

# Nonparametric production analysis with unobserved heterogeneity in productivity\*

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PRELIMINARY VERSION

## Abstract

We propose a novel nonparametric method for the structural production analysis in the presence of unobserved heterogeneity in productivity. We assume cost minimization as the firms' behavioral objective, and we model productivity on which firms condition the input demand of the observed inputs. Our model can equivalently be represented in terms of endogenously chosen latent input costs that guarantee data consistency with our behavioral assumption, and we argue that this avoids a simultaneity bias in a natural way. Our Monte Carlo simulation and empirical application to Belgian manufacturing data show that our method allows for drawing strong and robust conclusions, despite its nonparametric orientation. For example, our results pinpoint a clear link between international exposure and productivity and show that primary inputs are substituted for materials rather than for productivity enhancement.

**Keywords:** productivity, unobserved heterogeneity, simultaneity bias, nonparametric production analysis, cost minimization, manufacturing

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