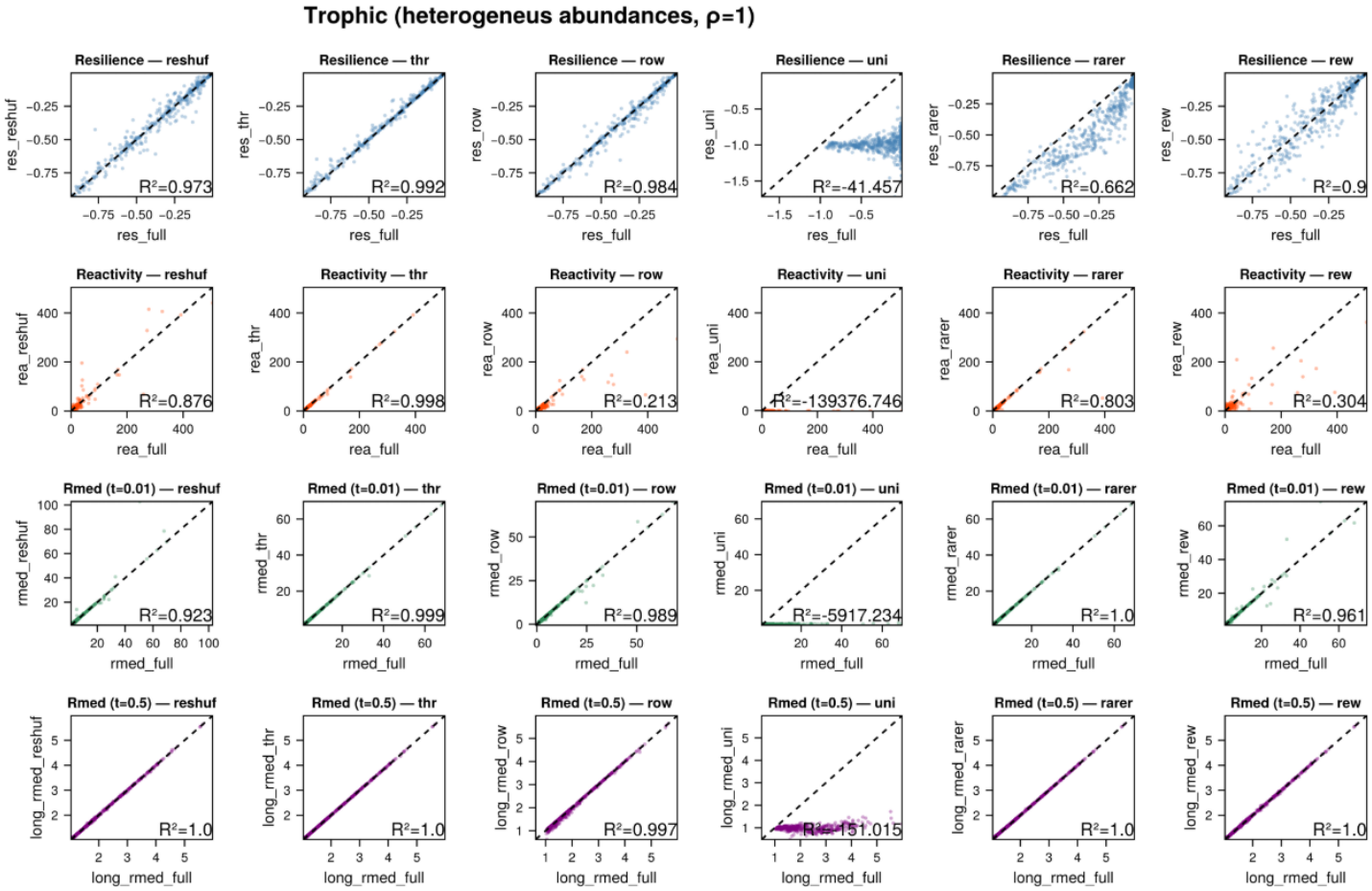
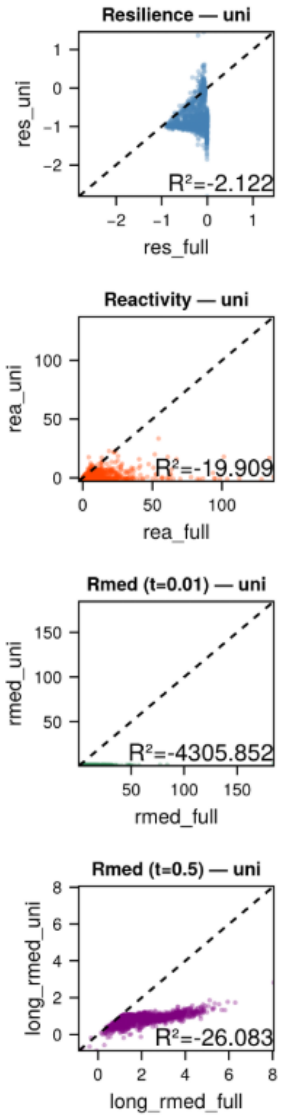
General claims

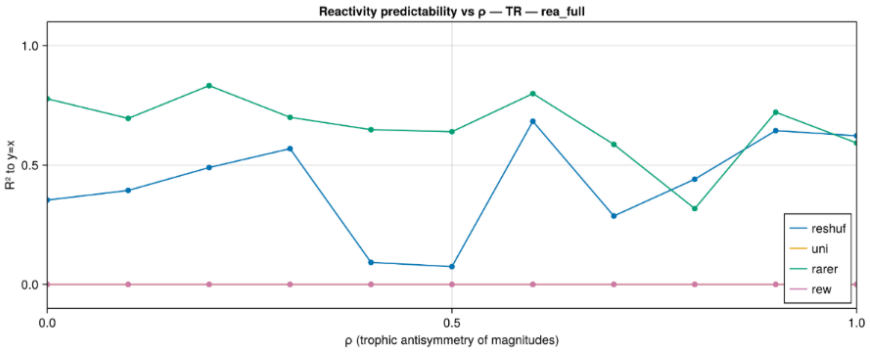


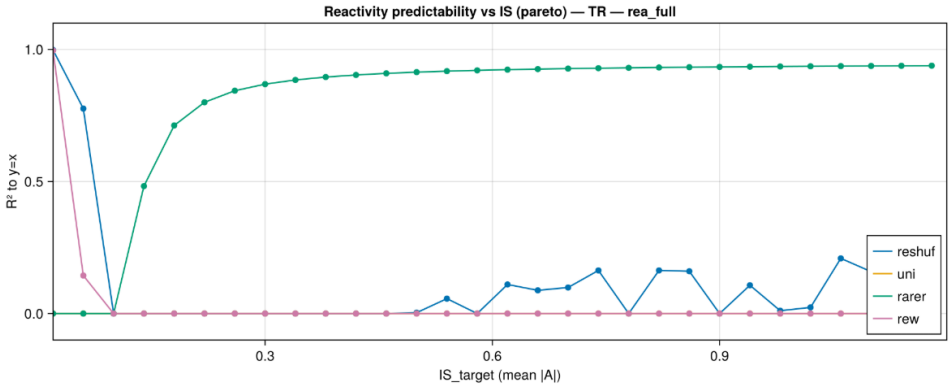
Claim 1. Time scale dominance

Heterogeneity in species time-scales (the u vector) is the primary determinant of predictability across dynamics. Homogenizing time-scales is consistently the most destructive operation for predictability—across resilience, reactivity, and median return rates.

Figure 1: Uniform u crushes predictability.



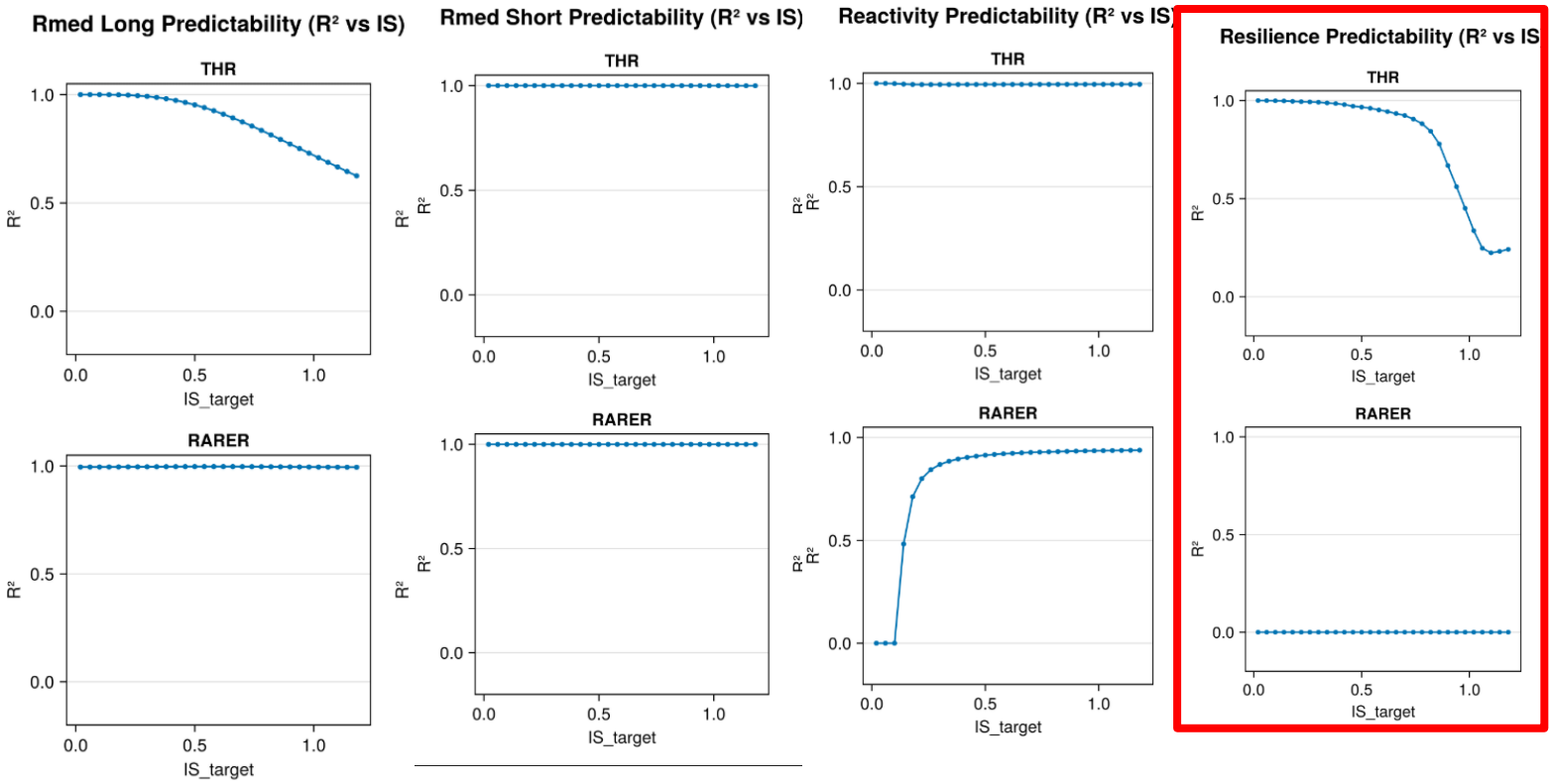




Claim 2. Coarse over detail

Most community-level responses are governed by a subset of strong interactions among common species. Modifications that mainly target weak links (e.g., thresholding 20%) or rare species have low to moderate influence on most dynamics, except for resilience when interaction strength is high or trophic asymmetry is very low.

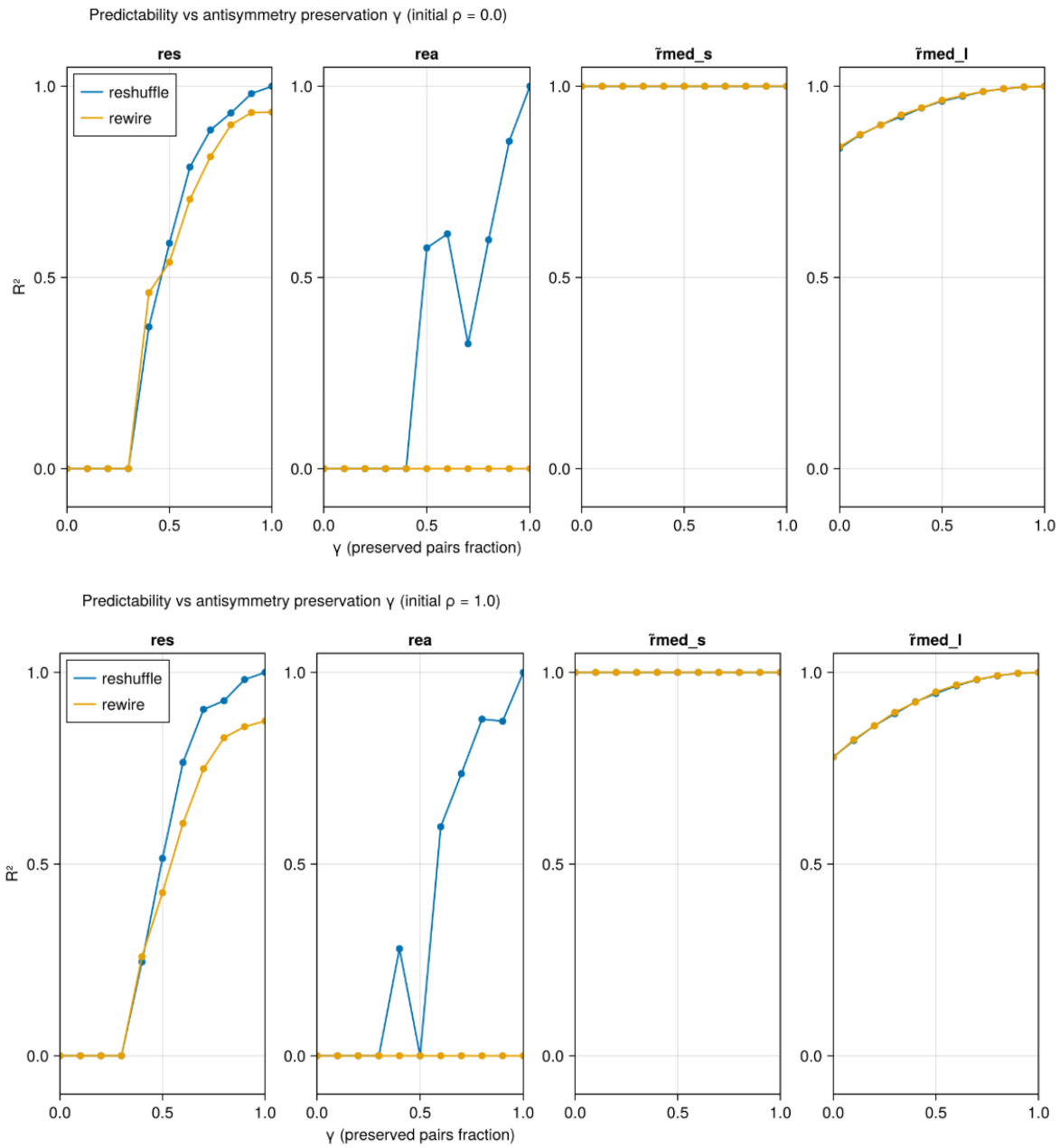
Figure 2: Weak-link pruning is mostly irrelevant, except for Resilience at high IS. R^2 vs IS for step = thr and step = rarer. Near-flat, high R^2 for reactivity and Rmed; declining R^2 for resilience as IS increases.



Claim 3. Distribution of IS and topology have similar relevance (in trophic webs).

Changing who carries strong interactions (reshuffling magnitudes among pairwise interactions) degrades predictability only when it breaks trophic antisymmetric at the pair level. If pairwise magnitudes are preserved, effects are minor and show up mostly in resilience (the most sensitive endpoint).

Figure 3: Placement matters only if pair antisymmetry is broken

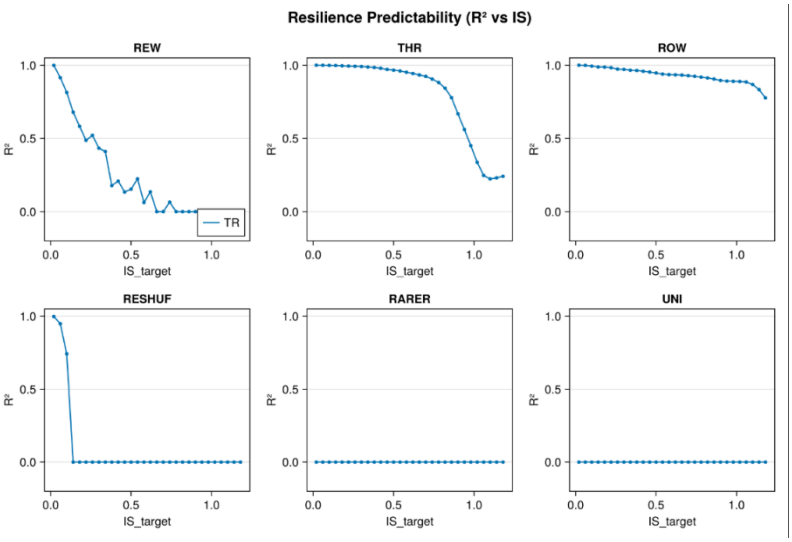


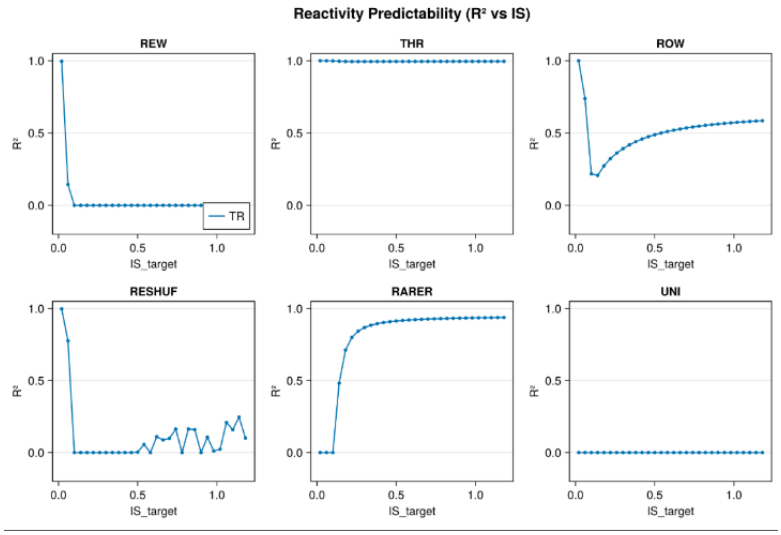
Claim 4. Interaction strength sets the regime.

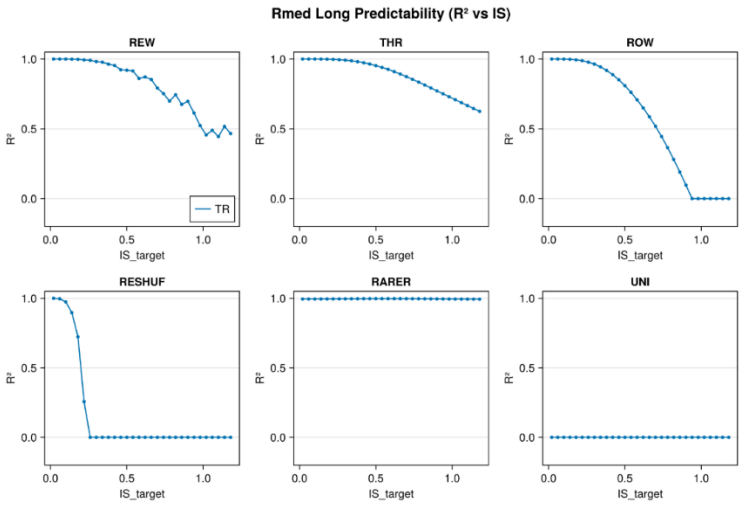
As IS (mean |A|) increases, network-level modifications become increasingly consequential—primarily for resilience, and to a lesser extent for reactivity; at low IS, abundance time-scales dominate and "touch-A" steps have little impact.

Figure 4. IS governs when structure kicks in. For each step ∈ {reshuf, rew, row, thr}, line of R^2 vs IS; facet by metric.

This does not happen for short rmed since it is always driven by the time scale vector

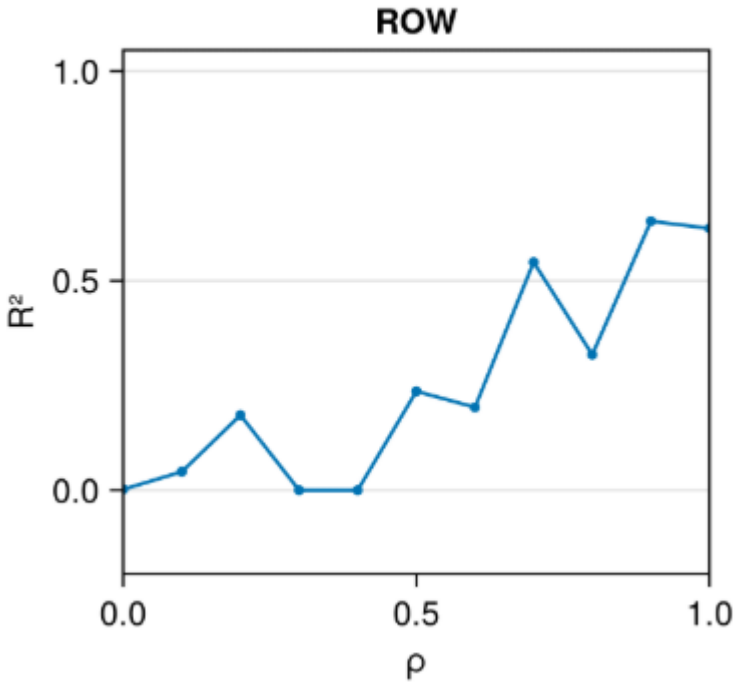




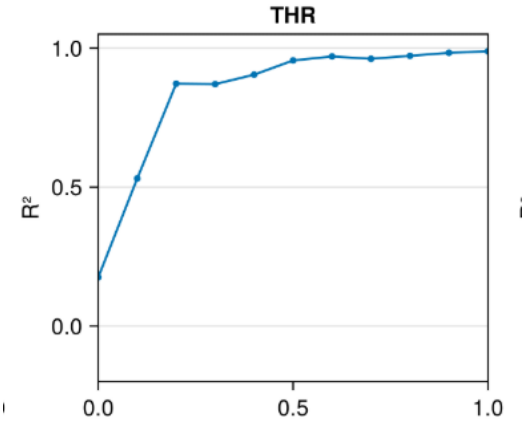


Claim 5. Antisymmetry tunes sensitivity (step × ρ interactions). The level of trophic antisymmetry (ρ) modulates which simplifications matter:

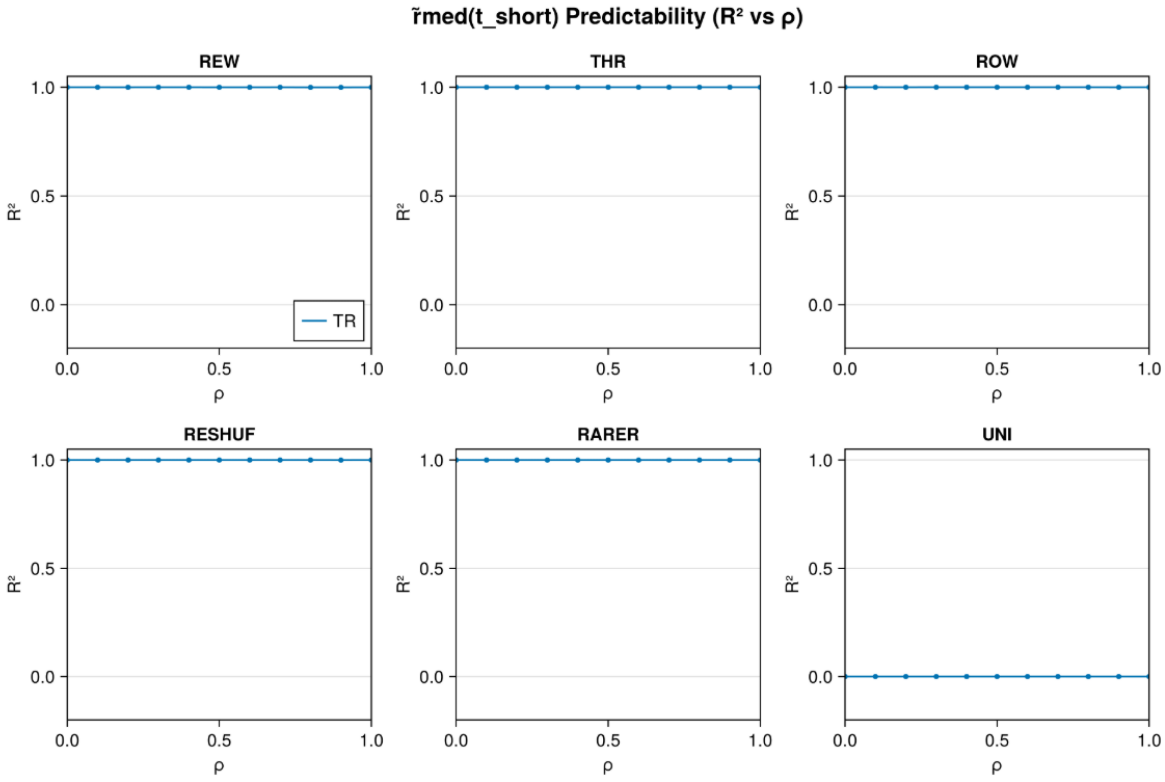
- Row-averaging: reactivity predictability is low at low ρ, high at high ρ.



- Thresholding: impact on resilience decreases with ρ.



- Rmed shows no systematic dependence on ρ (within the tested range).



Claim 6. Two-stage recovery, generally.

Early dynamics are time-scale driven and largely insensitive to wiring; later dynamics become structure-limited, with outcomes hinging on where strong effects sit and on slow or rare species.

Figure 6. Two-stage recovery is general. R^2(step vs full) vs t (log axis) for steps (thr, row, reshuf, rew) at mid IS and mid ρ.