

IZA DP No. 3478

**The Treatment Effect, the Cross Difference,
and the Interaction Term in Nonlinear
“Difference-in-Differences” Models**

Patrick A. Puhani

April 2008

The Treatment Effect, the Cross Difference, and the Interaction Term in Nonlinear “Difference-in-Differences” Models

Patrick A. Puhani

*Leibniz University of Hannover, SIAW, University of St. Gallen,
ERMES, Université Paris II and IZA*

Discussion Paper No. 3478
April 2008

IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0
Fax: +49-228-3894-180
E-mail: iza@iza.org

Any opinions expressed here are those of the author(s) and not those of IZA. Research published in this series may include views on policy, but the institute itself takes no institutional policy positions.

The Institute for the Study of Labor (IZA) in Bonn is a local and virtual international research center and a place of communication between science, politics and business. IZA is an independent nonprofit organization supported by Deutsche Post World Net. The center is associated with the University of Bonn and offers a stimulating research environment through its international network, workshops and conferences, data service, project support, research visits and doctoral program. IZA engages in (i) original and internationally competitive research in all fields of labor economics, (ii) development of policy concepts, and (iii) dissemination of research results and concepts to the interested public.

IZA Discussion Papers often represent preliminary work and are circulated to encourage discussion. Citation of such a paper should account for its provisional character. A revised version may be available directly from the author.

ABSTRACT

The Treatment Effect, the Cross Difference, and the Interaction Term in Nonlinear “Difference-in-Differences” Models^{*}

I demonstrate that Ai and Norton’s (2003) point about cross differences is not relevant for the estimation of the treatment effect in nonlinear “difference-in-differences” models such as probit, logit or tobit, because the cross difference is not equal to the treatment effect, which is the parameter of interest. In a nonlinear “difference-in-differences” model, the treatment effect is the cross difference of the conditional expectation of the *observed* outcome minus the cross difference of the conditional expectation of the *potential* outcome without treatment. Unlike in the linear model, the latter cross difference is not zero in the nonlinear model. It follows that the sign of the treatment effect in a nonlinear “difference-in-differences” model with a strictly monotonic transformation function is equal to the sign of the coefficient of the interaction term of the time and treatment group indicators. The treatment effect is simply the incremental effect of the coefficient of the interaction term.

JEL Classification: C21, C25, H0, I0, J0

Keywords: identification, nonlinear models, limited dependent variable, probit, logit, tobit, difference-in-differences, interaction effect

Corresponding author:

Patrick A. Puhani
Leibniz University of Hannover
Institut für Arbeitsökonomik
Königsworther Platz 1
D-30167 Hannover
Germany
E-mail: puhani@aoek.uni-hannover.de

^{*} This project was supported by the German Research Foundation (*Deutsche Forschungsgemeinschaft*) under the project Labor Market Effects of Social Policy (*Arbeitsmarkteffekte sozialpolitischer Maßnahmen*).

