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Program Report

Economics of Education

Caroline Hoxby*

The enterprise of education has a supply side, where institutions produce education, and an investment side, where people acquire education. I say an "investment side" and not a "demand side" because education is largely an investment and *not* a form of consumption. Because it is an investment, the economics of education is guided by a great deal of theory that would not apply if education were a consumption good like, say, bread. Education economists study both the supply of and investment in education.

On the supply side, we think about institutions' objectives and constraints. We consider competition among institutions and how institutions interact with governments and taxpayers. We use models from public economics, political economy, industrial organization, regulation, and finance.

On the investment side, we consider whether people are under- or over-investing in their own or others' education — a determination primarily based on whether they are earning a higher or lower rate of return than what they could earn in an alternative investment, such as physical capital. We consider market failures because the financing of human capital investments is failure-prone, owing to issues like moral hazard that occur when human beings themselves are the vehicles for investment. We often investigate the potential for market failures due to people being poorly informed or irrational about investing in themselves — mispredicting their returns, say, or discounting the future in a hyperbolic manner.

Applying economic analysis to education is the defining feature of the NBER's Economics of Education Program. As an NBER program, there are also some distinctive features. First, the research

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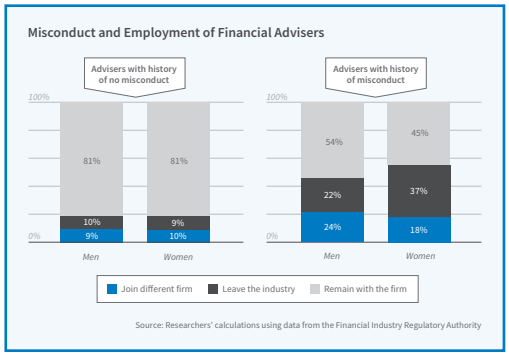
ALSO IN THIS ISSUE



The Labor Market for Financial Misconduct 9
The Return of Survey Expectations 14
What Inventions Are We Missing? 18
Do Government Grants to Charities Crowd Private Donations Out or In? 22
NBER News 26
Conferences 28
Program and Working Group Meetings 33
NBER Books 42

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carried out by education economists now relies, to an unusual extent, on extremely high-quality administrative data recorded by schools, governments, and authoritative third parties. The data are so accurate and comprehensive that we often can use ambitious econometric tools that are impractical with data that are sample-based, sparse, or prone to error. Second, the program features young scholars to an unusual extent, because in most years the share of education economists in the cohort of new PhDs is greater than the share in the previous year. These emerging scholars are highly productive, and they keep the program in a constant state of rejuvenation and intellectual excitement. Third, the program is unusually diverse and inclusive because education is so interesting to so many scholars. The participants in program meetings represent a wide array of institutions, demographic backgrounds, national origins, and policy views.

This energy and diversity make writing a report like this one a challenge: I cannot possibly do justice to all of the research. So, in this report, I emphasize a few key topics that have received considerable attention in the past few years. In my conclusion, I discuss some up-and-coming topics as well.

Productivity in Higher Education

Our most important project, since my last report, is our initiative to analyze productivity in higher education. Institutions of higher education — from large elite research universities to small private colleges and for-profit institutions — have never been under greater scrutiny. Policymakers, families, philanthropists, and the media question whether the benefits of higher education justify the costs. These questions are fundamentally about the productivity of the sector.

To answer these questions, the NBER, with support from the Alfred P. Sloan Foundation and the Spencer Foundation, commissioned nine papers to be the focus of a conference that brought together researchers, university leaders, policymakers, and journalists. The papers are available as NBER working papers and as chapters in a forthcoming volume, *Productivity in Higher Education*. The studies use rich and

novel administrative data, employ cogent economic reasoning, deploy the latest econometric methods, and evince deep institutional understanding. In combination, the papers are fairly comprehensive: They include studies of the returns to undergraduate education, how costs differ by major, the productivity of for-profit schools, the productivity of various types of instructors, and how online education has affected the market.

Analyses of productivity in higher education must confront significant challenges. Higher education affects many outcomes: students' skills, employment, innovativeness, and public service, to name a few. Higher education institutions conduct a bewildering array of activities across many domains, from undergraduate teaching to medical research. Even if we focus on a single outcome — the earnings-based returns to undergraduate education, for instance — assessing the contribution of an individual institution must overcome the fact that students select into schools based on their aptitude and often attend more than one school. Finally, some benefits of higher education are inherently public in nature and difficult to measure or attribute to any one institution. This project's studies demonstrate that these five challenges — multiple outcomes, the multi-product nature of institutions, selection, attribution, and public benefits — are surmountable.

For example, I attempt to compute the productivity of the vast majority of undergraduate programs (more than 6,000) in the United States.[1] While the study emphasizes productivity results based on lifetime earnings because these matter disproportionately for the financial stability of the postsecondary sector, it also shows results based on public service and innovation. The study's most important advance, however, is addressing the aforementioned selection problem by employing all of the possible quasi-experiments in which a student "flips a coin" between schools that have nearly identical selectivity or in which admission staff "flip a coin" between students with nearly identical achievement. Thus, the study exemplifies how having comprehensive data allows one to pursue ambitious econometric strategies.

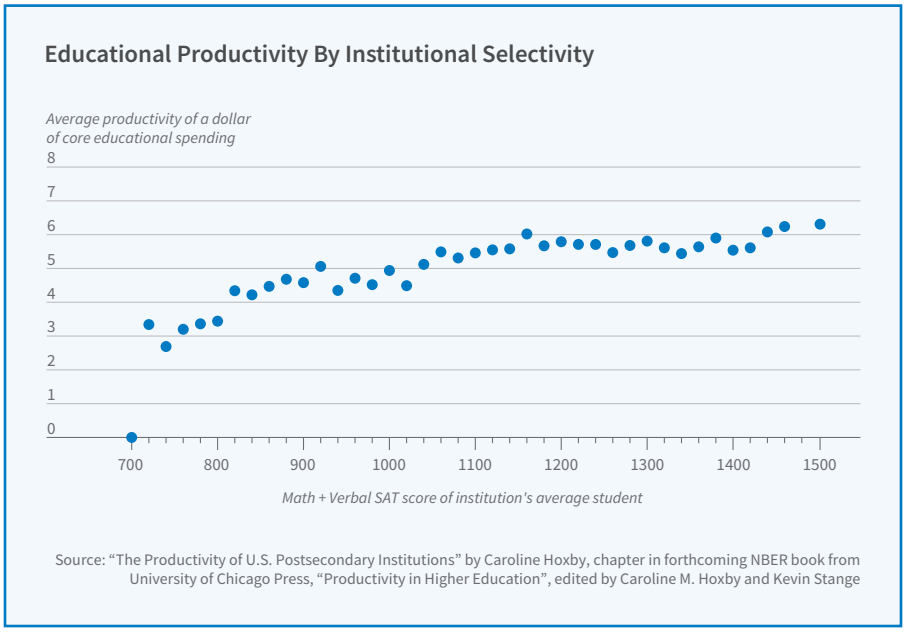

Figure 1

The study's most important finding, illustrated in Figure 1, is that when earnings are used to measure benefits, the productivity of a dollar is fairly similar across a wide array of selective postsecondary institutions. This result suggests that market forces compel some amount of efficiency among selective institutions. However, I also find that market forces appear to exert little productivity discipline on nonselective schools, possibly because their students are poorly informed investors or rely so greatly on third parties to pay their tuition.

Evan Riehl, Juan Saavedra, and Miguel Urquiola draw upon data from Colombia, a country with a vigorous market for higher education that is not dissimilar to that of the United States.[2] Importantly, Colombian students' learning is assessed by examinations not only before they enter universities but also when they exit. The researchers demonstrate that college productivity based on learning is quite different from productivity based on earnings, especially initial earnings. In particular, learning-based measures are much more correlated with long-term earnings than they are with initial earnings. This suggests that learning reflects long-term value-added, while initial earnings more heavily reflect skills that depreciate quickly or students' pre-college characteristics.

Joseph Altonji and Seth Zimmerman analyze whether productivity differs by college major.[3] There are at least three reasons why such analyses are hard. First, there is substantial selection into majors: Students with higher aptitude tend to major in certain fields. Second, the relationship between initial earnings and lifetime earnings varies by major. Engineering majors, for instance, have high initial earnings but subsequently experience unusually slow earnings growth. Third, different majors cost different amounts to produce.

Using administrative data for all Florida public institutions, Altonji and Zimmerman show that majors that are intensive in equipment,

space, or highly paid faculty are dramatically more costly on a per-student basis. If we consider costs, the productivity findings are very different than what we might conclude from a naive look at initial earnings. Strikingly, as Figure 2 demonstrates, the ratio of earnings to costs is similar in majors with high earnings and high costs, like engineering, and modest earnings and modest costs, like public administration.

Pieter De Vlieger, Brian Jacob, and Kevin Stange estimate instructor productivity in standardized courses at the University of Phoenix.[4] Employing data on more than 300,000 students and 2,000 instructors, they make use of the fact that the assignment of students to teachers is virtually random. They show that instructors' productivity varies greatly and, interestingly, varies much more in person than in online courses. Indeed, if students want to obtain instruction that has maximum value-added, they must get it in person, because the online experience suppresses variation in instructional value-added.

The study's most surprising result, though, is that the University of Phoenix, despite being a for-profit school, pays its highly variant instructors exactly the same amount. This finding suggests that the sort of students who consider non-selective for-profit institutions do not make their enrollment choices based on the schools' record of skill production. If that is the case, the University of Phoenix is probably not forgoing profit by paying all instructors the same amount.

This brings us to a key takeaway from Productivity in Higher Education: Higher education institutions do respond to market forces, but institutions' investors (the students), constraints, production functions, and revenue sources vary. Thus, the extent to which market pressure disciplines productivity differs greatly, with selective institutions probably being subject to much more discipline than non-selective ones.

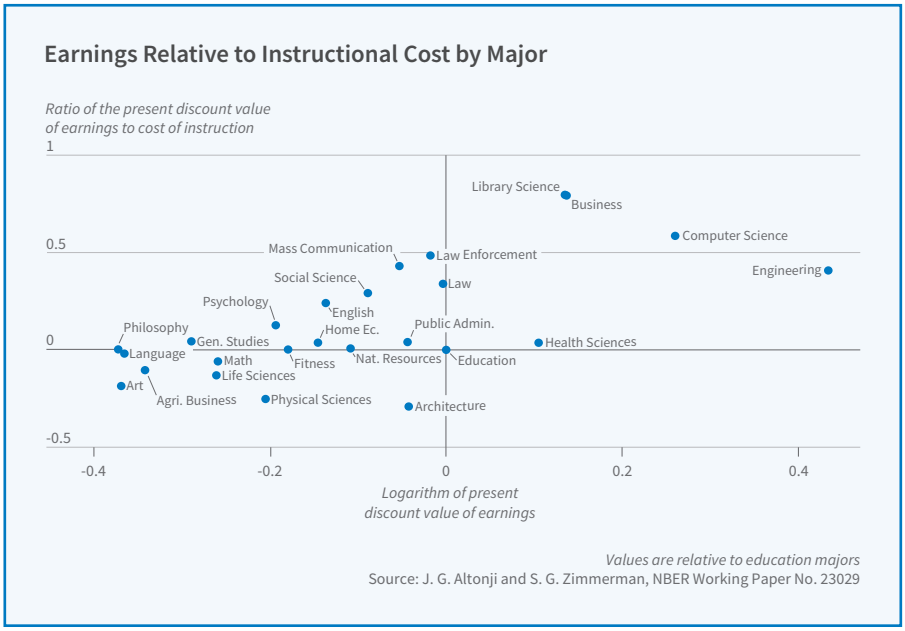

Figure 2

The Quality of Teachers Is Not Fixed

One of the main results of recent studies using large administrative datasets on educational inputs and outputs in K-12 education is a persuasive body of evidence that, as long assumed, teachers matter. A student who is fortunate enough to have a series of effective teachers can end up with substantially better outcomes, not just in terms of academic achievement but also in terms of college attainment, later earnings, and a variety of social outcomes. But the knowledge that teachers matter could be frustrating if there were no policies by which we could improve the set of people who teach. This is where economics comes in: Do economic logic and evidence suggest that we could have better teachers? This question is one on which research in the last few years has made substantial progress.

Barbara Biasi investigates how teachers responded when a change in Wisconsin law allowed school districts to pay teachers in a flexible way rather than in the rigid, "lockstep" manner based almost entirely on seniority that characterizes nearly all U.S. schools.[5] She finds that districts that adopted flexible pay ended up with teachers whose value-added was higher. Part of the improvement arose because young, high value-added teachers, who were systemically underpaid given their productivity, left the rigid-pay districts and joined flexible-pay ones where they could be paid more in proportion to their contributions. The evidence suggests that part of the improvement came through teachers improving their effectiveness in flexible-pay districts, presumably because effective teaching could be rewarded there.

Hugh Macartney, Robert McMillan, and Uros Petronijevic use data from North Carolina to demonstrate that teachers improve their value-added when accountability incentives are strengthened.[6] They use rich longitudinal data to separate the improvements into two parts: the part that arises because existing teachers raise their effort, and the part that arises because higher-ability people join teaching or decide not to leave it. The researchers use their estimates to compare the cost-effectiveness of alternative education policies and show that incentive-oriented reforms

can outperform policies that only target the recruitment of higher-ability teachers. This is essentially because incentive-oriented policies improve all teachers, including the "stayers," and effectively recruit better teachers.

Sally Hudson attempts to answer the question most often asked about Teach for America (TFA).[7] Even if TFA teachers, who come from the nation's most selective colleges, are really much more able than the average incumbent teacher, is it worthwhile to hire them? After all, they are inexperienced, and evidence is strong that instructors improve in their first couple of years. Moreover, TFA teachers need to be replaced every two to three years because the vast majority go on to careers outside the classrooms. Hudson shows that, in fact, hard-to-staff schools appear to benefit from a succession of TFA teachers. This is largely because the TFA teachers' effectiveness is so much greater, even when they are novices, than that of non-TFA teachers. Also, the TFA teachers improve their effectiveness faster than do non-TFA teachers.

Andrew C. Johnston conducts a novel experiment, asking teachers to choose between pay that is more or less merit-based, between systems of merit evaluation, and between compensation that is salary-focused or benefits-focused.[8] Much teacher compensation is currently in the form of unusually generous retirement and health benefits. Johnston asks teachers how they would trade off better pay versus students who were easier to teach, students who were lower-income, longer commutes, and so on. Crucially, he conducts these experiments in a district that is actually reconfiguring its entire system of teacher compensation. Thus, nearly all teachers participated in the experiments, and they had strong incentives to answer honestly in order to get the system they preferred. One important result is that teachers with high value-added prefer merit pay more than those with low value-added. This suggests that, by switching to pay that is more merit-based, a district can disproportionately pull in higher value-added recruits. Another interesting result is that, while teachers do need to be paid more to teach students who are low achievers, all else being equal, they do not need to be paid more to teach students from low-income or racial/ethnic minority backgrounds.

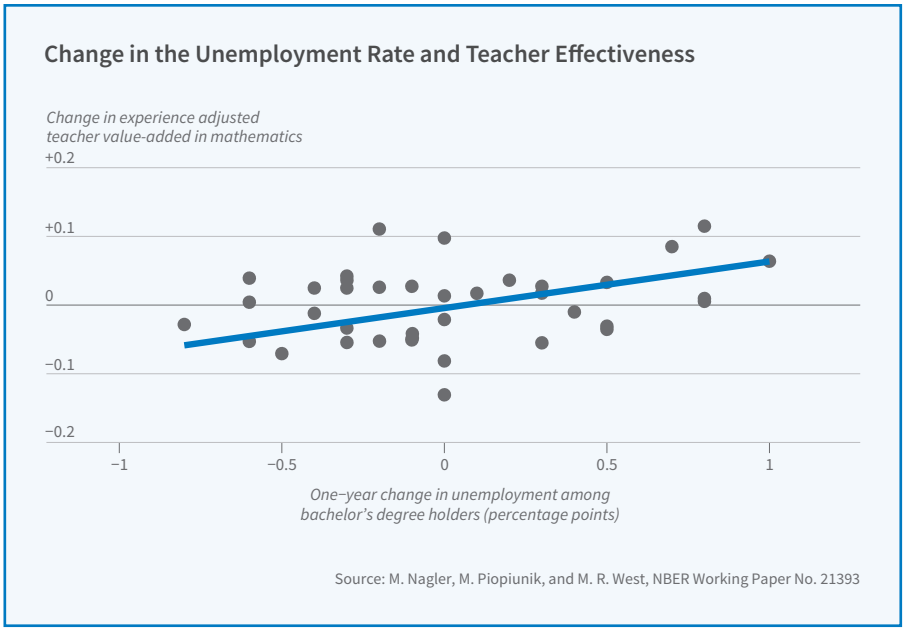

Figure 3

Two other papers that demonstrate that greater relative compensation allows schools to recruit more effective teachers are by Markus Nagler, Marc Piopiunik, Martin R. West, and Owen Thompson.[9,10] In short, the quality of teachers in the United States is not fixed, but depends on how they are recruited and the compensation-based incentives they face. For example, as Figure 3 illustrates, when the unemployment rate for recent college graduates rises, the quality of teachers, measured by their value added for students, rises.

Fascinatingly, much that can be said of U.S. education can also be said of other countries that might be thought to be very different. For instance, Natalie Bau and Jishnu Das showed that Pakistani teachers' value-added varies about as much as it does in highly industrialized countries, and is, as in those countries, uncorrelated with teachers' credentials.[11] As in other countries, teachers in Pakistan improve in their first couple of years, but not much after that. There is no relationship between teacher pay and performance in Pakistan's public schools, where compensation is based almost entirely on seniority, but there is a meaningful positive relationship in private schools, where average pay is lower. These findings apply in many countries, rich and poor. The similarities are so striking that they must reveal something about first, the underlying production function for instruction, and second, the political economy of public education.

Bau and Das' most surprising finding is that, in Pakistan, compensation was so out of line with effectiveness that public schools' actually recruited better teachers after a policy change that put teachers on temporary contracts — jobs more susceptible to performance review — even though that same policy cut their average salaries by 35 percent.

This phenomenon — public school teachers' pay being dra-

matically out of line with alternative jobs and with effectiveness — is fairly common in developing countries. In Colombia, for instance, Saavedra, Dario Maldonado, Lucrecia Santibanez, and Luis Omar Herrera Prada show that people across all ability levels earn a substantial premium if they teach in public schools rather than take alternative jobs.[12] The researchers demonstrate this convincingly by comparing people who barely pass and barely fail the national teacher-screening exam.

Finally, Isaac Mbiti, Karthik Muralidharan, Mauricio Romero, Youdi Schipper, Constantine Manda, and Rakesh Rajani find the intriguing result that teacher pay incentives are more effective when they are combined with additional resources, at least in Tanzania.[13] Their findings are based on an ambitious randomized controlled trial involving 350 schools where unconditional grants, teacher incentives, or a combination of both are implemented.

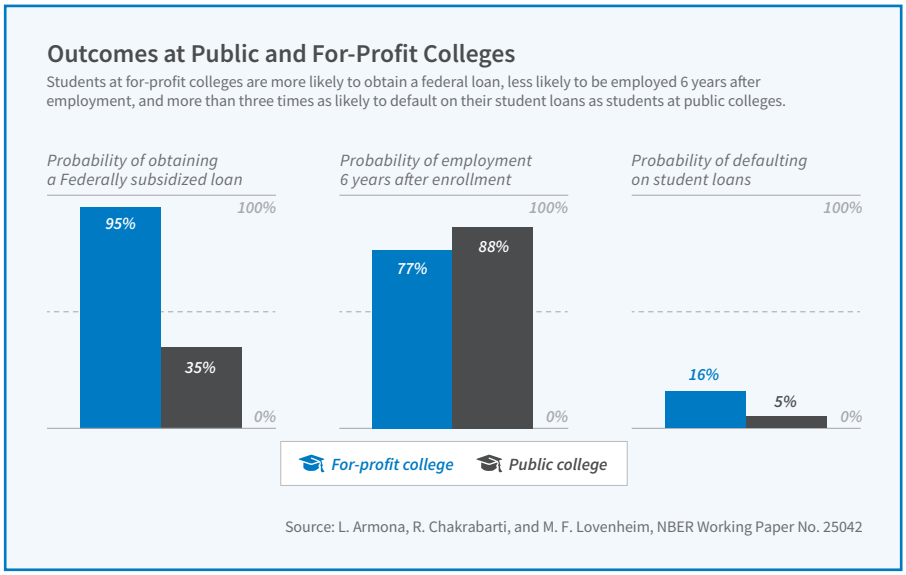

Figure 4

Student Loans

Student loans have risen greatly in volume in recent years and are now by far the largest source of unsecured debt in the United States. Moreover, some students are unlikely to repay, so these loans generate risks for the entire economy in a manner not unlike the risks generated by mortgages in the recent financial crisis. Fortunately, many economists of education associated with the NBER are helping everyone to gain a better understanding of student loans.

For instance, Luis Armona, Rajashri Chakrabarti, and Michael Lovenheim focus on the extremely important role that for-profit institutions play in the non-repayment of student loans.[14] These schools' students are very disproportionately responsible for non-repayment because they take on unusually great student debt and experience unusually little improvement in earnings. The researchers ask whether these patterns are causal. In other words, if the same students were to attend, say, public community colleges, would they end up with equal payment problems? By comparing enrollment and postsecondary outcome changes across areas that experience similar labor demand shocks but have different supplies of for-profit institutions, they are able to show that much of the effect is indeed causal. As Figure 4 shows, enrollment in for-profits leads to greater loans, increased non-repayment, and worse labor market outcomes.

Why might enrolling at a for-profit cause greater debt and non-repayment? Charlie Eaton, Sabrina Howell, and Constantine Yannelis answer this question.[15] Studying what happens when a for-profit college is subject to stronger incentives to maximize profits as the result of a private equity buyout, they find that institutions subject to high-powered profit-maximizing incentives intensify their focus on capturing federal government aid at the expense of student outcomes. It is worth noting that federal loans, federal aid, and veterans' GI Bill-based aid often make up close to 100 percent of the revenue at for-profit schools. In other words, a student paying tuition from his or her own pocket is a rare exception, not the rule, at such schools. The researchers find that, when their incentives to maximize profits are intensified, for-profit schools enroll more students, enroll students who are less likely to benefit from higher education, increase tuition, and increase student loans. The results are worse student outcomes in terms of graduation rates, employment, and earnings, and significantly lower repayment rates.

Other evidence of for-profit institutions' eagerness to capture government aid comes from Matthew Baird, Mike Kofoed, Trey Miller, and Jennie Wenger.[16] They show that for-profit schools quickly raised tuition to absorb the increases in maximum tuition allowed under the new Forever GI Bill. Given the high tendency of veterans to attend for-profits, the bill thus improved profits but did little for veterans. Arguably, this bill made matters worse for non-veterans who attend for-profit schools, since they too were faced with somewhat higher tuition and, consequently, greater loans.

What would happen if for-profit colleges were to lose some of their access to federal loans and other federal financial aid? Stephanie Cellini, Rajeev Darolia, and Lesley Turner examine what happened when, in

the 1990s, students at more than 1,200 for-profit institutions faced restricted access to loans because loan default rates were so high at the schools.[17] Using variation in the timing and restrictiveness of sanctions, the researchers find that low-income students were less likely to attend for-profit schools but were so much more likely to attend public community colleges that the effects on their enrollment were about a wash. The effects on loan repayment were positive, however, because the students who went to community colleges acquired less debt and were more likely to repay the smaller loans they took on.

Other Exciting Developments

The program is proud to report that a long-time member, Parag Pathak, won the American Economic Association's John Bates Clark Medal in 2018. The award citation recognized his work using market design theory to analyze systems in which students are matched to schools. Such systems are used in numerous cities. In a study of Taiwan's matching system, for example, Umut M. Dur, Fei Song, Pathak, and Tayfun Sönmez found that school assignment mechanisms which include deduction systems are manipulable, meaning that children from families which are strategic are more likely to receive desirable placements.[18]

As mentioned at the outset, there is much more exciting research associated with the Economics of Education Program than I can possibly describe here. To induce you to explore further, let me mention just a few topics that are "up and coming." A number of recent NBER working papers and conference papers evaluate online education, both at the K-12 and college level. The use of technology in education has also been the subject of recent studies which explore both developed and developing countries. Some evidence from India looks promising.

There is new evidence on the returns to college majors, calling into question the common impression that the greatest returns are to becoming an engineer. Supported by rich data and the econometric ambitiousness of program members, many program meetings now include presentations on applied econometric methods. Indeed, we now host methods symposia. Increasingly, advances from behavioral economics, brain science, and psychology are finding their way into papers in the economics of education.

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3 *J. Altonji and S. Zimmerman, "The Costs and Net Returns to College Major,"* NBER Working Paper No. 23029, January 2017.
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4 *P. De Vlieger, B. Jacob, and K. Stange, "Measuring Instructor Effectiveness in Higher Education,"* NBER Working Paper No. 22998, December 2016.
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15 *C. Eaton, S. Howell, and C. Yannelis, "When Investor Incentives*

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[18] *U. M. Dur, P. Pathak, F. Song, and Tayfun Sönmez, "Deduction Dilemmas: The Taiwan Assignment Mechanism,"* NBER Working Paper No. 25024, September 2018.
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The Labor Market for Financial Misconduct

Gregor Matvos and Amit Seru

Financial advisers in the United States manage over $30 trillion in investible assets, and plan the financial futures of roughly half of U.S. households. At the same time, trust in the financial sector remains near all-time lows. The 2018 Edelman Trust Barometer ranks financial services as the least trusted sector by consumers, finding that only 54 percent of consumers "trust the financial services sector to do what is right."[1] The distrust of finance is perhaps not surprising in the wake of the recent financial crisis and several high-profile scandals that have dominated financial news. While it is clear that some egregious fraud occurs in the financial services sector, it is less clear whether misconduct is limited to a few scandals or is a pervasive feature of the industry. Moreover, if misconduct is pervasive, why can it survive in the marketplace, and conversely, which mechanisms constrain it from enveloping the entire industry?

This summary describes our research, which is joint work with Mark Egan, on these questions. We start by describing how we measure misconduct among all registered financial advisers in the U.S. We then turn to the role of labor markets in constraining misconduct, documenting that while some firms penalize misconduct through a sharp increase in job separations, other firms are willing to hire these advisers, recycling the bad apples in the industry. We then discuss evidence that suggests this phenomenon arises because of "matching on misconduct," in which advisers with misconduct records match with firms which specialize in misconduct, and that the presence of uninformed consumers may be critical to maintaining this equilibrium. We find that similar forces may also explain gender discrimination in the labor market of financial advisers, leading to a "gender punishment gap." We conclude by discussing how academic research may help guide evidence-based policy.

Measuring Misconduct

We began our research program by documenting the extent of misconduct in the financial advisory industry.[2] To study misconduct by financial advisers, we construct a panel database of the universe of financial advisers (about 1.2 million) registered in the United States from 2005 to 2015, representing approximately 10 percent of total employment of the finance and insurance sector. Our data, which we have made available to other researchers, come from the Financial Industry Regulatory Authority's (FINRA) BrokerCheck website. The data contain advisers' complete employment history. Because the industry is heavily regulated, data on adviser qualifications provide a granular view of job tasks and roles in the industry. Central to our analysis, FINRA requires financial advisers to formally disclose all customer complaints, disciplinary events, and financial matters, which we use to construct a measure of misconduct.

We find that financial adviser misconduct is broader than a few heavily publicized scandals. Roughly one in 10 financial advisers who work with clients on a regular basis have a past record of misconduct. Common misconduct allegations include misrepresentation, unauthorized trading, and outright fraud — all events that could be interpreted as a conscious decision of the adviser. Adviser misconduct results in substantial costs: In our sample, the median settlement paid to consumers is $40,000, and the mean is $550,000. These settlements cost the financial industry almost half a billion dollars per year. A substantial number of financial advisers are repeat offenders. Past offenders are five times more likely to engage in misconduct than otherwise comparable advisers in the same firm, at the same location, at the same point in time. The large presence of repeat offenders suggests that consumers could avoid a substantial amount of misconduct by avoiding advisers with misconduct records.

Moreover, misconduct is not randomly allocated across firms. We find large differences in misconduct across some of the largest and best-known financial advisory firms in the U.S. Figure 1 [following page] displays the top 10 firms with the highest share of advisers that have a record of misconduct. Almost one in five financial advisers at Oppenheimer & Co. had a record of misconduct. Conversely, at USAA Financial Advisors, the ratio was less than one in 36.

These simple statistics lead to two direct questions. First, given the presence of repeat offenders, why do market forces and regulators not drive these bad apples from the industry? Second, why can advisers and firms that consistently engage in misconduct coexist in the market with firms and advisers with clean records?

Labor Market Discipline

One would expect labor markets to discipline misconduct. In fact, one might expect that firms, wanting to protect their reputation for honest dealing, would fire advisers who engage in misconduct. Other firms would have the same reputation concerns and would not hire such advisers. In this scenario, advisers would be purged from the industry immediately following misconduct, and only advisers with a clean record would survive in equilibrium. Under this benchmark, punishment is extreme. There is an alternative scenario, however, in which misconduct is tolerated by firms. Firms do not fire advisers who engage in misconduct, and they tolerate a misconduct record in employing new advisers. In this case, tolerance of misconduct is extreme. Our results suggest that labor market behavior departs from these benchmarks in an interesting way: while some firms fire advisers who engage in misconduct, other firms hire these advisers, recycling bad apples in the market.

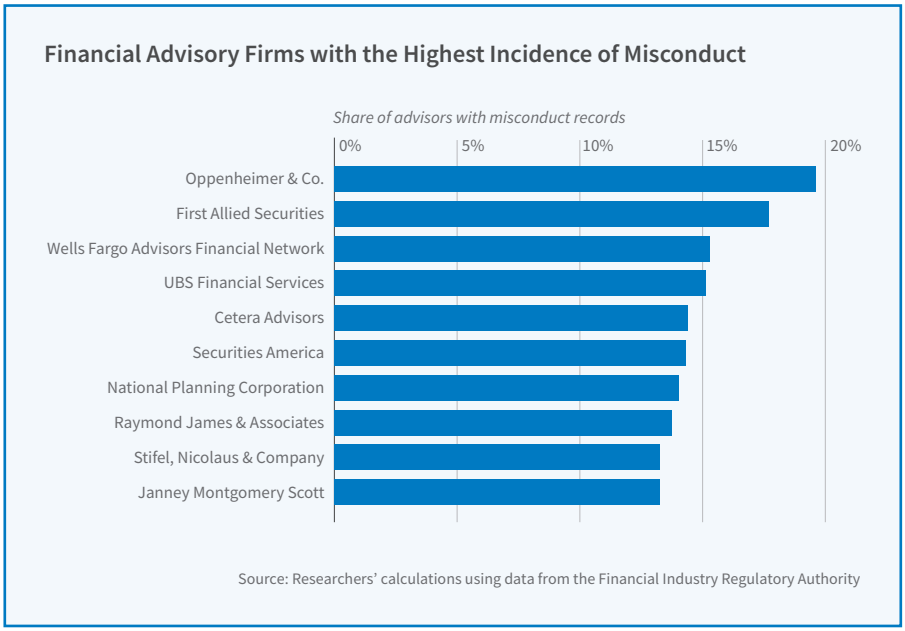

Figure 1

In fact, the average firm is relatively strict in disciplining misconduct. Following misconduct, roughly half of advisers do not keep their job in the subsequent year. The job turnover rate among advisers with recent misconduct is 48 percent per year — 29 percentage points higher than among advisers without recent misconduct. Firms account for the severity of misconduct when doling out punishments. Advisers whose misconduct results in higher monetary costs or those with more egregious misconduct such as fraud and forgery are more likely to lose their jobs following misconduct.

Although firms are strict in disciplining misconduct, the industry as a whole undoes some of the discipline by recycling advisers with past records of misconduct. Roughly half of advisers who lose a job after engaging in misconduct find new employment in the industry within a year. In total, roughly 75 percent of those advisers who engage in misconduct remain active and employed in the industry the following year. Industry reemployment

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Born and raised in Slovenia, Matvos earned a BA in economics and a PhD in business economics from Harvard University.

helps explain why recidivism is so high, even though the average firm is strict in disciplining misconduct.

Critical to understanding the phenomenon of recycling bad apples is firm and employee "matching on misconduct." Advisers with past records of misconduct tend to move to firms whose current employees are more likely to be actively engaging in misconduct, and which punish misconduct less severely. The willingness to recycle advisers with past misconduct, and the "matching on misconduct," undermines discipline in the financial advisory industry.

Misconduct in Equilibrium: Why Does Misconduct Survive?

Why can firms that employ advisers who engage in misconduct survive in equilibrium with firms that do not engage in this activity? One would expect consumer demand to reflect the reputation for misconduct in the product market. Eugene Fama, in one paper, and Fama and Michael Jensen in another, argue that competition should lead to career punishments in labor markets.[3] Then advisers who engage in misconduct and the firms that employ them, would not survive in the market for long. Which frictions prevent the market from achieving this outcome? This fact is even more puzzling when considering that the information on misconduct is publicly available.

We find evidence that the presence of unsophisticated consumers is one of the central frictions enabling misconduct. Even though misconduct records are public information, such unsophisticated customers do not know either that such disclosures exist, or how to interpret them. Differences in sophistication lead to market segmentation. Some firms "specialize" in misconduct and attract unsophisticated customers, and others cater to more sophisticated customers who recognize misconduct. We find evidence consistent with the idea that markets are segmented along dimensions of consumer sophistication. Misconduct is more common among financial advisers who deal with customers who are deemed less sophisticated by regulators. The type of compensation firms charge to clients is correlated with misconduct. Advisory firms that charge based either on assets under management or commissions tend to have higher rates of misconduct than firms that charge based on performance.

The geographic distribution of advisory firms is also consistent with market segmentation along the lines of investor sophistication. We find evidence that rates of misconduct are 19 percent higher, on average, in regions with the most vulnerable populations — those counties below the national averages in terms of household incomes and college education rates.

To summarize, unsophisticated consumers contribute to the existence and survival of firms that consistently engage in misconduct. By rehiring advisers with misconduct records, high-misconduct firms blunt the market discipline of low-misconduct firms.

The Gender Punishment Gap

In addition to finding that the labor market for financial advisers recycles bad apples and results in matching on misconduct, we also find evidence of a "gender punishment gap."[4] Following an incident of misconduct, female advisers are 9 percentage points more likely to lose their jobs than their male counterparts. Figure 2 [following page] displays job turnover in the financial advisory industry for male and female advisers with and without misconduct records. After engaging in misconduct, 54 percent of male advisers retain their jobs the following year while only 45 percent of female advisers retain their jobs, despite no differences in turnover rates for male and female advisers without misconduct records (19 percent). The gender punishment gap extends beyond

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Seru's primary research interest is in corporate finance; he is interested in issues related to financial intermediation and regulation, with recent work focusing on regulatory aspects of shadow banks, fintech lenders, and financial advisers. He is also interested in interactions of internal organization of firms with financing and investment, with particular emphasis on technological innovation. His papers in these areas have appeared in several leading journals. He is a co-editor of *The Journal of Finance* and was previously editor of *The Review of Corporate Finance Studies*, a department editor of *Management Science,* and an associate editor of *Journal of Political Economy*.

Seru earned a BE and an MBA from the University of Delhi. Subsequently, he received a PhD in finance from the University of Michigan.

the firm at which misconduct took place to other reemployment opportunities in the industry. While half of male advisers find new employment after losing their jobs following misconduct, only a third of female advisers find new employment.

We find no evidence that occupational segregation drives this gap. Because of the incredible richness of our regulatory data, we are able to compare the career outcomes of male and female advisers who are working at the same firm, in the same location, at the same point in time, and in the same job role. Differences in production, or the nature of misconduct, do not explain the gap. If anything, misconduct by female advisers is on average substantially less costly for firms.

The gender punishment gap increases in firms with a larger share of male managers at the firm and branch levels. For example, we find no evidence of a punishment gap at firms with an equal representation of men and women at the executive level. Conversely, at firms with no female representation at the executive level, women are 32 percentage points more likely to lose their jobs following misconduct than are their male counterparts. We extend our analysis to men with names that are relatively common in minority groups and find that the punishment gap and patterns of in-group tolerance extend to them as well. These results also suggest that the in-group tolerance we observe is not driven solely by gender-specific factors. In addition, we find no evidence that male minority managers decrease the gender punishment gap. In other words, managers only alleviate the punishment gap within their gender and ethnic group. This evidence is important because it rules out several potential alternatives, under which firms with female or minority male executives attract a pool of individuals with selected misconduct propensities. The gender punishment gap we identify is a potentially less salient form of discrimination that may limit the careers of women working in a high human capital, well-paid industry.

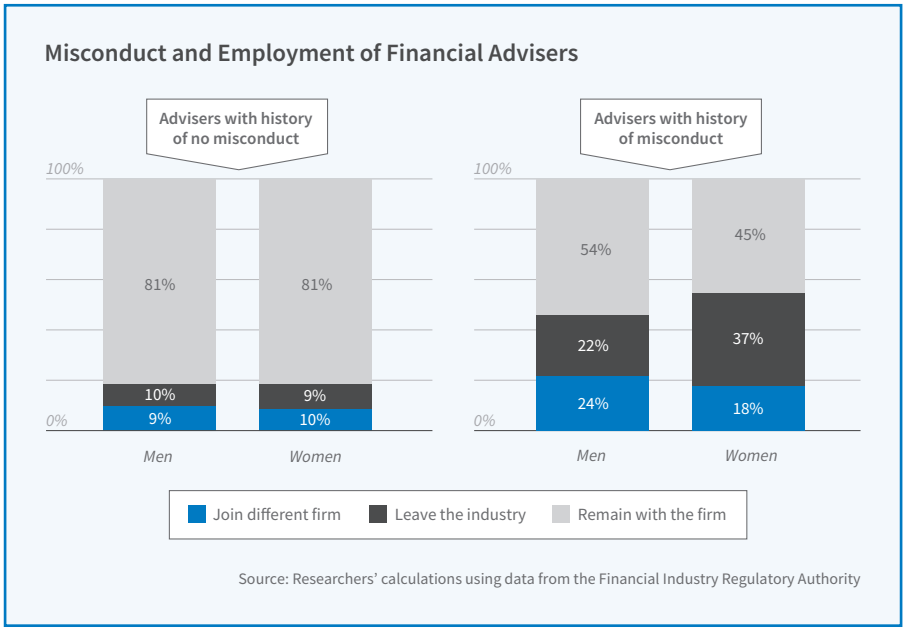

Figure 2

Our findings imply that too many female advisers with untarnished records are purged from the industry while too many fraudulent male advisers remain in the market, resulting in more misconduct. Gary Becker suggested that markets combat discrimination because discriminators are harmed with lower profits.[5] However, misconduct-tolerant firms that have male advisers with records of misconduct can survive in equilibrium due to the presence of unsophisticated consumers. In other words, the product market equilibrium with unsophisticated consumers may make it easier to discriminate against female advisers.

Policy Response

Our results suggest that financial firms and regulators may want to pay close attention to "high-risk" financial advisers with misconduct records who are recycled across firms in the industry. Since our research findings were first circulated, there have been several policy initiatives in this direction. The Office of Compliance Inspections and Examinations with the Securities and Exchange Commission, the Massachusetts Securities Division, FINRA, and the Financial Stability Board have added hiring and employment of high-risk and recidivist brokers to their examination priorities.

Our work also suggests that unsophisticated consumers are essential to the survival of misconduct in this market. Increasing market transparency and providing consumers with access to more information could reduce the number of unsophisticated consumers. FINRA's promotion of its BrokerCheck website is a step in this direction. We have also constructed a new website (www.eganmatvosseru.com) to help raise awareness of adviser fraud and to provide resources for policymakers, practitioners, and researchers.

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[1] 2018 Edelman Trust Barometer, Global Report; *M. Egan, G. Matvos, and A. Seru, "The Market for Financial Adviser Misconduct,"* NBER Working Paper No. 22050, February 2016.
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[2] *Ibid,* NBER Working Paper No. 22050.
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[3] *E. Fama, "Agency Problems and the Theory of the Firm,"* Journal of Political Economy*, 88(2), 1980, pp. 288–307; E. Fama and M. Jensen, "Agency Problems and Residual Claims," the* Journal of Law and Economics*, 26(2), 1983, pp. 327–49.*
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[4] *M. Egan, G. Matvos, and A. Seru, "When Harry Fired Sally: The Double Standard in Punishing Misconduct," NBER Working Paper No. 23242, March 2017.*
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[5] *G. Becker,* The Economics of Discrimination*, Chicago, Illinois: University of Chicago Press, 1957.*
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The Return of Survey Expectations

Andrei Shleifer

Andrei Shleifer is John L. Loeb Professor of Economics at Harvard University. He holds an undergraduate degree from Harvard and a PhD from MIT. Before coming to Harvard in 1991, he taught at Princeton University and the University of Chicago Booth School of Business. He is a research associate in the NBER's Corporate Finance, Public Economics, Asset Pricing, Economic Fluctuations and Growth, Law and Economics, and Political Economy programs.

Shleifer has worked in the areas of comparative corporate governance, law and finance, behavioral finance, and institutional economics. He has published seven books, including *The Grabbing Hand*, with Robert Vishny; *Inefficient Markets: An Introduction to Behavioral Finance;* and *A Crisis of Beliefs: Investor Psychology and Financial Fragility*, with Nicola Gennaioli, as well as over a hundred articles.

Shleifer is an editor of the *Quarterly Journal of Economics*, and a fellow of the Econometric Society, the American Academy of Arts and Sciences, and the American Finance Association. In 1999, he won the John Bates Clark Medal of the American Economic Association. According to the organization Research Papers in Economics (RePEc), Shleifer is the most-cited economist in the world.

The use of survey expectations data was a key feature of macroeconomics in the 1950s and 1960s, and an important part of research at the NBER during that period. Yet this work slowly ground to a halt in the aftermath of the rational expectations revolution. Under rational expectations, economic agents forecast the future by optimally using the true structure of the economy they operate in. This means that the structure of the economy itself dictates what beliefs they should hold. From the viewpoint of economic research, this implies that expectations data are redundant as long as the econometrician knows the model that economic agents rely on and can compute their statistically optimal expectations of future variables from that model. In financial economics as well as in macroeconomics, the rise of the efficient markets hypothesis rendered expectations data largely irrelevant for addressing key questions.

Although the last 30 to 40 years have seen occasional studies using survey expectations data, this line of work has picked up pace significantly in the last several years. Part of the reason is that we now have much better data, and that survey expectations are actually quite useful in distinguishing alternative models, but part is undoubtedly the fact that rational expectations models in both macroeconomics and finance have increasingly reached dead ends. As a result, survey expectations are staging a remarkable comeback.

Rapidly growing evidence shows that, far from being random noise, measured expectations are highly consistent across surveys that are conducted with different methodologies and using somewhat different questions. Furthermore, actual behavior of survey respondents is predicted more successfully by their survey responses than by some model-based predictors from a rational expectations model. People literally put their money where their mouth is — not where it ought to be in rational expectations models. Last but not least, the evidence shows that forecast errors can be predicted from the information that the decision maker has at the time of making the forecast. This is inconsistent with the rational expectations hypothesis, and points to more realistic economic models of expectation formation and actual behavior. In this summary, I review some of my research that contributes to these findings, conducted jointly with Pedro Bordalo, Nicola Gennaioli, Robin Greenwood, Rafael La Porta, and Yueran Ma. Many other researchers have generated closely related results.

Expectations of Aggregate Stock Returns

Perhaps because the movements of the stock market engage so many people, from individual investors to managers to professional forecasters, there are multiple sources of data on expectations of aggregate stock market returns. Robin Greenwood and I put together data on such expectations, some quantitative and some qualitative, from six sources, with very diverse surveyed populations and different survey questions.[1]

The first source is the Gallup survey of individual investors, with data from 1996 to 2012. For most of this period, this survey asked respondents about their beliefs about stock market returns over the next year, with possible answers ranging from "very optimistic" to "optimistic" to "neutral" to "pessimistic" to "very pessimistic." One can construct a qualitative indicator of return expected by Gallup respondents as the difference between the percentages of bullish and bearish investors. Between 1998 and 2003, the survey also asked for

quantitative estimates of expected stock market returns. Because during this overlap period the movements in the qualitative bullishness indicator and the quantitative expectations of returns are highly correlated, the overlap allows us to map the qualitative indicators into quantitative measures of expected return over the entire period since 1996.

The second source is the survey of Chief Financial Officers of large U.S. companies, conducted since 1998 by John Graham and Campbell Harvey at Duke University. Here respondents provide quantitative estimates of the expected stock market return over the next year. The other four sources are a member survey of investor sentiment conducted by the American Association of Individual Investors; a sentiment measure constructed by the editors of *Investors Intelligence* newsletter going back to 1963, summarizing the investment outlook of more than 120 independent financial market newsletters; Robert Shiller's survey of individual investor confidence in the stock market; and the University of Michigan Surveys of Consumers, which date to 1946.

Greenwood and I put these six data sources into comparable units and use average responses in each survey every month. We thus have a monthly time series of expectations of returns on the stock market from six sources. We find that, at any given point in time, different financial market participants, ranging from individuals to CFOs, have highly correlated expectations or sentiment about future returns. Despite the considerable heterogeneity of data collection procedures across these surveys, this evidence decisively rejects the hypothesis that survey expectations are merely noise. Indeed, we also find that investor expectations are highly correlated with the flow of money into equity mutual funds. When investors are optimistic about expected stock returns, they put money into equity mutual funds. This evidence shows that investors act on their beliefs. Survey expectations can be used to predict economically relevant choices.

If these expectations are highly correlated across data sources and investor types, then what do they reflect? Figure 1 plots, on the same graph, Gallup expectations of the next 12-month return and the past 12-month return on the S&P 500. The two series practically lie on top of each other. Gallup investors, as well as participants in other surveys, expect high future returns precisely when the last year's stock market return has been high. They appear to extrapolate past returns into the future.

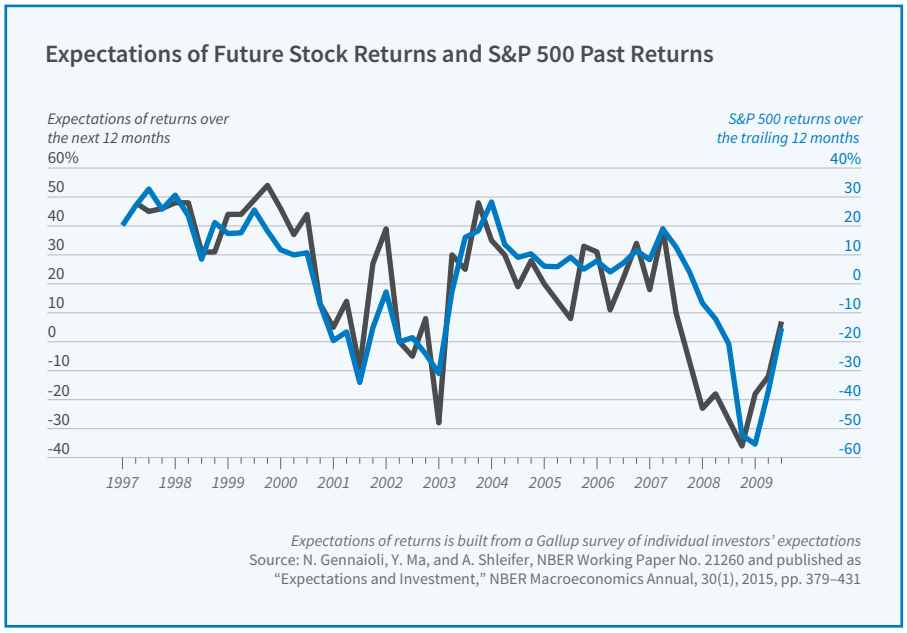

Figure 1

Is such extrapolation an effective return forecasting strategy? The answer is no. The correlation between the Gallup expected return and the S&P return for the next — as opposed to the past — 12 months is negative, though statistically insignificant. At the same time, high past returns predict expectation errors. When past returns are high, expected future returns are on average higher than realizations. A quick summary of what the data say is that when stock market returns have been high, investors expect high returns to continue, but in reality the returns are, if anything, on average low.

Greenwood and I also find that expected returns dictated by standard rational expectations asset pricing models are strongly and statistically significantly *negatively* correlated with survey expectations of returns. According to efficient markets models, stock prices are high when investors are willing to accept low returns going forward because their wealth or consumption is high today. With extrapolation, in contrast, stock prices are high precisely because, by extrapolating past returns, investors incorrectly expect future prices to become even higher, bidding up current prices. This evidence explains, in the clearest way, how the rational expectations models get it wrong. The models need investors to expect low returns in good times, the opposite of what they say they expect.

Expectations in a Cross-Section of Stock Returns

In 1996, La Porta published an intriguing finding.[2] He compared companies with the most optimistic and most pessimistic long-term earnings growth forecasts made by financial analysts. He found that stocks with the most optimistic analysts earn sharply lower returns than those with the most pessimistic ones. It is not just that when analysts are extremely optimistic, realized long-term earnings growth proves to be slower than analysts expect. Their optimism also infects prices, perhaps because they influ-

ence investors or perhaps because investors hold similar beliefs. This leads to overvaluation and to low subsequent returns on the stocks whose growth prospects the analysts find most favorable.

Bordalo, Gennaioli, La Porta, and I revisited La Porta's finding with 20 additional years of data and took a much closer look at how expectations are formed, how they are revised, and how earnings, beliefs, and prices co-evolve.[3] La Porta's initial finding still holds: A portfolio of high long-term growth (HLTG) stocks (those with the top 10 percent most optimistic earnings-growth forecasts) returns 3 percent on average in the year after formation during the 1981–2015 sample period. In contrast, a portfolio of low long-term growth (LLTG) stocks — those with the bottom 10 percent most pessimistic earnings-growth forecasts — returns 15 percent on average in the year after formation. The latter stocks are a much better investment, on average.

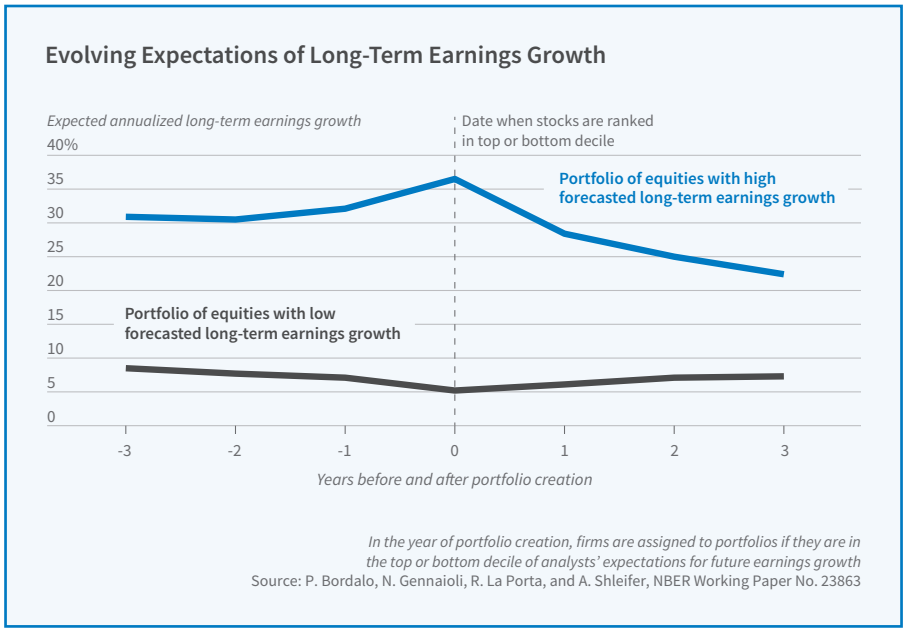

Figure 2

Why are HLTG stocks such a bad investment? First, as Figure 2 shows, analyst expectations of long-term earnings growth are at their peak at the time of portfolio formation for HLTG firms. These expectations have been rising, along with earnings, for several years prior to portfolio formation and decline in the years immediately following. Analysts learn that they are too optimistic about HLTG firms and revise their beliefs accordingly. The opposite pattern holds for LLTG firms: Analysts revise their views of these firms down prior to portfolio formation, but subsequently recognize that long-term earnings growth will not be as bad as they anticipated and correct their beliefs upward. Portfolio returns follow forecast revisions: As analysts curb their earlier enthusiasm, returns are poor; as they cheer up, returns are high.

We find similar trends in the earnings data: HLTG firms experience positive earnings surprises on the way up, yet disappoint looking forward from the peak. LLTG firms disappoint on their way down, but turn out not to be as bad as expected looking forward from the bottom. To put this differently, analysts extrapolate past performance and become excessively optimistic about HLTG firms and excessively pessimistic about LLTG firms. And critically, these extreme beliefs are reflected in valuations as well, leading to sharp differences in returns as analysts and others correct their mistaken extreme beliefs.

This evidence raises a deeper question about how analysts form beliefs in the first place. Do they mechanically extrapolate past earnings growth trends, or is there more to their belief formation? Our work suggests that belief formation is not mechanical, but takes a particular form of sophisticated yet not entirely rational learning. We find that among HLTG firms, there are in fact some whose earnings continue to grow spectacularly — they are the future Googles. It is just that most HLTG firms do not turn out to be Googles, but slow down instead. Analysts form average expectations for HLTG firms as if there are more future Googles among them than in reality there are.

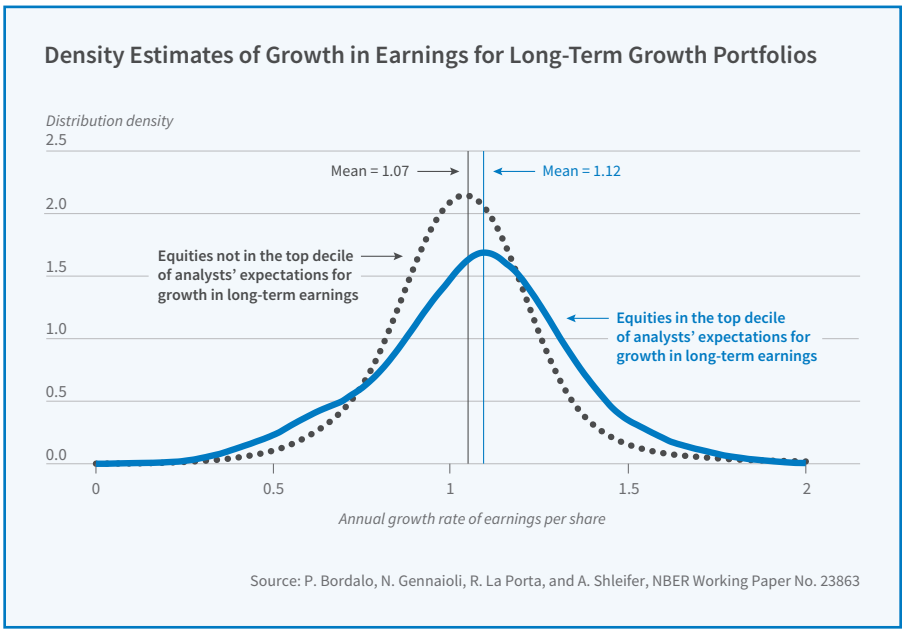

Figure 3

Figure 3 illustrates this finding. It shows

the distribution of long-term earnings growth rates from HLTG firms (solid curve) and other firms (dashed curve). HLTG firms have a fat right tail of performance outcomes relative to all firms. There are indeed more Googles among them, but not nearly as many as analysts think. Analysts use information about past performance but overreact by predicting too many high performers.

So we see that, in the cross-section of stocks, there are some very similar phenomena to those we saw in the aggregate. Good performance leads to predictions of good performance in the future, and the opposite for bad performance. Forecasters extrapolate, but not mechanically. They use some forward-looking logic. Analysts understand correctly that extremely high earnings growth portends extremely high continued growth for some firms; there is indeed information in high past earnings growth for future earnings growth. Among the HLTG firms, there actually are some remarkable performers going forward, many more than among LLTG firms. Unfortunately, such performers tend to be relatively few, and the forecasts become overly optimistic by expecting too many of them. Analysts react excessively to the good news of high earnings growth. Extrapolation is caused by overreaction to information.

Expectations and Investment

Do survey expectations shape corporate decisions as well? Gennaioli, Ma, and I have explored this question for corporate investment.[4] We use the Duke CFO Global Business Outlook survey of large U.S. companies already mentioned as a source of data on expected stock returns. These CFOs also report their expectations of earnings growth and investment plans for their own companies.

Figure 4 shows CFO earnings growth expectations and investment plans for the next year, aggregated over the firms in the Duke sample. It shows that the two follow each other closely. The collapse of earnings growth expectations following the Lehman bankruptcy, for example, is accompanied by the collapse of investment plans. The two recover together in 2009–10 as well. Actual investment is very close to investment plans, so CFO beliefs go hand in hand with economic activity. The study also shows that CFO earnings growth expectations are a much stronger predictor of investment plans (as well as realizations) than Tobin's q, the ratio of a company's market value to the replacement cost of its capital stock, which is the preferred indicator of investment opportunities in a standard rational expectations investment framework.

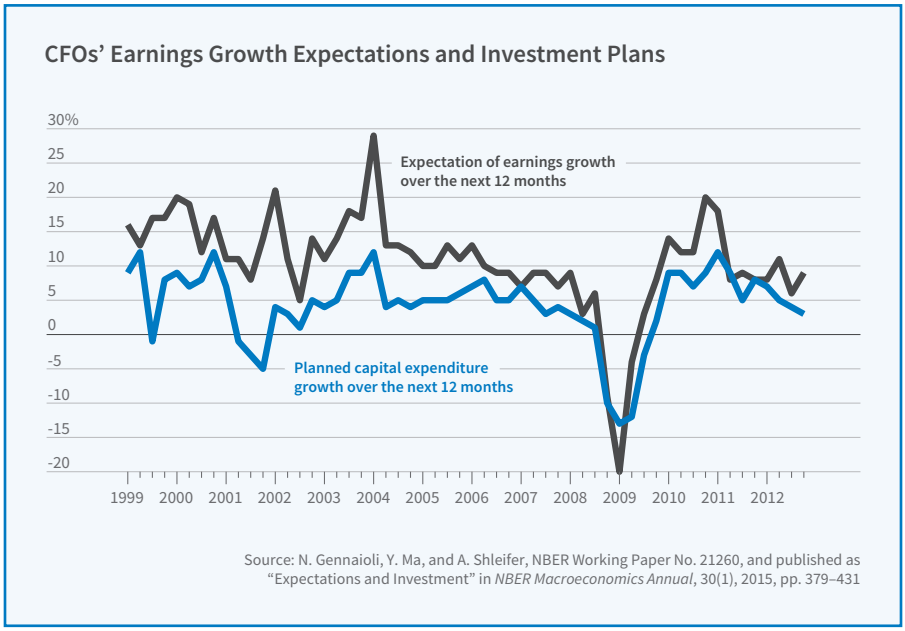

Figure 4

But are CFO expectations rational? It appears that they are not. Rather, the evidence shows that CFOs are excessively optimistic about their firms' earnings growth when past profitability has been high, and conversely when it has been low. The predictability of forecast errors is inconsistent with the rational expectations hypothesis, and the evidence again points to extrapolation: The CFOs expect the profitability of their firms to be more persistent than it turns out to be, on average.

In sum, recent research points to many new opportunities presented by survey expectations data. These include tests of rationality of expectations, but more importantly suggest avenues for constructing new models in macroeconomics and finance. These models could seek to fit not just data on quantities and prices, but also data on the beliefs of households and firms. Research on these issues could represent a return to issues that engaged many NBER researchers in the past, this time with better data, evidence, and theory.

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[1] *R. Greenwood and A. Shleifer, "Expectations of Returns and Expected Returns," NBER Working Paper No. 18686, January 2013, and* The Review of Financial Studies*, 27(3), 2014, pp. 714–46.*
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[2] *R. La Porta, "Expectations and the Cross-Section of Stock Returns,"* The Journal of Finance*, 51(5), 1996, pp. 1715–42.*
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[3] *P. Bordalo, N. Gennaioli, R. La Porta, and A. Shleifer, "Diagnostic Expectations and Stock Returns,"* NBER Working Paper No. 23863, September 2017, *and forthcoming in* The Journal of Finance.
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[4] *N. Gennaioli, Y. Ma, and A. Shleifer, "Expectations and Investment,"* NBER Working Paper No. 21260, June 2015, *and the* NBER Macroeconomics Annual 2015, *30(1), 2015, pp. 379–431*
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What Inventions Are We Missing?

Heidi Williams

Heidi Williams is a research associate in the NBER's Aging, Health Care, and Productivity Programs. She is an associate professor of economics at MIT, and is currently Trione Visiting Associate Professor at the Stanford Institute for Economic Policy Research. She is co-editor of the *Journal of Economic Perspectives*.

Her research focuses on investigating the causes and consequences of technological change, with a particular focus on health care markets. Williams received her AB in mathematics from Dartmouth College in 2003, her MSc in development economics from Oxford University in 2004, and her PhD in economics from Harvard in 2010. Her research has received support from the National Institutes of Health and an NSF CAREER grant, among others, and she has received a Sloan Research Fellowship and a MacArthur Foundation Fellowship.

Williams grew up in North Dakota, but has most recently been living in Cambridge and Palo Alto with her husband and two young sons.

Academics and policymakers have long recognized that competitive markets may under-incentivize innovation. This concern has motivated the design of public policies such as the patent system, which aims to encourage research investments into new technologies by allowing inventors to capture a higher share of the social returns to their research investments.

A well-developed theoretical literature has analyzed optimal patent policy, with a focus on the trade-off between providing incentives for the development of new technologies and tolerating higher prices during the life of the patent. Although such theoretical models — and, importantly, public policies — typically assume that stronger (e.g. longer or broader) patents will induce additional research investments, there is remarkably little empirical evidence on how patents affect research investments in practice.

This question has been difficult to tackle empirically for at least two reasons. First, measuring research investments can be quite challenging. Second, finding variation in patent protection that can be leveraged in an empirical study is difficult. On paper, the U.S. patent system is uniform, providing a 20-year period of protection for all inventions. While historically some cross-country variation in patent laws has existed, because innovations are generally developed for a global market, country-specific patent law changes may often induce only a relatively small change in global research incentives.

My research agenda attempts to overcome both of these challenges in order to develop empirical estimates of the key parameters needed to inform optimal patent policy. By combining detailed new measures of research investments with novel sources of variation in the *effective* patent terms provided to otherwise similar inventions, my work aims to construct frameworks within which we can infer the volume, type, and value of "missing" research investments that would have occurred under counterfactual patent policies. In this piece, I summarize some of the main findings that have emerged from my research in this area.

Measuring Innovation

Traditionally, economists who study innovation have relied on patent counts (or citation-weighted patent counts) as a measure of innovation, often leveraging the data constructed by Bronwyn Hall, Adam Jaffe, and Manuel Trajtenberg.[1] Although this approach has been useful in many settings, it encounters two major limitations. First, in many cases it is difficult or impossible to match patents with the specific products they protect, or to identify specific groups of consumers that might benefit from those products. For example, the text in a patent protecting a delivery method for a breast cancer drug may have no information suggesting the patent is relevant to breast cancer patients. Hence, it can be very difficult to use patents to measure research investments in a way that can be linked to product-market or consumer-level outcomes. Second, by construction, patent data can only measure patented inventions. Because many technologies are not patented, changes in patent counts may in some settings reflect changing levels of inventors' willingness to file for patents on their research investments, rather than changes in the underlying research investments themselves.

A major focus of my research agenda has been to attempt to overcome these two challenges by compiling "real," non-patent measures of innovation. For example, Eric Budish, Ben Roin, and I aimed to develop measures of research investments in cancer drugs.[2] The core of our data construction was to take advantage of a National Cancer Institute (NCI) clinical trial registry that includes an explicit listing of the patient groups eligible to enroll in each

clinical trial. Cancer treatment tends to be specific to an organ of origin, such as prostate, and stage of disease, for example, metastatic. As such, the organ-stage classification tends to be used both to label clinical trial-eligible groups (as in the NCI data, where such classifications are used to describe which patients can enroll in any given clinical trial) and to label patients in standard clinical datasets (e.g. the Surveillance, Epidemiology, and End Results cancer registry data, which provides data on the survival outcomes of U.S. cancer patients). Leveraging this organ-stage classification hence allowed us to use clinical trials as a real measure of research investments in new cancer drugs, and to link those research investments to measures of patient health outcomes — namely, survival outcomes for different groups of cancer patients over time.

As a second example, two of my papers — one joint with Bhaven Sampat — have constructed data on non-patent measures of innovation related to the human genome.[3] The set of human genes is curated by scientists in a way that assigns the equivalent of Social Security numbers — unique identifiers for each gene — called Entrez Gene IDs. These Entrez Gene IDs are in turn linkable to various databases which catalog scientific papers that have documented evidence for links between genes and diseases; this "paper trail" provides a consistent measure of scientific publications related to a given gene. Entrez Gene IDs can also be linked to product market databases such as the GeneTests.org database, which provides information on the use of genes in gene-based diagnostic tests, and the Pharmaprojects database, which provides information on drug compounds in clinical trials that relate to specific genetic variations. These types of curated scientific identifiers can thus provide unique opportunities to trace out meaningful links between basic scientific discoveries and commercialized products.

Our goal in constructing these data is to apply them in order to test and evaluate theories about economic factors that may be encouraging or hindering innovation. Let me now summarize some of the substantive findings of our research.

Incentives to Develop New Drugs

Why don't we have a cure for cancer? Informal discussions with doctors and scientists usually provide a variety of answers to this question, many of which boil down to some version of "the basic science is hard." But from an economic perspective, we are of course inclined to think that how "hard" any given scientific problem seems might reflect not only the innate difficulty of the problem, but also the level of past research efforts to solve it.

Budish, Roin, and I investigated one aspect of this question — namely, whether private firms underinvest in cancer drug development projects that require a long time to complete.[4] The basic idea of our study was this: Pharmaceutical firms face strong incentives to file patent applications at the time of invention. However, prior to marketing a new drug, firms must submit clinical trial results to the U.S. Food and Drug Administration (FDA) documenting that their product meets a set of safety and efficacy standards. These clinical trials generate a lag between the time of patenting and the time of commercialization, which reduces an invention's effective patent life — more so for drugs that require longer clinical trials. A key determinant of clinical trial length is patient survival time: Because clinical trials generally must show evidence that the treatment improves mortality-related outcomes, clinical trials tend to be longer — and hence, effective patent terms shorter — when enrolling patients with longer survival times. All else being equal, firms are thus awarded longer terms of market exclusivity for successfully developing drugs to treat patients with shorter survival times (such as patients with late stage, metastatic cancers) relative to drugs to treat patients with longer survival times (such as patients with early stage, localized cancers). This motivates the following empirical test: If longer patent terms encourage more research investments, we should see higher levels of private research investments on treatments for patient groups that require shorter clinical trials.

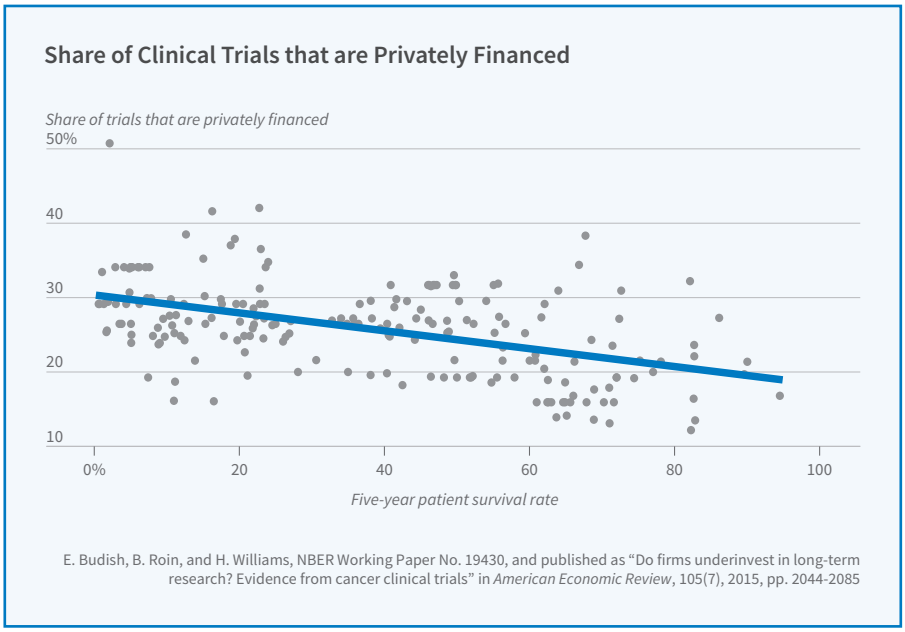

Figure 1

Using the cancer clinical trial registry data described above, we document several sources of empirical evidence that together are consistent with private research investments being distorted away from long-term projects such as drugs to prevent or treat early-stage cancers. For example, Figure 1, reproduced from our paper, documents that research on cancers which require longer

clinical trials because they have higher five-year survival rates is more likely to be publicly funded. A back-of-the-envelope calculation we present suggests that this distortion has quantitatively important implications for the survival outcomes of U.S. cancer patients.

Unfortunately, our estimates cannot speak directly to the potential role of patents, since excess impatience of private firms may also under-incentivize long-term research.[5] Our empirical evidence is nonetheless directly relevant to at least two policy levers. First, to the extent that valid surrogate endpoints — non-survival endpoints that are known to be causally linked with subsequent survival improvements but which can generally be observed more quickly than can changes in survival outcomes — are available, our evidence suggests that allowing clinical trials to rely on valid surrogate endpoints can meaningfully increase research investments and substantially improve patient health outcomes. Second, our results suggest a rationale for targeting public research subsidies toward projects that are expected to have long commercialization lags, such as many Alzheimer's drugs.

Human Genomes: Public and Private

The prediction that stronger patent protection induces additional research investments emerges unambiguously from a class of theoretical models that treat innovations as isolated discoveries. In practice, however, innovation is often "cumulative," that is, any given discovery is also an input into later, follow-on discoveries. In such cases, optimal patent policy will depend in part on how patents on existing technologies affect follow-on innovation. A well-developed literature has documented theoretically ambiguous predictions on how patents affect follow-on innovation, but there is little available empirical evidence.[6] I here describe two papers that aim to shed light on this question in the context of the human genome.

In 2001, the journals *Nature* and *Science* published the initial sequences of the human genome: *Nature* published a version completed by the publicly funded Human Genome Project, and *Science* published a version completed by a private firm, Celera.[7] As was described in an accompanying editorial in *Nature*, the rules surrounding data access differed across the two efforts.[8] The Human Genome Project placed all of its sequenced data in an open-access database within 24 hours of being sequenced, with the stated goal of maximizing the data's benefit to society. Celera instead chose to protect its data with a contract law-based form of intellectual property, which allowed free use of the data for academic research, but placed restrictions on redistribution of the data and required licensing agreements to be negotiated for any downstream discoveries. As emphasized in the *Nature* editorial, much public debate surrounded the question of whether Celera's data not being open access would hinder subsequent scientific research and product development.

I collected records of when each human gene was sequenced by Celera and by the Human Genome Project,[9] which indicates whether a gene was ever held with Celera's intellectual property. Genes sequenced first by Celera were held with Celera's intellectual property until the gene was re-sequenced by the Human Genome Project, at which time it moved into the public domain. I linked these records to the types of gene-level innovation measures described above. Using these data, I documented that Celera's property rights reduced subsequent scientific research and product development by approximately 30 percent.

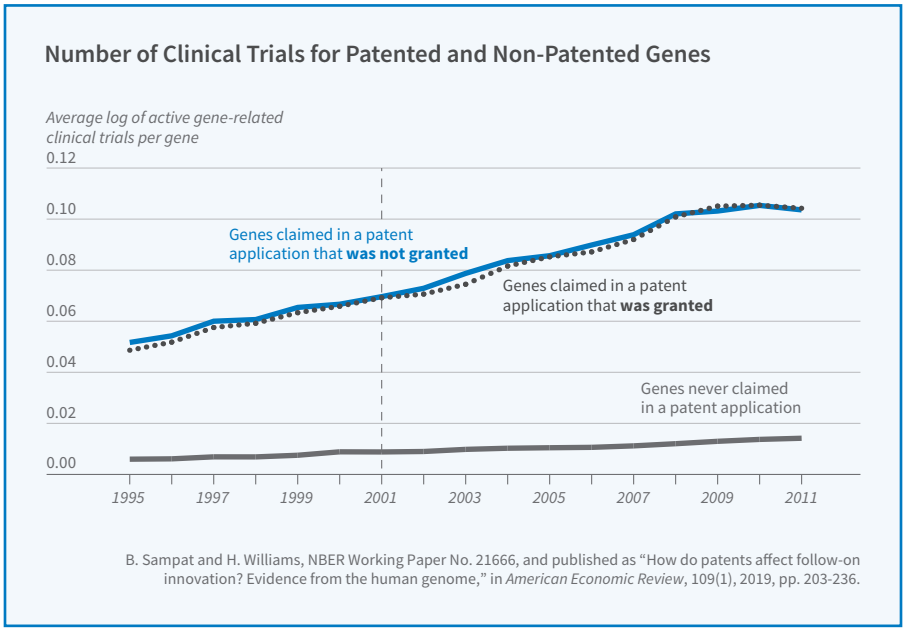

Figure 2

Taken at face value, these results clearly suggest that data access rules can have quantitatively important effects on the rate of innovation. Because the timing of that study coincided with a high-profile U.S. Supreme Court case (*AMP v. Myriad*) that ruled on whether human genes should qualify as patentable subject matter, a question naturally arose of whether the negative effects of Celera's non-patent intellectual property would be similar to the effects of gene patents. Sampat and I directly investigated this question.[10]

We proposed two quasi-experimental approaches for investigating how gene patents affect follow-on innovation. First, we compared follow-on innovation on genes claimed in accepted versus rejected patent applications. Figure 2 above, reproduced from our paper, shows that genes included in accepted and rejected patent applications were the

subject of a similar number of clinical trials both before and after the relevant patent applications were filed. The earliest patent application filing date in our sample is denoted by the vertical line.[11]

Second, we constructed an instrumental variable for whether a patent application is granted a patent, based on the "leniency" of the conditionally randomly assigned patent examiner. In contrast with the effects I observed with Celera's intellectual property, both of these approaches suggest that gene patents have *not* reduced follow-on innovation; in particular, we can statistically reject declines in follow-on innovation on the order of my earlier estimates for Celera's intellectual property.

Both of the quasi-experimental approaches developed in this paper have already been re-applied in a number of other papers, by myself as well as other authors, and I have been pleased to see refinements and improvements of them being developed as well, as in the work of Josh Feng and Xavier Jaravel.[12]

Taken together, the evidence from this set of papers suggests that the traditional patent trade-off (*ex ante* incentives versus deadweight loss) may be sufficient to analyze optimal patent policy design at least in some markets, but that non-patent policies governing access to materials — such as data exclusivity — may have important effects on follow-on innovation.

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[1] *B. Hall, A. Jaffe, and M. Trajtenberg, "The NBER Patent Citation Data File: Lessons, Insights, and Methodological Tools,"* NBER Working Paper No. 8498, October 2001, *and in A. Jaffe and M. Trajtenberg, eds.,* Patents, Citations, and Innovations, *Cambridge, Massachusetts, The MIT Press, 2002.*
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[2] *E. Budish, B. Roin, and H. Williams, "Do Firms Underinvest in Long-Term Research? Evidence From Cancer Clinical Trials,"* NBER Working Paper No. 19430, September 2013, *and* American Economic Review, *105(7), 2015, pp. 2044–85.*
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[3] *H. Williams, "Intellectual Property Rights and Innovation: Evidence From the Human Genome,"* NBER Working Paper No. 16213, July 2010, *and* Journal of Political Economy, *121(1), 2013, pp. 1–27; B. Sampat and H. Williams, "How Do Patents Affect Follow-On Innovation? Evidence From the Human Genome,"* NBER Working Paper No. 21666, October 2015, *and* American Economic Review, *109(1), 2019, pp. 203-36.*
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[4] *Ibid,* NBER Working Paper No. 19430.
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[5] *See, e.g., J. Stein, "Agency, Information, and Corporate Investment,"* NBER Working Paper No. 8342, June 2001, *and in G. Constantinides, M. Harris, and R. Stulz, eds.,* Handbook of the Economics of Finance, *Amsterdam, The Netherlands: Elsevier B.V., (1A), 2003, pp. 111–65; J. Stein,* Quarterly Journal of Economics, *104(4), 1989, pp. 655–69.*
Return to Text

[6] *For one recent paper that is an exception to this statement, see A. Galasso and M. Schankerman, "Patents and Cumulative Innovation: Causal Evidence From the Courts,"* NBER Working Paper No. 20269, July 2014, *and* Quarterly Journal of Economics, *130 (1), 2015, pp. 317–69.*
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[7] *International Human Genome Sequencing Consortium, "Initial Sequencing and Analysis of the Human Genome,"* Nature, *409(6822), 2001, pp. 860–21; J. Venter, et al., "The Sequence of the Human Genome,"* Science, *291(5507), 2001, pp. 1304–51.*
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[8] *"Human Genomes, Public and Private,"* Nature, *409(6822), 2001, p. 745.*
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[9] *Ibid,* NBER Working Paper No. 16213.
Return to Text

[10] *Ibid,* NBER Working Paper No. 21666, *and* American Economic Review, *109(1), 2019, pp. 203–36.*
Return to Text

[11] *The lower line in Figure 2 shows that genes that were never included in any patent applications were the subject of many fewer clinical trials over this entire period, suggesting that — perhaps unsurprisingly — there was positive selection of genes into patent applications.*
Return to Text

[12] *J. Farre-Mensa, D. Hegde, and A. Ljungqvist, "What Is a Patent Worth? Evidence From the U.S. Patent 'Lottery,'"* NBER Working Paper No. 23268, December 2018; *P. Kline, N. Petkova, H. Williams, and O. Zidar, "Who Profits from Patents? Rent-Sharing at Innovative Firms,"* NBER Working Paper No. 25245, November 2018, *and forthcoming in the* Quarterly Journal of Economics*; P. Gaule, "Patents and the Success of Venture-Capital Backed Startups: Using Examiner Assignment to Estimate Causal Effects," 2015, unpublished CERGE-EI Working Paper, Series No. 546; J. Feng and X. Jaravel, "Crafting Intellectual Property Rights: Implications for Patent Assertion Entities, Litigation, and Innovation," 2016, unpublished Harvard mimeo.*
Return to Text

Do Government Grants to Charities Crowd Private Donations Out or In?

James Andreoni

James Andreoni is a Distinguished Professor of Economics at the University of California, San Diego. Before joining UCSD in 2006, Andreoni was a professor at the University of Wisconsin from 1986 to 2005. He is a fellow of the Econometric Society, a research associate in the NBER's Public Economics program, past president of the Economic Science Association, former co-editor of the *Journal of Public Economics,* and co-founder of the Association for the Study of Generosity in Economics.

Over his career, Andreoni has published widely in the fields of public finance, experimental and behavioral economics, and economic decision-making. He is perhaps best known for his extensive work on charitable giving, studying what motivates people to give, and how donors, fundraisers, and policymakers interact. He has also made contributions to the fields of tax compliance, social preferences, delegated enforcement, decision-making by juries, revealed preference, and social interactions. In recent years, he has turned to issues of measuring time preferences, and studying the causes of apparent time inconsistencies in consumption, labor supply, and moral and ethical behavior.

The basic hypothesis of crowding out is simple: Suppose individuals care only about their own private consumption and the charity's capacity to spend. In particular, they are indifferent to whether their own gift is voluntary or is involuntarily paid through taxes. As a result, any effort by policymakers to support this charity through more involuntary taxes would be met with equal reductions of voluntary gifts as donors work to reestablish their optimal total contributions. The net effect is that the government support for the charity completely crowds out private giving.

When confronted with more realistic theory, the basic hypothesis of crowding out quickly falls apart. First, complete crowding requires that donors be "pure altruists," that is, they engage in consequentialist reasoning.[1] If individuals have other motives for giving, such as private benefits of a "warm glow," or social motives like image or pride, then complete crowd-out may not hold.[2] Notice too that without impurely altruistic motives for giving there is also little use for fundraisers. Yet charities have very sophisticated and active fundraising operations. This leads us to questions such as: How does fundraising attract donations? What are the objectives of fundraisers? How do government grants affect both donors and fundraisers?

To examine these questions empirically, we first need to observe how donors respond to changes in government grants to the charities they support. In doing so, we must recognize an important source of bias. If there is a natural disaster, for example, then both the donors and the government will want to give more money for the Red Cross. This will make it appear that donations and grants to the Red Cross are positively correlated, thus biasing estimates toward crowding *in*.

In an important and early paper that recognized this bias, Abigail Payne estimated crowding out of about 50 percent; private charitable giving to an organization fell by about half the amount of government transfers to it.[3] Her paper, like the previous literature, did not treat charities as active participants in the market for donations. My recent empirical work on crowding out, much of it done jointly with Payne, aims to look directly at the mechanism of crowding out. We do this by including charities as strategic players in a game with donors and the government.

Strategic Charities

One key question related to the link between receipt of a government grant and a charity's total resources is how the charity's fundraising activities will respond. In particular, are charitable fundraisers net revenue maximizers? It is useful here to follow the distinction that non-profits make between *continuing campaigns* and *capital campaigns.*

The goal of continuing campaigns is typically to raise enough money to continue meeting the ongoing needs of the charity. This means that most charities will set a funding goal for the year and, roughly speaking, stop raising money when the goal is reached. Managers of such charities are said to be *satisficers* rather than *maximizers.* The consequence of this is that charities will stop actively raising money even though the marginal return of the last dollar of fundraising effort is still greater than a dollar.[4] Moreover, a common measure of the quality of a charity used by watchdog groups like Charity Navigator is "fundraising efficiency," defined as the fund-

raising expenses divided by total contributions. This may further discourage charitable organizations from pursuing revenue maximization.

Capital campaigns, by contrast, are typically about expanding the size or scope of the charity. They often involve significant fixed costs, such as new buildings or offices, and may create situations where the managers, and some donors, have more information than others about the quality of the planned expansions. It is difficult for the charity or an informed donor to credibly convey this quality, as both have an incentive to mislead others to believe the charity's quality is high.

If no single donor can pay all the fixed costs associated with the capital campaign, then there is always a zero-equilibrium in which no one contributes. Interestingly, a rule of thumb for fundraising in a capital campaign is to raise about 30 percent of the ultimate goal from a handful of large donors before even announcing the campaign. By coordinating gifts among a limited number of large donors — typically called "leadership givers" — fundraisers can provide the assurance that the fixed costs will be met, and thus eliminate the zero-equilibrium. Moreover, a government grant — often called a "seed grant" — can double as a leadership gift. These large gifts and grants can rule out the zero-equilibrium. The effect could be either to *crowd out or crowd in* private donations, depending on the scale of the capital investment.[5] Leadership givers can also signal information about the quality of a charity. A leadership giver can provide a credible signal of high quality by giving a sufficiently large gift. Winning a government grant can have the same effect.[6]

New Estimates of Crowding Out

Payne and I have explored the strategic role of charities in several ways. First, we ask whether government grants crowd out giving directly, or work indirectly by causing a reduction in fundraising. [7] We focus our analysis on social services organizations and arts organizations. Social services rely heavily on government grants, while the arts do not. We demonstrate that increases in government funding significantly decrease fundraising efforts, especially for organizations that rely on grants more heavily.

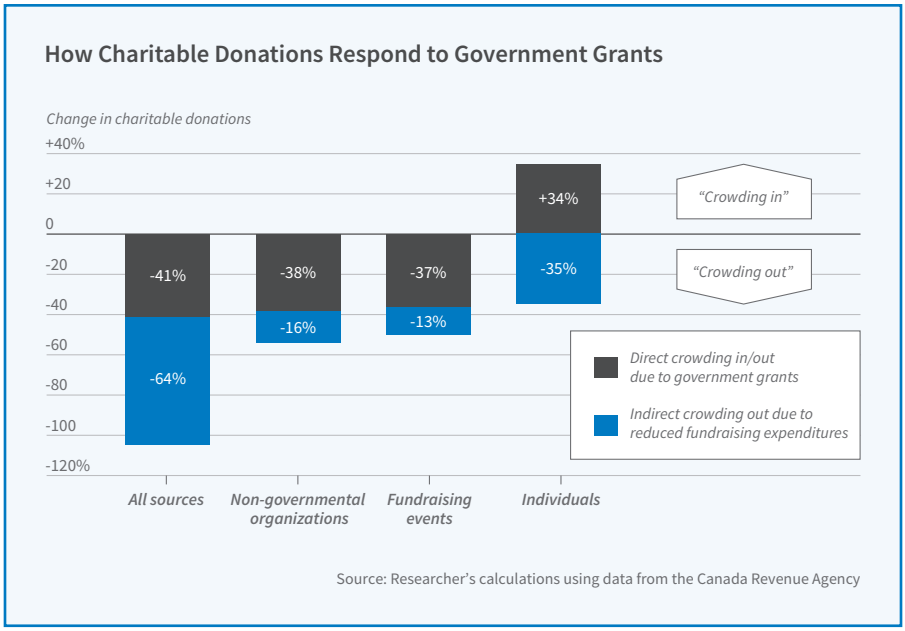

Figure 1

In a second study, we analyze data on more than 8,000 charities operating in the United States.[8] We measure an overall level of crowding out of about 75 percent: private donations fall by about three quarters of the amount of government grants. The bulk of the crowding out, 70 percent, is due to a change in fundraising. In fact, donors may be crowded in, as predicted by the informational role of grants as signals of quality. In a related study, we analyze more than 13,000 Canadian charities over more than 15 years.[9] In this dataset, we are able to measure whether individuals gave directly, or through participation in fundraising events such as gala dinners. The results are reported in Figure 1. For overall private giving, we measure crowding out of close to 100 percent of government grant amounts. Similar to our study using U.S. data, 64 percent of this crowding out is attributable to changes in fundraising efforts of charities. However, the Canadian data reveal a surprising new finding: Individuals who give directly are crowded in by government grants, not crowded out. This is consistent with government funding being a signal of quality. Crowding out of individual giving is entirely attributable to a decline in revenues from fundraising events.

Finally, in joint research with Sarah Smith, we study the UK lottery grant program.[10] The UK requires that 28 percent of all revenues of the National Lottery be set aside for distribution to UK charities. Eighty percent of all the money available is distributed through a program called Grants for Large Projects. Large projects are those requiring over £60,000 (about $90,000 at the time). We analyze over 5,000 applications to this program made between 2002 and 2005. Importantly, all applications are reviewed by a panel of citizens who first assign a score to each qualified applicant. The panel then meets publicly to discuss the proposals and select the grant recipients. Our data include cases where two charities have similar scores, but the charity with the inferior score receives the grant while the other does not.

We use a difference-in-differences

approach to identify the effect of grant funding on donations to the charity, in which we compare the change in donations before and after the funding decision across successful and unsuccessful charities. We find that receiving a grant has a positive and significant effect on a charity's total income. In other words, these grants do not completely crowd out other funding sources. Indeed, the data again point to crowding in. We then analyze the effects separately for different-sized charities. We find smaller charities, those with incomes less than £1 million per year, show the strongest evidence of crowding in. Moreover, the positive effect of a grant persists well beyond the year of the award. Finally, we observe that grant applications typically request funds for distinct, well-defined activities that extend the current mission of the charity. This is consistent with the idea that seed funding can crowd in other income.

Is Fundraising Making Us Worse Off?

Inherent in many studies of fundraising is an often-unstated premise that more funds raised means a better society. A revealed preference argument supports this: If donors were not made better off by giving, then they wouldn't give. But this ignores an important social aspect of fundraising: Individuals rarely give without having been asked first. Fundraisers often refer to this as the power of asking — asking is often a powerful percipient of a gift. What does this mean for the behavior of both charities and donors?

One can imagine two ways of framing this question. First, people like to give. Being asked simply reduces the transaction costs, making it easier to realize the joy of giving. Second, in a more subtle analysis, people with big hearts must exert self-control on their giving. There are far too many good causes in the world than a single person could possibly give to, meaning lines must be drawn somewhere. Then the question becomes: Can people stick within these lines, even if they are directly asked to give? Or, will they find more giving too tempting? A clever self-control strategy for such a donor is simply to avoid being asked — if the charity will let them.

A recent field experiment explored these questions by using the familiar Salvation Army Red Kettle campaigns. The Salvation Army allowed Hanna Trachtman, Justin Rao, and me to place bell ringers experimentally at one of the two main entrances of a suburban grocery store, making them easy to avoid, or at both entrances, making avoidance difficult. The bell ringers were either silent as people passed (although the ringing bells clearly signaled their receptivity to a gift), or simply said to those who passed by, "Please give today."[11] When the bell ringers were silent, and only one door covered, we found no effect on traffic in and out of the store. When the bell ringers asked shoppers to please give today, however, traffic through the *other* door rose by 30 percent. When both doors were covered, the verbal ask nearly doubled giving. This means that those avoiding the bell ringers were not avoiding saying no, but rather were avoiding saying yes and giving. This is an important distinction. It suggests that the fundraisers in this case were causing people to give by making a social interaction with them difficult to avoid.

Another way to see the givers' dilemma is that they face contradictory desires: a temptation to say yes to a fundraiser, and a personal preference to avoid actual giving. This opens a new strategy for fundraisers to exploit: Ask people to decide now to give later. If maintaining social image is more tempting than saving money, even a very short delay in paying for the gift could have significant effects.

Marta Serra-Garcia and I explored this question in a lab experiment.[12] We found that asking people now to commit to make a donation within one week resulted in a 50 percent increase in donations over asking for a gift today. This provides support for time-inconsistent preferences as described above. With a series of follow-up experiments, we learned more about the tension underlying individual behavior, focusing on the internal struggle between appearing generous to others and watching one's own budget. This finding raises deep and interesting questions about the welfare consequences of fundraising and more generally of a shift away from government, and toward private charities, as a means of solving social problems.

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[1] *J. Andreoni, D. Aydin, B. Barton, D. Bernheim, and J. Naecker, "When Fair Isn't Fair: Understanding Choice Reversals Involving Social Preferences,"* NBER Working Paper No. 25257, November 2018, *and forthcoming in the* Journal of Political Economy, *shows that non-consequentialism in social preferences is essential.*
Return to Text

[2] *J. Andreoni, "Impure Altruism and Donations to Public Goods: A Theory of Warm-Glow Giving,"* The Economic Journal, *100(401), 1990, pp. 464–77. The term "warm-glow" is slightly pejorative. The intent is to remind readers that, although the reduced form may help answer many questions, there is still much to learn by unlocking the ways warm-glow comes about. See also J. Andreoni, "Giving with Impure Altruism: Applications to Charity and Ricardian Equivalence,"* Journal of Political Economy, *97(6), 1989, pp. 1447–58. On social-image in unselfish behavior, see J. Andreoni and B.D. Bernheim, "Social Image and the 50–50 Norm: A Theoretical and Experimental Analysis of Audience Effects,"* Econometrica *77(5), 2009, pp.1607–36.*
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[3] *A. Payne, "Does the Government Crowd Out Private Donations? New Evidence From a Sample of Non-Profit Firms,"* Journal of Public Economics, *69(3), 1998, pp. 323–45.*
Return to Text

[4] *This conclusion can also be reached by invoking the non-distribution constraint imposed on non-profits: Charity managers are accepting as part of their compensation the personal satisfaction of doing good works, not simply engaging in onerous fundraising. Another way to motivate fundraising is to assume that charities vary qualitatively — two disaster relief organizations can be imperfect substitutes if one provides mostly food aid while the other specializes in medical aid. Suppose donors differ by how much they favor food over medical aid. If both charities approach a donor, the donor will give to the charity that represents her preferences best. If only one charity calls to ask for a donation, then the donor will give, but will give less the further the charity is from the donor's ideal quality. Thus, charities setting fundraising expenditures face both extensive and intensive motivations for seeking donations. This model is developed in J. Andreoni and A. Payne, "Do Government Grants to Private Charities Crowd Out Giving or Fund-raising?"* American Economic Review, *93(3), 2003, pp. 792–812.*
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[5] *This result is due to J. Andreoni, "Toward a Theory of Charitable Fund-raising,"* Journal of Political Economy, *106(6), 1998, pp. 1186–213. The theory was tested and confirmed in a field experiment by J. List and D. Lucking-Reiley, "The Effects of Seed Money and Refunds on Charitable Giving: Experimental Evidence from a University Capital Campaign,"* Journal of Political Economy, *110(1), 2002, pp. 215–33.*
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[6] *J. Andreoni, "Leadership Giving in Charitable Fund-Raising,"* Journal of Public Economic Theory, *8(1), 2006, pp. 1–22. For a related model, see L. Vesterlund, "The Informational Value of Sequential Fundraising,"* Journal of Public Economics, *87(3-4), 2003, pp. 627–57, and tests of these ideas by A. Bracha, M. Menietti, and L. Vesterlund, "Seeds to Succeed: Sequential Giving to Public Projects,"* Journal of Public Economics, *95(5-6), 2011, pp. 416–27.*
Return to Text

[7] *Ibid, J. Andreoni and A. Payne,* American Economic Review, *2003.*
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[8] *J. Andreoni and A. Payne, "Is Crowding Out Due Entirely to Fundraising? Evidence From a Panel of Charities,"* NBER Working Paper No. 16372, September 2010, *and* Journal of Public Economics, *95(5–6), 2011, pp. 334–43.*
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[9] *J. Andreoni and A. Payne, "Crowding-Out Charitable Contributions in Canada: New Knowledge From the North,"* NBER Working Paper No. 17635, December 2011.
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[10] *J. Andreoni, A. Payne, and S. Smith, "Do Grants to Charities Crowd Out Other Income? Evidence from the UK,"* NBER Working Paper No. 18998, April 2013, *and* Journal of Public Economics, *114, 2014, pp. 75–86.*
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[11] *J. Andreoni, J. Rao, and H. Trachtman, "Avoiding the Ask: A Field Experiment on Altruism, Empathy, and Charitable Giving,"* NBER Working Paper No. 17648, December 2011, *and* Journal of Political Economy *125(3), 2017, pp. 625–53.*
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[12] *J. Andreoni and M. Serra-Garcia, "Time-Inconsistent Charitable Giving,"* NBER Working Paper No. 22824, November 2016.
Return to Text

Annual Report of Awards to NBER Affiliates

Katherine Baicker was elected to the American Academy of Arts and Sciences.

Lucian Bebchuk received the 2018 IRRC Institute Award for work in corporate governance for his research with Scott Hirst on "Index Funds and the Future of Corporate Governance: Theory, Evidence, and Policy."

Roland J. Benabou was elected as a corresponding member of the Académie des Sciences Morales et Politiques, one of the five national academies that collectively constitute the Institut de France.

Eli Berman was selected as president of the Economics of National Security Association.

Howard Bodenhorn was awarded the Jonathan Hughes Prize for Excellence in Teaching Economic History by the Economic History Association.

John Y. Campbell received an honorary degree from the BI Norwegian Business School.

David Deming was awarded the David N. Kershaw Prize, which honors persons under the age of 40 who have made distinguished contributions to the field of public policy.

Amy Finkelstein was awarded a MacArthur Fellowship, which is awarded to extraordinarily talented and creative individuals, and was elected to the National Academy of Sciences.

Price V. Fishback served as president of the Economic History Association.

Gita Gopinath was elected a fellow of both the American Academy of Arts and Sciences and the Econometric Society, and was appointed economic counsellor and director of the Research Department of the International Monetary Fund.

Benjamin Handel received the American Risk and Insurance Association Early Career Scholarly Achievement Award, shared the ASHEcon Medal for Top Health Economist Under 40 with Jonathan Kolstad, and was awarded the National Institute for Health Care Management Foundation's Research Award for his paper "What Does a Deductible Do?" with Zarek Brot-Goldberg, Amitabh Chandra, and Jonathan Kolstad.

David Hirshleifer served as president elect of the American Finance Association and was elected a fellow of the Finance Theory Group.

Seema Jayachandran was awarded the 2018 Sustainability Science Award of the Ecological Society of America for her paper "Cash for Carbon" with Joost de Laat, Eric Lambin, Charlotte Stanton, Robin Audy, and Nancy Thomas.

Supreet Kaur received a Sloan Research Fellowship and a National Science Foundation CAREER award.

Mervyn King was awarded the Paul Volcker Lifetime Achievement Award by the National Association for Business Economics.

Morris M. Kleiner received a Lifetime Achievement Award from the Labor and Employment Relations Association.

Jin-Tan Liu was awarded a National Chair Professorship by the Taiwan Ministry of Education.

Matteo Maggiori received the AQR Insight Award for his paper "International Currencies and Capital Allocation" with Brent Neiman and Jesse Schreger, and an Excellence Award in Global Economic Affairs from the Kiel Institute for the World Economy.

Thomas McGuire received the Victor P. Fuchs Award for Lifetime Contributions to the Field of Health Economics from the American Society of Health Economics.

Benjamin Moll received the Germán Bernácer Prize for best European economist under 40 working in macroeconomics and finance. He also received the Economics in Central Banking Award for his paper with Greg Kaplan and Gianluca Violante on "Monetary Policy According to HANK."

Ariel Pakes was elected to the National Academy of Sciences, and shared the BBVA Frontiers Knowledge Award in Economics, Finance and Management with Timothy Bresnahan and Robert Porter.

Lubos Pastor received a Woodrow Wilson Award from the Slovak Embassy to the United States for contributions to Slovakia-U.S. relations, and won the QMA Award for Best Paper on Investment Management from the Western Finance Association for "Fund Tradeoffs" with Robert Stambaugh and Lucian Taylor.

Parag Pathak received the John Bates Clark Medal from the American Economic Association, honoring the American economist under the age of 40 judged to have made the most significant contribution to economic thought and knowledge.

Stephen Redding was awarded the Econometric Society's Frisch Medal for the best empirical paper published in Econometrica in the last five years for "The Economics of Density: Evidence from the Berlin Wall" with Gabriel Ahlfeldt, Daniel Sturm and Nikolaus Wolf.

Carmen Reinhart was awarded the King Juan Carlos Prize in Economics, which recognizes influential Spanish or Latin American economists; the Bernhard Harms Prize from the Kiel

Institute for the World Economy, for distinguished contributions in international economics; and the Adam Smith Award from the National Association for Business Economics.

Hugh Rockoff became president-elect of the Economic History Association.

Dani Rodrik was elected a fellow of the American Association for the Advancement of Science and received the John von Neumann Award from the Rajk László College for Advanced Studies in Budapest.

Christina Romer received the 2018 Robert A. Muh Alumni Award in the Humanities, Arts, and Social Sciences from MIT.

Paul Romer and **William Nordhaus** shared the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel.

Nancy L. Rose was elected to the American Academy of Arts and Sciences and named a distinguished fellow of the Industrial Organization Society.

Joshua L. Rosenbloom was elected a fellow of the Cliometric Society.

Maya Rossin-Slater received a National Science Foundation CAREER award.

Raffaella Sadun received the HBR McKinsey Award for the best paper published in the *Harvard Business Review* for "Why Do We Undervalue Competent Management?" with Nicholas Bloom and John Van Reenen.

Joseph Shapiro was named a Sloan Research Fellow by the Alfred P. Sloan Foundation.

Richard Sutch received the Social Science History Association Founder's Prize for the best article published in Social Science History, "The One Percent across Two Centuries: A Replication of Thomas Piketty's Data on the Concentration of Wealth in the United States."

Robert Shiller won the Global Economy Prize from the Kiel Institute for World Economy.

Esteban Rossi-Hansberg won the Robert E. Lucas, Jr. Prize for the most interesting paper in the last two years in the Journal of Political Economy for his paper on "The Geography of Development" with Klaus Desmet and Dávid Krisztián Nagy.

Frank Schorfheide was elected a fellow of the Econometric Society.

G. William Schwert was named a fellow of the American Finance Association.

Conferences

Economics of Infrastructure

An NBER conference on the Economics of Infrastructure took place March 1 in Cambridge. Research Associates Edward L. Glaeser of Harvard University and James M. Poterba of MIT organized the meeting, which was sponsored by the Smith Richardson Foundation. These researchers' papers were presented and discussed:

- **Abhishek Nagaraj**, University of California, Berkeley, "The Private Impact of Public Information: Landsat Satellite Maps and Gold Exploration"

* **Shoshana Vasserman** and **Valentin Bolotnyy**, Harvard University, "Scaling Auctions as Insurance: A Case Study in Infrastructure Procurement"

- **Christoph Boehm**, University of Texas at Austin, "Government Consumption and Investment: Does the Composition of Purchases Affect the Multiplier?"

- **Pablo Fajgelbaum**, University of California, Los Angeles and NBER, and **Stephen J. Redding**, Princeton University and NBER, "Trade, Structural Transformation, and Development: Evidence from Argentina 1869–1914"

- **Daniel Leff Yaffe**, University of California, San Diego, "The Interstate Multiplier"

- **Aleksandar Andonov**, University of Amsterdam; **Roman Kräussl**, University of Luxembourg; and **Joshua Rauh**, Stanford University and NBER, "The Subsidy to Infrastructure as an Asset Class" (NBER Working Paper No. 25045)

- **Christopher Severen**, Federal Reserve Bank of Philadelphia, "Commuting, Labor, and Housing Market Effects of Mass Transportation: Welfare and Identification"

- **Nicolas Campos**, **Eduardo Engel**, and **Ronald Fischer**, Universidad de Chile, and **Alexander Galetovic**, Stanford University, "Renegotiations and Corruption: The Odebrecht Case"

Summaries of these papers are at www.nber.org/conferences/2019/EIs19/summary.html

Transforming Rural Africa

An NBER conference on Transforming Rural Africa took place February 28–March 1 in Cambridge. Christopher B. Barrett of Cornell University, Abebe Shimeles and Hanan Morsy, both of the African Development Bank, and Research Associates Michael Carter of the University of California, Davis, Tavneet Suri of MIT, and Christopher R. Udry of Northwestern University, organized the meeting, which was sponsored by the African Development Bank. These researchers' papers were presented and discussed:

- **Fo Kodjo Dzinyefa Aflagah**, International Food Policy Research Institute; **Tanguy Bernard**, International Food Policy Research Institute and Bordeaux IV; and **Angelino Viceisza**, Spelman College, "Cheap Talk and Coordination in the Lab and in the Field: Collective Commercialization in Senegal"

- **Kibrom A. Abay**, International Livestock Research Institute; **Leah Bevis**, Ohio State University; and **Christopher B. Barrett**, Cornell University, "Measurement Error Mechanisms Matter: Agricultural Intensification with Farmer Misperceptions and Misreporting"

- **Tilman Graff**, Busara Center for Behavioral Economics, "Spatial Inefficiencies in Africa's Trade Network"

- **Toyin Samuel Olowogbon** and **Raphael O. Babatunde**, University of Ilorin, Nigeria, and **Edward Asiedu**, University of Ghana/University of Passau, "How Can Inclusive Agricultural Health Policy Intervention Promote Shared Agricultural Productivity in Nigeria? Evidence from a Randomized Control Trial"

- **Denise Hörner** and **Meike Wollni**, University of Goettingen; **Adrien Bouguen**, University of California, Berkeley; and **Markus Frölich**, University of Mannheim, "The Effects of Decentralized and Video-based Extension on the Adoption of Integrated Soil Fertility Management — Experimental Evidence from Ethiopia"

- **Aminou Arouna**, AfricaRice; **Jeffrey D. Michler**, University of Arizona; and **Jourdain Lokossou**, International Crops Research Institute for the Semi-Arid Tropics, "Contract Farming and Rural Transformation: Evidence from a Field Experiment in Benin"

- **Ameet Morjaria** and **Richard Merton Peck**, Northwestern University, "Entry, Growth, and Exit: Theory and Evidence from Ethiopia's Cut-Flower Exporters"

- **Rute Martins Caeiro**, Nova School of Business and Economics, "From Learning to Doing: Diffusion of Agricultural Innovations in Guinea-Bissau"

- **Esther Delesalle**, Institute of Economic and Social Research, Université catholique de Louvain, "The Impact of the Universal Primary Education Program on Labor Market Outcomes: Evidence from Tanzania"

- **Michael Carter**, University of California, Davis and NBER; **Rachid Laajaj**, University of Los Andes; and **Dean Yang**, University of Michigan and NBER, "Temporary Subsidies and the Adoption of Green Revolution Technologies by Mozambican Farmers and Their Social Networks"

- **Shilpa Aggarwal**, Indian School of Business; **Brian J. Giera**, Amazon Research; **Dahyeon Jeong** and **Alan Spearot**, University of California, Santa Cruz; and **Jonathan Robinson**, University of California, Santa Cruz and NBER, "Market Access, Trade Costs, and Technology Adoption: Evidence from Northern Tanzania"

- **Joshua Deutschmann** and **Emilia Tjernström**, University of Wisconsin-Madison; **Maya Duru**, Abdul Latif Jameel Poverty Action Lab; and **Kim Siegal**, One Acre Fund, "Information, Credit, and Inputs: The Impacts and Mechanisms of a Program to Raise Smallholder Productivity"

Summaries of these papers are at www.nber.org/conferences/2019/TRAs19/summary.html

Big Data: Long-Term Implications for Financial Markets and Firms

An NBER conference on Big Data: Long-Term Implications for Financial Markets and Firms took place March 8 in Cambridge. Itay Goldstein of the University of Pennsylvania, Research Associate Chester S. Spatt of Carnegie Mellon University, and Faculty Research Fellow Mao Ye of the University of Illinois at Urbana-Champaign organized the meeting, which was supported by the National Science Foundation in conjunction with the *The Review of Financial Studies*. These researchers' papers were presented and discussed:

- **Zheng Tracy Ke**, Harvard University; **Bryan T. Kelly**, Yale University and NBER; and **Dacheng Xiu**, University of Chicago, "Predicting Returns with Text Data"
- **Amber Anand**, Syracuse University; **Mehrdad Samadi** and **Kumar Venkataraman**, Southern Methodist University; **Jonathan Sokobin**, Financial Industry Regulatory Authority, "Institutional Order Handling and Broker-Affiliated Trading Venues"
- **Michael Gofman**, University of Rochester; **Sajjad Jafri**, Queen's University; and **James T. Chapman**, Bank of Canada, "High-Frequency Analysis of Financial Stability"
- **David Easley**, Cornell University; **Marcos López de Prado**, AQR Capital Management; **Maureen O'Hara**, Cornell University; and **Zhibai Zhang**, NYU Tandon, "Microstructure in the Machine Age"
- **Jura Liaukonyte**, Cornell University, and **Alminas Zaldokas**, Hong Kong University of Science and Technology, "Background Noise? TV Advertising Affects Real Time Investor Behavior"
- **Hedi Benamar** and **Clara Vega**, Federal Reserve Board, and **Thierry Foucault**, HEC Paris School of Management, "Demand for Information, Uncertainty, and the Response of U.S. Treasury Securities to News"
- **Robert P. Bartlett III**, **Richard Stanton**, and **Nancy Wallace**, University of California, Berkeley, and **Adair Morse**, University of California, Berkeley and NBER, "Consumer-Lending Discrimination in the FinTech Era"
- **Isil Erel**, Ohio State University; **Léa H. Stern**, University of Washington; **Chenhao Tan**, University of Colorado Boulder; and **Michael S. Weisbach**, Ohio State University and NBER, "Selecting Directors Using Machine Learning" (NBER Working Paper No. 24435)
- **Bo Cowgill**, Columbia University, and **Eric Zitzewitz**, Dartmouth College and NBER, "Stock Compensation and Employee Attention"

Summaries of these papers are at www.nber.org/conferences/2019/BDFMs19/summary.html

Big Data for 21st Century Economic Statistics

An NBER conference on Big Data for 21st Century Economic Statistics met in Washington on March 15–16. Research Associates Katharine G. Abraham of the University of Maryland and Matthew D. Shapiro of the University of Michigan; Ron S. Jarmin of the U.S. Census Bureau; and Brian Moyer of the Bureau of Economic Analysis organized the meeting, which was sponsored by the Alfred P. Sloan Foundation. These researchers' papers were presented and discussed:

- **Carol Robbins**, National Science Foundation; **Jose Bayoan Santiago Calderon**, Claremont Graduate University; **Gizem Korkmaz**, **Daniel Chen**, **Sallie Keller**, **Aaron Schroeder**, and **Stephanie S. Shipp**, University of Virginia; **Claire Kelling**, Pennsylvania State University, "The Scope and Impact of Open Source Software as Intangible Capital: A Framework for Measurement with an Application Based on the Use of R and Python Packages"

- **Katharine G. Abraham**, University of Maryland and NBER; **Margaret Levenstein**, University of Michigan; and **Matthew D. Shapiro**, University of Michigan and NBER, "Securing Commercial Data for Economic Statistics"

- **W. Erwin Diewert**, University of British Columbia and NBER, and **Robert C. Feenstra**, University of California, Davis and NBER, "Estimating the Benefits of New Products"

- **David Copple**, **Bradley J. Speigner**, and **Arthur Turrell**, Bank of England, "Transforming Naturally Occurring Text Data into Economic Statistics: The Case of Online Job Vacancy Postings"

- **Edward L. Glaeser**, Harvard University and NBER, and **Hyunjin Kim** and **Michael Luca**, Harvard University, "Nowcasting the Local Economy: Using Yelp Data to Measure Economic Activity" (NBER Working Paper No. 24010)

- **Rishab Guha**, Harvard University, and **Serena Ng**, Columbia University and NBER, "A Machine-Learning Analysis of Seasonal and Cyclical Sales in Weekly Scanner Data"

- **Gabriel Ehrlich** and **David Johnson**, University of Michigan; **John C. Haltiwanger**, University of Maryland and NBER; **Ron S. Jarmin**, U.S. Census Bureau; and **Matthew D. Shapiro**, University of Michigan and NBER, "Re-Engineering Key National Economic Indicators"

- **Andrea Batch**, **Jeffrey C. Chen**, **Alexander Driessen**, **Abe Dunn**, and **Kyle K. Hood**, Bureau of Economic Analysis, "Off to the Races: A Comparison of Machine Learning and Alternative Data for Predicting Economic Indicators"

- **Tomaz Cajner**, **Leland D. Crane**, **Ryan Decker**, **Adrian Hamins-Puertolas**, and **Christopher Kurz**, Federal Reserve Board, "Improving the Accuracy of Economic Measurement with Multiple Data Sources: The Case of Payroll Employment Data"

- **J. Bradford Jensen**, Georgetown University and NBER; **Shawn D. Klimek**, **Andrew L. Baer**, and **Joseph Staudt**, U.S. Census Bureau; and **Lisa Singh** and **Yifang Wei**, Georgetown University, "Automating Response Evaluation for Franchising Questions on the 2017 Economic Census"

- **Sudip Bhattacharjee** and **Ugochukwu Etudo**, University of Connecticut, and **John Cuffe**, **Justin Smith**, and **Nevada Basdeo**, U.S. Census Bureau, "Using Public Data to Generate Industrial Classification Codes"

- **Jeremy Moulton**, University of North Carolina, Chapel Hill, and **Marina Gindelsky** and **Scott A. Wentland**, Bureau of Economic Analysis, "Valuing Housing Services in the Era of Big Data: A User Cost Approach Leveraging Zillow Microdata"

- **Shifrah Aron-Dine**, Stanford University, and **Aditya Aladangady**, **Wendy Dunn**, **Laura Feiveson**, **Paul Lengermann**, and **Claudia R. Sahm**, Federal Reserve Board, "From Transactions Data to Economic Statistics: Constructing Real-Time, High-Frequency, Geographic Measures of Consumer Spending"

- **David Friedman**, **Crystal G. Konny**, and **Brendan K. Williams**, Bureau of Labor Statistics, "Big Data in the U.S. Consumer Price Index: Experiences & Plans"

- **Don Fast** and **Susan Fleck**, Bureau of Labor Statistics, "Measuring Export Price Movements with Administrative Trade Data"

- **Rebecca J. Hutchinson**, U.S. Census Bureau, "Investigating Alternative Data Sources to Reduce Respondent Burden in United States Census Bureau Retail Economic Data Products"

- **Abe Dunn**, Bureau of Economic Analysis; **Dana Goldman** and **Neeraj Sood**, University of Southern California and NBER; and **John Romley**, University of Southern California, "Quantifying Productivity Growth in Health Care Using Insurance Claims and Administrative Data"

Summaries of these papers are at www.nber.org/conferences/2019/CRIWs19/summary.html

Economics of Digitization

An NBER conference on the Economics of Digitization met at Stanford on March 22. Research Associate Shane Greenstein of Harvard University, Program Director Josh Lerner of Harvard Business School, and Research Associate Scott Stern of MIT organized the meeting, which was sponsored by the Alfred P. Sloan Foundation, Amazon, and The Tides Foundation. These researchers' papers were presented and discussed:

- **Alberto Cavallo**, Harvard University and NBER, "More Amazon Effects: Online Competition and Pricing Behaviors" (NBER Working Paper No. 25138)

- **Charles I. Jones** and **Christopher Tonetti**, Stanford University and NBER, "Nonrivalry and the Economics of Data"

- **John M. Barrios**, University of Chicago; **Yael Hochberg**, Rice University and NBER; and **Livia Hanyi Yi**, Rice University, "The Cost of Convenience: Ridesharing and Traffic Fatalities"

- **Abhishek Nagaraj**, University of California, Berkeley, and **Imke C. Reimers**, Northeastern University, "Digitization and the Demand for Physical Works: Evidence from the Google Books Project"

- **Timothy J. DeStefano**, Organisation for Economic Co-operation and Development, and **Richard Kneller** and **Jonathan D. Timmis**, University of Nottingham, "Cloud Computing and Firm Growth"

- **Shuang Wang**, Boston University; **Jacob LaRiviere**, Microsoft; and **Aadharsh Kannan**, Amazon, "Spatial Competition and Missing Data: An Application to Cloud Computing"

- **Ben T. Leyden**, Cornell University, "There's an App (Update) for That: Understanding Product Updating under Digitization"

- **Hunt Allcott**, New York University and NBER; **Luca Braghieri** and **Sarah Eichmeyer**, Stanford University; and **Matthew Gentzkow**, Stanford University and NBER, "The Welfare Effects of Social Media" (NBER Working Paper No. 25514)

Summaries of these papers are at www.nber.org/conferences/2019/EoDs19/summary.htm

Program and Working Group Meetings

Industrial Organization

Members of the NBER's Industrial Organization Program met February 8–9 at Stanford. Research Associates Eric Budish of the University of Chicago and Jean-François Houde of the University of Wisconsin-Madison organized the meeting. These researchers' papers were presented and discussed:

- **Thomas G. Wollmann**, University of Chicago and NBER, "How to Get Away with Merger: Stealth Consolidation and Its Effects on U.S. Healthcare"
- **Sumit Agarwal**, Georgetown University; **John Grigsby**, University of Chicago; **Ali Hortaçsu**, University of Chicago and NBER; **Gregor Matvos**, University of Texas at Austin and NBER; **Amit Seru**, Stanford University and NBER; and **Vincent Yao**, Georgia State University, "Searching for Approval"
- **Panle Jia Barwick**, Cornell University and NBER; **Myrto Kalouptsidi**, Harvard University and NBER; and **Nahim B. Zahur**, Cornell University, "China's Industrial Policy: An Empirical Evaluation"
- **Daniel Bjorkegren**, Brown University, "Competition in Network Industries: Evidence from Mobile Telecommunications in Rwanda"
- **Michael Ostrovsky**, Stanford University and NBER, and **Michael Schwarz**, Microsoft, "Carpooling and the Economics of Self-Driving Cars" (NBER Working Paper No. 24349)
- **Pietro Tebaldi** and **Alexander Torgovitsky**, University of Chicago, and **Hanbin V. Yang**, Harvard University, "Nonparametric Estimates of Demand in the California Health Insurance Exchange"
- **Gaston Illanes**, Northwestern University, and **Manisha Padi**, University of Chicago, "Competition, Asymmetric Information, and the Annuity Puzzle: Evidence from a Government-run Exchange in Chile"
- **Yuyu Chen**, Peking University; **Mitsuru Igami** and **Masayuki Sawada**, Yale University; and **Mo Xiao**, University of Arizona, "Privatization and Productivity in China"
- **Guangyu Cao**, Peking University and Guanghua-ofo Center for Sharing Economy Research; **Ginger Zhe Jin**, University of Maryland and NBER; and **Xi Weng** and **Li-An Zhou**, Peking University, "Market Expanding or Market Stealing? Competition with Network Effects in Bike-Sharing" (NBER Working Paper No. 24938)
- **Keaton S. Miller**, University of Oregon; **Amil Petrin**, University of Minnesota and NBER; **Robert Town**, University of Texas at Austin and NBER; and **Michael Chernew**, Harvard University and NBER, "Optimal Managed Competition Subsidies"
- **Rebecca Diamond** and **Petra Persson**, Stanford University and NBER; **Michael J. Dickstein**, New York University and NBER; and **Timothy McQuade**, Stanford University, "Take-Up, Drop-Out, and Spending in ACA Marketplaces" (NBER Working Paper No. 24668)
- **Mark L. Egan**, Harvard University; **Gregor Matvos**, University of Texas at Austin and NBER; and **Amit Seru**, Stanford University and NBER, "Arbitration with Uninformed Consumers" (NBER Working Paper No. 25150)

Summaries of these papers are at www.nber.org/conferences/2019/IOs19/summary.html

Insurance

Members of the NBER's Insurance Working Group met February 8–9 at Stanford. Research Associates Benjamin R. Handel of the University of California, Berkeley and Motohiro Yogo of Princeton University organized the meeting. These researchers' papers were presented and discussed:

- **Gaston Illanes**, Northwestern University, and **Manisha Padi**, University of Chicago, "Competition, Asymmetric Information, and the Annuity Puzzle: Evidence from a Government-run Exchange in Chile"
- **Radek Paluszynski**, University of Houston, and **Pei Cheng Yu**, University of New South Wales, "Pay What Your Dad Paid: Commitment and Price Rigidity in the Market for Life Insurance"
- **Robin Greenwood**, Harvard University and NBER, and **Annette Vissing-Jorgensen**, University of California, Berkeley and NBER, "The Impact of Pensions and Insurance on Global Yield Curves"
- **Andrew Ellul**, Indiana University; **Anastasia Kartasheva**, Bank for International Settlements; **Chotibhak Jotikasthira**, Southern Methodist University; **Christian Lundblad**, University of North Carolina at Chapel Hill; and **Wolf Wagner**, Erasmus University, "Insurers as Asset Managers and Systemic Risk"
- **Juan Pablo Atal**, University of Pennsylvania; **Hanming Fang**, University of Pennsylvania and NBER; **Martin Karlsson**, University of Duisburg-Essen; and **Nicolas R. Ziebarth**, Cornell University and NBER, "Long-Term Health Insurance: Theory Meets Evidence"
- **David Schoenherr**, Princeton University; **Janis Skrastins**, Washington University in St. Louis; and **Bernadus Doornik**, Banco Central do Brasil, "Unemployment Insurance, Strategic Unemployment, and Firm-Worker Collusion"
- **Michael Geruso**, University of Texas at Austin and NBER; **Timothy Layton** and **Mark Shepard**, Harvard University and NBER, and **Grace McCormack**, Harvard University, "The Two Margin Problem in Insurance Markets"
- **Keaton S. Miller**, University of Oregon; **Amil Petrin**, University of Minnesota and NBER; **Robert Town**, University of Texas at Austin and NBER; and **Michael Chernew**, Harvard University and NBER, "Optimal Managed Competition Subsidies"
- **Rebecca Diamond** and **Petra Persson**, Stanford University and NBER; **Michael J. Dickstein,** New York University and NBER; and **Timothy McQuade,** Stanford University, "Take-Up, Drop-Out, and Spending in ACA Marketplaces" (NBER Working Paper No. 24668)

Summaries of these papers are at www.nber.org/conferences/2019/INSs19/summary.html

Law and Economics

Members of the NBER's Law and Economics Program met February 15 in Cambridge. Program Director Christine Jolls of Yale University organized the meeting. These researchers' papers were presented and discussed:

- **Andrew Daughety** and **Jennifer Reinganum**, Vanderbilt University, "Reducing Unjust Convictions: Plea Bargaining, Trial, and Evidence Suppression/Disclosure"
- **Albert Choi**, University of Virginia, and **Kathryn E. Spier**, Harvard University and NBER, "Class Actions and Private Antitrust Litigation"
- **Martijn Cremers**, University of Notre Dame; **Scott Guernsey**, University of Cambridge; and **Simone M. Sepe**, University of Arizona, "Directors' Duties Laws and Long-Term Firm Value"
- **Huseyin Gulen**, Purdue University, and **Brett W. Myers**, Texas Tech University, "The Selective Enforcement of Government Regulation: Battleground States and the EPA"
- **Alexander Dyck**, University of Toronto; **Adair Morse**, University of California, Berkeley and NBER; and **Paulo Martins Manoel**, University of California, Berkeley, "Outraged by Compensation: Implications for Public Pension Performance"
- **Lucian A. Bebchuk**, Harvard University and NBER, and **Doron Y. Levit**, University of Pennsylvania, "Myopic Shareholders"
- **Marcella Alsan**, Stanford University and NBER, and **Crystal Yang**, Harvard University and NBER, "Fear and the Safety Net: Evidence from Secure Communities" (NBER Working Paper No. 24731)

Summaries of these papers are at www.nber.org/conferences/2019/LEs19/summary.html

Labor Studies

Members of the NBER's Labor Studies Program met February 22 in San Francisco. Program Directors David Autor of MIT and Alexandre Mas of Princeton University organized the meeting. These researchers' papers were presented and discussed:

- **Conrad Miller**, University of California, Berkeley and NBER; **Jennifer Peck**, Swarthmore College; and **Mehmet Seflek**, University of California, Berkeley, "Big Push Policies and Firm-Level Barriers to Employing Women: Evidence from Saudi Arabia"
- **Randall Akee**, University of California, Los Angeles and NBER, and **Maggie R. Jones**, U.S. Census Bureau, "Immigrants' Earnings Growth and Return Migration from the U.S.: Examining Their Determinants Using Linked Survey and Administrative Data"
- **François Gerard**, Columbia University and NBER; **Lorenzo Lagos**, Columbia University; **Edson R. Severnini**, Carnegie Mellon University; and **David Card**, University of California, Berkeley and NBER, "Assortative Matching

or Exclusionary Hiring? The Impact of Firm Policies on Racial Wage Differences in Brazil"

- **Shai Bernstein** and **Rebecca Diamond**, Stanford University and NBER, and **Timothy McQuade** and **Beatriz Pousada**, Stanford University, "The Contribution of High-Skilled Immigrants to Innovation in the United States"
- **David J. Deming**, Harvard University and NBER, and **Kadeem L. Noray**, Harvard University, "STEM Careers and Technological Change" (NBER Working Paper No. 25065)
- **Luigi Pistaferri**, Stanford University and NBER, and **Hamish Low**, University of Cambridge, "Disability Insurance and Gender Differences: Evidence from Merged Survey-Administrative Data"
- **Alisa Tazhitdinova**, University of California, Santa Barbara, "Increasing Hours Worked: Moonlighting Responses to a Large Tax Reform"
- **Brigham Frandsen** and **Emily C. Leslie**, Brigham Young University, and **Lars Lefgren**, Brigham Young University and NBER, "Judging Judge Fixed Effects"

Summaries of these papers are at www.nber.org/conferences/2019/LSs19/summary.html

Economic Fluctuations and Growth subgroup

Members of the NBER's Economic Fluctuations and Growth program's subgroup on growth met February 28 in San Francisco. Martí Mestieri of Northwestern University and Faculty Research Fellow Christopher Tonetti of Stanford University organized the meeting. These researchers' papers were presented and discussed:

- **Matthew J. Delventhal**, Claremont McKenna College; **Jesús Fernández-Villaverde**, University of Pennsylvania and NBER; and **Nezih Guner**, Center for Monetary and Financial Studies, "Demographic Transitions across Time and Space"
- **Sebastian Heise**, Federal Reserve Bank of New York, and **Tommaso Porzio**, University of California, San Diego, "Workers' Home Bias and Spatial Wage Gaps: Lessons from the Enduring Divide between East and West Germany"
- **Wyatt Brooks** and **Terence R. Johnson**, University of Notre Dame, and **Kevin Donovan**, Yale University, "Bringing Data to the Model: Quantitative Implications of an Equilibrium Diffusion Model"
- **Victor Couture**, University of California, Berkeley; **Cecile Gaubert**, University of California, Berkeley and NBER; **Jessie Handbury**, University of Pennsylvania and NBER; and **Erik Hurst**, University of Chicago and NBER, "Income Growth and the Distributional Effects of Urban Spatial Sorting"
- **Hugo Hopenhayn**, University of California, Los Angeles and NBER, and **Julian Neira** and **Rish Singhania**, University of Exeter, "From Population Growth to Firm Demographics: Implications for Concentration, Entrepreneurship, and the Labor Share" (NBER Working Paper No. 25382)
- **Jie Cai**, Shanghai University of Finance and Economics; **Nan Li**, International Monetary Fund; and **Ana Maria Santacreu**, Federal Reserve Bank of St. Louis, "Knowledge Diffusion, Trade and Innovation across Countries and Sectors"

Summaries of these papers are at www.nber.org/conferences/2019/EGCw19/summary.html

Economic Fluctuations and Growth

Members of the NBER's Economic Fluctuations and Growth Program met March 1 in San Francisco. Research Associates David Lagakos of the University of California, San Diego and Martin Schneider of Stanford University organized the meeting. These researchers' papers were presented and discussed:

- **Paolo Martellini**, University of Pennsylvania, and **Guido Menzio**, New York University and NBER, "Declining Search Frictions, Unemployment and Growth" (NBER Working Paper No. 24518)
- **Tarek Alexander Hassan**, Boston University and NBER; **Stephan Hollander**, Tilburg University; **Laurence van Lent**, Frankfurt School of Finance and Management; and **Ahmed Tahoun**, London Business School, "Firm-Level Political Risk: Measurement and Effects" (NBER Working Paper No. 24029)
- **Fernando E. Alvarez**, University of Chicago and NBER, and **Francesco Lippi**, LUISS Guido Carli University and Einaudi Institute for Economics and Finance, "The Analytic Theory of a Monetary Shock"
- **Pedro Bordalo**, University of Oxford; **Nicola Gennaioli**, Bocconi University; **Yueran Ma**, University of Chicago; and **Andrei Shleifer**, Harvard University and NBER, "Over-Reaction in Macroeconomic Expectations" (NBER Working Paper No. 24932)
- **Joel David**, University of Southern California, and **Venky Venkateswaran**, New York University and NBER, "The Sources of Capital Misallocation" (NBER Working Paper No. 23129)
- **Juan Morelli** and **Diego Perez**, New York University, and **Pablo Ottonello**, University of Michigan, "Global Banks and Systemic Debt Crises"

Summaries of these papers are at www.nber.org/conferences/2019/EFGw19/summary.html

International Finance and Macroeconomics

Members of the NBER's International Finance and Macroeconomics Program met March 8 in Cambridge. Faculty Research Fellow Cristina Arellano of the Federal Reserve Bank of Minneapolis, Research Associate Brent Neiman of the University of Chicago, and Program Director Pierre-Olivier Gourinchas of the University of California, Berkeley organized the meeting. These researchers' papers were presented and discussed:

- **Egemen Eren**, Bank for International Settlements, and **Semyon Malamud**, Swiss Finance Institute, "Dominant Currency Debt"
- **Javier Bianchi**, Federal Reserve Bank of Minneapolis and NBER, and **Jorge Mondragon**, "Monetary Independence and Rollover Crises" (NBER Working Paper No. 25340)
- **Kalina Manova**, University College London; **Antoine Berthou**, Banque de France; **Jong Hyun Chung**, Stanford University; and **Charlotte Sandoz**, International Monetary Fund, "Productivity, (Mis)allocation, and Trade"
- **Illenin Kondo**, University of Notre Dame; **Fabrizio Perri**, Federal Reserve Bank of Minneapolis; and **Sewon Hur**, Federal Reserve Bank of Cleveland, "Real Interest Rates, Inflation, and Default"

- **Juan Morelli** and **Diego Perez**, New York University, and **Pablo Ottonello**, University of Michigan, "Global Banks and Systemic Debt Crises"
- **Mishita Mehra**, Grinnell College, "Skilled Immigration, Firms, and Policy"
- **Rodrigo Barbone Gonzalez**, Central Bank of Brazil, and **Dmitry Khametshin**, **José-Luis Peydró**, and **Andrea Polo**, Pompeu Fabra University, "Hedger of Last Resort: Evidence from Brazilian FX Interventions, Local Credit, and Global Financial Cycles"

Summaries of these papers are at www.nber.org/conferences/2019/IFMs19/summary.html

Monetary Economics

Members of the NBER's Monetary Economics Program met March 8 at the Federal Reserve Bank of Chicago. Faculty Research Fellow David W. Berger of Northwestern University, Research Associate Giorgio Primiceri of Northwestern University, and Program Directors Emi Nakamura and Jón Steinsson, both of the University of California, Berkeley organized the meeting. These researchers' papers were presented and discussed:

- **Jasmine Xiao**, University of Notre Dame, "Borrowing to Save and Investment Dynamics"
- **Gauti B. Eggertsson**, Brown University and NBER; **Ella Wold**, Brown University; **Ragnar Juelsrud**, BI Norwegian Business School; and **Lawrence H. Summers**, Harvard University and NBER, "Negative Nominal Interest Rates and the Bank Lending Channel"
- **Pierpaolo Benigno**, LUISS Guido Carli University, "Monetary Policy in a World of Cryptocurrencies"
- **Gabriel Chodorow-Reich** and **Gita Gopinath**, Harvard University and NBER (on leave); **Prachi Mishra**, Goldman Sachs; and **Abhinav Narayanan**, Reserve Bank of India, "Cash and the Economy: Evidence from India's Demonetization" (NBER Working Paper No. 25370)
- **Stefano Giglio**, Yale University and NBER; **Matteo Maggiori**, Harvard University and NBER; **Johannes Stroebel**, New York University and NBER; and **Stephen Utkus**, Vanguard, "Five Facts about Beliefs and Portfolios"
- **Carlo Altavilla**, **Frank Smets,** and **Miguel Boucinha**, European Central Bank; and **José-Luis Peydró**, Pompeu Fabra University, "Banking Supervision, Monetary Policy and Risk-Taking: Big Data Evidence from 15 Credit Registers"

Summaries of these papers are at www.nber.org/conferences/2019/MEs19/summary.html

Productivity, Innovation, and Entrepreneurship

Members of the NBER's Productivity, Innovation, and Entrepreneurship Program met March 15 in Cambridge. Program Directors Nicholas Bloom of Stanford University and Josh Lerner of Harvard Business School, Research Associate Serguey Braguinsky of the University of Maryland, and Faculty Research Fellow Sabrina T. Howell of New York University organized the meeting. These researchers' papers were presented and discussed:

- **Shai Bernstein** and **Rebecca Diamond**, Stanford University and NBER, and **Timothy McQuade** and **Beatriz Pousada**, Stanford University, "The Contribution of High-Skilled Immigrants to Innovation in the United States"
- **Greer K. Gosnell**, London School of Economics; **John A. List**, University of Chicago and NBER; and **Robert Metcalfe**, Boston University, "The Impact of Management Practices on Employee Productivity: A Field Experiment with Airline Captains" (NBER Working Paper No. 25620)
- **Laurent Fresard**, University of Lugano and Sustainable Forestry Initiative, and **Gerard Hoberg** and **Donald E. Bowen III**, University of Maryland, "Technological Disruptiveness and the Evolution of IPOs and Sell-Outs"
- **Timothy J. DeStefano**, Organisation for Economic Co-operation and Development, and **Richard Kneller** and **Jonathan D. Timmis**, University of Nottingham, "Cloud Computing and Firm Growth"
- **Nicolas Crouzet**, **Apoorv Gupta**, and **Filippo Mezzanotti**, Northwestern University, "Shocks and Technology Adoption: Evidence from Electronic Payment Systems"
- **Achyuta Adhvaryu**, University of Michigan and NBER; **Anant Nyshadham**, Boston College and NBER; and **Jorge A. Tamayo**, Harvard University, "Managerial Quality and Productivity Dynamics"
- **George P. Ball**, Indiana University; **Jeffrey Macher**, Georgetown University; and **Ariel Dora Stern**, Harvard University, "Recalls, Innovation, and Competitor Response: Evidence from Medical Device Firms"

Summaries of these papers are at www.nber.org/conferences/2019/PRs19/summary.html

Environment and Energy Economics

Members of the NBER's Environment and Energy Economics Program met March 14–15 at Stanford. Research Associates Kelsey Jack of the University of California, Santa Barbara and Ryan Kellogg of the University of Chicago organized the meeting. These researchers' papers were presented and discussed:

- **Fiona Burlig** and **Louis Preonas**, University of Chicago, and **Akshaya Jha**, Carnegie Mellon University, "Out-of-Merit Costs and Blackouts: Evidence from the Indian Electricity Market"
- **Peter Christensen** and **Ignacio Sarmiento**, University of Illinois, and **Christopher Timmins**, Duke University and NBER, "Housing Discrimination and the Pollution Exposure Gap in the United States"
- **Koichiro Ito**, University of Chicago and NBER, and **Shuang Zhang**, University of Colorado Boulder, "Setting the Price Right: Evidence from Heating Price Reform in China"
- **Derek Lemoine**, University of Arizona and NBER, "Estimating the Consequences of Climate Change from Variation in Weather" (NBER Working Paper No. 25008)

- **David Keiser**, Iowa State University, and **Joseph S. Shapiro**, University of California, Berkeley and NBER, "Burning Waters to Crystal Springs? U.S. Water Pollution Regulation over the Last Half-Century"

- **Cloe Garnache**, University of Oslo, and **Todd Guilfoos**, University of Rhode Island, "The Effect of Salience on Risk Perceptions and Asset Prices"

- **Jonathan I. Dingel**, University of Chicago and NBER; **Kyle C. Meng**, University of California, Santa Barbara and NBER; and **Solomon M. Hsiang**, University of California, Berkeley and NBER, "Spatial Correlation, Trade, and Inequality: Evidence from the Global Climate" (NBER Working Paper No. 25447)

- **James M. Sallee**, University of California, Berkeley and NBER, "Pigou Creates Losers: On the Implausibility of Achieving Pareto Improvements from Pigouvian Taxation"

- **Nicholas Ryan**, Yale University and NBER, "Contract Enforcement and Productive Efficiency: Evidence from the Bidding and Renegotiation of Power Contracts in India" (NBER Working Paper No. 25547)

- **Stephen P. Holland**, University of North Carolina at Greensboro and NBER; **Erin T. Mansur**, Dartmouth College and NBER; **Nicholas Muller**, Carnegie Mellon University and NBER; and **Andrew J. Yates**, University of North Carolina at Chapel Hill, "Decompositions and Policy Consequences of an Extraordinary Decline in Air Pollution from Electricity Generation" (NBER Working Paper No. 25339)

- **Panle Jia Barwick** and **Shanjun Li**, Cornell University and NBER; **Liguo Lin**, Shanghai University of Finance and Economics; and **Eric Zou**, Cornell University, "The Value of Pollution Information: Evidence from China's Air Quality Disclosure"

Summaries of these papers are at www.nber.org/conferences/2019/EEEs19/summary.html

Chinese Economy

Members of the NBER's Chinese Economy Working Group met March 21–22 in Shanghai. Research Associates Hanming Fang of the University of Pennsylvania, Shang-Jin Wei of Columbia University, and Wei Xiong of Princeton University organized the meeting jointly with the Fanhai International School of Finance, Fudan University, and the School of Entrepreneurship and Management, ShanghaiTech University. These researchers' papers were presented and discussed:

- **J. Vernon Henderson**, London School of Economics; **Dongling Su**, Boston University; **Qinghua Zhang**, Peking University; and **Siqi Zheng**, MIT, "Local Factor Market Distortions in China"

- **Tao Chen**, Nanyang Technological University; **Yi Huang**, The Graduate Institute, Geneva; and **Chen Lin**, University of Hong Kong, "Finance and Volatility"

- **Shang-Jin Wei**, and **Chunliu Yang**, Fudan University, "Do Internet Finance Platforms Mitigate Conflicts of Interest? The Case of Mutual Fund Investment"

- **Kaiji Chen** and **Tong Xu**, Emory University; **Qing Wang**, Southwest University of Finance and Economics; and **Tao Zha**, Emory University and NBER, "Aggregate and Distributional Impacts of Housing Policy: China's Experiment"

- **Ran Duchin**, University of Washington; **Zhenyu Gao**, Chinese University of Hong Kong; and **Haibing Shu**, Shanghai Jiaotong University, "Involuntary Political Connections and Firm Outcomes"

- **Yan Bai**, University of Rochester and NBER; **Keyu Jin**, London School of Economics; and **Dan Lu**, University of Rochester, "Misallocation under Trade Liberalization"
- **Guangwei Li**, ShanghaiTech University, "The Role of R&D Offshoring in Knowledge Diffusion: New Evidence from China"
- **Sumit Agarwal**, Georgetown University; **Yongheng Deng**, University of Wisconsin-Madison; **Quanlin Gu**, Peking University; **Jia He**, Nankai University; and **Wenlan Qian** and **Yuan Ren**, National University of Singapore, "Mortgage Debt, Hand-to-Mouth Households, and Monetary Policy Transmission"
- **Zheng Michael Song**, Chinese University of Hong Kong; **Duncan Thomas** and **Daniel Xu**, Duke University and NBER; and **Miaojun Wang**, Zhejiang University, "The Rise of Modern Retail in China: An Anatomy of the Footwear Industry"
- **Kevin Lim**, University of Toronto; **Daniel Trefler**, University of Toronto and NBER; and **Miaojie Yu**, Peking University, "Trade and Innovation: The Role of Scale and Competition Effects"
- **Bo Li**, Tsinghua University, and **Jacopo Ponticelli**, Northwestern University, "Going Bankrupt in China"
- **Ziying Fan** and **Hang Zhang**, Shanghai University of Finance and Economics, and **Xiaxin Wang**, Fudan FISF and University of Michigan, "Understanding Misreporting: Responses to a Housing Transaction Tax Notch in China"

Summaries of these papers are at www.nber.org/conferences/2019/CEs19/summary.html

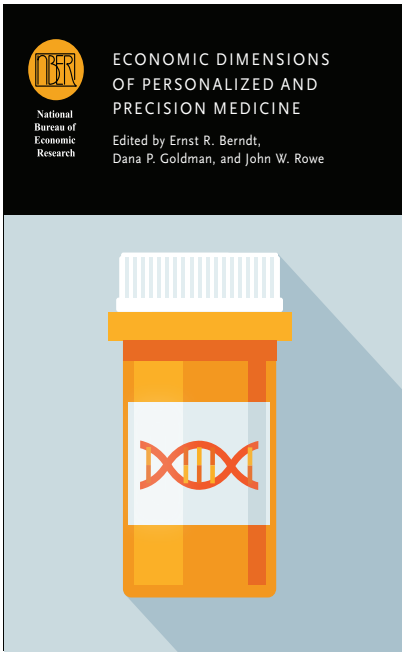
Development of the American Economy

Members of the NBER's Development of the American Economy Program met March 23 in Cambridge. Program Directors Leah Platt Boustan of Princeton University and William J. Collins of Vanderbilt University organized the meeting. These researchers' papers were presented and discussed:

- **Lisa D. Cook**, Michigan State University and NBER, "A New National Lynching Data Set and New Explanations for Lynching Behavior in the United States from 1684 to 1983"
- **Prottoy Akbar** and **Sijie Li**, University of Pittsburgh, and **Allison Shertzer** and **Randall Walsh**, University of Pittsburgh and NBER, "Racial Segregation in Housing Markets and the Erosion of Black Wealth"
- **Ariell Zimran**, Vanderbilt University and NBER, "Transportation and Health in a Developing Country: The United States, 1820–1847"
- **Shawn E. Kantor**, Florida State University and NBER, and **Alexander T. Whalley**, University of Calgary and NBER, "Space Race: Automation Innovation and Labor's Share"
- **Andrew Goodman-Bacon**, Vanderbilt University and NBER, and **Lucie Schmidt**, Williams College and NBER, "Federalizing Benefits: The Introduction of Supplemental Security Income and the Size of the Safety Net"
- **Joshua K. Hausman** and **Paul Rhode**, University of Michigan and NBER; and **Johannes Wieland**, University of California, San Diego and NBER, "Farm Prices, Redistribution, and the Severity of the Early U.S. Great Depression"

Summaries of these papers are at www.nber.org/conferences/2019/DAEs19/summary.html

Economic Dimensions of Personalized and Precision Medicine



Ernst R. Berndt, Dana P. Goldman, and John W. Rowe, editors

Personalized and precision medicine (PPM) — the targeting of therapies according to an individual's genetic, environmental, or lifestyle characteristics — is becoming an increasingly important approach in health care treatment and prevention. The advancement of PPM is a challenge in traditional clinical, reimbursement, and regulatory landscapes because it is costly to develop and introduces a wide range of scientific, clinical, ethical, and economic issues. The economic issues include: how information on accurate diagnosis and treatment success will be disseminated and who will bear the cost; changes to physician training to incorporate genetics, probability and statistics, and economic considerations; whether the benefits of PPM will be confined to developed countries or will diffuse to emerging economies with less developed health care systems; the effects of patient heterogeneity on cost-effectiveness analysis; and opportunities for PPM's growth beyond the treatment of acute illness, in particular to prevention and reversal of chronic conditions.

This volume explores recent empirical applications of PPM as well as the intersection of the scientific, clinical, and economic factors affecting the development of PPM, including its effects on the drug pipeline, on reimbursement of PPM diagnostics and treatments, and on funding of the requisite underlying research.

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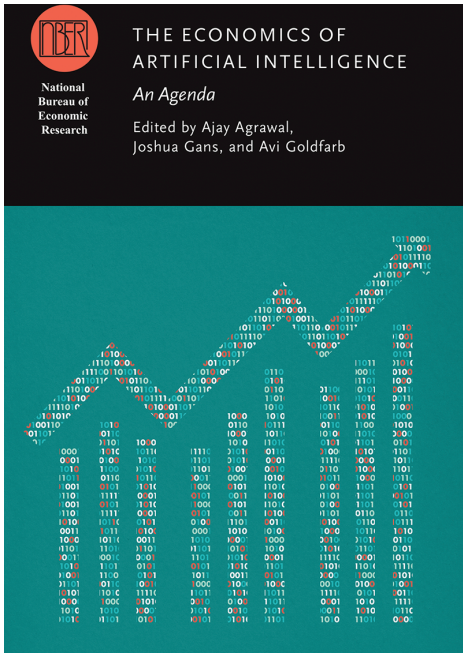
The Economics of Artificial Intelligence: An Agenda



Ajay Agrawal, Joshua Gans, and Avi Golfarb, editors

Advances in artificial intelligence (AI) highlight the potential of this technology to affect productivity, growth, inequality, market power, innovation, and employment. This volume seeks to set the agenda for economic research on the impact of AI. It covers four broad themes: AI as a general purpose technology; the relationships between AI, growth, jobs, and inequality; regulatory responses to changes brought on by AI; and the effects of AI on the way economic research is conducted. It explores the economic influence of machine learning, the branch of computational statistics that has driven much of the recent excitement around AI, the economic impact of robotics and automation, and the potential economic consequences of a still-hypothetical artificial general intelligence. The volume provides frameworks for understanding the economic impact of AI, and identifies a number of open research questions.

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