

WAIVE: Weighted Adjustment Instrumental Variable Estimator

T. Havranek^{1,2,3} P. Bom⁴ P. Cala¹ Z. Irsova^{1,3}
H. Rachinger⁵

¹Charles University, Prague

²Centre for Economic Policy Research, London

³Meta-Research Innovation Center, Stanford

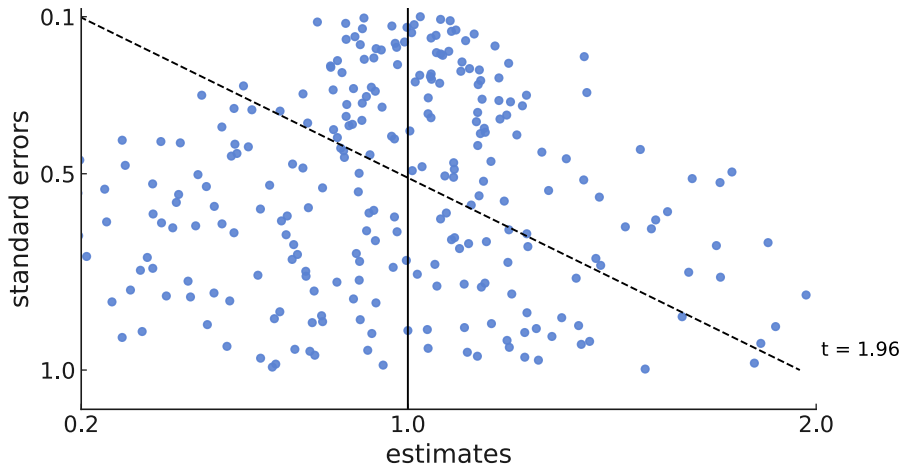
⁴University of Deusto, Bilbao

⁵University of the Balearic Islands, Palma

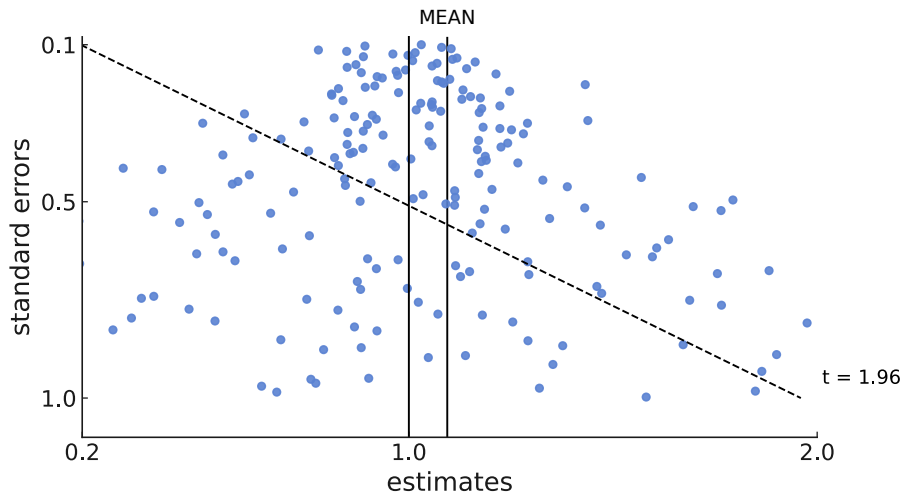
October 18, 2025

MAER-Net Annual Colloquium, University of Ottawa

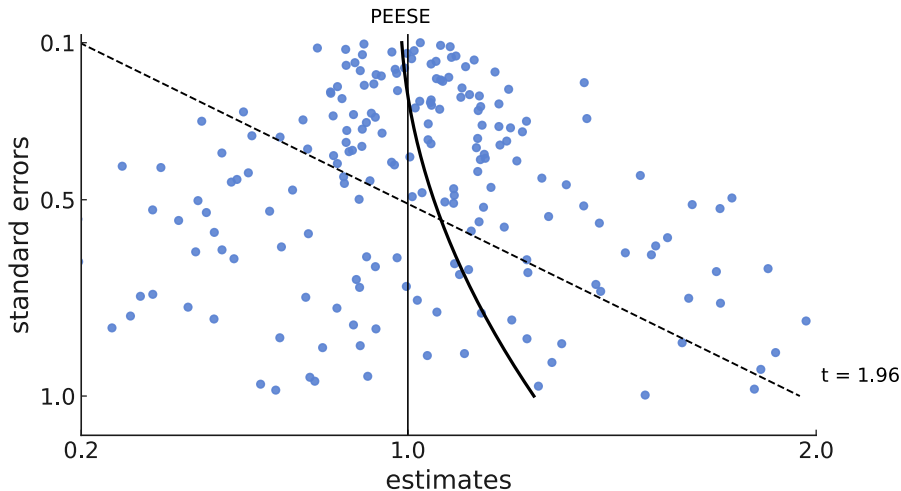
No selection, no bias



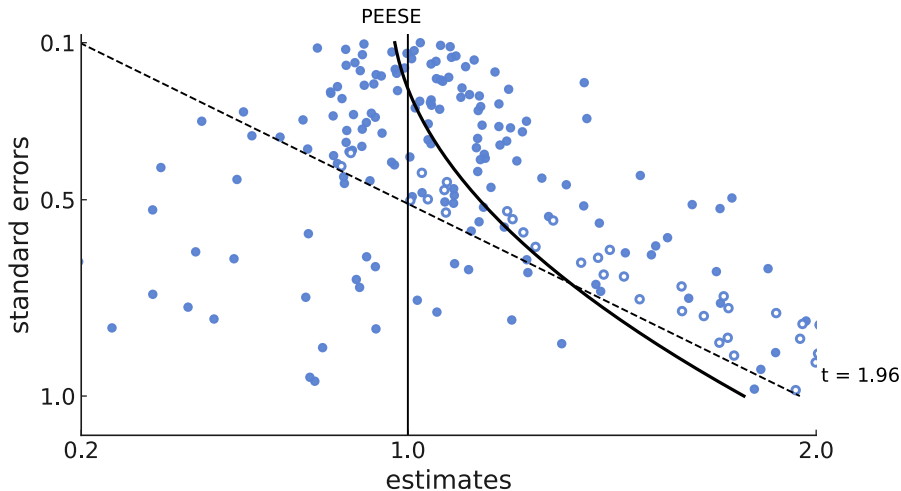
Publication bias: mean too large



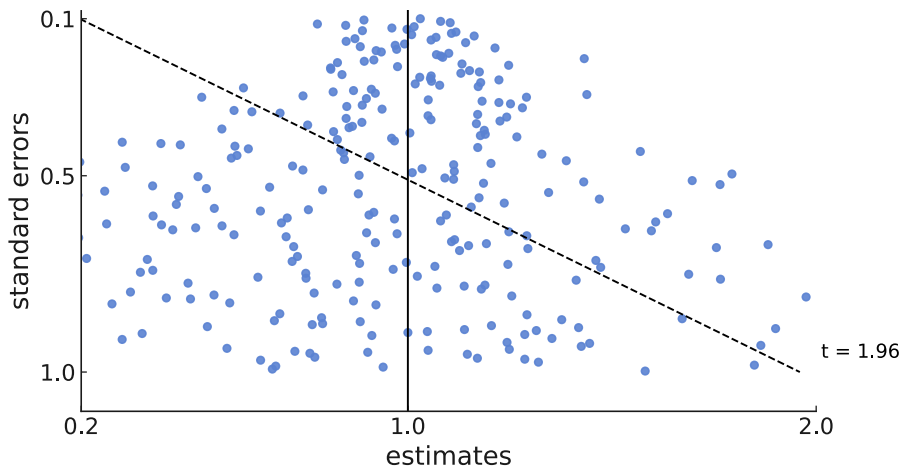
Publication bias: PEESE works



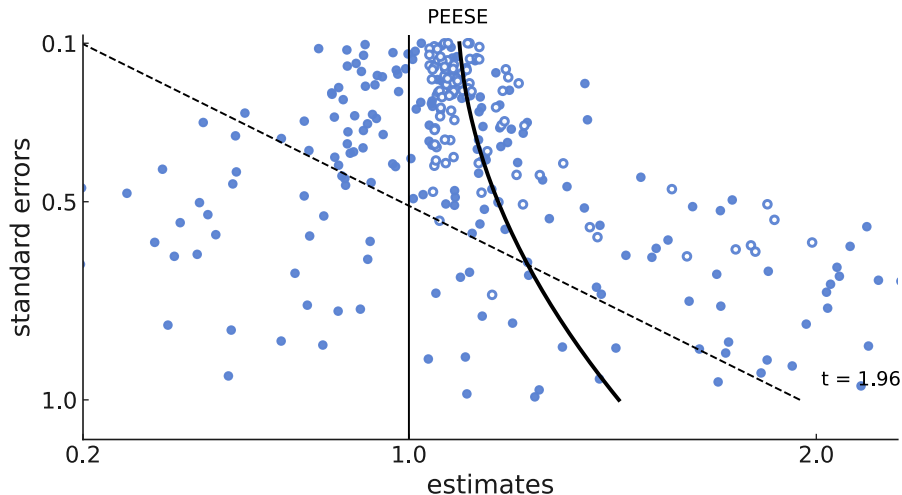
p -hacking on estimates: PEESE works



Back to no selection

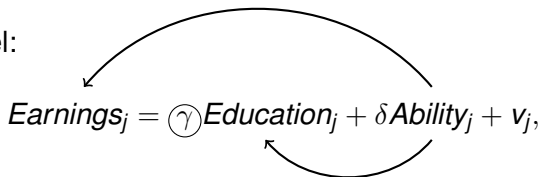


Aggressive p -hacking: PEESE in trouble



Could this happen? Meta of education premium

True model:


$$Earnings_j = \gamma Education_j + \delta Ability_j + v_j,$$

Ability **not observed**.

Primary studies:

- 1 ignore ability $\rightarrow \hat{\gamma}$ too large, $SE(\hat{\gamma})$ too small.
- 2 include a proxy $\rightarrow \hat{\gamma}$ smaller, $SE(\hat{\gamma})$ larger.
- 3 quasi-experiment $\rightarrow \hat{\gamma}$ even smaller, $SE(\hat{\gamma})$ even larger.

Could this happen? Meta of education premium

Omitted variable:

The diagram shows a feedback loop between $Earnings_j$ and $Education_j$. A curved arrow points from $Earnings_j$ to $Education_j$, and another curved arrow points from $Education_j$ back to $Earnings_j$. The coefficient γ in the equation is circled in red.

$$Earnings_j = \gamma Education_j + w_j,$$

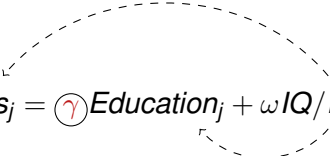
Ability **not observed**.

Primary studies:

- 1 ignore ability $\rightarrow \hat{\gamma}$ too large, $SE(\hat{\gamma})$ too small.
- 2 include a proxy $\rightarrow \hat{\gamma}$ smaller, $SE(\hat{\gamma})$ larger.
- 3 quasi-experiment $\rightarrow \hat{\gamma}$ even smaller, $SE(\hat{\gamma})$ even larger.

Could this happen? Meta of education premium

Proxy:


$$Earnings_j = \gamma Education_j + \omega IQ/PGS_j + x_j,$$

Ability **not observed**.

Primary studies:

- 1 ignore ability $\rightarrow \hat{\gamma}$ too large, $SE(\hat{\gamma})$ too small.
- 2 include a proxy $\rightarrow \hat{\gamma}$ smaller, $SE(\hat{\gamma})$ larger.
- 3 quasi-experiment $\rightarrow \hat{\gamma}$ even smaller, $SE(\hat{\gamma})$ even larger.

Could this happen? Meta of education premium

Instrument:

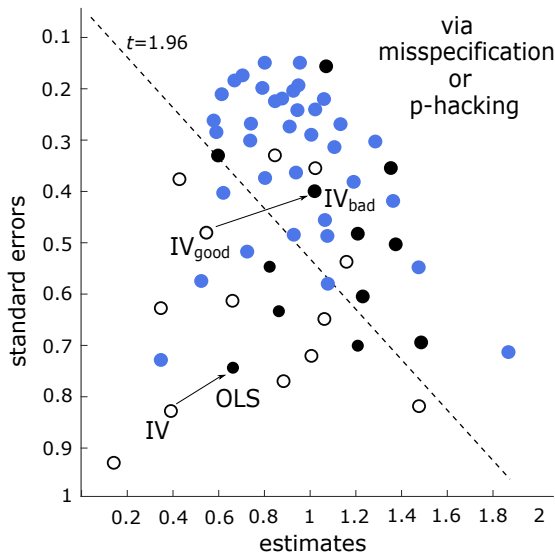
$$Earnings_j = \gamma Education_j + z_j, \quad \text{Policy reform}$$

Ability **not observed**.

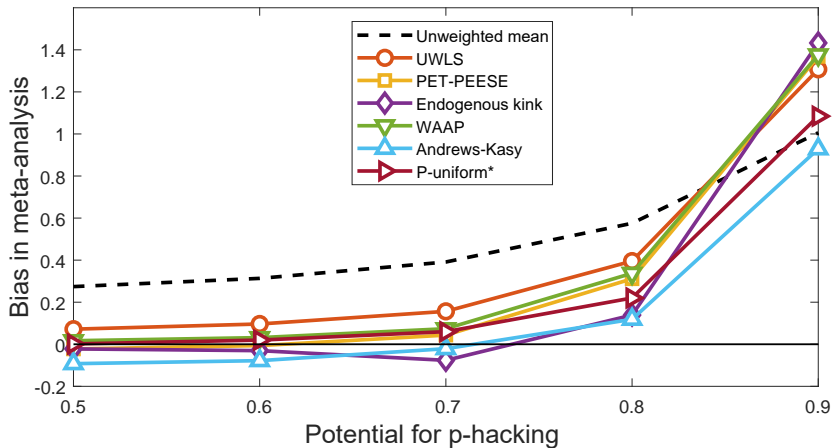
Primary studies:

- 1 ignore ability $\rightarrow \hat{\gamma}$ too large, $SE(\hat{\gamma})$ too small.
- 2 include a proxy $\rightarrow \hat{\gamma}$ smaller, $SE(\hat{\gamma})$ larger.
- 3 quasi-experiment $\rightarrow \hat{\gamma}$ even smaller, $SE(\hat{\gamma})$ even larger.

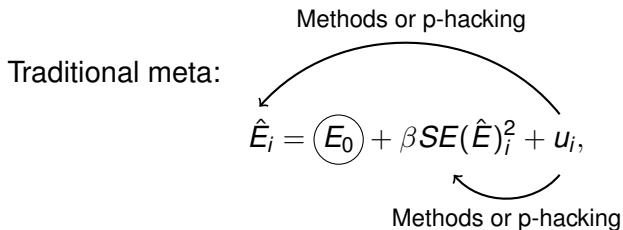
Some estimates spuriously large & precise



All meta estimators biased upwards



Why? Key meta assumption broken



$\text{corr}(SE, u) \neq 0 \Rightarrow \hat{\beta} \text{ and } \hat{E}_0 \text{ biased.}$

Natural solution: 1/N instrumenting $SE(\hat{E})_i^2 \rightarrow \text{MAIVE.}$

Meta-analysis instrumental variable estimator

MAIVE intuition:

Definition of SE

$$\hat{E}_i = \textcircled{E_0} + \beta SE(\hat{E})_i^2 + u_i \cdot 1/N_i$$


- Can **add controls**.
- Plug MAIVE-adjusted SEs into other estimators.
- In practice it's better to use logs in the first stage.

Meta-analysis instrumental variable estimator

MAIVE first stage:

$$SE(\hat{E})_i^2 = \alpha_0 + \alpha_1 (1/N_i) + \pi_i.$$

hacking or misspecifications



- Can **add controls**.
- Plug MAIVE-adjusted SEs into other estimators.
- In practice it's better to use logs in the first stage.

Meta-analysis instrumental variable estimator

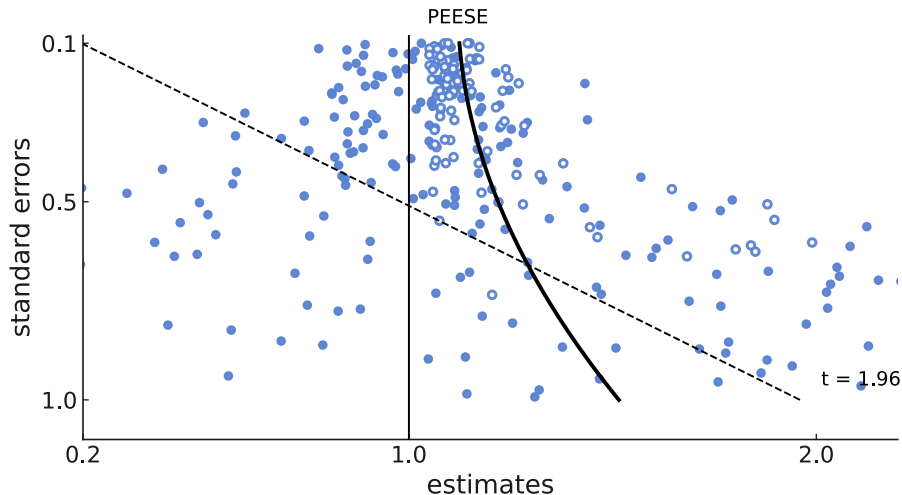
MAIVE adjustment:

$$SE(\hat{E})_{adj,i}^2 = \hat{\alpha}_0 + \hat{\alpha}_1 (1/N_i) + \pi_i.$$

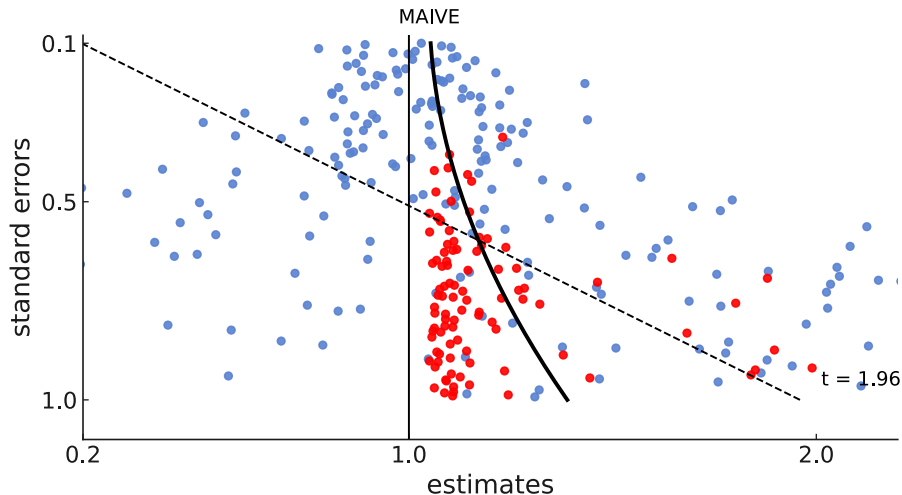
hacking or misspecifications

- Can **add controls**.
- Plug MAIVE-adjusted SEs into other estimators.
- In practice it's better to use logs in the first stage.

Aggressive p -hacking: PEESE in trouble



Meta-Analysis Instrumental Variable Estimator



MAIVE just published

nature communications

[Explore content](#) ▾ [About the journal](#) ▾ [Publish with us](#) ▾

[nature](#) > [nature communications](#) > [articles](#) > [article](#)

Article | [Open access](#) | Published: 26 September 2025

Spurious precision in meta-analysis of observational research

Zuzana Irsova , Pedro R. D. Bom, Tomas Havranek & Heiko Rachinger

Nature Communications **16**, Article number: 8454 (2025) | Cite this article

1036 Accesses | 15 Altmetric | [Metrics](#)

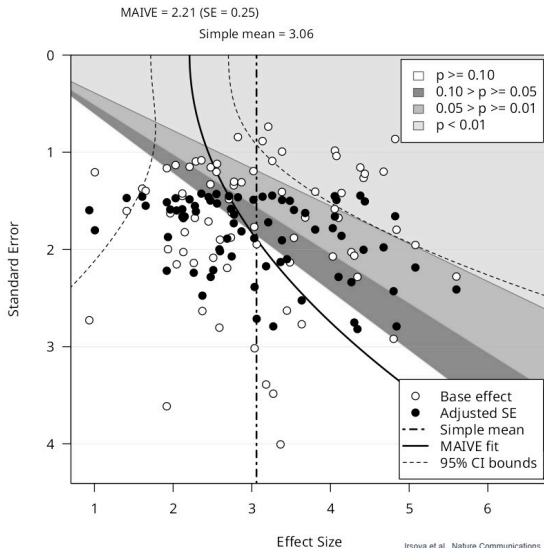
Web app: EasyMeta.org

Seamless Meta-Analysis with MAIVE

Adjust your data for publication bias, p-hacking, and spurious precision.
Powered by the MAIVE estimator (*Nature Communications*).

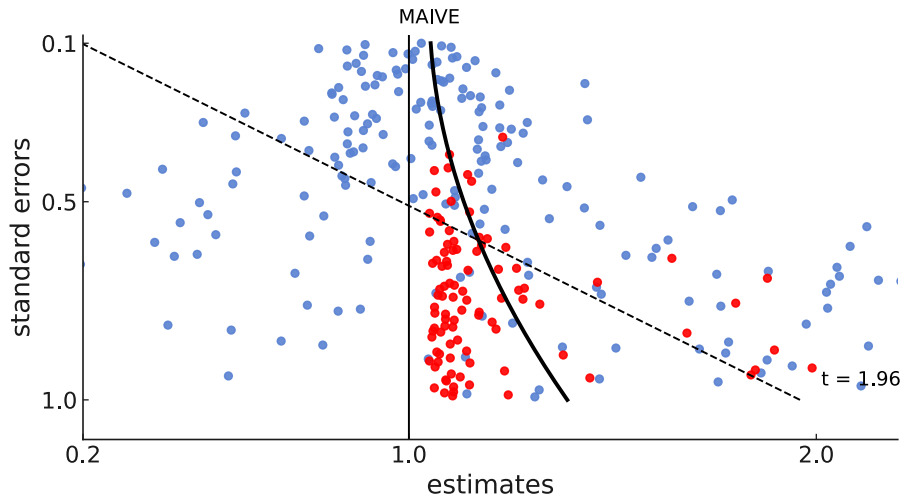
[Upload Your Data](#)[What is MAIVE?](#)[Run a demo](#)

Supports MAIVE, WAIVE, multilevel, clustering

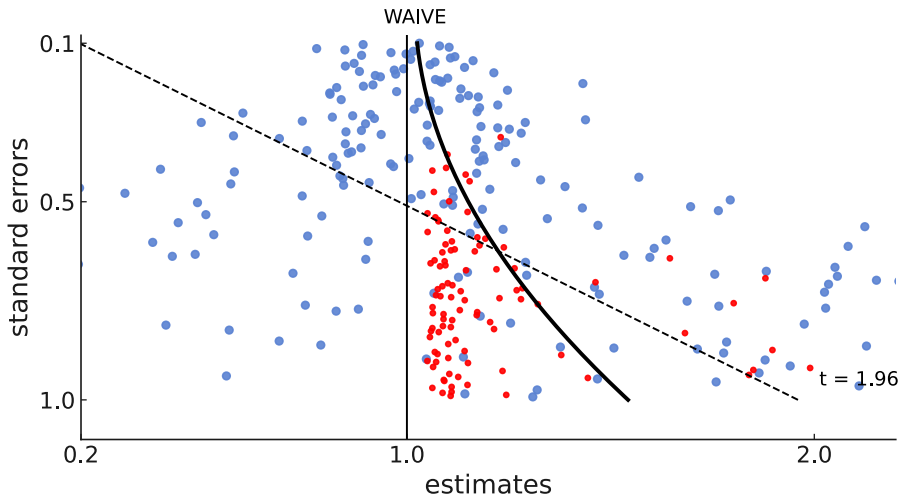


Irsova et al., Nature Communications, 2025

Meta-Analysis Instrumental Variable Estimator



Weighted Adjustment Instrumental Variable Estimator

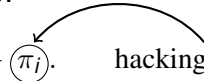


WAIVE first stage – same as MAIVE

Residual from MAIVE first stage:

$$SE(\hat{E})_i^2 = \alpha_0 + \alpha_1 (1/N_i) + \pi_i.$$

hacking if negative?



- Negative $\pi_i \rightarrow$ reported **SE too small relative to N** \rightarrow possibly p -hacking.
- Analogy: profit shifting in accounting (regress profits on sales, look at residuals).

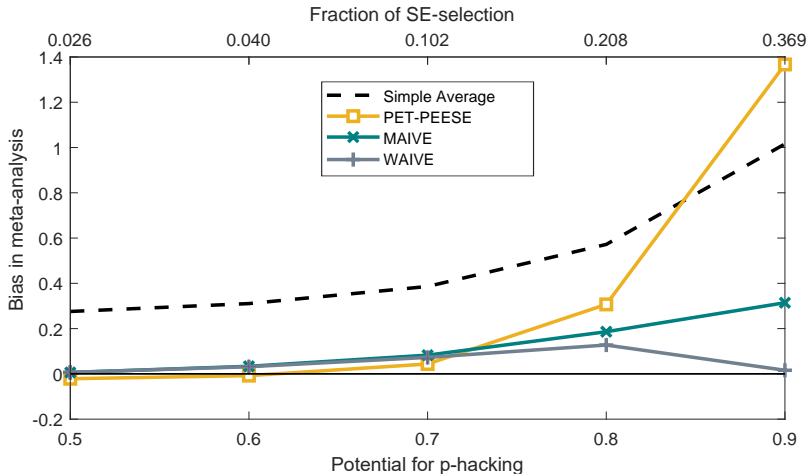
WAIVE weight for the second stage

Exponential tilt:

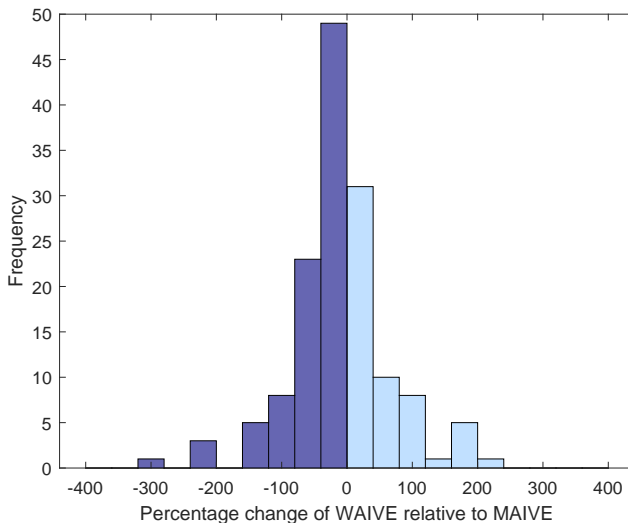
$$\omega_i = \exp[-\max(0, -\pi_i)]$$

- **Penalize only negative residuals** ($\pi_i < 0$) – downweight spuriously precise estimates.
- Weight $\in (0, 1]$, smooth and proportional decay.
- Then run PEESE of \hat{E}_i on $SE(\hat{E})_{adj,i}^2$ with weights ω_i .

WAIVE alleviates the bias



WAIVE reduces MAIVE in 2/3 of meta-analyses



MAIVE extensions we are preparing/working on

- 1 Test for spurious precision using 500+ metas
- 2 Discount incomparable estimates: SORT (Suppressing Outlier Residual Tilt)
- 3 Push correction to the first stage: FORT (Fitted Outlier-Robust Tilt)
- 4 Add more instruments via two-step GMM: SAGE (Stronger Adjustment with GMM Extension)
- 5 Combine with RTMA: WART (WAIVE-Adjusted RTMA)

Practical issues

WAIVE still just a concept. In the meantime, use MAIVE.

Main consideration

- Can methods or p -hacking affect SE ?
- Yes → MAIVE and WAIVE help ([EasyMeta.org](https://www.easymeta.org)).
- No → MAIVE and WAIVE don't hurt much (but wider CI).

Project Website

meta-analysis.cz/maive

Papers using MAIVE



Irsova Z., P. Bom, T. Havranek, & H. Rachinger (2025):
Spurious Precision in Meta-Analysis of Observational
Research.

Nature Communications 16: 8454.



Opatrny M., T. Havranek, Z. Irsova, & M. Scasny (2026):
Publication Bias and Model Uncertainty in Measuring the
Effect of Class Size on Achievement.

Journal of Labor Economics, forthcoming.



Cala P., T. Havranek, Z. Irsova, M. Luskova, J. Matousek
& J. Novak (2026): Financial Incentives and Performance:
A Meta-Analysis of Experiments in Economics.

Journal of Political Economy Microeconomics, forthcoming.