Writing does not impact the evolutionary dynamics of syntax

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Writing Effects

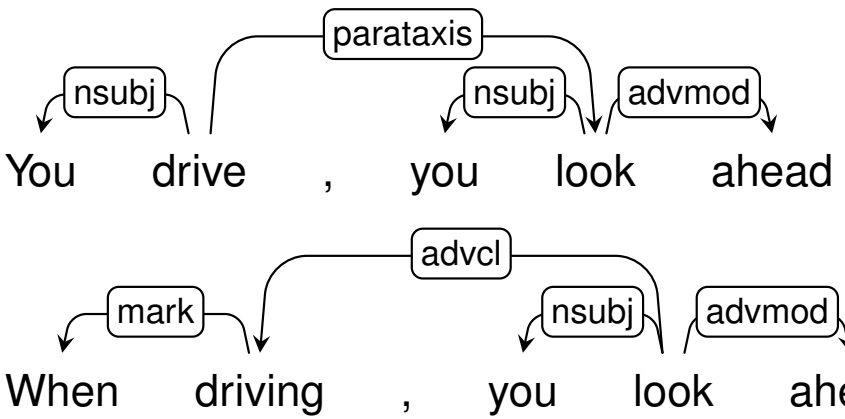
- Writing acquisition significantly impacts language processing (Dehaene et al. 2010; Cilibrasi, Adani, and Tsimpli 2019).
- However, its influence on the evolution of syntax remains unclear.
- Common hypothesis: writing fosters greater hierarchy and “syntactic complexity” (Delbrück 1900; Small 1924; Dąbrowska 2015).

Potential Effects on Language

- Writing may impact language on two levels:
  - **Language use**: Variation in syntactic usage across different communication mediums (synchronic).
  - **Language grammar**: Changes in the grammatical structure of a language (diachronic).

Assessing Language Use

– Universal Dependencies (UD) data used to quantify “syntactic complexity”:



– Metrics: total number of clauses per sentence, maximum clause depth (“maximum clausal path”).

Data

Catena Len.	Genre	Language	...
0	spoken	Abaza	...
2	spoken	Abaza	...
⋮	⋮	⋮	...
1	fiction	Czech	...
⋮	⋮	⋮	...
3	wiki	Chinese	...
⋮	⋮	⋮	...

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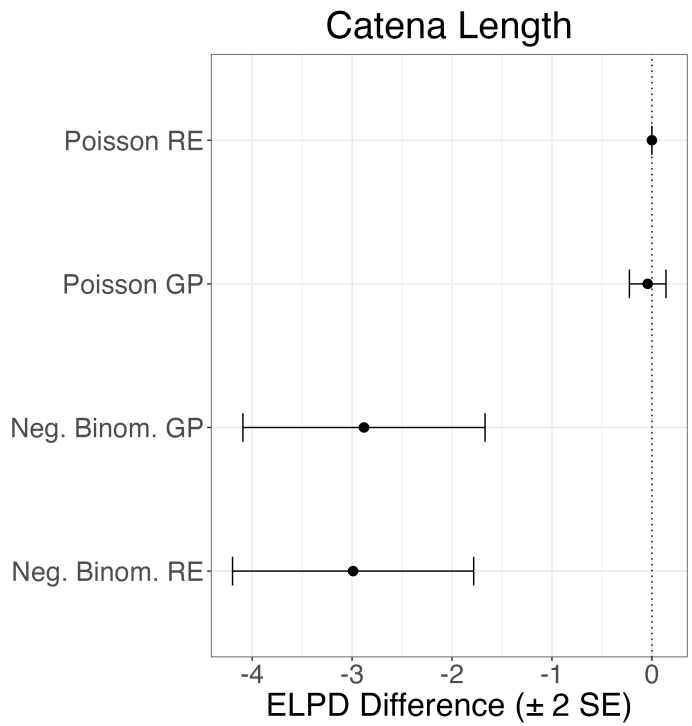
- We contrasted three genres: Spoken, Fiction and Wikipedia.
  - Spoken: 31,277 sentences.
  - Fiction: 35, 103 sentences.
  - Wiki: 33,454 sentences.

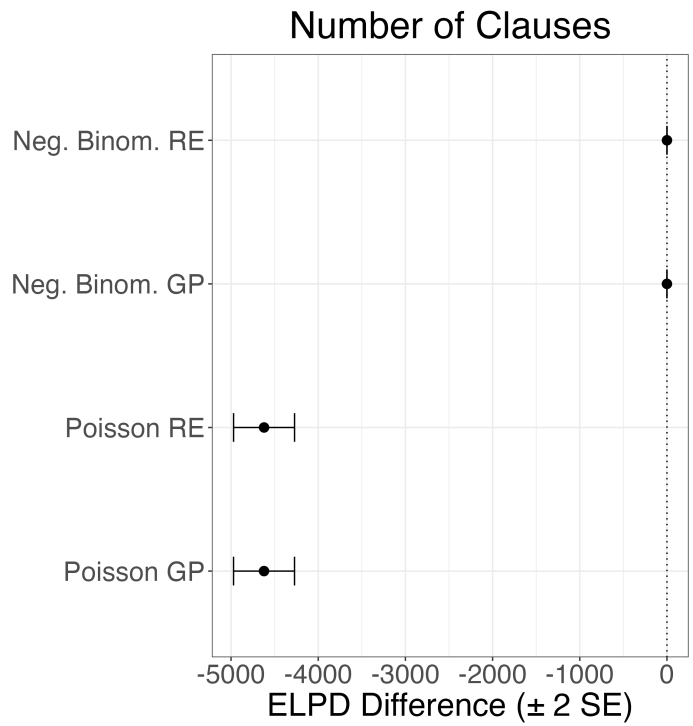
Modeling Approach

```
catena_len ~ 1 + genre + (1|treebank) + (1|area) +
             (1|gr(phylo, cov = phylo))
```

- We controlled for phylogenetic, areal and dataset-specific effects ("treebank").
- Employed regression models:
  - Poisson vs. Negative Binomial (accounting for over-dispersion).
  - Controlled for areal effect via Gaussian Process (GP) and Random Effects (RE) over micro-areas (Bickel et al. 2023).

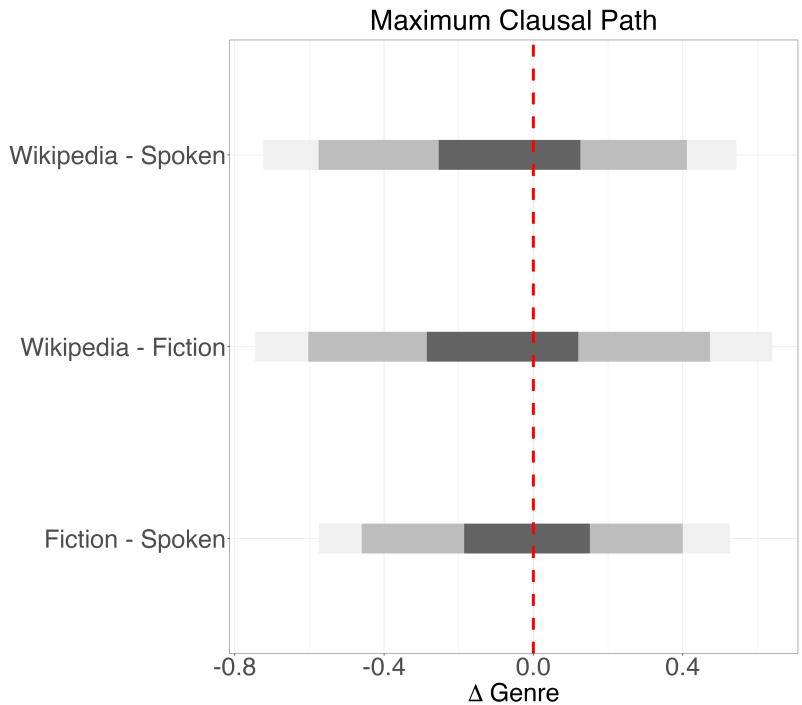
Model Comparison

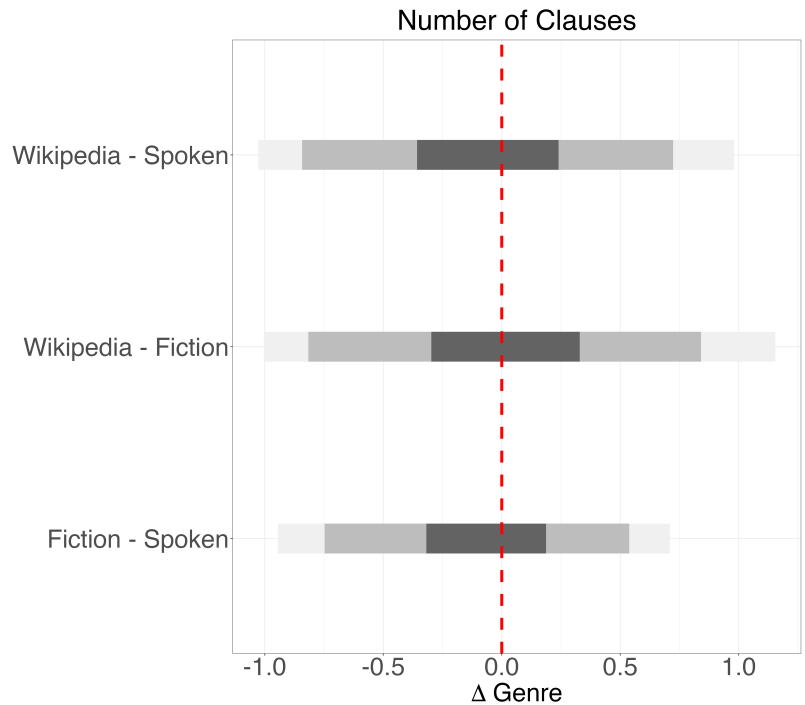




Results

- Marginal effects show no significant effect of genre on either measure of “syntactic complexity”.
- No detectable phylogenetic or areal influences.





Assessing Language grammar

– Examined 763 clause-combining constructions across 59 languages.

Data

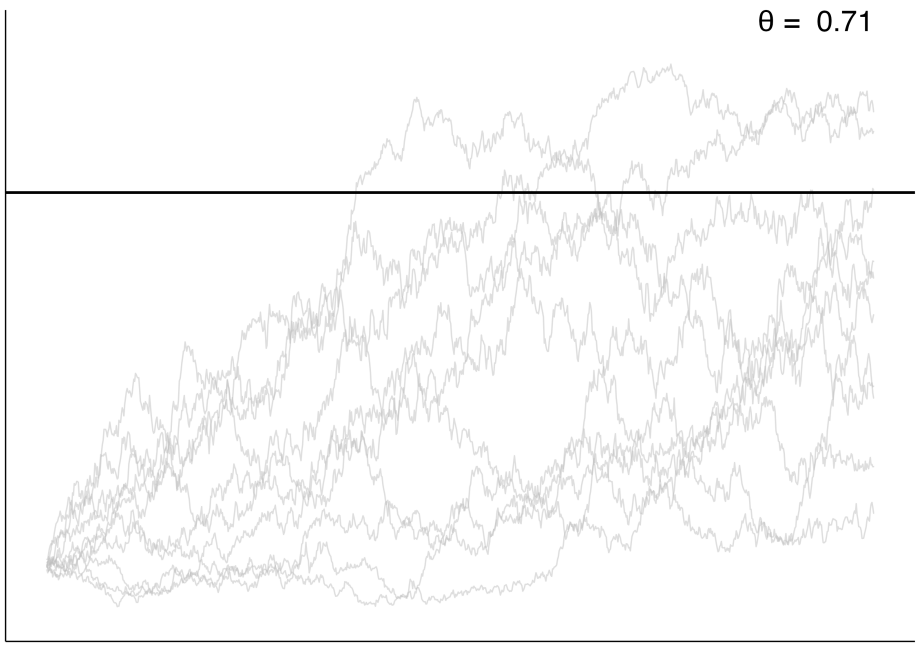
– Structured according to van Gijn, Galucio, and Nogueira (2015).

Construction	Asymmetry	Language	Value
C_{A1}	SubjAgrLim	Albanian	0
C_{F1}	SubjAgrLim	French	1
⋮	⋮	⋮	⋮
C_{T2}	ObjAgrLim	Tocharian	0
⋮	⋮	⋮	⋮
C_{G3}	OrderLim	Gothic	1
⋮	⋮	⋮	⋮

– Asymmetry values used to calculate the probability of a binomial process ($\mathrm{B}(n_{success}, p_{asymmetry})$).

Phylogenetic Modeling

$$\underline{\text{SDE}}: \underbrace{d\overbrace{X_t}^{\text{trait value}}}_{} = \underbrace{\alpha}_{\text{strength}}(\overbrace{\theta}^{\text{optimum}} - X_t)dt + \underbrace{\sigma}_{\text{rate}} dW_t$$



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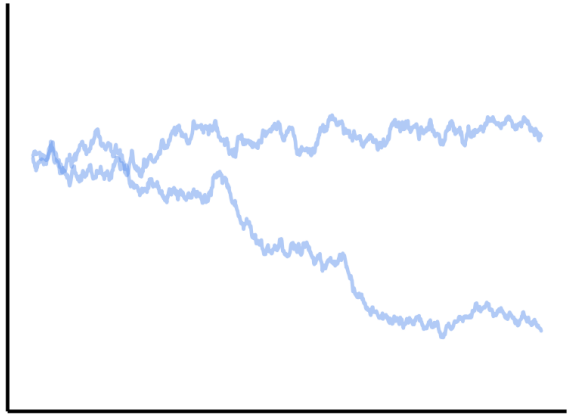
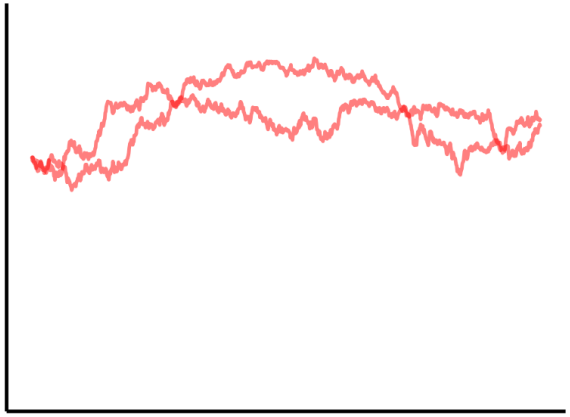
– Each regime has different θ, α and σ parameters.





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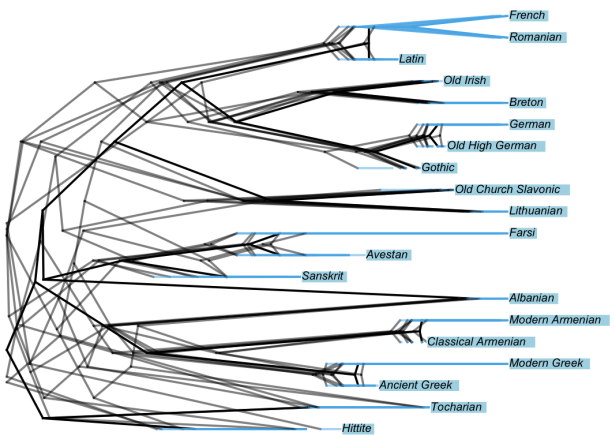
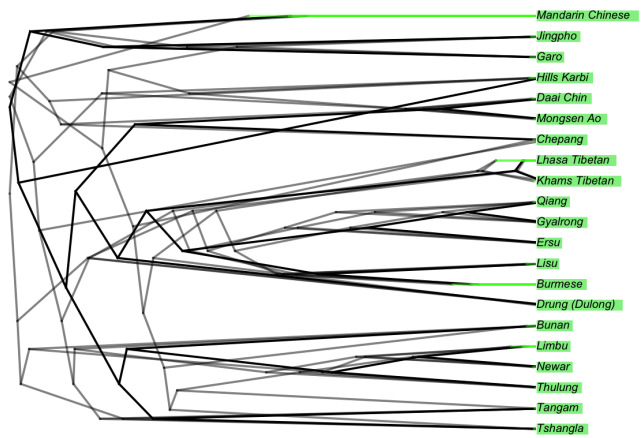
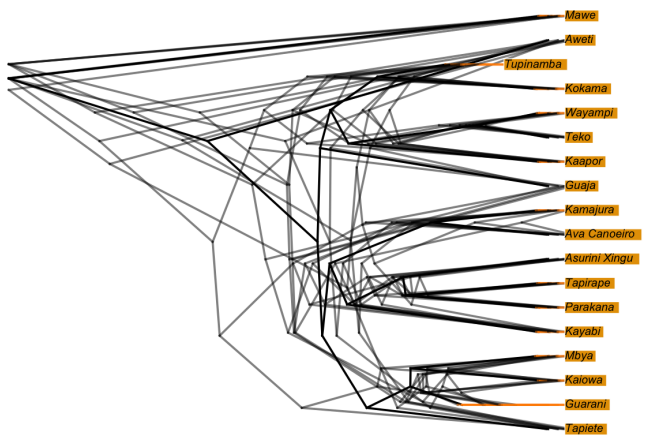
– We compared two regimes, “writing” (colored branches) vs. “non-writing” (black branches).







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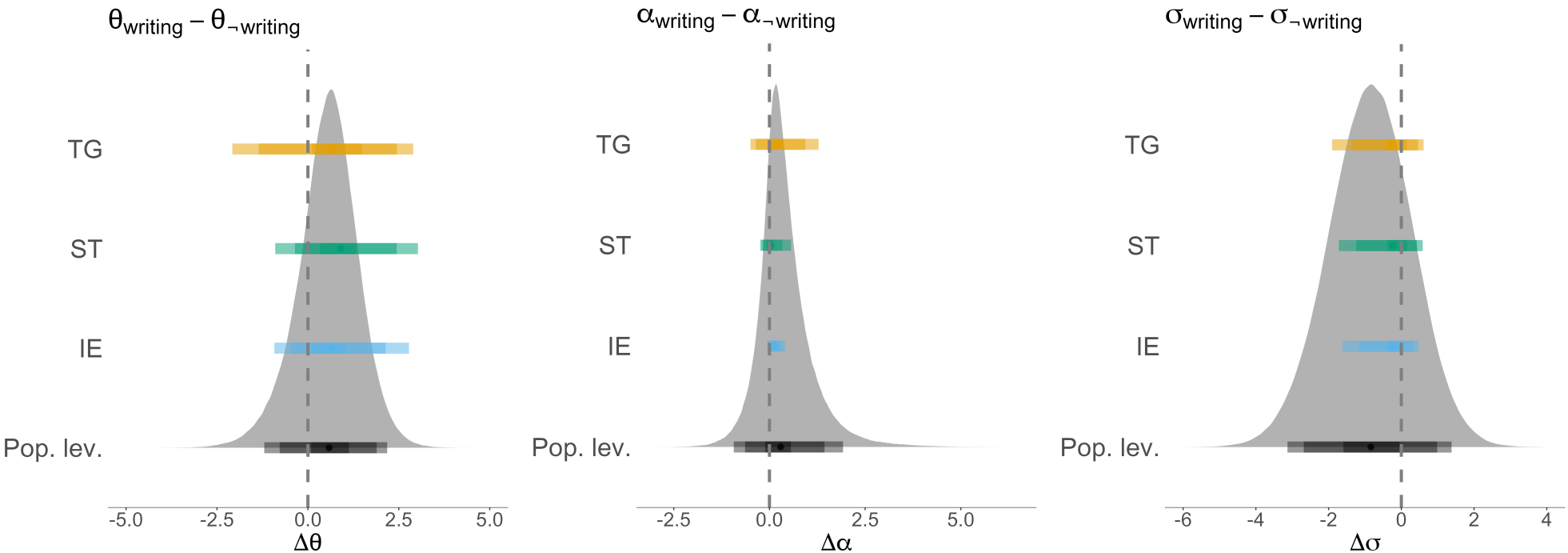
– No significant differences in parameter values (θ, α, σ) between writing and non-writing regimes.



Conclusions

- No evidence supporting the impact of writing on hierarchy degree, both in terms of language use and grammar.
  - No differences found across genres.
  - No differences in the parameter values across the two regimes.
- Decreased σ and increased α in IE (and to a lesser extent, ST and TG) may indicate a trend toward normativization in the writing regime.
  - Differences among families may reflect distinct cultural traditions of writing.

Thanks for your attention!

Questions?

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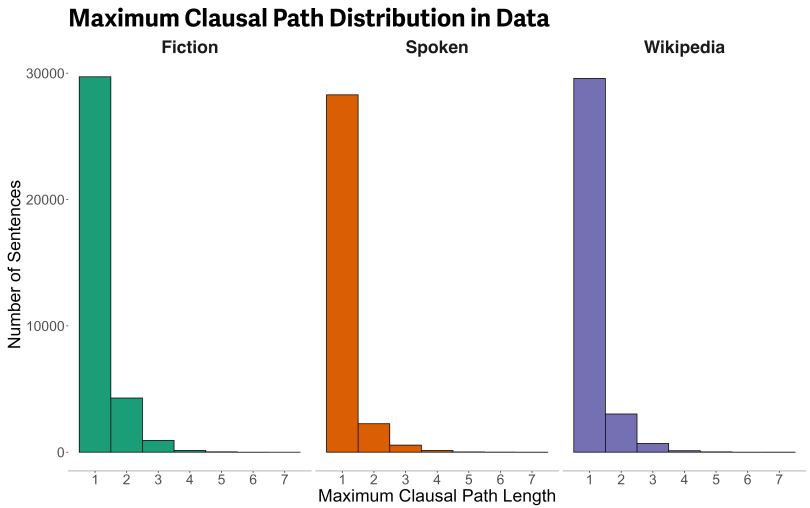

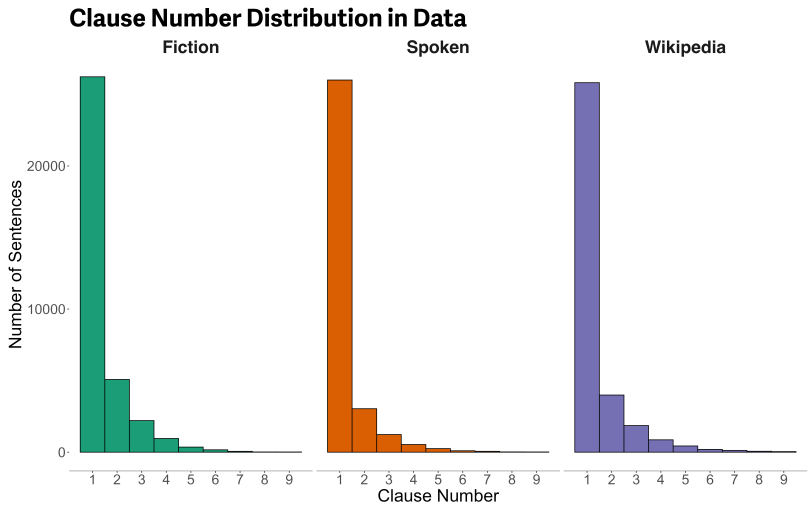

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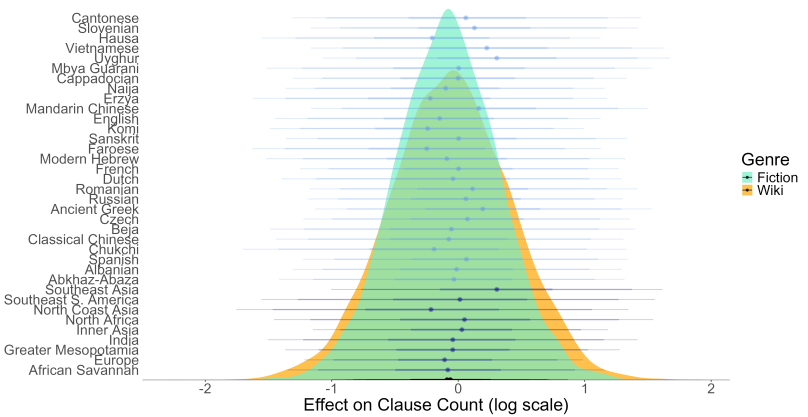
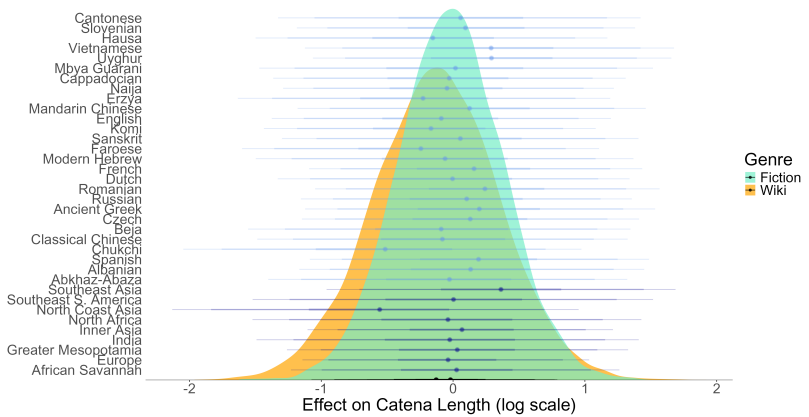
Clause Number
Predicted Differences from Spoken Genre



Maximum Clausal Path
Predicted Differences from Spoken Genre



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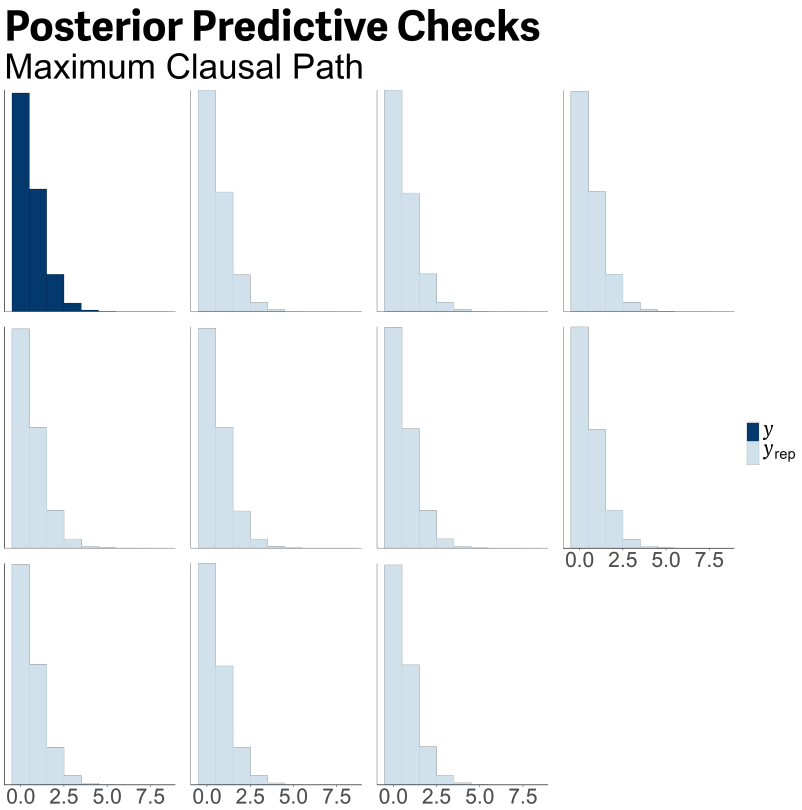

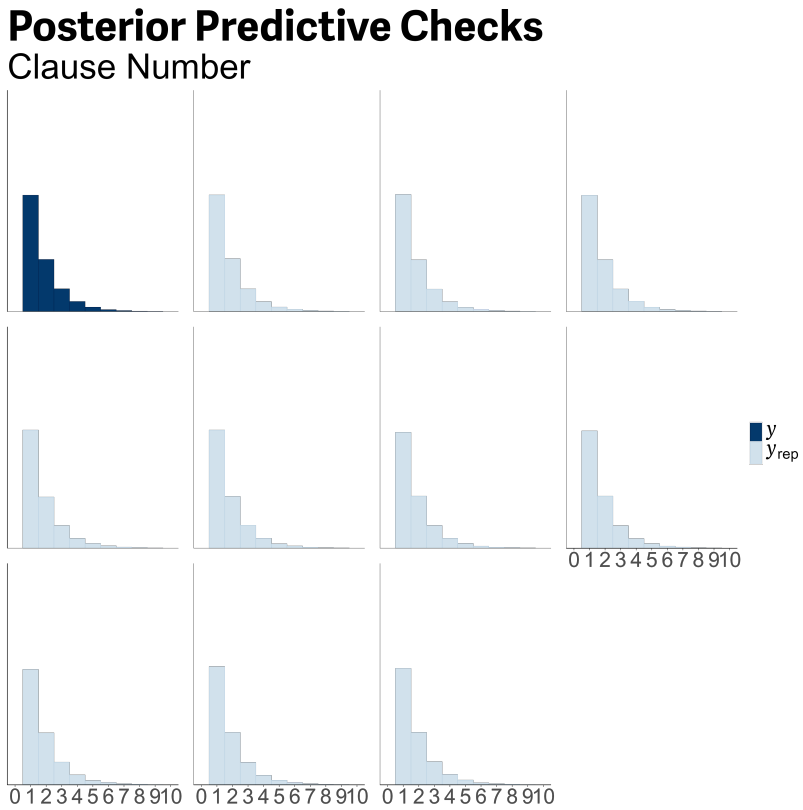

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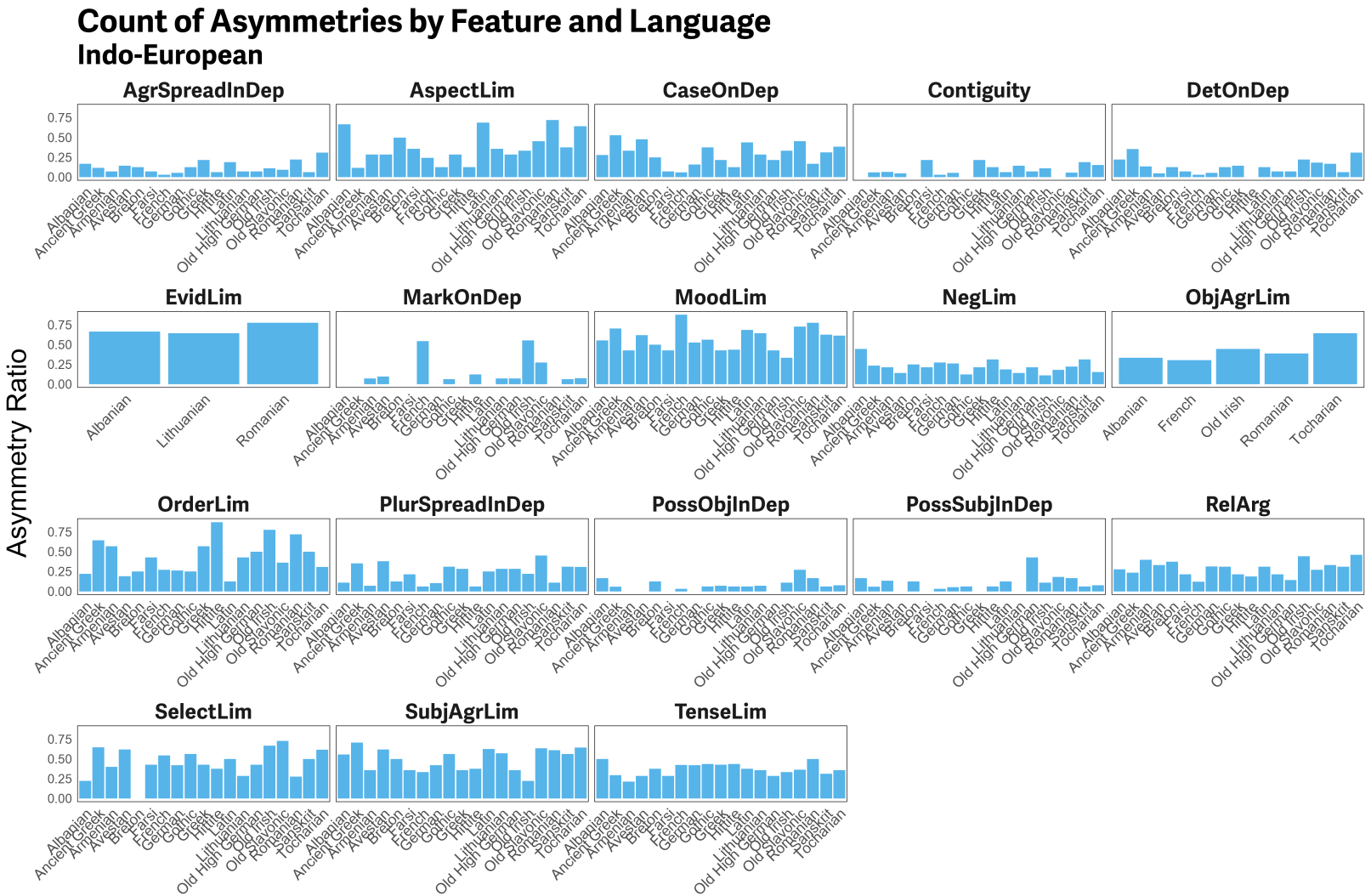

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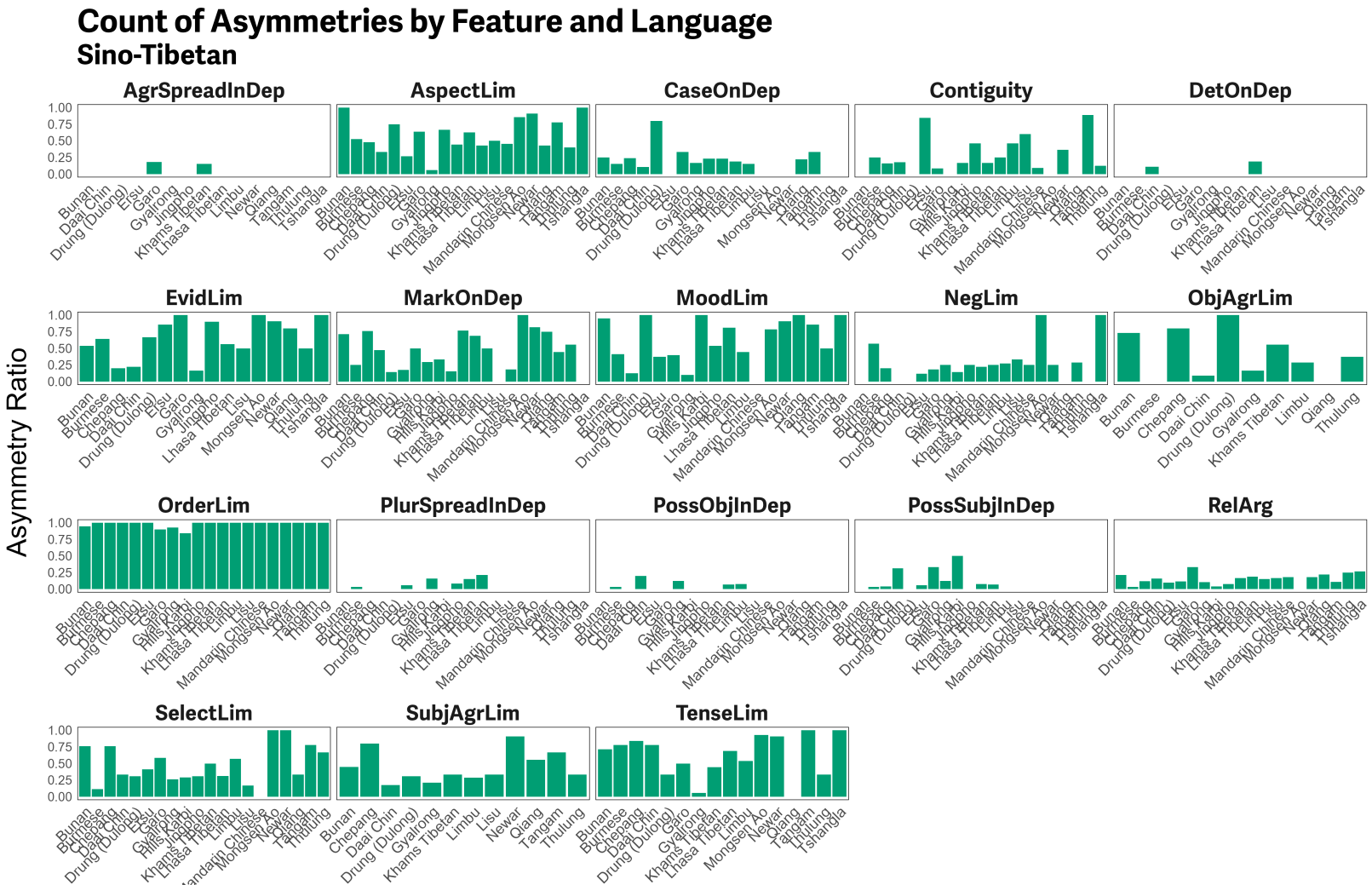

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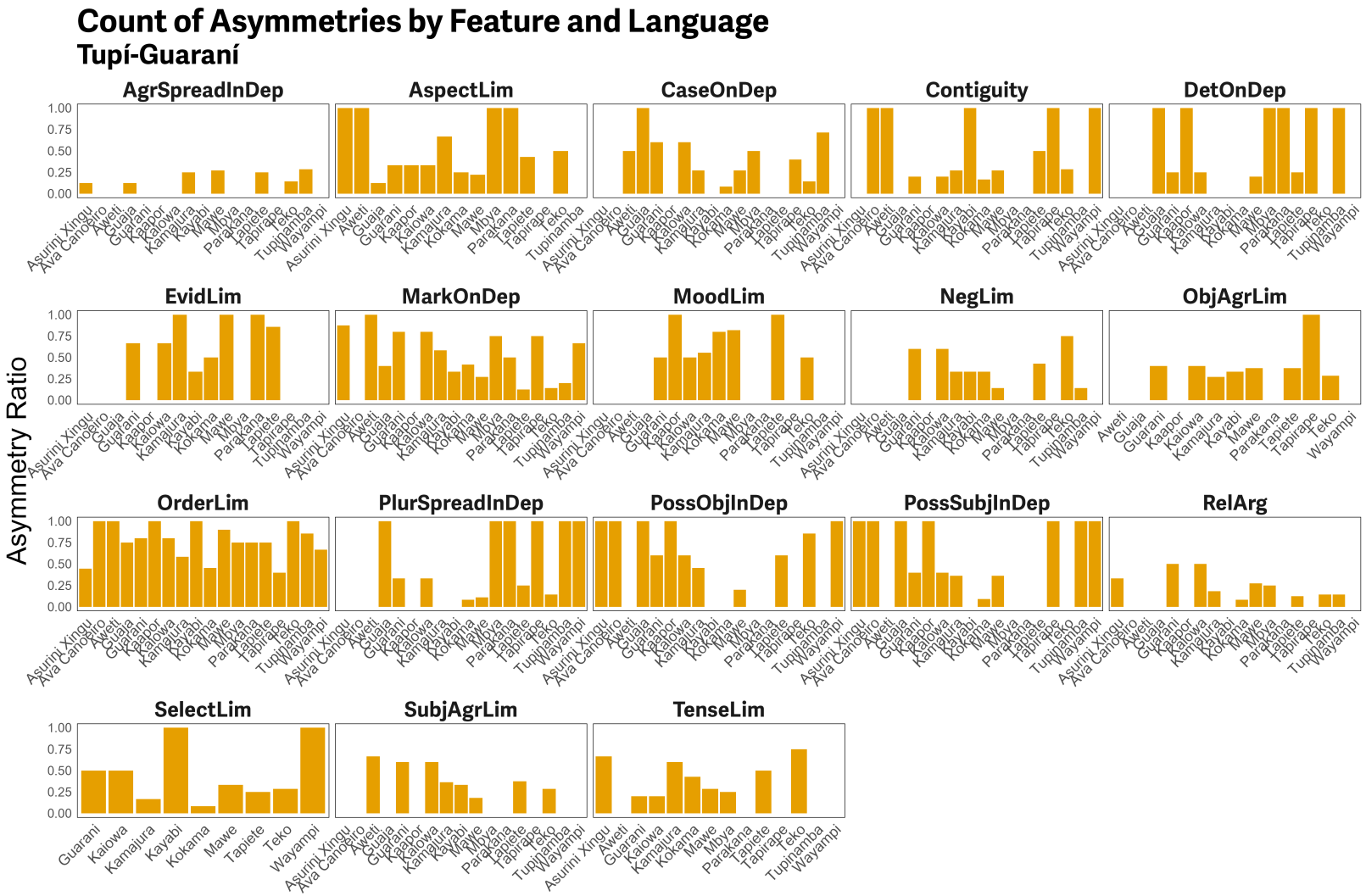

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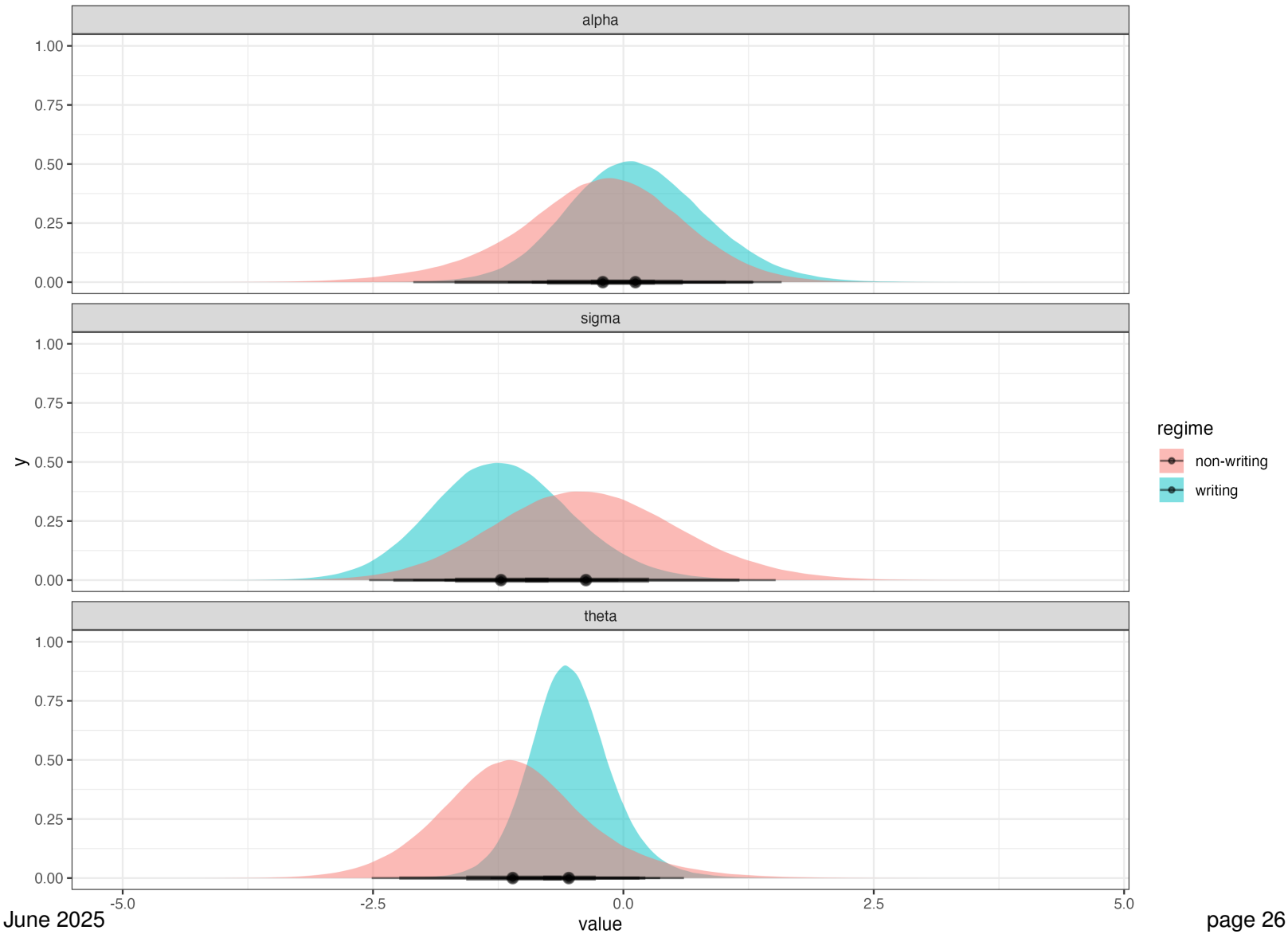

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Parameter	Median	HPDI (95%)	$\Pr(\Delta\beta) > 0$
θ_μ	0.58	$[-1.19, 2.18]$	76.62%
θ_{IE}	0.66	$[-0.95, 2.78]$	84.46%
θ_{ST}	0.90	$[-0.90, 3.08]$	89.45%
θ_{TG}	0.69	$[-2.13, 2.91]$	73.08%
α_μ	0.30	$[-0.93, 1.92]$	74.44%
α_{IE}	0.14	$[-0.06, 0.41]$	95.42%
α_{ST}	0.04	$[-0.24, 0.56]$	63.12%
α_{TG}	0.21	$[-0.50, 1.28]$	77.34%
σ_μ	-0.84	$[-3.14, 1.37]$	23.02%
σ_{IE}	-0.25	$[-1.62, 0.47]$	20.29%
σ_{ST}	-0.22	$[-1.72, 0.58]$	26.75%
σ_{TG}	-0.26	$[-1.90, 0.62]$	25.47%

Differences in Ornstein-Uhlenbeck process parameter values between writing and non-writing regimes. All values in the table represent the difference between the writing and non-writing regimes, calculated as $\beta_{\text{writing}} - \beta_{\neg\text{writing}}$.