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Efficiency or technology adoption: A case study in waste-treatment technology

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ABSTRACT

Improvements in the effectiveness and efficiency of supply-side waste management are necessary in many countries. In Japan, municipalities with limited budgets have delayed the introduction of new waste-management technologies. Thus, the central government has used subsidies to encourage municipalities to adopt certain new technologies to improve waste-management efficiency. In this study, we measure the efficiency of waste management and explore how technology is related to technical efficiency. We find that municipalities are likely to adopt less-efficient technologies and that the central government's policies are likely to promote inefficient technology adoption by local governments.

1. Introduction

Demand for public services that improve waste management has increased in tandem with income growth (Mazzanti and Montini, 2009; Ichinose and Yamamoto, 2011; Shinkuma and Managi, 2011).

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Although demand-side strategies to reduce waste generation and recycle waste are important policy topics, improving the effectiveness and efficiency of public services regarding waste management (i.e., the supply side of waste management) is also an important policy goal in many countries because government resources are often limited.

Many governments, from local authorities to federal governments, have examined the efficiency of their waste-management services. For example, the United States Governmental Accounting Standards Board has generated a methodology that municipalities use to calculate and disclose waste-management efficiency indicators. In Spain, a document designed to help calculate management indicators was issued to evaluate the effectiveness and efficiency of public services regarding waste management (Benito et al., 2010).

Many studies on demand-side waste-management policy have focused on the effectiveness of unit pricing of waste emissions and recycling (Fullerton and Kinnaman, 1996; Kinnaman, 2003, 2006). However, only a limited number of studies have focused on supply-side management policy (Ley et al., 2002; Callan and Thomas, 2001). Ley et al. (2002) assess the potential economic effect of a policy designed to restrict the flow of municipal solid waste across U.S. state borders. Alternatively, Callan and Thomas (2001) focus on the cost inefficiency of waste management and explore how the privatization of waste management, economies of scope (a combination of waste disposal and recycling) and economies of scale are related to cost efficiency.

There has been no evaluation of the efficiency of waste-treatment technology in supply-side studies. There are several technologies for incinerating waste, such as the gasification and melting system and the ash-melting system. The central government in Japan encouraged the use of melting systems – a decision that was based on promoting industrial policy rather than environmental policy. The purpose of our study is to measure the efficiency of Japanese waste management and to explore how technology is related to technical efficiency; in particular, we examine whether the technology promoted by the central government has resulted in the improvements in efficiency that were expected.

In Japan, the central government subsidizes municipalities to encourage the adoption of certain new technologies – including gasification and melting systems or ash-melting systems – to improve technical efficiency. Implementing these technologies was expected to reduce waste-management costs. However, in reality, these technologies are likely to be less technically efficient than the central government expected, and their implementation may have resulted in only small increases in efficiency. The government expected the cost savings to come from "learning by doing" (technology diffusion). However, these effects might be too small to offset the high cost of the new technologies. Neither ex-post nor cost-benefit analyses have been performed on the results of these processes; thus, the government does not know the outcome of its policies. In this study, we find that municipalities are likely to adopt less technically efficient technologies; therefore, the central government's technology policy is found to have failed to improve technical efficiency.

Section 2 provides the background of the subject of this study. Section 3 presents the study's methods and data, Section 4 discusses its results, and Section 5 provides concluding thoughts.

2. Background

Initial cost to install new technologies was high, but the government believed that the maintenance costs would be low in the long run, making these technologies cost-effective. The results of a newspaper survey, however, showed only 30% of municipalities considered reworking costs in response to changing circumstances are reasonable (Kobe Newspaper, 2007). This study aims to test the hypothesis that the Japanese policy of providing governmental subsidies to encourage municipalities to adopt new waste-management technologies is associated with lower total factor productivity (TFP).[2] Japan has more incinerators than any other country in the world (e.g., Ministry of Environment and Japan, 2002; Yamamoto, 2004). Decades ago, waste began to be incinerated because this approach was

[2] According to recent studies, the dioxin emissions from waste treatment do not affect human health (Watanabe and Hayashi, 2003). Therefore, this study does not consider this environmental externality.