

January 2018

INSIDE THIS ISSUE

- The Housing Market Crash and Wealth Inequality in the U.S.
- Limits on OPEC Output Increase Global Oil Production Costs
- Exploring the Intricacies of Venture Capital Valuations
- Nature Versus Nurture: A Look at American Inventors
- Some Taxpayers Forgo Benefits of Itemizing because of Filing Costs

In a Financial Crisis, Room to Maneuver Is Worth a Lot

Countries recovered from the global financial crisis of 2008 at very different rates. While Australia and South Korea were affected very little by the crisis, and output began growing in the United States and the United Kingdom within a year of the crisis, other nations—Portugal and Greece, for example—remained depressed for years. The same sort of heterogeneity can be found in earlier financial crises as well. Japan, for example, endured a “lost decade” of economic stagnation after the bursting of its asset and real estate bubbles in the early 1990s, while Norway recovered quickly from a banking crisis that occurred around the same time.

In **Why Some Times Are Different: Macroeconomic Policy and the Aftermath of Financial Crises** (NBER Working Paper No. 23931), [Christina D. Romer](#) and [David H. Romer](#) find that countries with more monetary and fiscal policy options at the onset of a crisis, namely those with interest rates well above the zero lower bound and with lower debt-to-GDP ratios, recover more quickly.

The researchers study the post-crisis economic performance of 24 advanced economies since 1967. They find that macroeconomic “policy space” has large effects.

Countries with higher interest rates and lower debt-to-GDP ratios at the start of a financial crisis use monetary and fiscal policy more aggressively and recover more quickly.

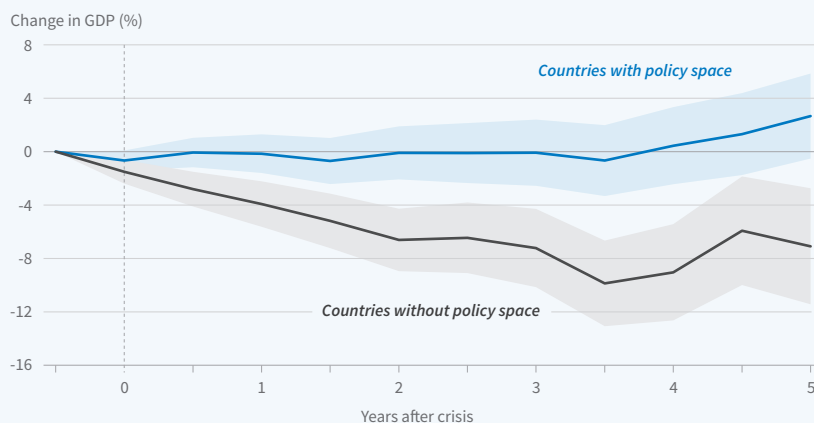
Countries that faced financial distress with substantial amounts of both monetary and fiscal policy space on average experienced output declines of less than 1 percent, while those that faced distress with neither type of space experienced average declines of

almost 10 percent. Policy space also explains a significant portion of the variation in the rates at which financial systems heal after a financial crisis.

The researchers find that countries with more macroeconomic policy space tend to use whatever policy instruments they have available much more aggressively in response to a crisis than countries with less space. In countries with monetary policy space, interest rates fall quickly, while rates change very little in countries without such space. The difference in fiscal policy responses is even more pronounced: countries with low debt-to-GDP ratios typically engage in aggressively expansionary fiscal policy after a crisis, while those without such space usually pursue highly contractionary policy.

The finding that macroeconomic policy space explains a great deal of the variation in

‘Policy Space’ and GDP Following a Financial Crisis



A country has “policy space” if the country’s policy interest rate at the end of the half-year before financial distress is greater than 1.25 percent and its debt-to-GDP ratio is one standard deviation below the sample average. Source: Researchers’ calculations using various data sources. Shading denotes 95% confidence intervals.

countries' post-crisis experiences suggests that policy-makers may find benefits to creating such space when they can. By drawing down their debt-to-GDP ratios during

favorable economic times, fiscal policy-makers can make it easier to cut taxes and raise spending in the event of a future financial crisis. Similarly, if makers of monetary

policy raise their target inflation rate during periods of expansion, they can create room for interest rate reductions during crises.

—Dwyer Gunn

The Housing Market Crash and Wealth Inequality in the U.S.

Wealth inequality in the U.S. rose steeply between 2007 to 2010, largely as a result of the sharp decline in house prices during that period, [Edward N. Wolff](#) reports in **Household Wealth Trends in the United States, 1962 to 2016: Has Middle Class Wealth Recovered?** (NBER Working Paper No. 24085). Households with a greater concentration of wealth in their homes—including younger households, African-Americans, and Hispanics—fared worse than other groups. The decline in home prices had a far greater percentage impact on the net worth of the middle class than the stock market plunge had on net worth of the top 1 percent.

The study draws on data from the Survey of Consumer Finances (SCF), which was conducted eleven times between the years 1983 and 2016. It defines wealth as net worth—the current value of all marketable assets minus any outstanding debts. This wealth measure excludes the future value of Social Security benefits and defined benefit pension payments. Median net worth declined from \$118,600 in 2007 to \$66,500 in 2010. Mean net worth, which is more sensitive to the holdings of high net worth households, declined from \$620,500 to \$521,000—a drop of 16 percent. By 2016, median net worth had rebounded to \$78,100, while mean net worth had reached \$667,600, surpassing its 2007 value.

The rich tend to have a more diverse range of investments than the middle class, making them less vulnerable to declines in particular asset categories. The middle class tends to be heavily leveraged, with their homes as primary assets. As a result, they were disproportionately affected by the housing crash. Median wealth fell more than house prices from 2007 to 2010.

Middle-class households tend to be heavily leveraged, with their homes as primary assets, while the rich tend to have more diverse investments. This made the middle class particularly vulnerable to the housing market crash.

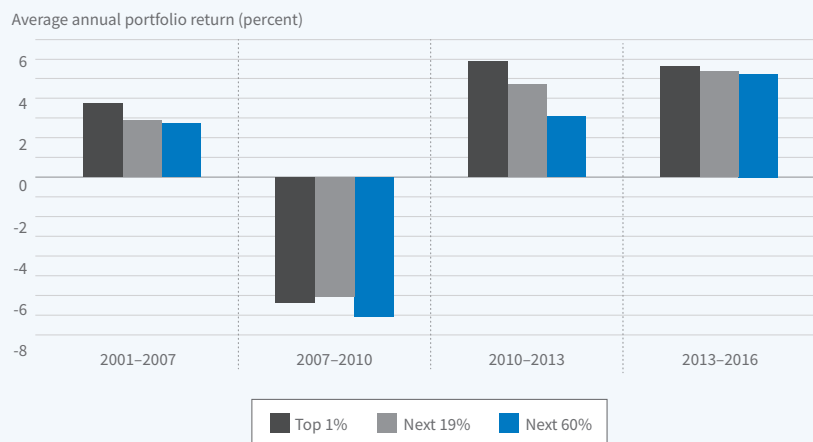
The study also reports the average return on all investments for households in different strata of the wealth distribution. For the period 1983–2016, “the average annual return

differential, which contributes to greater wealth accumulation by those in higher wealth categories, is largely due to greater weight on owner-occupied housing in the asset holdings of the middle class, and a higher weight on corporate stocks—historically a high return asset class—in the portfolios of the wealthiest households.

The racial divide in wealth-holding widened with the housing crisis. In 2007, the ratio of debt to net worth in African-American households averaged 0.553, as opposed to 0.154 for white households. The ratio of mortgage debt to home value was also greater for African-American households: 0.49 compared with 0.32. The greater leverage made the relative loss in home equity after the housing crash far greater for African-American households. Hispanic households were even harder hit, as many bought homes at high prices between 2001 and 2007 in states that saw particularly steep drops in home prices. Both African-Americans and Hispanics recovered fairly well after the Great Recession, though not quite to their 2007 levels.

The study also notes a significant reduc-

Rates of Return: Households at Different Places in the Wealth Distribution



Source: Researcher's calculations using data from the Federal Reserve's Survey of Consumer Finances

on gross assets for the top 1 percent was 0.57 percentage points greater than that of the next 19 percent and 1.44 percentage points greater than that of the middle quintiles.” This return

tion in the relative wealth of the young versus the old during Great Recession. “The average wealth of the youngest age group [households headed by someone under the age of 35] collapsed almost in half, from \$105,500 in 2007

to \$57,000 in 2010 (measured in \$2016), its second lowest point over the 30-year period ... while the relative wealth of age group 35–44 shrank from \$357,400 to \$217,600, its lowest point over the whole 1983 to 2010 period.”

This may be the result of younger households having bought homes at peak housing prices. The wealth of older age groups declined by less during this period.

—Jen Deaderick

Limits on OPEC Output Increase Global Oil Production Costs

Every microeconomics textbook explains that a business with market power can increase its profit by restricting output. In some cases, such quantity restrictions can lead to production being shifted to other firms. If those firms are relatively high-cost producers, this misallocation of production benefits the firm with market power, but means that society must spend more than it otherwise would to produce a given output.

In **Market Power, Production (Mis)Allocation, and OPEC** (NBER Working Paper No. 23801), [John Asker](#), [Allan Collard-Wexler](#), and [Jan De Loecker](#) estimate that OPEC’s exercise of market power to hold down output of petroleum shifted substantial amounts of oil production from low-cost fields to higher-cost ones, imposing extra oil production costs of \$163 billion (in 2014 USD) on the global economy from 1970 through 2014.

The researchers use data from Rystad Energy to estimate the costs of production misallocation. These data include estimates of oil production and costs for 13,248 oil fields that were active at some point during the period 1970–2014.

Oil production costs vary by geologic formation. In 2014, these costs ranged from an average of \$7 a barrel for the Ghawar field in Saudi Arabia, to \$21 a barrel in the offshore Norwegian fields, to \$51 a bar-

rel in the Bakken shale in the United States.

OPEC members generally face much lower costs of production than other producers. In Saudi Arabia and Kuwait, production costs per barrel rarely exceeded \$10 per barrel throughout the study period, and median costs

world, resulting in misallocated production. If OPEC withholds production from its cheaper fields, such as those in Saudi Arabia, then the resulting cost increase is even higher.

The U.S. oil industry has been shaped, in large part, by the substitution of production

Because the lowest-cost oil producers are OPEC members, unrestrained production by cartel members would substantially reduce Russian and American shares of the world market.

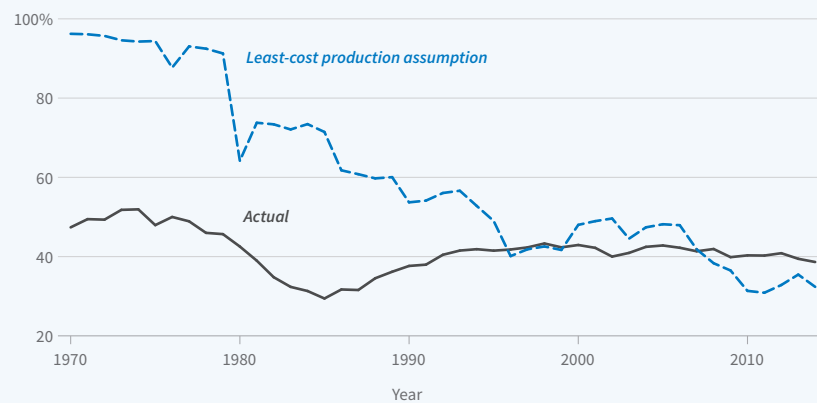
were \$5.40 a barrel. At the 95th percentile, the production cost was about \$10 per barrel. By contrast, among producers outside the OPEC cartel, median costs were closer to \$9.70 a barrel, with the 95th percentile at \$28.20 per barrel. Thus, if OPEC withholds production, say

away from cheap OPEC reserves toward the rest of the world. In 2005, shale accounted for just 24 million of the 2480 million barrels of oil produced in the U.S., or less than 1 percent. In 2014, 2039 million of the 4173 million barrels of oil produced — nearly half — were from shale. This expansion in higher-cost shale oil production was the primary driver behind an increase in the average cost per barrel of U.S. oil from \$7.30 in 2002 to \$20 in 2014. The researchers’ analysis shows that this expansion in shale oil production would not have occurred if OPEC members had not restricted supply.

To estimate the effect of OPEC’s market power, the researchers compare the cost of actual production each year with the cost of producing the same

amount of oil using the lowest-cost fields, as would occur in a competitive market. They show that if production were allo-

OPEC’s Share of Global Oil Production: Actual vs. Least-Cost Production Assumption



Source: Researchers’ calculations using data from Rystad Energy.

by limiting output from its most expensive fields, this will induce production to expand in the more expensive fields in the rest of the

cated across countries to minimize production costs, then in 2014 the market share of the lower-production-cost Gulf countries would have increased from 25.8 to 74.4 per-

cent. The Saudi Arabian share would increase to 28.1 percent and the Kuwaiti share to 12.5 percent, as opposed to current output shares of 13.3 and 3.0 percent. Production by non-

OPEC, higher-cost producers would have fallen, with the U.S. share of the market falling from 13.2 to 1.3 percent and Russia falling from 14.4 to 4.7 percent.

Exploring the Intricacies of Venture Capital Valuations

Private companies worth more than \$1 billion — so-called “unicorns” — are frequently overvalued, according to a study of 135 such firms. Fast-growing firms are always hard to value, but the largest challenge in valuing these firms is their complex financial structure. Shares in such companies differ in important ways from common stock and even from publicly traded preferred equity, and there can be significant differences between the shares offered in different financing rounds.

“These financial structures and their valuation implications can be confusing and are grossly misunderstood not just by outsiders, but even by sophisticated insiders,” William Gornall and Ilya A. Strebulaev write in *Squaring Venture Capital Valuations with Reality* (NBER Working Paper No. 23895). Their preferred estimates suggest that, on average, reported values overstate valuations by about 50 percent.

The researchers illustrate the issues involved by considering the valuation and funding history of Square Inc., a payment technology firm. In October 2014, the firm raised \$150 million by selling 9.7 million Series E Preferred Shares to investors for \$15.46 apiece. If the company did well, the shares paid off the same as common shares. But if the company failed or was acquired, Series E investors were still guaran-

teed to get at least \$15.46; in the case of an initial public offering, they’d get a minimum \$18.56. The company had already sold Series A, B-1, B-2, C, and D preferred shares, each

billion. A year later, the company went public at \$9 a share, far below the \$15.46 used in the post-money valuation. The researchers are not suggesting that the valuation of

A frequently used measure of the value of a private venture-backed company can overstate the company’s worth because prices and conditions vary in successive rounds of financing.

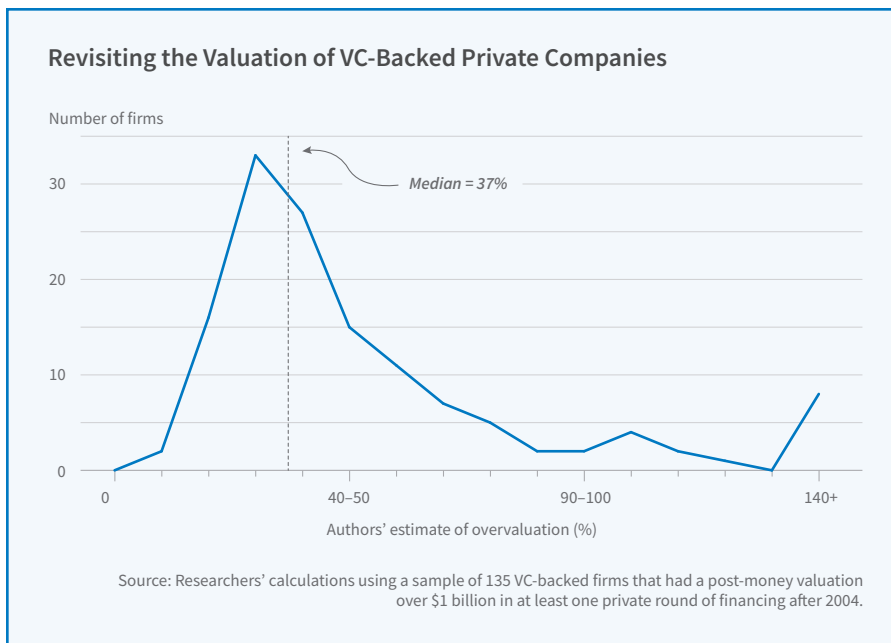
with different cash-flow, liquidation, control, and voting rights.

After the Series E round, Square got a “post-money valuation” — the venture capital industry’s main metric for determining company value — of \$6 billion (388 million

any share class is incorrect, just that the use of the price of a single share class to value all of the outstanding shares can be inappropriate when trying to calculate a firm’s aggregate valuation.

Failure to account for heterogeneity in outstanding share characteristics is common, and may lead to systematic overstatements of the total value of a firm’s equity. The researchers consider 135 firms that have been reported as worth more than \$1 billion, and they conclude that on average, the reported valuation is 50 percent greater than the estimate from their modeling. Their analysis suggests that 65 of the 135 firms were worth less than \$1 billion.

The researchers point out that even if a company’s business prospects are falling, if later share classes are issued with more generous terms for investors, it is possible that the reported share price will rise over time and result in increases in the firm’s post-money valuation.



shares multiplied by \$15.46). The researchers point out that this simple calculation did not recognize that all shares were not created equal. They develop a model to account for these differences and conclude that a more realistic total value would have been \$2.2

Developing accurate measures of the value of venture-capital-backed firms may be increasingly important as new classes of investors begin holding shares in these com-

panies. Mutual funds have begun investing in these firms, and even individual investors are participating in these firms through third-party marketplaces. While still a small

fraction of fund assets, mutual-fund purchases of unicorns have soared tenfold in three years.

—*Laurent Belsie*

Nature Versus Nurture: A Look at American Inventors

American inventors are disproportionately likely to be white men who grew up in financially successful families. In **Who Becomes an Inventor in America? The Importance of Exposure to Innovation** (NBER Working Paper No. 24062), Alexander M. Bell, Raj Chetty, Xavier Jaravel, Neviana Petkova, and John Van Reenen find that children from families in the top 1 percent of the income distribution are 10 times more likely to become inventors than those from families in the bottom 50 percent, and that over 80 percent of 40-year-old inventors are male.

The study examines three possible explanations for the demographic disparities: differences in genetic ability, differences in career preferences, and differences in the financial or human capital constraints faced by different demographic groups.

The researchers find that neither innate ability nor financial constraints fully explains the disparities. Using data from the New York City public schools, they find that while 3rd grade math test scores are predictive of the probability of securing a patent as a young adult, test score differences explain “less than one-third of the gap in innovation between children from high- vs. low-income families.” Among students who score well on 3rd grade math tests, students from low-income families are significantly less likely to become inventors than their wealthier peers. While the explana-

tory power of test scores grows over time, the researchers estimate that only 5.7 percent of the demographic gap in who becomes an inventor can be explained by differences in ability at birth. And they find financial constraints faced

likely to become inventors. This finding applies even among technology categories. Among people living in Boston, those who grew up in Silicon Valley are especially likely to patent in computers, while those who grew up

Children who grow up in particularly innovative geographic areas, or who are exposed to inventors via family connections, are more likely to become inventors.

during childhood likewise do not explain the gap, as students from low- and high-income families who attend colleges with large numbers of inventors become inventors at similar rates.

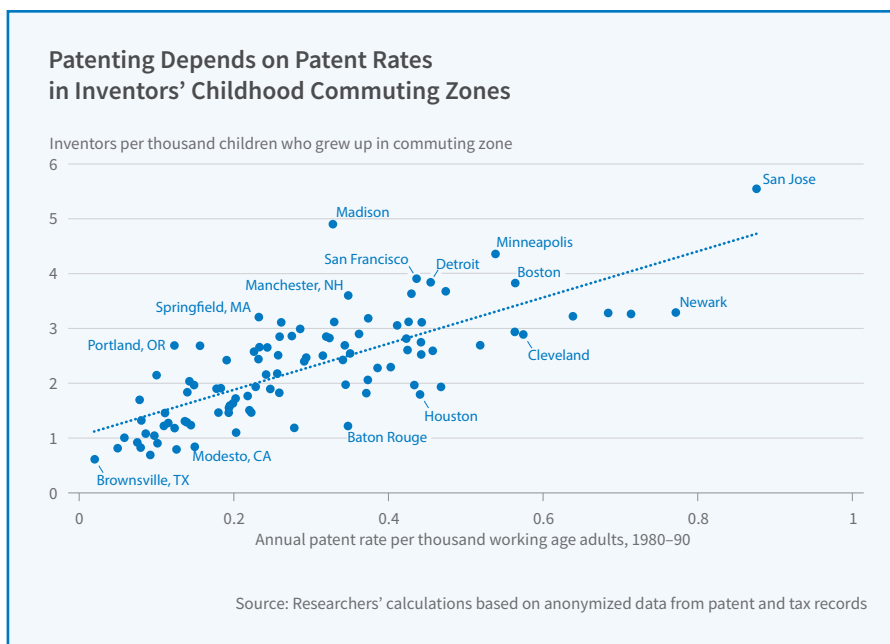
Instead, the researchers point to a pow-

erful causal exposure effect. Using nationwide data on where an individual grew up and patent awards in early adulthood, they find that children who grow up in particularly innovative geographic areas, or who are exposed to inventors via family connections, are more likely to obtain a patent in that same subclass than in another. There is also a strong gender-specific exposure effect: women are more likely to patent in a technology class if they were exposed as children to female inventors who held patents in that same type of technology.

The researchers estimate that if young girls were exposed to female inventors at the same rate as young boys are currently exposed to male inventors, the gender gap in invention rates would be halved. More broadly,

if women, minorities, and children from low-income families were to invent at the same rate as white men from high-income (top 20 percent) families, the rate of innovation in America would quadruple.

—*Dwyer Gunn*



Some Taxpayers Forgo Benefits of Itemizing because of Filing Costs

Many Americans complain about how much of their earnings each year go to taxes. But in **How Taxing Is Tax Filing? Using Revealed Preferences to Estimate Compliance Costs** (NBER Working Paper No. 23903), [Youssef Benzarti](#) shows that many taxpayers forgo tax savings in order to save the time, effort, and other costs required to itemize deductions on their returns. He estimates that the total cost of itemizing deductions rises with income, and that the total cost of tax filing, mostly the time spent filling out tax schedules and collecting receipts, is several hundred billion dollars.

Some taxpayers leave money on the table by opting for the standard deduction rather than spending time to itemize their deductions. Many explanations for this phenomenon have been offered, from taxpayers procrastinating on filing their returns to fearing audits if they itemize deductions to concluding that the cost in time and effort, including keeping receipts and filling out schedules, is not worth the savings. Among the most common itemized deductions in America are deductions for state and local income taxes, mortgage interest, property taxes, and charitable donations. The tax reform that was enacted in 2017 changed both deductions and the size of the standard deduction, so past patterns may no longer apply prospectively.

Benzarti estimates the perceived compliance costs to tax filers by computing whether there were “too few” taxpayers with itemized deduc-

tions slightly greater than the standard deduction threshold. Taxpayers who might save a few dollars by itemizing might decide that itemizing was not worth the effort; those who could save much larger amounts would presumably incur the cost

The total cost of taxpayers’ compliance with the U.S. tax system may exceed 1% of GDP.

of keeping records and itemizing their deductions. Using Internal Revenue Service data from 1980 through 2005, the researcher found just such a pattern of “missing taxpayers” above the standard deduction threshold.

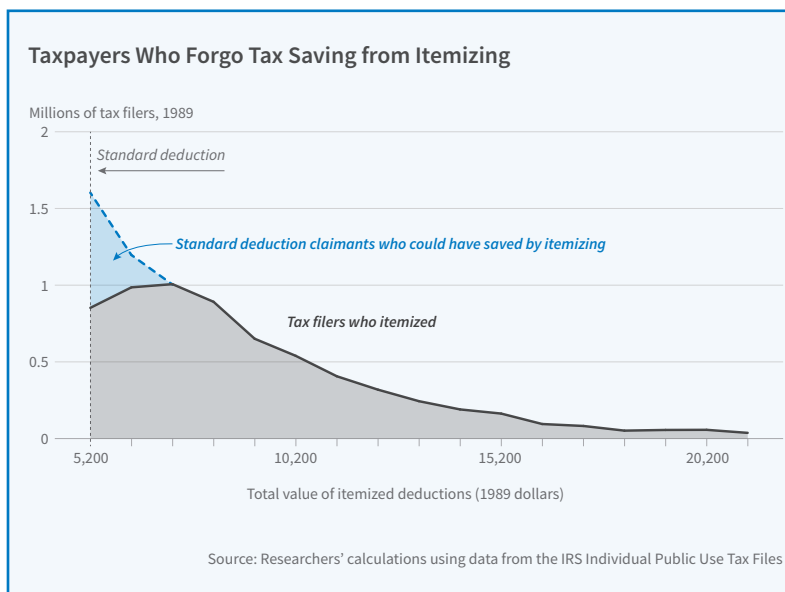
ers, and compared that year’s data to the years before and after 1988. He found that the level of deductions at which there were too few itemizers also shifted between 1987 and 1988, supporting the view that these “missing taxpayers” are the

result of choices, not chance variation in the distribution of deductible expenses.

By estimating the amount of tax savings that each taxpayer forwent, Benzarti computed what they must have perceived as the filing cost of itemized deductions. He concluded that these costs are large, and that they are higher for high-income households. This is consistent with the opportunity cost of time being higher for these households than for others. Aggregate compliance costs appear to have risen over time, from \$150 billion in 1984 to \$200 billion in 2006 (both figures in 2016 dollars). This suggests that compliance costs are about 1.2 percent of GDP in recent years.

Benzarti concludes that compliance costs create a “trade-off between requiring less forms and receipts (and therefore reducing filing costs) versus reducing evasion.” He further notes that if compliance costs are high enough, “reducing reporting might be welfare improving even if it leads to higher evasion costs.”

—Jay Fitzgerald



He next examined tax years in which there had been significant reforms in U.S. tax codes, specifically increases in the size of standard deductions. He focused on 1988, when the standard deductions were increased from \$2,540 to \$3,000 for single filers and \$3,760 to \$5,000 for joint fil-

NBER

The National Bureau of Economic Research is a private nonprofit research organization founded in 1920 and devoted to objective quantitative analysis of the American economy. Its officers are:

James M. Poterba—President & Chief Executive Officer
Karen N. Horn—Chair

John Lipsky—Vice Chair

The **NBER Digest** summarizes selected Working Papers recently produced as part of the Bureau's program of research. Working Papers are intended to make preliminary research results available to economists in the hope of encouraging discussion and suggestions for revision. The **Digest** is issued for similar informational purposes and to stimulate discussion of Working Papers before their final publication. Neither the Working Papers nor the **Digest** has been reviewed by the Board of Directors of the NBER.

The **Digest** is not copyrighted and may be reproduced freely with appropriate attribution of source. Please provide the NBER's Public Information Department with copies of anything reproduced.

Individual copies of the NBER Working Papers summarized here (and others) are available online free of charge to affiliates of subscribing organizations, such as universities and colleges, and to employees of NBER corporate associates. For others, there is a charge of \$5 per downloaded paper or \$10 per hard copy paper. Outside of the United States, add \$10 per hard copy order for postage and handling. To order, email the NBER Subscriptions Department at subs@nber.org or call (617) 588-1405; please have the Working Paper number(s) ready.

A full subscription to the NBER Working Papers entitles the subscriber to all new papers, recently more than 1,100 per

year. The online standard rate for a full digital subscription is \$2,400; the online academic rate is \$1,115. Subscriptions are free for corporate associates. The standard rate for hard-copy subscribers is \$10,000 per year and the academic rate is \$8,000. Higher rates apply for international hard-copy orders.

Partial Working Paper subscriptions, delineated by program, are also available. For further information, see our website, or write: National Bureau of Economic Research, 1050 Massachusetts Avenue, Cambridge, MA 02138-5398.

Requests for **Digest** subscriptions, changes of address, and cancellations may be sent to **Digest**, NBER, 1050 Massachusetts Avenue, Cambridge, MA 02138-5398 (please include the current mailing label), or emailed to subs@nber.org. Print copies of the **Digest** are only mailed to subscribers in the U.S. and Canada; those in other nations may request electronic subscriptions at www.nber.org/drsubscribe/.