



# Fear of nuclear power? Evidence from Fukushima nuclear accident and land markets in China



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## ABSTRACT

This paper examines whether the 2011 Fukushima Nuclear Accident (FNA) changed the Chinese public's attitude toward nuclear energy by studying transactions in land markets near nuclear power plants in China. Using a data set that matched the details of all nuclear reactors in China with information on land transactions around them before and after the FNA, we find that the accident had dynamic effects on land markets in China. Land prices within 40 km of nuclear power plants dropped by about 18% one month after the nuclear accident. However, the impact of FNA decreased over the longer term, eventually becoming statistically insignificant. Also, the impacts of the disaster varied with plant characteristics such as operating status, construction year, and size.

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## 1. Introduction

This paper provides empirical evidence of the effect of the 2011 Fukushima Nuclear Accident (FNA) on Chinese land markets located close to nuclear power plants. The FNA was triggered by an earthquake off the coast of Japan that registered 9.0 on the Moment magnitude scale. The earthquake and the ensuing tsunami resulted in massive economic losses and environmental damage.<sup>1</sup> Over 100,000 residents who lived within 20 km of the nuclear power plant were forced to evacuate one day after the accident. The Japanese Science Ministry reported that long-lived radioactive cesium had

contaminated over 30,000 km<sup>2</sup> of Japanese land (World Nuclear Association, 2014). Additionally, a large amount of contaminated water accumulated on the site, and managing the contaminated water is a difficult and risky endeavour.

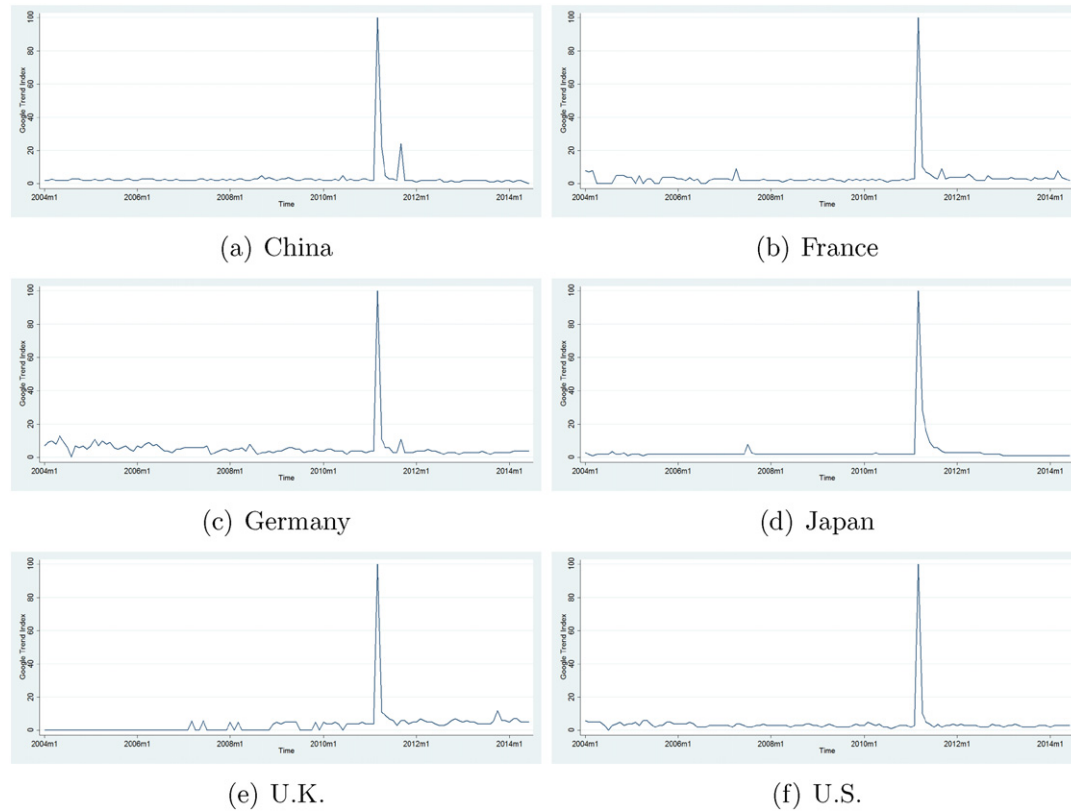
Along with its direct physical impact on the surrounding area, the FNA also had profound impacts on the nuclear industry worldwide. Many countries, including Germany, Italy, Switzerland, Belgium, and France, almost immediately re-evaluated their nuclear power programs, with China announcing that it would temporarily stop approving new nuclear plants.<sup>2</sup> Fifteen years after the April 1986

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<sup>1</sup> The total economic losses were estimated to be around 700 billion US dollars.

<sup>2</sup> Furthermore, the German Parliament passed the "Thirteenth Amendment to the Atomic Energy Act" on 30th June 2011 to phase the operation of seven oldest nuclear power plants in August 2011, and the phasing-out of the remaining nine nuclear power plants will be concluded by 2022.



**Fig. 1.** Google trends in different countries. Note: Data are downloaded from <http://www.google.com/trends/>, after searching the keyword “nuclear power plant” translated in respective languages. The statistics represent the trends of searching frequencies over time. Note that the indices are normalized to 100 at their highest points of different countries.

Chernobyl accident in Ukraine, FNA reignited global concern over the safety of nuclear power plants and led to a significant decline in the development of the nuclear energy industry worldwide.<sup>3</sup>

Social media played an important role in transmitting information about the direct consequences of the disaster. To provide a flavour of the public’s reaction to this large-scale nuclear accident, Fig. 1 presents the frequency of Google searches involving the keywords “Nuclear Power Plant” across six countries.<sup>4</sup> In each country, search frequencies soared to their peak levels in the days immediately after the FNA, but then declined sharply over the following one to two months. The trend of Google searches appears very similar across the six countries. Although the search frequency trend suggests intensive but short-lived public interest, the real effects of the FNA on the public acceptance of nuclear power are still unclear. On one hand, if people overreacted only temporarily as predicted by prospect theory, then the FNA will not have a persistent effect on risk perception. On the other hand, it is possible that risk assessment is permanently heightened as a result of the increased awareness of nuclear safety concerns in the post-FNA era.

The property market provides a unique lens to examine public perceptions of environmental hazards. Using data from various sources, a growing body of literature has sought to track the impact of environmental disamenities on property values using revealed

preference models.<sup>5</sup> An implicit assumption of early studies is that the risk associated with environmental disamenities is constant over time. However, this assumption is not sensible in our case, because the FNA led to the public updating their assessment of the risks of nuclear energy, which consequently affected their marginal willingness to pay for property located near nuclear plants. China was selected for our study on the price effects of changes in perceptions of nuclear safety-related risk because it has a fast-growing number of nuclear power plants. However, it was not itself directly impacted by the FNA, as it experienced neither earthquake-related destruction, nor radiation contamination.

Using a comprehensive micro-level dataset of urban land transactions that took place between July 2010 and December 2011, our empirical results suggest that, first, land prices in a 40 km radius around nuclear plants in China dropped by about 18% one month after FNA, which can be translated into about 2.2 billion RMB (347 million US dollars) loss in land transaction revenue for the local governments. However, we did not find significant negative effects further than that distance. This geographic cutoff is similar to the extended distance of contamination in Japan. Second, the effects are transitory, as the impact of FNA on land prices near nuclear plants decreased in the months following the disaster and became statistically insignificant. Third, the effects are heterogeneous across nearby plants. That is, the estimated short-run effects are stronger

<sup>3</sup> The FNA has triggered some large-scale anti-nuclear protests worldwide, such as in Japan and some European countries, as well as a recent protest in Taiwan in April 2014.

<sup>4</sup> Google Trends is a statistical compilation of the search frequencies of keywords used in Google’s search engine over time. The data can be downloaded from <http://www.google.com/trends/>.

<sup>5</sup> For example, there are papers on Superfund cleanups of hazardous waste sites and housing market (Gayer et al., 2000, Greenstone and Gallagher, 2008), nuclear waste transportation rail and housing market (Gawande et al., 2013), air pollution and housing prices (Chay and Greenstone, 2005), toxic plants and housing prices (Currie et al., 2013), and water quality and land prices (Leggett and Bockstael, 2000).

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