EUROPEAN CENTRAL BANK
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Very preliminary

Macroprudential Policy Instruments in Search of Objectives: A Meta-Regression Analysis

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Session 1: Macroprudential Policy

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Maslow's Hammer

"I suppose it is tempting, if the only tool you have is a hammer, to treat everything as if it were a nail"

--Abraham Maslow

Key issues

Since the global financial crisis, macroprudential policy authorities have been assigned many new instruments.

- What assignment of these instruments would ensure effective attainment of policy goals?
- What would be the outcome of inappropriate assignment?
- And, how best are these questions answered?

Outline

- Theory
- Empirical objective: classification of instruments
- Empirical strategy: Meta-regression
- Preliminary findings
- Next steps

From Maslow to Tinbergen and beyond (Mundell)

Suppose the Tinbergen (1952) condition, that the number of policy instruments equals the number of policy objectives, holds. And, suppose we have a lender-based instrument (e.g. a counter-cyclical capital buffer), M_l, and a borrower-based instrument (e.g. a loan-to-value ratio), M_b, available to enhance or diminish R , or to increase or reduce S. Then, we can write equilibrium conditions for, respectively, R and S:

$$\mathrm{R}(\mathrm{M_l},\mathrm{M_b}) = 0, \qquad R_{M_l} > 0,\ R_{M_b} > 0 \tag{1}$$

$$S(\mathrm{M_l},\mathrm{M_b}) = 0, \qquad S_{M_l} > 0,\ S_{M_b} > 0 \tag{2}$$

Assume that all of the partial derivatives with respect to changes in policy-instrument settings are positive, the slopes of both the resilience locus (where financial system resilience is at its desired level), and the smoothness locus (where financial cycle smoothness is at its desired level) are negative:

$$\left(\frac{\delta M_b}{\delta M_l}\right)_{R=0} = -\frac{R_{M_l}}{R_{M_b}} \tag{3}$$

$$\left(\frac{\delta M_b}{\delta M_l}\right)_{S=0} = -\frac{S_{M_l}}{S_{M_b}} \tag{4}$$

From Maslow to Tinbergen and beyond (Mundell)

Let both policy instruments respond to both objectives, so that the following dynamic system is postulated:

$$\frac{dM_l}{dt} = -k_R R(M_l, M_b) - h_S S(M_l, M_b) \tag{18}$$

$$\frac{dM_b}{dt} = -h_R R(M_l, M_b) - k_S S(M_l, M_b) \tag{19}$$

When linearized, the eigenvalues of this system are:

$$\lambda_i = \frac{Tr(B) \pm \sqrt{\left(Tr(B)\right)^2 - 4|B|}}{2} \tag{20}$$

$$Tr(B) = -\left(k_R R_{M_l} + h_S S_{M_l} + h_R R_{M_b} + k_S S_{M_b}\right) \tag{20a}$$

$$|B| = \left(R_{M_l} S_{M_b} - R_{M_b} S_{M_l}\right)(k_R k_S - h_R h_S) \tag{20b}$$

… and, from Tinbergen to Mundell's Principle of Effective Market Classification

And, stability is ensured if

$$Tr(B) < 0 \text{ and } |B| > 0$$

Since we have assumed that $Tr(B) < 0$ and that $\left(R_{M_l}S_{M_b} - R_{M_b}S_{M_l}\right) > 0$, this only requires that

$$(k_R k_S - h_R h_S) > 0.$$

Equivalently, giving **a testable hypothesis**:

$$k_R/h_S > h_R/k_S$$

or the ratio of the speed of adjustment of the lender-based instrument, when assigned to the resilience objective, to the speed of adjustment of the borrower-based instrument, when assigned to the smoothness objective, should exceed the ratio of the speed of adjustment of the borrower-based instrument, when assigned to the resilience objective, to the speed of adjustment of the lender-based instrument when assigned to the smoothness objective.

➔ This is precisely the Mundell principle of effective market classification: policy instruments should be assigned to the objectives on which they have the greatest effect.

➔ And, while Tinbergen tells us an equilibrium exists Mundell shows the path to get there.

Mundell Principle of Effective Market Classification

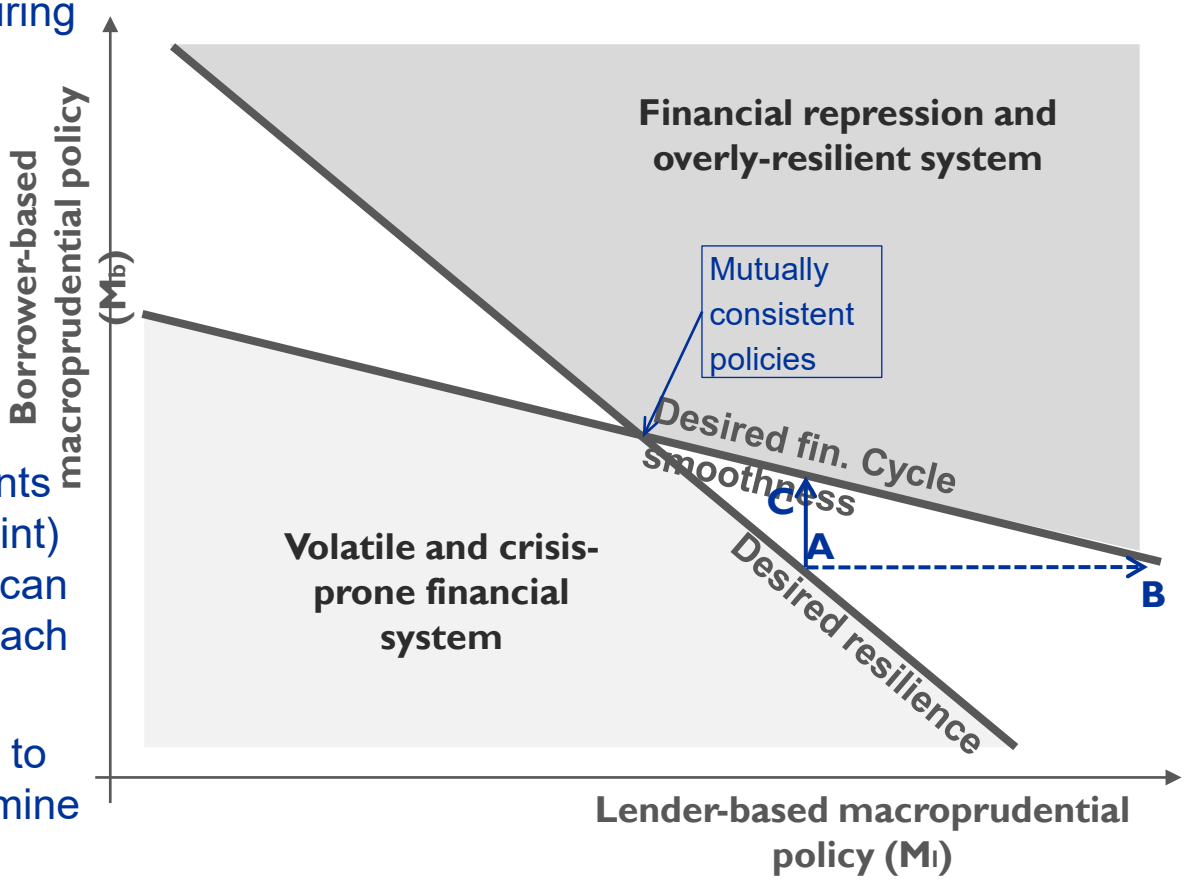
Assign instruments to the objectives on which they have the greatest effect

Hypotheses: Lender-based instruments more effective in ensuring resilience and borrower-based instruments more effective in moderating the financial cycle.

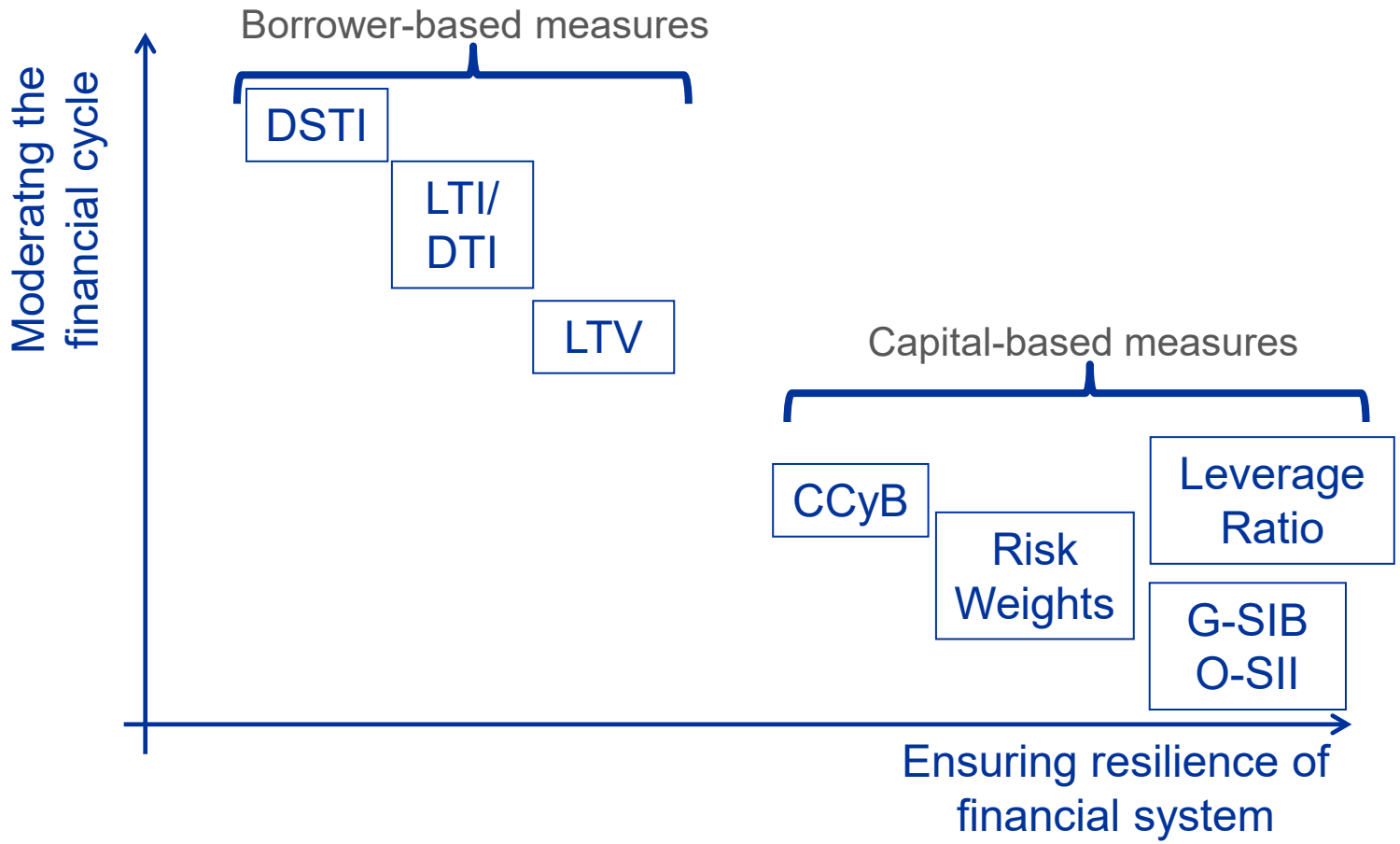
Implications:

1. For individual objectives, macroprudential policy instruments are substitutes but for overall (joint) financial stability objective, they can be complements (i.e. enhance each others effects)
2. Using capital-based instruments to moderate the cycle could undermine financial stability

Policy trade-offs within macroprudential policy space



Can we categorise macroprudential policy instruments by relative strength?



Qualitative surveying may suggest:

	Curbing the financial cycle	Enhancing resilience
Capital-based measures (e.g. CCB)	**?** **Impact**: Higher funding costs which intermediaries pass through to lending rates and quantities Measures may be insufficient to discourage risky lending: **Basten & Koch** (2015).	**Effective** **Impact**: Higher loss absorption (implementation lags less of an issue) BCBS (2010): a 1pp. rise in capital requirements reduces the likelihood of systemic crises by 20–50%
Borrower-based measures (e.g. LTV, DSTI limits)	**Effective** **Impact**: Counter joint cyclicality of asset prices, credit, leverage **Kuttner and Shim (2013)**: Tighter policy reduces credit growth by 4-7pp. **Claessens et al. (2014):** Tighter policy lowers bank leverage and asset growth during booms.	**?** **Impact**: Lower Probability of default (PD), Loss given default (LGD) Only an indirect effect on the resilience of financial intermediaries, more direct effect for borrowers, although country-specific **Dietsch & Welter-Nicol** (2014): limited impact of LTV on PDs.

Empirical strategy: Meta-regression analysis

Why meta-regression analysis?

It offers a framework for simultaneously (A) summarising estimates of policy-relevant parameters; and (B) correcting these estimates for a range of biases (including publication bias).

And, it can answer questions such as:

1) Do estimates of effect sizes converge to a meta-average that might be considered the true effect?

2) Do the estimates suffer from biases that should be corrected for?

3) Can the main sources of heterogeneity between studies be identified?

4) And, crucially, do effect sizes differ depending on the instrument?

Two levels of meta-regression

- **Level 1 – Estimate of true effect corrected for publication bias**
- Three steps (Stanley & Doucouliagos, 2016)
  i) Search for the effect size literature (in principle, every estimated effect size should be included in the data set)
  ii) Coding of the studies (
  iii) Computation of basic calculations of meta-average (which will, in general, differ from the mean due to publication bias)

  NB: as there are few choices in these steps, results should be robust

- **Level 2 – Moderator analysis (identifying sources of heterogeneity)**

Search for the literature: which effects?
What is likely to be available? (from Araujo et al. (2020)

	Credit	Household credit	House prices	Bank balance sheet fragility
MPP in place (0,1) Broad-based	25	22	21	93
Housing	11	73	38	46
MPP change (-1,0,1) Broad-based	78	63	57	2
Housing	4	193	182	2
MPP intensity Broad-based	6	13	119	9
Housing	-	151	4	-

Sample includes both published and unpublished studies

Which effect size measure to search for?

Choice will determine adequacy of sample size

1) Regression coefficients (not recommended)

2) Standardised regression coefficients (Araujo et al. (2020))

3) Zero-order correlations (not recommended)

4) Partial correlations (recommended, likely to give large sample but does not give a size measure)

5) Elasticities (statistics may not be provided by all authors)

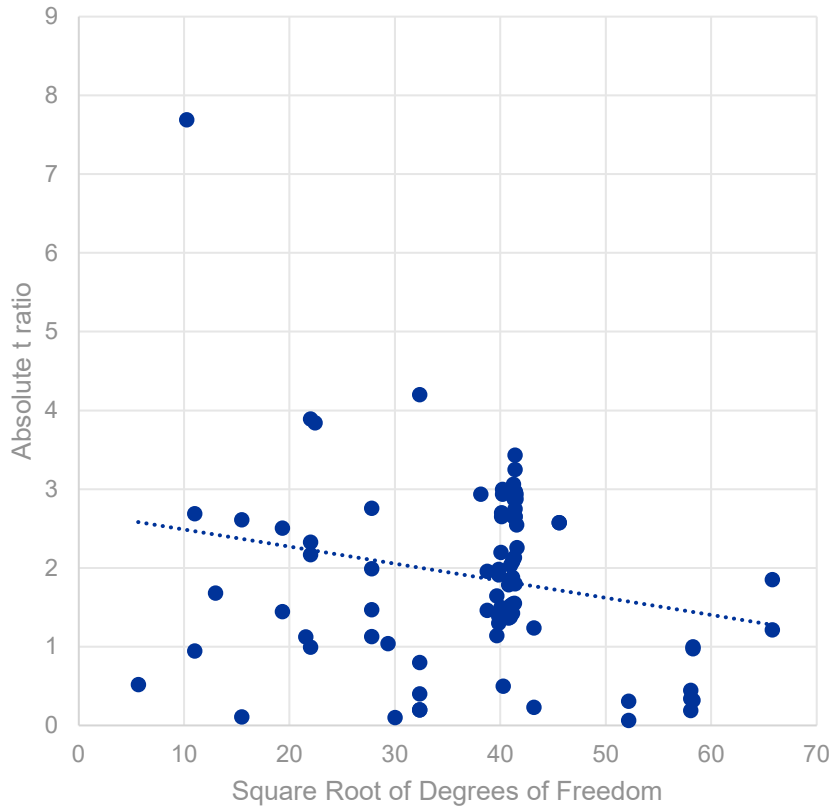
6) Semi-elasticities (as for 5)

7) T-statistics (recommended, likely to give large sample but does not offer a size measure)

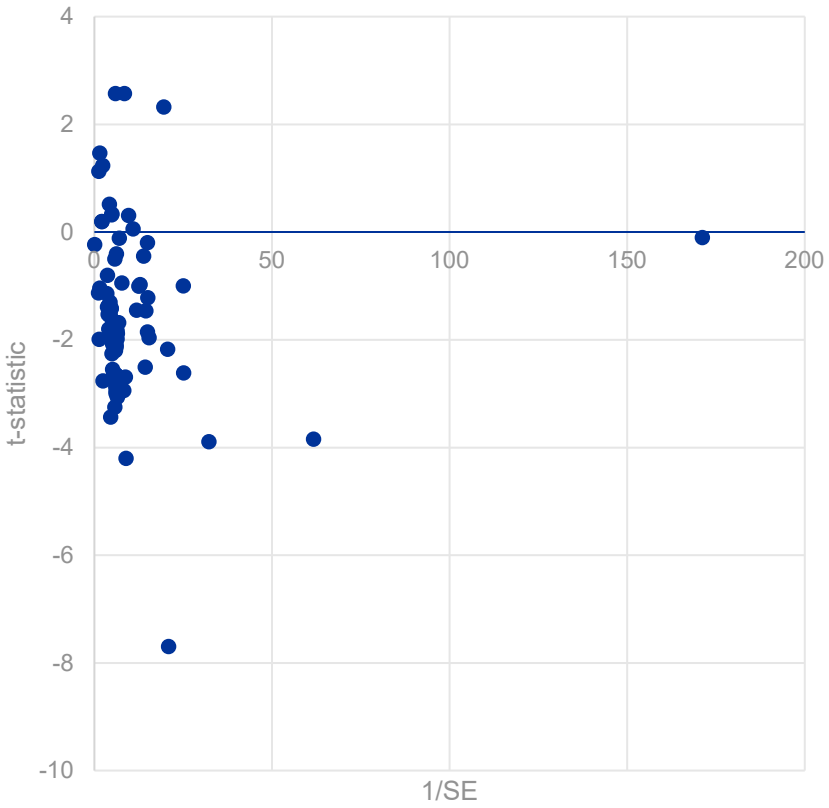
→ 2 complemented by 4 as a robustness check

Impact of capital requirements on real lending growth

Card & Kreuger (1995)

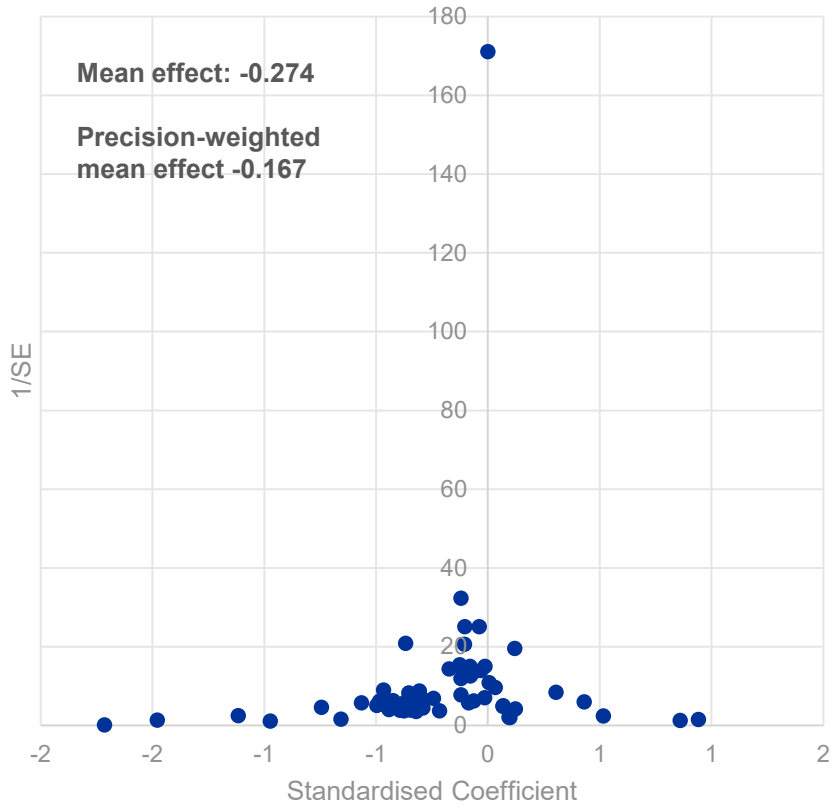


Galbraith plot

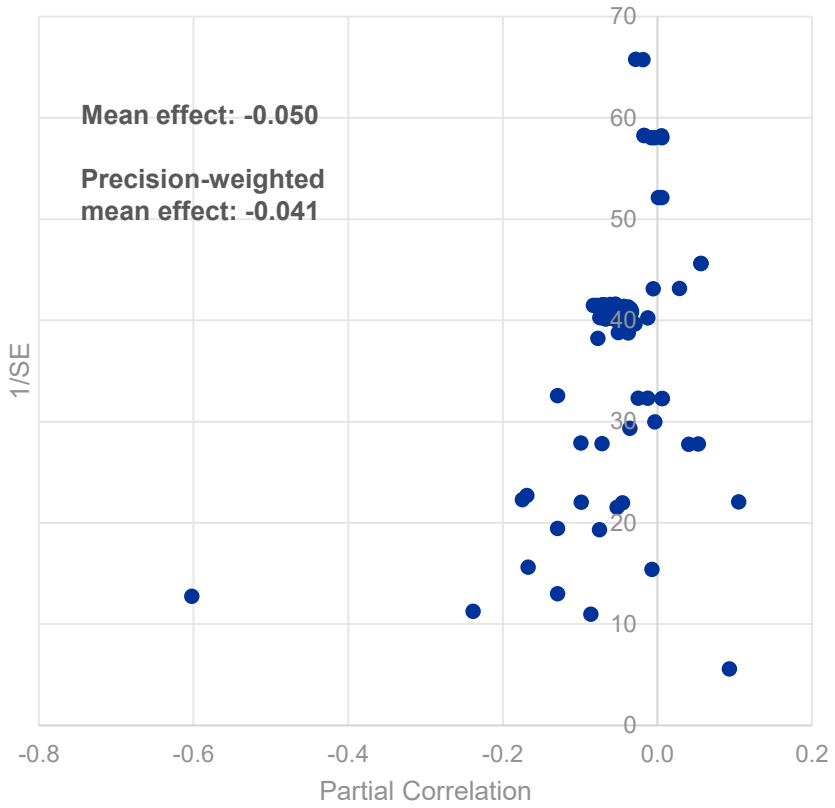


Impact of capital requirements on real lending growth

Funnel Plot: Standardised Coefficient



Funnel Plot: Partial Correlation



Testing for publication bias and correcting the estimate of effect size

Funnel Asymmetry and Precision Effect (FAT-PET) test:

$$effect_i = \beta_0 + \beta_1 SE_i + \varepsilon_i$$

Divide across by SE,

$$t_i = \beta_0 \left(\frac{1}{SE}\right) + \beta_1 + \nu_i$$

Precision Effect Estimate with Standard Error (PEESE):

$$effect_i = \beta_0 + \beta_1 SE_i^2 + \varepsilon_i$$

Divide across by SE,

$$t_i = \beta_0 \left(\frac{1}{SE}\right) + \beta_1 SE_i + \nu_i$$

Level I analysis
(from Stanley & Doucouliagos (2012)

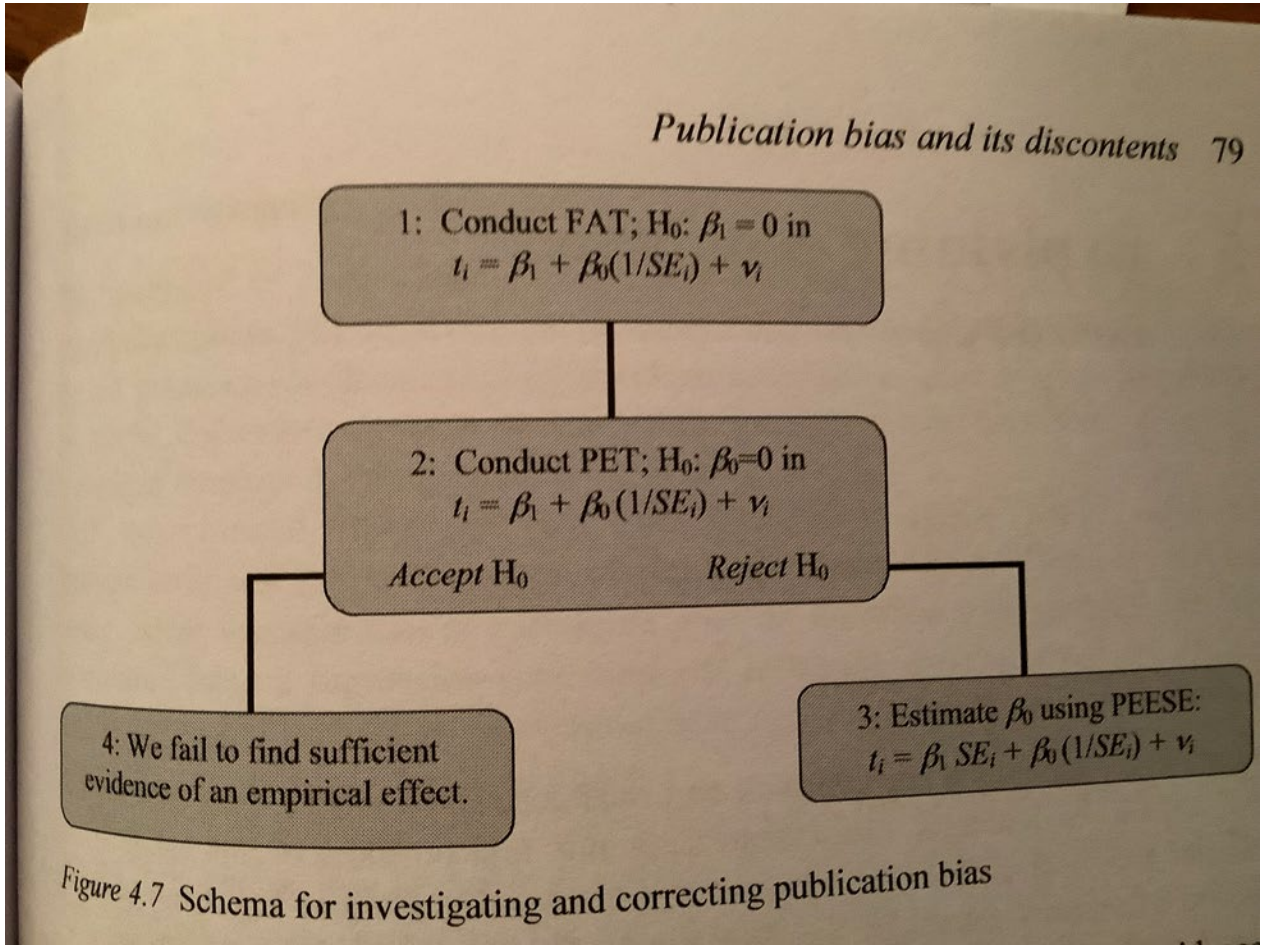
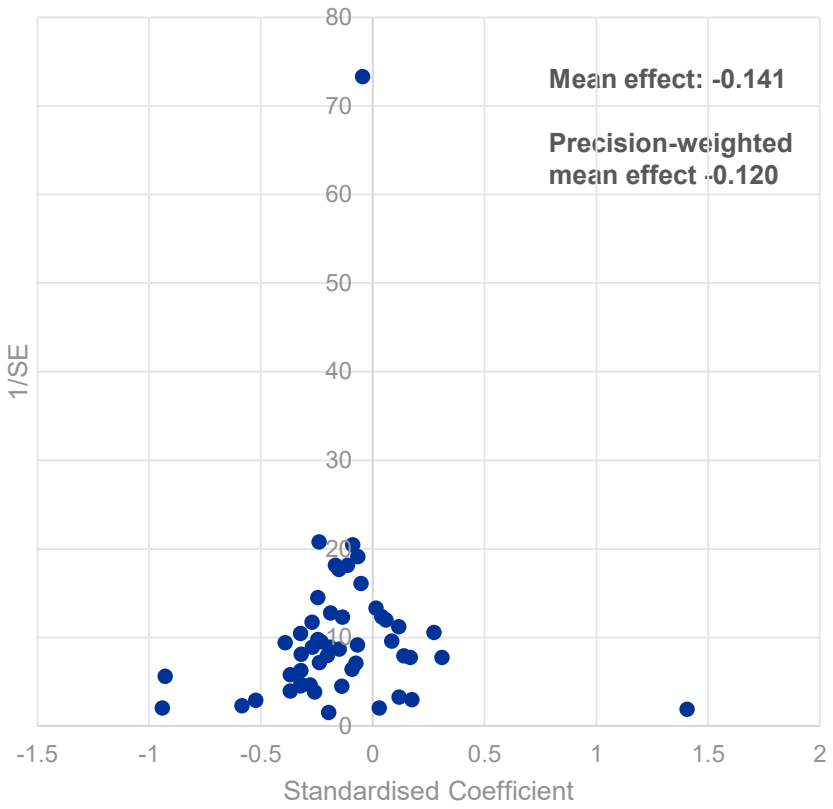


Figure 4.7 Schema for investigating and correcting publication bias

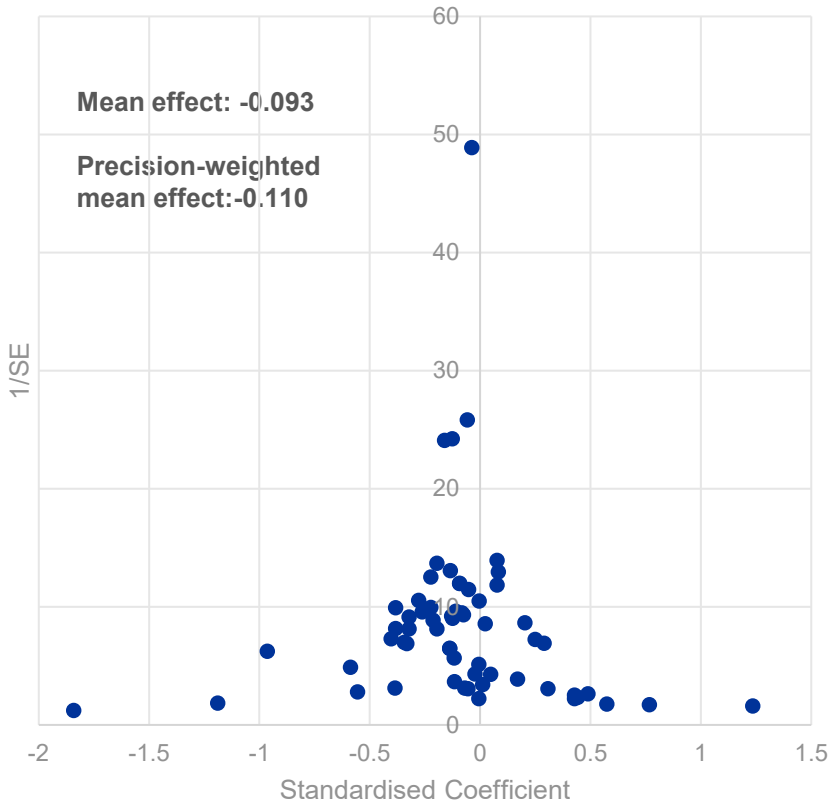
Impact of LTV on real lending growth

Funnel Plot: Standardised Coefficient



Impact of DSTI on real lending growth

Funnel Plot: Standardised Coefficient



Correcting for publication bias in estimates of effects capital requirements on credit growth (1)

FAT-PET for standardised coefficient

	Coefficients	*Standard Error*	*t Stat*	*P-value*	
B1	-1.59405	0.18517	-8.60862	3.08E-13	Evidence of publication bias
B0	0.003124	0.009023	0.346276	0.729981	Insignificant effect

PEESE for standardised coefficient

	Coefficients	*Standard Error*	*t Stat*	*P-value*	
B1	-0.34836	0.267013	-1.30465	0.195492	
B0	-0.03156	0.010861	-2.90627	0.004651	Estimate corrected for bias

Correcting for publication bias in estimates of effects capital requirements on credit growth (2)

FAT-PET for partial correlation

	Coefficients	*Standard Error*	*t Stat*	*P-value*	
B1	-2.16859	0.545652	-3.97431	0.000146	Evidence of publication bias
B0	0.015976	0.013773	1.159975	0.249269	Insignificant effect

PEESE for partial correlation

	Coefficients	*Standard Error*	*t Stat*	*P-value*	
B1	-16.2613	5.84742	-2.78094	0.006659	
B0	-0.02589	0.00569	-4.54903	1.76E-05	Estimate corrected for bias

Search for the literature: how to deal with multiple estimates in single studies

- Issue: multiple estimates from single studies introduce statistical dependence (so effect sizes no longer iid)
- Options to correct for it:
- 1) **Best-set** (i.e. preferred set of authors) (Not recommended when publication bias is present, smaller sample size)
- 2) **Average-set** (smaller sample size and loss of potentially relevant information)
- 3) **All-set** (avoids selection bias, panel data methods can be used to correct for it)

All-set using a panel estimator

Level II (moderator) analysis

Typical moderators

1) Is account taken of control variable Z in the estimate of b?
2) Does the estimator for b adjust for simultaneity?
3) Does the estimate for b depend on the affiliation of the author?
4) What is the impact factor of the journal where b is to be published?

Level II (moderator) analysis

- Moderator data collected for this study
  - Multi-country or single country study
  - Emerging or advanced economy (or mixed)
  - Individual bank or aggregate data
  - Average year of data set
  - Data-type: in place, change or intensity
  - Monetary policy included or not
  - Controls for leakage included or not
  - Modelling choices (e.g. panel, cointegration, etc)
  - Study quality
  - Degrees of freedom
  - Author affiliation
  - Previous studies in the same field by the same author

Notes:

1) list is needed in advance to avoid multiple coding rounds!!!
2) The longer the list, the stronger the case for an “all-set”

Moderator variables for estimates of effects capital requirements on credit growth

	Coefficients	*Standard Error*	*t Stat*	*P-value*
B1	-0.160	0.282	-0.565	0.573
B0	-0.007	0.041	-0.160	0.873
IntOrg	-0.050	0.091	-0.550	0.584
CB	-0.317	0.096	-3.294	0.001
EME	-0.601	1.048	-0.573	0.568
Bank	-0.141	0.138	-1.021	0.310
OtherMPru	0.149	0.057	2.627	0.010
MPIntensity	-0.058	0.074	-0.784	0.435
Risk Weights	0.005	0.040	0.113	0.910
Mpru tightening	-0.053	0.078	-0.679	0.499

Conclusions

Publication bias could be an issue for the macroprudential policy effectiveness literature

Evidence emerging that capital requirements may not have material credit growth implications

If these results prove robust, there are implications for how and when the countercyclical buffer is used