

The Impact of Special Economic Zones on Electricity Intensity of Firms

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Special Economic Zones (SEZs) have become a prevalent policy instrument for promoting export oriented economic growth. Between 1986 to 2014, the number of SEZs went from 176 to over 4000. By offering preferential policies such as lower export/import barriers or reduced tax rates, SEZs are intended to provide an environment that attracts FDI, encourages skill upgrading, and the adoption of new technologies, all of which can help developing economies to diversify their production base into manufacturing. With the explosion of SEZs in the developing world (60% are in Asia-Pacific countries with another 20% in the Middle East and Africa), the World Bank (2008) reports that over 40% of global exports are done by SEZs in the developing world. Alongside this increase in manufacturing comes the potential for significant environmental damage.

Previous studies have established a strong link between activities of manufacturing firms and greenhouse gas (GHG) emissions resulting from intensive energy use by firms. Most SEZs are in developing countries where environmental regulations are relatively weak, which raises the concern that SEZs may have significant environmental consequences. However, the environmental aspects of SEZs have not received significant attention. Emissions data is typically unavailable, as with the bulk of the literature, we therefore focus on energy intensity which is correlated with GHG emissions. Thus our aim here is to compare the energy intensity, and specifically the electricity intensity (electricity expenditures relative to sales) of SEZ and non-SEZ firms.

A priori, one can envisage a number of potentially conflicting differences between SEZ firms and non-SEZ firms that can affect their electricity intensity. First, if SEZ firms have more modern technologies, these may reduce the overall energy needs of production. Alternatively, if these more modern and more automated plants use electricity rather than coal or oil, this would increase electricity intensity. Further, SEZ firms may produce a different mix of products. Note that these possibilities may well be linked to a firm's funding opportunities since they represent a costly change in technology. Second, if an SEZ leads a firm to alter its product mix so that it manufactures more energy intensive goods within its industry, then SEZ firms may be more electricity intensive compared to their non-SEZ counterparts. Third, if SEZs are dominated by foreign multinationals seeking lower environmental regulation due to their energy use, firms in SEZs may be more energy intensive. Finally, it may be that electricity provision in SEZs is more reliable than outside of such zones, leading to higher reliance on this energy type (and perhaps energy overall). Therefore the net effect of SEZs on electricity intensity is an open question.

Against this backdrop, we estimate the electricity intensity of 11,186 firms across African and Asian countries controlling for firm, country, and time characteristics. We restrict our data to the manufacturing sector only, which is generally seen as being more energy intensive than services. After cleaning, matching, and harmonising the surveys, we were left with 32 surveys covering African and South Asian countries and a total of 11,186 firms. In our main specification, we find that SEZ firms are on average 4.2% more electricity intensive than their non-SEZ counterparts. In order to provide insight into what may be driving this higher energy intensity, we undertake several additional robustness checks. First, we omit the foreign-owned firms, something which does not affect the SEZ result. This suggests that

the difference is not driven by multinationals seeking low environmental regulation hosts. Second, we exploit cross-country and cross-firm variation in measures related to regulation and barriers to doing business. The rationale behind this is that access to finance has a significant impact on the pollution intensity of exports, potentially via firms' ability to upgrade their technology.

Greater regulatory burdens and greater financial barriers increase the electricity intensity of SEZ relative to non-SEZ firms. This latter result is telling as, in our data, non-SEZ firms more often indicate that financial barriers are a detriment to doing business than do SEZ firms. Thus, SEZ firms, particularly when funding is difficult to obtain, may be more apt to upgrade their technology. This suggests that the effect of SEZs may be coming from such firms having more modern, yet more electricity intensive, production methods. It should be noted, however, that even if electricity intensity is higher for SEZ firms, this does not necessarily translate into higher emissions and lower environmental quality. More advanced technologies, although requiring more energy, may also result in less emissions from that energy use. In addition, if the effect comes from a shift from coal or oil burning towards electricity, this too can lower the environmental impact of higher energy use. Finally, if SEZs have superior infrastructure that allows firms to rely on centrally-provided electricity as opposed to their own generators, this can also offset the environmental damages or greater electricity intensity.

With growing concern over climate change, an increased focus has been put on production, particularly in developing countries where environmental regulations are relatively lax. Special economic zones form a key part of the evolving manufacturing process in these nations and their use is rapidly rising. In this study, using firm-level data across Africa and Asia, we provide evidence that SEZs are linked to greater electricity intensity. This, combined with the greater size of SEZ firms, gives some credence to concerns that SEZs may have significant environmental impacts. However, we also find that this difference depends on the ability of firms to access finances (among other regulatory barriers). As such, this difference may be due to SEZ firms using more modern, yet electricity intensive technologies. To the extent that such production methods reduce emissions in other ways, this does not necessarily mean that SEZs increase pollution. Indeed, we do not find evidence that SEZ firms use more fuel than others. Nevertheless, it does point towards the need to be cognizant of potential environmental impacts from the formation of SEZs.