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Performing the economy, performing science: from neoclassical to supply chain models in the agrifood sector

Lawrence Busch

Abstract

Callon and Hilgartner, respectively, have argued that the economy and technoscience are performed and that neoclassical economics (NE) and scientific reports should be interpreted as performances. Building on that theme, it is argued here that the ongoing transformations collectively known as globalization signal a new way of thinking about and performing both economics and technoscience: supply chain management (SCM). A comparison of SCM with NE models reveals shifts in both the theoretical focus of its proponents and the reactions of critics. Recent developments in the agrifood sector are used to illustrate the argument.

Keywords: Supply chain management; neoclassical economics; food; globalization; performance; technoscience.

Introduction

Critics of the neoclassical approach to economics, both within and outside the discipline, have consistently argued that it fails to portray the economy that actually exists (e.g. Ormerod 1994; Schmid 2004). Put differently, they note that extant economies are rife with oligopolies and monopolies, have complex systems of taxation and subsidies, and that many if not most firms fail to conform to the neoclassical model. However, recently Callon (1998c); Callon

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et al. 2002) and others (Cochoy 2002a; MacKenzie and Millo 2003) have proposed a very different approach. Specifically, they argue that one should approach neoclassical economics (NE) as a performance. As in any performance in art or sport, there are both better and worse performances in the economic sphere. From this perspective – and counter to the protestations of the late Milton Friedman and others – neoclassical models are fundamentally normative; they propose what an economy *should* look like. Proponents of NE argue that, in an economy that performed fully in accordance with the model, the sum of the properties of the NE model would have positive social welfare implications, usually described in utilitarian terms as the greatest good for the greatest number, or more carefully as Pareto optimality.

The performance metaphor has also been used recently with respect to technoscience. Hilgartner (2000), in particular, using an approach reminiscent of Goffman, has argued that technoscience is often 'on stage'. Moreover, Hilgartner has applied this approach to the study of the report-making process at the US National Academy of Sciences. This allows him to discuss both the front-of-stage aspects of the report (e.g. the report itself, news releases, the official ceremonies where it is presented) and the backstage aspects usually concealed from the public (e.g. disputes among rival factions, disagreements as to wording and substance). Latour (1987) and Knorr-Cetina (1981) both emphasize the differences between science as performed in a laboratory and as written in scientific articles. In those articles, usually written in the third person, laboratory instruments virtually perform experiments by themselves without human intervention. One could extend this argument by noting that the articles themselves are performances designed to convince very specialized audiences of the truth and necessity of the claims made therein. Furthermore, the performance metaphor can also be applied to various forms of regulatory science, i.e. the application of science to testing and measurement (see, e.g., Power 1997; Salter 1988; Strathern 2000). Such forms of science are also performed but for very different audiences, including regulatory agency decision makers, certification organizations, legislators and even the general public.

Becker (1982), in his book *Art Worlds*, has noted that artistic performances never begin by producing everything anew. Instead, the performers and their audiences share certain conventions about materials, design and staging, which allow them to make decisions quickly and efficiently and to improve coordination. Recently, and independently, French theorists Luc Boltanski and Laurent Thévenot (1991; 1999) have developed a similar approach, applying the notion of conventions to virtually all social institutions. They see conventions as applying to a wide range of practices and always involving both those performing (more or less) according to the convention and those evaluating their performance. This approach has been applied to a wide variety of economic phenomena (Allaire and Boyer 1995; Ponte and Gibbon 2005; Renard 2003), although it has received less attention in studies of technoscience.

Of particular import for our analysis here is that both Becker's formulation and that of Boltanski and Thévenot emphasize that the determination of the *quality* of a performance is largely in the hands of the audience. As Ponte and Gibbon explain:

> The consequences of Boltanski and Thévenot's heuristic framework for the concept of quality are far-reaching: it suggests, first, that there is no 'universal' understanding of quality and, second, that quality is cognitively evaluated in different ways depending on what 'world' is used to justify evaluation and action – and hence on which broader normative order is invoked.
>
> (Ponte and Gibbon 2005: 7)

Similarly, Becker argues that art forms always include both art and audience; this notion can easily be extended to both economics and technoscience. Thus, economic or technoscientific performances are judged after the fact much as are those in theatres and on playing fields. Moreover, the audiences can be multiple in nature. Thus, economic performances may be judged by economists, accountants, workers, stockbrokers, shareholders and the general public, among others. Similarly, technoscientific performances may be judged by scientists within a given field and in other fields, but also by legislators, regulators, companies and the general public.

In this paper I shall attempt to extend the performance metaphor somewhat further. I shall argue (1) that supply chain management (SCM)[1] now offers another means by which to perform the economy, (2) that it is likely to subsume but not displace now dominant neoclassical approaches and (3) that technoscientific performances both in the lab and (perhaps more importantly) in regulatory matters are black boxed in NE models but are combined with economic performances in SCM models. Moreover, I will do this by occasional reference to recent changes in the global agrifood sector, although doubtless other sectors of the economy could be examined in the same way.[2]

The changing agrifood sector

The formation of the World Trade Organization was hailed as a triumph of the neoliberal model of development (e.g. Bhagwati 2002). To simplify, the elimination of tariffs and quotas would lead to something approximating the neoclassical model of the economy. As a result, competition would increase, nations would tend towards producing those things for which they had a comparative advantage and social welfare would rise as prices fell.

But things have worked out somewhat differently. To be sure the role of the State has changed and perhaps diminished. Nation-states are now far less likely to regulate directly and far more likely to delegate regulatory authority to other organizations. Moreover, the opening of the world economy has restricted the ability of nation-states to intervene in markets without significant and often negative consequences. In response to this devolution

of the State, non-governmental organizations (NGOs) have shifted their tactics. Rather than lobbying nation-states to change the rules by which companies may operate, many NGOs now focus on the direct lobbying of large companies in an effort to get them to modify their behaviour.

Food retailers have seen these changes as challenges and opportunities. In the past, it was commonplace for food retailers to operate mainly within national borders, in terms of both retailing and sourcing. Economic concentration in food retailing remained relatively limited, with few firms having more than a 20 per cent market share in any given nation. Now the big three global supermarket chains – Wal-Mart, Carrefour and Royal Ahold – have retail operations in and source their products from many nations (Busch and Bain 2004). Similarly, large institutional retailers such as Sysco and Metro source and sell globally. And one finds a similar trend in the fast food sector.

In short, retailer strategies have not only incorporated subnational and national markets but have also begun to look towards developing nations where growing middle classes offer relatively untouched terrain for sales and where sourcing at lower prices is possible (Dries *et al*. 2004; Konefal *et al*. forthcoming; Reardon *et al*. 2003; Weatherspoon and Reardon 2003). But such markets also pose challenges for supermarkets. Specifically, they raise new questions: on the one hand, foreign-produced food may not meet requirements with respect to food safety, cosmetic quality, taste, packaging and freshness. On the other hand, foreign-produced food may pose questions of regularity of supply. Given the growing awareness of the short- and long-term costs of 'out of stock' items (Gruen *et al*. 2002), supermarkets are increasingly resorting to various measures to ensure that shelves are full year round with only minimal price variations.

Thus, in order to ensure quality and timeliness, supermarkets have developed their own systems of standards, both as individual firms and as members of associations (Berdegué *et al*. 2003; Reardon and Farina 2001). For example, while nearly every supermarket has its own standards for the quality of fresh produce, EUREP (2002) provides shared quality, safety, environmental and worker health and safety standards for a group of European supermarkets, and CIES (2002) (a global association of supermarkets and processors) has its own food safety standards. NGOs are well aware of this trend and are lobbying supermarkets, demanding adoption of yet more standards – often those developed by the NGOs themselves, including standards for fair trade (Fair Trade Federation 2004), animal welfare (Animal Welfare Institute 2005), bird friendliness (Smithsonian National Zoological Park 2005), environmental sustainability (Natural Resources Defense Council 2005), organics (International Federation of Organic Agriculture Movements 2005) and use of child labour (Social Accountability International 2002).[3]

Enforcing these myriad standards has become a significant chore and big business in and of itself. Moreover, supermarkets find themselves uncomfortable in the role of both standards maker and enforcer. They much prefer to let some third party engage in enforcement – an NGO, a profit-making

certification company or even a government agency as in the case of organic foods – than to do it themselves. Third party certification (TPC) offers several advantages to retailers. (1) It relieves retailers of being in the potentially contradictory roles of both buyer and certifier. (2) It enhances credibility with the general public and even with sellers as, at least in principle, the certifier has no vested interest in the outcome of the certification process. (3) It may limit retailer liability by demonstrating that 'due diligence' has been done (Busch *et al*. 2005; Hatanaka *et al*. 2005; Mutersbaugh *et al*. 2005). Finally, (4) it allows retailers to shift costs to suppliers – to let someone else pay for the show (Ponte and Gibbon 2005).

This, in turn, opens both new opportunities and new challenges to producers. On the one hand, it offers the potential of long-term relations with buyers where prices are fixed at the beginning of the growing season thereby reducing economic risk. On the other hand, it demands considerable management expertise on the part of growers, who may or may not be able to meet the complex standards (especially with respect to record keeping and technology) demanded by the buyers.

From Smith to supply chain management

Central to the shift in retailer strategies is the adoption of a new approach to economics known as supply chain management (SCM). SCM appears to have originated from several different sources (Croom *et al*. 2000). On the one hand, SCM was linked to the rise of systems perspectives in the 1950s. Supply chains were seen (1) from the perspective of an individual firm, (2) as a particular commodity or (3) as an approach to purchasing, distributing and managing the various objects and people necessary to produce a product (New 1997).

On the other hand, it has been argued that SCM involved an attempt to replicate the extraordinary success of Japanese companies in the 1970s, and especially of Toyota. What Toyota did, through its 'lean manufacturing' strategy, was to reduce waste throughout its supply chain, thereby allowing it to cut costs while maintaining quality. Not surprisingly, this involved the increasing use of information technologies to manage suppliers. From this perspective, 'Companies are . . . instructed to construct ever more efficient and responsive supply chains because it will no longer be company competing with company, but supply chain competing against supply chain' (Cox 1999: 168).

Regardless of which history of SCM is taken to be the 'real' one, it appears that SCM arose out of certain practices and has been gradually theorized, refined, clarified and recast as a set of strategies for performing the economy. Today, most business schools teach future executives various aspects of SCM and some have entire departments that focus on it. Others, including the one at my own institution, have jettisoned their economics departments as well. This process is reminiscent of what Hacking (1999) described as 'looping'. In short,

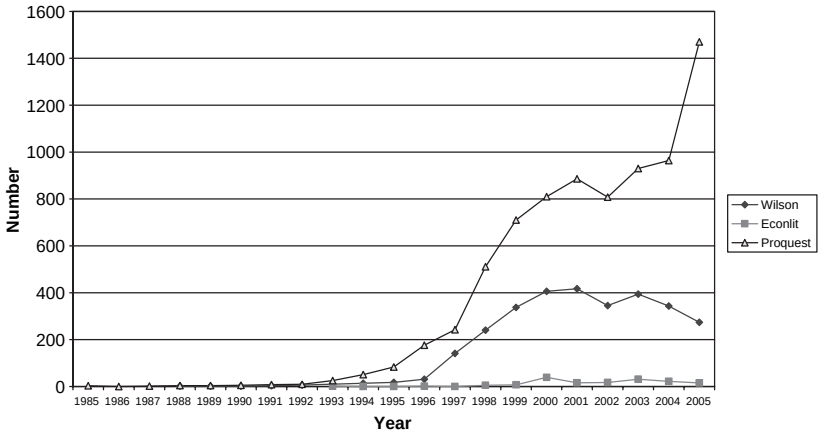

Figure 1 Citations to selected databases for 'supply chain management', 1985–2005.
Sources: Wilson Business Abstracts, Econlit and Proquest databases 1985–2005; citations to 'supply chain management' in title or abstract; search conducted 17 December 2005.

while engaging in empirical research about firm behaviour, SCM practitioners distilled a number of characteristics of successful firms, especially those firms that had successful business to business relations in the form of what SCM practitioners came to call supply chains. That, in turn, was recast normatively as a strategy, usually taught in business schools, for improving firm and supply chain performance.

Not surprisingly, given the relatively recent rise of SCM, there is considerable debate over its definition and approach. Some researchers see it as a means of coordinating purchasing and supply, others from the vantage point of transportation and logistics, others as the management of materials and information and still others as a set of decisions to be made (Ho *et al*. 2002). In addition, some researchers see SCM as data-driven (based on the manipulation of vast quantities of information). Others focus on processes and process improvement such as total quality management. Still others focus on process control, attempting to minimize undesirable behaviour (Akkermans and Dellaert 2005). Finally, while some authors employ it as an abstract concept, others use it to refer to material objects as they are moved from place to place.

That said, while the term 'supply chain management' was virtually unknown in the literature prior to 1985, twenty years later bibliographic databases reported more than 1500 articles per year on the subject (Figure 1). In addition, a search of the Online Computer Library Center's *WorldCat*, a

worldwide union catalogue, identified 1398 books and twenty-nine journals devoted to SCM. Moreover, SCM appears to have grown up outside economics as evidenced by the few references to it in Econlit, a database that, as the name implies, catalogues the economic literature. That said, given this meteoric rise to prominence, it is likely that SCM is here to stay.

SCM, much like NE, is best understood as a mode of performance. Like those of NE, SCM practitioners calculate efficiencies and costs of production. But SCM differs significantly from NE even as it subsumes the older form. Let us examine the similarities and differences (see Table 1). Neoclassical economics borrows from Adam Smith (1982) [1759], 1994 [1776]). Smith

Table 1 Two models for performing the economy

Neoclassical economics	*Supply chain management*
Microeconomics: theory of the firm	Obliterates distinction between micro and macro
Macroeconomics: structure of the economy	
Firm as unit of analysis	Supply chain as unit of analysis with transactions as constraints or opportunities
Strives to produce level playing field	Playing field assumed to have peaks and troughs; logistics used to minimize costs
Technical change is exogenous to economy	Technical change as means for reshaping the playing field
Invisible hand of market ensures that supply meets demand and markets clear	Visible hand of firm manages both the surface of the playing field and behind-the-scenes action. Markets do not necessarily clear
State sets the basic underlying conditions for the market (e.g. property rights, contract law) *or* itself the result of market failure	State policies are a collection of varied topological distortions that have positive or negative costs for each actor associated with them
NGOs as lobbyists of the state; little interest in market	NGOs as potential allies in improving supply chain efficiency and operation
Invisible hand of the marketplace moves towards equilibrium	Visible hand of SC manager attempts to organize playing field and rules of the game
Demand emerges from consumer preferences; price the result of intersection between supply and (effective) demand	Demand malleable through marketing; price result of product placement, style, advertising
Organizations well bounded; externalities as transgressions; and single clear goal	Organizations embedded in larger social world; have multiple goals
Models strive for mathematical elegance; integrates with utilitarian calculus	Models less elegant; potential for multiple ethical perspectives
Welfare ensured by invisible hand if conditions of model are met	Welfare assured by corporate social responsibility, possible that welfare is not optimized

understood the performance metaphor implicitly. Smith's invisible hand does not function satisfactorily unless markets are constructed in certain ways. As Samuels put it, 'The market is above all an institutional mechanism to compel men to pursue self-interest in social rather than anti-social ways' (1977: 196). Thus, unlike many of his current NE admirers, Smith is quite clear that the State must provide roads and canals, must educate citizens and must provide enforceable property rights. Moreover, the market works best for Smith when people – otherwise highly social animals – are treated as isolates. Thus, Smith rails against the evils of corporations, unions and professional societies. Neoclassical economists added several new features to Smith's model, while dropping others. These changes are relevant to our purposes here.

First, they more carefully specified his notion of the wealth of nations by substituting a utilitarian and quantitatively measurable welfare function: Pareto optimality, or the greatest good for the greatest number without disadvantaging anyone. Second, they distinguished sharply between the behaviour of individual firms (microeconomics) and the larger (socio)economic structures that set the stage (or level the playing field) on which the economy is performed. Third, they introduced the notion of marginality, arguing that the cost of and demand for the last unit of production are most important for economic decision making. Fourth, they formalized those aspects of Smith's prose dealing with the performance of the economy in a system of equations containing measurable variables. At the same time, they redefined backstage actions as 'structural changes' to which firms must 'adjust'. Finally, they jettisoned Smith's insistence on the sociality of human beings, substituting instead a methodological and theoretical individualism (Hodgson 1998).

SCM borrows much from NE models, but it nevertheless makes some profound changes in its performance model, effectively subsuming NE into SCM as a special case.[4] According to some proponents of SCM, it shifts from the firm to the supply chain as the basic unit of analysis (Croom *et al*. 2000). Put differently, SCM is concerned to maximize or optimize the supply chain as a whole (although often to the optimal benefit of one particular firm), from the production of raw materials all the way to the consumption and even disposal of the final product. This process usually involves a series of firms that handle the product (and all its ancillary components) as it flows from raw materials to consumed product. These firms may be vertically coordinated but are not necessarily (and empirically not usually) vertically integrated into a single firm under a single ownership structure. Indeed, it is the realization that such integration is unnecessary and perhaps undesirable that gives SCM its *raison d'être*.

But there is both some truth and some sleight of hand in the manner in which SCM shifts the unit of analysis to the supply chain. Optimization of the supply chain is generally not based on the entire chain, but is accomplished from the vantage point of one particular actor in the chain. Thus, for example,

Wal-Mart attempts to optimize its supply chains with the express intent of optimizing *its* return relative to that of other actors in the chain *as well as* relative to other competing supply chains. It is to Wal-Mart's advantage that all of its suppliers operate as efficiently as possible and provide it with goods that meet its quality, timing, pricing, packaging and other requirements. Thus, in order to maintain its 'everyday low prices' position in the market, Wal-Mart must simultaneously (1) continuously reduce the prices it pays to suppliers, (2) help suppliers to make their own operations more efficient, (3) see to it that all goods received are quality tested and (4) ensure that its suppliers earn sufficient profits to remain in business. To do this, Wal-Mart maintains a protected website which suppliers are required to use: 'Retail Link® provides information and an array of products that allows a supplier to impact all aspects of their business. By using the information available in Retail Link®, suppliers can plan, execute and analyze their businesses – thus providing better service to our common customers' (Wal-Mart 2006). Wal-Mart also insists on the use of electronic data interchange (EDI) (Hill and Scudder 2002) to order and track goods from suppliers to final purchase. Thus power is a central but usually undiscussed aspect of SCM, even as it is central to other parallel literatures such as that on global value chains (cf. Cox 1999; Ponte and Gibbon 2005).[5]

Building the level playing field

The commonly used metaphor of the level playing field is an apt one for describing the NE view of the market. Indeed, a strict NE interpretation assumes that all relevant action takes place on the two dimensional playing field. Like the residents of Edwin Abbott's (1963) [1891]) *Flatland*, we can consider the NE playing field as having only two dimensions. It is performed by firms that are constrained by the 'laws' of supply and demand. Importantly, the NE playing field is fundamentally Cartesian: space is straight and extends infinitely in all directions. Since the inhabitants are flatlanders, they are unaware of the possibility of any third dimension.

But, as Einstein showed about a century ago, space is curved. The economic plane on which the market is performed may be flat, but it is only so if viewed in two dimensions. Put differently, it is a plane surface, but it exists in three-dimensional reality much like a mathematical manifold. That third dimension adds peaks and troughs to the plane. From the two-dimensional standpoint of NE models, these peaks and troughs are structural changes that shift the location of demand and supply curves. In contrast, SCM models recognize these peaks and troughs as subject to modification by supply chain managers acting either individually or in concert. Let us consider some of the ways in which the economic plane is curved.

Property

In order to have a market of any kind, the participants need to have things that they own and wish to sell. But ownership is a bundle of rights in forms of real and intellectual property, each treated differently and backed up to varying degrees by the force of law, i.e. the State. For example, retail stores in the US are subject to local zoning laws and building codes, while food is subject to national regulation usually enforced by the individual states. Those rights can be and often are quite complex. For example, in the US I may not (legally) discharge farm animal wastes directly into estuaries. I may not sell food products that have more than a certain percentage of insect parts in them. I may not pay workers less than the minimum wage allowed by law. At the same time, if I hold a valid patent, I may legally exert monopoly control over the manufacture and sale or lease of the patented product until the patent expires.

From a NE position, these are among the givens that define the playing field on which competition is to take place. Changes to these laws are exogenous to the model.[6] In contrast, SCM models see these as parameters that vary and can be modified with more or less difficulty across time and especially space. Thus, having a piece of land re-zoned to permit retail development may be easy in some jurisdictions and difficult in others. A new zoning board might view a request more favourably than did the previous one. Helping the 'right' people to be elected may be a corporate goal. A more specific case is the recent debate over unpasteurized fruit juices: large manufacturers argued that food safety laws should be strengthened so as to prohibit the sale (i.e. remove that right to dispose of property) of unpasteurized juices that might contain harmful bacteria. Since few large manufacturers produced unpasteurized juices, this would require their smaller competitors either to invest considerable sums in pasteurization equipment or to leave the industry (Collins 2000; Klinkenberg 2003).

Taxes

Markets are clearly 'tilted' by taxes, tariffs, and quotas. While viewed as structural shifts by NE models, SCM models see such taxes, tariffs and quotas as variables. From an SCM perspective, lobbying to create or maintain favourable tax policies is seen as an appropriate activity, the cost of which can be weighed against the benefits to be received (or lost). As a *BusinessWeek* reporter put it, 'in practice every industry thrives on specific tax breaks, and corporate lobbyists get paid to defend those sacred cows, not principles of tax theory' (Gleckman 2005). Furthermore, as with property rights, SCM models include the possibility of moving to different jurisdictions. This includes outsourcing and shifting profits to jurisdictions with more favourable tax regimes. These, too, can be estimated and factored into SCM models.

For example, farm subsidies (negative taxes) permit some (generally very large) farmers to profit through market transactions even though their products would otherwise be more costly than those of unsubsidized competitors. A tariff on sugar keeps US sugar prices artificially high, even as it limits participation in the US market by foreign suppliers. Currently, large users of sugar are lobbying for a sugar subsidy to replace the current quota. This would allow the manufacturers to buy on the world market, while using taxes to support sugar growers' incomes. However, the sugar growers are opposed to this as the subsidy is far more visible to taxpayers than is the tariff.

Information

NE models have traditionally assumed that information was perfect. In recent years, the limits of that position have become apparent even to practitioners of NE. As Stiglitz (2000) painfully showed, information is virtually never freely available, but instead comes with a cost. As a result, some participants in the market know more than others about what is for sale. Obtaining information can be costly as can analysing it. Stiglitz and others have shown that differential access poses serious problems for NE models. But, in contrast, for SCM it poses no such dilemma. The cost of identifying, gathering and analysing information and the consequences of asymmetries can be estimated and factored into SCM models.[7]

Finance

The cost and availability of credit determines which investments in the production of marketable goods will be made and which ones will not. Similarly, the credit situation of buyers determines in part what goods they are likely to buy. Yet, credit is dependent on both firm characteristics (e.g. firm size, cash reserves, valuation) and such things as monetary policy, inflation rates and the decision-making structures of the Federal Reserve Bank and central banks in other nations. In an ideal NE world firms would not have cash on hand to invest in new business ventures; instead, they would distribute any profits to their shareholders in the form of dividends. In contrast, in SCM models, and in practice, most large firms have considerable cash reserves. These can be used by firms as they see fit. Put differently, whereas banks will generally lend to the enterprises that promise the highest return for a given risk, supply chain managers are both more and less constrained. On the one hand, they are constrained to invest in enterprises that promise to complement the core business(es) of the parent company. On the other hand, they are able to take greater risks and/or accept lower rates of return than banks. Nor are they necessarily restricted to a given nation if they do need to borrow. They

can often take advantage of different interest rates in different nations. Furthermore, firms can take advantage of social networks they have in order to obtain better rates (Uzzi 1999). Finally, firms may compare the cost of borrowing to engage themselves in a given task, such as research, to the cost of outsourcing that same task. In other words, credit can be included in SCM models as an endogenous rather than exogenous factor.

The same applies with respect to supplier and consumer credit. Large retailers often buy goods from suppliers without paying for those goods immediately. This leads to considerable 'float' time during which interest can accrue to the retailer. Similarly, (large) retail firms can increase sales by providing credit to their customers. Of late, Wal-Mart has announced its desire to be registered as a bank. That would permit it to gather considerable capital from its customers to use for its expansion.

Furthermore, firms can and do organize their finances so as to produce data that address concerns of shareholders. While accounting can be too 'creative', as it was in the Enron scandal, it is not merely a matter of ritualistically following some set of rules; instead, it involves some exercise of judgement. Hence, even within the legal limits, supply chain managers can encourage organization of data so as to present the most attractive picture of all aspects of firm finances to shareholders.

Standards

A myriad of standards – some public and others private – determine *de facto* what may and what may not be sold in the market. Standards may be viewed as a continuum of positive and negative sanctions, ranging from those that are required, to those prescribed, to those proscribed, to those prohibited. Each standard shapes the playing field as well as determining who may be allowed to play.

From a NE perspective, standards are designed to *standardize* (e.g. Hill 1990, 1991), thereby reducing transactions costs (Coase 1988), taking advantage of economies of scale, increasing competition and ultimately lowering prices to consumers. Such standardization implies a singular approach to quality ideally suited to mass production for a mass audience of undifferentiated consumers. Indeed, Herbert Hoover (1924) was convinced that government should encourage standardization of everything so as to cut prices, thereby improving everyone's level of living. Ironically, radical economist Thorsten Veblen (1921) shared this view with Hoover; however, Veblen believed that the engineers should simply take over control from the owners of capital and create unparalleled abundance.

In point of fact, there is plenty of evidence that following the NE approach to standardization will lead to lower prices all through the supply chain. The entire apparatus of US Department of Agriculture grain and meat inspection is based on this premise. But, as Cochoy (2002a) notes, standardization poses

the problem of Buridan's ass common to all bulk commodity production. Buyers of standardized commodities are faced with essentially meaningless decisions between lots x, y . . . n, all of which are indistinguishable. As Sen (1973) suggests, under these conditions it is likely that buyers will be totally indifferent with respect to the choice of object to purchase. Therefore, buyers make choices entirely based on the lowest price; conversely, sellers must compete based entirely on price.

In contrast, from the perspective of SCM, standards are strategic tools for advancing the supply chain or firm. Thus, from an SCM perspective, standard setting by firms, supply chains, industry associations and others is a strategic move designed to *differentiate* among otherwise similar products, increase market share and/or add value (Bingen and Busch 2005). Thus, SCM focuses on *qualities*, abandoning the notion of a quality continuum from good to bad, and replacing it with products that are (ideally) largely incommensurable. At the same time, standards can reduce or shift various kinds of health, economic or environmental risks that might impose costs as a result of process and product qualities. Such standards, and related actions such as branding, guarantees, packaging and design (Molotch 2003), also allow firms and chains to avoid the problem of Buridan's ass. They permit, and even encourage, competition based on a virtually infinite number of attributes rather than price. New Zealand fruit growers have effectively used this approach to segment (e.g. by size, colour, variety, waxing) their market into some 1400 different stock keeping units (SKUs) instead of merely selling undifferentiated apples in direct price competition with other producing nations (McKenna 1999; Perry *et al*. 1997). At the other end of the supply chain, retailers have been steadily increasing the number of private label (own brand) products on their shelves. Upscale British retailer, Marks and Spencer, now sells only private label products in its stores. Such private label products are largely incommensurable with other products on the market, reducing price competition and permitting competition on other attributes. At the same time, private label products enhance control by retailers who can impose stringent standards on (often captive) suppliers. In short, rather than being forced to compete on price, practitioners of SCM attempt to choose the parameters on which they will compete.

Beyond spot markets Related directly to the proliferation of standards is the decline of spot markets. In NE models, firms buy and sell largely undifferentiated commodities on spot markets. They do not produce for or purchase from specific customers as much as 'for the market'. Furthermore, they buy and sell whatever is available on spot markets based on binary decisions: either one buys (sells) or not for the asking price. Such prices are public, visible to those watching in the marketplace and collected and published by teams of government statisticians and economists. Learning in these NE models is largely the iterative result of binary success or failure in buying (selling) products that have been developed for an anonymous other.

In contrast, SCM queries every actor in the supply chain to ensure that the characteristics of the product, the process by which it was produced and the cost of the product are acceptable to some targeted subset of final consumers. This is often accomplished through contracting for production or marketing. In 2003, 39 per cent of the value of US agricultural products was produced under contract. For some commodities, especially livestock, contracting is the dominant form of economic relationship with producers. Not surprisingly, there is a high correlation between farm size and percentage of value under contract (MacDonald and Korb 2006). Furthermore, since contracts often preclude parties from revealing the prices of those products, the published 'market price' may well be the result of a 'thin market' (Hobbs and Young 2000). Hence, it is unreflective of the actual 'market price.'

Non-governmental organizations (NGOs)

In NE models there is no place for NGOs; they are merely another somewhat unwelcome exogenous factor that may bring on a structural shift. But NGOs are easily incorporated into SCM models. From an SCM perspective, NGOs are the new brands (Wootliff and Deri 2001). They are potential allies in the path to sales. Thus, McDonalds has aligned itself with the animal welfare movement to promote its friendliness to farm animals. Whole Foods advertises that it is the first supermarket chain to be certified organic by an organic NGO. The Ethical Trading Initiative includes NGOs as well as companies as members.

NGO strategies have changed as well. Previously, they lobbied the State to achieve their objectives. While they do not ignore the State, they now are equally interested in lobbying companies (especially those with visible brands) in support of their diverse goals.

So threatening are the advances of certain NGOs to some firms and industries that they have at times created what might be called pseudo- and quasi-NGOs. The former can only be described – following the performance metaphor – as front organizations. These are NGOs that maintain websites, issue press releases, publish brochures and engage in activities similar to those of private voluntary organizations. But one quickly realizes that they lack tax-exempt status, have no physical address and perhaps have fictional officers. For example, one pseudo-NGO was apparently central to the debate following publication of a paper considered critical of the genetically modified seed industry; as far as can be determined, the 'research director' of this organization and the organization itself did not exist (Monbiot 2002).

In contrast, quasi-NGOs may have apparent offices and perhaps even tax-exempt status, but further inquiry reveals a corporate link or the lack of any link to a private voluntary association. In both instances these tactics can be seen as attempts by supply chain managers to redirect public opinion in ways

favourable to the company or companies involved. However, such tactics may backfire if enterprising reporters uncover them.[8]

Technoscience

Finally, technical change can also warp the playing field. Technical change can be used to capture market share, decrease prices and increase sales, block entry into particular markets and even create new markets for products that previously did not exist. Indeed, technoscientific change is particularly disruptive, closing long-established lucrative markets for some even while opening new markets for others.

NE treats technoscientific change as exogenous (Rosenberg 1982); hence, it is an unperformed backstage phenomenon in NE models. Even the theory of induced innovation, as initially developed by Hicks (1932), and more recently expanded upon by Hayami and Ruttan (1985), treats technical change as merely an automatic response to the relative cost of the various factors of production (i.e. land, labour and capital). In contrast, SCM sees it as an endogenous instrument for enhancing the efficiency and effectiveness of the chain. From the SCM perspective, technoscientific change is always embodied in particular technoscientific objects and their development. Each must be evaluated based first on whether it can be purchased from a supplier for a price that results in an overall reduction in costs and/or an increase in market share. If this is not the case, then development costs must be estimated and weighed against savings from improved efficiency/effectiveness/reduced risk of operations.

While some innovations may be adopted by individual firms, many innovations require adoption by the entire supply chain. In these cases, organizational structures need to be designed to obtain and manage the new technologies. For example, supermarkets have been among the most ardent proponents of radio frequency identification (RFID) tags.[9] Such tags allow traceability of products from their point of origin to the checkout, permitting instant inventory checking, faster checkout and reduced pilfering. But their adoption has to take place across the supply chain. Unless they are widely adopted, much as has been the case for bar codes (Brown 1997), they will serve little purpose. What is important for us here is that the adoption decision affects the entire chain and is seen as little different in principle from any other chain-wide change (e.g. timing of deliveries).

But there is another difference in the place of technoscientific change in NE and SCM models. In the former technical artefacts are seen as lubricants for the technological treadmill (Cochrane 1993; Cox 1999). That is to say, from an NE perspective sellers can only increase profits or market share by being early adopters of cost-reducing technologies. From the vantage point of NE, the treadmill is desirable since it lowers costs to buyers. It does so at the cost of turning everything into commodities – into undifferentiated products that compete with each other solely on price.

In contrast, in SCM models technology is treated strategically and in a much more nuanced manner. The treadmill is considered quite negatively to the extent that it affects a particular supply chain actor. As General Electric Chief Executive Jeffrey R. Immelt put it, 'Managing innovation better may be the only way out of the "abyss called commodity hell"' (quoted in Hof 2004: 129). For Immelt and other proponents of SCM, innovation is accorded a special place as a means of differentiating product A from product B. That differentiation is in part accomplished through stronger intellectual property rights as well as steeper learning curves, so as to slow the treadmill and shift competition to something other than price.

Such homogeneity or differentiation is treated considerably differently depending on where one stands in the supply chain. In general, firms will wish to buy homogeneous products from their upstream suppliers and provide differentiated products to their downstream customers, thereby maximizing value from their investment. However, upstream actors will take advantage of their natural and social location in the chain to block such moves. Thus, producers of artisanal Camembert cheese have used their region, manufacturing methods, legal status and tradition to create a unique identity and maintain differentiation and high prices in production (Allaire and Wolf 2004; Boisard 1991).

It should also be noted that downstream actors will occasionally refuse to perform technologies developed upstream that potentially threaten their market position. For example, McDonald's (a retailer) and Mars and Hershey's (food manufacturers) blocked the introduction of genetically modified potatoes and sugar respectively (Kilman 2001; *Nation's Restaurant News 2001*). It appears that in both instances these companies saw the new technologies as likely to affect profits negatively; in addition, they had enough market power to block their use.

Furthermore, SCM models also link technoscientific change to 'superficial' features of products and services. Thus, packaging, styling and ease of servicing are used to differentiate one product from another, to make price comparison difficult if not impossible. As Cochoy (2002b, 2003, 2004) suggests, these features are inseparable from the product or service itself. The introduction of the Tetra Pak®, a new means for packaging liquid products in shelf-stable aseptic form, was simultaneously a technical breakthrough and a means of product differentiation. However, it has posed complex problems for recycling.

Convenient and even attractive packaging is also a technoscientific change and helps to differentiate products. Consider, for example, the development of pop top lids on cans, first as removable tabs and then remaining as part of the can. Designing a more convenient and later more environmentally friendly means of packaging ordinary products initially led to differentiation among otherwise identical and commonplace soft drinks. It slowed the treadmill, increasing the profits and market share of those companies that adopted it.

Front-of-stage/backstage

These backstage actions by means of which the surface of the playing field is warped or curved are recognized by both NE and SCM approaches. However, for NE models, backstage actions are based on classical Western political philosophy, following a long tradition stemming from Hobbes (1991) [1651], 1991 [1658/1642]), Locke (1955) [1690]) and especially Smith (1994) [1776]). The nation-state sets the conditions under which the market will operate by virtue of its actions with respect to money supply, finance, property rights, regulation, contract enforcement and crime prevention, among other things. Most economic behaviour is assumed to take place within the confines of a given nation-state whose legal framework is taken largely as a given by individual firms. Individual firms do not operate backstage, or perhaps, more precisely, *should* not operate backstage. Thus, for proponents of NE models, there is a sharp division between front of and backstage, micro- and macroeconomics, agency and structure, or, to use the metaphor somewhat differently, between the actors and the stage hands. Changes in government policies of all sorts, as well as changes in technoscience, are displayed in their models as shifts in demand or supply curves caused by 'structural adjustments'.

Like NE, SCM performs on the surface of the manifold, determining the best route from point A to point B in geographical and socioeconomic space where cost, price, quality and timing are as much factored into the calculation as is distance. But SCM also performs in ways that attempt to reshape the manifold so as to reduce costs for the chain and/or to increase costs for other chains. For SCM models, the front-of-stage/backstage distinction still exists, but there is no longer any prohibition in the model of backstage actions by firms. Indeed, supply chain approaches work a bit like the well-known scene in the *The Wizard of Oz* in which Dorothy whisks away the curtain and the wizard exclaims, 'Pay no attention to that man behind the curtain!' On the one hand, in textbooks, courses and consulting firms that focus on supply chains, an ever-growing set of backstage actions that firms can take is described and even encouraged. On the other hand, when public pronouncements are made, one can always (if it helps to justify otherwise unpalatable actions) 'let the market decide'. Put differently, the neoclassical curtain can always be drawn over the backstage activities. Indeed, it is precisely because – unlike publicly available retail prices – backstage activities are often difficult to document, highly heterogeneous, constantly shifting and not easily measured that they are simultaneously usually visible to the various affected supply chain actors even while invisible to the general public. In an ironic reversal of Adam Smith and Chandler (1962), the visible hand is invisible while the invisible hand is visible.

But SCM also involves enrolling or going around NGOs, supporting or fighting labour unions, investing in new technologies, designing new standards and manipulating information. It involves lobbying various and sundry state

agencies and legislative bodies, as well as taking cases to court, fending off competing supply chains and keeping final customers happy. All of these actions, which would have been understood as structural changes in neoclassical models, thereby putting them beyond the reach of the firm (and of microeconomics itself), are in SCM very much within the purview of the supply chain managers. The longest and most detailed list of actions would be incomplete. SCM promises to include in its models virtually any action by society or nature that impinges on the supply chain. Indeed, it is a feature of SCM – paralleling Latour's (1987) observation that the hardness of a fact or strength of a network is demonstrated by the resources that must be gathered to overturn it – that in principle any topological distortion may be flattened if enough effort is applied. In sum, unlike the closed equilibrium models of NE, SCM models are open to an endless string of changes exogenous to the chain itself, all of which can be the subject of strategic action.

By virtue of its acknowledgement and encouragement of operating both on the surface of the manifold *and* in reshaping it, SCM also eliminates the distinction between micro- and macro-levels. Whereas neoclassical firms can operate only at the micro-level, supply chains are simultaneously micro- and macro-, structure and agency.[10] Furthermore, if power is defined as the ability to make the rules that others must follow, then these backstage modifications are displays of power (and resistance) as much as they are of technical or organizational skill.

But there is a certain irony in all the posturing, manoeuvring, negotiating, bargaining, that goes on: a certain amount of stability is necessary to play the game at all. Certain (not fully definable) conditions must be met for the show to go on. These include not only conditions internal to the game, such as availability of raw materials, workers willing and able to engage in productive activities and even good weather, but also conditions largely external to the game, including delivery of basic services needed for production, a certain modicum of social order and continuing income of potential buyers. In short, even as players rewrite (some of) the rules in ways that suit them, so they depend on the stability of other rules to consolidate their positions.

The regulatory State

Unlike NE models, SCM models explicitly understand and encourage the *malleability* of the State. Depending on the situation, supply chain managers may lobby legislators, negotiate with regulatory agencies and/or litigate cases likely to be resolved in a manner particularly suitable to them. Importantly, different nation-states are more or less malleable on issues of concern to managers. Thus, country A may have strictly enforced labour laws while country B might have weak or poorly enforced labour laws, but strong and well-enforced environmental laws. Good supply chain managers have access to this sort of information from experience in the market, consulting reports or reports of other firms' experiences in those countries. Thus, a manager might

simply fire union workers in nations with very weak labour laws, mount a major anti-union campaign in a country with some labour protections, but at the same time accept and even embrace unionization in nations with strong labour laws. For example, in Canada Wal-Mart closed a Quebec store after it successfully unionized, while, in the United Kingdom, it has acceded to some of the demands of unionists at its ASDA stores.

Furthermore, SCM sees the State in its various manifestations as another set of topological distortions of the playing field. Put differently, state policies are viewed as either obstructions or lubrications for the flow of goods in the chain and policies to be challenged or supported in executive, legislative and judicial settings. Thus, firms continuously interact with executive agencies to extract policies they believe are more desirable for their supply chains, lobby legislators to encourage them to change or leave in place desired laws and bring both governmental agencies and other firms to court to challenge actions they find undesirable. When combined with the general tendency of the law to be reactive rather than proactive, this poses a significant conundrum for policy-makers.[11]

Even in instances where firms are not in a position to rewrite or modify laws and regulations, through executive, legislative or judicial routes, they may be able to use those regulations to their advantage by changing the division of labour along the supply chain. Hence, Wal-Mart was able to 'resolve' the problem of unionized in-store butchers in the US by handing off the job of meat-cutting to centralized processing plants and having meat delivered to the stores already cut and packaged.

In addition, even as the supply chain managers grapple with state laws, regulations and the like, they themselves create, and are expected to create as part of the management plan, a structure of governance that parallels or mirrors that of the State. Thus, as noted above, in recent years we have seen the dramatic rise of private-sector standards (regulations) that cover not only product quality but the production process (e.g. worker health and safety, environment, human rights) and management itself (e.g. ISO 9000) (Busch 2000; Busch and Tanaka 1996). We also see the rise of substantial private police forces, often rivalling in size those of small cities. Manuals of procedure, codes of conduct and a host of other documents resembling those of states are now commonplace. They are often used to improve supply chain efficiency and effectiveness. And in some instances private regulation includes regulating the State itself (Scott 2002).

Nor do states operate with a 'one size fits all' model any more. States also often distinguish among firms based on size and reputation, requiring different kinds of reporting from different firms (Marsden *et al*. 2000). In the US, for example, the Food and Drug Administration checks only about 2 per cent of imported foods. But, rather than choosing randomly, they focus on products and firms that are known to be more likely to pose health hazards.

Other differences between NE and SCM models

There are a few other ways in which SCM models eclipse NE models. First, NE relies on the actions of the invisible hand of the marketplace to ensure that prices move towards an equilibrium where supply and demand converge and markets clear. In contrast, SCM relies on the visible hand of the supply chain manager(s) to manage both the playing field on which SCM takes place as well as the backstage 'rules' that govern the game. Moreover, since chain optimality is negotiated both within each supply chain (among the various actors in the chain) and across supply chains (where chains compete for resources), there is no guarantee that supply and demand will converge or that markets will clear. Indeed, since the goal of SCM is the optimization of chain or, more likely, firm profits, the very issue of full or partial equilibrium for the economy as a whole is usually of little interest to proponents of that theory. Instead, much like the institutional economists of the past, they see the overall economy as continually evolving in response to a myriad of individual and corporate actions (Hodgson 1998).

Furthermore, in NE models demand emerges from essentially fixed consumer preferences; effective demand (as noted in actual purchases) is the display of those preferences at a given price (cf. Sen 1973). But in SCM models preferences are quite malleable. Advertising campaigns, focus groups and product placements, as well as marketing surveys, now shape demand to a significant extent. This is not merely an empirical fact, but is also an accepted theoretical premise within SCM models. As a result, 'category managers' in supermarkets continually engage in a kind of applied epistemology, endlessly rearranging the 40,000 items on the shelves of a typical US supermarket in an effort to boost sales. Like their philosophical counterparts, category managers are faced with the problem of organizing knowledge into intelligible categories. However, unlike philosophers category managers must physically move the objects around the store in a manner that simultaneously (1) permits consumers to find the products, (2) increases sales and (3) minimizes competition with other food retailers. For example, should the salad dressing be placed in the aisle with the greens or the one with cooking oils? Nor is this kind of analysis limited to internal marketing issues. One chain displays uncooked fresh prepared meat, seafood, sauces, chopped vegetables and condiments in the same section of the store, but packaged separately. Next to that display are free recipes. The products are deliberately kept separate so that customers may pick and choose, but also so that they do not compete directly with restaurants or with frozen cooked meals. The customer can go home and prepare an elaborate fresh cooked meal 'from scratch' in 10 minutes. This can be compared to the far less homey trip to the local restaurant.

This is not to suggest that customers are infinitely malleable. Indeed, despite the vast sums invested in marketing, and the 10,000 new products introduced each year, only 20–33 per cent succeed in the marketplace, and many of those displace existing products (Harris 2002).

Performing poorly, in error, not at all or something else

It is important to remember that, just as an actor may act poorly or a sports team member may take steroids or assault another player, so actors in supply chains can and do refuse to play the roles to which they are assigned, play them badly or merely to the extent necessary to 'get by'. When this happens supply chain managers scramble to find other players who appear able to perform the same role. A large producer of mediocre-quality dry beans, for example, may receive only a verbal warning from the buyer once or twice (due to the difficulty of finding a replacement quickly and the annual variability of the crop), but continued marginal performance is likely to lead to substitution with another producer.

Alternatively, just as an actor or player may misunderstand the cues given, so may a supply chain actor. Hence, products are sometimes mis-manufactured, such that they must be disposed of at a loss or even be destroyed. For example, some years ago, the National Commission on Productivity (1973) reported on how California breeders had developed a processing tomato variety that yielded far more than other varieties on the market. Within its first year of sales, the variety was widely adopted by farmers. However, it appeared that the entire increase in yield was due to the capacity of the variety to increase water retention – water which had to be boiled off by the processors. The situation is reminiscent of that described by Wittgenstein: 'The fundamental fact here is that we lay down rules, a technique, for a game, and that then when we follow the rules, things do not turn out as we had assumed. That we are therefore as it were entangled in our own rules' (1953: 50). From an NE perspective such errors are to be handled by the magic of the market; indeed, tomato processors soon banned the offending variety. In contrast, an SCM perspective would emphasize greater communication among the actors in the chain, thereby avoiding the problem in the first place.

Finally, players can attempt to change the rules in a manner that suits them well, but perhaps enrages other members of the chain. For example, in some instances, actors may attempt to change the rules in ways that are illegal. Hence, today there is considerable concern about counterfeit food and other products with packaging so well designed as to fool all but the most carefully trained inspectors. Such products may enter legitimate supply chains without the knowledge of chain managers. Alternatively, they may appear for sale in other venues, attracting (constructing) a different audience entirely. Thus supply chain managers must be vigilant in protecting their chains from such products lest their reputations be ruined.

Boundary maintenance

A key aspect of economic organizations is that in many ways they act like individuals. Scholarly observers of all stripes and persuasions agree that economic organizations may be more or less trustworthy, transparent,

reputable and honest in their dealings with the rest of the world. However, from an NE perspective, economic organizations are well bounded in several ways. First, phenomena that threaten to extend beyond NE models are treated as externalities. Indeed, one critic has acerbically argued that there is a never-ending supply of externalities available (Sagoff 1988).

In contrast, however, like Granovetter (1985), proponents of SCM models see economic organizations as embedded in the larger social world. They have little difficulty in introducing variables and in dealing with phenomena that extend far beyond economics. Hence, proponents of SCM frequently borrow from other disciplines, including marketing, management, sociology, geography and psychology. Moreover, they appear to share Callon's (1998a) view that framing or bounding is both rare and difficult, and that overflowing is far more common.

Second, proponents of NE generally assume that there is a single well-defined goal for both economic organizations and practitioners. Thus firms are seen as profit-maximizing organizations, and nation-states are seen as maximizing GDP. In contrast, proponents of SCM openly recognize the multiplicity of goals pursued by both organizations and individuals. Hence, an SCM proponent seeking to find a supply of cheap labour would inquire about a variety of characteristics, including cost, but also reliability, union status, quality and quantity of work accomplished and need for supervision. Furthermore, that same proponent of SCM would probably also ask about political stability, government support or lack of it for trade unions and other factors external to the firm itself.

Third, most proponents of NE define rationality in a very matter of fact way, although transaction cost approaches tend to take a somewhat broader view (Williamson 1994). They argue that economic actors act in a rational manner, attempting to maximize or optimize a single well-defined goal such as profits. In contrast, proponents of SCM are far more likely to use a concept of bounded rationality, in which actors satisfice by choosing among the options immediately available to them (Simon 1957).

Elegance and ethics

Yet another point of difference between NE and SCM models lies in the aesthetic domain. Without doubt, NE models are translatable into elegant sets of mathematical equations to be solved. Proponents find considerable pleasure and prestige in those solutions, and in being able to write 'QED' next to each. However, despite some attempts to extricate itself from its utilitarian roots in the early nineteenth century, largely by development of the slippery concept of efficiency (Schmid 2004), NE remains at least implicitly wedded to the utilitarian calculus. Thus, in addition to the central concerns of the theory, various forms of cost- and risk-benefit analysis and contingent valuation are widely practised. To put the matter differently, the very elegance of algebraic NE models links them closely to utilitarian ethics.

In contrast, while SCM proponents frequently use mathematical models, including those developed by NE, they reject the notion that the economy itself can be seen entirely in these terms.[12] This makes SCM models far less elegant than those of their NE counterparts. For many variables incorporated in SCM models, even quantification is lacking (e.g. leadership, innovation). But this allows SCM to incorporate ethical perspectives beyond utilitarianism and other forms of consequentialism. Proponents of SCM can ask about the virtues of a good manager or supply-chain captain. They can also ask about the rights of various actors in the supply-chain. While currently largely underdeveloped, SCM has the potential to incorporate all three major forms of ethical argument: consequentialist, virtue and rights theories.

Implications for social welfare

The welfare implications of neoclassical economics are quite different from those of SCM. For neoclassical economics, although no particular firm need worry about social welfare – *caveat emptor* remains central to market operation – the optimization of the general welfare is a central claim. If the terms of the model are realized in practice, then it follows by virtue of mathematical logic that the general welfare will be optimized. That is the seductive central point of the model. In contrast, SCM does not directly address the welfare function, either as a mathematical function or as a sociological one. Instead, social welfare re-emerges through another channel: corporate social responsibility (CSR). CSR is an incredibly slippery term that appears to encompass a wide range of social welfare goals from sustainability to human rights. Moreover, CSR is discussed in government, corporate and NGO circles, and each has played a role in shaping it. The development of measures by which to assess CSR occupies the time of a considerable number of persons. Furthermore, there is no shortage of critics lined up to point out its limitations (e.g. Jenkins 2005).

But it is worth noting that CSR – whether seen as merely corporate public relations or as a serious attempt to improve social welfare – is of no little concern to SCM. Indeed, by re-conceptualizing the economy as supply chains, the practitioners of SCM have made themselves responsible for the actions of entire supply chains. This includes those actions that cut costs and improve chain efficiency. But it also includes those actions that reflect poorly on the reputation of well-known brands and companies. Thus, however reluctantly, supply chain managers are coming to accept some form of CSR as essential to maintaining their bottom line.

What remains problematic is that CSR makes no claim to overall social welfare, only to the social welfare of those persons linked to a particular chain. Nor does it adequately address the equity, justice or power issues associated with the distribution of value in the chain. The neoclassical model claims to maximize social welfare, but that occurs only if the performance of the

economy is entirely faithful to the theory – a perhaps impossible task. In contrast, CSR might actually do a better job of maximizing social welfare despite its lack of mathematical rigour. As Voltaire suggested, the best may be the enemy of the good.

Conclusions: dramaturgy revisited

In short, it can be argued that NE and SCM models are radically different ways of performing the economy. NE describes a fixed, rational world in which the range of actions permitted by all the actors, stagehands and audience is well-known, well-defined and distinct. Both products and customers are constructed in standardized fashion (Cochoy 2002a). As Callon (1998b) has suggested, even as NE provides a model for an ideal economy, markets and marketing are under-theorized by NE practitioners.

In contrast, SCM is performed on a stage in which the set, the actors, the actions, the theatre and even the audience are constantly under (re)construction, much as in the case of 'improv' theatre. Hence, government policies of all sorts, technoscientific change, qualification of goods, persons, firms, standards, NGOs, the active shaping of consumer preferences, and in principle an endless range of other actors, can be the subject of SCM analysis.

Some would go further in arguing that the audience for NE models has been progressively limited to professional economists. In contrast, SCM practitioners perform the economy for a wide range of audiences, including professional economists but perhaps more importantly corporate managers and the public at large.

In sum, SCM, like all new approaches in technoscience and society, is both promise and fact. It is both the result of careful observation and a distillation of extant phenomena as well as a promise (or perhaps nightmare) of a very differently performed world. This writer sees it as subsuming much of NE models as well as posing some new questions – particularly those associated with the application of Lord Acton's dictum about power to supply chain managers. To be sure, SCM may turn out to be a passing fancy. It may signal the twilight of capitalism. Or, as it matures, it may morph into something quite different. The current pace of change is so rapid that it is impossible to do more than speculate.

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recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation or of my colleagues.

Notes

1 A number of different perspectives have emerged that attempt to grapple with the movement of commodities from point of production to point of consumption. These include 'global commodity chains' (Gereffi and Korzeniewicz 1994), 'global value chains' (e.g. Gibbon and Ponte 2005) and 'filière analysis' (e.g. Fontguyon *et al*. 2002). While these are important contributions to the literature, they are largely used by scholars. The focus here is on SCM since this approach is used by both scholars and practitioners.

2 Callon and his colleagues devote most of their efforts to careful examination of particular markets, for example, for strawberries, sliced ham, automobiles. In so doing, they generalize their results, either explicitly or by implication, to the economy/society as a whole. In this paper, I examine an entire sector of the economy – agrifood – and generalize from that to the economy/society as a whole.

3 It should be noted that NGOs, like firms, can and do engage in rent-seeking behaviour (Tullock 1967). Most large NGOs are well aware of their substantial political and market power. Indeed, Gereffi *et al*. (2001) have referred to the 'NGO-industrial complex'.

4 One might contrast this with the subsumption of Newtonian mechanics into Einsteinian physics.

5 As a reviewer of this paper noted, the literatures on SCM and GVC are quite distinct although both are concerned with how goods get through the chain of firms to the final consumer. SCM is a managerial tool designed to coordinate more effectively the functioning of the chain, while GVC is a social science critique that focuses on power relations and related distributive issues.

6 A partial exception is the work of Williamson (1975, 1994; cf. Soto 2000) and other transaction costs economists. However, they tend to see markets as foundational, with production organizations and institutions as arising only in cases of market failures (Dietrich 1994).

7 Bar coding and loyalty cards at supermarkets involve the collection of vast quantities of data. A small but growing data-mining industry has developed in an attempt to manage this information for corporate clients. However, this has proved to be a daunting task. Many supermarkets collect the data but do little analysis, while others use these data to order electronically from their suppliers. Radio frequency identification (RFID) devices will vastly increase the volume of data available, but only the most sophisticated supply chain managers will be able to use these data effectively (Accenture 2005).

8 A complete typology of NGOs is beyond the scope of this paper. However, it should be remembered that NGOs form a very heterogeneous group, including membership organizations, foundations, labour unions, trade and professional associations and charities. Their goals are equally diverse.

9 For an overview of the potential of such tags from the vantage point of a supermarket chain, see Metro Group (2005). For an NGO view, see CASPIAN (2005).

10 In a certain sense, SCM is economics' answer to the structure/agency debate that has raged in the social sciences (excepting economics) for several decades (e.g. Giddens 1979; Haraway 1997; cf. Hodgson 1998; Latour 1999; Law 1994). Supply chains are at

once agents that rearrange and reorder various aspects of the economy and structures that must be reckoned with by others.

11 This is not to suggest that this kind of activity is new. To the contrary, historical analysis suggests that the regulatory state has been around in one form or another for at least a century (e.g. Stanziani 2005). However, it has been largely ignored in NE models.

12 Some may well see this as a temporary phenomenon to be resolved as more sophisticated mathematical models are developed. In contrast, others may see it as a function of the limits to mathematical reasoning.

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