Advanced issues of Gravity Model

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Outline

- Issue of zero trade flows
- Solution to the zero trade flows
- Endogeneity Issues
- Solution to the endogeneity problem
- Summary

Issue of zero trade flows

- There are evidences that show that, a large portion of international trade matrix consists zero trade.

- Haveman and Hummels (2004) find that about one-third of the bilateral trade matrix is missing.

- Helpman et al. (2008) find that about half of the country pairs in their sample do not trade with each other at all.

- Despite the existence of a large number of zero trade in the trade datasets, the gravity equation was almost invariably estimated using trade data sets converted into logs.

Issue of zero trade flows

- What happens if bilateral trade between countries is zero and we estimate them using conventional Log linear model?

- Taking logarithms of such observations effectively drops them from the sample as log(0) is undefined.

- Dropping these observations causes reduction of observations. Which also causes loss of information.

- Moreover, using truncated samples in logarithms may yield misleading results.

Issue of zero trade flows

- The problem of zero trade was rarely emphasized because (Martin and Pham, 2015):
  - trade theories were silent on their causes
  - lack of recognition of their frequency
  - due to the convenience of the log-linear estimation
- Recently there has been growing recognition among trade economists that zero trade flows do not occur randomly
- There are some recent developments to tackle the issue of zero trade.

Solution to the Zero trade problem

- The solution to the zero trade problem could be sought in three ways:

i) **Simplest way:**

- One can add 1 to all the observations of the total trade flow. Ln (0) is undefined but, ln (1) is zero. Hence, we may be able to recur some of the potential information.

- However, a Tobit estimation is suggested as the OLS would provide biased results (distribution is censored at zero)

- This approach does not have any theoretical basis. This is mostly used in the policy literature.

Solution to the Zero trade problem

ii)   Pseudo Poisson Maximum Likelihood estimator:

- An alternative and theoretically more sound approach could be the use of Pseudo Poisson Maximum Likelihood (PPML) estimator.

- Santos Silva and Tenreyro (2006) suggest that, PPML can be a solution to the zero trade problem.

   They also highlight that, in the presence of heteroskedasticity, the PPML is a robust approach.

- This method can be applied on the levels of trade, thus estimating directly the non-linear form of the gravity model and avoiding dropping zero trade.

- The dependent variable is trade, not log (trade) whereas, the explanatory variables are still may be in log forms.

Solution to the Zero trade problem

- **Pseudo Poisson Maximum Likelihood estimator (Cont..):**
- This approach has been used in a number of estimation of gravity equations.

- **Estimating in Stata:**
- Estimating PPML is stata is fairly easy.
  Stata command: poisson *dep_var exp_var*, robust