Do Investments in Clean Technologies Reduce Production Costs? Insights from the Literature

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Adopting green or clean technologies is one of the primary responses to combat global climate change. Many fiscal and regulatory policies have been introduced globally to facilitate the increased deployment of clean technologies. National governments, international financial institutions, bi-lateral donors, non-governmental organizations, and the private sector have channeled hundreds of billions of dollars toward green or clean or low carbon economic development. The International Energy Agency (IEA) estimates that about US$600 billion was invested in clean energy technologies in 2019 (IEA, 2021a). It is estimated that US$130 billion annual investment would be needed globally on clean technologies to meet GHG mitigation targets set by various countries under the Paris Climate Accord (McCollum et al. 2018). Has the increased adoption of clean and low-carbon technologies helped increase productivity and thereby decreased production costs? Or will it do so? This study aims to answer these questions by exploring evidence of increased productivity and lowered production costs due to the increased adoption of clean technologies. To accomplish this research objective, we review relevant existing studies that investigate the relationship between the adoption of clean technologies and the reduction in production costs.

We find two types of studies in the literature—ex-post empirical studies and ex-ante modeling or analytical (numerical) studies. Some ex-post studies use global data pooling from all sectors (e.g., manufacturing, buildings, transportation, agriculture), whereas others use national-level data. Some studies use global data for a given sector (e.g., manufacturing). The ex-ante studies are focused more on the sectoral levels and examine the impacts of green/clean investments on the cost of energy services instead of sectoral productivity. They use economic/financial analysis at the technology level (e.g., electricity vehicle, refrigerator) or modeling at the network or sectoral level (e.g., solar and technologies for power generation).

Most of the ex-post or econometric studies we reviewed, particularly the more recent ones, show a positive relationship between investments in clean technologies and firms' productivity. They conclude that the increased adoption of clean technologies has caused a reduction in production costs. However, the relationships between the adoption of clean technologies and production costs can be influenced by factors such as the size of firms and types of investments. The findings of ex-ante studies are somewhat mixed. In the buildings sector, existing ex-ante studies mostly report that adopting clean (both energy efficient and clean energy supply technologies, such as solar home systems) saves energy and energy services. On the other hand, studies for the transportation sector show that vehicles utilizing cleaner fuels (electricity, hydrogen) are not yet economically attractive. Studies on the power sector suggest that the expansion of greener/cleaner renewable energy technologies, which is happening rapidly more recently, also has mixed effects on electricity supply costs. Despite rapid drops in their costs, renewable energy technologies, particularly solar and wind, do not necessarily reduce the average costs of electricity supply because of their intermittency and low level of penetration.

Since the existing studies using the observed data (i.e. empirical studies), in general, agree that adopting clean technologies reduces production costs and harmful environmental externalities, the adoption of clean and green technologies should be enhanced further. Policies to support the adoption of clean technologies should be continued or increased. Our study also reveals that reducing production costs is not the only incentive for the private sector to invest in green/clean technologies. Adopting

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green/clean technologies increases private companies' social images and market values. Since the investments in green/clean technologies increase productivity and enhance market values by improving social image, the private sector should increase the investments in green or clean technologies.