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# **Pollution Reduction by Rationalization in Indian Firms**

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*We investigate the relationship between energy intensity and firms' internationalization strategies by using data for Indian firms over the period 1987 to 2016 to estimate a panel data model that considers firm heterogeneity. Energy intensity is explained by the extensive and intensive margins of exports, estimated total factor productivity, foreign ownership, size and innovation activities. The main results indicate that exporters are more energy efficient than non-exporters, and that there is heterogeneity between industries. In particular, more energy-intensive industries present a higher reduction in energy intensity for exporters in comparison to non-exporters.*

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The importance of analyzing the effects of trade liberalization on environmental quality has been widely recognized since the seminal paper by Grossman and Krueger (1991). The early empirical results showed that trade was good for the environment. However, later research has shown that the results are, at best, mixed and dependent on many factors.

In the early 2000s the new-new trade literature started to consider the importance of accounting for heterogeneity in productivity at the level of the firm (Melitz, 2003). Some authors set up theoretical models that derived testable predictions concerning the effects of increased trade on the environment when the firm was taken as the main level of analysis (Najjar and

Cherniwchan, 2021; Forslid et al., 2018). The new theories put forward by Najjar and Cherniwchan (2021) and Forslid et al. (2018) concerning firm heterogeneity derives a number of testable hypotheses. One of them is the Pollution Reduction by Rationalization Hypothesis (PRR) stating that trade liberalization shifts the market share towards the higher-productivity firms, which are more successful at driving down emissions than the low-productivity firms. As a result, these dirty firms will, eventually, have to exit the market. The high-productivity firms then go on to become exporters and are cleaner than the other firms. The existing empirical literature that should help to prove these predictions is mostly limited to studies covering firms in developed countries such as the U.S. (Holladay, 2016), Japan (Jinji and Sakamoto (2015) and Sweden (Forslid et al., 2015). Evidence for – fast growing – newly industrialized countries is still scarce.

India is nowadays one of the fastest growing economies in the world, whose annual average growth rate stood at around 6 percent between 1991 and 2017 (World Bank, 2019). This development has been accompanied by a profound trade liberalization proceed since the early 1990s. The growth path could come at the expense of higher levels of energy consumption and emissions; however, the increasing trade flows could also lead to improvements in energy efficiency and lower emissions. It remains an empirical question what the net effect of the Indian trade liberalization process has been on environmental quality. We tests the PRR – that investigate the effect of trade liberalization on the environment

when firm heterogeneity is considered – using a rich panel data set of Indian firms over the period 1987-2016. In this way, the main novelty is to enrich the findings of Barrows and Ollivier (2018) for India, providing estimations for a more recent period and a richer panel of Indian firms. While Barrows and Ollivier (2018) mostly focus on the contribution of product mix on determining firm and aggregate emissions' intensity, our main focus is on the effect of exporting.

The main results indicate that exporters are more energy efficient than non-exporters. In particular, the results are driven by firms that belong to industries that use, in relative terms, more energy per unit of production than others. The fact that exporters have higher productivity indicates that trade liberalization can induce an improvement in environmental performance in production. Furthermore, the results suggest that these effects are not uniform across industries and, hence, firm heterogeneity plays a role when examining the influence of internationalization on environmental performance. The results obtained from different industries indicate that in high polluting industries, exporters seem to be much more energy efficient than non exporters in comparison to low polluting industries, where there is no difference between exporters and non-exporters in terms of energy intensity.

# Policy Implications

Generalizing the aggregate effect of trade on the environment is not sufficient to give policy recommendations. Our firm-level analysis indicates that targeting policies that promote export support for firms in industries with high-energy intensity will benefit the environment more than supporting industries with initially lower energy intensity. Energy generation will always come at a certain cost for the environment. When trying to bring economic prosperity in agreement with environmental protection and climate change mitigation, overall reduction in energy intensity is a must. Since differences in terms of environmental performance exist between different sources of energy, targeted policies to encourage firms to use cleaner energy will result in a strong improvement of the environmental performance of firms. This, however, is only feasible if cleaner sources of energy are available. In conclusion, a combination of cleaner energy sources, industry-specific policies and the inclusion of export-inherent costs for the environment in the analysis are important steps towards achieving the compatibility of economic and environmental goals.

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