

Be Rigorous

Because the dependent variable in a meta-regression analysis (MRA) is an estimated regression coefficient (or some transformation of one), MRAs will routinely contain heteroskedasticity. Therefore, economic MRAs almost always employ weighted least squares (WLS) using the inverse square of the estimate's variance ($1/SE^2$) as the weight. Alternatively and insightfully, one can divide the entire MRA by SE— see ([Stanley, 2008](#); [Stanley and Doucouliagos, 2010](#)).

When multiple estimates are reported by studies, we have an unbalanced panel structure ([Rosenberger and Loomis, 2000](#)), and some accommodation for potential dependence among estimates within a study must be made. Perhaps, the simplest adjustment is to calculate cluster-robust standard errors for the MRA, where clusters are defined by the study number. Alternatively, more complex fixed and random-effect panel models or multilevel mixed-effects models may also be used, where the two levels are estimates and studies. See [Nelson \(2010\)](#), [Feld and Heckemeyer \(2009\)](#), [Doucouliagos and Stanley \(2009\)](#) for illustrations. [Feld and Heckemeyer \(2009\)](#) contains an insightful diagram organizing the appropriate tests that can be used to decide which model best reflects a particular meta-data structure.

Some STATA commands to illustrate appropriate MRA methods

Suppose that our comparable empirical effect is an elasticity, called *elast*, and *elast* = the MRA dependent Var; *SE* = standard error of *elast*; $t = elast/SE$
Precision = $1/SE$; $SE_Sq = SE^2$; $Precision_Sq = 1/SE_Sq = 1/SE^2$; Moderator Var's = {*OmitVI*, *Linear*, *Panel*}; and *studyid* indicates the study used.

1. Simple MRA of Publication Selection, FAT-PET-MRA {WLS version}

`regress elast SE [aweight = Precision_Sq]` or equivalently,
`regress t Precision`

2. Simple MRA of Publication Selection, FAT-PET-MRA {cluster robust version}

`regress elast SE [aweight = Precision_Sq], robust cluster(studyid)`

3. Simple correction for Publication Selection, PEESE {WLS version}

`regress elast SE_Sq [aweight = Precision_Sq]`

4. Multiple FAT-PET-MRA {WLS version and cluster robust}

`regress elast SE OmitVI Linear Panel [aweight = Precision_Sq], robust cluster(studyid)`

5. Unblanced, fixed-effects panel MRA model

`xtreg elast SE OmitVI Linear Panel, fe i(studyid)`

6. Multilevel mixed-effect model

`xtmixed elast SE OmitVI Linear Panel, || studyid:, covariance(independent)`