Monetary Policy Has Long-Lasting Impact on Credit: Evidence from 91 VAR Studies

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Motivation and Contribution

- Understanding the credit channel of monetary policy is fundamental:
  - It is crucial for achieving and maintaining macroeconomic and financial stability.
  - It directly influences key economic variables such as consumption, investment, and overall growth.
  - It influences borrowing costs for all economic sectors.
- The contributions of our study are:
  - Enriching the literature on monetary policy neutrality and hysteresis through our meta-analysis.
  - Contributing to the discussion on publication selectivity.
  - Highlighting the significance of design and estimation techniques in achieving accurate results within the existing literature.

Summary of the Paper

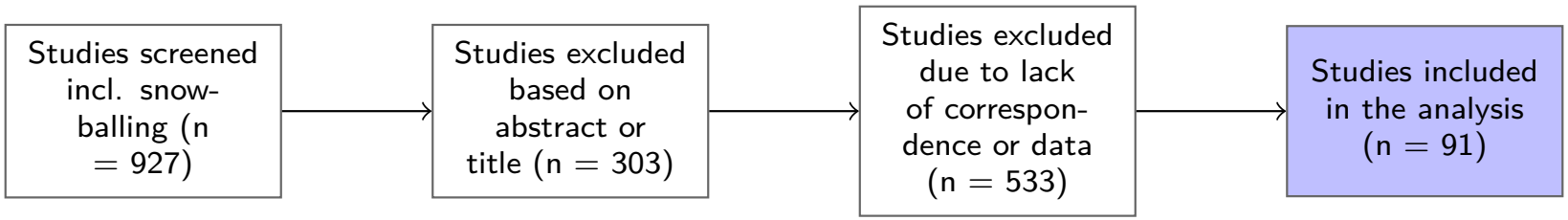
- We collected 3,175 semi-elasticity estimates (454 impulse responses) of credit to changes in the monetary policy rate from 91 vector autoregression (VAR) studies.
- It covers 68 countries between 1955 and 2019.
- We found that monetary policy tightening consistently yields a negative and long-lasting response in both credit volume and credit growth.
- We indicate that the literature overestimates the effect of monetary policy on credit due to publication bias.
- We identified significant heterogeneity drivers:
  - Studies using Bayesian methods and including house prices report a smaller decline in credit.
  - Studies with sign restrictions show a more pronounced drop compared to those using recursive identification.

Paper Selection Procedure

String in Google Scholar

"credit" OR "lending" OR "loan" AND "interest rate" OR "interbank rate" OR "policy rate" OR "repo rate" OR "monetary policy" OR "yield" OR "spread" OR "short rate" OR "long rate"

Simplified PRISMA Full Version



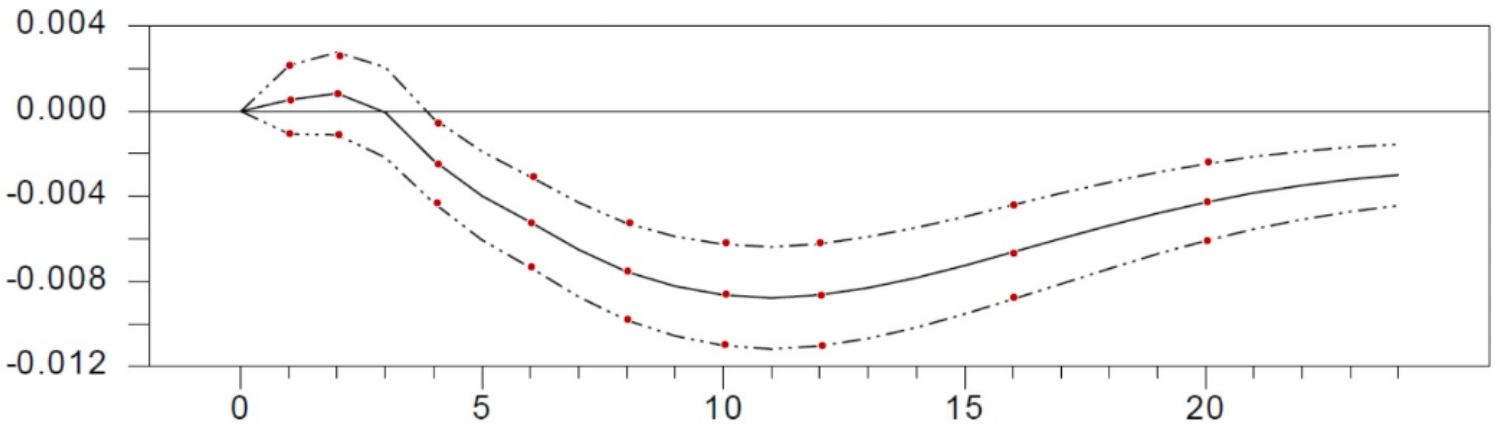
- 800 articles + forward citation searching and backward citation searching.

Main filtering criteria

1. The study employs a VAR (Vector Autoregression) model approach.
2. The study provides confidence intervals around the mean impulse response function of credit.
3. The model uses a short-term interest rate as a proxy for monetary policy.

Data Collection

- We extracted a total of 3,175 point estimates from 454 IRFs.
  - Collected horizons (Q): 1, 2, 4, 6, 8, 12, 16, max
- Web Plot Digitizer: https://automeris.io/WebPlotDigitizer/
- Steps:
  1. We uploaded the IRF from the respective article.
  2. We aligned the axes.
  3. We selected each desired point in the IRF.
  4. Imprecisely selected points were adjusted via the zoom tool.
  5. We downloaded the selected points into an Excel file.



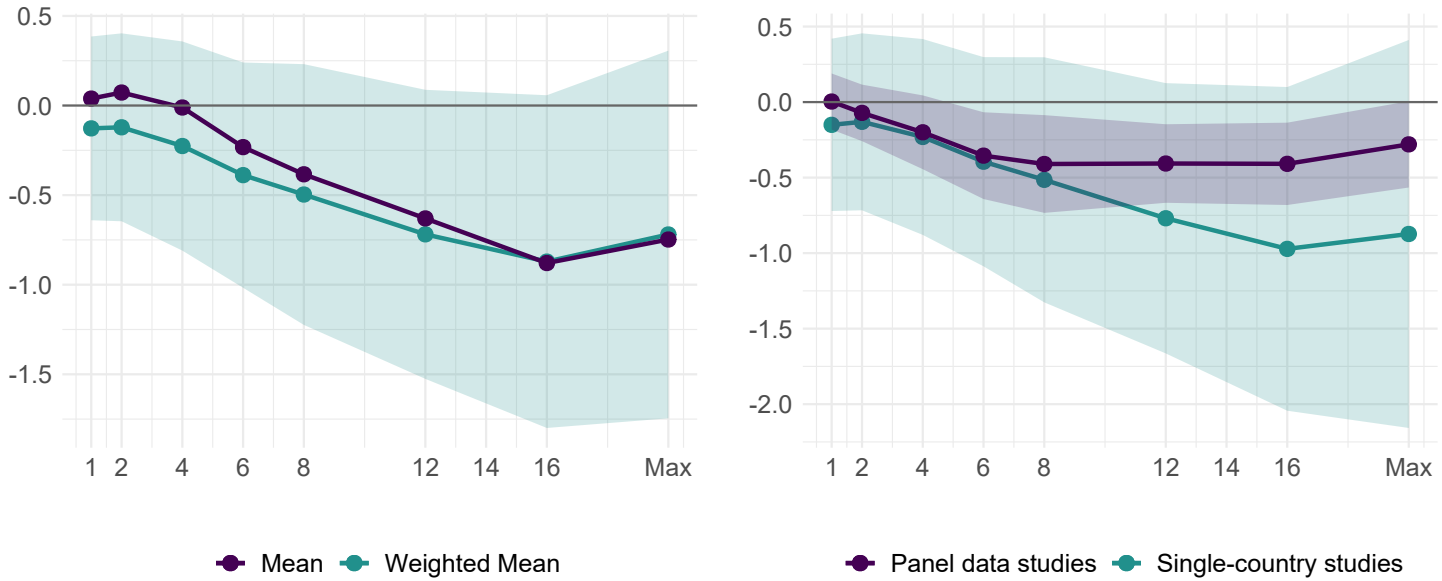
Note: IRF collected from Assenmacher-Wesche, Gerlach, 2008; page 29

Summary Statistics of Collected Semi-elasticities

Horizon		Obs.	Studies	Unweighted Mean	Unweighted 5%	Unweighted 95%	Unweighted Skew.	Weighted Mean	Weighted 5%	Weighted 95%	Weighted Skew.
Log-level of Credit											
Short-term	1	286	62	0.04	-1.78	1.87	0.84	-0.13	-2.16	0.93	-0.69
	2	295	64	0.07	-1.48	1.86	1.71	-0.12	-2.59	1.09	0.19
Medium-term	4	299	64	-0.01	-2.05	3.78	0.92	-0.23	-2.59	1.03	-0.22
	6	309	64	-0.23	-2.74	2.75	0.05	-0.39	-3.59	0.57	-1.34
	8	295	61	-0.38	-3.69	2.60	-0.59	-0.50	-5.02	0.80	-1.69
Long-term	12	289	57	-0.63	-4.88	1.72	-1.79	-0.72	-5.06	0.69	-2.22
	16	229	46	-0.88	-5.61	1.55	-1.80	-0.87	-5.49	0.52	-2.08
	Max	192	33	-0.75	-4.44	1.25	-1.86	-0.72	-4.02	0.68	-2.26
Growth Rate of Credit											
Short-term	1	118	24	-1.39	-14.93	2.29	-2.96	-0.68	-3.87	2.82	-3.87
	2	146	28	-0.90	-8.34	1.44	-2.46	-0.58	-4.63	1.37	-2.64
Medium-term	4	146	28	-1.07	-10.27	1.29	-3.06	-1.01	-11.08	1.26	-2.84
	6	145	27	-1.18	-11.88	1.28	-3.26	-1.51	-15.81	0.97	-2.75
	8	145	27	-1.35	-11.76	0.57	-3.13	-1.81	-15.49	0.89	-2.47
Long-term	12	128	24	-1.58	-11.06	0.47	-2.37	-2.36	-12.96	0.72	-1.73
	16	90	20	-1.88	-11.00	0.41	-2.00	-2.71	-14.03	0.73	-1.51
	Max	63	16	-1.45	-8.91	0.32	-1.92	-2.12	-9.59	0.44	-1.30

Mean Impulse Response Functions: Log-level of Credit

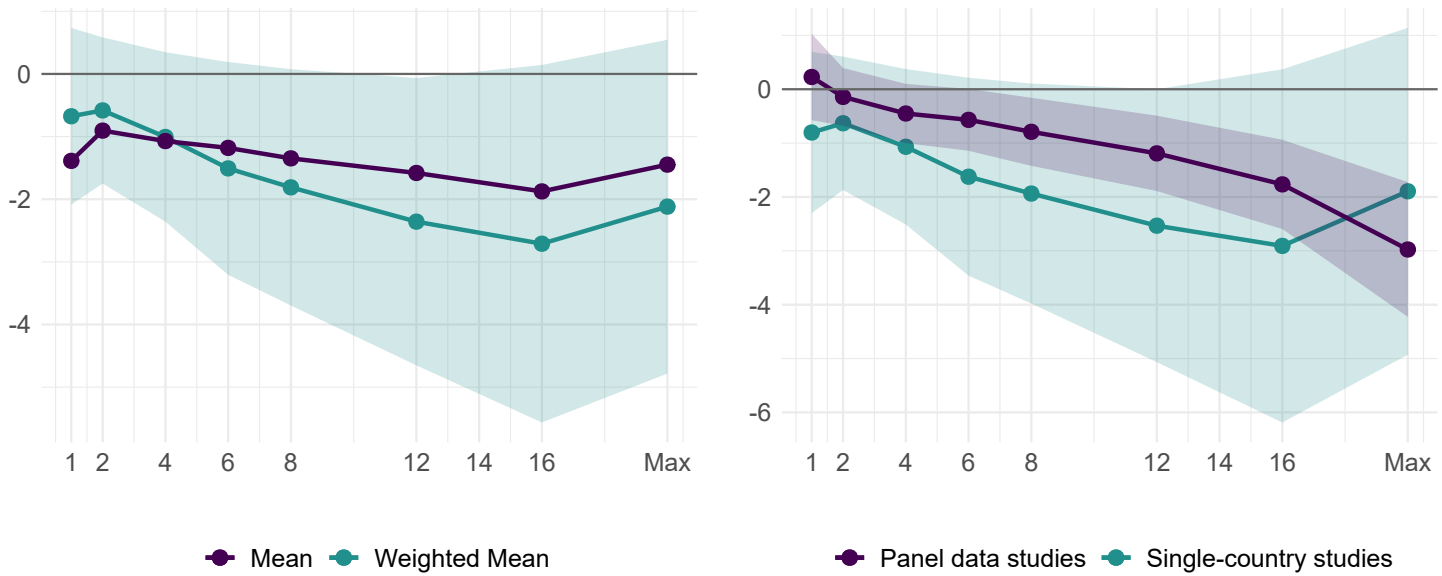
- 1 pp increase in the monetary policy rate leads to a 0.9% decrease in outstanding credit after four years, adjusting to -0.7% at six to seven years.
- The overall mean response is barely statistically significant, possibly due to limited sample size.
- Larger panel data studies show a clear statistical significance, aligning with expectations.



Note: Average response of credit to a one-percentage-point increase in the monetary policy rate, accompanied by the average 68% confidence interval. The horizons are in quarters.

Mean Impulse Response Functions: Growth Rate of Credit

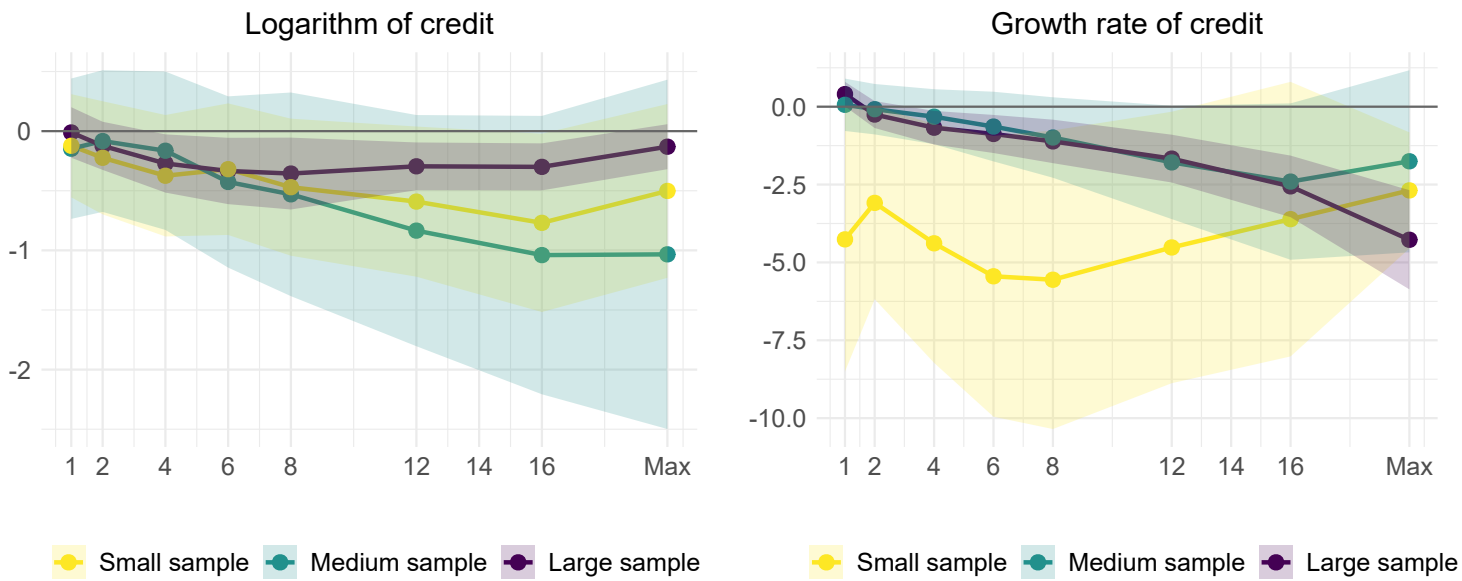
- 1 pp increase in the monetary policy rate leads to a 2.7 pp decrease in growth of outstanding credit after four years, adjusting to -2.1 pp at six to seven years.
- We observe similar pattern for larger panel data studies.



Note: Average response of credit growth to a one-percentage-point increase in the monetary policy rate, accompanied by the average 68% confidence interval. The horizons are in quarters.

Mean Impulse Response Functions: Sample Size Role

- Large samples show less pronounced, yet more significant IRFs.
- Publication Bias?



Note: Studies are categorized based on the sample size of data used in their estimations: small sample (first quartile), medium sample (second and third quartiles), and large sample (fourth quartile).

Publication Bias

Why do we expect it?

- The mainstream literature expects the effect of a monetary policy shock on credit to be negative (Gertler and Gilchrist, 1993; Barraza et al., 2019).
- Estimates above zero might create a psychological effect, suggesting the data or model specification is incorrect, leading to the discarding of such estimates.
- Researchers may also have similar reservations about estimates that are statistically weaker or smaller in magnitude, even if they have the expected sign.

Empirical tests:

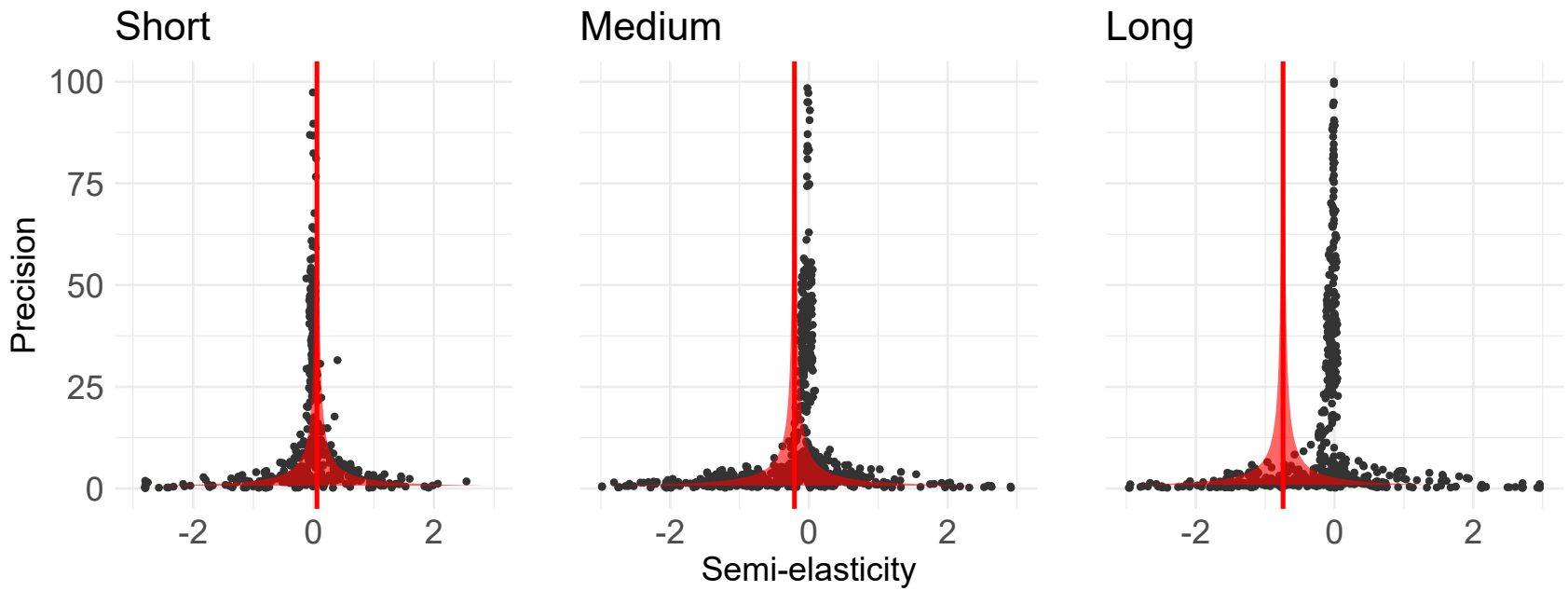
- PEESE & three-level model (between-study, within-study, and within-cluster heterogeneity)

$$\hat{\beta}_{i,j} = \alpha + \delta_i + \kappa_{i,j} + \gamma \hat{SE}^2_{i,j} + \epsilon_{i,j}$$

- Weighted: inverse of the estimate's variance (controls for heteroskedasticity).

Are the Results Biased in the Literature?

Figure: Funnel Plots: Log-level of Credit



- The distribution is shifted to the right across all horizons.
- Smaller studies, those with larger standard errors, tend to report higher effect sizes (and potentially discard the opposite ones).

Estimation of Publication Bias: Log-level Transformation

- The effects are weaker when correcting for publication bias.
- The mean effect beyond bias is significant for both the medium and long horizon.

Table: Results for the Log-level of Credit

	Short	Medium	Long
Effect beyond bias (constant)	-0.002	-0.107***	-0.142***
	(0.012)	(0.020)	(0.027)
Publication bias (SE^2)	0.024	-0.066***	-0.158***
	(0.024)	(0.022)	(0.015)
I^2 level 1 (%)	0	0	0
I^2 level 2 (%)	0	0	0
I^2 level 3 (%)	100	100	100
Observations	581	903	710
Studies	64	65	57

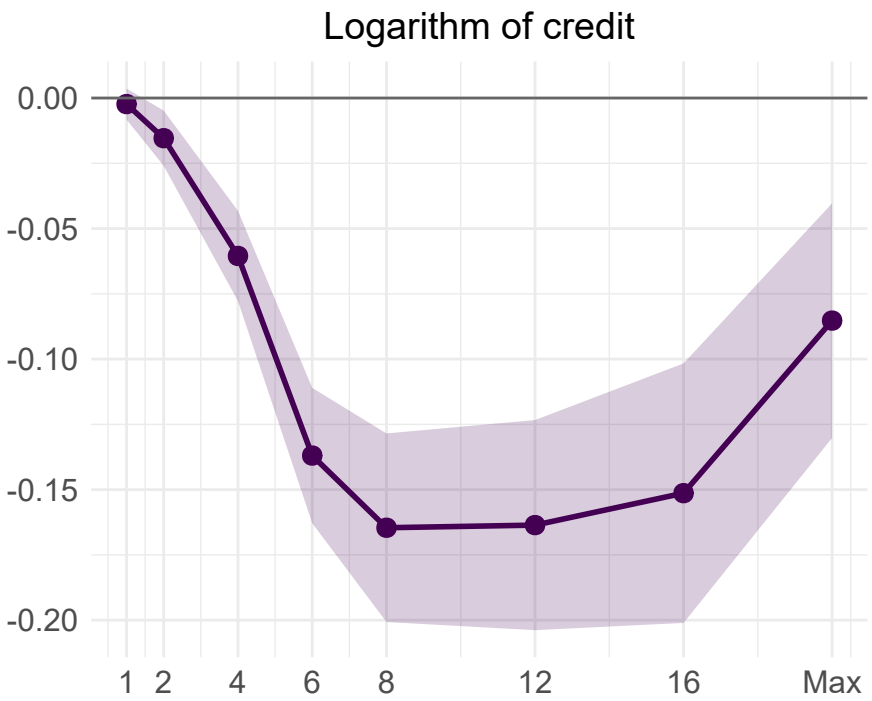
Estimation of Publication Bias: Growth Rate Transformation

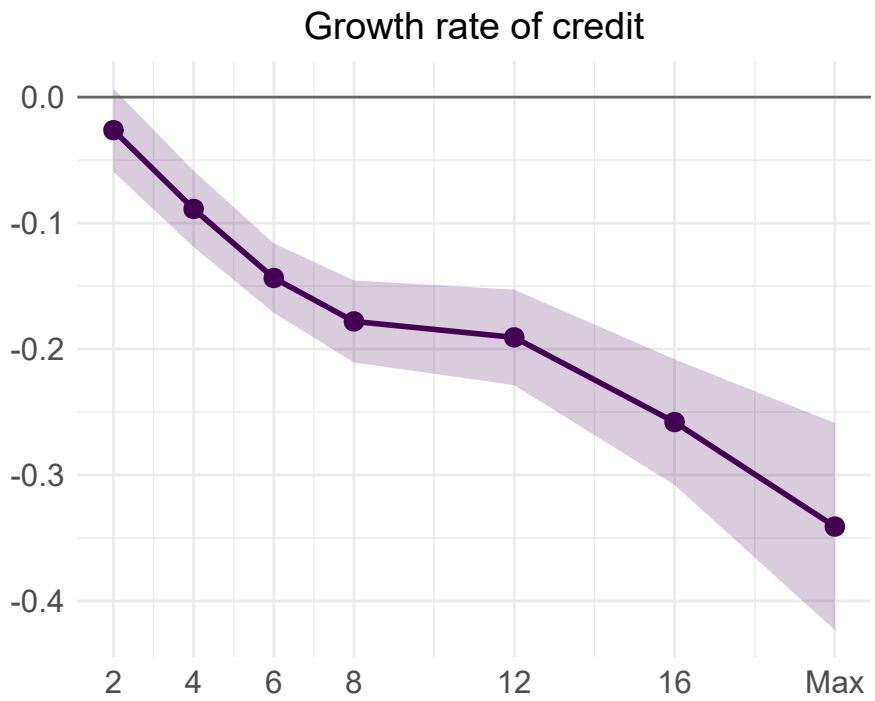
- Growth rate transformation of credit: similar results.

Table: Results for the Growth rate of Credit

	Short	Medium	Long
Effect beyond bias (constant)	-0.026	-0.162***	-0.341***
	(0.033)	(0.028)	(0.082)
Publication bias (SE^2)	-0.062***	-0.097***	-0.111***
	(0.009)	(0.007)	(0.011)
I^2 level 1 (%)	0	1	1
I^2 level 2 (%)	14	0	0
I^2 level 3 (%)	86	99	99
Observations	264	436	281
Studies	28	28	24

Mean Impulse Response Functions Corrected for Publication Bias: Individual Horizons





Additional Tests of Publication Bias

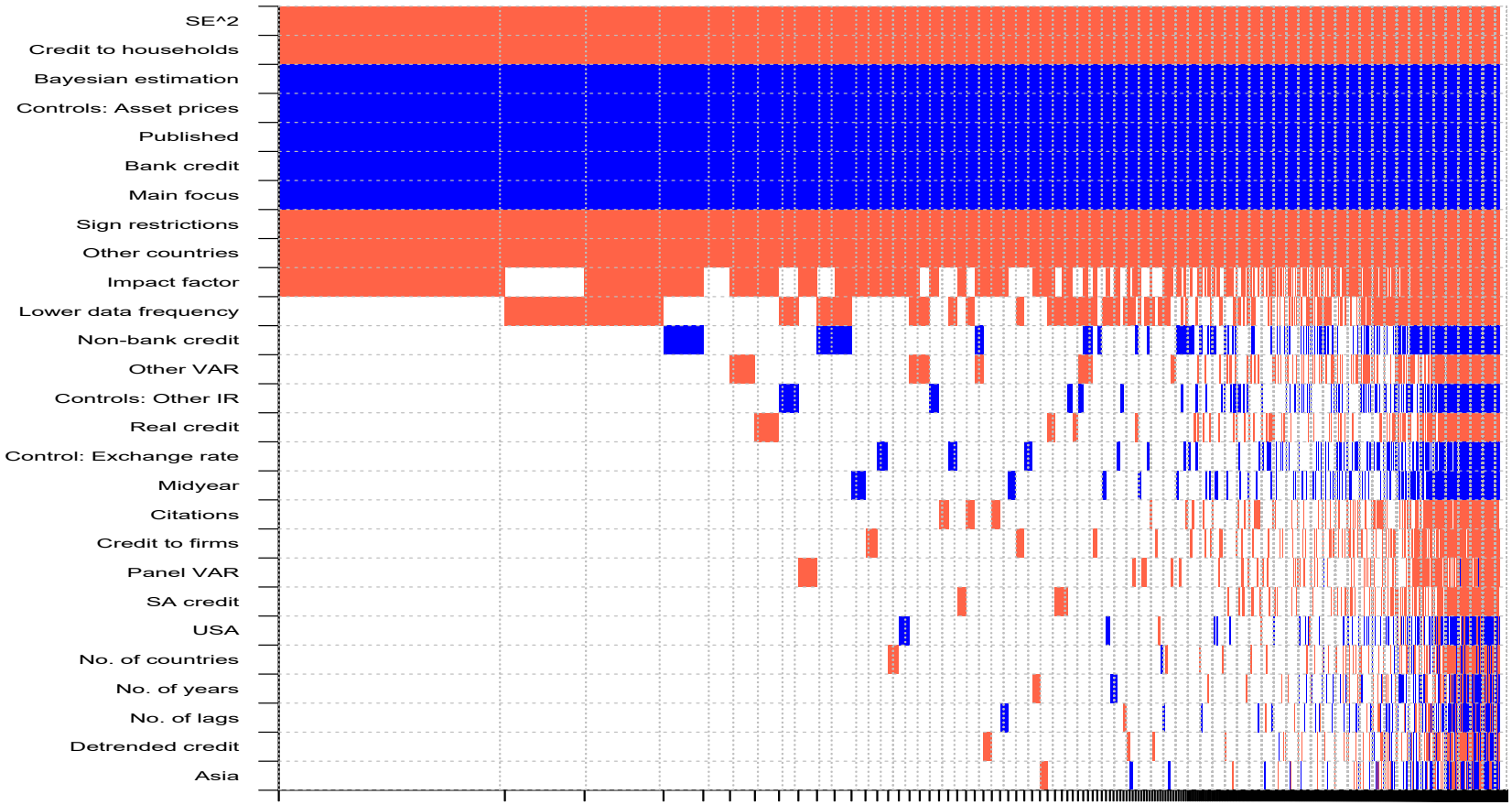
- Caliper Test Gerber and Malhotra (2008a,b):
  - Tested with t-statistic thresholds (1, 1.65, 1.96) and caliper sizes (0.1, 0.2, 0.3).
  - Results show publication selection across all estimates and horizons, especially for negative estimates.
- Nonlinear Tests:
  - Relax linearity assumption; precise estimates may be less biased.
  - Focus on isolating precise estimates to compute the average effect (Ioannidis et al. (2017); Furukawa (2019); Bom and Rachinger (2019); Andrews and Petroulakis (2019)).

What Drives the Heterogeneity?

- The mean impulse response obscures important distinctions in estimation design.
- We collected an additional 26 primary study characteristics to examine heterogeneity drivers:
  1. Data characteristics: type of credit, lender, data frequency, time period, country coverage, seasonal adjustment, etc.
  2. Model specification and estimation: estimation method, shock identification, control variables.
  3. Publication characteristics: main focus of the study, publication outlet and quality.
- Bayesian model averaging.

BMA – Graphical Results – Log-level of Credit and Medium-term Horizon

Figure: Model Inclusion in Bayesian Model Averaging: Log-level of Credit and Medium-term Horizon



Key Heterogeneity Drivers

- We have confirmed the existence of publication bias across all horizons.
- Monetary policy shocks have a stronger effect on household credit than on borrowing by other sectors
- Studies employing Bayesian estimation consistently yield less negative estimates.
- Models that integrate asset prices, including residential and commercial house prices, show less negative effects.
- The negative effect of monetary policy shock on credit is more pronounced if the shock was identified using sign restrictions as opposed to Cholesky decomposition.
- The results published in a peer-reviewed journal tend to be less negative.
- Studies focusing primarily on the identification of the credit channel of monetary policy generally exhibit less negative effects, mainly in the short and medium term.

Model Comparison and Effect Beyond Bias

- The expanded model with the identified drivers offers a significantly better explanation of effect heterogeneity beyond just publication bias (based on IC, LR, and QE test statistics).
- The effect beyond bias (corrected mean), taking into account primary study characteristics, confirms our previous findings: the effect remains negative in the medium term and intensifies further in the long term.

		Short horizon	Medium horizon	Long horizon
Unweighted				
	Simple mean	0.056	-0.208	-0.742
	Corrected mean	0.181	-0.019	-0.322
	32/68 credible intervals	(-0.252, 0.613)	(-0.604, 0.567)	(-0.987, 0.344)
Weighted				
	Simple mean	-0.124	-0.369	-0.764
	Corrected mean	0.023	-0.161	-0.377
	32/68 credible intervals	(-0.412, 0.457)	(-0.748, 0.426)	(-1.047, 0.293)
	Observations	581	903	710
	Studies	64	65	57

Note: Log-Level primary studies

Implied Effects

- Frequentist approach and sign restrictions: much stronger negative effects compared to models estimated using Bayesian method and shocks identified via Cholesky decomposition.
- Credit to households: the effect is stronger compared to other sectors.
- Growth rate transformation of credit: similar results.

	Short horizon	Medium horizon	Long horizon
Frequentist approach and sign restrictions			
Mean	-0.870	-1.140	-0.525
32/68 credible intervals	(-1.305, -0.434)	(-1.728, -0.553)	(-1.192, 0.142)
W. Mean	-0.863	-1.074	-0.510
W. 32/68 credible intervals	(-1.299, -0.426)	(-1.662, -0.485)	(-1.180, 0.160)
Credit to households			
Mean	-0.268	-0.825	-0.569
32/68 credible intervals	(-0.704, 0.169)	(-1.413, -0.238)	(-1.242, 0.103)
W. Mean	-0.433	-0.979	-0.621
W. 32/68 credible intervals	(-0.871, 0.005)	(-1.568, -0.390)	(-1.296, 0.053)

Note: Log-Level primary studies

Other Results and Considerations

Other tests

1. Only papers published in a peer-reviewed journal.
2. Studies that mainly focus on the identification of the credit channel of monetary policy.
3. Re-estimating the results for individual horizons, rather than using three grouped horizons.
4. Real vs. nominal credit variable.
5. The role of maximum horizon reported by the primary study.

Neither of these affect the main results significantly.

Conclusion

- We collected 3,175 semi-elasticity estimates (454 impulse responses) of credit to changes in the monetary policy rate from 91 vector autoregression (VAR) studies.
- It covers 68 countries between 1955 and 2019.
- We found that monetary policy tightening consistently yields a negative and long-lasting response in both credit volume and credit growth.
- We indicate that the literature overestimates the effect of monetary policy on credit due to publication bias.
- We identified significant heterogeneity drivers:
  - Studies using Bayesian methods and including house prices report a smaller decline in credit.
  - Studies with sign restrictions show a more pronounced drop compared to those using recursive identification.
- The long-lasting impact on credit challenges the long-run neutrality of monetary policy (see the recent literature on hysteresis).
- Other explanation: Most VARs in the existing literature are poorly identified.

Thank you for your attention!

Primary Studies

Panel A: Credit is expressed in log-levels

Afrin (2017)
Assenmacher-Wesche and Gerlach (2008)
Assenmacher-Wesche and Gerlach (2010)
Aysan et al. (2018)
Barraza et al. (2019)
Bäurle and Scheufele (2019)
Bayardavaa et al. (2015)
Binatli and Sohrabji (2019)
Busch et al. (2010)
Buttiglione and Ferri (1994)
Fornari and Stracca (2012)
Franz (2019)
Franz (2020)
Garretsen and Swank (2003)
Gertler and Gilchrist (1993)
Goodhart and Hofmann (2003)
Greenwood-Nimmo and Tarassow (2016)
Gupta (2004)
Halvorsen and Jacobsen (2016)
Hofmann and Peersman (2017a)
Hofmann and Peersman (2017b)
Hristov et al. (2012)
Hulsewig et al. (2005)
Hwang (2012)
Choi (2021)
Christiano et al. (1996)
Ibarra (2016)
Ibrahim and Shah (2012)
Jannsen et al. (2019)
Jiang (2015)
Jung et al. (2017)
Kabundi and Rapapali (2019)
Kakes and Sturm (2002)
Karim et al. (2006)
Kim and Lim (2020)
Kim and Mehrotra (2018)
Kim and Mehrotra (2019)
Koivu (2009)
Kubo (2008)
Lown and Morgan (2002)
Lungu (2007)
Łyziak et al. (2008)
Mertens (2008)
Morsink and Bayoumi (2001)
Oros and Romocea-Turcu (2009)
Ouchchikh (2017)
Papadamou and Siriopoulos (2012)
Peersman and Smets (2001)
Peersman and Wagner (2014)
Pescatori and Sole (2016)
Punzi and Kauko (2015)
Sá et al. (2011)
Seoela (2022)
Serwa and Wdowiński (2017)
Skibińska (2018)
Stakėnas and Stasiukynaitė (2017)
Steudler and Zurlinden (1998)
Suranjit (2016)
Suzuki (2004)
Tamási and Világi (2011)
Tan (2012)
Walsh and Wilcox (1995)
Wrobel and Pawowska (2002)
Wu and Yang (2018)
Zaidi and Fisher (2010)

Panel B: Credit is expressed in growth rates

Auel and de Mendonça (2011)
Belviso and Milani (2006)
Berkelmans (2005)
Bhattacharya (2014)
Breitenlechner et al. (2016)
Calmès and Théoret (2020)
Eickmeier et al. (2009)
Evans and Robertson (2018)
Goodhart and Hofmann (2008)
Gumata et al. (2013)
Hanisch (2019)
Hassan (2003)
Hofmann (2004)
Huber and Punzi (2020)
Iacoviello and Minetti (2008)
Kabashi and Suleva (2016)
Kronick and Wu (2019)
Martínez and Rodríguez (2021)
Mazelis (2016)
Mwankemwa and Mlamka (2022)
Nocera and Roma (2017)
Pescatori and Sole (2016)
Pool et al. (2015)
Prabheesh and Rahman (2019)
Robstad (2018)
Singh and Nadkarni (2020)
Stakėnas and Stasiukynaitė (2017)
Wilhelmsson (2020)

Paper Selection Procedure

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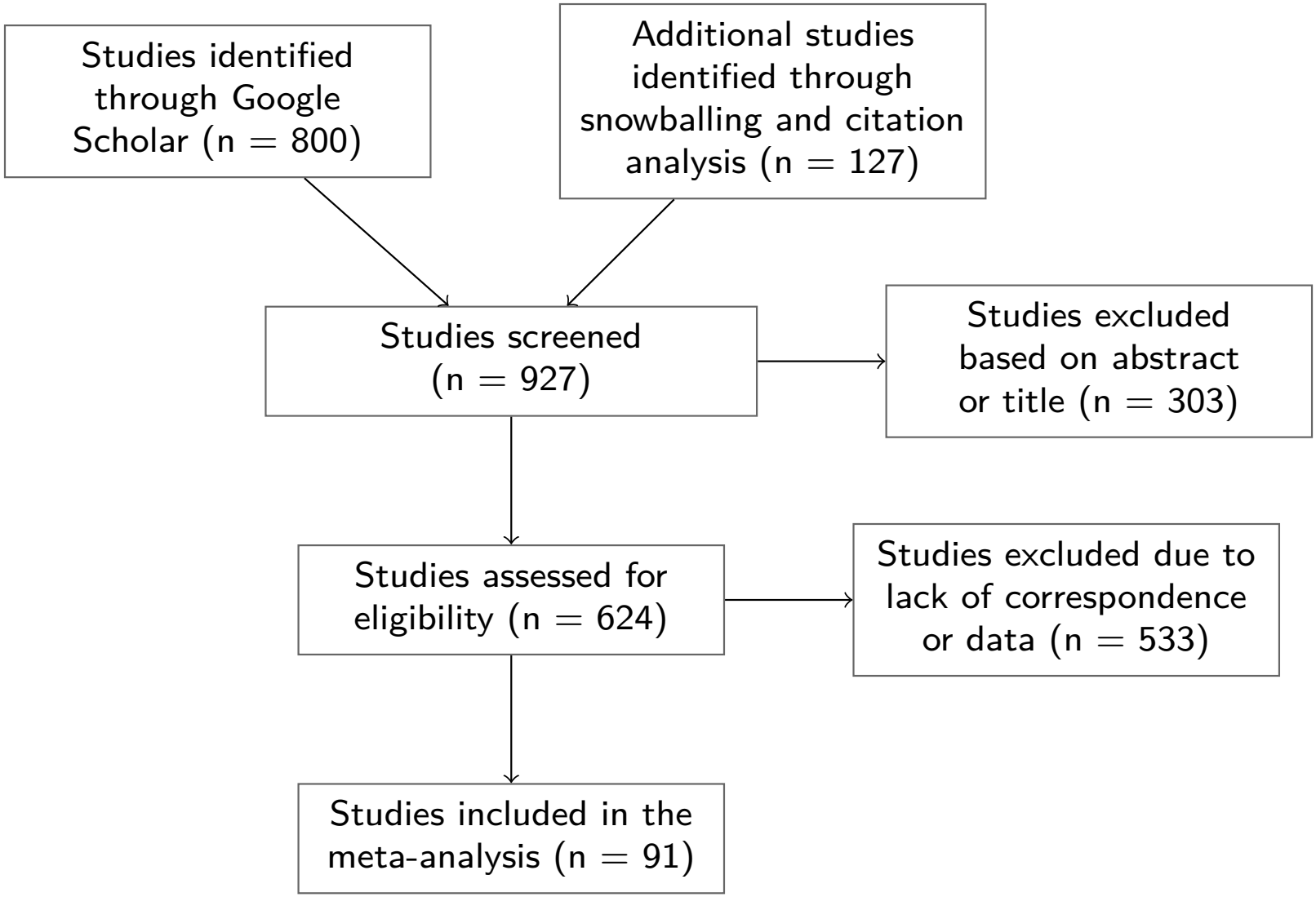

Publication Bias: Interactions

Table: Estimation of Publication Bias With Interaction Terms: Log-level of Credit

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Dummy: I(t-stat<1.65)			Dummy: I(β <0)			Dummy: I(t-stat<1.65, β <0)		
	Short	Medium	Long	Short	Medium	Long	Short	Medium	Long
Constant	-0.009	-0.082***	-0.102***	-0.003	-0.116***	-0.148**	0.011	-0.073***	-0.101***
	(0.011)	(0.023)	(0.028)	(0.011)	(0.041)	(0.072)	(0.010)	(0.019)	(0.028)
SE^2	-0.006	-0.048**	-0.112***	0.415***	0.405***	0.210***	0.054**	0.021	-0.106***
	(0.020)	(0.021)	(0.012)	(0.064)	(0.040)	(0.043)	(0.025)	(0.022)	(0.012)
Dummy	0.000	-0.005	-0.009	-0.003	-0.006	-0.012	-0.003	-0.007	-0.012
	(0.004)	(0.032)	(0.040)	(0.003)	(0.052)	(0.089)	(0.006)	(0.033)	(0.050)
$SE^2 \times$Dummy	0.720***	-0.531**	-0.961***	-0.600***	-0.694***	-0.440***	-4.567***	-2.226***	-1.090***
	(0.200)	(0.224)	(0.156)	(0.068)	(0.049)	(0.045)	(0.795)	(0.405)	(0.175)
I^2 level 1 (%)	0	0	0	0	0	0	0	0	0
I^2 level 2 (%)	0	0	0	0	0	0	0	0	0
I^2 level 3 (%)	100	100	100	100	100	100	100	100	100

Robustness tests – impulse responses, part 1

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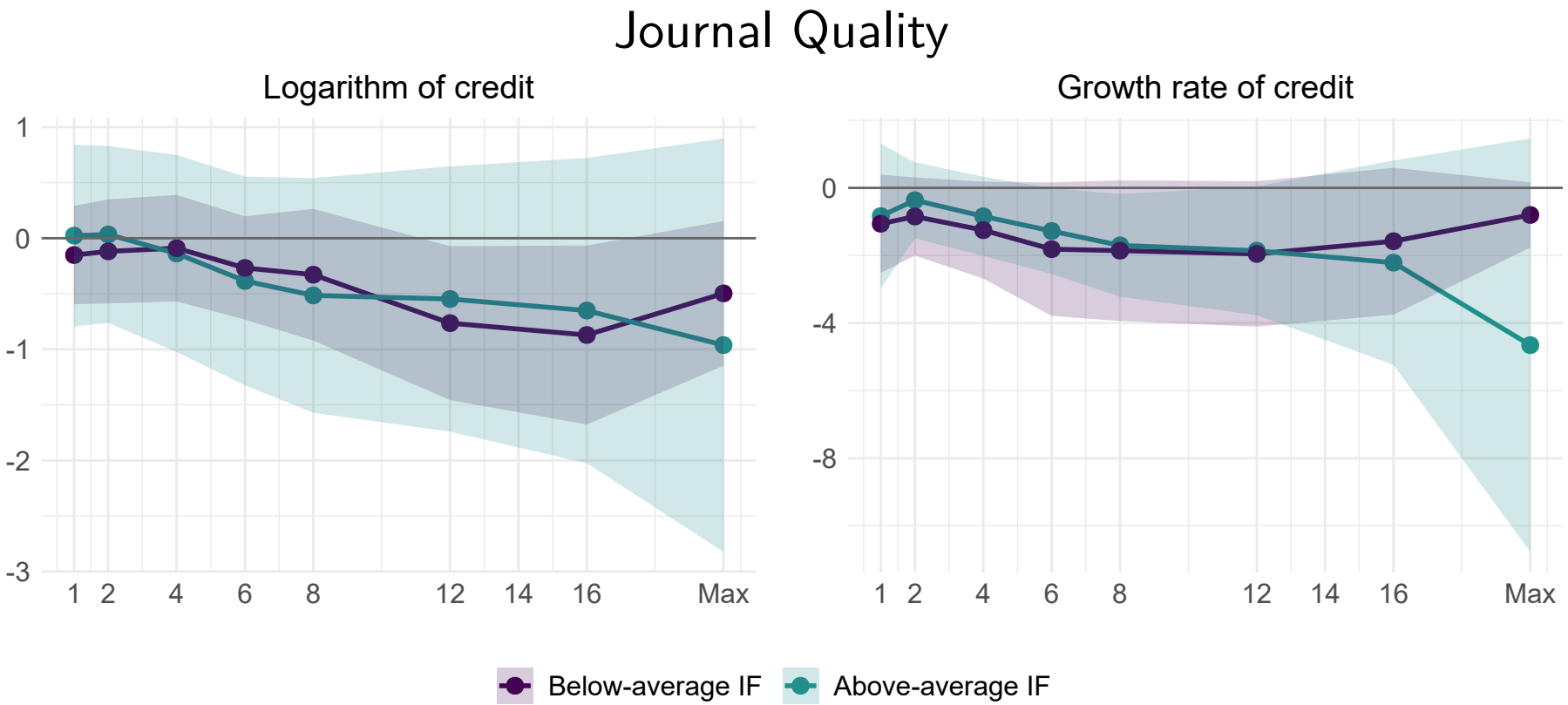
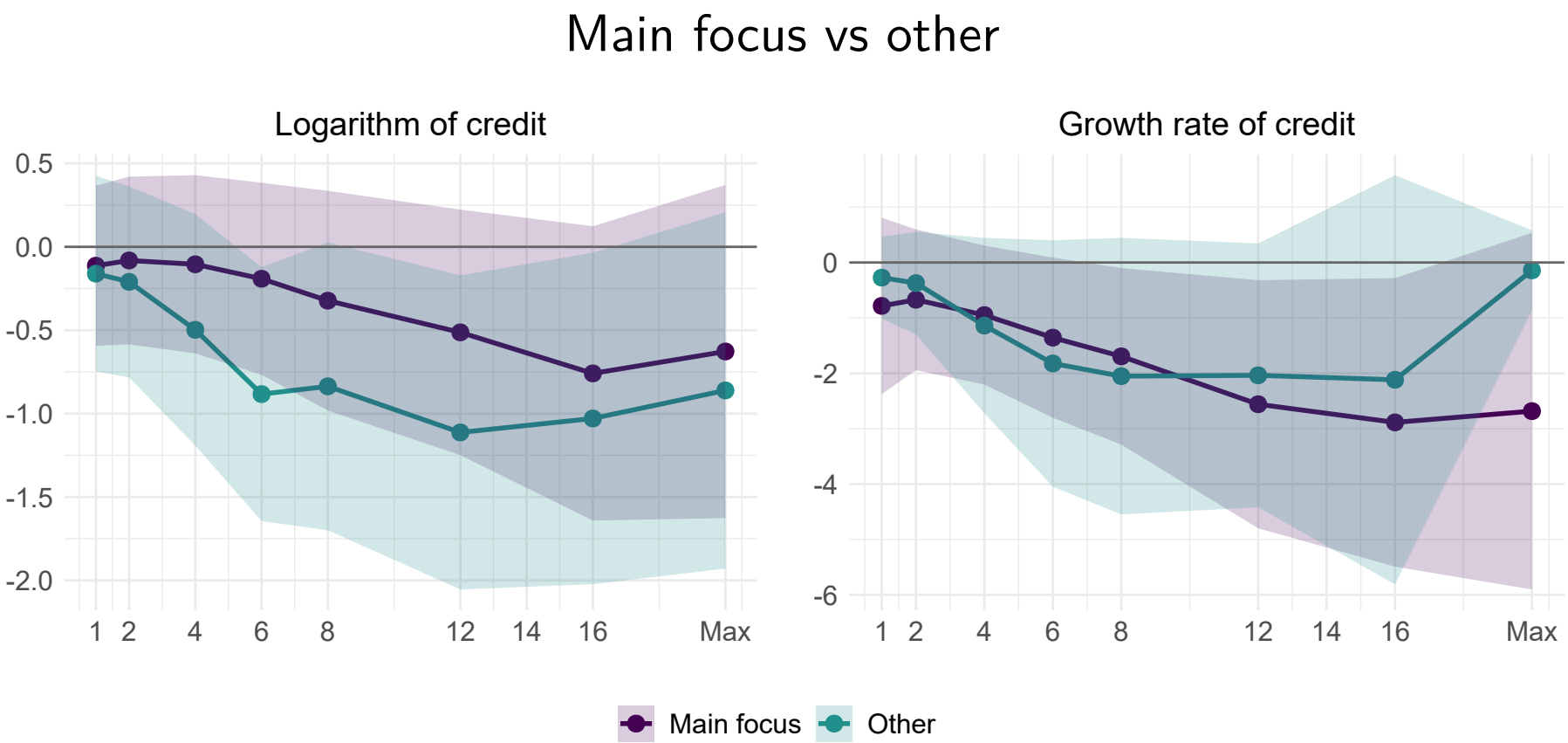
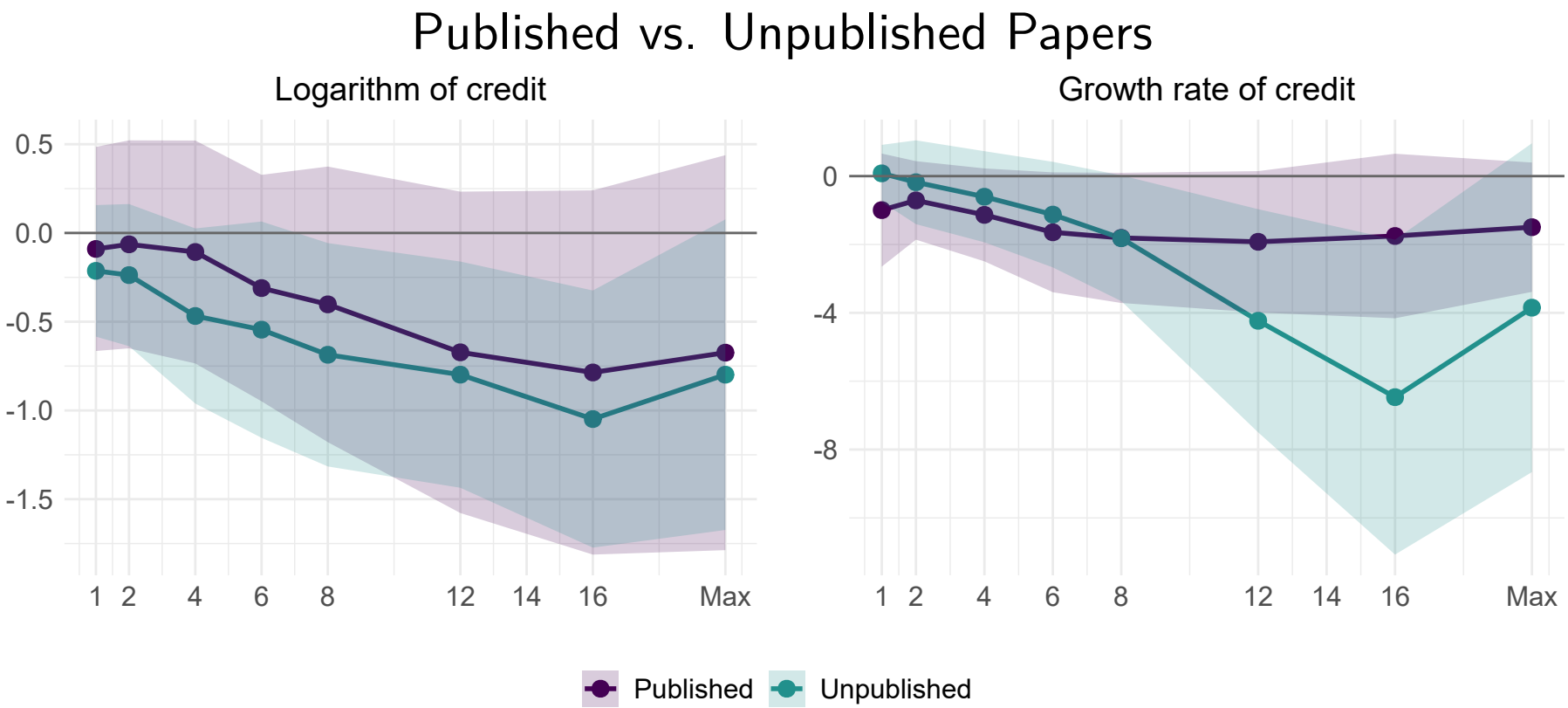


Robustness tests – impulse responses, part 2

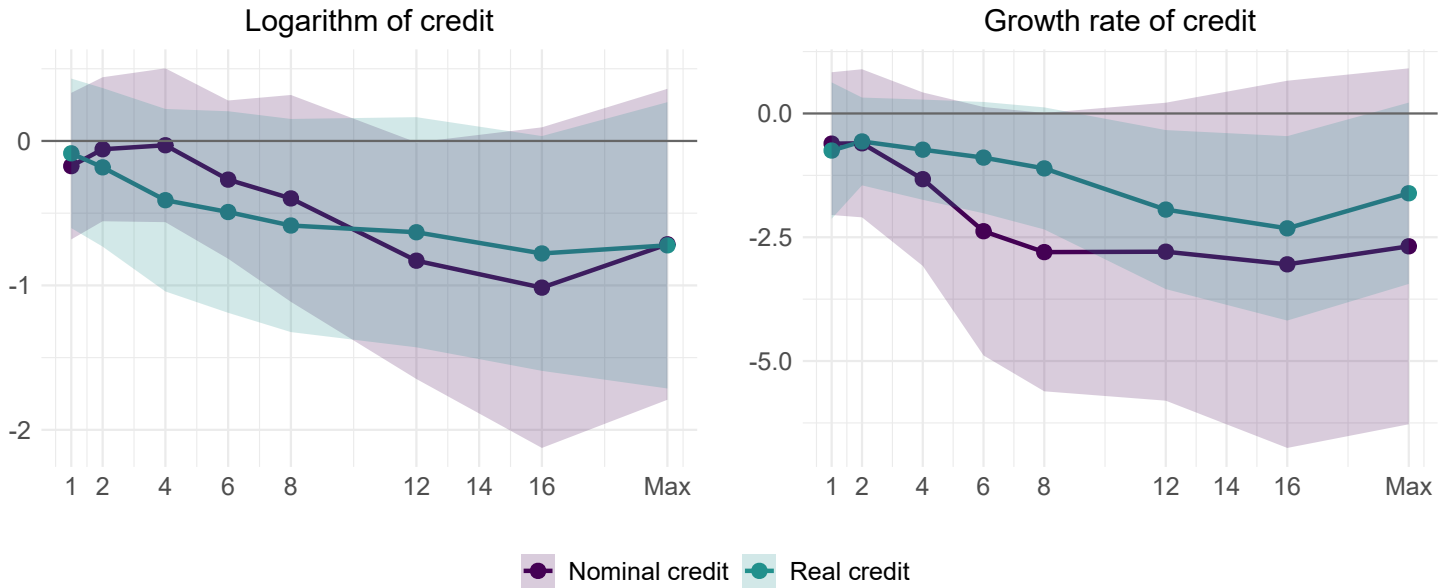


Robustness tests – impulse responses, part 3



Real vs. Nominal Credit

- For the context, 55% of primary studies (65% of semi-elasticities) in our sample use real credit.
- Studies that use nominal credit with those using real credit, we find that their results are very similar
- Moreover, the real credit is not a significant heterogeneity driver in the BMA.

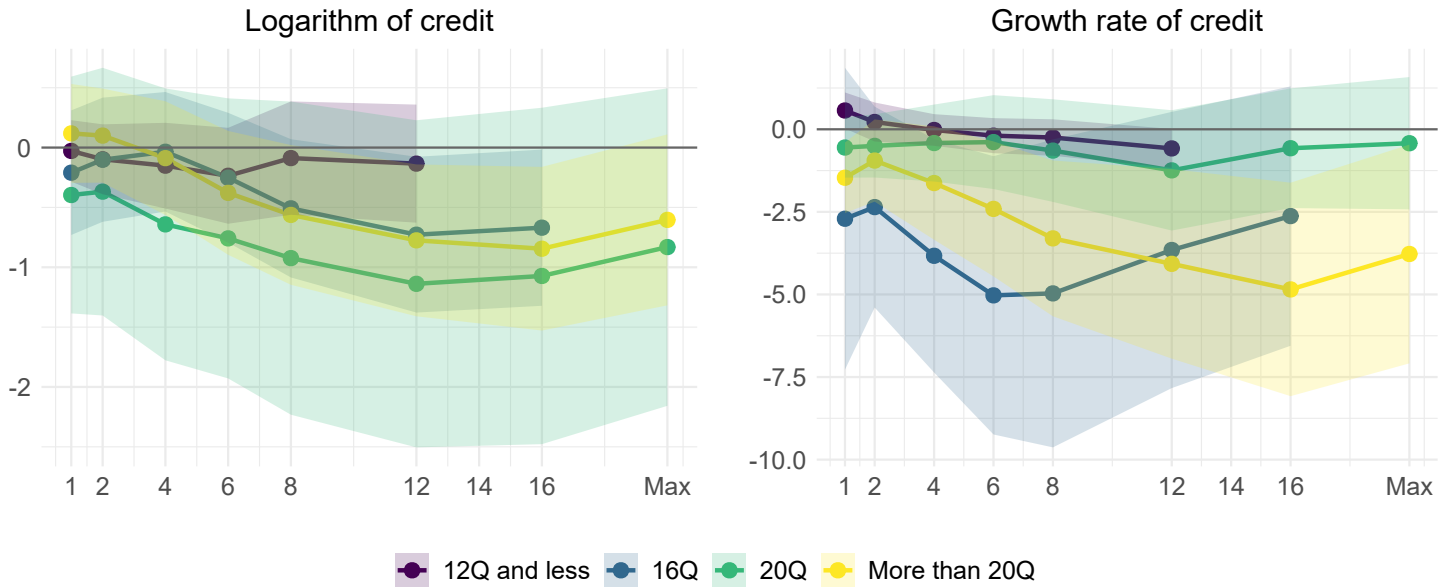


The Role of the Maximum Horizon (1/2)

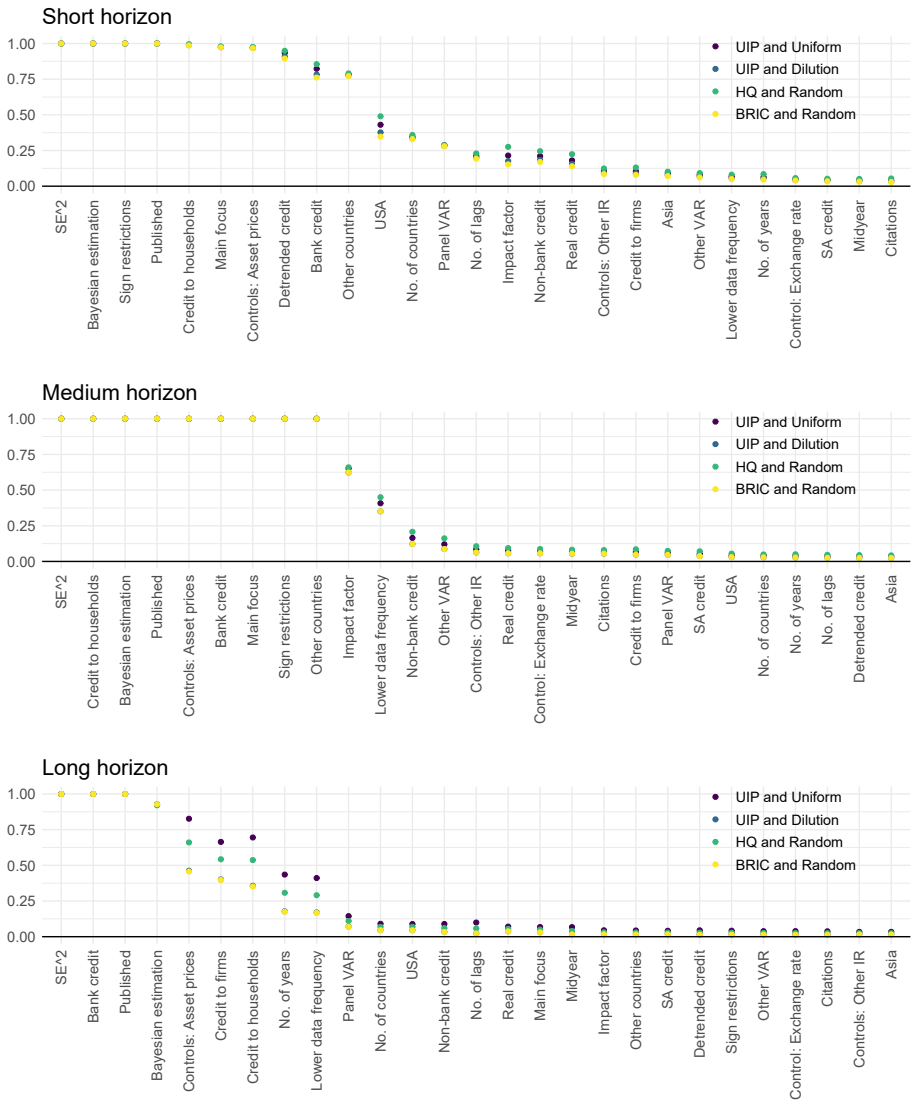
Max horizon	Obs.	Studies	Unweighted Mean	Unweighted 5%	Unweighted 95%	Unweighted Skew.	Weighted Mean	Weighted 5%	Weighted 95%	Weighted Skew.
Log-level of Credit										
6	16	4	-0.29	-1.36	0.23	-0.99	-0.17	-1.36	0.20	-1.70
8	6	4	0.17	-1.78	2.10	-0.06	0.18	-2.32	1.93	0.11
12	59	11	-0.22	-1.37	0.49	-1.69	-0.13	-1.42	0.49	-2.17
16	20	5	-0.66	-5.14	0.21	-2.29	-0.80	-5.51	0.10	-2.07
20	68	17	-0.99	-7.33	1.30	-1.51	-0.83	-7.33	0.93	-1.87
24	59	7	-0.44	-4.42	2.12	-1.11	-0.31	-3.35	0.93	-1.74
32	57	9	-0.71	-2.58	0.18	-1.27	-0.71	-3.18	0.00	-1.60
Growth Rate of Credit										
4	1	1	0.06	0.06	0.06	-	0.06	0.06	0.06	-
8	17	3	0.01	-0.11	0.16	2.58	0.18	-0.10	0.47	0.65
12	32	4	-0.44	-1.80	0.54	-2.39	-0.58	-4.77	0.34	-2.31
16	2	2	-0.06	-0.09	-0.04	0.00	-0.06	-0.09	-0.04	0.00
20	31	8	-0.57	-3.10	0.45	-1.48	-0.42	-3.06	0.49	-1.58
24	8	4	-3.55	-9.37	0.32	-0.38	-3.92	-9.60	0.31	-0.30
32	24	4	-1.89	-9.42	0.22	-1.36	-3.61	-9.60	0.03	-0.38

The Role of the Maximum Horizon (2/2)

- Potential bias: reporting response function only up to the horizon where convergence to zero is achieved.
- Both the table and the figure shows that studies that cut the response early rarely report zero-convergence.



BMA Sensitivity Analysis



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