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Restricting Visas for Skilled Workers Leads to Offshoring

Restrictions on the number of visas issued to highly skilled foreigners are designed to encourage US firms to hire American rather than foreign skilled workers. However, US multinational corporations (MNCs), which are responsible for 80 percent of domestic research and development, have an alternative: hiring skilled workers overseas through their affiliated foreign companies. This effect is the focus of **How Do Restrictions on High-Skilled Immigration Affect Offshoring? Evidence from the H-1B Program** (NBER Working Paper 27538).

Britta Glennon investigates this effect by linking H-1B visa data with data on the activities of US MNCs and their foreign affiliates. Using two alternative research designs, she finds that restrictions on high-skilled immigration have made MNCs more likely to both increase employment within existing foreign affiliate companies and to open entirely new foreign affiliates.

The first approach compares MNCs' for-

eign-affiliate activity post-2004—when visa caps restricted their hiring activity—with those same firms' employment of workers on H-1B visas pre-2004, when caps did not

When H-1B visas were capped in 2004, firms that were dependent on high-skilled foreign workers increased employment at foreign affiliates 27 percent more than less-dependent firms.

restrict them. It suggests that firms that had historically been highly dependent on workers with H-1B visas increased their foreign-affiliate employment by 27 percent more than firms

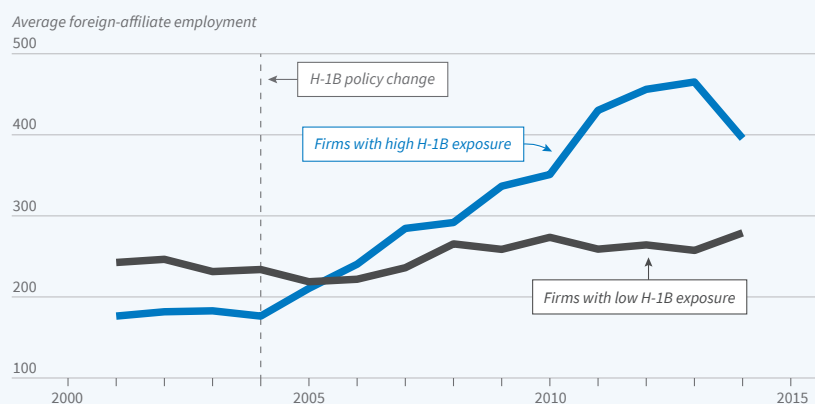
that were less dependent on such workers.

Three countries account for much of this increase in MNCs' activity overseas: India, China, and Canada. India and China are

prominent because they were the source of a high percentage of the skilled labor that firms hired before visas became scarce. Canadian workers are hired at a high rate because of their country's proximity to the United States and its more relaxed rules on high-skilled immigration. An example noted in the study is the increasing relocation of activity to Vancouver, Canada, by Microsoft—an MNC headquartered three hours from Vancouver in Seattle. Significantly, US MNCs appear to have increased both the level and the share of their activity in these three countries.

The effect is strongest among MNCs that

The 2004 Drop in the H-1B Visa Cap and Employment at Foreign Affiliates



Firms with high and low H-1B exposure are firms in the top and bottom quintile of non-zero H-1B positions requested in Labor Condition Application requests. Source: Researcher's calculations using data from the Bureau of Economic Analysis, H-1B visa microdata, Labor Condition Application data, and US Patent and Trademark Office patent data

are more R&D-intensive, that operate in industries in which services can be more easily offshored, and that were more reliant on H-1B visas prior to the cap restrictions.

Glennon's second research strategy focuses on 2007 and 2008, when H-1B visas were allocated by lottery due to high demand. This analysis focuses on the gap between a firm's visa demand (the number of applications it filed) and its visa supply (the number of visas granted). The study exam-

ines how firms responded as visa caps became more restrictive over time.

The results show that firms with greater visa shortfalls were more likely to open foreign affiliates and to increase employment at existing foreign affiliates. Specifically, a reduction in H-1B supply equal to 1 percentage point of initial employment caused an increase in the foreign affiliate growth rate of between 12 and 16 percent. This translates to about 0.3 jobs being created in a foreign affil-

iate for every unfilled H-1B position.

Encouraging firms to hire skilled workers overseas, rather than domestically, may have implications for US innovation, Glennon concludes, because skilled immigrants tend to positively impact innovation in their host country through spillover effects that require geographical proximity. If skilled workers are not in the US, then the US is unlikely to reap the benefit of these effects.

—Dylan Parry

World War II R&D Spending Catalyzed Post-War Innovation Hubs

A large, mission-driven government research and development (R&D) program can have far-reaching effects on the growth of technology clusters and the direction of technological progress. This is the conclusion of Daniel P. Gross and Bhaven N. Sampat in *Inventing the Endless Frontier: The Effects of the World War II Research Effort on Post-War Innovation* (NBER Working Paper 27375).

The researchers analyze the US government's unprecedented effort in World War II to mobilize science for war through the newly created Office of Scientific Research and Development (OSRD). The OSRD entered into over 2,200 R&D contracts with industrial and academic contractors, spending roughly \$7.4 billion in current dollars. The OSRD's outlays more than doubled the government's previous spending on scientific research. The researchers show that these investments had large effects on the direction and location of US invention and on high-tech industrial employment, setting in motion forces of agglomeration that shaped the technology clusters of the post-war era.

The researchers use archival records to create a dataset of OSRD contracts that includes detailed information on the contractors and the inventions and scientific publications they produced. They merge

foreign countries, and they compare patenting in US counties that received large versus small infusions of funding.

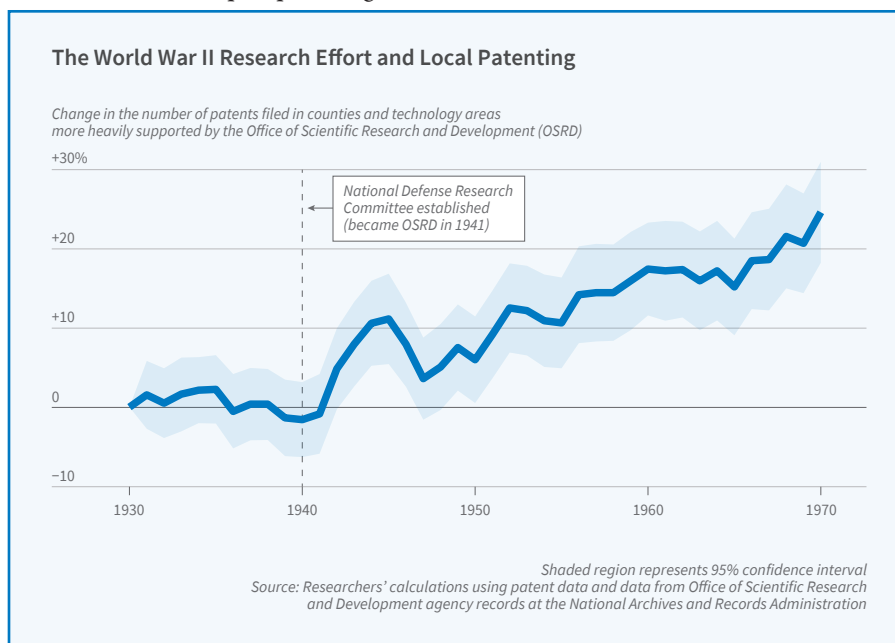
The study finds a clear divergence in the technological focus of patenting between

Federal support for research led to a surge in wartime patenting and also propelled innovation hubs that fostered post-war discoveries and related employment growth.

these records with data on the complete US patent record and on patenting abroad. They compare pre- and post-war patenting in technology areas that received substantial support from the war effort. They also compare patenting in these areas in the US and in

the US and other Allied countries after the war. By 1970, US patenting in the technologies that were the focus of OSRD-supported research was more than 50 percent higher than in Great Britain and France.

The researchers also find sharp effects on the geography of domestic invention. When they compare counties and technology areas in which OSRD funding was most concentrated with those with less OSRD-supported research activity, they find that patenting surged during the war, fell back to pre-war levels when the conflict ended, and subsequently experienced a long-lived takeoff with persistent growth. This growth appeared to be concentrated in coun-



ties that were already patenting more heavily in these technology areas before World War II. The researchers conclude that although the wartime research effort did not create these technology clusters per se, it set in motion forces that led to growing agglomeration and widening disparities in the inventive output of different parts of the country.

Local research ecosystems sprang up in the locations and technology areas where OSRD activity was concentrated, including universities, federally funded research centers, and private invention. In communications and electronics manufacturing—industries that were closely tied to the wartime research effort—doubling of

OSRD patents in the 1940s is associated with 60 to 65 percent higher employment in the 1970s. OSRD support seems to have built up local scientific and technological capabilities which allowed local innovation to thrive after the war and created jobs in associated manufacturing industries.

—Lauri Scherer

Variation in Public and Private Insurers' Hospital Reimbursements

The amount US hospitals receive for treating a patient depends on who's paying the bill. In **Variation in Health Care Prices Across Public and Private Payers** (NBER Working Paper 27490), [Toren L. Fronsdal](#), [Jay Bhattacharya](#), and [Suzanne Tamang](#) use the American Hospital Utilization Database to show that the amount private insurers pay for the treatment of patients who fall into one of the five most common Medicare Severity Diagnosis Related Groups (MS-DRGs) is 37 percent more than traditional Medicare reimbursement. Private Medicare Advantage plans pay an average of 10 percent more than traditional Medicare, while Medicaid pays 21 percent less. Though large national Medicare Advantage insurers reimburse at a rate similar to that of traditional Medicare, smaller regional Medicare Advantage plans tend to pay more.

MS-DRGs classify inpatient visits based on diagnoses, treatments, severity, and comorbidities. Most Medicare payments are prospective: Medicare pays a fixed amount for each patient in a given MS-DRG regardless of the quantity of services rendered. In contrast, private insurers negotiate prices with each hospital and their negotiated prices are considered trade secrets. Payment structures vary. Some insurers negotiate prospective payments with hospitals. Others pay

a percentage of a hospital's list price, agree to payments that are a percentage of its Medicare reimbursements, or simply negotiate specific payments for specific conditions.

The researchers study a hospital utili-

zation database that includes 474 providers. Most are hospitals, but actual payments are also available for inpatient and outpatient care from skilled nursing facilities, home health providers, and clinics in urban and rural locations. The database includes payments made for the treatment of 80 million patients in 38 states from 2009 through 2016, and it incorporates information on the amounts paid both by patients and insurers, providers' billed

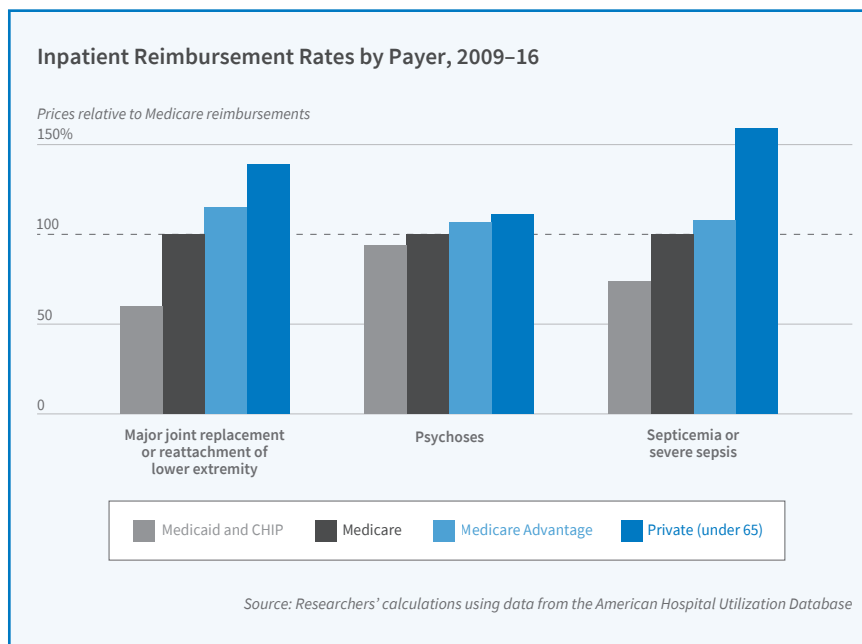
charges, negotiated discounts, and any contractual adjustments for insurers. Medicare Advantage plans tend to negotiate reimbursements for inpatient care that are prospective, like traditional Medicare. In

While Medicare pays similar rates to hospitals across the board, the prices private insurers negotiate vary significantly within and across hospitals based on insurers' size and market share.

contrast, commercial insurers are less likely to pay hospitals prospectively for inpatient visits. The researchers find little correlation between billed charges and the transaction price paid for inpatient care, while outpatient visits are more likely to be reimbursed as a share of charges for any services rendered during the visit. Insurers tend to negotiate widely different prices at different hospitals. Further, though large insurers receive roughly similar discounts on average, the discounts they negotiate at any given hospital vary considerably. The researchers study the correlation between the discounts for hip and knee replacements given by various hospitals to each of the five largest insurers—Aetna, Anthem, Cigna, Humana, and UnitedHealthcare—and find almost no correlation for some insurance company pairs, and a correlation as high as 0.82 for others. For the insurer pair with the highest correla-

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tion, discounts vary in similar ways across hospitals. For other pairs, however, knowing that one had negotiated a large discount at a given hospital provides almost no information on the discount of the other.

Insurer size matters. A 10 percent increase in market share is associated with a 6 to 7 per-

cent decrease in negotiated prices. Additionally, insurers with dominant market positions tend to negotiate contract structures that are more prospective—based on diagnoses rather than the quantity of care provided. These contracts place financial risk on hospitals.

The researchers do not control for differ-

ences in the makeup and competitiveness of the hospital market or for differences in hospital quality, but they conclude that greater insurer market share improves the insurer's position in hospital-insurer bargaining and allows them to negotiate favorable payment structures.

—Linda Gorman

US versus European Productivity Growth and the ICT Boom

Growth in both labor productivity and total factor productivity—the combination of labor and capital productivity—slumped below pre-1995 levels in both the US and Western Europe after 2005. But between 1995 and 2005, the US saw a sharp acceleration of growth, while Western Europe did not.

This temporary increase in US productivity growth is typically credited to a surge in investment in information and communications technology (ICT). In **Transatlantic Technologies: The Role of ICT in the Evolution of US and European Productivity Growth** (NBER Working Paper 27425), Robert J. Gordon and Hassan Sayed present new evidence on this issue by asking whether ICT investment explains why during 1995–2005 productivity growth accelerated in the US while it slowed in Western Europe.

They begin by showing that in aggregate data, the increase in ICT can explain only about one-third of the US productivity growth surge between 1995 and 2005—an apparent refutation of the standard narrative. However, the researchers dig deeper and explore the relationship between the growth of labor productivity and ICT intensity in 27 industries, which they categorize as “ICT-producing,” “ICT-use-intensive,” and “non-ICT-intensive.” Contrary to the economy-wide analysis, this industry-specific approach suggests that ICT-intensive industries in the services sector explain most of the US increase in productivity growth during 1995–2005.

Why the different findings? The researchers explain the disparity by the way in which ICT contributes to productiv-

ity. That is, it doesn't just create a relatively larger role for capital—and an associated uplift in labor productivity—but generates spillover effects that increase overall productivity of capital and labor. This is

Different patterns of ICT adoption explain most of the sharp increase in the US's productivity growth, relative to Europe's, between 1995 and 2005.

a phenomenon that the growth accounting method is unable to reveal, since that method separates the sources of growth into the productivity of labor and the overall productivity of all inputs. Given the spillover effects between these sources, the standard approach gives ICT investment less credit than it deserves.

To compare the Western European experience with that of the US, the researchers aggregate data from 10 Western European economies into a single EU-10 entity. One piece of evidence that ICT investment was less important in the EU-10 is that productivity growth in ICT-intensive industries did not differ from non-ICT-intensive industries during 1995–2005 or

after 2005. The only exception to this was the information/communications industry itself, which was unique among EU-10

industries, performing almost as well as those in the US during the 1995–2005 interval.

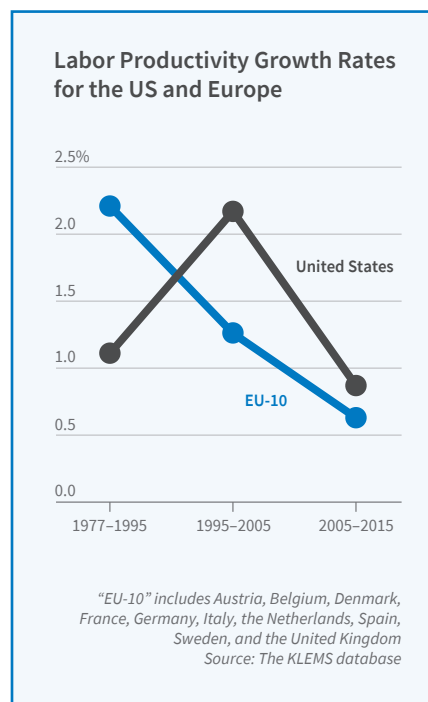
The two-stage slowdown in the EU-10—after 1995 and again after

2005—occurred across all industries. The researchers conclude that the disappointing EU-10 experience in 1995–2005 versus that of the US is explained not just by a single cause but rather by a multiplicity of factors: (1) lower productivity growth in the production of ICT equipment, (2) lower investment in ICT across all industries, (3) a lower payoff to the ICT investment that did occur, and (4) poor productivity performance compared to the US in specific industries, particularly retail-wholesale, finance-insurance, and agriculture.

The slowdown in US productivity growth after 2005 reverses its post-1995 acceleration. This suggests that the ICT boom in the US resulted in a one-off lift

in the level of productivity, rather than a permanently higher rate of productivity growth.

—Dylan Parry



The Impact of the 1965 Voting Rights Act on Arrests of Black Residents

The 1965 Voting Rights Act (VRA) protected the voting rights of minority voters and effectively expanded the franchise, particularly in counties that were identified as “covered” under the law. In *The Franchise, Policing, and Race: Evidence from Arrests Data and the Voting Rights Act* (NBER Working Paper 27463), Giovanni Facchini, Brian G. Knight, and Cecilia Testa find that following passage of the VRA, Black arrest rates fell in counties that were covered by the legislation, had a large number of newly enfranchised Black voters, and had elected chief law enforcement officers (CLEOs).

Many CLEOs in the United States — including all sheriffs and some municipal police chiefs in the South, the region most affected by the VRA — are directly elected, rather than appointed. CLEOs are in charge of policing practices that have direct effects on the treatment of minorities and might also, through their leadership, be able to influence departmental culture.

To empirically investigate whether there were links between minority voting, elected government officials, and police treatment of minority groups, the researchers exploit the dramatic changes wrought by the VRA, which compelled a group of mostly Southern jurisdictions to remove restrictions on voting, and required federal authorization for any changes to their voting laws. As a result, previously disenfranchised Black voters in former Confederate states fully cov-

ered by the VRA in 1965 — Alabama, Georgia, Louisiana, Mississippi, South Carolina, and Virginia — along with those in 39 counties in North Carolina, became able to cast their bal-

lot votes freely and thus potentially influence the election of officials, including CLEOs. The researchers compare the outcomes in these counties with those in other locations — Arkansas, Florida, Tennessee, Texas, and 61 counties in North Carolina — that were not covered by the VRA.

The researchers examined data on arrest patterns by race from the FBI’s Uniform Crime Reports. They studied

Arrest rates for Blacks fell in counties that were both covered by the VRA and had a high concentration of Black residents, relative to other counties.

significant Black populations, which were more impacted by the VRA, versus counties with fewer Black residents.

Before the introduction of the VRA, the overall average arrest rate was

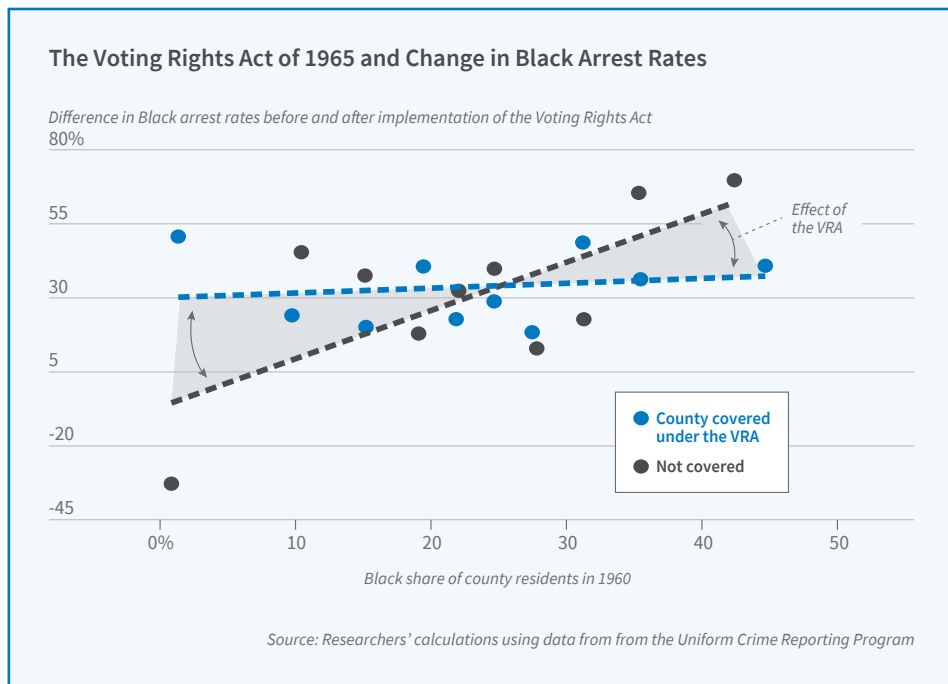
6.29 per thousand for Blacks, whereas the corresponding figure for Whites was 1.99. After the passage of the VRA, the number of arrests slightly increased for Blacks, reaching on average 6.59 per thousand, and nearly doubled for Whites, averaging 3.07 per thousand. Further analysis revealed that arrest rates for Blacks fell in counties that were both covered by the VRA and had a high concentration of Black residents,

with no corresponding patterns in White arrest rates. Arrests of Blacks by municipal police fell in counties that were covered by the VRA, had a high concentration of Black residents, and had elected police chiefs.

The researchers could not explain their findings with differences in collective bargaining, changes in underlying propensity to commit crimes,

responses to changes in policing practices, or changes in the suppression of civil rights protests. They conclude that by increasing the accountability of CLEOs to the Black electorate, the VRA led to changes in police behavior and changes in patterns of arrests.

—Lauri Scherer



the averages over the 1960–1965 and the 1975–1980 periods to create pre- and post-VRA arrest measures. Their baseline analysis compared arrest patterns along four dimensions: for Blacks versus Whites; before and after the passage of the VRA; areas covered by the VRA versus non-covered areas; and counties with

Measuring Infrastructure Investment in the United States

Infrastructure provides critical support for economic activity, and assessing its role requires reliable measures. In the working paper **Measuring Infrastructure in BEA's National Economic Accounts** (NBER Working Paper 27446), researchers [Jennifer Bennett](#), [Robert Kornfeld](#), [Daniel Sichel](#), and [David Wasshausen](#) assess trends in basic, social, and digital infrastructure in the national economic accounts and develop new prototype measures for maintenance expenditures and state-level highway investment.

Real gross infrastructure investment, measured in 2012 prices, peaked at \$340 billion in 1968, declined slightly during the next decade and a half, and then grew to reach nearly \$800 billion in 2017. These overall figures show the resources devoted to infrastructure each year, though they mask differences across categories. Investment in basic infrastructure, which includes the nation's roads, bridges, power grids, dams and so on, follows a similar path until the early 2000s.

Since then it has been largely flat, while the share of infrastructure investment in other areas has increased. These areas include social infrastructure, encompassing schools, hospitals, and public safety, as well as digital infrastructure.

Digital infrastructure, the fastest-growing area, includes cell towers, computers, commu-

Real net investment per capita has drifted downward since the financial crisis and stands near its lowest level since 1983.

nications equipment, software owned by companies in broadcast and telecom, data processing, internet publishing, and information services. Investment in this area rose about tenfold from the 1980s to 2017.

Real net infrastructure investment per capita, which adjusts gross investment for popu-

ture has moved lower in recent decades.

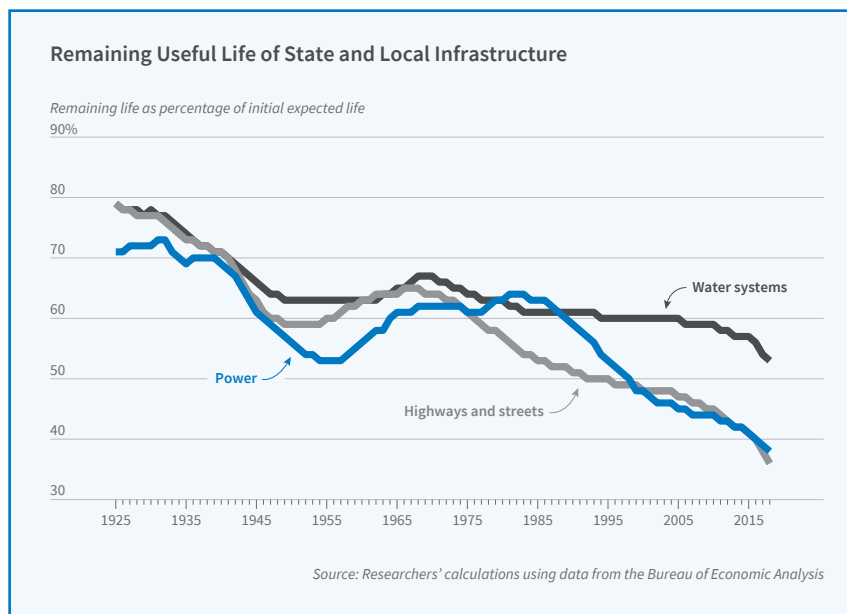
Accurate measurement of both net investment and the stock of infrastructure requires an estimate of how quickly a given piece of infrastructure capital wears out. The depreciation profiles that are used to calculate the net capital stock of infrastructure in the United States date back nearly 40 years and are well below those used in Canada and several European nations.

Another vexing challenge is distinguishing between major infrastructure upgrades, which count as investment, and maintenance, which doesn't. New prototype measures for highways indicate that spending on maintenance represents about 15 percent of gross investment.

The researchers note that there is substantial variation in infrastructure investment across regions.

For real gross highway investment per capita, for example, upper Midwest and North Central states are in the top quintile in the last decade, while many Western states such as Arizona, California, Colorado, Oregon, and Utah fall in the bottom 40 percent.

—*Laurent Belsie*



lation growth and depreciation, highlights whether infrastructure investment is keeping up with wear and tear as well as population growth. Here, basic infrastructure has drifted down during the last decade and currently stands near its lowest level since 1983. Moreover, the remaining useful life of many types of basic infrastruc-

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