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Freedom Versus Coercion in Industrial Ecology: A Reply to Boons

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LINK TO ABSTRACT

One of the signal advances made by this many-sided century has been in invention and industry. In no way has this progress been more vividly shown than in its conquest of waste. Nature, despite her marvellous prodigality, when closely studied, is seen to waste nothing, to use and to re-use all things in unending cycles of activity. At the miraculous feeding of the five thousand, when loaves and fishes were multiplied without sting, it was commanded that the people should gather up the fragments that remained, that nothing be lost. This lesson, carried out by Science as an instructive lesson in economy, contains most interesting instances.

—William George Jordan ("Wonders of the World's Waste," *The Ladies' Home Journal*, October 1897, page 8)

"Industrial ecology" (IE) is an emerging interdisciplinary perspective whose proponents have been based by and large in business and engineering schools. Industrial ecologists adopt a systems approach to study material flows between firms and industries and seek ways to reduce their effects on natural systems. Common among the pioneers of IE was a belief that the institutional constraints of market economies were not conducive to the development of "loop closing," that is, the development of by-product recycling linkages between firms operating in

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different lines of work. One of their early goals was to devise various public policy measures to correct this alleged market failure (Ayres and Ayres 2002).

Coming from a different academic background, I had independently developed an interest in the history of loop closing and had reached the opposite conclusion on the subject before coming across the IE literature in the late 1990s. I submitted my alternative take on the issue to the *Journal of Industrial Ecology* and its editors accepted two articles by me. I followed up with additional papers in different outlets exploring other dimensions of the subject (Desrochers 2000; 2002a; 2002b; 2002c; 2004; 2005). In recent years I have explored the history of by-product development in the coal gas, iron making (slag), and synthetic dyes industries (Desrochers 2008b and 2009a), the source material available to document past loop closing (Desrochers 2007; Desrochers and Lam 2007), antecedents to the so-called "Porter Hypothesis" (Desrochers 2008a), the work of Peter Lund Simmonds and Lyon Playfair in promoting by-product development in Victorian England (Desrochers 2009b; 2011) and the history of industrial symbiosis (i.e., geographically localized loop closing) in economic and geographical thought (Desrochers and Leppälä, 2010).

In his "History's Lessons: A Critical Assessment of the Desrochers Papers," Frank Boons[2] (2008) criticizes several of my papers published during the years 2000 to 2005. Boons challenges my two main conclusions, namely: 1) loop closing was widespread before 1900; 2) it was overwhelmingly the result of free-market interactions. Boons also criticizes me for failing to incorporate structural, cultural, and political considerations. My conclusions are "overly simple," my policy prescriptions "naïve," and my case on behalf of the "market as the preferred coordinating structure to stimulate interfirm recycling" untenable (Boons 2008, 148-149). This reply will revisit my two main points and engage Boons's arguments, evidence, and interpretations. I also treat the related work of business historian Christine Meisner Rosen. A draft of the present reply was submitted to the journal in which Boons's critique of me appeared, the *Journal of Industrial Ecology*, but was rejected after being peer reviewed.

On the Use and Abuse of Historical Sources

The most important sources for the claims made in the papers treated by Boons include Peter Lund Simmonds (1862; 1876), who researched by-product development and loop closing for decades and created a major exhibit on the subject (Desrochers 2009b; 2011); Charles Lipsett (1963), the founder and director

2. Boons's webpage is at http://www.eur.nl/fsw/staff/homepages/boons/ (**link**).

of a publishing house devoted to the waste trades; John B. C. Kershaw (1928) and Theodor Koller (1918), respectively a chemical engineer and a chemist with years of practical experience in various industries; and Paul Razous (1937/1921; 1905), a French engineer who worked for several years as a governmental safety inspector. These sources, however, represent only a small fraction of the material used in my early papers. For instance, in Desrochers (2000), I referred to specialized monographs on animal by-products, waste tomato seeds and skins, waste oranges, waste liquid residues for metallurgical operations, residues from paper manufacturing operations, and fish, wood, silk, brewery, cotton, and cement waste, among others. Like Perry (1908)—another source I quoted occasionally—these and other authors argued along the lines that "the commercial spirit of [the] age has developed wonderful genius for utilizing waste products" (71); that "the greatest source of wealth, in these days of great riches, has been acquired largely through the wise use of that which men term *waste*. In all departments of life men have studied how to utilize to the utmost the refuse and remnants that follow in the wake of legitimate enterprise" (12-13); and that "Men are more and more patterning after the Maker and turning everything into a source of wealth. It is a law of nature and the closer that we keep to this law the wiser and wealthier we grow" (28).

Boons's critique, however, is essentially limited to my use of general overviews and omits specialized monographs. His most important point is that their authors do not support my contention that loop closing was widespread before 1900. Instead, they

> describe technological possibilities for material recovery (inventions) and—for some of these—their commercial exploitation by at least one firm at some point in time. The authors do not go into the question of how widespread the application is in a certain country. And in many cases, these authors show that there are more waste streams to be addressed and discuss innovations that await commercial exploitation. In short, although technological possibilities are described, they do not constitute proof of widespread practice. (Boons 2008, 150-151)

Boons is right that several potential opportunities were raised by Simmonds and others, but all of them also specifically observed that countless problematic residuals had been converted into profitable by-products (as illustrated in, among other writings, my subsection "Turn-of-the-Century Assessments of Closed Loops" in Desrochers 2000). Furthermore, the publishing rationale for devoting much attention to the former rather than the latter was rather straightforward. As one anonymous reviewer of Koller's first (German) edition observed:

> The utilisation of waste products has been for years a favorite subject with technologists… The appearance of a work like the present [Koller] is therefore quite in accordance with the spirit of the age, especially as there prevail very crude notions as to what may and what may not be profitably extracted from refuse. The author has attempted to select from a superfluity of materials only such processes as the practical man may apply with advantage—a task which he recognizes as difficult. Such a work, to be really valuable, should contain nothing but what will readily approve itself on a working scale, and nothing which is already thoroughly familiar to manufacturers and technologists. (Anonymous 1880, 33)

The editors of the American trade journal *The Manufacturer and Builder* (1884, 98) made similar points in their discussion of Simmonds's work when they pointed out that finding a profitable use for the waste of industries opens "a rich field… to the enterprising inventors," that the Danish-born journalist's contribution was the "most instructive book for the ambitious technologist and… man of practice to read," and that it contained "a hundred suggestions, with latent possibilities of rich reward, to inspire his zeal." In short, the authors of these broad overviews had no incentives to delve into relatively well-known practices or to document the detail of their economic impact, especially at a time when reliable economic data were scarce or non-existent. Discussing potentially profitable opportunities, however, increased the marketability of their work. Despite the fact that they do not always provide in-depth coverage of the most common and successful by-product recovery practices of their time, these books remain the best general treatments available on the subject and, along with other contemporary documents, provide much more evidence as to the widespread nature of the practice than Boons is willing to admit.

My stance finds support in the recent work of O'Brien (2008, 6) who apparently rediscovered this material without prior knowledge of my work and similarly concludes that "although waste is usually construed as the curse of profit and innovation, the fact is that uncountable wastes have entered, and continue to enter, into industrial production." Indeed, "some of these wastes have been so central to the social and industrial development of modern societies that it is impossible to imagine what the world today might look like without them" (idem). O'Brien (2008, xiii) observes that there is much material on the issue, and that he was left "with such vast heaps of research papers, media stories, social science and engineering books that the small study in my house looks more like a landfill site than a place of scholarly activity."

Since 2000, when I published my first papers on the topic, new technologies have made searching old sources much easier. Indeed, I have located much additional evidence to back up my earlier assessments.[3] That said, "rigorous" quantification of the type favoured by engineers and economic historians remains an impossible goal when dealing with by-product linkages, a point acknowledged in 1902 by no less an authority than the Chief Statistician for Manufactures of the U.S. Census, in the preface to a bulletin on *The Utilization of Wastes and By-Products*: "[I]t is impossible to measure statistically the addition of wealth of the country created by turning to some useful purposes the residues and by-products which were formerly thrown away or left to rot." He added that "the volume thus preserved and turned to some useful account must be enormous" (Kittredge 1902, 1).

Additional quotes from Victorian Britons of which I was unaware when I published my early papers can further illustrate, *contra* Boons (2008, 151), how prevalent was this view. In the table that follows I have limited myself to sources now freely available online, with one exception (Cornish 1892).

Table 1: Some Victorian Assessments on the Scale and Scope of By-Product Development.

> The valuable discoveries in chemistry which have been made of late years, and their extensive application to the useful arts, have originated a variety of trades more or less curious in their character, but exceedingly important in their social effect. The active industry of many thousands of the population is at this moment employed in a manner unheard of fifty years ago; and it is gratifying to think that this employment is afforded, to a large extent, by the converting of commodities long regarded as worthless into articles of great commercial value and importance. *The trades thus originating, though of a unique and singular character, are not popularly known, if known at all, beyond the narrow limits of their immediate connection.* (Anonymous 1851, 310, my emphasis)

> At the present time period, commerce is making such demands for increased supplies of various substances, that scientific men are carefully studying the residue of every manufacture, and the special qualities of each new product. (Anonymous 1863, 254)

3. For links to some of this material see Desrochers and Lam (2007) and the references listed at the end of this paper.

> The progress of our great chemical manufactures during the last ten years… appears chiefly to have been directed towards the utilisation of waste substances. (Crookes 1863, 58)

> One of the blessings of modern science presents itself in the form of economy, frugality, utilisation. Things which were formerly thrown away as waste are now applied to man's purposes, to an extent far beyond our general supposition. (Anonymous 1869, 807)

> With the perpetual growth of civilisation and industry comes and equal increase in the amount of waste products caused by each new manufacture. Every industrial process has naturally among its resultant numerous products besides that one to obtain which it is carried on. To utilise such by-products has been a frequent object of modern invention. Such efforts, when successful, may be considered as accumulating so much pure gain, by turning a useless and, therefore, cumbersome, or even a noxious product, into a valuable and useful material. Manufacturers have learnt that there are very few things that are really waste, while, thanks to the investigations of science, the list of really waste substances is daily diminishing. Perhaps it would not be difficult to frame a list of industries of which the by-products have become of nearly equal importance with the main process, and it is certainly true of very many of our principal manufacturing processes that they could hardly be carried on but for the commercial value of products once stigmatised as waste. (Anonymous 1873, 11).

> The utilisation of waste products is a subject which ought to possess a special interest for a manufacturing nation like ourselves. The phrase itself is indeed something like a standing reproach, as it expresses a fact—patent to all observers—that many possible sources of national wealth are allowed to pollute the air we breathe and the water we drink, or to accumulate in unsightly heaps, because we do not know how to make them available for any useful purpose. Day by day, however, this reproach diminishes, as patient ingenuity discovers the means of rescuing from the category of waste products materials which may be available for various industrial processes, and while much remains to be done, it is encouraging to note how much had already been effected. (Anonymous 1876, 57)

> Numerous substances which were formerly thrown away, destroyed, or neglected, are now utilized… A long list of instances of this class might

> be adduced if it were necessary, some of them of very great importance. (Gore 1882, 151-152)
>
> "Waste nothing," is the key-note of our material industry. Just as the farmer turns even the weeds to account, as a manure for the fields which they encumbered, so in all things we must utilize "refuse," and see that everything is of use, if we take it to the right place and put it to its right use. (Platt 1883, 336)
>
> It is a matter of history in Europe that in some instances what were originally regarded as waste products have become, if not the principal objects of manufacture, at least those upon which the success of the undertaking, from a commercial point of view, depends. (Rennie 1887, 233)
>
> A leading feature of the Victorian epoch has been the utilisation of waste materials and by-products. (Anonymous 1887, 299)
>
> A full account of the various inventions by which the utilization of the bye-products has been brought about would fill a volume, and does in fact actually fill many volumes of technical literature. (Cornish 1892, 209)

As I illustrated in my early and more recent papers, similar comments can be found in all rapidly industrializing market economies at the time, and most knowledgeable writers credited market institutions (the profit motive and property rights) for this outcome. I cannot fully restate my arguments and supporting evidence, but will now clarify and bolster my main points.

Free Enterprise, Governmental Planning and Intervention, and Loop-Closing

Boons's second goal is to challenge my assessment of the effect of market institutions on the development of loop closing. He criticizes me on at least four counts: 1) I allegedly failed to define and explain the workings of a "free market" satisfactorily; 2) much evidence presented by Simmonds (1862; 1876) is from polities that cannot be considered market economies; 3) Talbot (1920) and Rosen (2007) allegedly demonstrate significant market failures and the need and capability

for governmental interventions to generate more loop closing; 4) markets are social constructions in which structure, politics, and culture play a larger roles.

Free markets and loop closing

My view of market economies is the one traditionally espoused by thinkers of the (European) liberal tradition.[4] Markets are defined by voluntary exchanges within the context of a price system (and its attendant profits and losses) and the protection of private property rights. In this context, the action of one person is limited by the property rights of another. As a result of both the price system and private property rights, market institutions have long ensured that wealth creation proceeds in a way that is much more sustainable than is generally understood.

Sustainable wealth creation has been fostered in several ways. First, the profit motive has long enticed creative businesspeople and their employees to wage war on the waste of costly resources, a view endorsed by Karl Marx and others, as discussed in my papers. Indeed, in more recent years I have come across the work of many nineteenth- and twentieth-century analysts who held similar views. For example, the author of the most successful American economic textbook of the first half of the nineteenth century stressed the importance of consuming "every utility possessed by any substance," that "all the fragments and remnants should be, so far as possible, employed to some valuable purpose," and that "all the values must be consumed in the most profitable manner" (Wayland 1837, 421-423). Writing less than three decades later, the American environmentalist George Perkins Marsh (1864, 37) observed in his classic *Man and Nature* that the "utilization—or, as the Germans more happily call it, the Verwerthung, the *beworthing*—of waste from metallurgical, chemical and manufacturing establishments, is among the most important results of the application of science to industrial purposes." These "incidental products" of laboratories and factories, Marsh added, "often become more valuable than those for the preparation of which they were erected." Johannes Rudolf Wagner (1877, 3), the author of the influential German *Handbook of Chemical Technology*, similarly emphasized that the "ideal of a chemical manufactory is that there should be no real waste products at all, but only chief or main, and by-products. The better, therefore, the waste products are applied to good and advantageous use, the more nearly the manufactory will approach the ideal, and the larger will be the profit."

4. This perspective is labeled classical liberalism in the American context. Anderson and Leal (2001) is an influential work on environmental issues written from this perspective, but does not discuss industrial by-product development in much detail.

Second, in a market system private property rights are protected by the rule of law. That protection helped to ensure that substantial and unreasonable interferences with the use and enjoyment of private property resulting from neighboring manufacturing activities could be tackled effectively by individuals whose health and property suffered from such operations. In the Anglo-Saxon world, recourse for abnormally dangerous conditions and activities could be had through common law doctrines of negligence, trespass, nuisance, and strict liability. The system allowed private parties to recover monetary damages for harm caused and even in some cases to gain an injunction that could ultimately result in a polluter's obligation to shut down its operation until emissions had been addressed. Liability considerations in a market economy have long stimulated innovative behaviour and the development of "win-win" innovations (Desrochers 2008a). As such, some loop-closing developments in market economies were partly motivated, *contra* Boons, by "ecological and human health effects" (Boons 2008, 153).

Of course, despite positive long-term trends, significant polluting emissions could be observed at particular locations, for the development of practical and profitable solutions often took much effort, resources and *time*. As one anonymous contributor to *The Warehousemen and Drapers' Trade Journal* observed in 1876:

> Much, however, as society in general may be interested in the economical use of the materials for manufacture… it has a still greater concern in the matter from a sanitary point of view. A few years ago, the oily and soapy liquors of our woollen factories were universally allowed to run to waste. The streams and canals in the neighbourhood of the works became in consequence intolerably filthy and offensive… The fatty acids, which would have combined with earthy salts in the water 'to form insoluble soaps and slimy scum which give off unpleasant odours and injurious gases,' have been precipitated from the factory liquor by a simple chemical process, and are thus not only prevented from becoming a direct and all but unbearable nuisance—which is the most important result for society at large—but are actually changed into a source of profit for the manufacturer. (Anonymous 1876, 57)

This pattern of outcome was also obvious to an 1886 encyclopedia contributor:

> In many branches of manufacture, especially in the earlier days of their existence, certain portions of the materials used have been cast aside as 'waste,' that designation implying that such portions were available for no useful purpose. As time had advanced, first in one branch, and then in another, this 'waste' material has been experimented upon with a view to

> finding some profitable use for it; and in most instances the experiments have had a more or less satisfactory result. (Anonymous 1886, 464)

Although this should go without saying, specific problems at one point in time do not constitute a refutation of the long-run benefits of market-generated loop closing.

Loop closing in non-market economies

Boons suggests that my case is not helped by the presence of some loop-closing activities in non-market economies, such as Russia, Japan and Hawaii at the time of Simmonds's (1862; 1876) writings.[5] Yet, it is their absence that would be truly astonishing, for human ingenuity predates the development of market institutions. Forms of loop closing or waste reuse can be observed in all human societies—indeed, I provided a number of Neolithic illustrations to this effect in Desrochers (2000). My argument has always been that market institutions were better than other real-world alternatives in rewarding risk-taking and in giving economic actors strong incentives to challenge the status quo. They were thus essential for rapid, large-scale, and sustained progress in such matters, but this is not to say that creative people in less favourable social environments did not sometimes find valuable uses for waste materials. In other words, the level of success achieved by the inhabitants of Victorian England cannot be dissociated from the institutional regime under which they lived. Burdened with extensive governmentalization and restrictions of all kinds, the same individuals would not have achieved similar results.

Government intervention, public planning, and loop closing

Mercantile activities have been denigrated by countless intellectuals since at least Plato. The profit motive is denounced as encouraging selfishness and avarice and as rewarding polluting emissions in order to reduce production costs. Some version of this vision obviously underlies both Boons's case against my papers and the two main sources he uses to support his argument, Talbot (1920) and Rosen (2007).

5. Of course, in practice all economic/social systems exhibit varying degrees of freedom and coercion. To my knowledge, the use of currency was widespread in Russia and Japan at the time, while whalers and traders had long integrated Pacific islands into the world economy.

Frederick Ambrose Talbot

Beginning in the late nineteenth century, a perspective emerged suggesting that market economies were inherently wasteful. To give one illustration, Edward Bellamy's (1888, 157) fictional *Looking Backward: 2000-1887* denounced the "four great wastes" of the market system: "first, waste by mistaken undertakings; second, the waste from the competition and mutual hostility of those engaged in industry; third, the waste by periodical gluts and crises, with the consequent interruptions of industry; fourth, the waste from idle capital and labor, at all times." In Bellamy's and later writers' view, the economic revolution associated with industrialization both enabled and required a revolution in social organization. He and they wanted to insulate powerful technocrats from traditional market signals of profits and losses so that they would, through a top-down public planning process, re-orient production for use rather than profits. This vision was taken up by an increasing number of economists, industrial engineers, "scientific management" consultants, and conservationists.

Most authors who shared this "wasteful production" critique of free enterprise, however, had literally nothing to say on by-product development. Two exceptions are Henry J. Spooner's (1918) *Wealth from Waste* and Stuart Chase's (1926) *The Tragedy of Waste*. Writing on the heels of various World War I national planning efforts, both authors had special praise for German planning measures.[6] As I have argued elsewhere, the collapse of centrally planned economies has discredited their case. Building on insights of liberal economists such as Friedrich Hayek, I traced the failure of governmentalization in general, and centrally planned measures to close the loop on industrial residuals in particular, to three main causes: 1) the lack of individual incentives; 2) the misallocation of resources due to the absence or distortion of the price system; and 3) the inability of central planners to tap into the local knowledge and know-how possessed by people (Desrochers 2004; Desrochers and Ikeda 2003).

Frederick A. Talbot's (1920) *Millions from Waste* is best read as a reflection of the intellectual climate rather than as an accurate account of industrial behavior and results of contemporary planning initiatives. A prolific popular writer on topics such as the history of the Canadian railway, steamships, airplanes, and the movie and oil industries, Talbot completed only one book on waste products and aimed it not at industrialists but at the "uninitiated reader," although he also hoped that his contribution "may prove of certain service to those who are fully alive to the potentialities of refuse of every description" (5).

6. I discuss the work of these authors and their comments on German wartime planning in Desrochers and Ikeda (2003), a piece not referenced in Boons's essay.

Talbot made some valid points that I did not hesitate to use despite misgivings about other aspects of his analysis. For example, his observations on the recurring pattern in the "utilitarian conjugation of waste" through which "waste—by-product—staple… constitutes the brief evolution of more than one of the world's leading lines of trading" (13-14); the fact that "to relate all the fortunes which have been amassed from the commercialization of what was once rejected and valueless would require a volume" (17-18); and that typical German industrial behavior toward residuals was to view them as "so much raw material for another line of endeavor" on which one "at once sets to work to attempt to discover some use" (19).

Talbot, however, also engaged in some speculative historical and economic interpretations that were influenced by the wartime planning and "wasteful production" literatures. It is these passages that Boons uses to challenge my claims on the benefits of market institutions. For example, he quotes Talbot as stating that "the British race is generally assailed as being woefully improvident and remiss in the profitable exploitation of waste" (149), a statement that I do not consider credible in light of the numerous quotations already provided here and elsewhere (Desrochers 2009a; 2009b; 2011). Like several British commentators at the time, Talbot deplored both the failure of British dye-stuff manufacturers (whose main input were light oils derived from coal tar, a residual of coal gas production) to protect their original lead against German competitors[7] and British industrialists' apparent incapacity to develop several of their inventions into commercially successful products.

Talbot's critique of British dye-stuff manufacturers prompts Boons (151) to ask "if Britain is the exemplary free market, then why could this be so?" And yet, as Kealey (2008, 224) observes, the British chemical industry grew faster between 1881 and 1911 than any other industry in the country except for public utilities. What actually happened at the time was that the German chemical industry grew faster than any other on earth. Despite greater government involvement and some significant successes, however, German GDP per capita in 1914 and 1939 still represented only approximately 75% of the British one, a share similar to what it was in the early nineteenth century (Kealey 2008, 218-219).

In short, free-market policies do not imply that an economy will outperform its more *dirigiste* competitors in every industry (especially those that benefit from extraordinary government support), but rather that it will typically be more prosperous overall.[8]

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7. I discuss this historical episode in more detail in Desrochers (2008b).

8. For a more detailed discussion and several empirical facts on this issue, see the economic freedom projects headed by the Heritage Foundation (**link**) and the Fraser Institute (**link**).

Boons also mentions approvingly Talbot's stance on the benefits of recovering local waste in order to reduce foreign purchases, along with his fear that resurging post-war international trade "might bring the country back to its old habit" (151). I take Talbot's position on this issue to be a reflection of wartime propaganda which singled out allegedly successful initiatives in this respect in both the UK and Germany. Interestingly, however, he was much more circumspect in the latter case than Spooner (1918) and Chase (1926), inasmuch as he admitted that some German recovery initiatives "were grossly misrepresented and exaggerated" (Talbot 1920, 76).

That was also the main conclusion of a more detailed survey on the *Uses of Waste Materials* published a few years later under the aegis of the International Institute of Agriculture of Rome (Bruttini 1923).[9] The objective of this work was to document the wartime legislative, administrative, and technical measures taken in various countries to encourage "the collection and conversion by manufacturing processes of waste material in view of their utilisation as food or feedingstuffs, in the manufacture of fertilisers… etc." (vii). Not surprisingly, the author devoted most of his efforts on the German case and found that virtually none of these practices proved superior to pre-War alternatives.[10] The following quotation critical of the German war food policy and rationing by a member of the Reichstag and Prussian Diet is illustrative:

> Even in the Central Committee of the Reichstag we have had to listen to an address delivered by an official of the Imperial Ministry for the Interior… which would have realised the wildest dreams of the agrarians. The orator brought home to us the fact that by drying lees, grinding straw, weeds, carcases, fish, by working up food refuse, etc. we should be able, even during the war, and better still afterwards, to fill the gaps in our forage reserves. But the songster then became mute. A member of the Committee having asked Dr. HELFERICH whether this new branch of production was remunerative, the latter… had to reply "that the manufacture of the said substitutes is so costly that the question is bound to arise whether once the war is over, their preparation should be continued; the highly vaunted drying of lees, especially, is so costly, that in certain exceptional cases they might perhaps be used as a feed for sick animals, but never for livestock as a whole… The importance of the

9. The International Institute of Agriculture was dissolved and its functions and assets transferred to the Food and Agriculture Organization of the United Nations in 1946.

10. Durr (2006) reaches a somewhat similar conclusion in his analysis of World War II American recycling campaigns.

> utilisation of table refuse and that of wild plants (e.g., thistles) has been greatly exaggerated…
>
> Many draught animals in towns and in the country have died from inanition, the official ration given them being quite insufficient to sustain them. The situation was somewhat ameliorated when establishments for treating straw were set up, which gave good results everywhere…" (Bruttini 1923, 36-37)

In other words, much evidence suggests that the termination of numerous wartime recovery efforts was a vindication of the greater efficiency and economic value of pre-war trading activities. Furthermore, the fact that Talbot thought he had identified allegedly better ways of conducting business than practices that had actually survived competitive pressures should be met with skepticism, for he obviously lacked the in-depth knowledge of practitioners and was unlikely to know about all the trade-offs involved in his various suggestions.

In the end, while Talbot has interesting things to say, a portion of his analysis reflects the increasingly dominant mistaken perspectives of his time and cannot be used as evidence that governmental planning is a more desirable way to coordinate inter-firm recovery linkages.

Christine Meisner Rosen[11]

In her recent work, business historian Christine Meisner Rosen (2007, 340) writes that the most innovative American meatpackers found "profit in the wastes that their contemporaries were throwing away," but strongly emphasizes that "sanitary regulation, pollution litigation and public protest" played a crucial role in the modernization of the industry. Boons uses this article to champion the idea that, above and beyond the protection offered by private property rights, increasing the number and scope of governmental interventions can induce short-sighted producers to devote more effort to the development of "win-win" innovations.

Yet, while it is true that Rosen argues that political interventions were needed to bring about loop closing, Boons is apparently unaware of her remarkable departure from her earlier writings in which she argued that loop closing was almost nowhere to be observed in the industrial age and that early twentieth-century engineers dealt with industrial pollution "primarily through the development and installation of end-of-pipe pollution-abatement and treatment technologies" (Rosen 2003, 329). For instance, Rosen (1997, 126) wrote that "[m]aterials used in manufacturing flow from the biosphere into the production

11. Rosen's webpage is at http://facultybio.haas.berkeley.edu/faculty-list/rosen-christine (**link**).

process and back into the biosphere in the form of air and water pollution and solid waste. From there they are rarely returned to the production process. Humans have done little to recycle the materials used in the industrial world…" In spite of these revisions, Rosen still argues against the role of markets in encouraging loop closing.

As I have detailed elsewhere (Desrochers 2008a), regulations and litigation have long triggered some by-product development in a broad range of industries. The idea that they were more important than the profit motive, as Rosen and Boons argue, implies that industrialists who daily watched wasted inputs go down drains, out smokestacks, or into waste bins were systematically unalert to the lucrative opportunities they represented, while less knowledgeable and less motivated outsiders knew better. Rosen (2007, 308) suggests that most American meatpackers "were intensely disinterested… in turning their wastes into valuable products and of doing anything beyond what they were already doing to abate their stenches." This is highly unlikely, based on both theory and evidence. While it might be the case that most individuals, whatever their line of work, are resistant to change once they are set in their ways, the fact that such behavior impairs profitability and even survival of any firm in a competitive economy has also long been understood by business people and researchers alike.

Rosen's argumentation is incompatible with much available evidence. First, by-product development was occurring on a large scale in a wide range of industries that were not targeted to the same extent by public health officials and regulators. Second, relatively sophisticated loop-closing operations existed in the American meatpacking industry long before her study period (1865-1880). To give one example, Wayland (1837, 423) describes New England industrial linkages where soap, candle, glue and "neat's [bovine] foot oil" operations were connected to larger slaughterhouses, the refuse of which was used to fatten a substantial number of hogs, insuring in the process that "every part of the slaughtered animal is profitably consumed." Third, similar arrangements could be observed in contemporary locations where manufacturers did not benefit from the presence of American regulators and public health officials. Indeed, according to Simmonds (1876, 40):

> In all civilised and densely-populated countries, of the animals used for the food of man, it may be said that nothing is wasted, every part that is not eaten being turned to some useful purpose; the refuse fat is converted into tallow or soap, the greater portion of the skin is made into leather, and the scraps, with the hoofs, feet, and membranes, converted into glue, the horns made into various useful articles, and the bones produce phosphorus and manure.

Lastly, another problem in Rosen's and Boons's perspective is their view of electoral politics, especially their belief that American municipal governments during the heydays of machine politics were following the dictates of public-minded health officials. Not only is it unlikely that the health officials were in charge, it is also possible that the reluctance of businessmen to submit to the regulations singled out by Rosen was an attempt to avoid coming under the direct control of political figures such as "Boss Tweed." And even if saint-like reformers spearheaded public health initiatives, the powers of health officials might have been appropriated in time by individuals of lesser purity who might have then used various means to extract bribes, such as controlling both the access and the size of operations in state-run abattoirs.[12]

Another problem with Rosen's and Boons's "public interest" perspective is that, as Adam Smith never tired of telling us, well established industrialists are fond of using the political process to serve their own interests. They may have influenced new regulations to make it more difficult for small firms to compete with larger operations. Well established businesspersons have always had two ways to increase or maintain their market shares. The first is to compete by voluntary means. The second is to use the political process to enact restrictions of various sorts in order to suppress or hinder competition. Much evidence suggests less charitable motives behind the advent of early environmental regulations, such as rent-seeking opportunities and the trampling of private property rights by the enactment of statutory laws that in effect legalized pollution (Meiners and Morriss 2000; Brubaker 1995; 2007).

Boons's "complex" analysis and prescription

Boons's own historical perspective on loop-closing development borrows from the business history and economic sociology literatures in an attempt to incorporate structural, political and cultural considerations. Some of his arguments are interesting, while others display his own inadequate historical knowledge and understanding of the case for free enterprise. For example, he argues that the "market mechanism can be seen in some cases to assist in bringing about recycling practices, but in other cases it contributes to their abandonment. Thus simple conclusions cannot be drawn." (156) He does not realize it, but the process he describes reflects one of the most beneficial aspects of markets, the process of "creative destruction" and its constant tendency to redirect resources from good

12. My view of electoral politics has been shaped and is much closer to the work of, among others, Buchanan and Tullock (1999/1962) or Mitchell and Simmons (1994), than to any "public interest" perspective on the issue.

to better uses. Improvements are delivered to the vast majority of consumers, and producers are impelled to use resources more efficiently and creatively.

Contrary to Boons's charge, my argument for leaving decision-making to free enterprise is not simplistic at all. It actually entails a much more complex approach than the most detailed five-year plan. What the Smith-Hayek stance implies is that millions of individuals with very different perspectives and expertise should be allowed to tackle, within the bounds of commutative justice, the problems they face.

By contrast, the incentive structure in which government bureaucrats and elected officials operate is inherently less conducive to innovation and efficient reallocation because they are rarely held accountable for their inertia or bad decisions. As an early British critic of socialism observed, "functionaries are under a chronic temptation to keep on standing upon old paths. They habitually defend the machinery and the methods to which they have got accustomed, and treat with coolness all proposals of reform or improvement" (Robertson 1891, 58). Similarly, politicians are under constant pressures to defend the status quo and bail out poorly run operations. Their decisions to use other people's money to save wealth-destroying jobs in favored industries necessitate that other jobs in other industries will be lost. The more governmentalized production becomes, the less efficient and creative the economy becomes.

Ultimately, it seems clear that the available historical evidence supports my basic dichotomy between free-enterprise and politico-bureaucratic decision-making processes, along with their recurring patterns of outcome.

Conclusion

Like most sustainable development theorists, Boons discounts the notion that free enterprise might be capable of directing individuals towards both economic and environmental progress. He states as much when he argues that the "minimalist approach" to the IE metaphor (which is limited to closing the loop on industrial waste) "cannot serve as a basis to develop policy prescriptions for a field in which the central concern is not the economic viability of closing loop but rather the reduced ecological impacts that results from it." What ultimately matters, he says, "is not so much the quantity of instances in which material recovery is practiced but their quality: the extent to which the loops of a system are closed and harmful effects are prevented. This makes the modern concept of IE fundamentally different." (153)

The primary result of market institutions is improved standards of living. It cannot be denied, of course, that some (sometimes significant) environmental

damage has resulted from specific market activities. It seems obvious, however, that many individuals were and are still willing to make that trade-off, and that, over time, the environmental track record of market economies is superior to that of any real-world alternative in which government intervention brings its heavy hand to issues of IE.

Looking at a more recent time period, and in particular and in the economic and environmental divergence between market and centrally-planned economies in the second half of the twentieth century, Bernstam (1990) argues that changes in the amount of wastefully used resources, rather than increased production and consumption levels, ultimately determine the relationship between economic growth and pollution. In other words, when the growth in output exceeds the growth in resource input required, material wealth will increase while pollution levels decline. On the other hand, a poorer economy that uses a smaller amount of resources less efficiently will experience greater environmental damage.[13] It is my hope that a more open-minded reading of my work will help sustainable development theorists come around to this view.

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