Meta-Regression Methods for Publication Selection Bias: Simulations and Heckman Regression

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Publication selection (PS) exists when editors, referees, or researchers have a preference for statistically significant results, successful clinical trials or for confirmation of their favored theory. Medical researchers have long been concerned about the potentially pernicious effects of PS (*e.g.*, deaths associated with taking Paxil and Vioxx). Register or perish! As a consequence, the best medical journals now have explicit PS policies (Krakovsky, 2004). In economics, the biases produced by publication selection often exceed the magnitude of the underlying empirical phenomenon being estimated.

In a forthcoming paper in the *Oxford Bulletin of Economics and Statistics*, I offer meta-regression methods that address the three fundamental issues of publication selection:

- How can publication selection be detected? [FAT—Funnel Asymmetry Test]
- How can an empirical effect be identified, regardless of publication selection? [PET—Precision Effect Test]
- How can the magnitude of the effect be estimated in a manner that is robust to publication selection? [PEESE—Precision Effect Estimate with Standard Error]

The first two questions can be answered by a simple meta-regression model:

$$t_j = \beta_0 + \beta (1/Se_j) + \Sigma \alpha_k Z_{jk}/Se_j + v_i \qquad (1)$$

Where t_j is the t-value associated with the j^{th} reported estimate in a given literature, and Se_j is the standard error of this estimate. FAT tests $H_0: \beta_0 = 0$, and PET tests $H_0: \beta = 0$. Simulations validate both FAT and PET, but they do have their limitations (Stanley, 2007). FAT has low power, and PET can have inflated Type I errors when misspecification error (or heterogeneity) is much larger than sampling error.

The third question above is best answered by the Heckman meta-regression model.

$$t_j = \beta_0 Se_j + \beta (1/Se_j) + \Sigma \alpha_k Z_{jk}/Se_j + v_i \qquad (2)$$

Where $\hat{\beta}$ serves as an estimate of effect corrected for publication selection (**PEESE**), and Z_{jk} are moderator variables that are used to explain variation in the underlying empirical effect (Stanley and Doucouliagos, 2007). The following table summarizes these publication bias methods and their limitations.

Meta-Regression Tests and Estimates for Publication Bias and Empirical Significance

Test/Estimate	MRA Model	H_1 and Its Implications	Limitations
Funnel Asymmetry ***(FAT)***	$t_i = \beta_0 + \beta\,(1/Se_i) + \varepsilon_i$	$\beta_0 \neq 0$ *publication bias*	*Low Power*
Precision-Effect ***(PET)***	$t_i = \beta_0 + \beta\,(1/Se_i) + \varepsilon_i$	$\beta \neq 0$ *genuine empirical effect*	*OK if we accept* H_0: $\sigma_e^2 = 2$ @.001
Precision-Effect Estimate with Standard Error ***(PEESE)***	$t_i = \beta_0\, Se_i + \alpha\,(1/Se_i) + v_i$	$\hat{\alpha}$ *estimates the magnitude of the empirical effect corrected for publication selection*	*Like PET above, one should exercise caution if* σ_e^2 *is too large.*

References

Krakovsky, M. (2004) Register or perish, *Scientific American*, 291(Dec.), 18-20.

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