

Alternative Gravity Estimators

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Introduction

- So far, we have worked with log-linearized version of the gravity model.
- What happens if bilateral trade between the partners i and j is in fact zero?
- Taking logarithms effectively drops such observations from the sample, because $\log(0)$ is undefined.
- What are the consequences of dropping zero observations? What can we do to avoid dropping them? What can we learn from them?

How Common are Zeros?

- There is a good amount of recent evidence to the effect that zeros are in fact surprisingly common in the bilateral international trade matrix.
- Helpman and Hummels (2004) find that nearly $\frac{1}{3}$ of the bilateral trade matrix is empty.
- Helpman et al. (2008) find that about half of the country pairs in their 158 country sample do not trade with each other at all.
- As we drill down to ever finer levels of product disaggregation, we can expect the problem to become more and more serious.

Potential Consequences of Zeros

- Dropping zeros means we are getting rid of potentially useful information. We might be able to learn something about why some countries trade in some products, but others do not.
- By only using a portion of the available data, we might be producing biased estimates of the coefficients we are primarily interested in.
- Returning to the non-linear gravity model—which is what attention to zeros can imply—might indicate some ways in which we can make empirical models fit the data better.

Overview

- The recent literature has paid a good deal of attention to the “zero problem”.
- Three main approaches:
 - Ad hoc solutions;
 - The Poisson model;
 - Heckman’s sample selection model.
- Estimating the AvW gravity model using nonlinear methods is also a possibility. But it is cumbersome, relatively labor intensive (you need to program it), and thus rarely used in practice.

An AD Hoc Solution

- $\log(0)$ is undefined, but $\log(0+0.0001)$ is not.
- For all but very small numbers, $\log(x + 0.0001)$
 $\log(x)$.
- Adding a small, positive number to all trade flows can be a sensible place to start, to see if including or excluding zeros appears to make much of a difference empirically.
- It is commonly used in the policy literature, but has no theoretical basis, and is approximate at best.



The Poisson Model

and Tenreyro (2007) propose an econometric model to solve the zero problem.

The Poisson model commonly used for count data can be extended more generally to non-integer variables, equivalent to (weighted) non-linear least squares. It is consistent under weak assumptions, and does not need to be distributed as Poisson.

It is in fact a very general one: the econometric log-linearized models can be misleading due to a spurious, and noxious, type of heteroskedasticity. But it is only on the gravity implications only.