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The long-run impact of nuclear waste shipments on the property market: Evidence from a quasi-experiment ☆

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ABSTRACT

We use evidence from a quasi-experiment – the shipping of radioactive spent nuclear fuel by train through South Carolina – to assess whether many years of incident-free transport of nuclear waste no longer negatively affects market valuation of properties along the route. Using Charleston County (SC) property sales data over 13 years we find, to the contrary, that the negative impact of the nuclear waste shipments on property values continues to be felt over the long run. The perception of risk from nuclear waste transport appears to be resilient. We contribute methodologically by comparing well-defined treatment and control groups of properties to estimate the average treatment effect of the nuclear waste shipment program. The results are affirmed in both a pooled cross-section sample, as well as a panel data sample of repeated property sales.

1. Introduction

Handling highly radioactive waste has proved to be one of the most difficult parts of hazardous materials management. As the United States debates large-scale transport of spent nuclear fuel (SNF) from the 73 storage sites scattered across 33 states to more centralized interim storage sites and permanent deep-geologic repositories versus maintaining the status quo of continued on-site storage at or near reactors,[1] concerns have focused on safety and efficiency of the transport [5], National Research Council, [45]). The Obama administration's decision to withdraw the license application to construct the 77,000-ton capacity Yucca Mountain repository site, reversing the policy of former President Bush, remains controversial. The stalemate leaves in limbo the long-run solution to the current US inventory of 70,000 ton of SNF in existing sites, plus the annual output of more than 2000 ton of SNF annually produced by the country's reactors. Subsequent to its withdrawal of the license application for Yucca Mountain, the Obama administration appointed a blue-ribbon commission to advise the government on a new strategy for managing nuclear waste. In January of 2012 the commission concluded that the US

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[1] Most commercial used nuclear fuel is stored at or near operating reactors. However nine of the 73 storage sites are at shutdown reactors, often referred to as "orphan" storage sites.

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will require interim storage sites and one or more permanent, centralized geologic repositories, and recommended early preparation for transport of used nuclear fuel and high-level radioactive wastes [5].

Of interest in this paper are the economic effects that transporting spent fuel may activate, possibly resulting from beliefs about the risks posed by such transport. Experience with hazards, ranging from chemical wastes at Superfund sites to deposition of lead from smelting plants has demonstrated that property values can be sensitive to proximity to such hazards.[2] But does proximity to the route by which radioactive materials are shipped in highly resilient transport casks also affect property values? If so, by what amount do values diminish, and over what geographic scope? Finally, and most importantly, are these effects permanent or transitory?

This paper supplies answers to these questions using new methods. It is motivated by Gawande and Jenkins-Smith's [17], henceforth GJS, study of shipments of spent fuel through South Carolina in the early years after the shipments began in 1994. At that time, the shipments were beset by enormous controversy and the wide press coverage that followed was rarely positive. Into the first two years of the shipments, GJS found that in populous Charleston County, a home five miles from the shipment route was worth 3% more than a similar home located on the route. This result has been used on both sides of a fierce policy debate over Yucca Mountain.[3]

The shipments continue to this day. There has not been a single negative incident over the fifteen years, and newspaper reports of the shipments are almost negligible. This suggests that individuals' perceptions about the risk of SNF shipments may have been updated over time due to the lack of media coverage and absence of incidents. A large literature on environmental clean-ups argues that clean-ups restore property values in the long run.[4] This literature, while related, is distinct from risk revision. Cleanups entail the removal of a risk, whereas the risk may continue to be inherent in the current context, though individuals may have updated their beliefs about the risk. The time is not only apt for re-investigating the finding using long-term data, but it has critical implications for both research and policy.[5]

This paper uses the same South Carolina SNF shipment setting as Gawande and Jenkins-Smith, and improves on it in three respects. First, we appropriately view the SNF shipment as a natural experiment and use average treatment effect estimators. We use a difference-in-differences strategy to identify and estimate the average treatment effect in the treated population of properties in Charleston, South Carolina. Gawande and Jenkins-Smith [17] suffers methodologically from the same issues that Greenstone and Gallagher [21] critique in earlier studies of the impact of NPL clean-ups, namely that the methods do not control for untreated properties. We remedy this deficiency. Second, the data include property transactions over a much longer duration. We obtained records of all residential property sales in Charleston County between 1992 and 2005 (the GJS paper stopped at 1996). The transactions data permit us to estimate the effects of the spent fuel shipment program on property values over a decade of shipments without incident. Third, we are able to weigh in with panel data, while much of the literature has used pooled cross-sections. Existing studies of the effects of the environment on land and property values has largely used cross-sectional data combined with a heavy reliance on hedonic variables to control for heterogeneity. Even with the controls, doubts may remain about unobserved heterogeneity in the cross-section. Therefore, in addition to the pooled cross-section, we use repeat sales information to create panel data on a number of properties.

The paper proceeds as follows. In Section 2 we describe the foreign spent nuclear fuel shipments that began in 1996. Section 3 describes the difference-in-differences methodology using both pooled cross-section data and panel data. Section 4 explains in detail the construction of our data set. The data are unique in many respects, and add new dimensions to the environmental impact evaluation enterprise. Section 5 presents and analyzes the findings. The main finding is that the prices of properties in the most urban and populous County (Charleston) continue to be influenced negatively by SNF shipments despite the absence of any incidents that might heighten risk perceptions about the shipments. Section 6 provides our discussion and conclusions.

[2] The idea that property values will be affected by the presence of hazardous materials – including incinerators, electricity transmission lines, landfills, and nuclear power plants – has been studied, for example, by Kiel and McClain [33], Kiel [32], McClelland et al. [38], Kohlhase [34], Michaels and Smith [41], and Gamble et al. [16]. These studies use the hedonic pricing logic, viewing proximity to the environment as a characteristic of the property. The earliest efforts involved inference about the marginal value of clean air from housing prices [23,39].

[3] Board of County Commissioners Lincoln County NV [4], Clark County Department of Comprehensive Planning, Nuclear Waste Division [11], Hom et al. [25], Nuclear and Radiation Studies Board [45], O'Connor [46], State of Nevada [52,51], and US Nuclear Regulatory Commission [58].

[4] In a properly functioning market if a disamenity is transitory, it should not have permanent effects on housing prices. Stock [53], Kohlhase [34], and Ketkar [31] find this to be true about properties near cleaned-up hazardous waste sites as do Carroll et al. [7] and Dale et al. [13] in the context of chemical clean-ups. Studies by Nelson [43], Gamble and Downing [15] and Gamble et al. [16] examining incidents near nuclear power plants, specifically the Three Mile Island (TMI) accident, found no decrease in housing prices due to proximity to the TMI plant. However, since nuclear power plants produce jobs and tax revenues, they may offset the possible disamenity effects. Studies of waste sites such as the Frenald plant in Ohio (Feiertag, [60]) and Rocky Flats in Colorado (Hunsperger, [27]) indicate the effects on property values to be similar to those of Superfund sites.

[5] In a white paper, Department of Energy analysts Holm et al. [25, p. 12] write: "The numerous and complex socioeconomic analyses that attempt to quantify stigma damages for various transportation scenarios are based on a single, limited, preliminary study whose authors themselves argue that the issue requires further study. Apart from the GJS study, there appears to be no defensible empirical evidence whatsoever that stigma from transportation even exists. Their finding that there may be a statistically significant effect may be supported by further research, or it may not. What is certain is that repeated and sustained citations to this single isolated study in secondary sources and reports do not validate the findings themselves."

"Much of the research conducted to date has used polling methodologies, as opposed to empirical or real-time data. The GJS study, by contrast, used real estate sales data along with the results of systematic surveys to reach its conclusions. DOE's Appendix I of the FEIS on Yucca Mountain suggests that additional research is needed. If such analysis is undertaken …(t)he research should use actual real estate transaction data for a significant period of time…."