

The Reporter

No. 4, 2024

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Working Group Report: Market Design

Michael Ostrovsky and Parag Pathak

The Market Design Working Group, established in 2009 under the leadership of Susan Athey and Parag Pathak, is a preeminent research forum in the field of market design. The working group meets annually, alternating between Cambridge, Massachusetts, and Palo Alto, California, to present research that bridges theoretical economics and practical applications, all focused on what *The Economist* aptly characterized as “an intelligently designed invisible hand.”¹ Research in market design has been celebrated in academic circles, as evidenced by recognitions like the 2012 Nobel Prize for work on matching markets and the 2020 Nobel Prize for auction theory, and has also been instrumental in catalyzing tangible reforms in real-world institutions and markets.

One feature that sets market design apart from much of traditional economic theory is its unwavering commitment to practical applications. Market designers have developed a unique professional profile, equally at home in university lecture halls, hospital surgery wards, school committee meetings, and the boardrooms of technology companies. This versatility allows them to translate complex economic

models and analyses into solutions for real-world problems. The field’s research has informed an impressive range of applications across various sectors of society.

Markets for Kidney Exchange

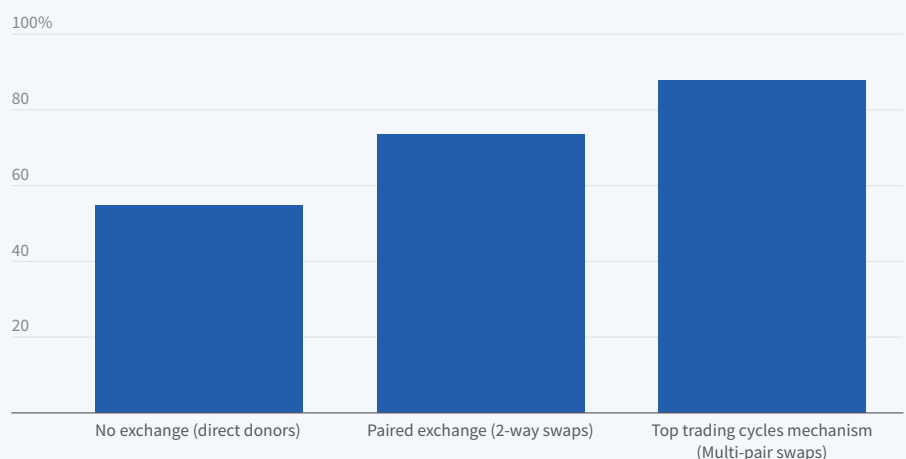
Kidney exchange is one of market design’s most celebrated success sto-

ries. In the United States, over 90,000 patients await kidney transplants. Economic research has helped create sophisticated matching systems that identify chains of compatible donor-recipient pairs. A long list of studies by NBER affiliates have contributed to increasing paired-exchange transplants more than a hundredfold to over 1,000 annually.² Tayfun Sönmez and M. Utku

Kidney Transplants and Living-Donor Exchange Systems

Figure 1

Kidney transplant rate for a system with 100 donor-patient pairs



Source: “Kidney Exchange,” Roth AE, Sonmez T, Unver MU. NBER Working Paper 10002, September 2003, and Quarterly Journal of Economics 119(2), May 2004, pp. 457–488.

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The NBER is funded primarily by research grants from government agencies and private foundations. It also relies on support from corporations through its Corporate Associates program, and from individual contributions. Inquiries concerning research support and contributions may be addressed to James Poterba at poterba@nber.org. The NBER is a 501(c)(3) charitable organization.

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Ünver have expanded this approach to liver transplants with a groundbreaking center in Turkey that recently completed the world's first seven-way liver exchange.³ This expansion demonstrates how market design principles can be adapted and applied to different medical contexts, each with unique constraints and requirements.

Spectrum Auctions

Another landmark achievement of the field is the development of auctions for electromagnetic spectrum, first in the United States and then worldwide. As the use of wireless technologies exploded in the 1990s, along with the corresponding demand for electromagnetic spectrum, policymakers turned from administrative and lottery-based allocation rules to auction-based systems. Leo Herzel and Ronald Coase had called for market-based spectrum allocation in the 1950s.⁴ In practice, implementing this idea required inventing novel, complex auction mechanisms due to the large number of objects being auctioned (many different frequencies over many different regions) and complex bidder preferences (e.g., a bidder may be interested in bidding on frequencies in Los Angeles only if they are also highly likely to win frequencies in San Francisco, and vice versa). John McMillan and Paul Milgrom describe the initial designs of these mechanisms.⁵ The development of market mechanisms for the allocation of electromagnetic spectrum continues to be an active research area, with many of the developments spurred by the changing economics of available spectrum and the physical properties of various new technologies and spectrum bands. For example, the 2017 two-sided "incentive auction" involved not just selling frequency bands to telecommunications companies but also simultaneously purchasing frequency rights for spectrum from TV stations. Lawrence Ausubel, Christina Aperjis, and Oleg Baranov and Milgrom and Ilya Segal explain how its design relied on both theoretical and computational innovations in auction design; Kevin Leyton-Brown, Milgrom, Neil Newman, and Segal describe broader lessons from the spectrum auctions.⁶

Design of Digital Platforms

As technology continues to reshape markets at an unprecedented pace, market design research has focused on new questions about platform regulation and digital marketplace dynamics. A prime example is the ongoing debate about search engine competition. When Google faced regulatory scrutiny over its dominant position in online search, market designers provided crucial insights into auction design for choice screens—the interfaces that allow users to select their default search engine.

Ostrovsky's analysis revealed that seemingly minor technical details in auction design could have major implications for competition.⁷ For instance, the choice between having search engines bid per appearance versus per installation could significantly affect market outcomes and competitive dynamics. The field has also contributed to understanding and improving other digital marketplaces, from ride-sharing platforms to online advertising markets. Researchers have developed frameworks for analyzing two-sided markets, network effects, and platform competition, helping shape business practices and regulatory approaches.

Education

Market design has also made important contributions in the field of education, with many scholars contributing to this area.⁸ When the city of Boston faced the challenge of balancing neighborhood school assignment with citywide choice, Umut Dur, Scott Kominers, Pathak, and Sönmez, and Pathak and Peng Shi conducted detailed analyses of various policy options. Their research led to a surprising finding: a policy that supposedly gave preference to local students for half of each school's seats performed almost identically to having no neighborhood preference at all.⁹ This insight helped policymakers better understand the true implications of different assignment mechanisms and make more informed decisions about school choice policies. Similar work has been conducted in other major school districts, leading to nationwide reform in student

assignment systems. These projects highlight ways in which market design research can advance multiple objectives, including increased student satisfaction and better academic outcomes.

Military Labor Markets

The US military has also relied on market design analysis to assign soldiers to positions. The Army's recent overhaul of its cadet assignment system exemplifies how sophisticated economic theory can be translated into practical solutions. The new system, based on the "matching with contracts" framework, allows for nuanced expression of preferences. Under this system, cadets can rank complex combinations of assignments and service terms. For example, they can express preferences such as ranking infantry service for three years above cyber operations for three years but below infantry service for five years. This flexibility has led to improvements in both cadet satisfaction and organizational effectiveness.¹⁰ Market design research has also resulted in changes to how cadets obtain their first placements at both the United States Military Academy and through the ROTC program.

Financial Markets

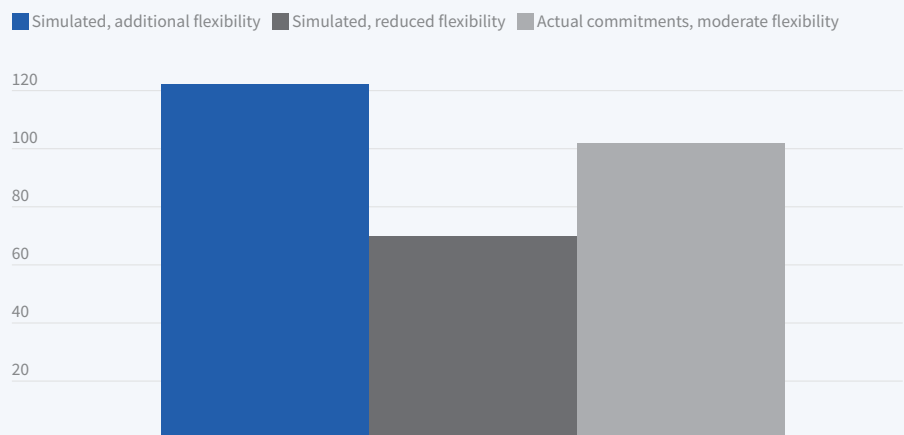
Regulation and concerns about the performance of financial markets have also spurred research on market design approaches to financial markets. Eric Budish, Peter Cramton, and John Shim argue that the quest for ever-faster trading entails high costs but creates little value.¹¹ Their analysis of high-frequency trading reveals a flaw in modern financial markets: when new information arrives, continuous trading creates a race to react first, spurring massive investments in speed technology. These races happen frequently but last mere milliseconds. The researchers point out that replacing continuous trading with frequent batch auctions — essentially creating very short but discrete trading intervals — could eliminate the advantage of being microseconds faster than rivals, redirecting competition from speed to price. For ordinary investors, who trade in much longer time frames, the market would still feel continuous. This trading structure has yet to be adopted by any major exchange, prompting Budish, Robin Lee, and Shim to investigate the incentives organizations face when adopting new market designs.¹²

Energy and Electricity

Another area that has been the subject of much research in market design

Flexibility and Extended Service Assignments

Number of US Military Academy Class of 2021 cadets with additional 3-year service commitment



Source: "Redesigning the US Army's Branching Process: A Case Study in Minimalist Market Design," Greenberg K, Pathak PA, Sönmez T. NBER Working Paper 28911, March 2023, and American Economic Review 114(4), April 2024, pp. 1070-1106.

Figure 2

is the operation of electricity markets. Electricity supply is characterized by nonconvexities and indivisibilities, making market clearing difficult. Some technologies, especially older, carbon-intensive ones, face relatively low fixed costs and moderate marginal costs. Burning a bit more coal, for example, produces a bit more electricity. At the same time, newer, often cleaner technologies may face high fixed costs and completely inflexible supply, sometimes as extreme as having essentially zero marginal cost up to some point and infinite marginal cost beyond it. For example, once installed, a solar panel will produce an amount of electricity that depends only on the amount of available sunlight and not on the current electricity price or demand conditions. To avoid blackouts, it is critical for electricity markets to always be in equilibrium while adjusting to uncertain changes in demand conditions. Mete Şeref Ahunbay, Martin Bichler, and Johannes Knörr, and Cramton summarize research on designing markets that can resolve these difficult issues efficiently.¹³

The shift to alternative technologies for electricity production raises additional market design challenges beyond the design of electricity markets themselves, such as the “interconnection queue,” studied by Sarah Johnston, Yifei Liu, and Chenyu Yang.¹⁴ Before a new power generator can start supplying electricity to consumers, it must be connected to the electrical grid. This requires costly and time-consuming investment by the electricity grid to improve its transmission infrastructure to handle the additional load. Many grid regulators employ simple first-come, first-served waiting lists for processing the applications, and, given the backlog, the process often takes years. Renewable energy developers frequently cite this “interconnection” process as one of their biggest hurdles, and most end up not completing the process after submitting initial applications. Alternatives to the interconnection queue and mechanisms for deciding which generators to connect first can lead to substantially improved outcomes and a faster transition to cleaner forms of energy.

Public Housing and Refugee Resettlement

Recent market design research has explored policies for the allocation of government-owned housing. Government agencies worldwide use a variety of procedures for this critically important allocation problem. Nick Arnosti and Shi, and Daniel Waldinger examine the properties of various mechanisms and illuminate the trade-offs between the objectives policymakers face when designing allocation rules and mechanisms.¹⁵

A related body of research analyzes policies for refugee resettlement. Worldwide conflicts lead to large numbers of displaced individuals and families, and after countries agree to accept them as refugees, decisions need to be made about which regions, cities, and specific locations will be suitable hosts. This is a complex two-sided market: localities may have specific needs and availabilities, while refugees may also have diverse preferences. Three recent studies — by David Delacrétaz, Kominers, and Alexander Teytelboym; Tommy Andersson and Lars Ehlers; and Kirk Bansak, Soonbong Lee, Vahideh Manshadi, Rad Niazadeh, and Elisabeth Paulson — characterize effective mechanisms for resolving these competing preferences.¹⁶

The Human Factor

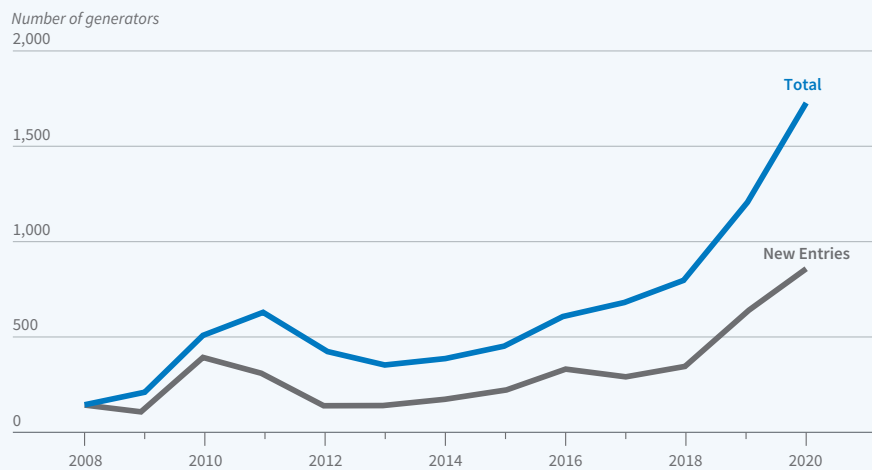
Success in market design increasingly depends on understanding human behavior as much as formal economic models, incorporating “behavioral” aspects — how participants actually make decisions — as well as the implications of rational behavior. This focus on human behavior has led to important insights about information provision in school choice systems and physician decision-making in hospitals. Empirical research by Fan-yin Zheng on the allocation of hospital resources and by several research teams on parental behavior in ranking schools suggests that the way choices are presented and information is structured can significantly affect outcomes.¹⁷ These findings can lead to more nuanced approaches to market design.

New Directions

The Market Design Working Group convened a landmark conference in 2023, supported by Schmidt Futures, where leading contributors to the field assessed past research and addressed emerging opportunities in environmental markets — including those related to water resources and climate change — healthcare resource allocation, and artificial intelligence (AI).¹⁸ Market design's expansion brings new

Power Grid Queue for New Wind and Solar Generators

Figure 3



Source: “An Empirical Analysis of the Interconnection Queue,” Johnston S, Liu Y, Yang C. NBER Working Paper 31946, December 2023.

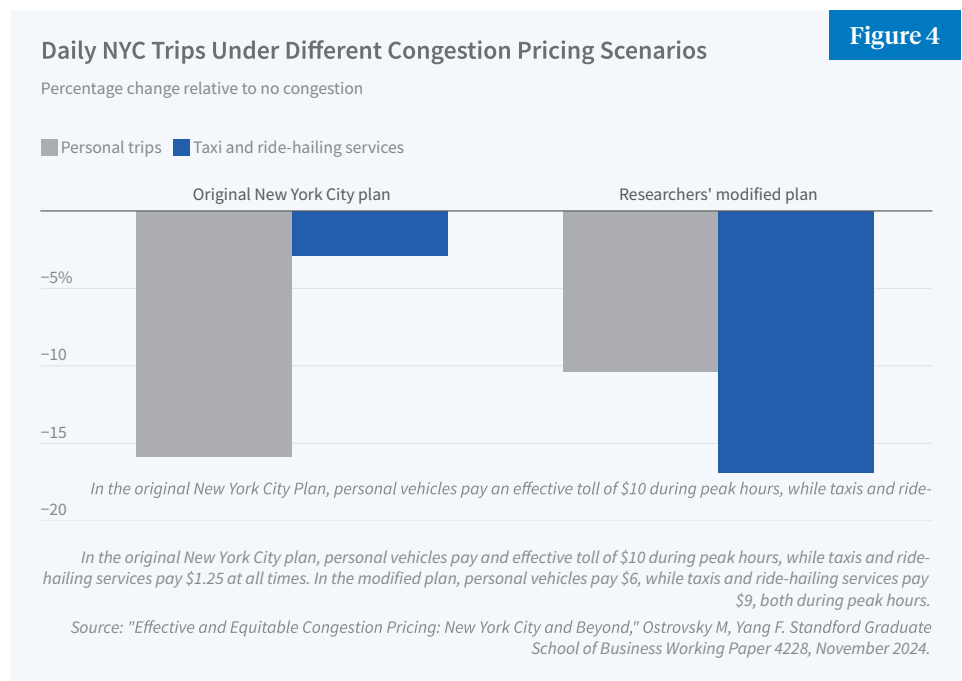
challenges. As the discipline tackles increasingly complex problems, it must balance theoretical elegance with practical implementation. Healthcare resource allocation is a case in point. Market design research on vaccine allocation during the COVID-19 pandemic and on government incentives for vaccine development, for instance, requires navigating not only economic efficiency but also ethical considerations and entrenched institutional practices.¹⁹

Looking Ahead

Early research in market design drew on complementarities between noncooperative and cooperative game theory to deliver insights into practical design problems.²⁰ Sönmez and Ünver have advocated for “minimally invasive market design,” which focuses on the consequences of targeted improvements rather than wholesale institutional changes.²¹

Increasingly, market design researchers draw on a comprehensive array of tools that extend beyond theoretical modeling. Researchers now routinely analyze empirical data from existing markets to understand how systems actually perform and identify real-world patterns and problems. They employ sophisticated counterfactual simulations to test potential market changes before implementation, allowing them to predict the likely outcomes of different reforms. Natural experiments arising from policy changes provide valuable evidence about how market adjustments work in practice, while carefully designed field experiments allow researchers to test new mechanisms with actual market participants. These real-world trials are complemented by laboratory experiments where market rules can be tested under controlled conditions to understand better how people make decisions.

This multi-method approach enables researchers to validate theoretic-



cal predictions with concrete evidence, uncover practical challenges that pure theory might miss, test potential solutions before full implementation, and refine market mechanisms based on observed behavior. By combining multiple research approaches, market designers can offer more reliable and effective solutions to complex design situations.

Another new methodological development involves partnerships between market designers and computer scientists, enriching the field through interdisciplinary exchange. Computer science scholars bring a distinctive analytical perspective centered on computability and approximation algorithms, complementing economists' traditional focus on incentives and efficiency. The engineering-oriented mindset in computer science also helps translate theoretical insights into practical, scalable solutions. The emergence of AI has created new opportunities for collaboration, as market design challenges increasingly involve complex computational problems and large-scale data analysis. AI applications raise novel questions about mechanism design, platform governance, and resource allocation,

benefiting from both economic and computational perspectives. These cross-disciplinary interactions are likely to deepen as markets become more digitized and algorithmically driven, with computer scientists and economists working together to design and implement better market mechanisms.

Market design's combination of theoretical rigor and practical impact continues to attract new scholars and practitioners. Current projects span an impressive range — from Kominers and Jesse Shapiro's research on content moderation on social media platforms,²² to Jason Baron, Richard Lombardo, Joseph Ryan, Jeongsoo Suh, and Quitze Valenzuela-Stookey's research on foster care placement,²³ to Ostrovsky, Michael Schwarz, and Frank Yang's studies of congestion pricing²⁴ — evidence that the “economic engineering” approach central to the group has found application far beyond its original domains. The field demonstrates how rigorous research, when combined with practical application and careful attention to institutional context, can deliver important insights into some of society's most intractable problems.

Research Associates Michael Ostrovsky and Parag Pathak are the codirectors of the NBER's Market Design Working Group. Ostrovsky is the Fred H. Merrill Professor of Economics at Stanford Graduate School of Business. Pathak is the Class of 1922 Professor of Economics at MIT.

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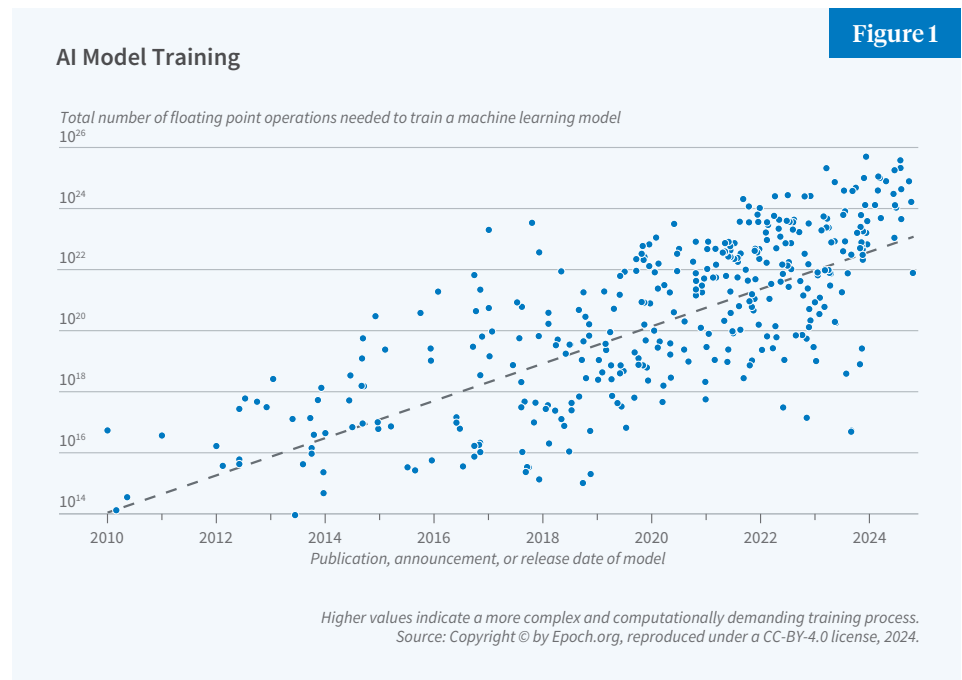
The Economics of Transformative AI

Anton Korinek

The rapid advancement of artificial intelligence (AI) may usher in the most significant economic transformation since the Industrial Revolution. For nearly a decade, as I witnessed the continuous progress in deep learning, I have been studying *the economics of transformative AI* — how our economy may be transformed as AI systems advance toward mastering all forms of cognitive work that can be performed by humans, including new tasks that don't even exist yet. The prospect of understanding the strange new world we will inhabit when transformative AI is developed has felt both intellectually urgent and personally meaningful to me as a father of two young children.

Today, AI systems are approaching and exceeding human-level performance in many domains, and it looks increasingly like our world will be transformed before my children have grown up. In this research summary, I outline my analysis of how transformative AI could reshape our economy, discuss frameworks for preparing for this transition, and explore how AI tools are already transforming economic research itself.

The pace of advancement in AI has been nothing short of extraordinary. Over the past 15 years, the computational resources employed to train cutting-edge AI systems have grown by a factor of four every year, as illustrated in Figure 1. The costs of such training are currently in the realm of hundreds of millions of dollars, as described in a market structure analysis with Jai Vira.¹ This exponential growth in compute has been accompanied by significant improvements in algorithmic efficiency, which Epoch AI estimates to be occurring at a rate of two and a half times per year. Taken together, these advances imply increases in the effective compute of frontier AI systems of 10 times per year. So-called scaling laws describe how the rapid growth in inputs translates into AI's performance gains, providing AI labs and their investors with some predictability for the returns on their investments and facili-



tating their bets on the next billion-dollar training runs. While returns to additional computing power may eventually diminish in some domains due to data scarcity, there are compelling reasons to expect that scaling will continue to yield significant capability gains in the coming years.

A growing number of leading AI researchers and industry figures now predict transformative AI could arrive within years, not decades. Geoffrey Hinton, the 2024 Nobel laureate in physics, considers it a possibility before the decade's end. Sam Altman of OpenAI anticipates superintelligence "within a few thousand days," while Anthropic's CEO Dario Amodei expects transformative AI by 2027, if not sooner. While these experts — and critics who view recent AI advances as overhyped — acknowledge the profound uncertainty in such predictions, the potential consequences of transformative AI are so significant that I consider it crucial for economists to analyze them.

Given the rapid pace of advancement of AI, my research agenda focuses on two critical areas: (1) analyzing transformative AI's economic implications, and (2) leveraging AI to enhance economic research and increase our

research productivity.

In the context of (1), I have recently laid out a research agenda for the economics of transformative AI together with Ajay Agrawal and Erik Brynjolfsson.² The agenda poses what we view as key economic questions to help us better prepare for the age of transformative AI. They cover economic growth, innovation, income distribution, decision-making power, geopolitics, information flows, AI safety, and human wellbeing under AI.

A New Economic Paradigm

To analyze the economic implications of transformative AI, it is instructive to examine how past technological revolutions have reshaped the structure of our economy. The transition from the Malthusian to the Industrial Age is particularly relevant for the changes and challenges that may lie ahead, as I explain in a recent paper.³

In the Malthusian Age, land was the critical bottleneck factor, while human labor could be considered reproducible on the relevant time scales. As technology was largely stagnant, the available supply of land limited the

size of the human population it could support. In this era, land was the most valuable economic resource. Human labor, in contrast, was not particularly valuable.

The Industrial Age — the world we still inhabit — transformed this reality. Rapid technological progress became a key driver of growth, accompanied by reproducible capital in the form of machines and factories, as captured by the standard neoclassical production function. With technology advancing and capital accumulating, labor suddenly became the bottleneck. This scarcity of labor led to large increases in wages, giving rise to today's living standards, which have grown about twentyfold in advanced economies since the Industrial Revolution.

Transformative AI could usher in another paradigm shift by making human-level intelligence reproducible. AI systems and robots could eventually substitute for both cognitive and physical human labor. In this new age, both traditional capital and intelligent machines would be reproducible resources, with the distinction between them increasingly blurred. These factors could be accumulated without bounds and generate ever more economic capacity.⁴

The implications are profound. Growth would accelerate as capital accumulates and artificial brainpow-

er drives innovation. However, labor would lose its special status, and therefore the main bottleneck of the Industrial Age would be surmounted.

Understanding these changes requires careful analysis of how relative prices will evolve. While many noneconomists predict that transformative AI will dramatically reduce all prices, relative prices are what matter economically. For instance, the relative prices of computers, robots, and human labor may decline while those of energy, food, and housing may rise. Systematic analysis must distinguish between reproducible factors — like compute and robots — and irreproducible ones that may become relatively more valuable, such as land, raw materials, and perhaps energy. This may fundamentally challenge our present system of income distribution.

Given the profound uncertainty about the trajectory and timeline of AI progression, I have developed a systematic scenario planning approach. In recent work, Donghyun Suh and I compared a “business as usual” scenario where AI automates tasks gradually as in past decades with two scenarios where transformative AI emerges in either 5 or 20 years.⁵ For each scenario, we model how automation and capital accumulation interact to determine economic outcomes. The various scenarios produce starkly different trajec-

tories — from steady growth with rising wages in the business-as-usual case to more than tenfold output expansion but collapsing wages in the transformative AI scenarios, as illustrated in Figure 2.

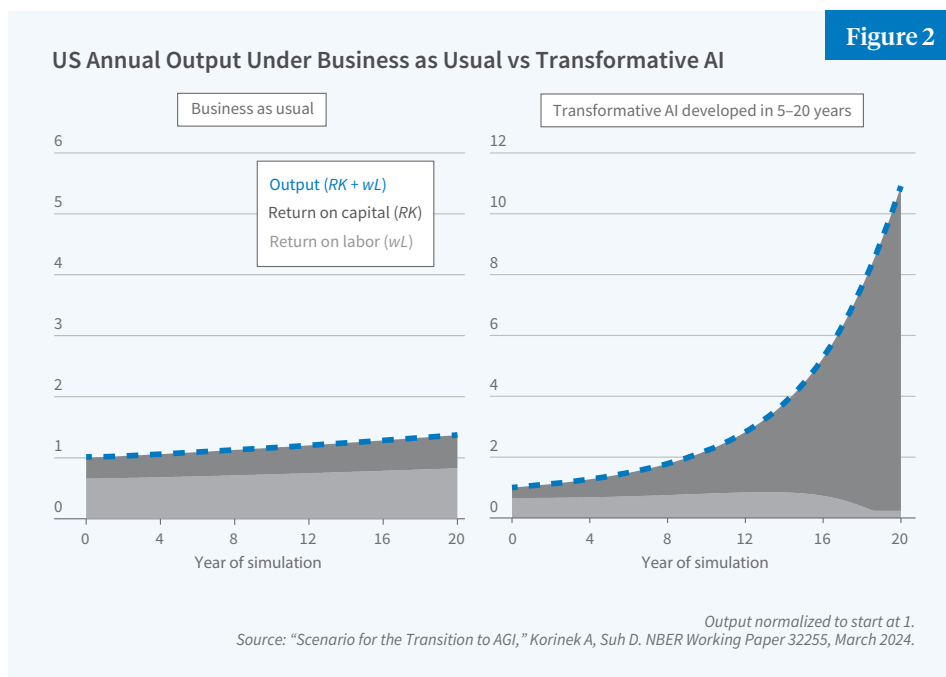
This scenario-based framework provides a structured way for policymakers and business leaders to stress test existing institutions and develop contingency plans for possible futures. Rather than betting everything on a single prediction, it allows us to identify robust strategies that work reasonably well across scenarios while maintaining the flexibility to adapt as the future unfolds. The stark differences between scenarios also highlight the importance of considering the labor market challenges that may emerge.⁶

Labor Market Challenges

Labor serves three vital functions in our modern economy: it acts as the key bottleneck factor in production, provides the main source of income for most people, and constitutes the primary use of time for working-age individuals. If transformative AI and advanced robots can substitute for human cognitive and physical capabilities, it threatens to fundamentally disrupt all three functions.⁷

As a first approximation, if AI becomes a substitute for human labor, it will eliminate labor's role as a bottleneck factor in production. Just as the Industrial Revolution ended the Malthusian era, transformative AI could end the Industrial Era by making labor reproducible. This would likely lead to significant devaluation of human labor as machines become progressively cheaper and more capable. As I observe in a paper with Joseph Stiglitz, it also calls for discussion of potential systems of income distribution that are independent of labor market earnings.⁸ Moreover, these economic challenges could pose significant risks to democratic stability, as rising inequality may trigger a vicious cycle of eroding democracy and further increasing inequality.⁹

However, as we transition to such a state, there are also opportunities



to actively steer the direction of technological progress. In other joint work with Stiglitz, we develop a theoretical framework for identifying and promoting innovations that increase labor demand and create better-paying jobs as a second-best measure to obtain a desirable distribution of income.¹⁰ Examples of such innovations include intelligent assistants that enhance worker productivity rather than replace workers entirely. The framework analyzes how different innovations affect labor demand and factor shares through their technological complementarity to workers and their impacts on relative incomes. Building on this, my work with Katya Klinova proposes practical guidelines for AI developers to evaluate the labor market impacts of their innovations, providing them with a framework to advance shared prosperity rather than exacerbate inequality.¹¹

The decline of work as society's primary use of time raises important questions about whether humans need work beyond its economic value. Economic analysis suggests that if the meaning people derive from work is purely a private good, like most other work amenities, there is no inherent reason for policy intervention — those who gain sufficient personal value can continue working even at low or zero wages. However, if work generates positive externalities, for example, through social connections and political stability, or if individuals systematically undervalue work's benefits due to internalities, there may be a role for policy to encourage work participation. That said, as autonomous machines become more capable, it may be more efficient to develop alternative institutions that provide these social benefits without requiring humans to work.

The AI transformation also challenges the traditional value proposition of education and human capital development, which has historically served as society's primary mechanism for economic advancement. A fundamental reevaluation of education's role and purpose will be necessary in a world where cognitive skills are increasingly automatable.¹²

The challenges of managing transformative AI's distributive effects be-

come even more complex in our globalized economy. As I detailed in a third paper with Stiglitz, while domestic policy measures can potentially compensate losers within countries, there are no effective mechanisms for cross-border compensation if technological progress deteriorates the terms of trade of entire nations.¹³ Transformative AI may exacerbate these challenges by concentrating economic power in a few increasingly advanced economies. The capital- and knowledge-intensive nature of AI development may make it harder for developing countries to keep up. Without international action to ensure an equitable distribution of AI's benefits, there is a risk of reversing decades of progress in global development.

Advancing Economic Research with AI

Having outlined these critical challenges facing our economy, let me return to the second prong of my research agenda: exploring how we can leverage AI to enhance economic research. The ongoing advances in generative AI are creating opportunities to revolutionize how we conduct economic research, making economists more productive and better equipped to address the complex challenges discussed above. My work explores both the practical applications of these technologies and their broader implications for the economics profession.

In a recent paper and on the dedicated website genaforecon.org, I demonstrate with tangible examples how large language models (LLMs) can serve as powerful research assistants across the entire research workflow.¹⁴ LLMs can help with ideation and brainstorming, providing fresh perspectives and counterarguments to evaluate and strengthen analyses. They excel at writing tasks, from drafting and editing to generating engaging summaries for different audiences. In background research, they can process and synthesize vast amounts of information, making literature reviews more comprehensive and efficient. For data analysis, they can extract information from text, classify content, and

even simulate human subjects. They are particularly capable at coding tasks and can increasingly assist with mathematical derivations.

In a November 2024 paper, I describe the latest advances in generative AI that are useful for researchers.¹⁵ These include improved math and reasoning capabilities, real-time search, and more sophisticated collaboration tools that are changing how we can interact with these systems. New LLM-powered workspaces allow for dynamic, iterative collaboration between researchers and AI assistants. Moreover, the introduction of real-time voice interfaces and autonomous computer-use capabilities is making these interactions more natural and powerful.

These developments suggest a future where the role of economists will evolve significantly. In the short to medium term, we may focus more on our comparative advantages, such as posing questions, suggesting research directions, discriminating between useful and irrelevant content, and coordinating complex research projects. The basic and mundane aspects of research may be increasingly automated, allowing economists to focus on higher-level thinking and creative problem-solving.

A research agenda emerges from these observations. We need to develop frameworks for evaluating AI-augmented research output as the bottleneck shifts from generation to assessment. We should investigate how to best integrate AI tools into our research workflows while maintaining rigorous standards and avoiding potential pitfalls like the homogenization of research approaches. We must also consider how to optimally time research projects given the rapid pace of AI advancement; some inquiries might be optimally postponed until more powerful tools are available.

Looking further ahead, when transformative AI is reached, it will surpass human capabilities in generating and articulating economic insights. As with all human labor, this possibility also raises profound questions about the future of the economics profession.

It may well be that we have only a

handful of research projects left before our ability to write insightful economics papers is outpaced by machines that surpass our intellectual capabilities. This increases the stakes and makes it important to carefully choose the most impactful work to pursue. I believe that one of the highest-value research priorities is to help ensure that increasingly powerful AI systems are developed and deployed in our economies in ways that are aligned with human values. As economists, we are uniquely positioned to translate concepts from the social sciences into analytic frameworks that can guide the development of aligned AI systems, making this an urgent and worthy focus.¹⁶

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Anton Korinek

Anton Korinek is a professor of economics at the University of Virginia and the Darden School of Business and a research associate of the National Bureau of Economic Research. He is also a senior researcher at the Complexity Science Hub, a visiting fellow at the Brookings Institution, the Economics of AI Lead at the Centre for the Governance of AI, and a member of a G7 high-level panel of experts on AI. He received his PhD from Columbia University in 2007 after working at the intersection of information technology and finance. He also held positions at the University of Maryland and Johns Hopkins University, the Bank for International Settlements, the International Monetary Fund, the World Bank, and as a visiting scholar at Harvard University.

His research analyzes how to prepare for a world of transformative AI systems. He investigates the economic implications of advanced AI for growth, innovation, labor markets, market concentration, and inequality as well as the governance of transformative AI systems. He also analyzes how to leverage increasingly powerful AI systems for economic research. In his past work, he investigated the mechanics of financial crises and developed policy frameworks to prevent future crises.

Gender, Work, and Family: Progress and Ongoing Challenges

Claudia Olivetti

How do societal norms, public policies, and economic forces shape outcomes for men and women? My recent work, with several collaborators, addresses how gender disparities in labor markets influence individual opportunities, household decisions, and overall economic productivity. It brings together insights from long-term historical trends and the extensive gender literature to examine both progress and persistent challenges to gender equality.

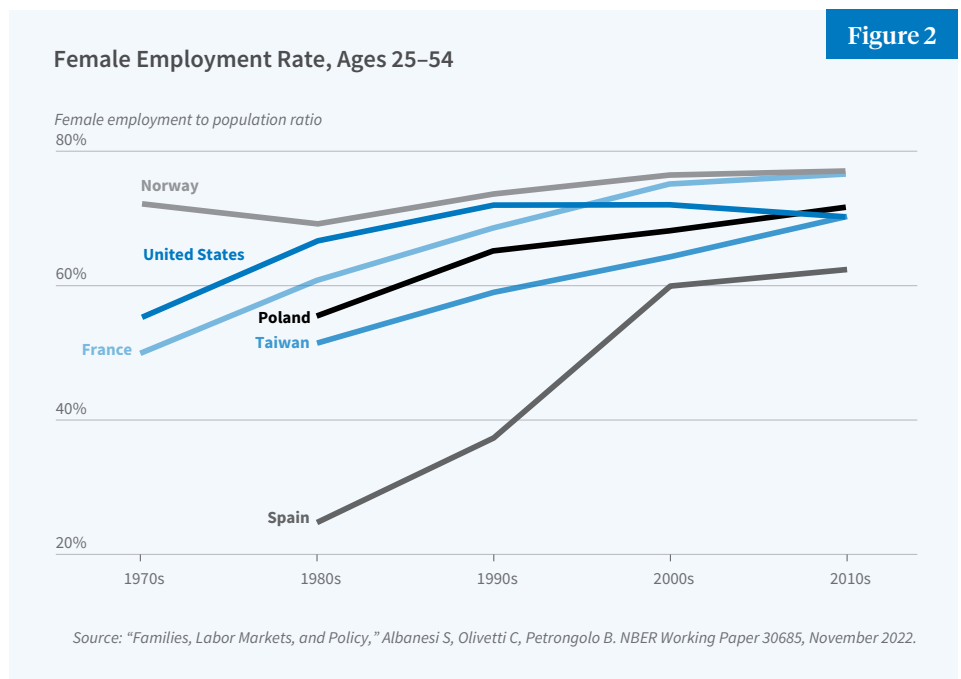
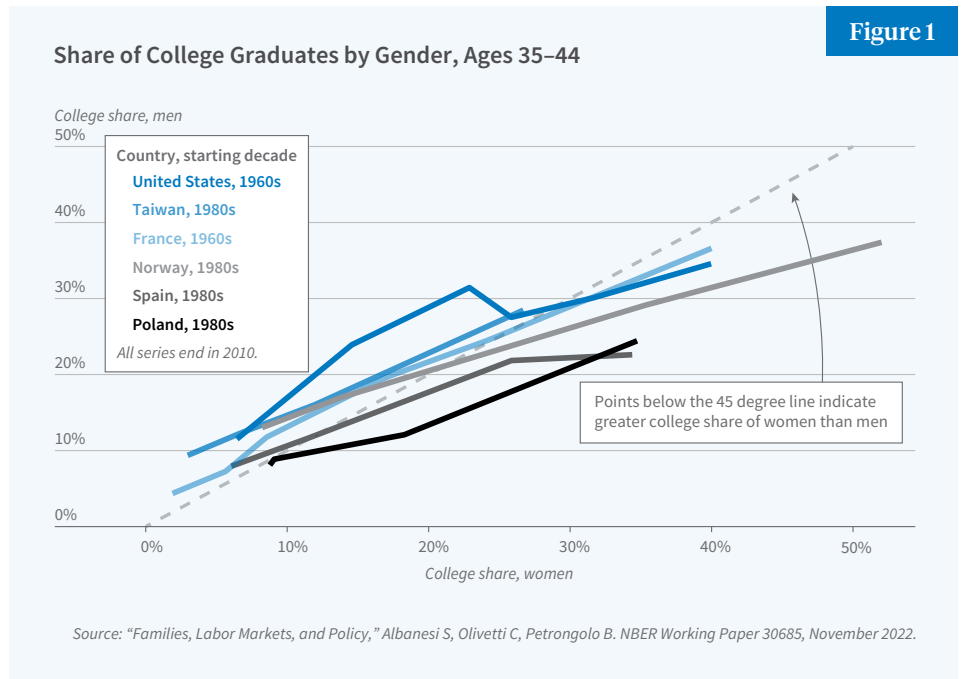
Narrowing Gaps, Persistent Inequalities

The remarkable progress of women in the labor market marks one of the most significant economic and social changes of the past 75 years across many developed economies. Jessica Pan, Barbara Petrongolo, and I recently reviewed the vast body of work studying women's changing roles in the economy and the underlying driving forces behind these developments.¹

A widely documented trend is the female gain in human capital accumulation, leading to narrowing and then reversing gender gaps in college completion rates. In the 2010s, more women than men had a college education in all but one of the 24 countries that Stefania Albanesi, Petrongolo, and I studied in a recent analysis of cross-country gender trends and family policies.²

Women's labor force participation has increased substantially in many countries, with some variation in the pace of change. As women's labor market experience increased, their college majors became more relevant to their employment and their education and professional degrees expanded. Women delayed marriage, had fewer children, and entered traditionally male professions.

Despite decades of progress, sizable gender inequalities in employment and earnings remain. Pan, Petrongolo, and I analyze data from the Panel



Study of Income Dynamics and find that as women have overtaken men in completed years of schooling and narrowed their gap in work experience relative to men, slightly more than half of the gender wage gap is now accounted for by the differential sorting of women and men into occupations and indus-

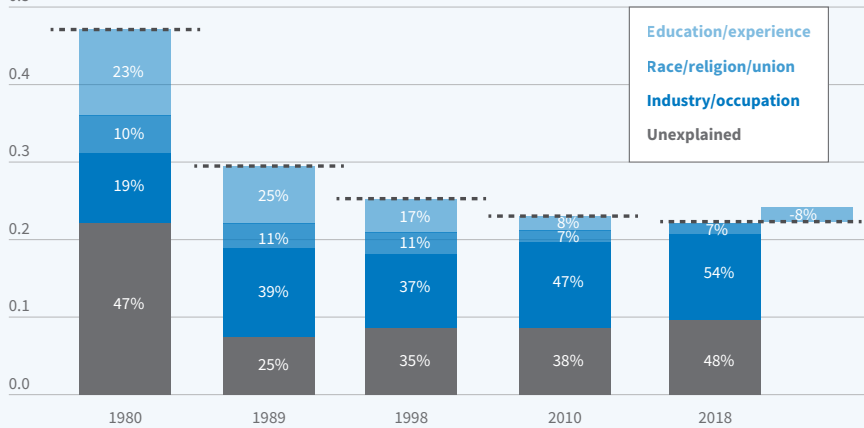
tries, with the remainder "unexplained" by observable characteristics.³ Structural issues within occupations and societal expectations, particularly regarding caregiving, are important for explaining the remaining gender gaps. Our analysis also proposes a simple model of labor supply to illustrate how

Figure 3

Gender Wage Gap

Percentages represent the share of the wage gap attributed to each source

Male minus female log wage gap
0.5



Sample includes individuals ages 25–64 who worked for at least 26 weeks during the preceding year.
Source: “The Evolution of Gender in the Labor Market,” Olivetti C, Pan J, Petrongolo B. NBER Working Paper 33153, November 2024.

unequal gender roles in the household and departures from competitive wage setting can shape earnings gaps even once gender productivity differentials (due to education, experience, or occupational choice) have vanished.

Evolving Perspectives

Over time, gender research has become mainstream, and there has been a clear shift from viewing women and men as single, representative agents to adopting a household-centric view where men and women take on dual roles in the labor market and the home. These roles are shaped by work-family trade-offs and cultural influences.

Why, despite this progress, do men and women still work different hours in the market and the home, sort into different jobs, and face different wage returns? There are two fundamentally different explanations for the existence of such gaps. One view is that men and women have inherently different preferences, skills, or psychological traits that drive their choices in education and careers. In this case, gender inequality is simply a manifestation of essential differences between men and women. The other view posits that men and women are similar in the relevant dimensions but face different opportunities and constraints. In this case, gender inequality can be

a symptom of misallocation, and policies that promote gender equality can improve allocative efficiency. A key challenge in distinguishing between these views is that observed gender differences in skills, traits, or preferences can be affected by constraints in the form of norms, stereotypes, and discrimination.

Parenthood and Career Inequality

Women’s roles as child bearers and caregivers are significant hurdles to their continued participation in the workforce, particularly in highly paid but time-demanding careers. The consensus of past research on the trade-off between family and career for mothers and fathers holds that parenthood drives widening gender gaps in earnings and that, following the decline in productivity gaps and outright pay discrimination, the remaining gender gaps in developed countries are related to children.

Much of this extensive literature focuses on mothers. Mothers often reduce their work hours or leave the labor force altogether after having children, leading to slower career progression and a widening earnings gap. What happens when the kids grow up? What is the impact on fathers’ earnings relative to those of men who don’t have

or will never have children?

In recent work, Claudia Goldin, Sari Kerr, and I use longitudinal data from the National Longitudinal Survey of Youth (1979), which tracks respondents from their twenties to their fifties, to analyze parenthood earnings dynamics as children age out of the parental household.⁴ We find that as children grow up and women work more hours, the motherhood penalty — that is, the earnings of mothers relative to those of non-mothers — is greatly reduced. The parental gender gap in earnings remains substantial, however, and is largely due to fathers benefiting from a “fatherhood premium” as societal norms reinforce their roles as primary earners.

Fathers earn a wage premium that cannot be fully explained by selection into fatherhood. That is, the tendency for higher-ability or harder-working men to be more likely to become fathers cannot explain the differential. This fatherhood premium is larger among college graduates and especially among men working in occupations that require long and/or inflexible hours. This evidence is consistent with progressive specialization of paid and unpaid work by men and women, respectively, once they become parents. Given the scant work in this area, investigating labor market and normative determinants of the fatherhood premium may be a promising area for further research.

Historical Patterns and Structural Shifts

In predominantly agricultural and less urban societies, most women work flexibly on or near household premises, making their work compatible with marriage and childcare. The transition to industrialization and the service economy, coupled with urbanization and the delocalization of work, drives progressively larger child-related gaps in employment. At the highest income levels, economies can create family-friendly jobs that make it easier to combine work and family life.

My recent work with Rachel Ngai and Petrongolo shows that this U-shaped pattern in women’s work is also found

historically for the United States when we account for unpaid work on family farms.⁵ We construct a consistent measure of male and female work hours for the US over the period 1870–2019, encompassing extensive and intensive margins of labor supply. We emphasize the measurement of unpaid work in family businesses; this is hard to quantify pre-1940 when information on work hours was not recorded. For paid work hours and earnings by sector and gender, we use surveys commissioned by state Bureaus of Labor from the late 1880s to 1901, digitized by the Historical Labor Statistics Project at the University of California. For unpaid hours on family farms, we analyze early time-use studies conducted by the US Department of Agriculture and several state’s Agricultural Experiment Stations and other organizations between the mid-1920s and the mid-1950s. In addition to being critical for measuring women’s contributions to the economy, tracking unpaid work on family farms matters for the estimation of agricultural productivity and structural transformation.

We also examine the relationship between gender trends in work and economic development through the lens of two processes: structural transformation across agriculture, manufacturing, and services and the marketization of home production. During early development stages, declining agricul-

ture leads to reallocation to services — both in the market and the home — and leisure, reducing market work for both genders. In later stages, structural transformation reallocates labor from manufacturing to services, while marketization reallocates labor from home to market services. Given gender specialization, male hours continue to decline while female hours increase.

We find that structural transformation and marketization can explain the decline in women’s work hours in the US before 1950. However, labor reallocation across sectors and marketization can only explain a quarter of the later changes, which were accompanied by other structural changes including the evolution of women’s aspirations and societal perceptions about appropriate gender roles in the household and the labor market.

The Role of Family Policies

The changing role of women in society generated government intervention and firm policies that often eased the struggles of families and, especially, new mothers. Albanesi, Petrongolo, and I recently reviewed evidence on the effect of these policies.⁶

Early legislation on parental leave rights mostly focused on protecting mothers’ health around birth and supporting child development, emphasis-

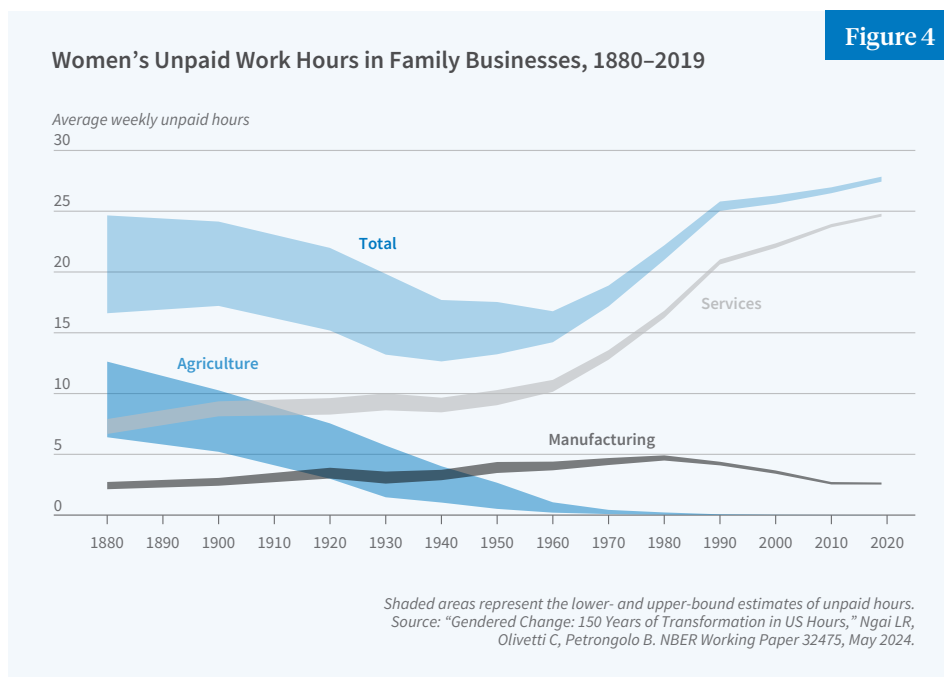
ing — explicitly and implicitly — women’s traditional gender roles as wives and mothers in a male-breadwinner society. As more women entered the workforce in the latter half of the twentieth century, the demand for policies that balanced work and family life grew. Scandinavian countries led the charge with longer maternity leaves and quotas for fathers, while the US has been slower to adopt paid parental leave. Some states adopted such laws in recent years.

What lessons can be learned from decades of legislation and evaluations about the role of family policies for the new century? Studies of parental leave reforms in several European countries suggest that parental leave extensions typically delay mothers’ return to work after childbirth, with negative impacts on maternal earnings in the short run.

But there do not seem to be long-lasting effects — positive or negative — of parental leave on maternal earnings. Fathers’ quotas are a step toward encouraging shared parenting, but most fathers take only the bare minimum leave they are allotted. Funding for childcare consistently shows positive effects on women’s participation in the workforce across countries, especially when it replaces the need for mothers to provide childcare themselves.

Interestingly, the only example in US history of an (almost) universal, largely federally supported childcare program occurred during WWII under the Lanham Act, a federal infrastructure bill passed by Congress in 1940 and eventually used to fund programs for the preschool and school-aged children of working women. Joseph Ferrie, Goldin, and I find that these programs, though limited in scope, were more numerous in places with high female workforce participation, suggesting their effectiveness in supporting mothers working long hours in intensive employment.⁷

As gender inequality is increasingly tied to parenthood, women’s ability to reconcile work and family life remains crucial.



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² “Families, Labor Markets, and Policy,” Albanesi S, Olivetti C, Petrongolo B. NBER Working Paper 30685, November 2022.

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³ “The Evolution of Gender in the Labor Market,” Olivetti C, Pan J, Petrongolo B. NBER Working Paper 33153, November 2024.

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⁴ “When the Kids Grow Up: Women’s Employment and Earnings across the Family Cycle,” Goldin C, Kerr SP, Olivetti C. NBER Working Paper 30323, August 2022.

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⁵ “Gendered Change: 150 Years of Transformation in US Hours,” Ngai LR, Olivetti C, Petrongolo B. NBER Working Paper 32475, May 2024.

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⁶ “Families, Labor Markets, and Policy,”

Albanesi S, Olivetti C, Petrongolo B. NBER Working Paper 30685, November 2022.

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⁷ “Mobilizing the Manpower of Mothers: Childcare under the Lanham Act during WWII,” Ferrie JP, Goldin C, Olivetti C. NBER Working Paper 32755, July 2024.

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Claudia Olivetti

Claudia Olivetti is the George J. Records 1956 Professor of Economics at Dartmouth College and a research associate of the National Bureau of Economic Research. She is also a codirector of the NBER Working Group on Gender in the Economy.

Her research focuses on women in the labor market, including wages, hours, and careers, and on intergenerational mobility and marriage institutions from a historical perspective. She has worked on the baby boom and maternal health and on historical and comparative perspectives on the gender gap.

Before joining Dartmouth in 2019, Olivetti was a professor of economics at Boston College from 2015 to 2019 and at Boston University from 2001 to 2015, where she began as an assistant professor. She earned her PhD in economics from the University of Pennsylvania.

Consumer Credit Markets

Christopher Palmer

Consumer credit markets play a pivotal role both in the macroeconomy and in people's lives because they are tightly linked to consumption, financial distress, household investment, financial inclusion, and monetary policy transmission. Put another way, what happens in credit markets doesn't stay in credit markets. Both supply-side and demand-side disruptions and dysfunctions in credit markets have real effects on outcomes as widely varying as car prices, bankruptcy, education, and where people live. Public policy reflects this importance, with significant regulatory efforts dedicated to supporting healthy credit markets, including consumer financial protection, mortgage guarantees, bankruptcy statutes, and banking supervision. In this article, I review my recent research highlighting the value of understanding both credit supply and credit demand to appreciate the many ways credit-market imperfections affect household financial wellbeing and the broader economy. I conclude with a discussion of promising areas for research to inform public policy issues.

Why Are Credit Markets Special?

Consumer credit markets are special for several reasons. First, credit is not a final good; consumers value debt not for its own sake but in service of consumption or investment in assets and human capital or to self-insure against shocks. Trouble in credit markets therefore affects outcomes in other markets and households' financial resilience. Second, credit contracts entail long-term commitments with ongoing cash-flow obligations that affect households' continuing ability to spend, save, borrow, and handle unexpected shocks. Making such decisions necessitates forward-looking optimization under uncertainty, and a wide variety of households struggle on some level with this complexity. Especially when borrowing costs are high and compound over time, the financial

consequences of indebtedness can quickly spiral into nonfinancial consequences. This long-term nature of credit decisions also elevates the importance of consumer expectations, which often seem to be formed with some degree of irrationality. Third, household credit access is often limited by asymmetric information between lenders and borrowers, leading to significant borrowing constraints at both the extensive margin, such as credit access, and the intensive margin, such as credit limits and interest rates. Fourth, an important channel of monetary policy is its impact on borrowing conditions for households. Credit market frictions impact the pass-through of monetary stimulus or tightening, inhibiting the ability of monetary policies to meet their mandates.

Household Budgeting

Even though committing to a monthly budget — category-specific monthly spending limits — is a central feature of personal-finance advice, classical economic theory, such as the permanent income hypothesis, does not acknowledge any role for monthly budgeting. Similarly, the economic literature on credit constraints acknowledges the existence of binding credit limits but does not explain why households might voluntarily attempt to constrain their own per-period spending. Whether to cope with their own self-control issues or their inability to otherwise insure against all financial shocks, many households use a monthly budget. However, in the absence of a precise way to set category-specific monthly spending limits, many households target cognitively accessible round numbers and exhibit left-digit bias, meaning, for example, that amounts ending in \$99 seem disproportionately lower than amounts just higher. While this decision-making may help households avoid overspending, it has several unintended consequences that I explore in a series of papers focusing on the auto-loan industry. The auto-loan

market itself is a useful laboratory for studying how consumer credit supply and demand interact. Auto loans are the largest category of non-mortgage consumer debt in the US, directly affect car purchasing behavior, and are held by most US households.

First, with Bronson Argyle and Taylor Nadauld, I demonstrate that households indeed target specific round-number monthly payments when they shop for cars and car loans, a phenomenon we refer to as “monthly payment targeting.”¹ We show that many borrowers base their debt decisions primarily on the associated monthly payment consistent with the complexity of making affordability decisions and with the ubiquity of heuristic budgeting. Monthly payment targeting makes demand particularly sensitive to a loan's maturity and relatively less sensitive to interest rates because of the outsize effect of longer maturity on reducing monthly payments. On the supply side, this leads lenders, who are often car dealers themselves, to cater to the demand-side preference for low monthly payments by offering longer-term loans, keeping car buyers indebted for longer and raising total interest payments.

The emphasis consumers place on monthly payment levels affects the prices they pay for cars, too. With Argyle, Nadauld, and Ryan Pratt, I find that when a lender restricts the maturity of a car loan, consumers are more likely to negotiate the price of that car down, even when the seller and the lender are not integrated.² For example, a given lender may be unwilling to make a five-year car loan on used cars more than four years old. In January 2023, when a 2018 Honda Accord switched from being four to five years old, that lender would demand a higher monthly payment. To cope, buyers with more expensive credit terms negotiate larger discounts from car sellers. This dynamic underscores the broad importance of credit conditions for related markets. Lengthening maturities for consumer loans over time can contrib-

ute to inflation by pushing up the prices of finance-dependent goods like cars. Moreover, the effectiveness of monetary or fiscal policy is attenuated when the change in demand induced by such policies is partially offset by changes in durable goods prices.

Not Shopping Around for Credit

A textbook example of credit market imperfections directly affecting consumers is the failure to shop around for credit, which limits what people buy. Consumers often fail to find the best interest rate available to them. Using car loans as a setting again, Argyle, Nadauld, and I estimate that the average borrower needs around three quotes to find close to the best available rate.³ Higher interest rates from not shopping around for credit combined with a focus on monthly payment sizes means consumers may cut back on their spending to maintain their targeted payment levels. We show that people facing expensive loans because of high loan search costs, such as those who have few potential lenders nearby, often cope by buying older and less expensive cars instead of searching for a better interest rate.

Figure 1 illustrates the interconnectiveness between credit markets and final goods markets. When borrowers are just below a key credit-score

threshold with a given lender, they face sharply higher interest rates, which then reduces the amount they ultimately spend on a car. The cost of searching for credit thus distorts consumption levels; this highlights the importance of credit access for households and the value of financial inclusion for an economy. Furthermore, to the extent that the cost of shopping for credit partially decouples borrowing costs from lending costs, this could hinder the pass-through of monetary policy. Future research could examine whether the post-COVID acceleration of digital banking has changed competition and facilitated access to financial services.

Supporting Borrowers Through Credit Market Policies

A number of public policies seek to support healthy credit markets through stimulus during recessions, support for consumer decision-making, and regulations that protect consumers from financial distress. Below, I review my research studying the effectiveness of such policies.

The importance of consumer credit for monetary policy

The importance of well-functioning consumer credit markets is exemplified

by how mortgage market frictions modulate the pass-through of monetary policy to households. My research with Marco Di Maggio and Amir Kermani shows that the refinancing spurred by quantitative easing (QE) raises consumption and is an important channel through which monetary policy operates.⁴ Many central banks now purchase large amounts of long-term bonds to drive down long-term interest rates when extraordinary monetary stimulus is warranted. We document the causal effects of Federal Reserve QE mortgage purchases on mortgage refinancing, equity extraction, and consumption. Households with better access to credit and lower interest rates because of QE were more likely to increase their durables consumption and extract home equity during the Great Recession. Figure 2 illustrates one dimension of this refinancing channel, showing that many households finance a car purchase with some of the savings from refinancing into lower interest payments.

Are you paying attention?

Across a wide range of decisions, households update their decisions infrequently. This inertia has consequences as consumers, for example, spend money on gym memberships they don't use, fail to refinance into lower mortgage interest payments, and miss out on retirement saving subsidies. Such consumer stickiness motivates a variety of policies to promote active choice, information gathering, and competition among providers. One of the most common forms of consumer protection is mandated disclosure, resulting in much of the fine print and paperwork that accompanies consumer debt contracts. To test whether disclosure improves consumer outcomes, I partnered with Paul Adams, Stefan Hunt, and Redis Zaliauskas to test whether redesigned disclosure can increase the interest depositors earn on their savings.⁵ In a series of randomized controlled field trials with five UK banks, we find that most people ignore disclosures, regardless of how they are designed or delivered or how valuable their information content might be.

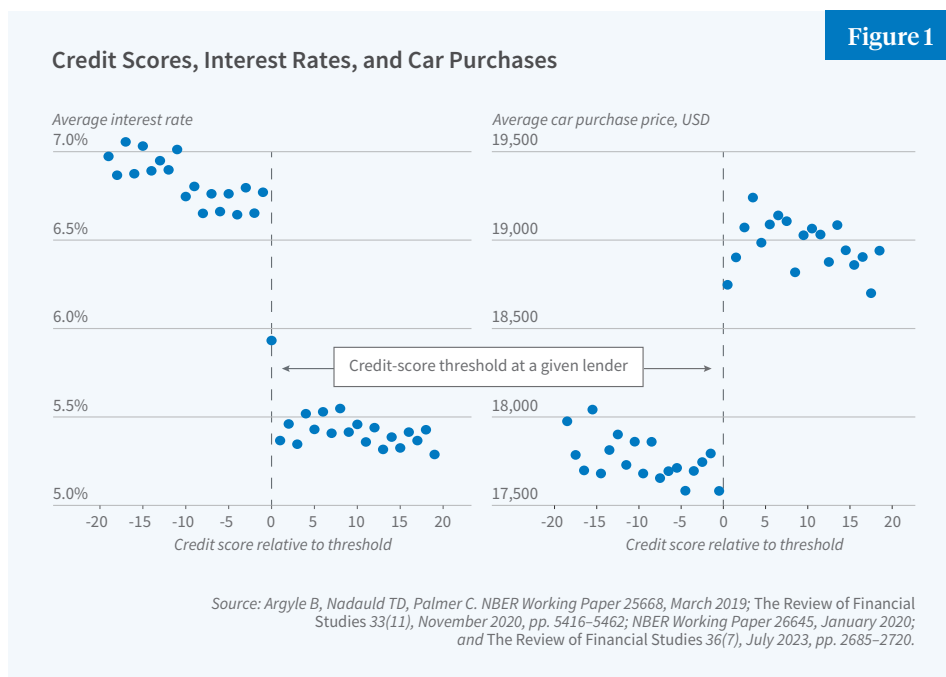
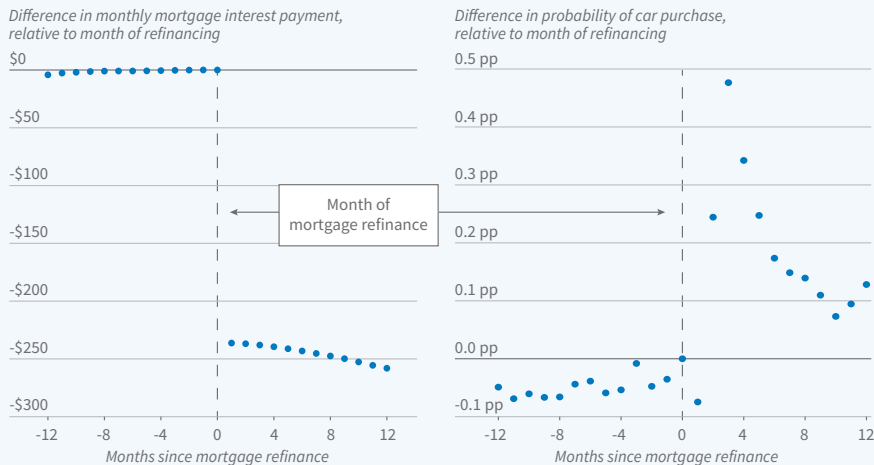


Figure 2

Mortgage Refinancing, Interest Payments, and Car Purchases



Source: "How Quantitative Easing Works: Evidence on the Refinancing Channel," Di Maggio M, Kermani A, Palmer C. NBER Working Paper 22638, September 2016, and The Review of Economic Studies 87(3), May 2020, pp. 1948-1528.

If inattention is a ubiquitous demand-side friction that is important for understanding a wide variety of consumer behaviors, it is natural to ask how inattention is affected by policy. Given the importance of the refinancing channel of monetary policy transmission, inattention to refinancing opportunities could be a particularly valuable friction for policy to address. Figure 3 illustrates the scope of the policy opportunity using data on the US mortgage market. Interest rates on the flow of newly originated mortgages (dark gray line) are reasonably re-

sponsive to monetary policy (light gray line). By contrast, because of the prevalence of fixed-rate mortgages and the slow responsiveness of borrowers to refinancing opportunities most of the time, interest rates on the stock of outstanding mortgages (blue line) reflect conventional monetary policy only sluggishly.

A follow-up study inspired by the savings field experiments suggests a way in which policy could matter. Partnering with Shane Byrne, Kenneth Devine, Michael King, and Yvonne McCarthy, I analyze a large-scale field

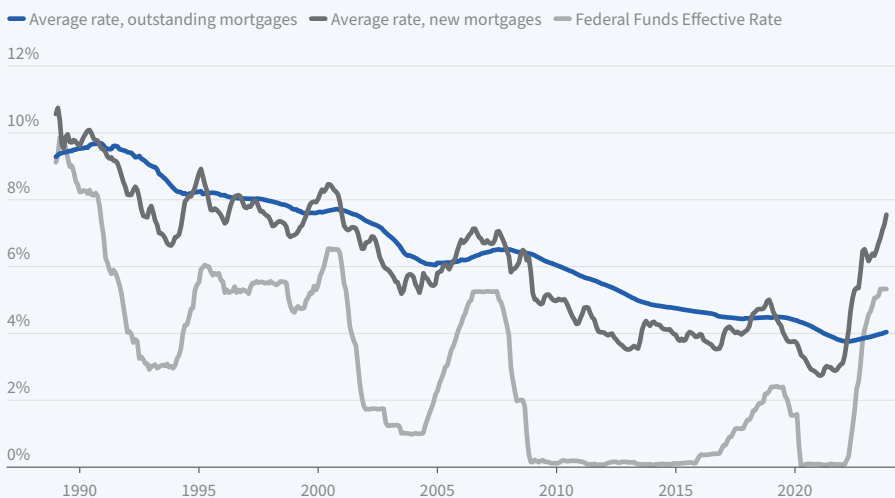
experiment in Ireland to study the potential of reminders about mortgage refinancing opportunities to improve refinancing decisions.⁶ Testing several possible interventions, we find that combining disclosures with a simple follow-up reminder letter increases refinancing from 9 percent to 16 percent. Monetary policy is sometimes maligned as "pushing on a string" because it ultimately relies on credit demand to respond to the change in financial slack. However, our results demonstrate that readily implementable communication strategies can improve and complement monetary policy transmission through the refinancing channel.

Balancing credit access and consumer protection

One of the strongest tensions in consumer credit policy is between efforts to increase credit access and efforts to minimize financial distress. This policy pendulum swings back and forth over time, sometimes emphasizing one objective over the other. For example, as subprime mortgage foreclosures spiraled in the wake of the global financial crisis, many commentators argued for tighter mortgage lending standards. Subprime mortgages accounted for most foreclosures during the crisis despite only having a 13 percent market share of outstanding mortgages at the time. A central question in the postmortem has been the extent to which this subprime crisis was driven by looser lending standards during the pre-crisis credit boom or by falling house prices during the bust. Given that house prices fell by an average of 30 percent, would so many mortgages have defaulted even if they had been originated under tighter credit standards? I take up this question using a new methodology to estimate loan default models when factors such as house price declines are themselves partially driven by loosening credit, eventually leading to a credit and housing bust.⁷ Even accounting for the potential feedback between credit and prices, I find that most defaults were driven by house-price declines and would have happened even under tighter underwriting standards.

Figure 3

Interest Rates on Outstanding and Newly Originated Mortgages



Source: "The Last Mile of Monetary Policy: Inattention, Reminders, and the Refinancing Channel," Byrne S, Devine K, King M, McCarthy Y, Palmer C. NBER Working Paper 31043, March 2023.

Although this conclusion does not fully excuse risky lending practices, it highlights the importance of balancing consumer protection with financial inclusion. If credit-market regulations lock many potential borrowers out of credit markets, these real consequences deserve to be weighed alongside efforts to prevent consumer financial distress.

Future Considerations for Research and Policy

The lessons discussed above suggest several potential paths for research to inform policy. First, research could quantify the distortions created when credit access is restricted and characterize the trade-offs between preserving credit access and protecting consumers from financial distress. For example, usury laws cap the maximum interest rate that lenders can charge but can make it difficult for high-risk households to access credit. Capital requirements aim to ensure banks have sufficient cushions to weather shocks without bailouts or harmful cuts to credit supply but can tilt lending away from consumers who value credit access the most. Regulations that make subprime lending unattractive for lenders can lock households out of credit markets, preventing them from accumulating wealth through homeownership. The net welfare effects of credit-market access merit significant attention, including through the lens of equal opportunity across groups. Second, consumers interacting with credit

markets necessarily form expectations about a host of economic variables.⁸ There is currently only limited evidence on ways to sharpen the forecasting ability of consumers whose expectations are persistently inaccurate. Third, recent work shows that a significant portion of household liabilities are not observable to analysts using traditional data sources.⁹ Learning why, when, and how consumers resort to such “shadow debt,” including studies of credit deserts, could inform financial inclusion efforts.

¹ “[Monthly Payment Targeting and the Demand for Maturity](#),” Argyle B, Nadauld TD, Palmer C. NBER Working Paper 25668, March 2019, and *The Review of Financial Studies* 33(11), January 2020, pp. 5416–5462. [Return to Text](#)

² “[The Capitalization of Consumer Financing into Durable Goods Prices](#),” Argyle B, Nadauld TD, Palmer C, Pratt RD. NBER Working Paper 24699, September 2020, and *The Journal of Finance* 76(1), September 2020, pp. 169–210. [Return to Text](#)

³ “[Real Effects of Search Frictions in Consumer Credit Markets](#),” Argyle B, Nadauld TD, Palmer C. NBER Working Paper 26645, January 2020, and *The Review of Financial Studies* 36(7), November 2022, pp. 2685–2720. [Return to Text](#)

⁴ “[How Quantitative Easing Works: Evidence on the Refinancing Channel](#),” Di Maggio M, Kermani A, Palmer

C. NBER Working Paper 22638, September 2016, and *The Review of Economic Studies* 87(3), May 2020, pp. 1498–1528.

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⁵ “[Testing the Effectiveness of Consumer Financial Disclosure: Experimental Evidence from Savings Accounts](#),” Adams PD, Hunt S, Palmer C, Zaliauskas R. NBER Working Paper 25718, May 2020, and *Journal of Financial Economics* 141(1), July 2021, pp. 122–147.

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⁶ “[The Last Mile of Monetary Policy: Consumer Inattention, Disclosures, and the Refinancing Channel](#),” Byrne S, Devine K, King M, McCarthy Y, Palmer C. NBER Working Paper 31043, March 2023.

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⁷ “[An IV Hazard Model of Loan Default with an Application to Subprime Mortgage Cohorts](#),” Palmer C. NBER Working Paper 32000, December 2023, and forthcoming in the *Journal of Finance*.

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⁸ “[Are Stated Expectations Actual Beliefs? New Evidence for the Beliefs Channel of Investment Demand](#),” Liu H, Palmer C. NBER Working Paper 28926, June 2021.

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⁹ “[Personal Bankruptcy, Moral Hazard, and Shadow Debt](#),” Argyle B, Iverson B, Nadauld TD, Palmer C. NBER Working Paper 28901, June 2021.

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Christopher Palmer

Christopher Palmer is an associate professor of finance at the MIT Sloan School of Management where he teaches courses on corporate finance. He is also a research associate of the National Bureau of Economic Research and an affiliate with the Abdul Latif Jameel Poverty Action Lab and the MIT Sloan Consumer Finance Initiative. His research studies how consumers make financial decisions and interact with financial institutions, the effects of government intervention in household finance, and how credit and real estate markets react to periods of significant upheaval. Before joining MIT Sloan, Palmer was an assistant professor at the University of California, Berkeley Haas School of Business, where he taught courses on real estate finance. He is the winner of multiple teaching awards, including the MIT Sloan Jamieson Prize for Excellence in Teaching. Palmer has been a visiting scholar at the Federal Reserve Banks of New York, Boston, and San Francisco, and is currently on sabbatical at Harvard Business School. He holds a PhD in economics from MIT and studied economics and mathematics as an undergraduate at Brigham Young University.

What Drives Fluctuations in Exchange Rates? An Asset Market Perspective

Zhengyang Jiang, Arvind Krishnamurthy, and Hanno Lustig

From an asset market perspective, there are three main drivers of variation in the dollar exchange rate. First, foreign investors value dollars more if dollar investments pay out higher interest rates than abroad. This is the interest rate channel. Second, foreign investors value dollars more if the dollar appreciates when volatility in global financial markets spikes. In this case, the dollar offers protection against increases in global volatility, and foreign investors are willing to accept a negative excess return on dollar assets, the equivalent of paying an insurance premium to hold the dollar. This is the currency risk premium channel. Third, foreign investors value dollars because of the safety and liquidity of dollar-denominated safe assets, such as Treasuries. Foreign investors earn extra convenience yields from holding these dollar-denominated safe assets instead of domestic safe assets. This is the convenience yield channel.

The dollar appreciates today when investors expect higher US interest rates, better insurance from the dollar against global shocks, or higher convenience yields on dollar-denominated safe assets compared to foreign currency safe assets. This exchange rate valuation framework is similar to the cash flow and discount rate decomposition commonly used to understand variation in stock prices. Stock prices increase today either because investors expect higher cash flows or lower discount rates. The interest rate differences and the convenience yields represent the “cash flows” that accrue to foreign investors who have long positions in the dollar. Currency risk premia are the equivalent of “discount rates.”

Our research shows that the interest rate and risk premium drivers are relevant for understanding exchange rate variation in general, while the convenience yield channel is largely specific to the dollar. Our recent work focuses on the special roles the dollar plays in the international financial system.

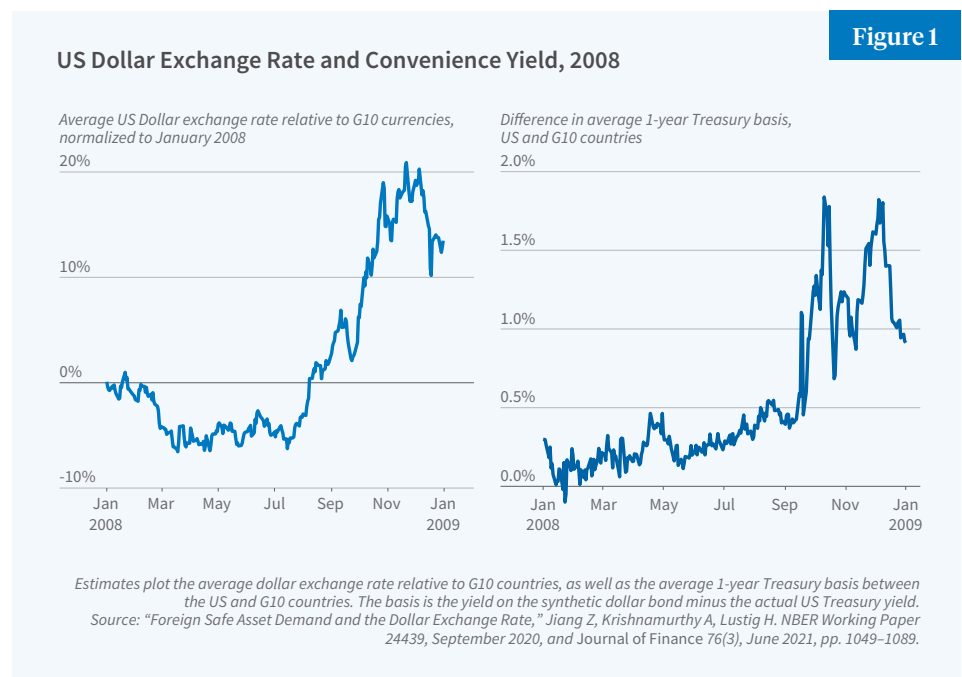
The Convenience Yield Channel and the Dollar

The US is at the center of the international financial system today. The US is the world’s safe asset supplier and the dollar is the world’s reserve currency. Foreign investors derive extra convenience yields from holding dollar safe assets such as US Treasuries compared to foreign currency safe assets. We infer the size of these extra convenience yields earned by foreign investors from covered interest rate parity deviations in sovereign debt markets. When investors buy a foreign government bond and convert into a dollar payoff by hedging out the currency risk, they typically find that this “synthetic” Treasury is cheaper than the US Treasury of the same maturity. In other words, the yields on the synthetic Treasury are higher than actual Treasury yields.¹ This yield differential reflects investors’ willingness to accept lower returns on US Treasuries due to their safety and liquidity benefits.

We measure the dollar’s convenience yield using the 1-year Treasury basis, which is defined as the difference between the 1-year foreign Treas-

ury yield plus a currency forward contract that hedges the foreign exchange risk and the 1-year US Treasury yield.² We use safe government bonds for G10 countries to measure foreign government yields, so that default risk is not a factor.

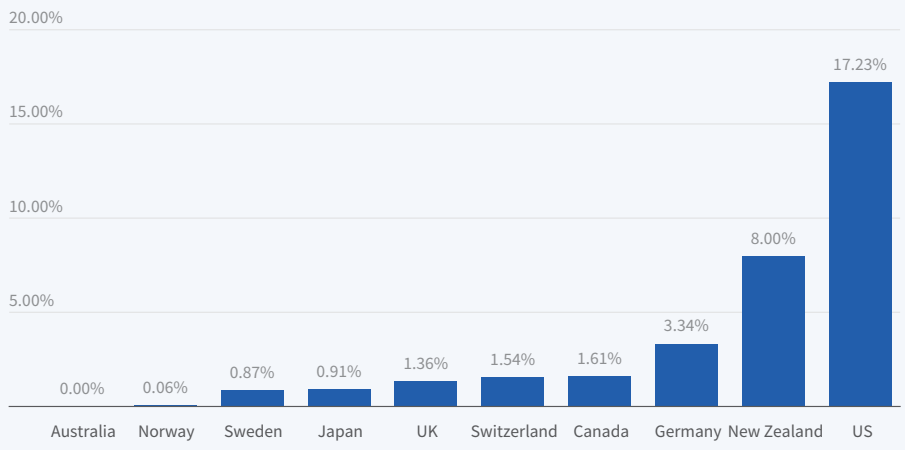
This convenience yield channel connects the dollar exchange rate to the global demand for and supply of safe assets. The dollar exchange rate constantly adjusts to clear the market for dollar-denominated safe assets as the convenience yield on dollar safe assets such as Treasuries varies over time. As predicted by the exchange rate valuation framework, the dollar appreciates instantaneously against G10 currencies when the global demand for dollar safe assets increases, which corresponds to wider Treasury basis. One example of a positive demand shock was the 2008–09 Global Financial Crisis (GFC). Figure 1 plots the equal-weighted dollar exchange rate against other G10 currencies and the average, across G10 Treasury basis in 2008. In this period, the US Treasury basis widened by 60 basis points, while the dollar appreciated by 14.3 percent.



Exchange Rate Variation and Sovereign Bond Basis

Figure 2

Bars plot the fraction of exchange rate variation explained by convenience yield shocks for each of the G10 currencies



Source: "Foreign Safe Asset Demand and the Dollar Exchange Rate," Jiang Z, Krishnamurthy A, Lustig H. NBER Working Paper 24439, September 2020, and Journal of Finance 76(3), June 2021, pp. 1049–1089.

This flight to the safety of Treasuries is also borne out by the large net purchases of Treasuries by the rest of the world during the GFC. Foreigners were the largest net purchasers of US Treasuries, dominating all other sectors combined.

When we study the time series of the dollar exchange rate since 1988, we find that the Treasury basis can explain 17 percent of the quarterly variation in the dollar against G10 currencies. This is not the case for other currencies. Figure 2 presents the fraction of exchange rate variation explained by convenience yields for each of the G10 currencies. The convenience yield factor is far more important for the dollar than any of the others. The yen equivalent of the Treasury basis, for example, measured from Japanese government bonds, explains only about 1 percent of the variation in the yen exchange rate.

An important, but nuanced, point is that all safe dollar assets earn the dollar's convenience yield. While 1-year Treasuries, which have been the dollar safe assets par excellence, offer the highest convenience yield, other dollar safe assets also offer high convenience yields. Indeed, we find that the Treasury basis is only about 10 percent of the extra convenience yield investors derive from a cash position in dollar-denominated Treasuries, whereas the remaining 90 percent is shared across all dollar safe assets.

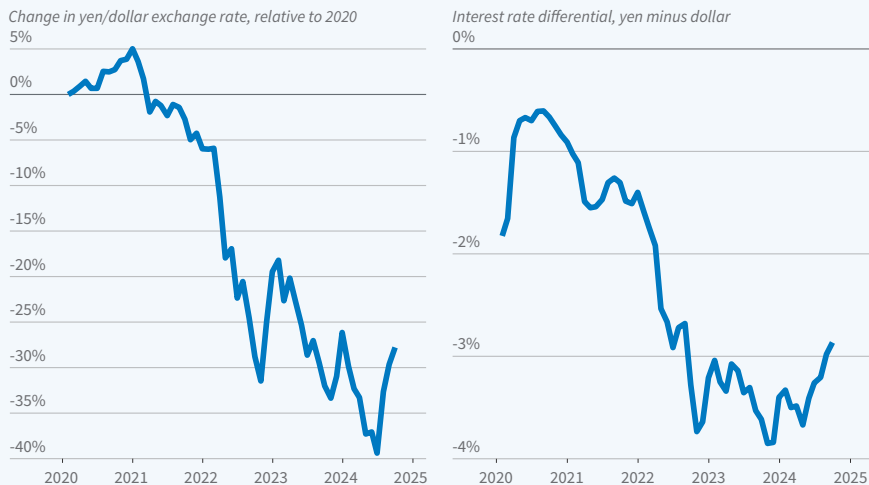
The Interest Rate and Risk Premium Channels

Comparing the convenience yield channel to the interest rate and risk premium channels offers additional insight about the drivers of exchange rates. Consider the interest rate channel first. An interesting case study is the recent behavior of the yen/dollar exchange rate. Because of the Bank of Japan's low-rate policies, including its yield curve control policy, Japanese short- and long-term rates have been close to zero, as other countries, in-

cluding the US, started to tighten and rates increased. The yen, in light blue (Figure 3a), has depreciated by 24 percent against the dollar since 2021 as foreign rates lifted off from the zero lower bound. Figure 3a shows that the yen depreciation is mirrored almost perfectly by changes in the interest rate spread between Japan and the US. The 10-year yields reflect not only the current short-term interest rate, but also the market's expectation of the future short rates.³ The yen has depreciated against the dollar as the long-term yield gap between Japan and the US widened.

In this recent episode, movements in the yen were largely driven by interest rate differentials, but there are other periods in which the yen's currency risk premium was the dominant driver. Figure 3b plots exchange rate movements of the pound and the yen as well as the VIX during the GFC. The yen, a low interest rate or funding currency, appreciated against the dollar, while the pound, a higher interest rate currency, depreciated, as the VIX increased in the fall of 2008. The yen is a "safe-haven" currency that appreciates during global downturns.⁴ It is special in that it appreciates even against the dollar. Given this insurance characteristic, the yen carries a negative currency risk premium. Foreign investors value assets that appreciate in global downturns. As a result, they are willing to accept lower returns when investing in yen.

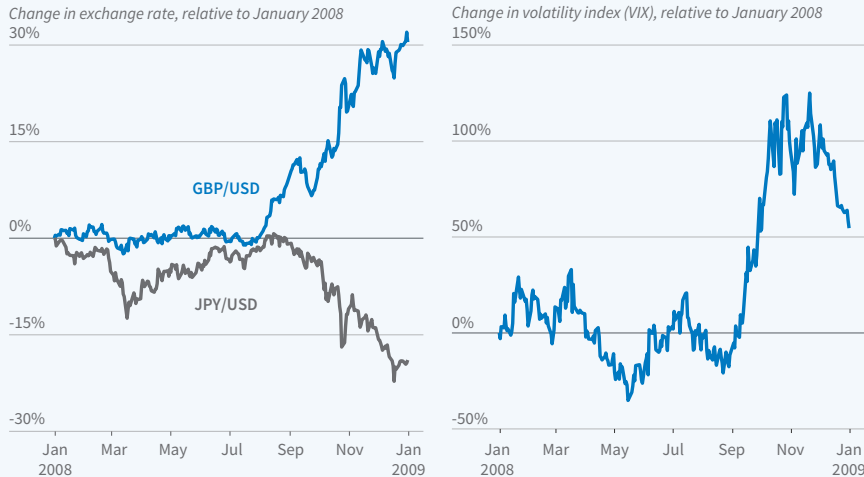
Figure 3a



Source: Federal Reserve Board.

Figure 3b

Yen/Dollar versus Pound/Dollar Exchange Rates



Source: Federal Reserve Board.

Global Insurer versus Safe Asset Supplier

If a country has persistently lower interest rates than other countries, the low rates need to be justified by some offsetting benefits: either foreign investors value the currency because it offers protection against global shocks, as in the case of the yen, or safe assets denominated in that currency offer extra convenience yields, as in the case of the dollar. Both Japan and the US have low interest rates and currencies that tend to appreciate during global downturns, but for different reasons. This distinction matters.

Japan is a surplus country that does not have to attract net capital inflows from abroad. Over the past decades, Japan has accumulated a large positive net foreign asset position. The Japanese government and its taxpayers run a multitrillion dollar carry trade by borrowing locally at low interest rates and investing abroad at higher interest rates. The consolidated Japanese government funds itself at the rate of interest on reserves in yen, through the Bank of Japan’s bond purchases and its issuance of bank reserves, and then goes long in foreign bonds and equities without hedging the currency risk, mainly through the government-run pension fund.⁵ This is a profitable but risky trade

that helps the Japanese government finance large deficits. Foreign investors pay an insurance premium when they go long on the yen. The consolidated Japanese government pockets these insurance premia. During times of turmoil, the yen appreciates and the Japanese government suffers losses on its carry trade. Indeed, when the VIX spiked in August 2024, there was a reversal of the carry trade. The yen appreciated by 4 percent from July 31 to August 5, 2024, leading to losses to the Japanese government and taxpayers. In this sense, Japanese taxpayers provide insurance to the rest of the world by bearing losses in times of heightened global volatility.

By contrast, the US is a deficit country but still manages to attract sufficient foreign capital inflows in spite of its lower rates, albeit not as low as the Japanese rates. Over the past decades, the US has accumulated a large negative net foreign asset position. The US government and the private sector run a different carry trade relative to the rest of the world. The US borrows abroad by selling dollar safe assets to the rest of the world and then goes long in risky foreign assets.⁶ In doing so, the US earns a profit on average from the convenience yield on this carry trade.

However, in this carry trade, the US is not insuring the rest of the world. Rather, as a supplier of safe assets, the

US provides the rest of the world with a stream of safety and liquidity services, resulting in significant seigniorage revenue. In times of increased volatility, convenience yields increase and the US earns more seigniorage revenue on its supply of safe assets. This additional revenue allows the US to run larger current account deficits. The present value of these carry trade profits gives the US the capacity to absorb the portfolio losses due to dollar appreciation.^{7,8} As a result, the US government gains additional fiscal capacity, and the private sector gains extra borrowing capacity during a global downturn.

As the primary supplier of safe assets, the US enjoys a countercyclical revenue stream that boosts the government’s fiscal capacity in times of stress. No other nation is in this position. However, the convenience yields on US Treasury bonds have declined over the last few years. At the onset of the COVID-19 pandemic, there was no flight to the safety of Treasuries. In fact, the 10-year Treasury yield increased by 70 basis points between March 9 and March 18, 2020, in line with UK, German, and French yields. Foreign investors sold Treasuries in the first quarter of 2020. Those sales were concentrated at the long end. In March 2020, foreign investors sold more than \$400 billion of US Treasury notes and bonds. The next month, they sold another \$200 billion. Importantly, foreign investors were not selling corporate bonds or agency bonds.

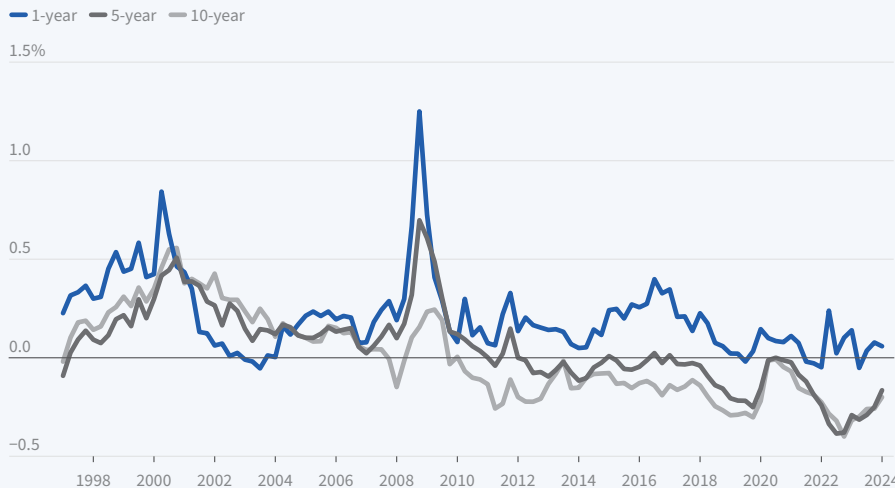
The Dollar Is Special, but for How Long?

Global demand for the safety and liquidity of US Treasuries is downward sloping. The convenience yield on Treasuries varies in response to shifts in the supply of dollar safe and liquid assets. The evidence for this is clearest in Krishnamurthy and Annette Vissing-Jorgensen’s work, which examines variation in Treasury supply and convenience yields since 1920.⁹

At the start of the GFC, the US total public debt to GDP ratio was 64 percent. Today it is 120 percent. As the US has increased the supply of

US Dollar Treasury Basis, by Tenor

Figure 4



The basis is the yield on the synthetic dollar bond minus the actual US Treasury yield.

Source: "Convenience Lost," Jiang Z, Richmond R, Zhang T. SSRN working paper, November 2024

dollar-denominated safe assets over this period, the convenience yields on Treasuries have decreased. Figure 4 shows the Treasury basis for 1-year, 5-year, and 10-year bonds from 1996 to 2024. The basis has clearly declined as the quantity of Treasury debt has increased. Jiang, Robert Richmond, and Tony Zhang present statistical evidence tying increased debt supply to declines in the Treasury basis.¹⁰ Roberto Gomez Cram, Howard Kung, and Lustig report high-frequency evidence that the convenience yield on US Treasuries decreases on days when investors receive adverse fiscal news that increases expected future Treasury supply.¹¹

During the COVID-19 pandemic, the convenience yield on Treasuries continued to decline as investors anticipated a large increase in their supply as a result of increasing deficits.^{12,13} In Figure 4 we can see that only the 1-year Treasury basis remains positive and is higher than the 5-year and 10-year bases. The bases in US Treasuries have actually flipped signs at longer tenors, suggesting that the convenience yields are expected to decline in the future. This is consistent with other evidence. At the 10-year horizon, US Treasuries no longer trade at a premium relative to AAA corporates, once one corrects for the measured credit risk of corporates.

Because of these fiscal developments, the convenience yield channel for the dollar may be weakening, and

the dollar might start to trade more like other currencies. This may cause the US' countercyclical revenue stream from supplying the world with safe assets to dry up. When the hegemony of the dollar ends, the extra fiscal capacity that bond markets have allocated to the US may be withdrawn. That's what the experience of the UK and the Dutch Republic teaches us.^{14,15}

¹ "The US treasury premium," Wenxin D, Im J, Schreger J, *The Journal of International Economics* 112, 2018 pp. 167–181.

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² "Foreign safe asset demand," Zhengyang Z, Krishnamurthy A, Lustig H, NBER Working Paper 24439, September 2020, and *The Journal of Finance* 76, 2021, pp. 1049–1089.

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Zhengyang Jiang

Zhengyang Jiang is an associate professor of finance at Northwestern University's Kellogg School of Management, where he studies international finance and macroeconomics. His research focuses on exchange rates, capital flows, public debt valuation and sustainability, the international monetary system, and the cognitive processes behind expectation formation and financial decision-making. He is a faculty research fellow of the National Bureau of Economic Research and associate editor of the *Journal of International Economics*. He received his PhD in finance from Stanford Graduate School of Business and his bachelor's degree in mathematics and business economics from the California Institute of Technology.

His research has been published in major peer-reviewed journals, including *Econometrica*, the *Journal of Political Economy*, the *Review of Economic Studies*, and the *Journal of Finance*. His work has appeared in the *American Economic Review* and the *Brookings Papers on Economic Activity* and has been featured in the *Wall Street Journal* and *Yahoo Finance*. The *Economic Report of the President* has cited his research as well.

Hanno Lustig

Hanno Lustig has been a professor of finance at Stanford Graduate School of Business since 2015. His research focuses on the intersection of macroeconomics and finance, particularly currency markets and exchange rates, government guarantees in financial institutions, and firm volatility. He is a research associate of the National Bureau of Economic Research and serves as an associate editor for both the *Journal of Finance* and *Econometrica*. In 2019, he joined the Norges Bank Investment Management Allocation Advisory board, which advises on asset allocation strategies.

Prior to Stanford, he held positions at UCLA's Anderson School of Management and Economics Department and at the University of Chicago. He received his PhD in economics from Stanford University in 2002 and earlier degrees from the Catholic University of Louvain and UFSIA in Belgium. His work has been recognized with the 2012 JP Morgan Award for Best Paper on Financial Institutions and Markets and the 2010 NASDAQ OMX Award for Best Paper on Asset Pricing.

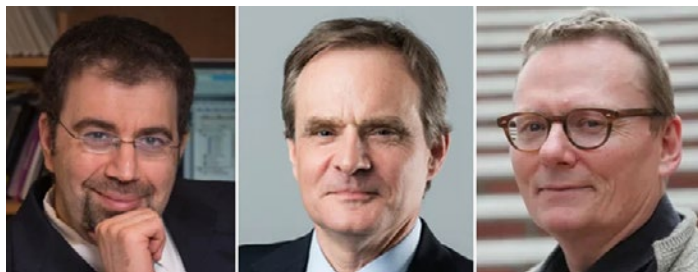


Arvind Krishnamurthy

Arvind Krishnamurthy is the John S. Osterweis Professor of Finance at the Stanford Graduate School of Business and a research associate of the National Bureau of Economic Research. His research covers finance and macroeconomics, with work on financial intermediation, debt and housing markets, financial crises, monetary policy, and financial regulation. His studies examine liquidity crises in emerging and developed markets, government policy in crisis stabilization, and the role of US Treasury bonds and the dollar in the international monetary system. He was a faculty member at Northwestern University's Kellogg School of Management from 1998 to 2014 and holds a PhD in financial economics from MIT and degrees in economics and electrical engineering from the University of Pennsylvania.

He received the Smith Breeden Prize for best paper in the *Journal of Finance*, the Western Finance Association Corporate Finance Award, and the Swiss Finance Institute Outstanding Paper Award. His research on financial crises and monetary policy has been cited by central banks and covered in national media. He served as an associate editor for the *American Economic Review*, the *Journal of Finance*, and *American Economic Journal: Macroeconomics* and was a board member of the American Finance Association from 2015 to 2019.

Daron Acemoglu, Simon Johnson, and James Robinson Awarded 2024 Nobel Prize



(L to R) Daron Acemoglu, Simon Johnson, and James Robinson

Research associates [Daron Acemoglu](#), [Simon Johnson](#), and [James Robinson](#) have been awarded the [2024 Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel](#) “for studies of how institutions are formed and affect prosperity.” The Royal Swedish Academy of Sciences explained that the three scholars “contributed innovative research about what affects countries’ economic prosperity.” Their work highlights the critical role of political and economic institutions in affecting the evolution of living standards. It not only offers important clues for explaining disparities in per capita income across nations, but also provides guidance on the design of policies to promote economic development.

Acemoglu is an Institute Professor at MIT. He is affiliated with four NBER programs: Development Economics (DEV), Economic Fluctuations and Growth, Labor Studies, and Political Economy (POL). Johnson, the Ronald A. Kurtz Professor of Entrepreneurship and Professor of Global Economics and Management at the MIT Sloan School of Management, is affiliated with the Corporate Finance, DEV, International Finance and Macroeconomics, and POL programs. Robinson, the Reverend Dr. Richard L. Pearson Professor at the University of Chicago Harris School of

Public Policy, and a University Professor and Professor of Political Science, is an affiliate of the DEV, Development of the American Economy, and POL programs.

In announcing the prize, the Academy released a [high-level summary](#) of the three researchers’ contributions, along with a [more detailed account](#) of their work.

With this year’s awards, 41 current or past NBER research affiliates, and an additional six current or past members of the NBER Board of Directors, have received the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel. Affiliates awarded the prize are Daron Acemoglu, Simon Johnson, and James Robinson, 2024; Claudia Goldin, 2023; Ben Bernanke and Douglas Diamond, 2022; Joshua Angrist, David Card, and Guido Imbens, 2021; Abhijit Banerjee, Esther Duflo, and Michael Kremer, 2019; William Nordhaus and Paul Romer, 2018; Richard Thaler, 2017; Oliver Hart and Bengt Holmström, 2016; Angus Deaton, 2015; Lars Hansen and Robert Shiller, 2013; Alvin Roth, 2012; Thomas Sargent and Christopher Sims, 2011; Peter Diamond, 2010; Paul Krugman, 2008; Finn Kydland, 2004; Robert F. Engle, 2003; Joseph E. Stiglitz, 2001; James J. Heckman and Daniel L. McFadden, 2000; Robert C. Merton and Myron S. Scholes, 1997; Robert E. Lucas, Jr., 1995; Dale Mortensen, 2010; Edward C. Prescott, 2004; Robert W. Fogel, 1993; Gary S. Becker, 1992; George J. Stigler, 1982; Theodore W. Schultz, 1979; Milton Friedman, 1976; and Simon Kuznets, 1971. In addition to this group, the six current or past NBER directors who have received the prize are: George Akerlof, 2001; William Vickrey, 1996; Douglass North, 1993; Robert Solow, 1987; James Tobin, 1981; and Paul Samuelson, 1970.

New Initiative on the Economics of Alzheimer’s Disease

Recognizing the rising toll of chronic late-life diseases as the US population ages, the NBER has launched a multi-year initiative on the economics of Alzheimer’s Disease and Alzheimer’s Disease Related Dementias (AD/ADRD). The National Institute on Aging (NIA) has awarded the NBER a five-year grant to serve as a Coordinating Center for the Economics of AD/ADRD, focusing on the care, treatment, and prevention of these diseases. The Center is co-directed by neurobiologist Rhoda Au of Boston University, Julie Bynum, a geriatric care specialist at the University of Michigan, and research associate Kathleen McGarry of UCLA; Susan Stewart is the executive director. It will coordinate the work of several NIA-funded research teams, support scholars who are launching new projects on ADRD-related issues, and host an annual conference showcasing relevant economic research.

A team of investigators led by research associates Katherine Baicker of the University of Chicago and Kosali Simon of Indiana University has also been awarded a closely related five-year program project grant to study “Health Care Decision-Making and Outcomes for People Living with Alzheimer’s Disease.” Their project will investigate the unique challenges and potential barriers to providing care to people living with AD/ADRD. It is the latest phase of a program project on health and well-being at older ages that the NBER has hosted for several decades.

A number of other NBER-affiliated research teams are also carrying out research on the diagnosis and treatment of AD/ADRD as well as the delivery of care to those it affects.

CRIW Members Elect Karen Dynan as Chair

The members of the [Conference on Research in Income and Wealth](#) (CRIW) have elected Research Associate [Karen Dynan](#) of Harvard University to succeed Katharine Abraham of the University of Maryland as CRIW Chair. Dynan’s research focuses on consumer spending, household finance, and applied macroeconomics. Before joining the Harvard faculty, she served as assistant secretary for economic policy at the US Department of the Treasury (2014–17), and was a codirector of the Economic Studies program at the Brookings Institution. She spent almost two decades at the Federal Reserve Board, where she was the assistant director of the Division of Research and Statistics. Abraham, who served as CRIW Chair for nine years, is the president-elect of the American Economic Association. The CRIW membership includes more than four hundred researchers from colleges and universities, think tanks, and government statistical agencies. Each year, The CRIW organizes an annual conference on economic measurement as well as a meeting at the NBER Summer Institute.



Conferences and Meetings

Detailed programs for NBER conferences are available at nber.org/conferences

Title of Conference/Meeting	Organizers	Dates
Wage Dynamics in the 21st Century	Erik Hurst, Lisa B. Kahn, and Ayşegül Şahin	September 12–13, 2024
Megafirms and the Economy	Chad Syverson and John Van Reenen	September 13, 2024
Economics of Artificial Intelligence	Ajay K. Agrawal, Joshua S. Gans, Avi Goldfarb, and Catherine Tucker	September 19–20, 2024
Financial Market Frictions and Systemic Risks	Wenxin Du, Alp Simsek, and Chester S. Spatt	September 20, 2024
Distributional Consequences of New Energy Policies	Catherine Hausman, Shanjun Li, and Arik Levinson	September 20, 2024
39th Annual NBER Tax Policy and the Economy Conference	Robert A. Moffitt	September 26, 2024
Economics of Mobility	Sandra E. Black and Jesse Rothstein	September 27, 2024
Financial and Economic Decision-Making, Alzheimer’s Disease, and Outcomes over the Lifecycle	Megan Jensen, Clare Kolevar, Nicholas W. Papageorge, Jonathan S. Skinner, and Julie Bynum	October 17–18, 2024
Economics of Transportation in the 21st Century	Edward L. Glaeser, James M. Poterba, and Stephen J. Redding	October 18, 2024
Market Design Working Group Meeting	Michael Ostrovsky and Parag A. Pathak	October 18–19, 2024
Public Economics Program Meeting	Marika Cabral and Jacob Goldin	October 24–25, 2024
Economic Fluctuations and Growth Program Meeting	Fabrizio Perri and Carolin Pflueger	October 25, 2024
Corporate Finance Program Meeting	Song Ma and Jacopo Ponticelli	October 31–November 1, 2024
International Finance and Macroeconomics Program Meeting	Wenxin Du and Kei-Mu Yi	November 1, 2024
Asset Pricing Program Meeting	Harrison Hong and Bryan T. Kelly	November 1, 2024
Economics of Place-Based Policies	Cecile Gaubert, Gordon H. Hanson, and David Neumark	November 7–8, 2024
Labor Studies Program Meeting	David Autor and Alexandre Mas	November 8, 2024
Monetary Economics Program Meeting	Christoph Boehm and Chen Lian	November 8, 2024
Behavioral Finance Working Group Meeting	Nicholas C. Barberis	November 8, 2024
Political Economy Program Meeting	Matthew Gentzkow, Paola Giuliano, and David Y. Yang	November 15, 2024
Economics of Talent Meeting	Ruchir Agarwal, Glenn Ellison, and Patrick Gaulé	November 15, 2024
International Trade and Investment Program Meeting	Stephen J. Redding	November 22–23, 2024
Digital Platforms: Competition and Regulation Workshop	Nancy L. Rose, Carl Shapiro, Michael D. Whinston, and Ali Yurukoglu	December 5, 2024

Title of Conference/Meeting	Organizers	Dates
Organizational Economics Working Group	Raffaella Sadun and Andrea Prat	December 5–6, 2024
Economics of Education Program Meeting	Caroline M. Hoxby, Robert McMillan, and Jonah E. Rockoff	December 5–6, 2024
Place-Based Policies and Entrepreneurship	Sabrina T. Howell, Josh Lerner, and David T. Robinson	December 6, 2024
Development Economics	Natalie Bau, Dave Donaldson, Raymond Fisman, Namrata Kala, Sara Lowes, Benjamin A. Olken, and Seema Jayachandran	December 6, 2024
Innovation Information Initiative Technical Working Group Meeting	Matt Marx	December 6–7, 2024
Competition in the US Agricultural Sector	James MacDonald and Fiona Scott Morton	December 12, 2024
Resilience in Supply Chains	Laura Alfaro, James M. Poterba, and Chad Syverson	December 13, 2024
Innovative Data in Household Finance: Opportunities and Challenges	Sean Higgins, Sasha Indarte, and Stephen P. Zeldes	December 13, 2024
Big Data, Artificial Intelligence, and Financial Economics	Itay Goldstein, Chester S. Spatt, Mao Ye, and Tarun Ramadorai	December 13, 2024
Information and Competition in the Digital Economy	Shilpa Aggarwal and Amit Seru	December 14–15, 2024

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