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Analysis

The Great Recession, the Treadmill of Production and Ecological Disorganization: Did the Recession Decrease Toxic Releases Across US States, 2005–2014?

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ABSTRACT

The treadmill of production, ecological Marxist, steady-state economics and the natural science literatures suggest that economic growth and pollution are linked. We use the economic downturn resulting from the Great Recession in 2008–2009 as a natural experiment to test this hypothesis. Specifically, we examine the effect of the Great Recession on pollution measured by the Environmental Protection Agency's Toxics Release Inventory (TRI) using maps and fixed-effects regression models for US states for the period 2005–2014. Multivariate time-series analysis demonstrates that even when adjusting for controls there is a unique and negative effect of the recession on TRI levels. We situate our findings in the relevant literature, suggest possibilities for what the recession effect may be capturing, and discuss some implications of increased pollution levels.

1. Introduction

It has long been posited that economic production and the ecological crisis are connected. An important perspective on that connection was developed in environmental sociology (Schnaiberg, 1980) and ecological Marxism (Foster, 1992; O'Connor, 1988) and suggests that it is constantly expanding production that is increasing environmental harm. Specifically, an increased reliance on natural resources, fossil fuels and chemical labor to intensify production is harming the environment at an accelerating rate that can only be described as a 'treadmill of production' or 'ToP' (Gould et al., 2008).The intensification of production generates ecological disorganization (i.e., a condition that exists when ecosystems cannot reproduce and regenerate and which has been linked to the detrimental effects of ecological additions and withdrawals on the ecosystem by Schnaiberg). This perspective about the connection between the economy and environment is also consistent with traditional or orthodox assessments in the steady state economics literature (Daly, 1974, 1991), the limits to growth literature (Meadows et al., 1972; Meadows, Randers and Meadows, 2004), the scientific literature (Rockström et al., 2009a, b) and the social analysis of ecological footprints (Jorgenson and Burns, 2007).

One area that is understudied in the entwined relationship between economic development and ecological disorganization is impeded economic development. That is, can inhibited economic development slow ecological disorganization? In other words, what is also referred to as "economic degrowth" (Kallis, 2011) may have positive effects with respect to the ecological crisis. Given the extent of the current ecological crisis, those 'positive effects' may not turn back the ecological disorganization clock, but can at least temporarily obstruct the expansion of ecological disorganization, possibly even temporarily limiting the deleterious impacts of the ToP on the extent or expansion of ecological disorganization. Interesting in this regard is the potential effect of the Great Recession of 2008–2009 on the regression of the treadmill of production and on ecological disorganization. The Great Recession, which affected world markets during the early 2000s, was exacerbated by financial crises and the subprime mortgage crises in the US during 2008 and 2009 (Fligstein and Goldstein, 2011). In the US, the Great Recession was marked by a decline in real gross domestic product, rising unemployment, a declining and stagnant stock market, and a fall in household net worth and manufacturing output and productivity (Kotz, 2009). These conditions essentially establish a natural experiment in which the effects of slowing the ToP on ecological disorganization can be observed. To do so, we examine the trend in toxic releases by US manufacturers across US states before (2005–2007), during (2008–2009) and after (2010–2014) the Great Recession as measured by the US Environmental Protection Agency's Toxics Release Inventory (TRI).

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2. Background

The deleterious effects of economic production on environmental stability and the disorganization of ecosystems have long been recognized. In our view, there are two primary explanations of this association since the 1970s. The first includes what can be classified as more traditional or orthodox economic analyses of that connection illustrated in the steady state economics literature by Daly (1973), the *Club of Rome* 'Limits to Growth' report (Meadows et al., 1972) and its 30 year up-date (Meadows et al., 2004), and Nicholas Georgescu-Roegen's (1971) *The Entropy Law and Economic Process*, which led to the development of ecological economics. The second approach characterized as a heterodox or non-traditional economic approach to this subject includes theory and research in environmental sociology and ecological Marxism associated with the work of James O'Connor, John Bellamy Foster, Allan Schnaiberg, and many empirical studies of related arguments by Andrew K. Jorgenson.

The first notable empirical effort to address the relationship between economic growth and ecological (in)stability was Meadows et al.'s well known study, *The Limits to Growth*. Using computer simulations, the authors examined three projections of ecological collapse using industrialization, pollution, ecological resource depletion, food production and world population data, while accounting for the ability of changes in technology to offset some of the resource availability problems that would emerge. Two of the three models predict a global ecological collapse after the middle of the 21st century, with the third model reaching an equilibrium state. The Report was widely criticized when first released (Bardi, 2011), and was long attacked by radical free-market proponent Simon (2014). However, recent re-analyses (Meadows et al., 2004; Bardi, 2011) and reviews (Nørgaard et al., 2010) have been much more favorable.

For his part, Georgescu-Roegen made two related arguments. He was perhaps the first to propose an elaborate explanation which argued that there were natural limits to economic growth imposed by the ecosystem. He also examined how this occurred in relation to entropy, noting that the process of production uses up stored energy (what he called 'low entropy' natural resources) and returns degraded ('high entropy') matter as waste back into the ecosystem. These ideas were extended by his student, Herman Daly, who as an economist for the World Bank popularized the idea of steady state economics. Daly also proposed that economic production has physical limits tied to the ecosystem both as a source of raw materials and as a sink for pollution. In this view, as economic production expands and consumes nature, it accelerates ecological destruction, and Daly argued for the need for state intervention to constrain the deleterious effects of economic expansion on ecosystems, proposing the need for a zero-growth or steady state economy (see also, Costanza et al., 2014).

The ideas found above are also central to other indicators of the tension or contradiction between continuous economic development and ecological disruption and disorganization. One of those measures is the ecological footprint (Rees, 1992; Wackernagel and Rees, 1997, 1998), which includes an index relating various aspects of consumption of ecological resources (including the pollution of ecosystems) to ecological resource availability. Related to that concept is the development of planetary boundary analysis associated with the work of environmental scientist Johan Rockstrom, chemist, Will Steffen, atmospheric physicist and former head of NASA's Goddard Institute for Space Studies, James Hanson, and, among others, the Noble Prize winning atmospheric chemist, Paul Crutzen (Rockström et al., 2009a, b). Unlike other studies which are more critical of the ecological crisis-economic development connection, Rockstrom et al. (2009b, 475) state, 'The evidence so far suggests that, as long as the thresholds are not crossed, humanity has the freedom to pursue long-term social and economic development.'

In contrast to the view of Rockstrom et al. sits the more critical approach of the ecological crisis-economic development nexus taken up by environmental sociologists and ecological Marxists. The first major and extensively developed position on this issue was proposed by Schnaiberg (1980) in his book, *Environment: From Surplus to Scarcity*, which introduced treadmill of production theory. Drawing on Marxist arguments, Schnaiberg proposed that capitalism entered a new phase following World War II, in which production was accelerated by an increased reliance on fossil fuel and chemical energy. In doing so the treadmill of production increased ecological withdrawals (the extraction of raw materials) and ecological additions (the generation of pollution), creating increasing levels of ecological disorganization. Essentially, this argument posits that as the treadmill of production expands globally, and global capitalism expands, ecological disorganization will also expand. This outcome is not always immediately apparent because in the global treadmill of production, ecological additions and withdrawals and hence ecological disorganization, shifts across nations and there is often insufficient global pollution and resource depletion data to be able to precisely illustrate this process empirically (but see various important empirical studies related to this argument by: Jorgenson, 2010, 2006; Jorgenson et al., 2009; Jorgenson and Burns, 2007; Jorgenson et al., 2010; Jorgenson and Rice, 2015).

Related arguments concerning the adverse connection between economic development and ecological disorganization have also been addressed by ecological Marxists elaborating upon observations made, though not extensively developed, by Karl Marx (Foster, 1992, 2000). Important in the development of this argument was O'Connor's (1988) analysis of the contradictions of capitalism, which includes the proposition of a contradiction between capitalism and nature, or the idea that capitalism, as it expands, must destroy nature, an issue that Foster (1992) elaborates.[1] For his part, O'Connor is also critical of the more traditional, orthodox or general arguments linking economic development to ecological crisis (e.g., limits to growth, steady state economics) because in those analyses:

> 'Class exploitation, capitalist crisis, uneven and combined capitalist development, national independence struggles, and so on are missing …The results of these and most other modern efforts to discuss the problem of capitalism, nature, and socialism wither on the vine because they fail to focus on the nature of specifically capitalist scarcity, that is, the process whereby capital is its own barrier or limit because of its self-destructive forms of proletarianization of human nature and appropriation of labor and capitalization of external nature' (O'Connor, 1988, 13).

In other words, those traditional views do not make it clear that the ecological crisis is an outcome of an inherent crisis within capitalism involving the contradiction between economic expansion and ecological stability (Foster, 1992). This view is called the 'second contradiction of capitalism,' which Foster (1992, 78) refers to 'the absolute general law of environmental degradation under capitalism.' As Foster noted (1992, 78–79):

> 'this contradiction can be expressed as a tendency toward the amassing of wealth at one pole and the accumulation of conditions of resource depletion, pollution, species and habitat destruction, urban congestion, overpopulation and a deteriorating sociological life-environment' (in short, degraded 'conditions of production').

In Foster's view, it is 'impossible to overthrow' or overcome the

[1] The AQI reflects the US EPA AQI, which normally is scored on a scale of 5–500. Some nations, however, use different AQI indexes, generating higher scores on the AQI scale. These score can change throughout the day since portions of those scores are based on changes in hourly readings, while other portions of the scale represent 24-hour averages for some pollutants. As an example of how those scores change throughout the day, we also examined AQI scores on waqi.info at 3 PM Eastern Standard Time on November 9th. At that time, Kashi, China had an AQI of 534; Jiuquan, Baiyin, Lanzhou (four sites), and Zhangye, China reached 999; Dingxi, China reached 580; Pingliang, China had scores ranging from 580 to 884; Hurriyet, Turkey reached 565; Batman, Turkey, 890.