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## Industrial Scientists and Engineers Don’t Just Do R&D

While many scientists and engineers in industry work in laboratories and create patents, the majority employed in the United States falls outside of the oft-studied “research and development” umbrella. Most work for goods- and services-producing establishments, implementing new technologies and lowering production costs. About 80 percent of industry scientists and engineers work outside of formal R&D roles, and over two-thirds of scientists’ and engineers’ work time is engaged in non-R&D activity.

In **The Effects of Scientists and Engineers on Productivity and Earnings at the Establishment Where They Work** (NBER Working Paper No. 23484), Erling Barth, James C. Davis, Richard B. Freeman, and Andrew J. Wang find a positive relationship between the share of scientists and engineers in an establishment’s workforce and in its productivity and employee earnings. The researchers use the Census of Manufactures, the decennial census, and the Longitudinal Employer-Household Dynamics database to link manufacturing establishments with employees and to measure the “scientists and engineers proportion” (SEP) of employment between 1992 and 2007.

Manufacturing serves as a prime area of study because its annual labor productivity growth rate, 3.5 percent, is higher than that seen in the rest of the U.S. economy (2.0 percent) between 1990 and 2016. While the manufacturing sector accounts for 10 percent of the overall industrial work force, it employs

20 percent of all scientists and engineers.

The researchers find a significant positive relationship between SEP and total factor productivity at manufacturing firms. However they note that, because they can only identify the occupation of 17 percent

from the match, and by applying a “shrinkage” adjustment to the estimated SEP of an establishment, depending on the variance of the estimated SEP. They find that a 10 percentage point increase in SEP is associated with a 4 percent increase in an establish-

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Production establishments with higher percentages of scientists and engineers in their workforces have higher productivity and pay more.

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of the workers in their manufacturing sample, their estimates of SEP may be imprecise. They address measurement error by limiting the sample to establishments with at least 10 workers who have an identified occupation

ment’s total factor productivity.

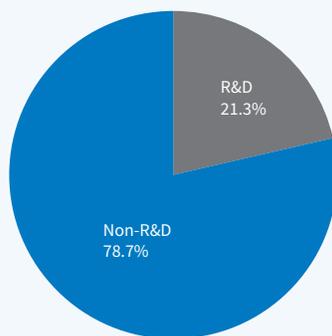
The researchers also find a positive relationship between SEP and earnings. They caution that this could be a selectivity issue caused by firms choosing whom to employ and employees choosing where to work. To overcome this, they examine the same employees over time when the SEP in the workplace changes either because the employer increases or decreases SEP or because the employee switches to an establishment with a different SEP. The positive correlation between earnings and SEP is mostly due to workers changing employers, not to employers changing the share of scientists and engineers at the workplace. Moving to an establishment with a 10 percentage point higher SEP can mean 2 percent higher earnings.

These findings indicate that scientists and engineers work not only in dedicated R&D activity to create new technology, but also at the establishment level to implement technology in production processes and thereby improve productivity.

—Morgan Foy

### Scientists and Engineers Play Varied Corporate Roles

Proportion of scientists and engineers in different corporate roles



Source: Occupational Employment Statistics from the Bureau of Labor Statistics

## Colleges Vary Widely in Promoting Upward Mobility

In **Mobility Report Cards: The Role of Colleges in Intergenerational Mobility** (NBER Working Paper No. 23618), [Raj Chetty](#), [John N. Friedman](#), [Emmanuel Saez](#), [Nicholas Turner](#), and [Danny Yagan](#) explore the differences across colleges in the extent to which they advance the economic fortunes of students from low-income backgrounds. They find that, on average, students from affluent and disadvantaged backgrounds at a given college experience similar post-college earnings outcomes. Colleges vary widely, however, in their admission of low-income students.

“[T]he degree of income segregation across colleges is comparable to the degree of income segregation across neighborhoods in the average American city,” the researchers report. “These findings challenge the common perception that colleges foster greater interaction between children from diverse socioeconomic backgrounds than the environments in which they grow up.”

The researchers calculate a measure for each college that they call its mobility rate, defined as the product of the percentage of students at the college who are drawn from the lowest quintile of income distribution and the percentage of those students who went on to careers that placed them in the top quintile of the distribution. The mobility rate represents the fraction of a school’s entire student body who are bottom-to-top success stories, in that they come from low-income parents

and make it into the top of the income distribution. Many of the colleges receiving the highest scores are mid-tier public institutions, including many campuses of the City University of New York, several California colleges and several campuses

Mid-tier public institutions are most likely to enroll low-income students and successfully prepare them for high-earning careers.

of the University of Texas.

Ivy League and other elite colleges have lower mobility rates. While their graduates from low-income backgrounds earn higher incomes, on average, than students from low-income backgrounds who attend less-prestigious schools, students

Columbia University with the State University of New York at Stony Brook. Five percent of the Columbia students who were tracked came from the bottom quintile. Of these, 61 percent ended up in the top quintile of earners, leading to

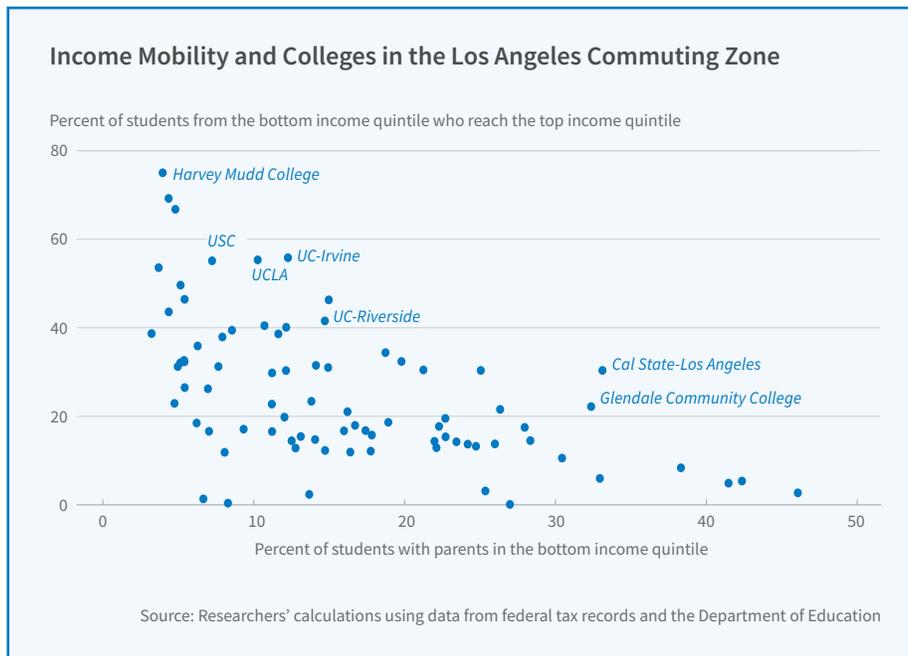
a bottom-to-top mobility rate of 3.1 percent. Of Stony Brook students tracked, 16.4 percent came from the lowest quintile; of these, 51 percent wound up in the top quintile, resulting in a mobility rate of 8.4 percent.

However, if the measure of success is reaching the top 1 percent of earnings, Columbia is by far the winner: 15 percent of bottom quintile students at Columbia entered that exclusive club, compared with just 2 percent at Stony Brook.

The researchers note that the colleges with the highest mobility rates are not necessarily those with the highest expenditure per student. For example, mean instructional expenditure at the Ivy-plus colleges

is \$54,000 per student, compared with \$8,000 per student at colleges ranked in the top 10 percent by mobility rate. The researchers note that at high-mobility colleges the share of the student population from low-income families declined during the first decade of this century, perhaps because of budget cuts that raised tuition and reduced financial assistance at these schools.

— Steve Maas



from families in the bottom income quintile make up a relatively small portion of their student bodies.

The researchers analyze data on college attendance from 1999 through 2013. They focus on individuals who were born from 1980 through 1982, track their college experience, and measure their earnings in 2014, when they were between the ages of 32 and 34.

As a case study, the paper contrasts

## Access to Fast Internet Spurs Growth in Africa

The slow pace of economic progress among the poor in Africa and other less-developed regions of the world has perplexed many economists. In **The Arrival of Fast Internet and Employment in Africa** (NBER Working Paper No. 23582), Jonas Hjort and Jonas Poulsen find that the absence of key technologies may play a role. They demonstrate this by studying the recent introduction of high-speed, high-capacity internet service from other continents to Africa. They find that when submarine cables reach a particular destination, there is a large positive effect on employment, specifically an increase in employment in higher-skill occupations. The arrival of high-speed internet also is associated with higher firm entry, productivity, exports, and other economic benefits that boost income and wealth.

The study examines the employment impact of 10 submarine cables that arrived on the coast of Africa between the closing years of the last decade and the early years of this one, connecting areas near the terrestrial network to fast internet in 12 African nations with

a combined population of a half-billion people. Using data from the Afrobarometer, Demographic and Health Surveys, and various country-specific datasets, the researchers tracked economic and employment activity before and after the introduction of high-speed internet service in connected and unconnected areas.

The researchers find a major positive impact on employment in the connected areas. Because they use different datasets for different nations, they obtain a range of estimates. Using one dataset that covers eight countries—Benin, the Democratic Republic of the Congo, Ghana, Kenya, Namibia, Nigeria, Togo, and Tanzania—they find a

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Economic performance improves when high-speed, high-capacity bandwidth is introduced.

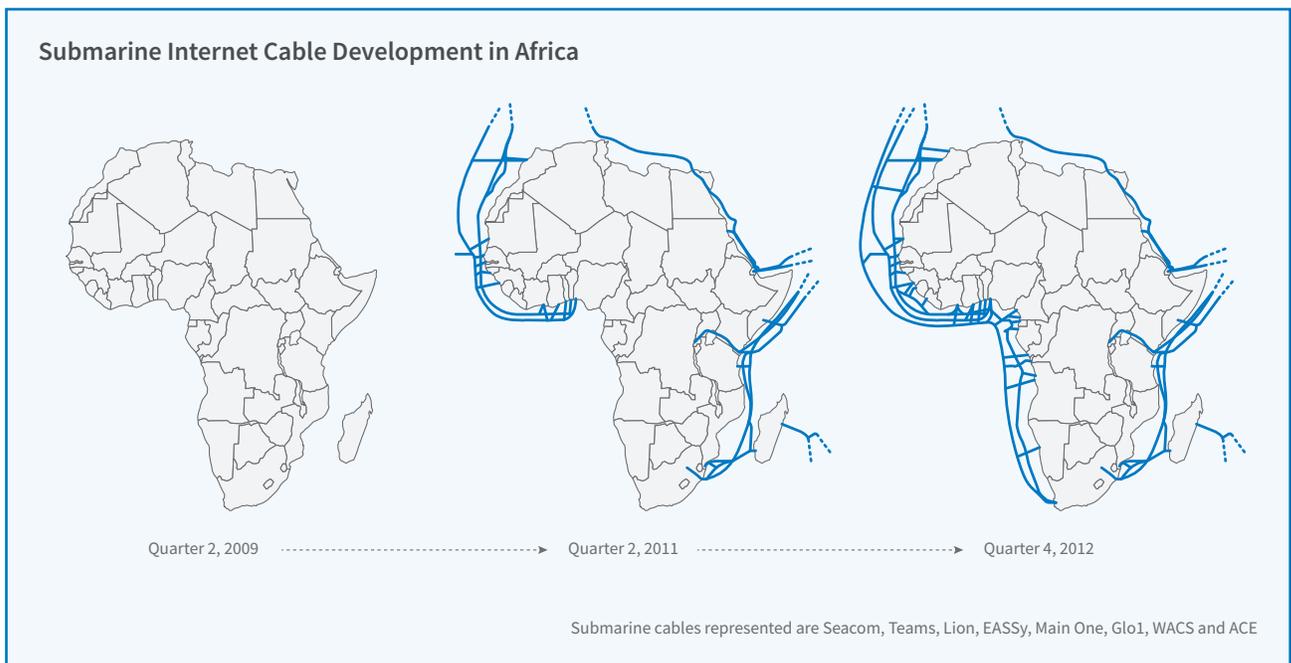
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3.1 percentage point, or 4.4 percent, average increase in the probability that an individual is employed when fast internet arrives. Using a different dataset, covering nine countries—Benin, Ghana, Kenya, Madagascar, Mozambique, Nigeria, Senegal, Tanzania, and South Africa—they estimate an even larger 5.8 percentage point, or 10 percent,

bility of being employed in a skilled occupation increased after the arrival of fast internet, while the probability of holding an unskilled job decreased. Access to fast internet appears to shift employment out of low-productivity occupations, such as small-scale farming, into higher productivity jobs, such as professional, clerical, and

service jobs within a number of sectors, including retail and even finance and manufacturing. “The observed changes in average speeds and use of the internet after the arrival of the submarine cables suggest that new and new types of jobs may have been created,” the researchers conclude.

The net result is improved economic



average increase in the employment rate. Based on data from before and after the introduction of fast internet, they conclude that the improved employment outlook was not simply a result of job displacement toward terrestrial backbone networks that started where the submarine cables came ashore.

The researchers find that the proba-

performance, with internet infrastructure enabling firms and individuals to communicate among themselves and with potential overseas customers. Average incomes and wealth rose, and job inequality declined, after the arrival of this new communications technology.

—Jay Fitzgerald

## The ‘Daughter Effect’ at Venture Capital Firms

Only about 10 percent of new venture capital (VC) hires are women, despite higher female representation among MBAs and advanced degree holders in science and technology. Approximately 75 percent of venture capital firms have never had a senior investment professional who is a woman, and the percentage of venture capitalists who are women has not increased over the past 25 years.

Although past research suggests that venture capitalists’ tendency to collaborate with others who are like themselves can reduce performance, it has been difficult to examine the relationship between gender diversity and performance because of the lack of variables that affect gender diversity but not other aspects of firm operation and performance.

In **And the Children Shall Lead: Gender Diversity and Performance in Venture Capital** (NBER Working Paper No. 23454), [Paul A. Gompers](#) and [Sophie Q. Wang](#) suggest that the proportion of daughters among the offspring of VC firms’ senior partners is just such a variable. They demonstrate that this variable affects gender diversity at VC firms, then use this relationship in turn to study how diversity affects firm performance.

Prior research suggests that parents of daughters show greater support for feminist causes and gender equity, and that they make different decisions on gender-related questions. U.S. congressmen with more daughters, for example, are more likely to vote for legislation supported by women’s groups. The researchers find a “daughter effect” in VC firms’ hiring deci-

sions. At firms whose senior partners had more daughters than sons, the female hiring rate was 11.87 percent; the rate was 9.78 percent at firms where senior partners had equal num-

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Firms at which senior partners had more daughters than sons hired more women partners and performed better than their competitors.

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bers of daughters and sons, and 8.68 percent where they had more sons than daughters. Other measures of the partners’ children’s gender mix, such as the ratio of daughters to sons among partners, the proportion of partners with more daughters than sons, and the share of partners with at least one daughter, were also correlated with hiring decisions.

Daughters over 12 years of age had a greater effect on hiring than younger daughters. “Older daughters

ger influence in hiring decisions.

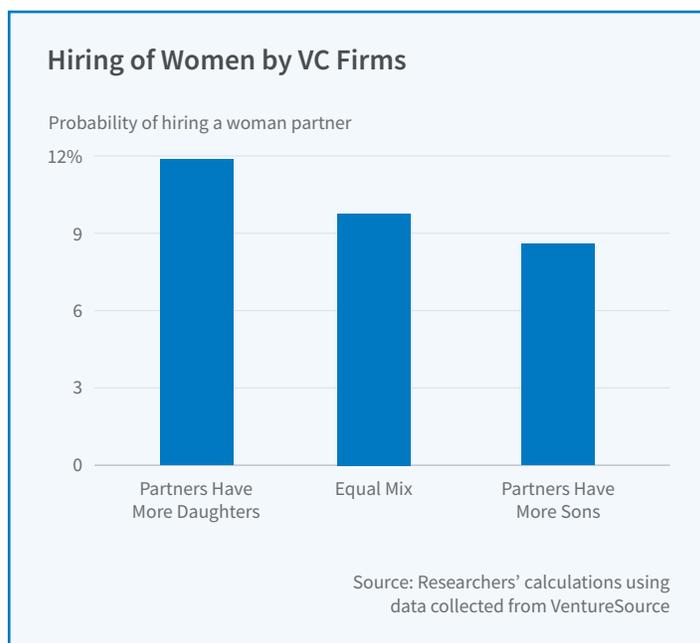
Firms whose partners had more daughters exhibited better performance than their competitors. For all VC firms in the researchers’ sample,

the probability that a deal resulted in an IPO or in an acquisition valued higher than the amount of capital invested was 28.7 percent. When a senior partner had one more daughter and one less son, a firm’s deal success rate increased by about 2.9 percent. This “son for daughter swap” was also associated with a 3.2 percent higher net internal rate of return for the firm.

The researchers also investigated how the gender composition of partners’ children, as well as the number of women partners at a firm, affected a firm’s probability of investing in companies with female founders. These companies, they hypothesize, could be overlooked by less diverse investment firms, and might correspondingly yield higher returns. They did not find any evidence that firms at which the partners have more daughters increase their investment in woman-led companies, but they did find that firms with at least one female partner do so.

The researchers calculate that if the typical VC firm increased the fraction of female partners by 10 percentage points, from the current average of 8 percent to 18 percent, “this would translate into an additional \$23.2 billion being raised.”

—Deborah Kreuze



may have more of an effect on the attitudes of their fathers,” the researchers write. “This is consistent with fathers observing potential gender biases that their daughters face as they get older,” and with senior partners having stron-

## Declining Work Hours and the Rise in Young Men's Gaming

Technological improvements and reduced prices for online video games have increased the attractiveness of leisure time for young men and may be contributing to declining hours of work, according to the researchers of **Leisure Luxuries and the Labor Supply of Young Men** (NBER Working Paper No. 23552). They find that young men spend far more time playing online games than young women and older people of both genders.

Mark Aguiar, Mark Bilal, Kerwin Kofi Charles, and Erik Hurst note that from 2000 through 2015, average hours of work for men ages 21–30 fell by 203

hours per year, compared to a fall of 163 hours for men aged 31–55. The declines for both groups started prior to last decade's Great Recession, but they accelerated during the severe downturn. Hours worked have rebounded only modestly during the recovery.

The researchers recognize that reductions in demand for workers in manufacturing and routine jobs may have contributed to the fall in wages and work hours by those without college degrees. But they observe that although the real wages of younger men have tracked those of older men, their hours worked have fallen more than those of their older male counterparts. The objective of the paper is to distinguish the increase in lei-

sure due to improved leisure technology from increases in leisure due to other forces such as declining labor market prospects. The “demand for leisure” is the flip side of “the supply of labor.”

Increased leisure time and reduced labor supply of young men may be partly due to the improved quality of video games.

There is precedent for technological improvements precipitating shifts in labor supply, as when improved household technologies in the 20th century led to increased participation in the labor force by women. The researchers investi-

video games, while younger women and older men and women spent negligible extra leisure time in this way. These data are drawn from the American Time Use Survey (ATUS). In all, young men's time playing video

games increased by 99 hours per year from 2004 to 2015, a 50 percent increase.

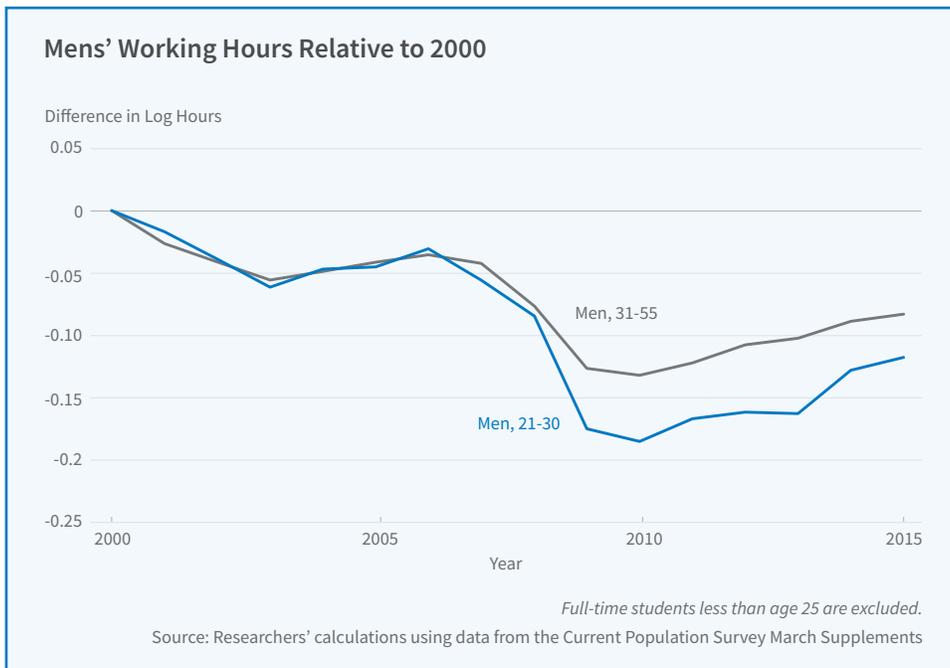
The researchers document that time spent playing video games is very sensitive to total leisure time for younger men, but not for other demo-

graphic groups such as younger women or older men. They estimate that innovations to recreational computing and video games since 2004 can explain on the order of half the increase in leisure for younger men, and could explain a decline in work hours of 1.5 to 3.0 percent, or 30 to 60 hours per year.

The researchers also found other interesting trends in the

young male population. They report an increase in the percentage of young men living with a close relative, from 23 percent in 2000 to 35 percent in 2015, suggesting that the young men's lifestyles are being partially subsidized by others. At the same time, the self-reported overall happiness of young men has been increasing.

—Jay Fitzgerald



gate whether innovations in leisure technology, specifically recreational computing and video games, could have contributed to the work-hour and leisure-time disparities between younger men and other groups.

During the period 2004–15, approximately 60 percent of the 2.3 hours of increased leisure time per week for young men was spent playing

# Home Purchases and Household Spending

Economists have long recognized that household spending rises and falls with booms and busts in the housing market. Most research on this topic has focused on ways in which spending is affected by changes in housing wealth and by employment changes linked to housing construction. In **Making the House a Home: The Stimulative Effects of Home Purchases on Consumption and Investment** (NBER Working Paper No. 23570), [Efraim Benmelech](#), [Adam Guren](#), and [Brian T. Melzer](#) explore the direct effects of moving to a new home on household spending. They label this the “home purchase channel” for consumer spending.

The researchers theorize that in the months preceding and following the purchase of a new home, buyers are apt to increase their spending on home-related durables and home improvement projects in order to customize their new space. New homeowners buy curtains and light fixtures, renovate kitchens and bathrooms. The researchers assume that these purchases and investments are frequently non-transferable, meaning that they must be repeated with every new home purchase. This implies that household spending should increase in housing markets characterized by high numbers of

transactions, and decrease in slower, or stagnant, markets.

Analyzing data on household spending from the Consumer Expenditure Survey

When home sales plunged by almost 50 percent during the Great Recession, spending on home-related durable goods and home improvements declined by 12 percent and 28 percent, respectively.

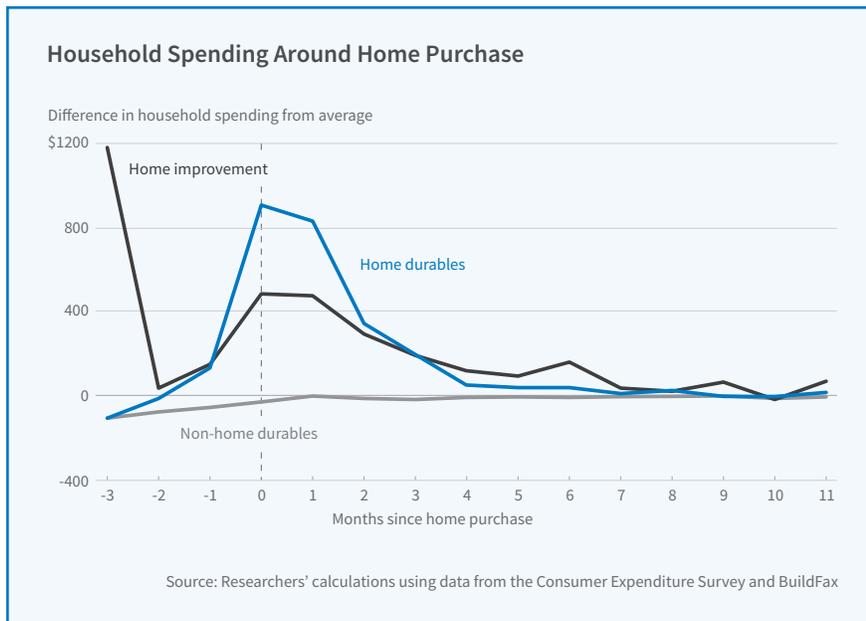
and data on construction permitting activity from BuildFax, the researchers find that home buyers between 2001 and 2013 spent about \$3,700 more in the months surrounding a home purchase, and that this spending was concentrated in home-related

months prior to and the year after a home purchase. These spending increases are especially pronounced in the first quarter after a home purchase, and they remain slightly

higher for six to nine months. The researchers did not find concurrent increases in spending on non-home-related goods.

Changes in consumer spending associated with this home purchase channel had significant economy-wide effects during the Great Recession, the researchers report. Between 2005 and 2010, as home sales plunged by almost 50 percent, spending on home-related durable goods and home improvements declined by 12 percent and 28 percent, respectively. In total, the researchers estimate that the housing bust led to a \$14.3 billion-a-year decline — equivalent to 0.1 percent of GDP — in household spending on home-related goods and improvements during the recession. This represents a third of the overall decline in household spending on home-related durable goods, and a fifth of the decline in spending on home improvement and maintenance.

— Dwyer Gunn



goods and home improvements. The effects were more pronounced for owner-occupiers than for renters. Owners spent \$5,900 more on home-related goods and improvements in the period encompassing the three

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