On the External Effects of Nuclear Power

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On the External Effects of Nuclear Power: Further Evidence

by

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Abstract

Papers by Nelson (19xx), Gamble and Downing (19xx) and xxxx (xx) found no detrimental externalities of nuclear power plant in estimates of the distance coefficient (distance to the nuclear facility) within a model of housing real estate prices. Other papers by xxxx (xxx) and Folland and Hough (1991) found significant negative coeffients of a nuclear power dummy when predicting real asset prices in cross-sections of market areas. The present research combines 11 cross-sections into a panel spanning 1945 to 1992, permitting something closer to a crucial test. We estimate coefficients for time variables when modeling agricultural land prices and assess whether the installation of a nuclear plant causes a negative drift relative to the general upward trend; we find little or no effect of installation. We then simulate a pre-installation ghost nuclear plant th test the alternate hypothesis that nuclear companies were merely selecting cheaper land to begin with. We find a negative effect of this ghost installation, supporting the alternative hypothesis. Finally, we measure the effects of “old” vs. “middle” vs. “new” reactors and corroborate the negative effective reported previously for the old reactors, but we find “perverse” positive effects for the post 1980 vintage. Tentatively, we conclude that these data cannot reject the null hypothesis.

On the External Effects of Nuclear Power

The harm from a nearby nuclear facility, which commonly have no history of serious accidents, is the increase in perceived risk, real or imagined. It is an understandable perception to the farmer, because a nuclear leakage could cause him damage in two ways. As a profit-maximizer, he is worried because the added risk lowers the present value of the expected future profits from the land (Folland and Hough, 1991). As spouse and parent, he is worried about the health risks, an issue similar to the affect of amenities on housing values (xxxx). In either case, the decline in land prices begins upon the news of the installation of the nuclear facility. In one case, the expected future value of the land depreciates, much like ordinary depreciation. In the second case, exit is immediately anticipated, and supply exceeds demand at preexisting prices.

It is without question that some people perceive a substantially increased risk. Whether they are being reasonable in these perceptions or whether these perceptions of risk warrant compensation or other action is a legal issue beyond the scope of this paper. Our focus is on whether farmers and other landowners are expressing their perceptions of risk in objectively observable ways, which go beyond responses to questions (often hypothetical) on surveys. In contrast to subjective expressions, selling at a reduced price, leaving the area, etc. have real effects including declines in average relative land prices.

Previous empirical research is mixed on this issue. Two designs are prevalent. Nelson (xxxx), Gamble and Downing (xxxx), and xxx (xxxx) assembled data from a few market areas that contained a nuclear facility. The researchers built a model of housing prices for each area, including a plant distance variable in the manner of hedonic pricing models of real estate that include amenities. The coefficients for distance (the distance gradients) were usually insignificant, if of the “correct” sign. The occasional finding of positive effects led to one type of alternative hypothesis: the plants may improve housing values by promising a broader tax base.

In contrast, our research on a cross-section of market areas across the United States in 1980, found a significant negative coefficient for the nuclear dummy and related nuclear variables suggesting a possible detrimental nuclear externality. xxx (xxx) corroborated these results, and the results are confirmed for each of the 11 cross-sections constituting the panel in the present study.

The Data and the Basic Model

To approach a resolution, we have assemble a panel of 494 market areas based on Rand McNally's original areas. These break up the contiguous 48 states into small collections of counties, creating areas roughly 30 miles in radius (if they were precisely round) and xxxx acreas on average. The 11 cross-sections in the panel are surveys of the years 1945, 1950, 1955, 1959 ,1964, 1969, 1974, 1978, 1982, 1987, and 1992. Agricultural data are derived in each case from the Census of Agriculture, data on nuclear power plant location and installation date are from xxxxx, the remainder are geographic data. Panel data analyses were conducted with Limdep 7.0.

The basic model assumes a constant *supply of land*, (agricultural land within a given time period), the other variables of interest enter on the demand side. We further assume market clearing prices, so that the resulting hedonic *price* equation requires that *supply of land* enters with a negative sign. Over time the local supply of agricultural land tends to decline, due primarily to the encroachment by urban areas, which tend to drive up land prices on the urban fringe. To distinguish market areas by the anticipated

$$(Eq.1) \quad Price = a_o + a_1 land + a_2 fert + a_3 dist + a_4 port + a_5 nuclear + a_6 timenuclear + a_7 time$$

urban encroachment we include *population density* as a demand variable. We also assume that transportation costs to bring produce to market are positive; under conventional assumptions, which require that land farther from the market center will sell at a lower price other things being equal, *distance* will enter with a negative sign, while *port* earns a positive sign. The quality of the agricultural land is measured by *soil fertility* which is the cash value of agricultural product per acre. *Time* is the year count starting with 1945 = 1. The presence of a nuclear facility in the area is measured alternatively by a dummy variable *nuclear*, which equals one if a plant is present, or *nuclear count*, which equals five at maximum, or an interaction term, *timenuclear,* which starts counting the year the plant is installled. We present three versions of the price equation: linear, loglog, and the BoxCox transformation on these two forms. The basic model presented