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ALSO IN THIS ISSUE

Inflation Dynamics during COVID-19	8
Public Health Efforts and the US Mortality Transition	12
Augmenting National Income Statistics to Include Environmental Services	18
Gender, Race, and Academic Career Outcomes — Does Economics Mirror Other Disciplines?	22
NBER News	27
Conferences	31
Program Meeting	34
NBER Books	35

The 2021 Martin S. Feldstein Lecture

The Taxation of Business Income in the Global Economy

Alan J. Auerbach*

It is a great pleasure to give the Martin Feldstein Lecture at the NBER Summer Institute. Marty was my dissertation adviser and a coauthor, and I learned a lot from him over the years. Indeed, I want to begin with a couple of Marty's contributions to the topic of my lecture, not simply to remind us how versatile Marty was in his research, but also because the points he made in these papers inform my discussion.

The first of these contributions is a paper that Marty wrote with David Hartman in the late 1970s that derived optimal tax rates for the domestic and foreign source income of multinational companies.¹ Key implicit assumptions in the paper were that companies' residence, and where they earn their income, are well determined. Both assumptions were perhaps quite sensible in the 1970s, but they clearly are not today.

Let me also call to your attention Marty's paper with Paul Krugman in an NBER conference volume.² The paper has the following quotation, expressing its aim: "The point of this analysis is more modest; we want to show that the common belief that a VAT [value-added tax] is a kind of disguised protectionist policy is based on a misunderstanding." This was an important clarification to make then, given the extent of misunderstanding. Unfortunately, it still is needed today, when policymakers debate the merits not only of value-added taxes, but of other consumption-based or destination-based taxes. This was evident during the US tax reform debate a few years ago.

**This is an edited version of the Martin Feldstein Lecture delivered on July 28, 2021, at the NBER Summer Institute. Alan J. Auerbach is the Robert D. Burch Professor of Economics and Law, director of the Burch Center for Tax Policy and Public Finance at the University of California, Berkeley, and an NBER research associate affiliated with the programs on Public Economics and Economic Fluctuations and Growth.*

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To continue, let me start with a figure common to discussions of international taxation today, the G7 corporate tax rates going back a few decades. One would get a similar picture looking at other groups of developed countries.

It is evident that corporate tax rates have been declining throughout this period, starting from a much higher range in the early to mid-1990s than now. It's also worth pointing out that although the United States' tax rate reduction in 2017 occurred during a Republican administration, in other countries where tax rates have come down, they've done so under left-leaning governments. This is a phenomenon relating to something more fundamental than the politics of the day: the change in the world economy over this period.

A Changing Economic Setting

A good way to illustrate what's happened in the world economy, in particular in the US economy, is to compare the list of the largest US companies 50 years ago and today. Fifty years ago, the top five companies by market capitalization were IBM, General Motors, AT&T, Standard Oil of New Jersey (Esso, the predecessor of today's ExxonMobil), and Eastman Kodak. (Although these names are mostly still familiar, one should remember that AT&T wasn't the AT&T of today, but rather the enormous regulated monopoly, "Ma Bell," which provided local and long-distance telephone services and also manufactured and provided telephones.) These were companies that "made things" in identifiable locations, to a large extent in the United States. If we shift to today, we see another five familiar names, all giant companies: Apple, Microsoft, Amazon, Alphabet (Google's parent), and Facebook. These companies are worldwide multinationals, relying very heavily on the use of intellectual property in the goods and services they provide.

To highlight how things have changed, some statistics are also helpful. In the last half century, the share of intellectual property measured in US nonfinancial corporate assets more than doubled, according to the Fed's Financial Accounts of the United States.³ That's probably a conservative estimate, because the measurement of intellectual property is a fairly narrow one here. The share of before-tax US corporate profits coming from overseas operations nearly quintupled, according to data from the Bureau

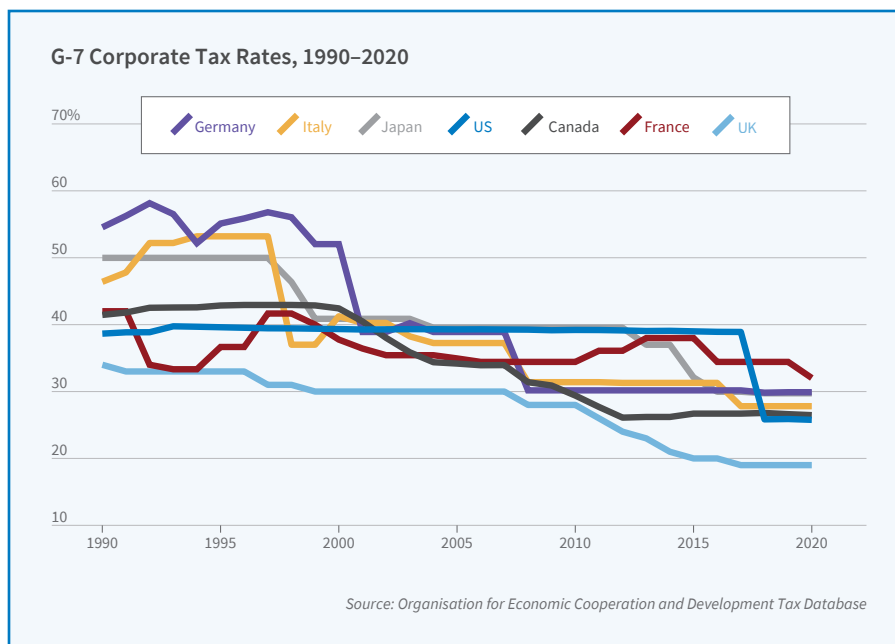


Figure 1

of Economic Analysis.⁴ US companies have become much more multinational in character, not just selling things abroad, but making them abroad as well. And the share of cross-border equity ownership has steadily increased, to the point that foreign individuals and companies account for a significant fraction of US companies' share ownership.⁵

What do these changes imply for tax policy? First, there is increased pressure on tax systems that are based on corporate residence. It's natural to think of individuals as residents of particular countries, but our income tax system also identifies corporations by where they reside. In 1971, it may have been pretty obvious what a US company was, in terms of who owned the company and where it produced. That's much less true now. There is much greater multinational activity of companies that legally reside in the United States, and they have many more shareholders abroad as well. These two factors make it easier to engage in so-called corporate "inversion"—that is, to change the corporate residence through corporate reorganization—which a company might want to do if being a resident of a particular country, such as the United States, is disadvantageous from a tax perspective.

The second implication for tax policy is increased pressure on tax systems

based on where companies produce. The location of production is easier to change now because companies have internal supply chains; they're producing around the world already. So if they want to shift production from one location to another, they have existing operations to make that easier. Moreover, because they're producing things like microchips and pharmaceuticals and, indeed, services, rather than heavy things like autos and steel, they don't have to worry about location as much in terms of transportation costs.

Finally, there is increased pressure on tax systems based on where companies report their profits, as distinct from where they produce. We normally think of companies as earning profits where they produce, but one of the problems governments face today is that companies may produce in one location and report the profits deriving from that production in another. It's easier now for companies to shift profits in this manner because they have operations in so many countries, and it's particularly easy when the income is being generated by intellectual property because intellectual property has no easily identifiable location. We may know where a factory is, but it's a lot harder to say where a piece of intellectual property is, or is being used in production.

I should add one qualification. Many

estimates in the recent literature have suggested that profit shifting is occurring on a vast scale. At least some of these estimates may have overstated the extent of profit shifting, according to analysis by Jennifer Blouin and Leslie Robinson, because of double-counting and other difficulties involved in interpreting government data.⁶ Nevertheless, the increased capacity for shifting profits to low-tax countries remains an important issue, one that certainly drives thinking about tax reform.

So we have a situation where existing tax systems—the ones traditionally used for decades in the United States and elsewhere to tax corporations based on where corporations reside, where they produce, and where they earn their profits—seem unstable and ill-suited to the evolving world economy. What are the options for reform? Several approaches have been tried, and others have been proposed.

The most common approach to dealing with the problems of traditional tax systems involves so-called "anti-avoidance" rules. Tax officials implement specific provisions aimed at restricting the range of transactions in which companies can engage to shift profits—for example, the extent to which they can use related-party borrowing to generate interest deductions in high-tax countries. But such mechanisms also have adverse effects from the adopting country's perspective. Simply put, if you make it harder for a company that's producing in the United States to report profits in a lower-tax country, that shifts taxable profits back to the United States, but at the same time increases the effective tax rate that the company faces on its US activities and may make its production decisions more sensitive to the US tax rate.⁷ Likewise, the United States has been trying to come up with rules to limit inversions, but these rules are becoming increasingly complicated as corporations devise different strategies for changing residence.

A second approach that has been used, especially in Europe, has been to implement so-called "patent boxes"—favorable regimes for intellectual property. The idea is that if income associated with intellectual property is particularly sen-

sitive to tax rates and typically difficult for tax authorities to locate, then governments should impose lower tax rates on such income, essentially conceding that they're not going to be able to impose a higher tax rate. Governments also justify such favorable regimes with the argument that intellectual property development and use may have positive productivity spillovers in other parts of the economy. One problem with patent boxes is that, in a sense, they deal with tax competition by simply giving up. Also, research suggests that companies are responding to these favorable regimes by locating intellectual property income in favorable places, but not necessarily doing the kind of research and development in those places that would be associated with productivity spillovers.⁸ So this doesn't appear to be a fundamental solution to the problem of tax competition either.

Third, starting in Europe but spreading more broadly, a series of recent proposals and policies have targeted big, largely US tech multinationals with new, separate taxes on receipts based on where companies' users are. The rationale for such taxes is that companies like Google or Facebook have lots of users in the countries in question, but by traditional income tax rules lack what is referred to as nexus in those countries: they don't engage in any traditional production operations there. By standard income tax rules, the companies owe little or nothing under these countries' income taxes, so individual countries, and indeed the European Union collectively, have pursued an ad hoc solution — digital service taxes (DSTs) based on where users are.

A fourth type of response to the difficulties of traditional taxation approaches

is to adopt destination-based taxes, in some sense what DSTs do but in a much more fundamental way. The idea is to tax companies based not on where they reside, where they report their profits, or where they produce, but on where their sales are, because consumers are relatively immobile. A tax based on destination is likely to be less susceptible to competition over tax rates among countries because competing for corporate residence, production, or profits is likely to be much more intense than trying to get people to move across borders to take advan-

the VAT is a tax on consumption rather than a tax on income, but because it's a tax based on destination rather than on the location of earnings, production, or corporate residence.

Because of the reduced focus on residence and the location of profits or production, the unilateral adoption of destination-based taxes by one country might actually push other countries in the same direction. If the United States, for example, were to move to a corporate tax based on destination, it would encourage more companies to produce and report

their profits in the United States because they would no longer be subject to tax based on those actions; that might pressure other countries to follow suit. This interaction would be a form of tax competition, but it doesn't require a low tax rate, simply a different kind of tax base, and reflects an important and overlooked objective of international tax policy, in addition to all the other things we'd like tax systems to satisfy, such as economic efficiency, equity, and ease in administra-

tion: incentive compatibility, that is, countries perceiving it to be in their own best interest to adopt a tax system without having to be coerced by others.

The advantages of destination-based taxation and the importance of incentive compatibility in international tax reform are emphasized in the book *Taxing Profit in a Global Economy* that several collaborators and I recently published.⁹ In this book, produced over a period of several years, we analyze two specific proposals, one big, one small in terms of the magnitude of changes from the current system. The small one would tax residual profits based on the location of sales income, which we call Residual Profit

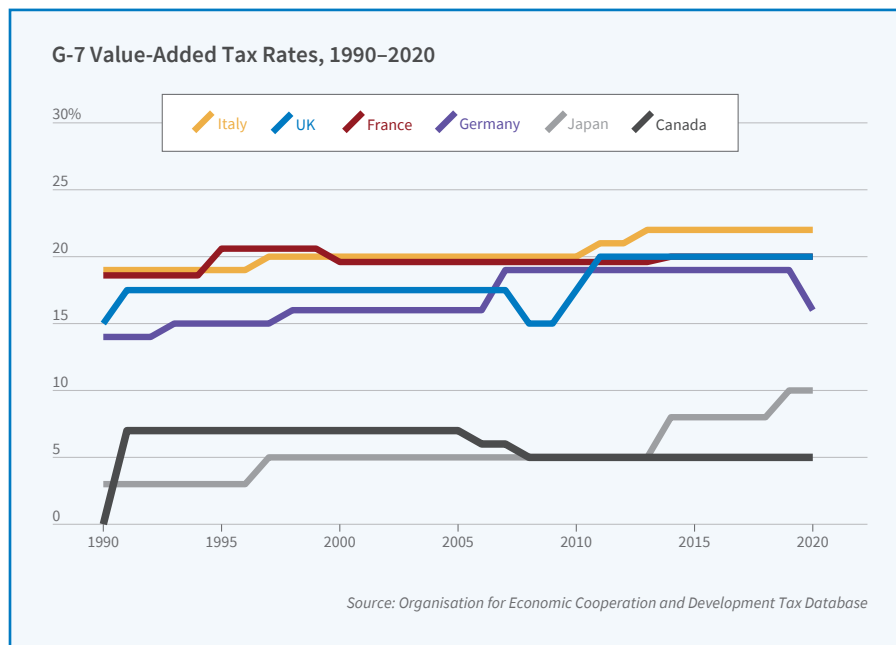


Figure 2

tage of lower tax rates. The main existing tax based on destination, the value-added tax, unlike the corporate tax, shows little susceptibility to tax rate competition, as this corresponding figure for the G7 shows. (Of course, there are only six countries represented here because the United States, alone among the G7 and indeed among developed countries, does not have a value-added tax or any national consumption tax.)

There is no obvious downward trend in VATs, and indeed some of the downward blips represent countercyclical policies, such as by the United Kingdom during the global financial crisis. This difference in trends arises not because

Allocation by Income (RPAI). The large one is a Destination-Based Cash Flow Tax (DBCFT), which received serious consideration in the United States a few years ago. Let me explain each proposal in a bit more detail.

The RPAI is a hybrid system. For routine operations involving traditional production using tangible assets and likely not earning a particularly high rate of return, the old system probably still works pretty well, and the plan would continue to tax such earnings based on where companies report that they are producing and earning profits. But for many companies, especially the biggest US companies, a lot of residual earnings will remain after these “routine” profits are taken out. These residual earnings would be allocated based on the location of net sales revenues. This is a partial apportionment system; apportionment is familiar for those of us in the United States from the way that states tax corporate income. An interesting development among the US states has been the steady movement over the years toward apportionment based on sales—rather than payroll or assets—with no coercion or coordination. That states have chosen destination independently confirms the idea of incentive compatibility for this approach.

The DBCFT would impose a cash-flow tax on domestic operations. It would also implement border adjustments, eliminating the import deduction and the tax on exports. These border adjustments would work precisely as they do under existing value-added taxes. Border adjustment accomplishes two things. First, it shifts the location of the tax base from production to consumption. Commodities consumed in the United States would be taxed in the United States even if produced elsewhere, and those produced in the United States but consumed elsewhere wouldn't be taxed in the United States. But of equal importance, border adjustment would eliminate profit-shifting opportunities because transactions with related parties in other countries would not be part of companies' tax calculations.

Although structured as a tax on business income, the DBCFT is equivalent to a value-added tax but with one important difference: it doesn't tax the wage and salary component of value added, making it a tax on profits rather than a tax on value added. This difference makes the DBCFT much more progressive. Indeed, one can show that the destination-based cash-flow tax is equivalent to a one-time tax on the wealth of residents through a tax on the future cash flows that they receive.¹⁰

As already mentioned, the DBCFT was proposed in the United States in 2016 during the discussion leading up to the Tax Cuts and Jobs Act (TCJA) passed in 2017. It was not implemented because of several concerns, including the short-run effects associated with exchange rate adjustment, possible World Trade Organization reaction, given the focus of WTO rules on form over substance, and, alas, a general lack of understanding of the proposal's economic effects, including a continuing failure to comprehend the point made by Feldstein and Krugman that border adjustment is not a trade-distorting policy.

Finally, we have what the United States did enact in 2017, which follows something of a “kitchen sink” approach. The TCJA contained a little bit of everything. It reduced the corporate tax rate, thereby continuing tax competition. It introduced some additional tax avoidance measures, including a global minimum tax on US companies, on Global Intangible Low-Taxed Income (GILTI), taxing income earned abroad by US companies if that income faced a low rate of tax. It introduced investment expensing and narrowly targeted border adjustments on exports and imports, thus borrowing from the DBCFT.

The TCJA didn't have a unified logical basis. It also did not produce a stable situation, for the United States or the world. It generated a tax revenue loss that the United States can ill afford. It discourages US corporate residence because the minimum tax was adopted by the United States alone, and therefore could be avoided by not being a US resident

company. Finally, there was no measure in the TCJA to deal with digital services, which will not leave other countries happy with the outcome.

The Two Pillars

The foregoing review of the various approaches tried or considered brings us to where we are now, which is the initiative that has taken place over many years, started by the OECD and reflected in a specific proposal this year known as the Two Pillars. I have to pause here and note that I have not been educated to think about the tax system as having pillars, although I suppose the idea is that these two pillars are going to hold up the world tax structure. For me, unfortunately, a different picture comes to mind, based on a familiar story from the Old Testament, in which the two pillars fail: those that Samson pushes apart to bring down the temple on his tormentors, the Philistines. If one continues this analogy a little further and thinks about who Samson is in this situation (leaving aside who the current Philistines are), perhaps it might be the Republic of Ireland or one of the other countries that have not yet signed on and become a member of the “coalition of the willing” in this initiative.

How would the two-pillar approach work? Pillar 1 is essentially a replacement for digital service taxes. It would allocate to market countries a fraction of profits of extremely large companies, above a threshold. Specifically, 20 to 30 percent of profits above 10 percent of sales revenues would be taxable for those companies (excluding those in financial services and resource extraction) with over 20 billion euros a year in annual revenues. Pillar 2 would be a global minimum tax, along the lines of what the United States adopted in 2017, with some important differences. It would be at a rate of at least 15 percent imposed above a threshold of 7.5 percent of tangible assets plus payroll for multinationals with more than 750 million euros in annual revenues. Pillar 2 also includes some other provisions to encourage adoption by imposing penalties on those countries not doing so.

Regarding Pillar 1, estimates suggest that if the aim is to target large US multinationals, it is successful in doing so. These estimates are that close to two-thirds of global tax revenues would be generated by US companies, and half of that amount would come from five companies: Apple, Microsoft, Alphabet, Intel, and Facebook.¹¹ While Pillar 1 does introduce the idea of destination-based taxation in a manner similar to the RPAI plan discussed above, it is much more limited in scope. It only applies to a small number of extremely large tech companies and allocates only 20 to 30 percent of excess profits rather than all. However, one might think of this as the first step in the direction of adopting the principle more broadly, a point to which I will return.

Pillar 2 is a bit like the US GILTI provision, but it would be tougher because it would impose a higher tax rate. On the other hand, it doesn't go as far as a proposal put forward by the Biden administration earlier this year, which would have had a tax rate of 21 percent and no threshold over which taxes would be assessed. By taxing even "normal" returns in low-tax countries, the Biden approach was aimed not just at companies shifting profits to low-tax countries, but also at companies shifting production activities themselves. It thus would have targeted a broader array of multinational activities.

We now come to two important questions. Can the agreement work? Should it work? In the short term, there are serious challenges to getting the system off the ground. Among these is whether the United States can get approval for renegotiated treaties needed to adopt Pillar 1, ceding the right to tax income to destination countries. Though the Biden administration has expressed support for Pillar 1, it would also need the support of two-thirds of the Senate for treaty approval. As many countries have agreed to Pillar 2 in order to gain adoption of Pillar 1, a US failure to adopt Pillar 1 could lead to a loss of support elsewhere for Pillar 2. A second short-term question is whether the United States can get the proposed minimum tax through the budget recon-

ciliation process, which would require 50 votes in the US Senate. And finally, can Europe achieve unanimity? Without it, certain elements of the plan could not be imposed on other members of the European Union, and as of now three EU members—Estonia, Hungary, and Ireland—have not signed on.

But beyond the immediate hurdles facing adoption, there is also a more fundamental, longer-term challenge arising from the attempt to preserve a tax system based on concepts that don't really work anymore, that are ill-defined and endogenous: corporate residence and the location of production and profits (something that tax authorities have taken to referring to as the location of value creation). Because it relies on these ill-defined concepts, the two-pillar system is not going to be sustainable unless countries adopt and adhere to similar rules that lessen incentives for companies to shift production, profits, and residence.

What does this outcome require? It requires that countries adopt similar minimum tax rates and bases across home countries (so that the base and the rate together provide similar effective tax rates), to lessen the incentives for companies to shift corporate residence, as residence determines which minimum tax applies. Also needed are similar regular corporate tax rates and tax bases among the countries, to prevent companies from shifting their production and profits location from one country to another in cases where the minimum taxes do not apply. Finally, it is necessary for any given country to have similar regular and minimum tax rates and bases to keep companies that are resident in those countries from shifting their profits and their production abroad. This is relevant, for example, for the United States, which has agreed to a 15 percent minimum tax, with the Biden administration currently proposing a 28 percent tax rate on domestic income.

What should determine these similar tax rates and tax structures? There has been so much focus on the objective of limiting tax competition that one can easily lose sight of the fact that limiting tax competition isn't the only major

objective of tax policy. There are many other objectives as well that can help determine whether the corporate tax rate should be, say, 21 percent, 28 percent, or 35 percent; whether the minimum tax rate should be 15 percent or 21 percent, as the Biden administration originally proposed; and whether the tax base should have a threshold or not. These are questions that can only be answered if one thinks about what governments are trying to achieve, for example how much revenue they are trying to raise and the extent to which they seek to encourage saving and investment. These questions are not addressed simply by agreeing to coordinate on policy, and different countries likely will have different objectives that push in different directions, toward differences in tax rates, tax bases, and minimum taxes. Had the two-pillar framework focused less on trying to preserve the existing system and more on moving in the direction of destination-based taxation, governments could have pursued different objectives without worrying about tax competition. For example, had the United States adopted the DBCFT in 2017, it could have kept its 35 percent corporate tax rate and would not have needed to adopt a global minimum tax.

So where does that leave us? I will not make the mistake of trying to predict what happens in the short run, i.e., how far we get with Pillars 1 and 2 and the proposed international agreement. But over the longer term, whatever the short-run success in getting this agreement adopted widely, there will continue to be pressures of the type I just discussed for countries to move in opposite directions. Part of the movement that results likely will be in the direction of destination-based taxation. I mentioned earlier that the 2017 Tax Cuts and Jobs Act included certain pieces taken from the DBCFT. The incentives for policymakers to include such provisions remain and will continue to be a part of the tax policy process. For example, it's quite possible that Pillar 1, although very narrow as proposed, may eventually be expanded. As countries see that it works pretty well,

they may want to lower its size threshold so that it applies to a much larger group of companies, and to increase the share of profits allocated in this manner. Or, they may increase their VATs, which, with compensating reductions in labor income taxes, simulates gradual adoption of the DBCFT. Changes like these do not require international coordination.

Whatever form it takes, such movement toward destination-based taxation will not only provide more tax revenue, it will also lessen the need for minimum taxes, which are, after all, aimed at enforcing taxes based on traditional approaches. One consequence is likely to be further pressure on minimum taxes, as countries moving toward destination-based taxation see them as no longer needed to provide revenues or protect their tax bases. In short, whatever the world's tax landscape in the near future, one should expect a continuing evolution toward a tax system that is more logical and self-sustaining.

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¹ “The Optimal Taxation of Foreign Source Investment Income,” Feldstein M, Hartman D. NBER Working Paper 193, November 1980, and *Quarterly Journal of Economics* 93(4), November 1979, pp. 613–629.

[Return to Text](#)

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[Return to Text](#)

³ Release Z.1, Table B.103.

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⁴ NIPA Table 6.16.

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⁵ “Who’s Left to Tax? US Taxation of Corporations and Their Shareholders,” Rosenthal S, Burke T. Urban-Brookings Tax Policy Center, October 2020.

[Return to Text](#)

⁶ “Double Counting Accounting: How Much Profit of Multinational Enterprises Is Really in Tax Havens?”

Blouin J, Robinson L. April 2021, SSRN.

[Return to Text](#)

⁷ See, for example, the evidence presented in “At a Cost: The Real Effects

of Thin Capitalization Rules,” De Mooij R, Liu L. *Economics Letters* 200, March 2021.

[Return to Text](#)

⁸ “Should There Be Lower Taxes on Patent Income?” Gaessler F, Hall B, Harhoff D. NBER Working Paper 24843, June 2019, and *Research Policy* 50(1), January 2021.

[Return to Text](#)

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[Return to Text](#)

¹⁰ “Consumption and Cash-Flow Taxes in an International Setting,” Auerbach A, Devereux M. NBER Working Paper 19579, October 2013, and published as “Cash-Flow Taxes in an International Setting,” *American Economic Journal: Economic Policy* 10(3), August 2018, pp. 69–94.

[Return to Text](#)

¹¹ “Who Will Pay Amount A?” Devereux M, Simmler M. *Policy Brief* 36, European Network for Economic and Fiscal Policy Research, July 2021.

[Return to Text](#)



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Cavallo's research focuses on the behavior of prices and its implications for macroeconomic measurement, models, and policies. He started using online data to measure inflation and conduct research on high-frequency pricing dynamics during his PhD studies at Harvard. He created *Inflación Verdadera* in 2007 to measure the real inflation rate in Argentina, and cofounded The Billion Prices Project in 2008 to expand the measurement of online inflation globally. In 2011, he cofounded PriceStats, a private source of inflation and purchasing power parity statistics in over 20 countries.

Cavallo grew up in Argentina. He received a BS from the Universidad de San Andrés in Buenos Aires in 2000, an MBA from the MIT Sloan School of Management in 2005, and a PhD in economics from Harvard University in 2010. He lives in Cambridge with his wife and two sons.

Inflation Dynamics during COVID-19

Alberto Cavallo

For over a decade, my research has explored the use of high-frequency microdata to measure inflation and other economic statistics in real time in an effort to make academic macroeconomic research more timely and useful for policymakers. The COVID-19 pandemic has provided a unique opportunity to test this methodology, particularly around the topic of inflation. After the crisis started, the United States experienced a relatively small decline in inflation in 2020, followed by a sudden surge in prices in early 2021. Understanding these inflation dynamics has been the focus of my recent papers. In particular, I studied the impact of COVID-related consumer price index (CPI) measurement distortions and supply disruptions, both of which can be quantified with new sources of high-frequency microdata.

Measurement Distortions with CPI Basket Weights

Early in the pandemic, W. Erwin Diewert and Kevin J. Fox warned that the standard fixed-basket-of-goods approach used by CPIs, which relies on category weights updated infrequently with lagged expenditure data, could introduce significant measurement bias.¹ In the US, CPI weights were last updated in December 2019, shortly before the pandemic dramatically changed consumer spending patterns. To quantify the extent of this basket bias, I relied on the work of Raj Chetty, John N. Friedman, Nathaniel Hendren, Michael Stepner, and the Opportunity Insights Team, who publish real-time consumer spending patterns based on credit and debit card transactions.² Using their

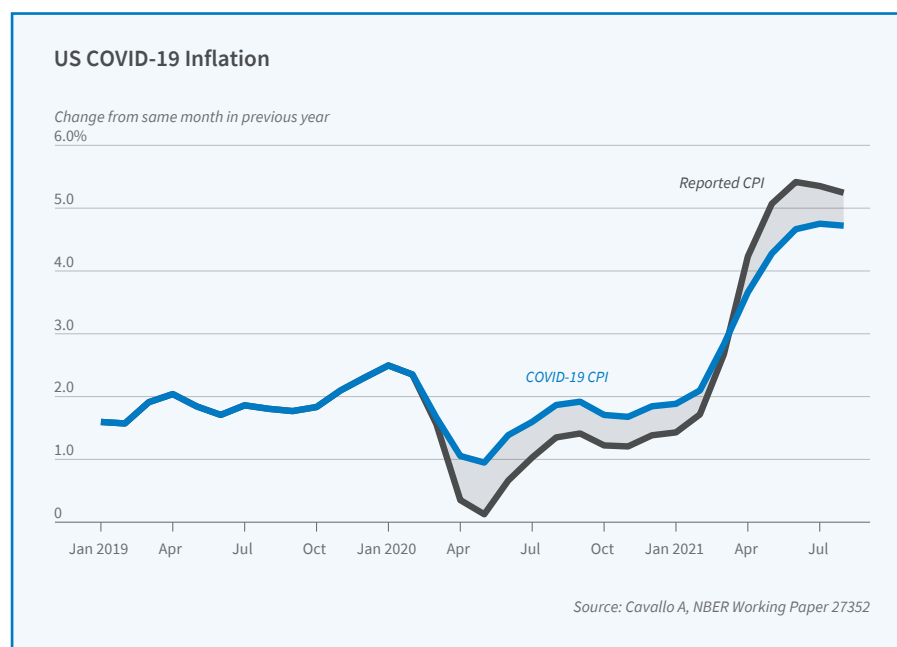


Figure 1

high-frequency data, I updated the official CPI basket weights on a monthly basis, and combined them with CPIs for various categories of goods to compute an alternative index that can approximate the inflation rate of a COVID-adjusted consumption basket.³

With this “COVID CPI,” I found that the annual CPI inflation rate in the US was significantly underestimated in 2020, as shown in Figure 1.

This was because there was too much weight given to Transportation, a category initially experiencing deflation, and too little weight on Food at Home, where prices were rising. The distortion extended to the core CPI because non-energy transportation categories were impacted, as well as to the PCE (Personal Consumption Expenditures) Price Index, which has a chaining methodology that only partially adjusted to the sudden changes in consumer expenditure patterns.

The CPI basket distortion is temporary, but it is still affecting the annual inflation rate in mid-2021. In fact, US annual inflation is now being overestimated by about 0.7 percentage points. There are two reasons for this. First, the CPI was still placing too much weight on Transportation during the first half of 2021, a time when CPI categories such as Used Cars and Trucks experienced

particularly strong increases in prices. Second, the base effects in the annual inflation calculation are larger than they would have been if the CPI basket had been adjusted. The base effects occur because the annual rate compares prices today to those 12 months ago. The fact that the CPI was underestimated in the second quarter of 2020 means that the annual inflation rate is higher in mid-2021.

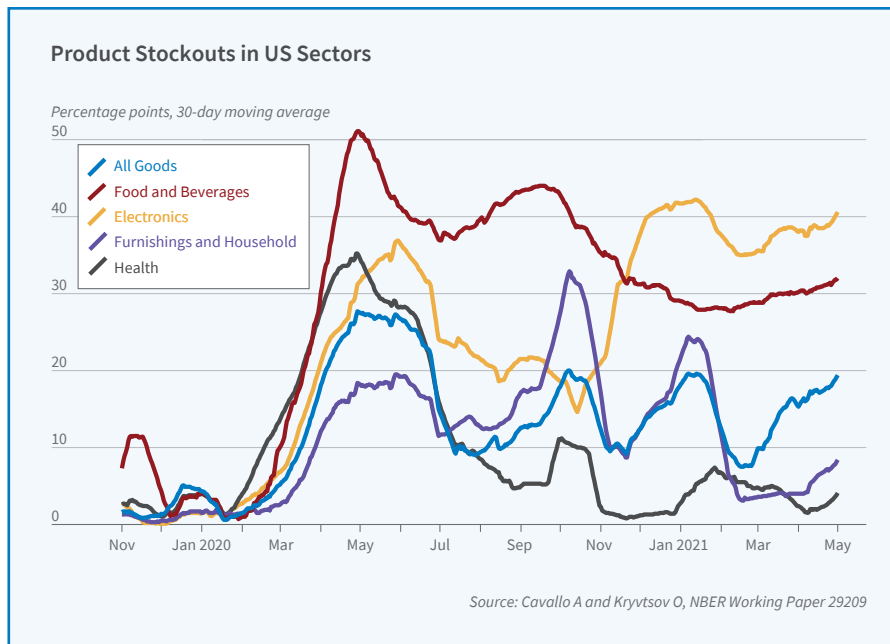


Figure 2

mentioned in media and policy reports, so far there has been little empirical analysis of its impact on inflation.⁴

I provide direct evidence in joint work with Oleksiy Kryvtsov using microdata collected online to construct a high-frequency measure of product shortages in a wide range of consumer products.⁵ We focus not just on out-of-stock signals that are visible to consumers, but also on the higher incidence of discontinued goods, which

are harder to detect. Our stockout measures, shown in Figure 2, prove that shortages were widespread early on in the pandemic, affecting far more than just toilet paper and disinfecting wipes. Over time, the composition of shortages evolved from many “temporary” stockouts to mostly discontinued goods, or permanent stockouts, concentrated in fewer sectors. By early May 2021, US stockouts showed signs of improvement in some categories, but

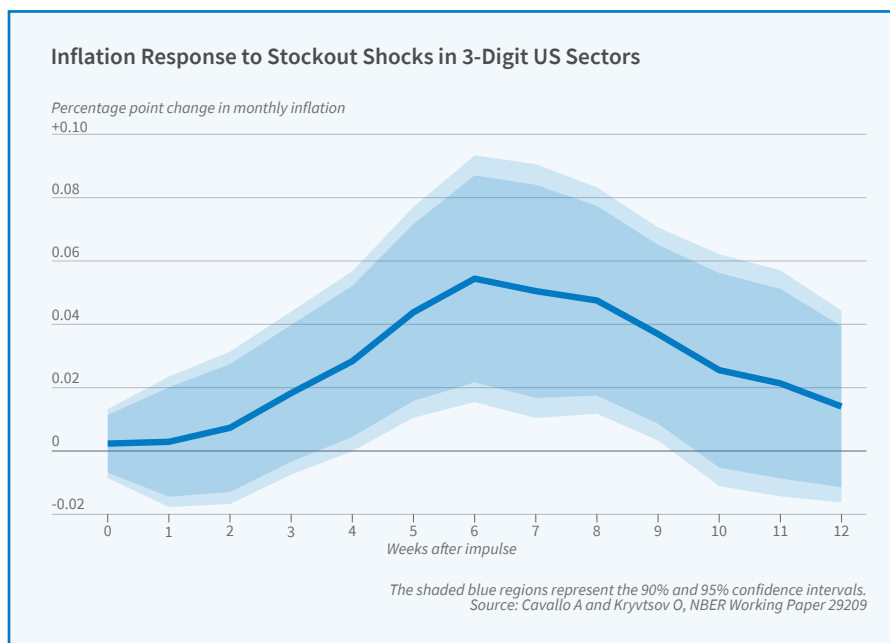


Figure 3

remained near record levels for Food and Beverages and Electronics.

Combining these stockout measures with micro price data, we find that their impact on inflation is significant, gradual, and transitory. This can be seen in Figure 3, which shows the estimated response of monthly inflation to a stockout shock. Our estimates imply, for example, that an increase in the stockout rate from 10 percent to 20 percent would bring about a 0.10 percentage point increase in the monthly inflation rate within two months. The impact rises gradually after two weeks, peaks around six weeks, and dissipates after three months. We find a similar response when we focus only on temporary stockout shocks, which were more significant at the beginning of the pandemic, suggesting that shortages have been putting upward pressure on prices all along, even though the effects were harder to detect with aggregate statistics when demand was falling. Furthermore, in previous work⁶ I showed that online and offline prices are similar for large US retailers, which suggests that the inflation effects likely extend to brick-and-mortar store prices as well.

These results are also qualitatively similar when the shock is measured using a model-based estimation of the underlying replacement cost. To show this, we develop a model of a monopolistic firm with inventories and use it to derive an empirical specification for estimating the costs behind the observed dynamics of stockouts and prices at a sector level. We then construct empirical responses of inflation to the estimated cost shocks, and find that accounting for the endogeneity of stockouts makes the inflationary effects stronger immediately after the shocks, but also more transitory.

This estimated cost pass-through into retail prices is relatively quick when compared to that of other recent shocks, such as the rise in tariffs during the US-China trade war. For example, Gita Gopinath, Brent Neiman, Jenny Tang, and I showed in 2019 that the tariffs on Chinese goods had limited short-run effects on consumer prices.⁷ We found evidence of other margins of adjustment, such as front-running of inventories and trade diversion, which

were not possible in the pandemic, but also some evidence that retailers delayed the pass-through because they expected the tariffs to be temporary. We speculated that if the shock had remained for much longer, pressure on these retailers would likely have risen and the pass-through into consumer prices would have increased. Consistent with this hypothesis, in the more recent COVID stockouts paper we found that the impact on inflation is higher in sectors where the stockouts have been particularly persistent, such as Food and Electronics. This result also applies at the country level, with the US, Canada, and Germany having both more persistent stockouts and also the largest impacts on annual inflation rates.

Another explanation for the quick retail pass-through is that the COVID crisis moved a large share of transactions online. In a 2018 paper prepared for the Federal Reserve Bank of Kansas City's Economic Policy Symposium in Jackson Hole, I showed that large traditional retailers competing with online firms tend to adjust their prices more frequently and have more uniform prices across locations.⁸ This makes their prices react faster to national-level cost shocks. I argued that retail prices are becoming less insulated and that as online transactions increase any other shock that may enter the pricing algorithms used by large retailers is more likely to have a larger impact on retail prices than in the past. This is precisely the type of shock caused by COVID supply disruptions.

Looking Ahead

Overall, my recent research suggests that temporary factors, such as measurement distortions and supply disruptions, are an important driver of inflation at this stage of the pandemic. However, high-frequency online inflation indices, based on a methodology I started developing in my PhD thesis over a decade ago,⁹ continue to show that inflationary pressures are abnormally high in the US, with monthly rates above 10-year averages for the past 11 months.¹⁰

Whether inflation remains high will

depend on how COVID-related supply and demand shocks evolve moving forward. But this is certain: the pandemic has highlighted the importance of high-frequency data for economic measurement during times of crisis. It has dramatically accelerated the use of online data collection at the Bureau of Labor Statistics and other statistical agencies, and could potentially lead to other changes in practice, such as an increase in the frequency of expenditure surveys and the updating of CPI weights.¹¹ These changes would provide a more detailed and less distorted picture of inflation during times of crisis. More importantly, the development and growing availability of new microdata will continue to improve our understanding of the mechanisms affecting inflation dynamics in the future.

Alberto Cavallo is a cofounder of, and has an ownership stake in, PriceStats LLC, a private company that uses online data to compute inflation indices. He is also an unpaid member of the Technical Advisory Committee of the US Bureau of Labor Statistics, where he provides advice on various issues, including the use of online data in the construction of consumer price indexes and other statistics.

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[Return to Text](#)

Public Health Efforts and the US Mortality Transition

D. Mark Anderson, Kerwin Kofi Charles, and Daniel I. Rees

In the mid-1800s, mortality rates in US and Western European cities were much higher than those in rural areas. Since then, urban mortality rates have fallen dramatically. Driven by reductions in infectious diseases and

diseases of infancy and childhood, this phenomenon is often referred to as the mortality transition and has been recognized as one of the most significant developments in the history of human welfare.¹ By the 1940s, the mortality

“penalty” from living in a major urban center had all but disappeared in modern, developed countries.²

Economists originally attributed the mortality transition to increases in income, the onset of modern eco-

D. Mark Anderson, Kerwin Kofi Charles, and Daniel I. Rees are conducting collaborative research on how municipal-level public health efforts contributed to the decline in urban mortality in the United States, with a focus on the pre-1900 period. They also are investigating the relationship between hospital desegregation efforts and the Black-White infant mortality gap in the Deep South during the Civil Rights Era.



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Anderson received his BS from Montana State University and his MA and PhD from the University of Washington. He currently lives in Livingston, Montana with his wife and daughter.

Kerwin Kofi Charles is the Indra K. Nooyi Dean and Frederic D. Wolfe Professor of Economics, Policy, and Management at the Yale School of Management. He is vice president of the American Economic Association, vice chair of NORC at the University of Chicago, an NBER research associate affiliated with the Labor Studies Program, and an elected fellow of the Society of Labor Economists. He is also a member of the Federal Economic Statistics Advisory Committee and the editorial board of the *Journal of Labor Economics*.

Charles is interested in earnings and wealth inequality, racial earnings differences, labor market discrimination, the intergenerational transmission of economic status, the labor market consequences of housing bubbles and sectoral change, and leisure technology. He received his BA from Miami University and his MS and PhD from Cornell University.

He currently lives in New Haven, Connecticut with his wife and two sons.



Daniel I. Rees, a professor of economics at the University of Colorado Denver and a research associate affiliated with the NBER's Health Economics Program, is joining the economics faculty at the Universidad Carlos III de Madrid. He is an associate editor of *Economic Inquiry* and the *European Economic Review*, and a coeditor of the *Journal of Policy Analysis and Management*. He has been a research fellow at the Institute of Labor Economics (IZA) since 2011.

Rees is interested in the determinants of risky behavior, the effects of prenatal stress on child health, and the long-term effects of smoking on health. Rees received his BA from Oberlin College, his MA from the University of Wisconsin-Madison, and his PhD from Cornell University. He currently lives in Madrid with his wife and two children.



conomic growth, and improved nutrition.³ However, more recent analyses have stressed the importance of public health efforts, particularly efforts to supply clean water to the residents of major American cities.⁴

In a series of papers, we revisited the causes of the US urban mortality decline at the turn of the 20th century. We explored the role of clean water technologies and estimated the effectiveness of other public health efforts that were seen as vital to reducing food-related and waterborne diseases, including the building of sewage treatment plants; requirements that municipal milk supplies meet strict bacteriological standards; and requirements that milk come from tuberculin-tested cows. We also explored the determinants of the Black-White infant mortality gap in the first four decades of the 20th century and studied the extent to which public health efforts contributed to the narrowing of this gap. Finally, we estimated the effects of the US campaign against tuberculosis (TB) on pulmonary TB mortality during the early 1900s. The US anti-TB movement pioneered many of the strategies of modern public health campaigns, but its effectiveness had not been studied in a systematic fashion by previous researchers.

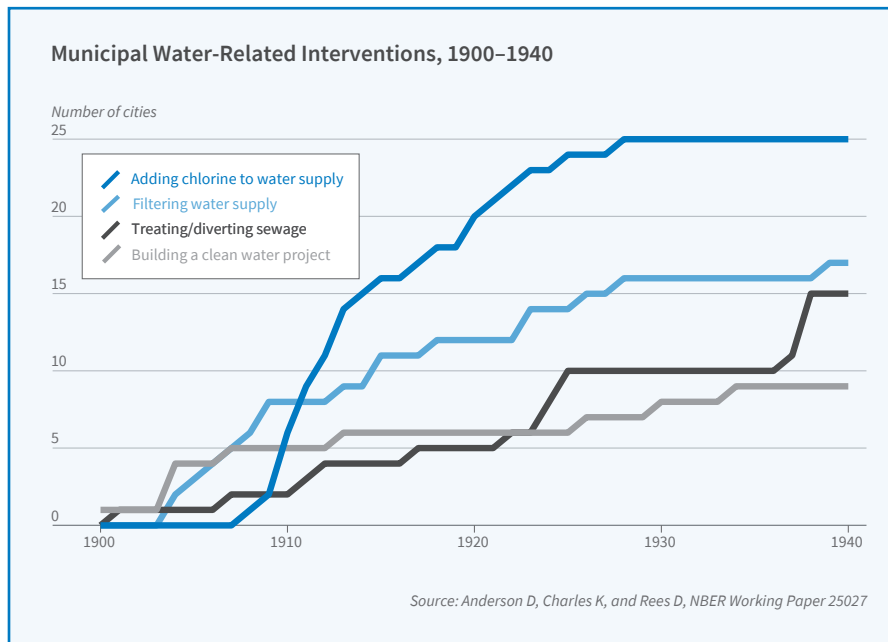


Figure 1

Public Health Efforts and the Decline in Urban Mortality

Previous research suggests that the US mortality transition was driven primarily by public health interventions aimed at reducing food-related and waterborne illnesses.⁵ However, because the same city would often implement several interventions

within a span of a few years, it has been difficult for researchers to isolate the effect of any single intervention, especially when taking a case-study approach.

Using data from the US Census Bureau's Mortality Statistics and Vital Statistics of the United States on 25 major American cities for the period 1900–1940, we conducted a statistical horse race to distinguish the effects of ambitious, often

very expensive, public health interventions.⁶ Figures 1 and 2 illustrate the rollout of the water- and milk-related interventions, respectively, for our sample of cities.

Consistent with the results of several previous studies,⁷ we found that filtering the municipal water supply led to large reductions in typhoid mortality. Although we found no evidence that adding chlorine to drinking water,

building sewage treatment plants, or testing dairy cows for TB were effective, filtering the water supply was also associated with an 11 to 12 percent decrease in infant mortality and a 14 percent reduction in diarrhea/enteritis mortality. While these estimates were measured with precision, they were not nearly large enough to explain the overall declines in infant and diarrheal mortality observed during the period 1900–1940. Our findings

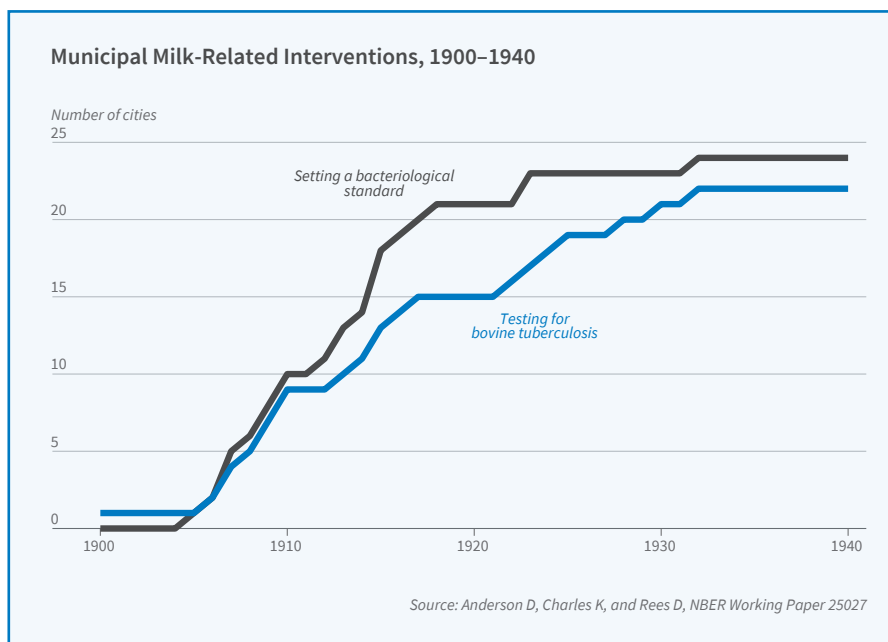


Figure 2

are inconsistent with David Cutler and Grant Miller's widely cited finding⁸ that water filtration was a large contributor to the mortality decline.⁹

Water Purification Efforts and the Black-White Infant Mortality Gap

In another study, we explored the relationship between clean water technologies and the Black-White infant mortality gap during the period 1906–1938.¹⁰

Werner Troesken observed that urban Blacks and Whites lived in close proximity — “almost side by side” — at the turn of the 20th century.¹¹ He famously hypothesized that, because of this lack of residential segregation, it was costly to deny Blacks access to clean water, and that fear of water-borne diseases spreading from Blacks to Whites “played a role in motivating cities to install relatively equitable sewer and water systems.”¹² More generally, it is theoretically ambiguous whether health inequalities are exacerbated or mitigated by technological innovation. Exclusive technologies can be subject to “elite capture,” while there is evidence that less expensive “breakthrough” technologies disproportionately benefit poorer, underprivileged individuals.¹³

Consistent with Troesken's hypothesis, we found that chlorinating the water supply, which was relatively cheap, had no observable effect on the White infant mortality rate (IMR), but led to a 9 percent reduction in the Black IMR and a 10 per-

cent reduction in the Black-White IMR ratio — our measure of the Black-White infant mortality gap. Moreover, we found that adding chlorine to the water supply narrowed the Black-White infant mortality gap, at least in part, through its effect on diarrheal disease. Specifically, we found that chlorination led to a 17 percent reduction in diarrhea/enteritis mortality among Black children under the age

municipal water supplies and water-borne disease mortality.¹⁴

The Phenomenon of Summer Diarrhea and Its Waning

At the start of the 20th century, diarrheal deaths among US infants and children surged every summer. This seasonality waned considerably by 1930 (Figure 3). Economists and historians have argued that summer diarrhea was eventually controlled by public health interventions,¹⁵ especially municipal-level efforts to purify water and milk supplies.

Building upon the results described above, Anderson, Rees, and Tianyi Wang explored whether water filtration and other municipal public health interventions contributed to the diminishing severity of summer diarrhea among children under age two.¹⁶

We found that the

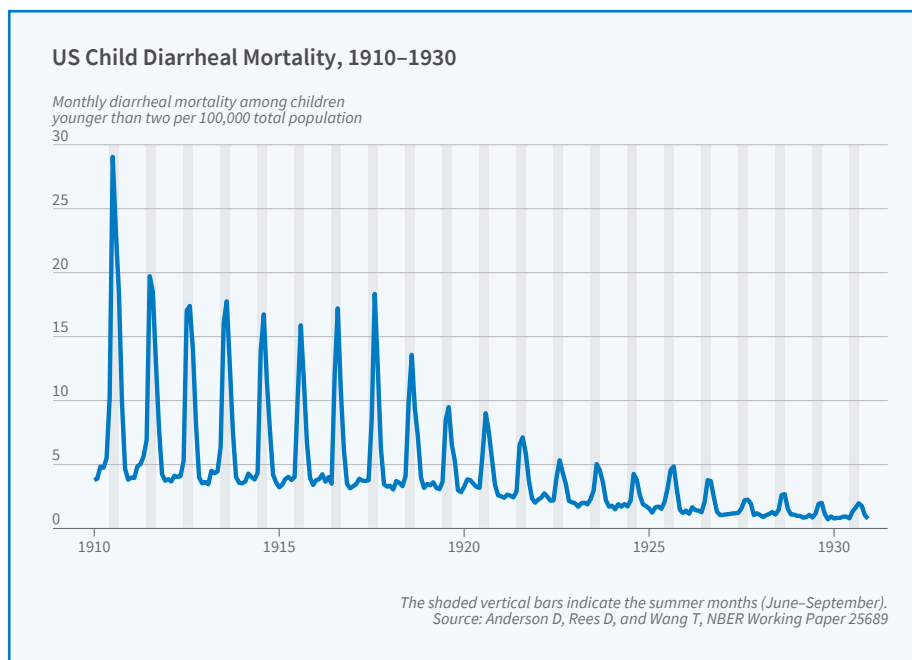


Figure 3

of two. The construction of water filtration plants, by contrast, was equally effective at reducing Black and White death rates.

Why would chlorination only affect Black infant mortality? One potential explanation is that it mattered more for Black families because, on average, their children were more likely to suffer from nutritional deficiencies, making them relatively vulnerable to waterborne infections. Another possibility is that Black families did not have the resources to disinfect or boil their water prior to chlorination. Consistent with this argument, Troesken found a stronger positive association among Blacks than among Whites between bacteria counts in

the construction of a water filtration plant was associated with a 15 percent reduction in diarrheal mortality during the non-summer months, which is consistent with the hypothesis that transmission occurred through contaminated water. Perhaps surprisingly, there was little evidence that filtration affected diarrheal mortality during the months of June through September, suggesting that the phenomenon of summer diarrhea was driven by contaminated food or person-to-person contact. Improvements in the refrigeration chain, better nutrition, or some combination of these and other factors may have contributed to the dramatic decline in summer diarrheal deaths among infants and children in the United States shown in Figure 3.

The US Anti-Tuberculosis Movement

In 1900, 194 out of every 100,000 Americans died of TB, making it the second-leading cause of death behind pneumonia/influenza. By 1930, the TB mortality rate had fallen dramatically to 71 per 100,000 persons.¹⁷ Scholars have proposed several explanations for this decline, including improved nutrition, better living conditions, reduced virulence, and herd immunity. The introduction of basic public health measures is another possible and popular explanation.

Widely regarded as the first public health campaign, the US anti-tuberculosis movement was remarkable in its scope and intensity. During the early 1900s, hundreds of state and local TB associations sprang up across the United States. These associations distributed educational materials and provided financial support to sanatoriums and TB hospitals where TB patients were isolated from the general public. The anti-TB movement was also characterized by the passage of legislation at the state and local levels to, for instance, ban public spitting and forbid the use of common drinking cups, require physicians to report TB cases to public health officials, and mandate the disinfection of premises after the removal of a TB patient.

Using data on pulmonary TB mortality

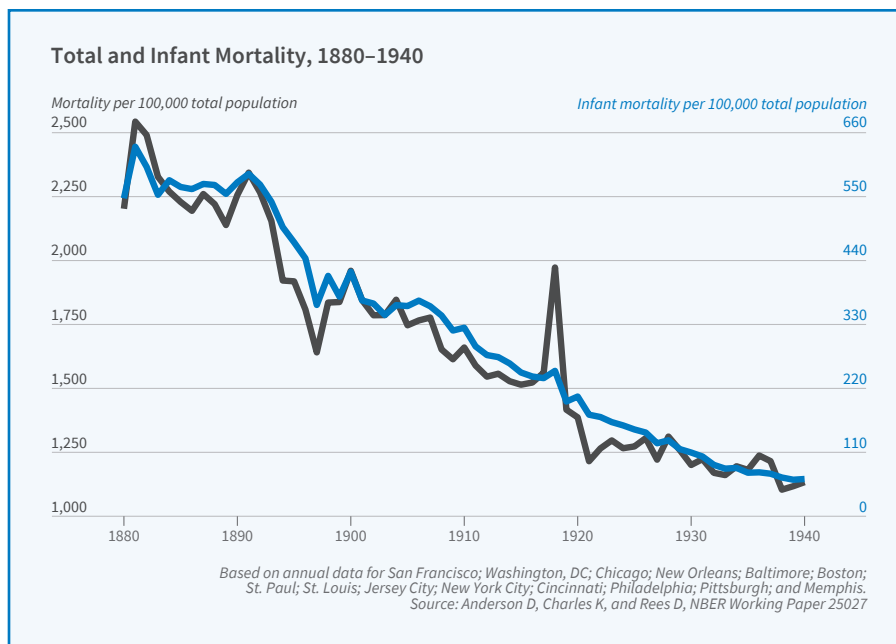


Figure 4

for over 500 municipalities, we explored the effectiveness of the public health measures championed by the anti-TB movement for the period 1900–1917.¹⁸ We found evidence that requiring TB cases to be reported to local health officials led to a modest reduction in pulmonary TB mortality. We also found that the establishment of a state-run sanatorium led to an almost 4 percent reduction in pulmonary TB mortality. By

What's Next?

Figure 4 shows total and infant mortality trends over the period 1880–1940 for a sample of 14 US cities. It is based on data from the US Census Bureau's Mortality Statistics and Vital Statistics of the United States for the period 1900–1940, and mortality data we recently gathered from the archives at the National Library of Medicine for the period 1880–1899. Figure 5 shows typhoid mortality trends for the same years for these 14 cities.

The research projects described above provide little evidence to support the notion that public health measures drove the mortality transition in the United States. It is, of course, possible that other factors such as nutrition and income were responsible for the steep

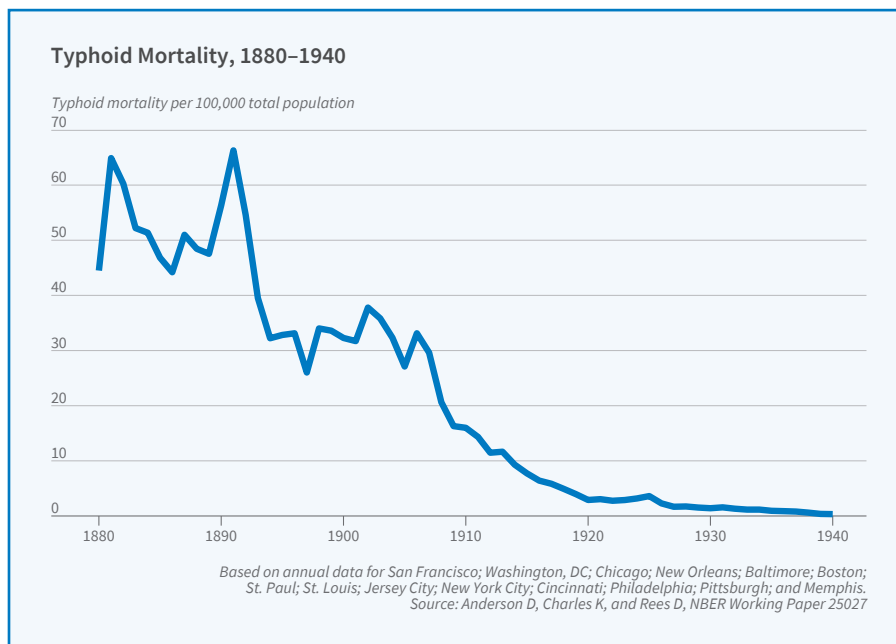


Figure 5

decline in mortality starting in the mid-19th century, but it is worth noting that each of our research projects used data from the early 20th century, when the mortality transition was well underway. Our plan is to analyze the determinants of urban mortality in the 19th century, when public health innovations included the building of extensive sewer systems and the establishment of pathology laboratories by local health departments. Refrigeration, in the form of manufactured ice, also made its first appearance in the last decades of the 19th century. Our future research will explore the effect of these and other innovations on the mortality transition.¹⁹

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[Return to Text](#)



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Muller teaches microeconomics, benefit-cost analysis, environmental and natural resource economics, and energy policy. Much of his research focuses on the development and subsequent use of integrated assessment models for air pollution. He uses these tools to measure air pollution damage and to inform the design of market-based policies. His current work focuses on global environmental accounting and sustainability, estimating air pollution and greenhouse gas damage in the US economy in 2017, air pollution policy and municipal finance systems, and developing environmental performance measures for ESG indices. He is the director of the Tepper School's Sustainability Initiative and a coeditor of the *Journal of the Association of Environmental and Resource Economists*.

Muller has consulted for federal, state, and local governments, environmental advocacy groups, and publicly traded firms. From 2015 to 2017, he served on the United States Environmental Protection Agency's Scientific Advisory Board. Muller has published papers in the *American Economic Review*, *Science*, *Proceedings of the National Academy of Sciences*, *Nature Sustainability*, and *Nature Climate Change*. He earned his PhD from Yale University's School of the Environment.

Augmenting National Income Statistics to Include Environmental Services

Nicholas Z. Muller

For nearly a century, the National Income and Product Accounts (NIPAs) have provided policymakers, investors, academics, and the lay public with essential indicators of economic performance. However, since their inception, it has been widely acknowledged, especially among economists, that the NIPAs are an incomplete gauge of output and growth. Critical omissions include the value of home production, leisure time, environmental pollution damage, and natural resources in situ.

Beginning with the seminal work of William Nordhaus and James Tobin in 1973, economists have estimated the magnitude of these gaps.¹ Subsequent research estimating the magnitude of pollution damage in the United States and the global economy finds that they loom large relative to conventionally measured output.² Both their magnitude and the central importance of the NIPAs to decision-making broadly suggest that including environmental pollution damage in an augmented accounting system would have far-reaching consequences. The importance of this augmentation lies in four areas: the level of output and its distribution across sectors within the economy, growth, monetary policy, and sustainability. This research summary highlights key issues and research in each of these domains.

By way of background, it is important to recount some of the historical obstacles to empirical estimation of pollution damage as well as remaining challenges to developing an augmented system of accounts. First, at the time of Nordhaus and Tobin's work, emission quantities of

common air and water pollutants were just beginning to be measured in a rigorous fashion. In the US, the passage of landmark environmental legislation in the early 1970s meant that regulators were now charged with tracking emissions in order to document compliance. This was a crucial step toward enabling environmental accounting. Second, the effects of pollution on human health, one of the most important sources of damage from pollution exposure, were just beginning to be known. The pioneering work of Lester Lave and Eugene Seskin provided some of the earliest quantitative evidence of pollution's association with mortality risk.³ Even today, this effect category remains the largest single quantifiable contributor to environmental pollution damage. Third, monetization of nonmarket services such as mortality risk was in its infancy. In 1968, Thomas Schelling developed the idea of valuing tradeoffs between mortality risk and income.⁴ This approach, known as the Value of a Statistical Life (VSL), is one of the most important parameters in environmental benefit-cost analysis and environmental accounting. Finally, though in 1973 the social cost of carbon had not been estimated, this parameter is central to estimates of damages from greenhouse gases.

Documenting environmental pollution damage affects the magnitude of aggregate output, net of pollution damage, and the contribution to national product across economic sectors. For example, air pollution damage from the production side of the economy amounted to over 5 percent of gross domestic product (GDP) in 2002.⁵ Importantly,

this estimate does not include emissions from households' economic activity such as combusting fossil fuels for space heating, water heating, cooking, and personal transport.

The degree of pollution intensity varies dramatically across sectors. In the early 21st century, agriculture and utilities generated air pollution damage on par with reported value-added (VA), whereas the pollution intensity of output from the manufacturing sector was much lower.⁶ Drilling down further, several industries produced damage in excess of their VA. These particularly polluting industries included enterprises in waste management and fossil-fuel-fired power generation.⁷ Since the early 21st century, the US economy has greatly reduced its air pollution intensity due to both regulatory and market forces.⁸ Some sectors, such as utilities, transportation, and manufacturing, spearheaded this reduction, while others, like agriculture, remain pollution-intensive.⁹

Tracking environmental pollution damage also affects apparent growth rates. How growth changes when pollution damage is deducted from GDP or VA depends on the relative rates of change. If pollution damage rises more rapidly than GDP or VA, then the adjusted measure (which deducts damage) will grow more slowly. Conversely, if pollution damage grows less rapidly, or falls over time, the adjusted measure of output will outpace GDP or VA. I have presented estimates of these effects in the US economy between 1957 and 2016.¹⁰ This period featured the passage of the Clean Air Act (CAA) in 1970 and its subsequent implementation through the 1970s, as well as several business cycles. This research suggests that pollution dam-

age began to decrease just after the CAA was enacted, and the orientation between GDP growth and that of the adjusted measure, or environmentally adjusted value added (EVA), switched.

Prior to 1970, damage grew at above 4 percent annually, while GDP increased by between 2 and 3 percent. Thus, EVA grew by less than 2 percent. After the CAA became law in the 1970s, damage fell by 1 percent per year, GDP grew at a 2 percent rate, and EVA expanded by more than 3 percent.¹¹ This reversal of the orientation between EVA and GDP growth

benefits of reduced pollution.¹²

The differences between GDP growth and EVA also have ramifications for monetary policy. One of the key determinants of central banks' interest rate targets is the natural interest rate. This is conventionally defined as the rate at which an economy operates at its full potential. What comprises full potential depends on how output is measured. Specifically, recognizing pollution damage lowers real output in any given period relative to a measure that overlooks pollution. Policymakers' expectations about trend

growth in output also factor into estimates of the natural interest rate. As demonstrated above, EVA growth may diverge appreciably from GDP growth. My recent research explores the difference between conventional estimates of the natural interest rate and a green interest rate based on EVA.¹³ If policymakers were to employ the green interest rate target, pollution damage would fall because consumption is reallo-

cated from periods of high pollution intensity to periods of low pollution intensity. The effect of this alternative rate is greatest following the introduction of binding environmental policy, during periods of rapid technological innovation, and over the business cycle. This research may inform central banks that have expressed concerns over direct risks from climate change and transition risk as the global economy decarbonizes.

Measuring environmental pollution damage also informs assessments of sustainability. Economists have defined sustainable growth as that which results in non-negative capital formation.¹⁴

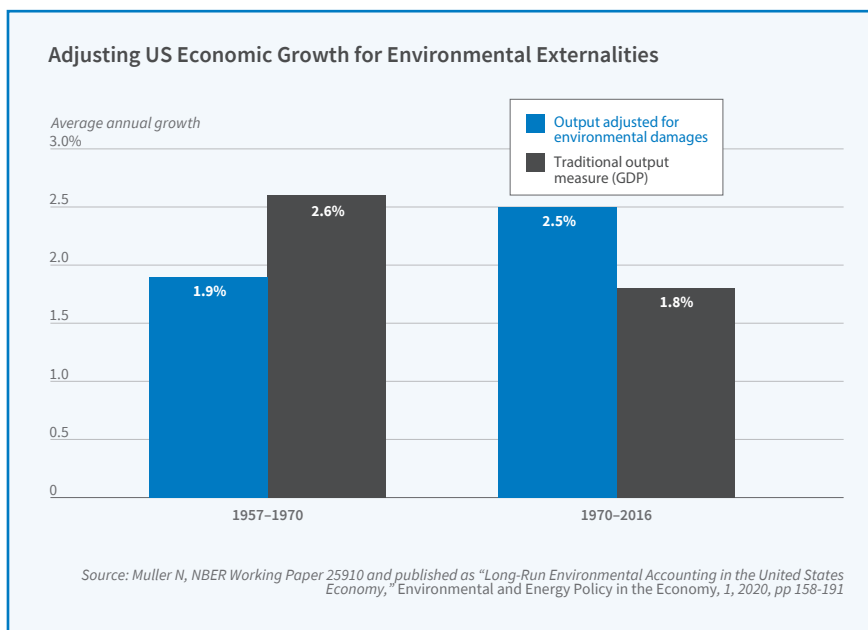


Figure 1

rates before and after 1970 is shown in Figure 1. The heightened rate of EVA growth after 1970 has potentially broad implications for the measurement of productivity. As the United States allocated trillions of dollars to the provision of environmental public goods, GDP growth waned relative to its pre-1970 levels. But GDP fails to capture the returns to these investments. The estimates of EVA growth, while only a partial measure of the environmental benefits of the CAA and other environmental legislation, reveal that our productivity estimates might be appreciably affected if they were to include nonmarket pecuniary

Pollution damage is, in effect, natural capital depreciation. Thus, accounting for pollution has the potential to influence whether economies grow sustainably because rising pollution damage represents capital depreciation while falling damage is a form of capital appreciation.

A recent working paper computes air pollution and greenhouse gas damage for 168 countries from 1998 to 2018.¹⁵ This damage is then deducted from GDP to tabulate EVA. This research shows that North American and Western European economies have been cleaning up since the late 1990s. Damage as a percentage of GDP has fallen significantly in these countries. In contrast, China and India have grown considerably more pollution-intensive over this time. Countries in the lowest income category have shown no change in pollution intensity. A comparison of EVA and GDP growth rates reveals that EVA expanded more rapidly than GDP in Western Europe and North

America. In contrast, GDP growth exceeded EVA growth in China and India by as much as 100 basis points during the period under study.

This research also compares sustainability defined in terms of emissions, as is done in prior work,¹⁶ and in terms of monetary damage. A comparison of the United States and China [Figure 2] demonstrates the importance of this distinction. Measures of ambient air pollution in China have fallen since 2012. Growth in carbon dioxide (CO₂) emissions has decreased rapidly. Thus, one might conclude that China has begun to grow sustainably. In contrast, damage from air pollution and CO₂ continues to rise rapidly. Thus, according to the definition of

sustainable growth based on damages, China has not yet achieved a sustainable growth path.

Much of the prior work focusing on measuring pollution damage zeroes in on air pollution and greenhouse gases, but a notable exception examines the consequences of the Clean Water Act in terms of costs and benefits as capitalized into housing prices.¹⁷ Ongoing research on sustainable growth, and environmental accounting more generally, should focus on other pollutants beyond the local air

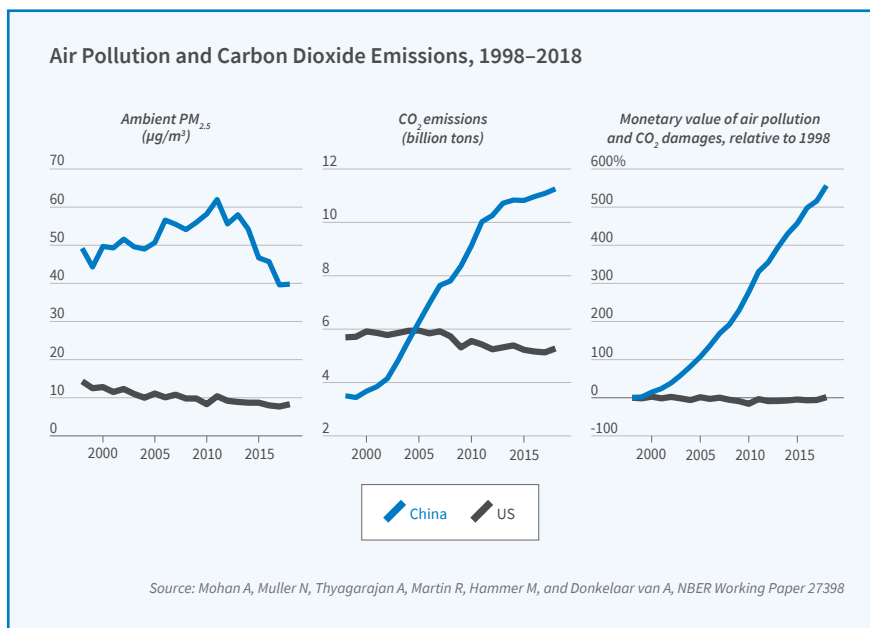


Figure 2

pollutants and primary greenhouse gases discussed above, and on other pollution types such as water, solid waste, and toxins. Inclusion of these pollutants may appreciably affect the conclusions drawn from the research cited above.

Finally, though data sources and methods always may be improved, the techniques used to estimate pollution damage have matured to the point where regulators could develop a set of environmental accounts. Doing so has the potential to broadly affect the perceived performance of the US economy and the economies of others around the world.

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Donna K. Ginther is the Roy A. Roberts Distinguished Professor of Economics and director of the Institute for Policy and Social Research at the University of Kansas. She is a research associate affiliated with the NBER's Labor Studies Program and Program on Children; her major fields of study are scientific labor markets, gender differences in employment outcomes, wage inequality, scientific entrepreneurship, and children's educational attainments.

Ginther has published in *Science*, the *Journal of the American Statistical Association*, the *Journal of Economic Perspectives*, *Demography*, *Psychological Science in the Public Interest*, and *American Economic Association Papers and Proceedings*. Her research has been supported by the National Science Foundation, the National Institutes of Health (NIH), the Alfred P. Sloan Foundation, and the Ewing Marion Kauffman Foundation, and has been featured in *The Economist*, *The New York Times*, *The Washington Post*, National Public Radio, and other major media.

Ginther testified before the Subcommittee on Research and Science Education of the US House of Representatives on the Fulfilling the Potential of Women in Academic Science and Engineering Act of 2008, and has advised the National Academy of Sciences, the NIH, and the Sloan Foundation on the diversity and future of the scientific workforce. She currently serves as chief academic adviser to Kansas Governor Laura Kelly's Tax Reform Council.

Gender, Race, and Academic Career Outcomes — Does Economics Mirror Other Disciplines?

Donna K. Ginther

The textbook model of the labor market posits that workers are paid their marginal products. In this setting, equally productive workers should be paid and promoted at the same rate. While in the general labor market we are able to observe individual education, industry, occupation, and earnings, in most cases it is difficult to link individuals' capital investments and productivity outcomes. My research has focused on academic labor markets because capital — in the form of federal research funding — and output — in the form of publications and citations — can be linked to individuals to yield new findings about academic careers and knowledge production.

Together with my collaborators, I have examined gender and race/ethnicity differences in research career outcomes as well as the effect of

research funding on research productivity. New and improved datasets and administrative data have yielded key insights on these issues.

Gender Differences in Career Outcomes for Economists

With my long-time collaborator Shulamit Kahn, who has played a key role in this work, I have examined gender differences in career outcomes for economists and for other academic fields. We found that after controlling for research publications, women were significantly less likely to be promoted to tenure in economics.¹ Our most recent study used Academic Analytics data to update the analysis of the economics profession compared with other science and social science fields.² Figure 1 shows survival curves by gender and

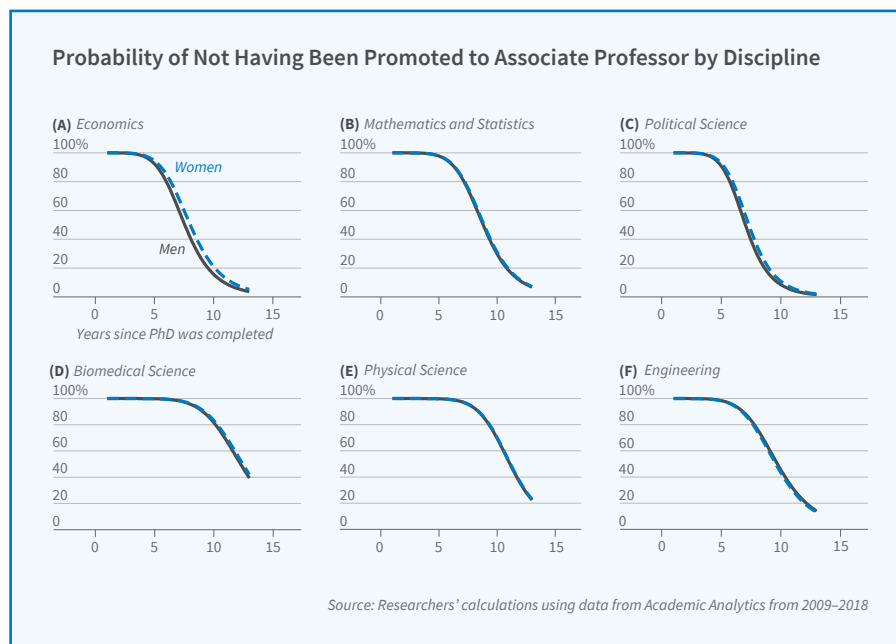


Figure 1

compares economics to the fields of mathematics and statistics, political science, biomedical science, physical science, and engineering. The only significant gender difference in promotion to associate professor is in economics, where women were 15 percent less likely to be promoted after controlling for publications, citations, and research grants.

We split the sample into top research and less research-intensive institutions, and our results suggest that women's promotion disadvantage in economics is driven by lower-ranked research universities. The results also show that the gender parity in academic promotion in science careers that Kahn and I found using data through 2001 persists at least in research-intensive universities.³ Furthermore, our research shows that aggregating separate academic fields into the broad science, technology, engineering, and mathematics (STEM)

category ignores the fact that each academic field constitutes a unique labor market. What is true of the economics profession does not generalize to other academic disciplines.

While women remain disadvantaged in academic careers in economics, the CeMENT program developed by the Committee on the Status of Women in the Economics Profession (CSWEP) and initially supported by a National Science Foundation grant to the American Economic Association has shown promise in improving women's academic career outcomes. CeMENT was designed as a randomized controlled mentoring trial. Together with Francine Blau, Rachel Croson, and the head of the CeMENT research team, Janet Currie, we evaluated the impact

of the program six years and 14 years after the first cohort began the mentoring process. Our interim evaluation found that women who participated in the two-and-a-half-day workshop published more papers overall and in top economics journals, and received more research funding than comparable scholars who did not participate.⁴ Our subsequent evaluation of six cohorts found that women who par-

aged them to form more research collaborations.⁶

Gender and Race/Ethnicity Differences in Academic Careers

In addition to studying the economics profession, my coauthors and I have examined gender and race/ethnicity differences in STEM careers. In two separate reviews of the literature,

we have examined the antecedents for women's underrepresentation in math-intensive science fields: geoscience, engineering, economics, math and computer science, and physical science (GEEMP). Stephen Ceci, Wendy Williams, Kahn, and I examined the literature on gender differences in academic science careers in GEEMP fields where women are underrepresented and in life science, psychology, and social sci-

ence fields (LPS — where social science excludes economics) where women have reached parity or are overrepresented.⁷

This review began with the literature on in utero conditions and early childhood and spanned the life course to academic career placements. We found significant gender differences in attitudes toward mathematics that emerged in kindergarten and led to lower propensities for girls to major in the mathematics-intensive GEEMP fields. However, gender differences in math performance primarily emerged after puberty and differed across countries and cultures. Our research found little evidence for bias against women in academic careers conditional on receiving a doctorate. We found that women were less likely to remain in academia

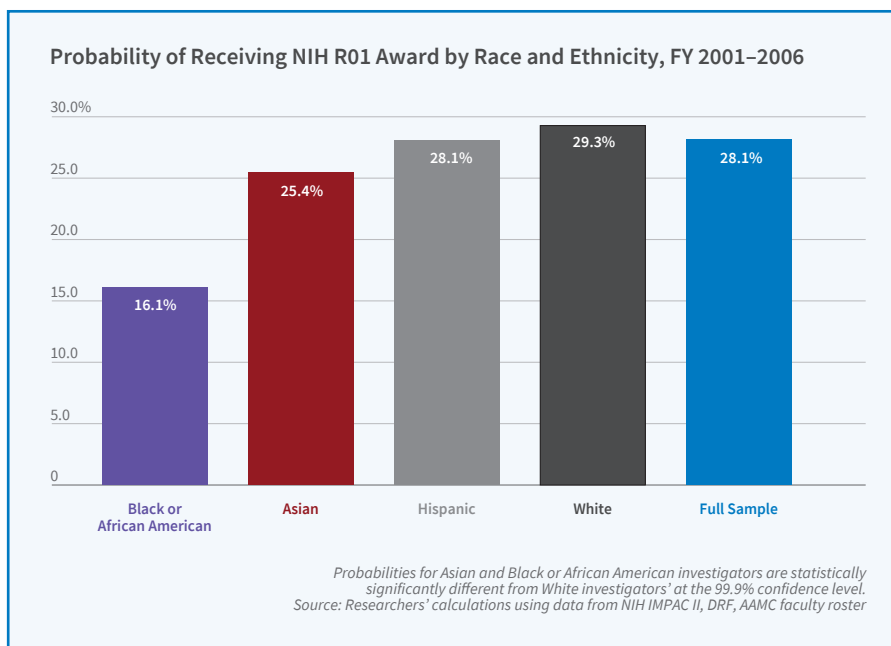


Figure 2

ticipated in CeMENT published more papers overall and in the top five journals, and were more likely to get tenure in the top 100 research departments.⁵

Work with Rina Na examined potential mechanisms behind CeMENT's success. One can think of the CeMENT workshop as a random shock to professional networks. We found that women had significantly more coauthors after being mentored. These additional coauthors contributed to more publications. However, few of these women formed collaborations with women who attended the workshop. Instead, they added an average of three new coauthors in the profession. We interpret this result as showing women received tacit knowledge from the workshop that encour-

in the LPS fields where they are over-represented, but this is not true in the GEEMP fields. Kahn and I revisited this issue by focusing almost exclusively on the economics literature. As with our previous work, we distinguished between GEEMP and LPS fields and concluded that the roots of women's underrepresentation in GEEMP fields starts in childhood, where girls lack role models and face biased views on women and mathematics achievement in their families or schools.⁸

What is true of gender differences in academic careers does not generalize to race/ethnicity differences. Using administrative data from the National Institutes of Health, Walter Schaffer, Joshua Schnell, Beth Masimore, Faye Liu, Laurel Haak, Raynard Kington and I examined race/ethnicity differences in the likelihood of receiving NIH R01 research awards. The R01 mechanism at NIH is designed for investigator-initiated research awards and is the mark of an independent research career. Figure 2 shows the race/ethnicity differences in R01 research awards. African American or Black investigators were half as likely to receive NIH funding as White investigators. Even after controlling for education, prior research awards, employer characteristics, and publications, we could explain less than 25 percent of the African American or Black/White funding gap.⁹ This research resulted in a series of working groups at NIH to investigate the lack of diversity of the biomedical workforce,¹⁰ and a 10-year, \$500 million commitment to improve outcomes for African American or Black NIH investigators.¹¹

Based on feedback from the advisory committee to the director of the NIH's Working Group on Diversity in the Biomedical Research Workforce, Schaffer, Schnell, Kington

and I, along with Jodi Basner and Unni Jensen, revisited the previous analysis by coding every line of nearly 2,400 NIH biosketches and matching the 54,000 publications listed on these biosketches to their bibliometric records. Our research showed that African American or Black investigators reported fewer papers on their biosketches, had fewer citations, and those that were reported appeared in journals with lower impacts. Using improved measures of publications, we were able to explain half of the African American or Black/White NIH funding gap.¹² We also examined how careers diverged in terms of publications and citations.

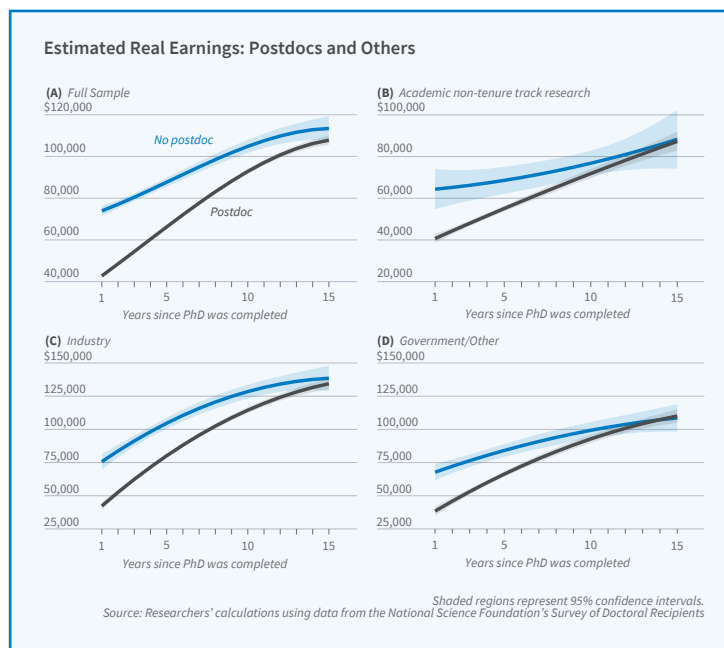


Figure 3

Although African American or Black investigators published the same number of papers during their PhD and postdoc years, these papers were cited less often. These results imply that African American or Black investigators may not receive the same advice from mentors as Whites related to research topics and publication strategies during doctoral training. These disadvantages accumulate as the African American or Black/White publication and citation gaps widen when African American or Black researchers become principal investigators.

Research Funding and Early Career Scientists

With Joshua Rosenbloom and other collaborators, I have also examined how research funding affects knowledge production in chemistry. We created a panel of the top 147 funded chemistry departments in the United States along with faculty, graduate student, and postdoc counts in the period 1990–2009. Rosenbloom, Joseph Heppert, Ted Juhl, and I found that research funding to academic chemistry departments increased publication and citation-weighted publications.¹³ In particular, our research identified rapid growth in chemistry knowledge production in the 1990s that we attributed to technological change in the form of lab computerization. In a follow-up study, Rosenbloom and I examined the determinants of institution-level chemistry research funding.¹⁴ We found that institutional funding was much more volatile than discipline-level funding for chemistry. Our estimates showed that research capacity in the form of numbers of postdocs and prior publications predicted subsequent research funding in chemistry. The fact that postdocs were a key input for future research funding underscores their importance to the scientific enterprise.

While postdocs are important predictors for institutional research funding, Kahn and I looked into the value of the postdoc to an individual's career. It turns out to be "not much," at least when it comes to earnings.¹⁵ Using data from the National Science Foundation's Survey of Doctorate Recipients, we tracked people who started in a postdoc and then compared their outcomes to those of people who skipped the postdoc in biomedical research fields. We found that, over time, the proba-

bility of obtaining a tenure-track faculty position in biomedical fields has dropped dramatically, but despite that, the majority of PhDs in biomedicine start their careers in postdoctoral positions. However, the postdoc entails a significant opportunity cost: we found that former postdocs earned less than those who skipped the postdoc up to 10 years after the PhD. Figure 3 shows the estimated salaries of individuals who start in and skip the postdoc. Individuals who skip the postdoc have higher earnings for the first 13 years of their careers in the full sample (Panel A). We found similar salary penalties for non-tenure-track academic research, industry, and government employment sectors (Panels B, C, and D). Over the first 15 years of their careers, ex-postdocs earn 17 percent less than non-postdocs in non-tenure-track academic research, 21 percent less in industry, and 17 percent less in government. We concluded that the postdoc is not consistent with a human capital investment, and instead operates as a tournament for the limited number of tenure-track positions. The only benefit of doing a postdoc is its association with a tenure-track research position. By and large, we conclude, most young scientists would be economically better off skipping the postdoc.

However, not all postdocs are created equal. The NIH's Advisory Committee to the Director on the Biomedical Workforce called for additional opportunities for postdoctoral fellowships.¹⁶ In two papers, we examined the causal impact of the NIH F32 fellowship — a mentored, independent postdoctoral fellowship — on career outcomes as well as the role of discretion in making these awards. Misty Heggeness, Maria Larenas, Frances Carter-Johnson, and I examined the causal impact of NIH F32 fellowships on subsequent NIH funding.¹⁷ Previous research by Brian Jacob and Lars Lefgren modeled the F32 fellowship using a regression discontinuity design, but we found evidence of significant discretion in F32 awards.¹⁸

Using propensity score methods, we found that receiving the F32 fellowship increased the probability of receiving an NIH R01 award by 49 percent.

Heggeness and I probed the role of discretion in awarding F32 fellowships, asking whether the NIH peer review process identifies the best science and most-promising future scientists. The answer is yes. NIH has a two-stage review process where proposals are first given an overall score. In the second stage, an NIH institute can make one of three decisions: 1) fund proposals in order given the score; 2) skip over higher scoring proposals and do not fund them in favor of ones more aligned with the institute's scientific priorities; 3) reach for worse-scoring proposals and fund them because of institute priorities. Whenever an institute "skips" or "reaches" for a proposal, it is exercising discretion. We compared the outcomes of proposals that were funded in order based on their review score to those that received meritorious scores but were "skipped" and those that had worse scores and were "reached." Those that were "reached" compared to not funded were 60 percent more likely to receive an R01 award. However, those that were "reached" were 35 percent less likely to receive subsequent R01 funding than those that were "skipped" and not funded. There was no significant difference in receiving an R01 award between those that were "skipped" and those that were funded in order.¹⁹ Thus, we concluded that the NIH F32 peer review process does a good job of identifying the most promising scientists early in their careers. Those with exemplary peer review scores are more likely to have independent research careers, regardless of whether they receive funding. Although peer review has many critics, our results indicate that it is an efficient method of allocating research funding compared with institutional discretion.

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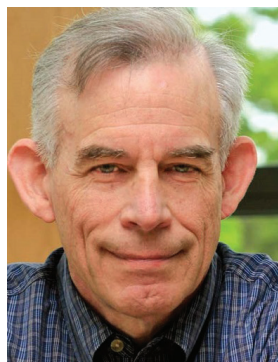
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[Return to Text](#)

Three New Directors Elected to NBER Governing Board



Maureen O'Hara



Christopher Sims



Richard H. Steckel

Maureen O'Hara, Christopher Sims, and Richard H. Steckel were elected to the NBER Board of Directors at the board's September 2021 meeting.

O'Hara is the Robert W. Purcell Professor of Finance at Cornell University's Johnson Graduate School of Management. She is the board representative of the American Finance Association. Her research focuses on market microstructure, most recently including issues such as how exchange-traded funds affect market stability, liquidity in corporate bond markets, and transaction costs in bitcoin. She is a past president of the American Finance Association, the Western Finance Association, the Financial Management Association, and the Society for Financial Studies, and serves on the Board of Trustees of Teachers Insurance and Annuity Association (TIAA). For more than a decade, she chaired the board of the Investment Technology Group, Inc., a global agency brokerage firm.

She received her BS in economics from the University of Illinois, and an MS in economics and PhD in finance from Northwestern University.

Sims is the John J. F. Sherrerd '52 University Professor of Economics, emeritus, at Princeton University. He is that university's representative on the board of directors. His main areas of research are econometric theory for dynamic models and macroeconomic theory and policy. Together with Thomas Sargent, he was awarded the Nobel Memorial Prize in Economic Sciences in 2011

for "empirical research on cause and effect in the macroeconomy." Sims is a past president of the American Economic Association and the Econometric Society, and a member of the American Academy of Arts and Sciences and the National Academy of Sciences. He was an NBER research associate for more than four decades before joining the board of directors. He earned both his AB in mathematics and his PhD in economics from Harvard University.

Steckel is a Distinguished University Professor and professor of economics, emeritus, at The Ohio State University, which he represents on the board. He is an economic historian with strong interests in demography. His research focuses on measurement of long-term trends in the standard of living using diverse sources and methodologies, including heights and skeletal remains. A pioneer in the field of anthropometric history, Steckel is a past president of both the Economic History Association and the Social Science History Association. He was an NBER research associate for four decades before joining the board of directors. He earned his AB from Oberlin College, master's degrees in economics and mathematics from the University of Oklahoma, and an MA and PhD in economics from the University of Chicago.

In addition to these new appointments, the NBER board elected Martin Gruber of New York University, formerly the board member representing the American Finance Association, to emeritus status.

40 Faculty Research Fellows Become Research Associates

The NBER Board of Directors promoted 40 faculty research fellows to research associates at its September 2021 meeting. Research associates must be tenured faculty members at North American colleges or universities; their appointments

are recommended to the board by directors of the NBER's 20 research programs, typically after consultation with a steering committee of leading scholars. The new research associates are affiliated with 34 different colleges and universities; they

received graduate training at 21 different institutions. As of October 1, 2021, there were 1,325 research associates and 306 faculty research fellows. The names and university affiliations of newly promoted research associates are listed below.

Research Associates

Jason Abaluck	----- Yale University -----	Aging
Samuel Bazzi	----- University of California, San Diego -----	Development Economics
Nicola Bianchi	----- Northwestern University -----	Economics of Education
Peter Blair	----- Harvard University -----	Economics of Education
Jing Cai	----- University of Maryland -----	Development Economics
Steve Cicala	----- Tufts University -----	Environment and Energy Economics
Anna Cieslak	----- Duke University -----	Asset Pricing
Sarah Cohodes	----- Columbia University -----	Economics of Education
Javier Cravino	----- University of Michigan -----	International Finance and Macroeconomics
Jeffrey Denning	----- Brigham Young University -----	Economics of Education
Rebecca Diamond	----- Stanford University -----	Labor Studies
Christian Dippel	----- University of Western Ontario -----	Political Economy
Shari Eli	----- University of Toronto -----	Development of the American Economy
Katherine Eriksson	----- University of California, Davis -----	Development of the American Economy
Kenneth Gillingham	----- Yale University -----	Environment and Energy Economics
Adam Guren	----- Boston University -----	Monetary Economics
Valentin Haddad	----- University of California, Los Angeles -----	Asset Pricing
Kyle Handley	----- University of California, San Diego -----	International Trade and Investment
Samuel Hanson	----- Harvard University -----	Corporate Finance
Mitchell Hoffman	----- University of Toronto -----	Productivity, Innovation, and Entrepreneurship
Taylor Jaworski	----- University of Colorado -----	Development of the American Economy
Ashley Langer	----- University of Arizona -----	Environment and Energy Economics
Jennifer La'O	----- Columbia University -----	Monetary Economics
Ethan Lieber	----- University of Notre Dame -----	Health Care
Haizhen Lin	----- Indiana University -----	Health Care
Ioana Marinescu	----- University of Pennsylvania -----	Labor Studies
Ian McCarthy	----- Emory University -----	Health Economics
Robert Metcalfe	----- University of Southern California -----	Environment and Energy Economics
David Molitor	----- University of Illinois -----	Health Care

Research Associates

Melanie Morten	----- Stanford University -----	Development Economics
Erik Nesson	----- Ball State University -----	Health Economics
Pablo Querubín	----- New York University -----	Political Economy
Maya Rossin-Slater	----- Stanford University -----	Children
Jessamyn Schaller	----- Claremont McKenna College -----	Children
Hitoshi Shigeoka	----- Simon Fraser University -----	Aging
Emilia Simeonova	----- Johns Hopkins University -----	Children
Sita Slavov	----- George Mason University -----	Aging
Richard Townsend	----- University of California, San Diego -----	Productivity, Innovation, and Entrepreneurship
Margarita Tsoutsoura	----- Cornell University -----	Corporate Finance
James West	----- Baylor University -----	Economics of Education

Benjamin Jones, Heidi Williams Leading Innovation Policy Working Group

Benjamin Jones and Heidi Williams are the new codirectors of the NBER Innovation Policy Working Group. Jones is the Gordon and Llura Gund Family Professor in Entrepreneurship and Professor of Strategy at Northwestern University's Kellogg School of Management. Williams is the Charles R. Schwab Professor



Benjamin Jones



Heidi Williams

of Economics at Stanford University and a senior fellow at the Stanford Institute of Economic Policy Research. They succeed Scott Stern, the David Sarnoff Professor of Management at MIT's Sloan School

of Management, who, along with Adam Jaffe of Brandeis University and Josh Lerner of the Harvard Business School, launched the working group over two decades ago.

The new codirectors have studied a wide range of issues in the field of innovation economics. Jones' research focuses on the contributions of innovation and scientific progress to economic growth. He has been an NBER affiliate since 2005. Williams' research examines the determinants and consequences of technological

change, with a particular emphasis on innovation in the healthcare sector. She has been an NBER affiliate since 2010, and also is a codirector of the NBER Health Care Program.

Hoffman Codirecting Personnel Economics Working Group



Mitchell Hoffman

Mitchell Hoffman, an associate professor of strategic management at the University of Toronto's Rotman School of Business Management and a research associate at the NBER, is a new codirector of the Personnel Economics Working Group. He joins the current director, Kathryn Shaw of the Stanford Graduate School of Business, in this role. Hoffman's research focuses on

the determinants of workplace productivity and human resource economics, in particular on the hiring process and the role of various sources of information, including employee referrals, in contributing to hiring outcomes. Hoffman received his BA in economics from Yale University and his PhD from the University of California, Berkeley. He became an NBER affiliate in 2005.

Conferences

The Economics of Caregiving

An NBER conference on the Economics of Caregiving took place online on June 4. Research Associates Claudia Goldin of Harvard University, Claudia Olivetti of Dartmouth College, Rohini Pande of Yale University, and Alessandra Voena of Stanford University organized the meeting, which was supported by the Bill and Melinda Gates Foundation. These researchers' papers were presented and discussed:

- **Rebecca Thornton**, University of Illinois at Urbana-Champaign; **Scott Cunningham**, Baylor University; and **Gregory DeAngelo**, **Yunie Le**, and **Anuar Assamidanov**, Claremont Graduate University, "COVID-19, Shelter-in-Place, and Domestic Violence"
- **Heidi Stöckl**, London School of Hygiene and Tropical Medicine, and **Gerry H. Mshana**, National Institute for Medical Research, "The Effect of COVID-19 on Women, Livelihood and Violence in Mwanza, Tanzania"
- **Sonia R. Bhalotra**, University of Warwick; **Emilia Brito Rebolledo**, Brown University; **Pilar Larroulet**, Pontificia Universidad Católica de Chile; and **Damian Clarke** and **Francisco Pino**, University of Chile, "Dynamic Impacts of Lockdown Mandates on Domestic Violence — Evidence from Multiple Policy Shifts in Chile"
- **María José Prados**, University of Southern California, and **Gema Zamarro**, University of Arkansas, "School Reopenings, Childcare Arrangements, and Labor Outcomes during COVID-19"
- **Orazio Attanasio**, Yale University and NBER; **Ricardo Paes de Barros**, Insper; **Pedro Carneiro**, University College London; **David K. Evans**, Center for Global Development; **Lycia Lima**, Fundação Getulio Vargas; **Pedro Olinto**, World Bank; and **Norbert Schady**, Inter-American Development Bank, "Public Childcare, Child Development, and Labor Market Outcomes"
- **Kuan-Ming Chen**, University of Chicago, "Understanding Adult Children's Labor Supply Responses to Parents' Long-Term Care Needs"
- **Pierre Pora**, Drees-CREST-EconomiX, "Keep Working and Spend Less? Collective Childcare and Parental Earnings in France"
- **Karen Shen**, Harvard University, "Who Benefits from Public Financing of Home Care for Low-Income Seniors?"
- **Kjetil Bjorvatn**, Norwegian School of Economics; **Denise Ferris**, BRAC; **Selim Gulesci**, Trinity College Dublin; **Arne Næsgowitz** and **Vincent Somville**, Norges Handelshøyskole; and **Lore Vandewalle**, Graduate Institute, Geneva, "Childcare and Cash Grants for Labor Supply and Well-Being: Experimental Evidence from Uganda"
- **Nicole Maestas**, Harvard University and NBER; **Matt Messel**, Social Security Administration; and **Yulya Truskinovsky**, Wayne State University, "Caregiving and Labor Force Participation: New Evidence from Administrative Data"
- **Keith Finlay**, US Census Bureau; **Michael G. Mueller-Smith**, University of Michigan; and **Brittany Street**, University of Missouri, "The Determinants and Aftermath of Victimization in US Households and the Implications of COVID-19"
- **Sarah J. Baird**, George Washington University, and **Manisha Shah**, University of California, Los Angeles and NBER, "The Shadow Pandemic: COVID-19 and Violence against Adolescent Girls in LMICs"

- **Madhulika Khanna**, Georgetown University, and **Divya Pandey**, University of Virginia, “Reinforcing Gender Norms or Easing Housework Burdens? The Role of Mothers-in-Law in Determining Women’s Labor Force Participation”
- **Erica M. Field**, Duke University and NBER, and **Ursula T. Aldana**, Institute for Peruvian Studies, “The Impact of COVID-19 on Intimate Partner Violence in Urban Peru”
- **Amalia R. Miller**, University of Virginia and NBER; **Carmit Segal**, University of Zurich; and **Melissa Spencer**, University of Richmond, “Effects of the COVID-19 Pandemic on Domestic Violence in US Cities” (NBER Working Paper 28068)
- **Bilge Erten** and **Silvia Prina**, Northeastern University, and **Pinar Keskin**, Wellesley College, “Social Distancing, Stimulus Payments and Domestic Violence: Evidence from the US during COVID-19”
- **Pelin Akyol** and **Zeynep Yilmaz**, Bilkent University, “Effects of Grandmothers’ Proximity on Mothers’ Labor Force Participation”

The conference agenda is at <https://www.nber.org/conferences/economics-caregiving-spring-2021>

COVID-19 and Health Outcomes

An NBER conference on COVID-19 and Health Outcomes took place online on June 16. Research Associates David M. Cutler of Harvard University and Kosali I. Simon of Indiana University organized the meeting, which was supported by Grant #P30AG012810 and Grant #P01AG005842 from the National Institute on Aging. These researchers’ papers were presented and discussed:

- **Aaron Chalfin**, University of Pennsylvania; **Shooshan Danagoulain**, Wayne State University; and **Monica Deza**, City University of New York and NBER, “The COVID-19 Pandemic, Domestic Violence and the Riskiness of Alcohol Consumption”
- **Natalie Bau** and **Manisha Shah**, University of California, Los Angeles and NBER; **Gaurav Khanna**, University of California, San Diego; **Corinne Low**, University of Pennsylvania and NBER; **Sreyashi Sharmin**, Stanford University; and **Alessandra Voena**, Stanford University and NBER, “Women’s Well-Being during a Pandemic and Its Containment”
- **Tom Chang**, University of Southern California; **Mireille Jacobson**, University of Southern California and NBER; **Manisha Shah**; and **Rajiv Pramanik** and **Samir B. Shah**, Contra Costa Health Services, “COVID-19 Vaccination Take-Up in a County-Run Medicaid Managed Care Population”
- **Michael Kremer**, University of Chicago and NBER, “Market Design to Accelerate COVID-19 Vaccine Supply”
- **Zirui Song** and **Lindsey Patterson**, Harvard University; **Lowry Barnes**, University of Arkansas; and **Derek Haas** and **Luka Zhang**, Avant-garde Health, “Hospitalizations, Mortality, and Racial/Ethnic Disparities in the COVID-19 Pandemic”

Summaries of some of these papers are at <https://www.nber.org/conferences/covid-19-and-health-outcomes-spring-2021>

International Seminar on Macroeconomics

The NBER International Seminar on Macroeconomics took place online on June 17–18. Research Associates Jordi Galí of Centre de Recerca en Economia Internacional, Barcelona, and Kenneth D. West of the University of Wisconsin-Madison organized the meeting. These researchers' papers were presented and discussed:

- **Emine Boz**, International Monetary Fund; **Camila Casas**, Banco de la República; **Gita Gopinath**, Harvard University and NBER (on leave) and International Monetary Fund; and **Georgios Georgiadis**, **Helena Le Mezo**, and **Arnaud J. Mehl**, European Central Bank, "Patterns in Invoicing Currency in Global Trade"
- **Philippe Bacchetta** and **Margaret Davenport**, University of Lausanne; and **Eric van Wincoop**, University of Virginia and NBER, "Can Sticky Portfolios Explain International Capital Flows and Asset Prices?"
- **Pierpaolo Benigno**, University of Bern; **Linda Schilling**, École Polytechnique CREST; and **Harald Uhlig**, University of Chicago and NBER, "Cryptocurrencies, Currency Competition and the Impossible Trinity" (NBER Working Paper [26214](#))
- **Silvia Miranda-Agrippino**, Bank of England, and **Tsvetelina Nenova**, London Business School, "A Tale of Two Global Monetary Policies"
- **Anusha Chari**, University of North Carolina at Chapel Hill and NBER; **Karlye Dilts Stedman**, Federal Reserve Bank of Kansas City; and **Kristin Forbes**, Massachusetts Institute of Technology and NBER, "Spillovers at the Extremes: The Macroprudential Stance and Vulnerability to the Global Financial Cycle"
- **Charles Engel**, University of Wisconsin-Madison and NBER, and **Ekaterina Kazakova**, **Mengqi Wang**, and **Nan Xiang**, University of Wisconsin-Madison, "A Reconsideration of the Failure of Uncovered Interest Parity for the US Dollar" (NBER Working Paper [28420](#))
- **John Hassler**, Stockholm University; **Per Krusell**, Stockholm University and NBER; and **Conny Olovsson**, Sveriges Riksbank, "Finite Resources and the World Economy"
- **Simon Gilchrist**, New York University and NBER; **Bin Wei**, Federal Reserve Bank of Atlanta; **Vivian Yue**, Emory University and NBER; and **Egon Zakrajšek**, Bank for International Settlements, "Sovereign Risk and Financial Risk"

Summaries of these papers are at <https://www.nber.org/conferences/international-seminar-macroeconomics-2021>

New Directions in Transportation Economics

An NBER conference on New Directions in Transportation Economics took place online on June 17. Research Associates Edward L. Glaeser of Harvard University, James M. Poterba of the Massachusetts Institute of Technology, and Stephen J. Redding of Princeton University organized the meeting, which was supported by the US Department of Transportation through an inter-agency agreement with the National Science Foundation (Grant 155903). These researchers' papers were presented and discussed:

- **Fiona Burlig**, University of Chicago and NBER; **James B. Bushnell**, University of California, Davis and NBER; **David S. Rapson**, University of California, Davis; and **Catherine Wolfram**, University of California, Berkeley and NBER (on leave) and US Department of the Treasury, "Low Energy: Estimating Electric Vehicle Electricity Use" (NBER Working Paper [28451](#))

- **Stephen P. Holland**, University of North Carolina at Greensboro and NBER; **Erin T. Mansur**, Dartmouth College and NBER; **Nicholas Z. Muller**, Carnegie Mellon University and NBER; and **Andrew J. Yates**, University of North Carolina at Chapel Hill, “The Environmental Benefits from Transportation Electrification: Urban Buses” (NBER Working Paper 27285)
- **Lucas W. Davis** and **James M. Sallee**, University of California, Berkeley and NBER, “Should Electric Vehicle Drivers Pay a Mileage Tax?” (NBER Working Paper 26072)

The conference agenda is at <https://www.nber.org/conferences/new-directions-transportation-economics-spring-2021>

Program Meeting

Economic Fluctuations and Growth

Members of the NBER’s Economic Fluctuations and Growth Program met online on July 17. Faculty Research Fellow Jennifer La’O of Columbia University and Research Associate Giovanni L. Violante of Princeton University organized the meeting. These researchers’ papers were presented and discussed:

- **Cecilia R. Caglio** and **Matthew Darst**, Federal Reserve Board, and **Şebnem Kalemli-Özcan**, University of Maryland and NBER, “Risk-Taking and Monetary Policy Transmission: Evidence from Loans to SMEs and Large Firms” (NBER Working Paper 28685)
- **Daron Acemoglu**, Massachusetts Institute of Technology and NBER, and **Pascual Restrepo**, Boston University and NBER, “Tasks, Automation, and the Rise in US Wage Inequality” (NBER Working Paper 28920)
- **Martin S. Eichenbaum**, Northwestern University and NBER, and **João Guerreiro** and **Riccardo Bianchi Vimercati**, Northwestern University, “Fiscal Policy at the Zero Lower Bound without Rational Expectations”
- **Daniel Greenwald**, Massachusetts Institute of Technology; **Matteo Leombroni**, Stanford University; **Hanno Lustig**, Stanford University and NBER; and **Stijn Van Nieuwerburgh**, Columbia University and NBER, “Financial and Total Wealth Inequality with Declining Interest Rates” (NBER Working Paper 28613)
- **Sergio de Ferra** and **Federica Romei**, University of Oxford, and **Kurt Mitman**, Institute for International Economic Studies, “Why Does Capital Flow from Equal to Unequal Countries?”
- **Francisco J. Buera** and **Yongseok Shin**, Washington University in St. Louis and NBER; **Hugo Hopenhayn**, University of California, Los Angeles and NBER; and **Nicholas Trachter**, Federal Reserve Bank of Richmond, “Big Push in Distorted Economies” (NBER Working Paper 28561)

Summaries of these papers are at <https://www.nber.org/conferences/economic-fluctuations-and-growth-summer-2021>

Economic Analysis and Infrastructure Investment

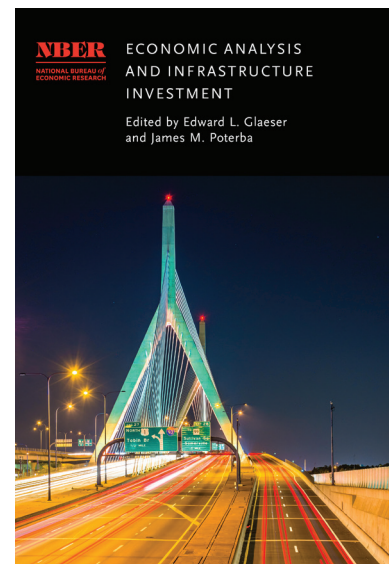
Edward L. Glaeser and James M. Poterba, editors

<https://press.uchicago.edu/ucp/books/book/chicago/E/bo125508048.html>

Policymakers often call for increasing public spending on infrastructure, which includes a broad range of investments from roads and bridges that facilitate moving people and goods to digital networks that will expand access to high-speed broadband. Some point to near-term macroeconomic benefits and job creation, while others focus on long-term effects on productivity and economic growth.

This volume explores the links between infrastructure spending and economic outcomes, as well as key economic issues in the funding and management of infrastruc-

ture projects. It describes the short-run stimulus effects of infrastructure spending, develops new estimates of the stock of US infrastructure capital, and explores the incentive aspects of public-private partnerships. A salient issue is the treatment of risk in evaluating both publicly funded infrastructure projects and public-private partnerships. The volume provides a reference for researchers seeking to expand the knowledge base on infrastructure issues, and for policymakers tasked with determining the appropriate level of infrastructure spending.



Economics of Research and Innovation in Agriculture

Petra Moser, editor

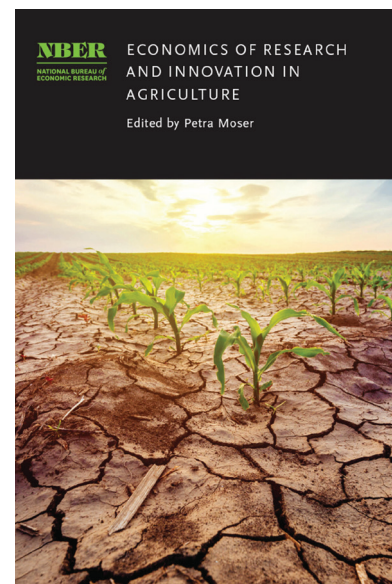
<https://press.uchicago.edu/ucp/books/book/chicago/E/bo123177052.html>

With constraints tightening on water, arable land, and other natural resources, feeding the world's growing population is a critical challenge for the 21st century.

Agricultural innovation can help meet the needs of future generations. However, the returns to agricultural R&D are difficult to measure. Many wealthy countries have reduced their share of GDP devoted to agricultural R&D. Dwindling public support leaves universities—historically a major source of agricultural innovation—increasingly dependent on funding from industry, with uncertain effects on the nature and

direction of agricultural research. These factors create a need for systematic empirical evidence on the forces that drive agricultural research and innovation.

This volume examines the potential consequences of the shift from public to private sector funding and the changing sources of agricultural innovation. It also addresses the challenges of measuring the returns to adopting new technologies, the interactions between university engagement and scientific productivity, and the role of emerging mechanisms such as agricultural venture capital to fund agricultural R&D.



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