

## Characterizing Relative Performance: The Energy Efficiency Advantage of Foreign-invested Enterprises in China

Topic: Productivity and efficiency analysis I

Author: Xuemei Jiang

China has become the world's largest energy consumer and the largest carbon emitter. The improvement of energy efficiency is one of the most effective ways to reduce the total energy consumption and subsequently the total carbon emission. According to the economic census data, the Foreign-Invested Enterprises (FIEs) had energy efficiency advantage over Domestic-Owned Enterprises (DOEs).

However, being based on data for aggregate manufacturing they fail to control for the industrial distribution of FIEs: the possibility being that FIEs are disproportionately represented in the high-tech and low energy-intensive industrial sectors, without being necessarily more energy efficient than DOEs within each sector.

The immediate purpose of this paper is to measure whether the total energy intensity of FIEs has advantage over DOEs, and if they do, to quantify the extent to which the aggregate energy intensity advantage is due to a 'better' industrial distribution (the structural effect) and how much it reflects a widespread tendency for FIEs to be more energy efficient than their DOE counterparts within each industry (the ownership effect). In order to do this, we develop a new energy occupancy input-output table characterizing FIEs and DOEs, to compare both their direct and indirect differences of energy intensities across manufacturing industrial sectors in mainland China for year 2007. With the new input-output table, not only the products flows and energy consumption in SCE are depicted at a detailed industrial level, but also the differential of production technology as well as the energy intensity in FIEs and DOEs is exhibited.

Our principal empirical findings include:

- (1) The direct energy intensity underestimates the energy consumption of the industrial sectors. For the high-tech industries, such as transportation equipment manufacturing and electrical machinery manufacturing (which thought to be relatively low energy-intensive), the total energy intensities are about 5-10 times of their direct energy intensities, if we include the indirect energy consumption of downstream industries.
- (2) The total energy intensity of FIEs is 4.36 ton of SCE in per 10,000 value added of exports, lower than 50% of the total energy intensity of DOEs' exports (8.81 ton SCE per 10,000 RMB). No more than quarter the FIEs advantage is due to structural factors. If DOEs has identical uniform structure of exports with FIEs across industries, the aggregate differential would fall by 10%.
- (3) If DOEs were to exactly mirror the existing energy efficiency pattern of FIEs, the aggregate differential would remain as high as 30%. Further investigation shows that the energy intensity per unit of value added of FIEs is generally lower 10%-40% than their counterparts of DOEs within identical sector. Moreover, this result holds for specific kinds of energy, e.g. coal, oil, natural gas, electricity and heat.
- (4) If DOEs were to exactly mirror the existing production technology of FIEs (i.e. identical input structure), the aggregate differential would fall by 50%. This implies that FIEs use relatively low energy-intensive sectors are their intermediate inputs compared with DOEs, even if they produce identical products.