

# How does Graduate Education Affect Inventive Performance? Evidence from Undergraduates' Choices during Recessions

Koichiro Onishi

*(Osaka Institute of Technology)*

Sadao Nagaoka

*(Tokyo Keizai University/RIETI)*

January 2018

**Abstract:** This paper investigates the effects of graduate education on inventive performance, as well as the underlying mechanisms, using inventor life-cycle data to focus on the factors affecting the capability of an inventor to absorb and combine diverse external knowledge. In order to control for endogeneity in the choice of graduate education, we use as an instrument the unemployment rate of college graduates in the year preceding the graduation of the focal inventor, as well as in the academic field in which the inventor is specialized. Our first-stage estimation results show that a college student who graduates under adverse labor market conditions chooses much more frequently to pursue a graduate degree. This instrument is also likely to satisfy the exclusion restriction, since our dependent variables are long-run inventor activities. We find that graduate education induced by this instrument significantly enhances inventive performance, measured by the level and scope of forward citations and the number of patent applications. It also significantly enhances the scope of knowledge exploited for inventive processes, both in the use of scientific knowledge as well as in the scope of knowledge cited in the prior patent literature.

*Keywords:* Invention, graduate education, knowledge exploitation, patent, recession

JEL Classifications: O31, O34, I21