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2022: (Oral) Macroeconomics, Financial Economics
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Committee:

Professor Michael Peters (Co-Chair)
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Education:

Ph.D., Economics, Yale University, 2026 (expected)
M.Phil., Economics, Yale University, 2023
M.A., Economics, Yale University, 2022
B.Sc., Quantitative Finance, Hong Kong University of Science and Technology, 2020

Fellowships, Honors and Awards:

University Dissertation Fellowship, Yale University, 2025 – 2026
Nathan Hale Associates Fellow, Yale University, 2021
Doctoral Fellowship and Cowles Foundation Fellowship, Yale University, 2020 – 2026

Teaching Experience:

Fall 2024, Teaching Assistant to Prof. Benjamin Polak, Game Theory (Undergraduate/MBA cross registration), Yale University
Spring 2024, Teaching Assistant to Prof. Fabrizio Zilibotti, Introductory Macroeconomics (Undergraduate), Yale University
Fall 2023, Teaching Assistant to Prof. Michael Peters, Introductory Macroeconomics (Undergraduate), Yale University

Spring 2023, Teaching Assistant to Prof. Tony Smith, Computational Methods in Economics (Undergraduate/Ph.D. cross registration), Yale University

Fall 2022, Teaching Assistant to Prof. Eduardo Dávila, Financial Economics (Undergraduate), Yale University

Work Experience:

Projects Officer, International Monetary Fund, July – August 2022

Publications:

“Dynamic Bank Expansion: Spatial Growth, Financial Access, and Inequality” (2023) [with Yan Ji and Robert Townsend], *Journal of Political Economy*, Volume 131, Issue 8, p. 2209-2275

Working Papers:

“Innovation through Recombination” (October 2025), *Job Market Paper*

Work In Progress:

“Learning Complementarity via Experiment: A Bayesian Theory of Combinatorial Innovation” (October 2025)

Seminar and Conference Presentations:

2021: Asian Meeting of the Econometric Society, China Meeting of the Econometric Society, Society for Economic Dynamics

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Dissertation Abstract

My dissertation examines how economic growth is shaped by the dynamics of idea generation – particularly the recombination of existing ideas – and by financial access, through granular measurement and micro-founded macroeconomic models disciplined by microdata.

Innovation through Recombination [Job Market Paper]

New ideas often arise by recombining existing ones, for instance, modern software development combines reusable libraries to build new applications. Does recombination crowd out fundamentally novel ideas and slow growth? Or does an ever-expanding space of possible combinations sustain it? Evidence is scarce: the debate has been largely theoretical, often treating “combination” as a narrative device. This distinction matters for policy: if innovation is primarily combinatorial, priorities should tilt toward knowledge diffusion and combinatorial tools (e.g., artificial intelligence); if novelty is essential, basic research subsidies are critical.

This paper takes combinatorial growth to measurement and quantifies its empirical relevance to aggregate growth. I focus on the pharmaceutical industry, where the novelty-recombination distinction is transparent. Using a chemistry-based measure, I decompose each drug into its constituent functional groups, discrete chemical building blocks that shape its properties. This measure aligns with how chemists conceptualize drug development and allows me to identify whether a new drug introduces new building blocks or purely recombines existing ones.

Focusing on anti-allergic drugs from the Cortellis database, three patterns emerge. First, recombination is more prevalent than novelty. From 1990-2010, 79% of new drugs are recombinations of existing functional groups, while 13% contain new functional groups; novelty declines as recombination rises. Second, firms with less accumulated knowledge, measured as fewer distinct functional groups in their patented drugs, tend to develop drugs by adopting new functional groups, while more knowledgeable firms recombine the functional groups they have already used. This points to a firm life cycle: early-stage knowledge accumulation to later-stage

internal recombination. Third, conditional on entering clinical trials, drugs containing novel functional groups command higher market and scientific value than pure recombinations.

Motivated by these findings, I develop a theory that formalizes combinatorial growth. I build on Klette and Kortum (2004) and introduce the distinction between a firm's knowledge stock and product portfolio. Innovation operates along two distinct yet intertwined margins: novel innovation expands knowledge, while combinatorial innovation deploys knowledge to create new products. As the aggregate knowledge pool expands, it becomes harder to find new ideas. The model thus delivers declining novelty, while growth is sustained by the expanding combinatorial opportunities.

Quantitatively, the calibrated model matches salient firm- and macro-level patterns and attributes a large share of aggregate creative destruction to recombination. The model reveals a sharp policy trade-off: subsidizing novelty delivers a powerful but temporary boost to growth, whereas subsidizing recombination raises growth more persistently with heterogeneous effects across firms.

Learning Complementarity via Experiment: A Bayesian Theory of Combinatorial Innovation

Innovation through recombination creates value when underlying ingredients complement one another; firms learn these complementarities through costly experimentation and often hoard information. Existing works highlight the role of learning in discovering high-value combinations but leave its properties and efficiency implications unexamined. I develop a theory in which firms experiment and learn about the quality of new combinations. Each firm holds an ingredient stock and chooses between adding new ingredients and recombining existing ones. Ingredient qualities and complementarities are uncertain; firms observe only realized outcomes from tested combinations and update beliefs. Knowledge diffuses via patent disclosure and admits a tractable Bayesian representation. I solve the model using graph neural networks. Three insights follow: (1) novelty and recombination are mutually reinforcing: novelty expands combinatorial possibilities, while recombination sharpens knowledge of complementarities among ingredients and raises the option value of subsequent novelty; (2) an endogenous decline in novelty can arise without rising innovation costs as the expanding stock of known ingredients tilts returns toward recombination; and (3) gains from knowledge diffusion policies (e.g., FDA-mandated disclosure of clinical trial results) hinge on how disclosed ingredients complement a firm's ingredient portfolio.

Dynamic Bank Expansion: Spatial Growth, Financial Access, and Inequality (2023) [with Yan Ji and Robert Townsend], *Journal of Political Economy*, Volume 131, Issue 8, p. 2209-2275

We propose a model with local spatial markets and heterogeneous agents to understand and evaluate the geographic expansion of bank branches after banking deregulation in Thailand. The model features heterogeneity in financial frictions across regions, with the costs of accessing credit and deposits depending on the distance from the nearest branch. Disciplined by micro estimates of the effects of branch openings, the model reproduces salient regional and aggregate patterns concerning occupational choice, financial access, and inequality. We apply the model to study two counterfactual financial sector policies in distant markets, one subsidizing branches and the other subsidizing household deposits.