomy are tied into the bodily strategies enacted on individuals and vice versa. In this article I have sought to show how the current and ongoing debate around economic performativity and virtualism provides a useful means to explore such issues. For example, Leyshon et al. (2005) argue that virtualism explains the large scale better than small scale, which perhaps explains why it proves useful in certain circumstances where performativity does not. In contrast Callon argues that we need to avoid macro-scale analyses of economies and markets (Barry, Slater and Callon, 2002: 302), but in so doing misses out on considering the role of scale in understanding something like the bioeconomy.[2] At different scales different claims and policies appear sensible, whether or not they actually work in the performative sense. For example, bioeconomy clusters can be seen as claims to attract global finance when made at a global scale, whilst they are also simultaneously claims to produce institutional identity at a local scale. In both cases the failure of economic performance (i.e. the lack of cluster characteristics of biotech clusters) does not preclude an alternative effect on economic practices.

In flattening scale with a network approach like performativity we end up with the structure (i.e. network) representing the explanation. Consequently we are liable to end up with a tautological explanation. Since it has been argued that performativity corresponds most closely with Granovetter's (1985) network analysis in economic sociology (see Barry and Slater, 2005b: 13), it is possible to argue that it encounters similar difficulties. For example, Krippner (2001: 799) has argued that Granovetter isolates a 'single aspect of social life' which he then 'analyzed *solely* in their structural aspect'. Thus performativity can be seen to rely on network structures (i.e. agencements) that are as much social constructions in which economic activities occur as was the idea of institutional embedding in economic sociology which Callon (1998a) originally criticised. That is unless such networks can include everything in which case they would prove particularly problematic. An agencement can include anything that the author wants and we cannot distinguish between the different elements.

In outlining how the failure of performativity is necessary for markets and economies it is possible to show how the concept of bioeconomics is also as dependent upon the failure of things to work (e.g. health). It is in this failure of vitality that the bioeconomy produces value and through the logic of morbidity that we can understand how the differences and similarities between values enable the economic exchange of modern biotechnology. Through the production of illness, new genetics provides the means to differentiate between use values (i.e. treatment) that are tied into the fixed abstraction of health as exchange value. In this way it is possible to see how bioeconomics embodies a reversal of eugenics in that morbidity both produces economic value (i.e. national competitiveness) and moral value in the form of individual responsibility to acquire, develop and maintain the vitality of our own bodies.

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## Notes

1 There is a distinction between ‘new economic geography’ associated with the work of the economist Paul Krugman and economic geography itself. The latter has a long disciplinary pedigree stretching back several decades, whereas the former is a relatively recent perspective in economics that seeks to incorporate geography into economic modelling.

2 I want to stress that the different theories of virtualism and performativity are not necessarily mutually exclusive. The debate has obviously been somewhat heated to date (e.g. Holm, 2002; Miller, 2002; 2005; Callon, 2005), so it is important to acknowledge that the theory of performativity is useful for understanding certain markets. However, I would argue that it is more useful in relation to the micro-scale – as Callon intends (Barry, Slater and Callon, 2002) – and in reference to financial markets (e.g. MacKenzie, 2004). With regards to economic practices in organisations (e.g. corporations), which represent a significant proportion of all economic activities (Hodgson, 2005), or in everyday transactions it may prove less useful because there is considerably more room for failure. Thus it may not be applicable to understanding the impact of economic theories in organisations where calculation may prove less central (see Ferraro, Pfeffer and Sutton, 2005).

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