



R&D Management Workshop 2026

Who Survives the Scientific Pivot?

Long-Term Consequences of Scientific Pivots

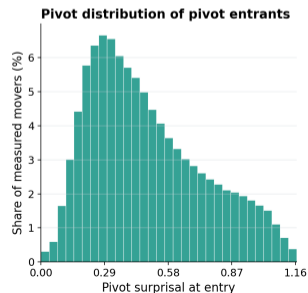
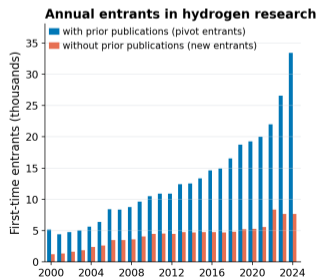
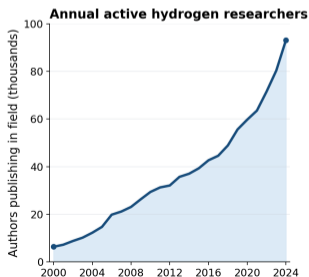
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This work was supported by the NRF Grant funded by the Korea Government (MSIT) under Grant No. RS-2025-00516776.
This work was also supported by the Ministry of Education of the Republic of Korea and the NRF of Korea (NRF-2020S1A3A2A02093277).

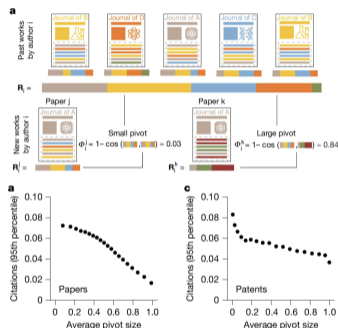
Emerging fields grow through heterogeneous researcher mobility.

- Emerging fields (e.g., hydrogen research) expanded rapidly, with increasing number of active researchers over time.
- This growth is driven especially by entrants with prior publications outside the focal field, i.e., pivot entrants.
- Among pivot entrants, their magnitude of departure from prior trajectories (pivot magnitude) varies widely.



Recent studies document the prevalence and consequences of scientific pivots.

- Research interests evolve over scientific careers (Jia et al., 2017).
- Scientists have become more likely to switch between topics over time (Zeng et al., 2019).
- Recent work formalizes the cost of pivots and documents a **pivot penalty** (Hill et al., 2025).
- Existing studies have typically focused on short-term outcomes (e.g., citation impact of the pivot paper).



Hill et al. (2025)

- Yet, little is known about what happens to scientists after they pivot to a new field, leaving the **long-term career consequences of pivots** underexplored.

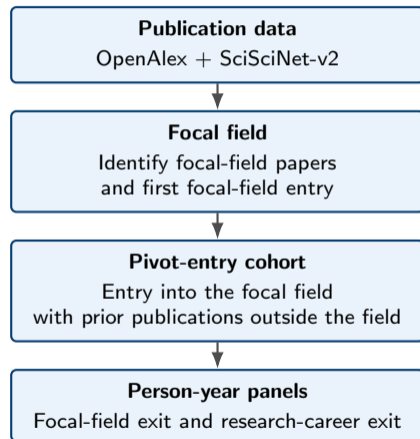
- Yet, little is known about what happens to scientists after they pivot to a new field, leaving the long-term career consequences of pivots underexplored.
- Pivot entrants differ in how far the new field is from their prior trajectory, making **pivot magnitude** a key source of heterogeneity in post-pivot outcomes.
- We examine post-pivot adaptation as a survival process: whether entrants remain in the focal field, continue their career elsewhere, or retire from research.

How does pivot magnitude shape post-pivot survival?

How does pivot magnitude shape post-pivot survival?

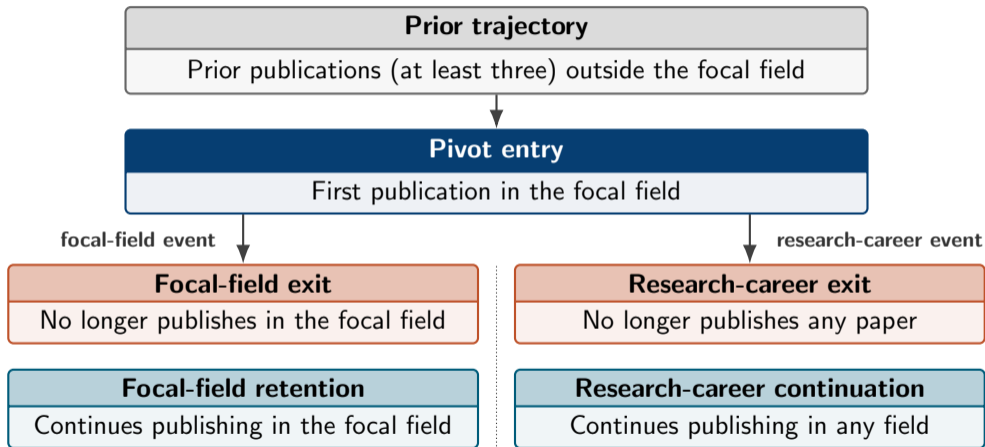
- We examine post-pivot adaptation as a survival process with two key outcomes: focal-field retention and research-career continuation.
- **RQ1:** How is pivot magnitude associated with retention in the focal field?
- **RQ2:** How is pivot magnitude associated with research-career continuation?
Does focal-field exit imply research-career exit?
- **RQ3:** Do these patterns generalize across fields?

- **Data sources:** scholarly publication data from OpenAlex and SciSciNet-v2.
- **Focal domain:** [hydrogen research](#) as an exemplary emerging field.
- **Analysis cohort:** researchers who entered the focal field between 2000 and 2021, with at least three prior non-focal-field papers (89,838 researchers).
- **Event definitions:** focal-field exit and research-career exit, measured by absence of publications in three-year windows after pivot entry.



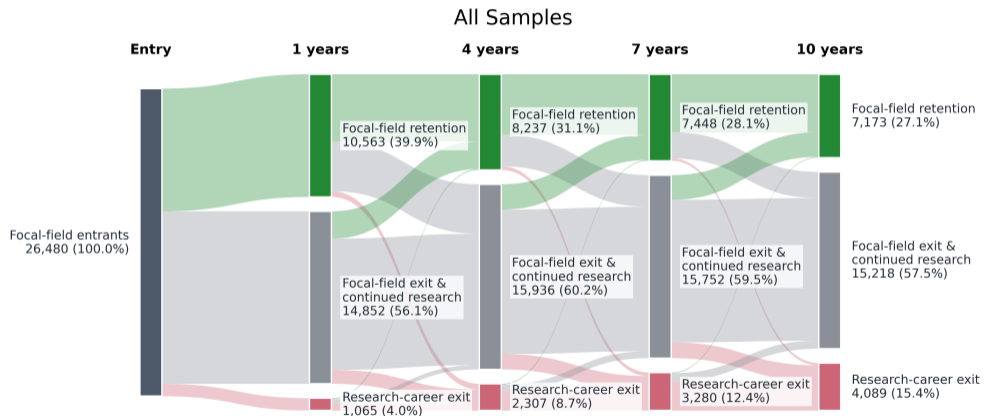
Conceptual Framework

Separating two kinds of risk: focal-field exit vs. research-career exit



Survival and exit are measured using three-year publication windows after entry.

Illustration: Sankey diagram of post-pivot trajectories



Discrete-time survival models estimate the risk of each event separately.

$$\Pr(\text{event}_{i,t} = 1) = f(\text{pivot magnitude}_{i,t_0} \times \text{career stage}_{i,t_0} \\ + \text{duration FE} + \text{entry cohort FE} + \text{pre-entry controls}_{i,t_0})$$

t_0 : pivot year; t : years since pivot. Standard errors clustered by author.

- **Outcome 1: focal-field exit**, i.e., three-year absence from the focal field publication.
- **Outcome 2: research-career exit**, i.e., three-year absence from any publications.
- **Pivot magnitude**: pivot surprisal (trajectory-conditioned) or pivot size (static distance).
- **Career stage**: whether the pivot entry occurs in researchers' early (1–5 years), mid (6–15 years), or late (16–30 years) career.
- To avoid post-treatment adjustment, the models condition only on pre-entry controls measured at or before the pivot year.
- Pre-entry controls: publication productivity and field diversity.

Measuring Pivot Magnitude

- **Pivot size** (Hill et al., 2025) is used as a static-distance-based benchmark:
 $\Phi_{t_0} = 1 - \cos(p_{t_0}, p_{<t_0})$, where p_{t_0} and $p_{<t_0}$ are the aggregated reference vectors.

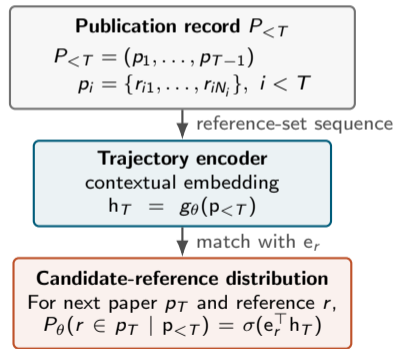
- **Pivot surprisal** measures how unexpected the pivot paper's references are.
- A sequential model predicts the next paper's references based on the prior trajectory:

$$P_{\theta}(r \in p_{t_0} \mid p_{<t_0})$$

- Then, pivot surprisal is the average negative log-probability of the pivot paper's references:

$$S_{t_0} = \frac{1}{N_{t_0}} \sum_{r \in p_{t_0}} -\log P_{\theta}(r \in p_{t_0} \mid p_{<t_0})$$

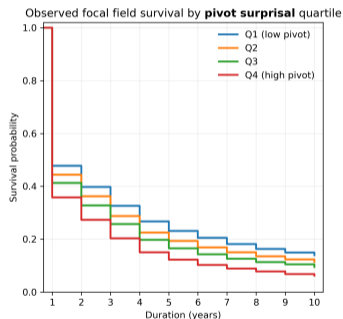
- Larger surprisal means that the pivot paper is less expected from the prior trajectory.



Result 1: Focal-field Retention

Research Question 1-1

How is pivot magnitude associated with retention in the focal field?



Term	Coef.	SE	Odds Ratio
pivot surprisal (early-career, 1–5 yrs)	0.120	0.012	1.13
pivot surprisal (mid-career, 6–15 yrs)	0.210	0.008	1.23
pivot surprisal (late-career, 16–30 yrs)	0.218	0.011	1.24

Focal-field exit logit. Odds ratio is per 1 SD increase in z-standardized pivot surprisal;

$N = 200,104$ person-years (89,838 persons).

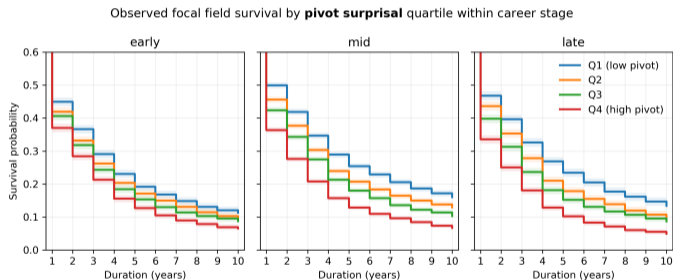
- **Larger-pivot entrants are more likely to leave the focal field.** (left, KM curve)
- Field-exit risk increases with pivot surprisal, and this pattern is consistent across career stages. (right, discrete-time logit)

Result 1: Focal-field Retention

Career-stage heterogeneity

Research Question 1-2

How do these relationships vary by career stage?

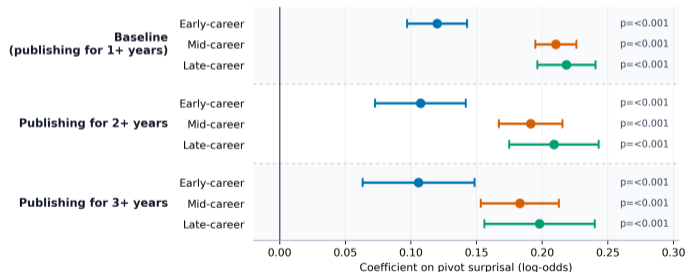


- While consistent across career stages, the pivot-survival relationship is stronger for mid- and late-career entrants than for early-career entrants.
- (smaller-pivot) Mid- and late-career entrants show relatively higher retention.
- (larger-pivot) The career stage narrows, as all entrants face high exit risk.

Result 1: Focal-field Retention

Robustness checks

- Baseline **pivot entry** include anyone who publishes at least one paper in the field, which may include some exploratory entries that do not reflect a true pivot.
- Re-estimate among entrants who keep publishing after the pivot year, i.e., conditional on early retention in the focal field.



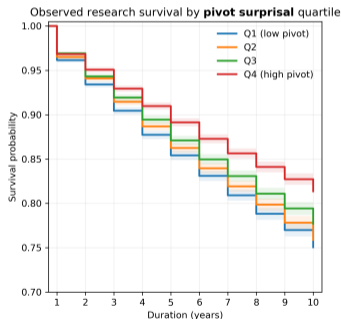
- Conditional on early retention, the field-exit association remains positive and stage heterogeneity remains consistent.

Result 2: Research-career Continuation

Research Question 2-1

How is pivot magnitude associated with research-career continuation?

Does focal-field exit imply research-career exit?



Term	Coef.	SE	Odds Ratio
pivot surprisal (early-career)	-0.166	0.016	0.85
pivot surprisal (mid-career)	-0.104	0.015	0.90
pivot surprisal (late-career)	-0.093	0.021	0.91

Research-career exit logit. Odds ratio is per 1 SD increase in z-standardized pivot surprisal;
 $N = 486,858$ person-years (89,838 persons).

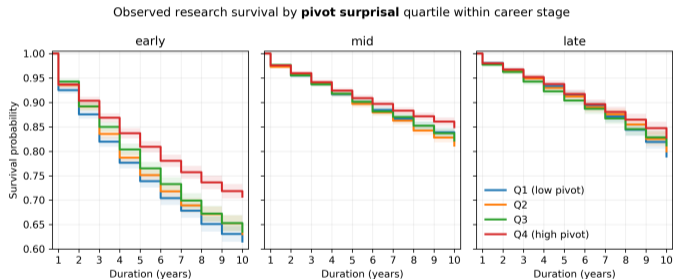
- **Larger-pivot entrants are less likely to exit research.**
- Career-exit risk decreases with increasing pivot surprisal, opposite to the field-exit pattern.

Result 2: Research-career Continuation

Career-stage heterogeneity

Research Question 2-2

How do these relationships vary by career stage?

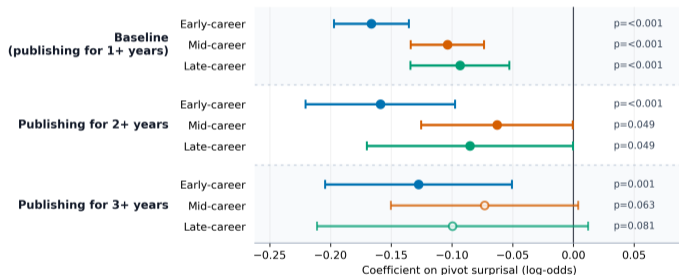


- **The pivot-survival relationship** (decreasing career-exit risk with Larger pivots) **is most pronounced among early-career entrants.**
- Nevertheless, the negative association between pivot magnitude and career-exit risk is generally consistent across career stages.

Result 2: Research-career Continuation

Robustness checks

- Re-estimate among entrants who keep publishing after the pivot year, i.e., conditional on early retention in the focal field.



- The negative career-exit association persists only among early-career entrants.
- For mid- and late-career entrants, the association is inconsistent and weaker after conditioning on early retention.

Focal-field retention and research-career continuation show divergent relationships with pivot magnitude:

- Larger pivots are robustly associated with higher field-exit risk.
- Yet, this does not imply career-exit.
- Larger pivots do not predict higher career-exit risk (negative or null association).

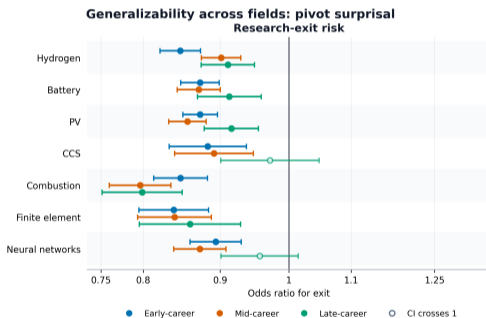
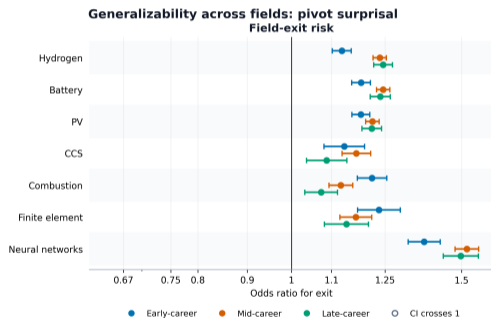
Career-stage heterogeneity is observed in both focal-field retention and research-career continuation, but the patterns differ:

- Pivot magnitude has a stronger positive association with field-exit risk for mid- and late-career entrants than for early-career entrants.
- Pivot magnitude has a consistently negative association with career-exit risk only among early-career entrants.

Result 3: Generalizability across Fields

Research Question 3

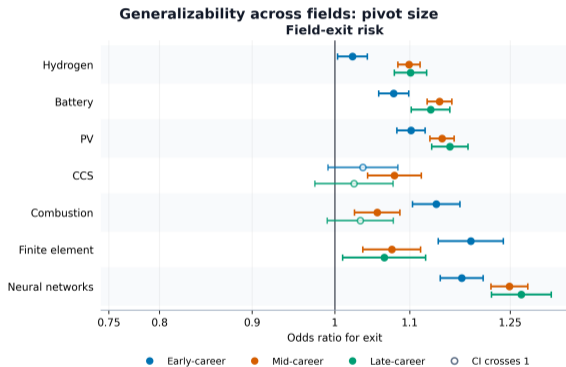
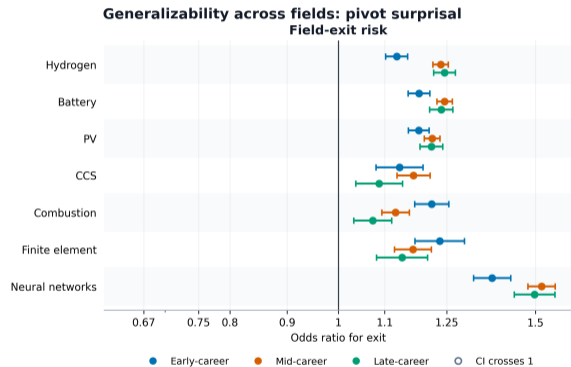
Do these patterns generalize across fields?



- Larger pivot magnitude is generally associated with higher field-exit risk across fields.
- The divergence between field-exit and career-exit patterns is common across fields.
- Career-stage heterogeneity is not consistent across fields.

Generalizability across Fields

Pivot surprisal vs. pivot size



● **Pivot surprisal is more informative than pivot size for focal-field retention.**

Focal-field retention and research-career continuation show divergent relationships with pivot magnitude (common across fields).

→ *Why do large pivots raise field-exit risk but not career-exit risk?*

Career-stage heterogeneity is observed in both focal-field retention and research-career continuation (patterns different across fields).

→ *What drives the career-stage heterogeneity, and why does it differ across fields?*

Discussion

Distinct patterns in focal-field retention and research-career continuation

Discussion 1

Why do large pivots raise field-exit risk but not career-exit risk?

- An exploitation-exploration trade-off may underlie the divergent patterns.
- Smaller-pivot entrants may have stronger field-commitment (exploitation), as they can leverage their accumulated expertise and networks.
- Larger-pivot entrants may have weaker field-commitment (exploration), as they find it difficult to integrate their prior expertise into the focal field.
- This divergence of strategies may lead to different risk profiles: smaller-pivot entrants may be more likely to stay in the focal field, while larger-pivot entrants may put less of their career capital at risk in the focal field.

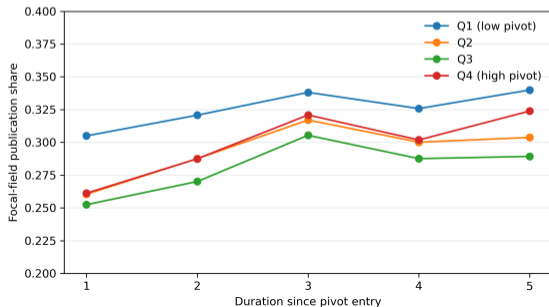
Discussion

Distinct patterns in focal-field retention and research-career continuation

Discussion 1

Why do large pivots raise field-exit risk but not career-exit risk?

- Even among researchers who stay active in the focal field, larger-pivot entrants allocate a relatively smaller share of their publications to the focal field than smaller-pivot entrants, suggesting weaker field-commitment.



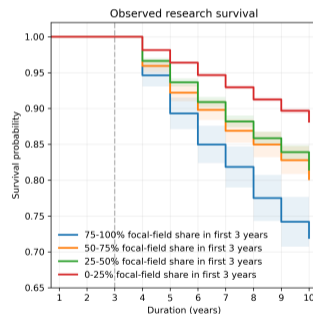
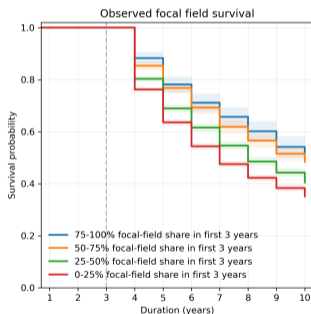
Discussion

Distinct patterns in focal-field retention and research-career continuation

Discussion 1

Why do large pivots raise field-exit risk but not career-exit risk?

- Stronger field-commitment after pivot entry (in first 3 years) is associated with higher focal-field retention and lower research-career continuation.



- While stronger field-commitment (exploitation) supports field retention, broader portfolios (exploration) help researchers survive field-level failure without exiting research.

Discussion 2

What drives the career-stage heterogeneity?

Why does it differ across fields?

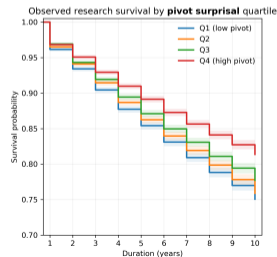
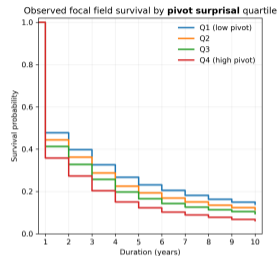
- Early-career entrants
 - (+) may be more adaptable to the new field (flexible with less sunk cost).
 - (–) have less transferable career capital.
 - (–) may be more vulnerable to failure (higher career-exit risk).
- Established entrants
 - (+) have more transferable career capital (both intellectual and social).
 - (–) may be less adaptable to the new field (rigidity with more sunk cost).
- When pivot magnitude is large, prior expertise becomes less directly transferable, weakening the career advantage in focal-field retention.
- **But this is not consistent across fields, suggesting that field conditions may shape the career-stage heterogeneity.**

Summary of findings

- Pivot magnitude is positively associated with focal-field exit risk, implying the long-term retention cost of large pivots.
- Yet, higher field-exit risk does not predict higher career-exit risk, showing divergent patterns.
- These patterns are generally consistent across fields, but career-stage heterogeneity is not, suggesting that field conditions may shape the career-stage dynamics of pivot survival.

Implications

- As there are distinct patterns in long-term retention after pivot entry, we should consider the dynamics of field retention and career continuation.
- To promote researchers' adaptability to emerging fields, science policy should
 - support smaller-pivot entrants, who are more likely to stay in the focal field but face higher career-exit risk, by mitigating the career risks of early-career pivots through targeted funding and career development resources.
 - help larger-pivot entrants, who are less likely to stay in the focal field, by reducing adaptation costs through bridge funding.

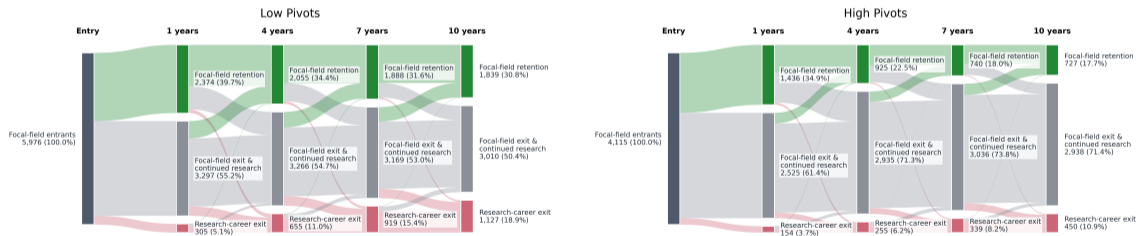


Thank you for your attention!
Questions and feedback are very welcome.

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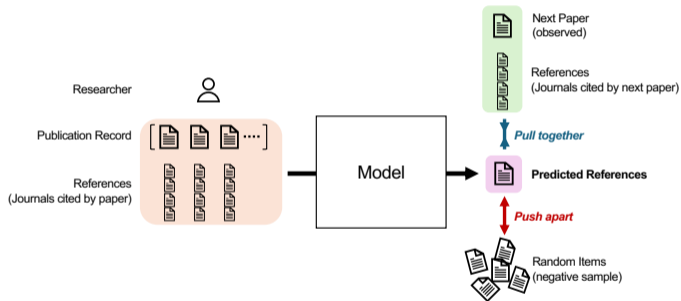
Backup: Sankey diagram of post-pivot trajectories

Although our first-event risk models cannot capture the full complexity of post-pivot trajectories, descriptive analysis of trajectory flows shows similar patterns.

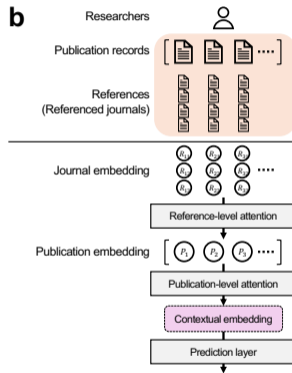


Backup: Sequential model details

a

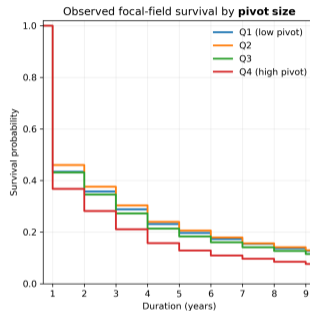
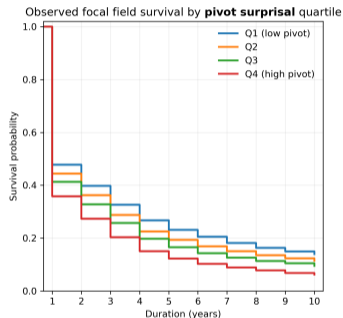


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Backup Result 1: Metric robustness in focal-field retention

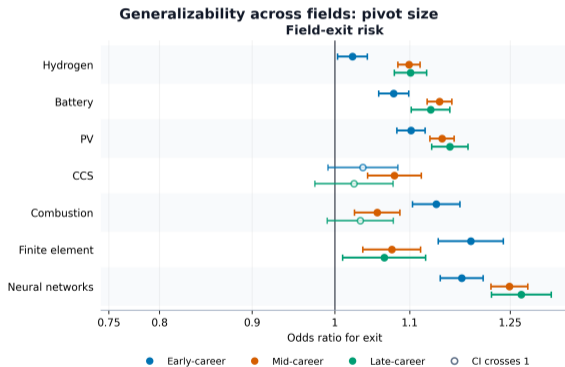
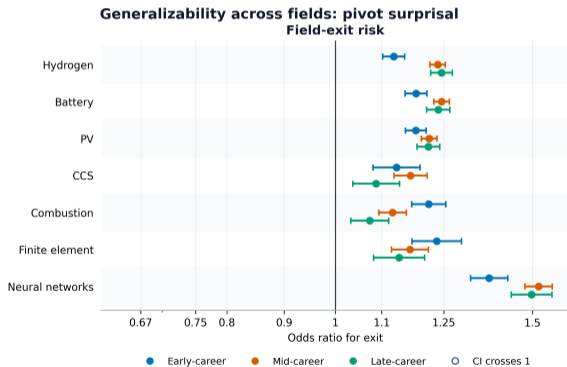
Pivot surprisal is more informative than pivot size for focal-field retention.



Model (pivot magnitude)	pseudo R^2	Coef.	SE	p -value
Not included (controls only)	0.1420	—	—	—
Pivot size + controls	0.1432	0.0225	0.010	.019
Pivot surprisal + controls	0.1468	0.1199	0.012	< .001

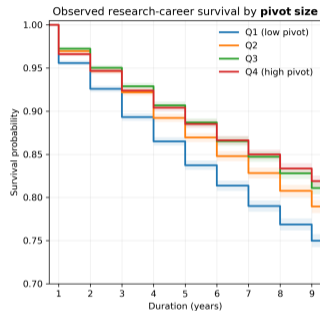
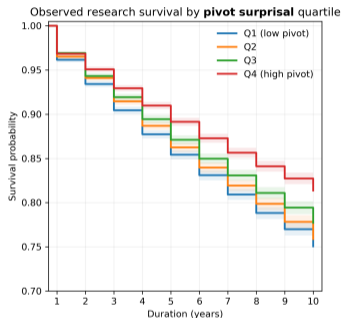
Backup Result 1: Metric robustness in focal-field retention

Pivot surprisal is more informative than pivot size for focal-field retention.



Backup Result 2: Metric robustness in research-career continuation

Pivot surprisal and pivot size show similar negative associations with career-exit.



Model (pivot magnitude)	pseudo R^2	Coef.	SE	p -value
Not included (controls only)	0.0482	—	—	—
Pivot size + controls	0.0556	-0.1766	0.013	< .001
Pivot surprisal + controls	0.0546	-0.1663	0.016	< .001

Backup Result 2: Metric robustness in research-career continuation

Pivot surprisal and pivot size show similar negative associations with career-exit.

