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South African attitudes about nuclear power: The case of the nuclear energy expansion process

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Excessive use of fossil fuels is widely acknowledged as one of the main causes of climate change. The energy sector is one of the sectors that make use of fossil fuels. Greenhouse gasses are released during the combustion of fossil fuels, such as coal, oil, and natural gas, to produce electricity. Generating electricity from nuclear reduces pollution externalities hence it is argued by some to be part of a sustainable solution to achieving low-carbon energy options. This option According to Ertor-Akyazi et al. (2012) since energy security is a critical element in an economy, nuclear energy can play a role in ensuring smooth supply of electricity; it is reliable, and can provide electricity on a larger scale, similar to fossil fuels.

Nuclear power itself is an expensive investment (Liao et al., 2010). Households will be expected to contribute towards the capital required to invest in increasing and diversifying the power supply. Given this background, the objectives of our study are to investigate households' attitudes and willingness to pay (WTP) for the proposed nuclear power plant. In this study, the contingency valuation method (CVM) is used to estimate WTP for nuclear power. Given the desire of the South African and other African governments to build power plants, and growing resistance against such plans, it is important to win public acceptance of the expansion and introduction of nuclear power, and of the cost burden.

Electricity is a marketable public good. In other words, it does not fit neatly into either extreme category of a public and a private good. It is subject to political considerations. The electrification programme in South Africa since new democratic era is a good example of government intervention aimed by providing cheap and affordable electricity to all. It is important for households to participate in the decision-making regarding the type of energy source the government will invest in, since households will be paying for it.

The recent nuclear accident in Japan has resulted in some countries (such as Germany) abandoning their nuclear plans altogether. Some new nuclear projects have been cancelled altogether, with plans to shut down present plants in the near future (International Energy Agency, 2015).

The South African government, like those of China, India and France, is in favour of further investment in nuclear power stations. It has announced that it plans to build two more nuclear power stations, in an effort to reduce reliance on coal and reduce carbon emissions. Nuclear power has a large load factor,

compared to other power-generating sources. Even though building a nuclear power station is costly, the cost of the electricity generated from nuclear is low. But although nuclear is considered clean, there are concerns about its safety.

The study was undertaken in the Eastern Cape province, in and around the Thyspunt area proposed for a nuclear power station. A review of the literature suggests that WTP for protection against nuclear-related risks such as a nuclear accident decreases *ceteris paribus* with distance from the nuclear plant. To test the spatial dimension of responses to the external effects of nuclear power, a survey was also carried out in and around Johannesburg, in Gauteng province, which is 1 150km away from the proposed site. The aim here is to test if there are differences in WTP due to distance. Johannesburg is the country's economic hub. The total sample was 695 respondents, of which 365 were in Johannesburg.

Our descriptive statistics from the raw data shows that a similar share of the people in Gauteng and the Eastern Cape support the proposed nuclear power plan. The two main reasons for supporting nuclear power are that it is deemed reliable, and that it can result in lower electricity prices eventually. In both provinces, the main reason cited for not supporting nuclear power was the risk inherent in the transportation and disposal of nuclear waste. The second reason for not supporting nuclear in Gauteng is the fact that constructing a nuclear power plant is costly. In the Eastern Cape, the second most important reason for condemning nuclear was that construction in Thyspunt would change the wave structure in Jeffrey's Bay, which would have a detrimental impact on tourism.

A spike model is employed to analyse the determinants of not being WTP for nuclear power. The first decision is modelled with a binary probit model, where the dependent variable is equal to one if WTP is positive. The second decision, WTP given positive WTP, is modelled with a truncated regression model¹. The proximity to the nuclear plant dummy is negative and significant in the probit model, which implies that those who are closer to the plant are more unlikely to state a zero WTP. The other variables that are negatively signed and significant are male dummy, availability of backup power, and children under 18 years.

The coefficient of distance to the nuclear plant in the truncated model is an insignificant determinant to $WTP > 0$, which is in contradiction to the sample WTP descriptive. Males are more pessimistic about nuclear plants, which is reflected in their lower WTP compared to their female counterparts. The finding that having a higher electricity bill is likely to predict higher WTP may be due to the higher dependence on electricity of those households.

Gauteng households are prepared to pay R124.28 (\$10.37) in support of the proposed nuclear plant, while households in and around the proposed site in the Eastern Cape are WTP significantly less (R70.47/\$5.87). This is in line with the argument in the literature that WTP for coverage against the risks of a nuclear accident decreases with distance from the plant. We therefore conclude that for

¹ Note that with censored variables, all of the observations are in the dataset, but we do not know the 'true' values of some of them. With truncation, some of the observations are not included in the analysis, because of the value of the variable (Carlsson, 2008).

geographical reasons, households further away from the nuclear power plant are more supportive, as they are not directly exposed to the risk associated with nuclear plants.

A picture that emerges from the whole sample is that most respondents are in favour of the construction of the country's second nuclear power plant. The modelling results suggest that putting more distance between residences and the nuclear plant would have little effect on WTP. This implies that distance effect does not matter as far as WTP for nuclear plant is concerned.