

2017

# Do Recessions Accelerate Routine-Biased Technological Change? Evidence from Vacancy Postings

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## Citation

Hershbein, Brad, and Lisa B. Kahn. 2017. "Do Recessions Accelerate Routine-Biased Technological Change? Evidence from Vacancy Postings." *Employment Research* 24(4): 1-4. [https://doi.org/10.17848/1075-8445.24\(4\)-1](https://doi.org/10.17848/1075-8445.24(4)-1)

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## EMPLOYMENT RESEARCH

Do Recessions Accelerate  
Routine-Biased  
Technological Change?

## ARTICLE HIGHLIGHTS

- *The Great Recession increased employers' skill requirements in their job postings, and these increases persisted as the economy recovered.*
- *Employers in more severely affected areas were also more likely to increase their IT investments as they "upskilled" their jobs.*
- *A permanent shift in the demand for skills and technology helps explain why laid-off workers faced difficulty in reemployment.*

## Evidence from Vacancy Postings

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The employment shift from occupations in the middle of the skill distribution toward those at the high and low ends is one of the most important trends to affect the U.S. labor market over the past 30 years. Previous research has suggested that a primary driver of this job polarization is routine-biased technological change (RBTC), whereby new technologies substitute for middle-skill jobs and complement high-skill cognitive jobs (Autor and Dorn 2013; Autor, Levy, Murnane 2003). Think of word processors replacing typists or engineers using AutoCAD software. Until recently, RBTC had been thought to be a gradual, secular phenomenon. However, a long theoretical literature, beginning with Joseph Schumpeter's (1939) "creative destruction," suggests that adjustments to technological change, writ large, may be more episodic. In boom times, high opportunity costs, or frictions such as adjustment costs, may inhibit resources from being reallocated optimally in the face of technological change. Recessions, in contrast, lower the opportunity cost and can produce large enough shocks to overcome these frictions.

Whether adjustments to new technology are gradual or sudden is important for policy and for our understanding of recoveries. The recoveries from the last three U.S. recessions (1991, 2001, 2007–2009) have been jobless: employment was slow to rebound despite recovery in aggregate output. If adjustments are sudden and concentrated in downturns, large numbers of displaced workers may be left with the wrong skills for new modes of production.

## Skill Demand and the Great Recession

This article highlights findings from a recent working paper that investigates how the demand for skills changed during and after the Great Recession (Hershbein and Kahn 2016). Using nearly all electronically posted job vacancies in 2007 and 2010–2015 collected by the analytics company Burning Glass Technologies and spatial variation in economic conditions, we establish a new fact: the skill requirements in job ads increase in metropolitan statistical areas (MSAs) that suffered larger employment shocks in the Great Recession relative to the same areas before the shock and other areas that experienced smaller shocks.<sup>1</sup>

As shown in the top two panels of Figure 1, our estimates imply that between 2007 and 2010, ads posted in hard-hit metro areas became about 5 percentage points (16 percent) more likely to contain education and experience requirements than ads posted in less-affected metro areas. Ads in hard-hit MSAs also became about 2–3 percentage points (8–12 percent) more likely to state requirements for cognitive and computer skills (Panels C and D of Figure 1).

Moreover, the vast majority of this "upskilling" does not fade away but instead persists through the end of our sample in 2015. That is, even while most measures of local labor-market strength—such as the unemployment rate, job growth, and the share of the population working—have converged back to prerecession levels, differences in advertised skill demands remain. This holds true even when we statistically control for the availability of skilled labor and the composition of ads across firms and occupations. In fact, we find that this

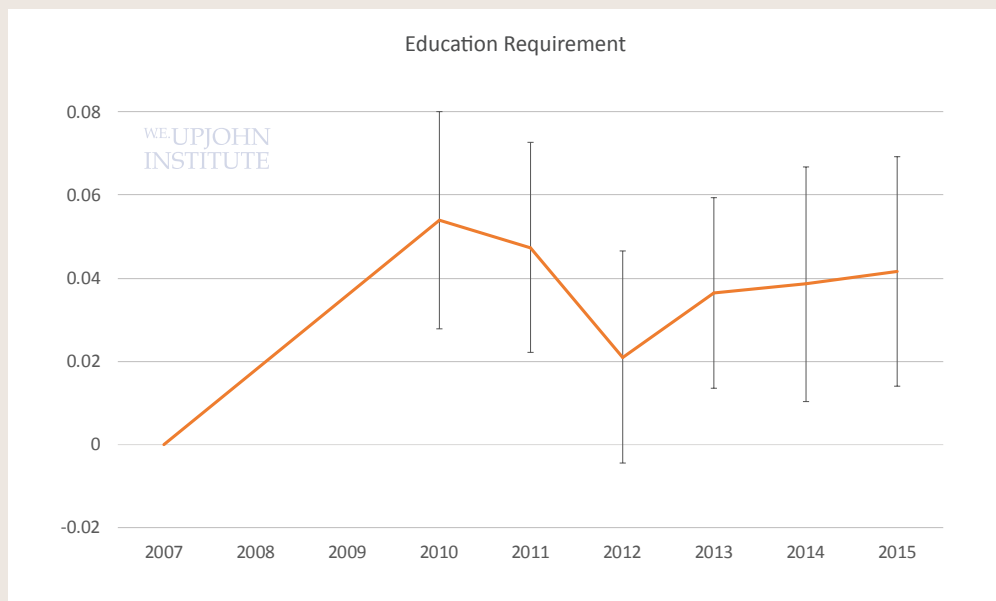
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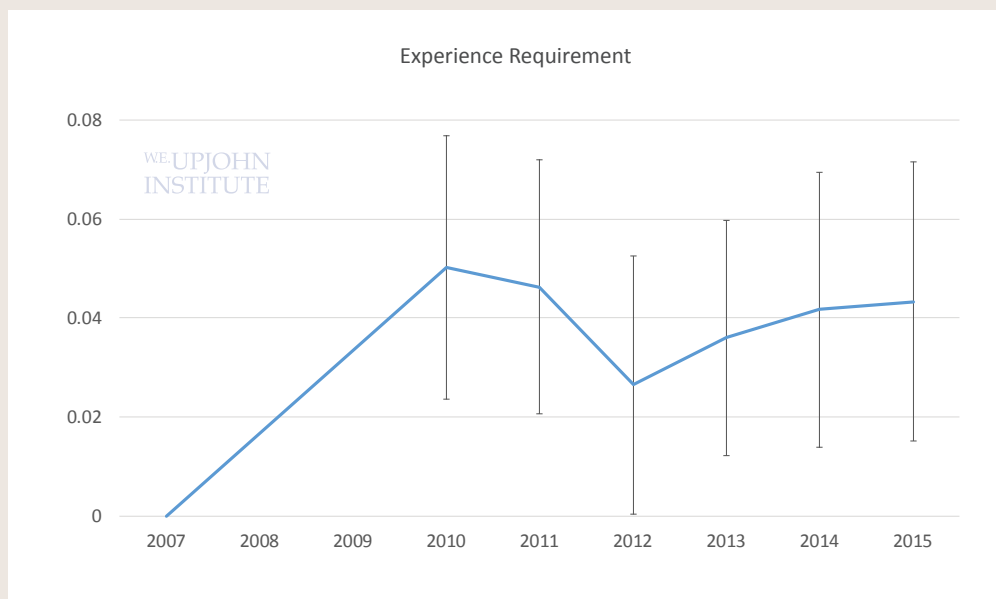
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**Figure 1 Effect of MSA-Specific Great Recession Employment Shock on Skill Demand in Job Postings - Panel A**



**Panel B**



upskilling occurs almost entirely within occupations, and that the same firms that upskilled by 2010 drive the persistence later in our sample period.

### Technology Adoption

These patterns collectively suggest that a structural shift in the demand for skill occurred disproportionately in harder-hit areas. Why might that

have happened? Notably, the skill requirements we analyze—education, experience, cognitive, and computer—have been found to complement routine-biased technologies. If a structural shift in line with RBTC is occurring, we would expect changes in these skill requirements also to be accompanied by an accelerated adoption of such technologies.

Indeed, we find that increases in skill requirements are correlated with capital investments for both MSAs and individual firms. Using the Ci Technology Database from Harte-Hanks, a market intelligence firm, we show that businesses in harder-hit MSAs exhibited faster adoption of personal computers at the same time that they upskilled in job postings. These differences emerge only after the Great Recession and, once again, persist through our sample period. We are also able to link firms in our job postings database to those in the Harte-Hanks database, as well as to publicly traded firms in the Compustat database, which contains measures of physical capital (property, plant, and equipment). We show that the firms with greater increases in capital investments, either PC adoption or physical capital holdings, are also more likely to upskill in their job postings.

### Routine Jobs

Furthermore, if this increased investment and upskilling is in fact related to routine-biased technologies, we would expect to see the strongest changes to labor characteristics for the jobs most susceptible to such technologies—ones that involve routine, codifiable tasks. We distinguish routine-cognitive occupations (e.g., clerical, administrative, and sales) from routine-manual ones (e.g., production and operatives). For routine-manual occupations, we find evidence consistent with firms' substitution of technology for labor—a sharp increase in layoff risk for workers in harder-hit areas early in the Great Recession, followed by persistently depressed employment level with little impact on skill requirements. This is the traditional view exhibited in studies of job polarization and in the popular press of the fear of automation: employment losses concentrated in occupations we expect to be most readily replaceable by machines.

However, in contrast to this conventional view of labor substitution,

routine-cognitive occupations in harder-hit MSAs surprisingly exhibit only modest increases in layoff risk and no relative employment losses. Instead, we show that these occupations experience pronounced upskilling, as well as modest relative wage and employment growth after the recession. That is, rather than disappearing entirely, surviving routine-cognitive occupations appear to have become both relatively higher-skilled and more productive. These occupations thus became less routine—and more cognitive—because of the Great Recession.

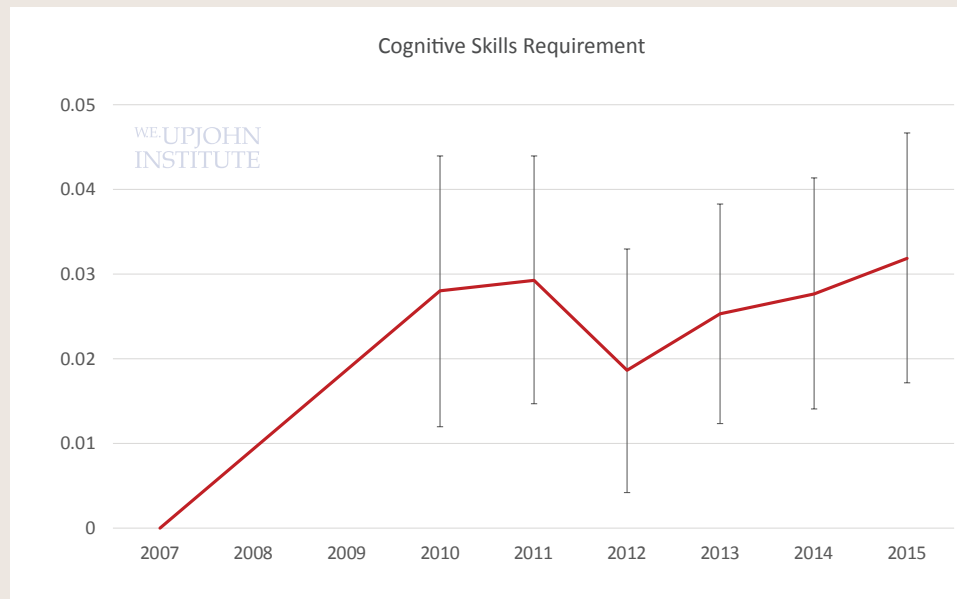
**Conclusion**

During the recovery from the Great Recession, anecdotal evidence suggests that the composition of new hires shifted toward higher-skilled workers, resulting in many workers being “overeducated” for their jobs (Burning Glass Technologies 2014). However, it was not clear how broad, deep, or enduring these effects were, or the extent to which they were driven by labor supply or labor demand responses.

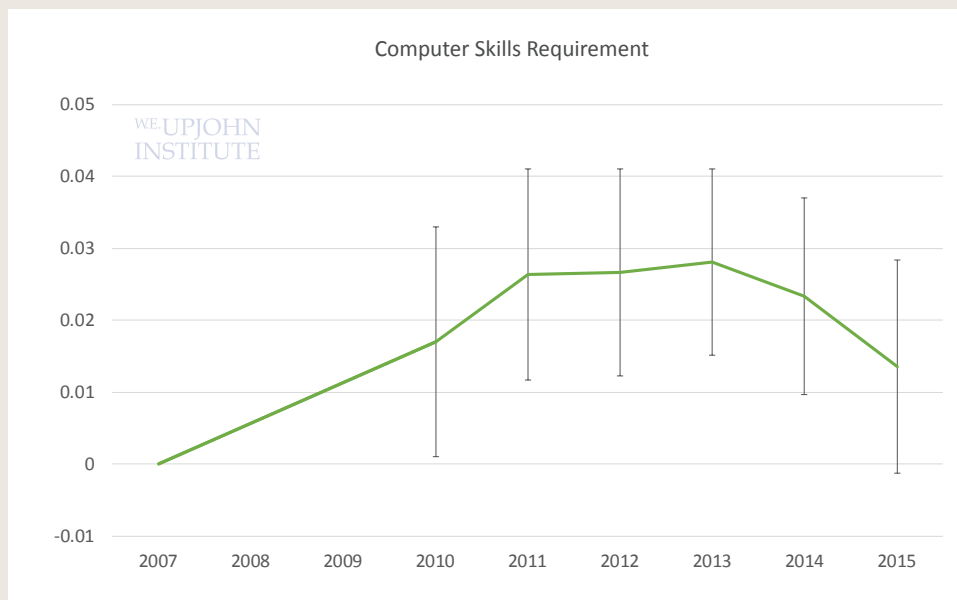
The evidence we bring to bear supports that shifts in skill requirements in the aftermath of the recession reflect technologically driven changes in the means of production, not just changes in whom firms seek to hire. As hypothesized by many other researchers, these kinds of episodic, productivity-enhancing changes can result in jobless recovery. Our findings are thus extremely relevant for policymakers, who allocate billions of taxpayer dollars to subsidize workers’ job searches in a downturn.

The U.S. economy has seen remarkable changes over the past 30 years, brought on by the computer revolution and globalization. These changes have led to great increases in productivity and wealth, but the benefits have not been shared among all workers. Indeed, a large population of workers, formerly employed in routine-task jobs, have suffered

**Figure 1 Panel C**



**Panel D**



NOTE: Figures show the change in likelihood of a job posting having the listed requirement, relative to 2007, for an MSA at the 90th percentile of the Great Recession employment shock compared to an MSA at the 10th percentile. For example, the Education Requirement graph shows that between 2007 and 2010 the probability of a job posting listing an education requirement increased by 5.3 percentage points more in a hard-hit MSA than a less-affected MSA.

SOURCE: Hershbein and Kahn (2016).

permanent labor market, health, and social consequences from structural changes in the economy. Our results highlight that a worker’s ability to adjust to these changes may be especially

difficult because the changes are sudden, concentrated in recessions. If the changes to production instead occurred more gradually, workers would still need to be retrained, but

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fewer of them at any given time, and with more time in which to do it. Instead, large numbers of workers can find their skills depreciated at the same time, with limited prospect of finding comparable reemployment. Public policy has yet to figure out how to reallocate workers on a large scale following a recession, or provide training in the new skills demanded by employers, but the need to do so is likely only to grow.

### NOTE

1. We rank 381 MSAs in the United States according to the predicted change in employment growth between 2006 and 2009. For ease in interpretation, we define a “hard-hit” MSA as one that experienced an employment shock at the 90th percentile (in absolute value, so that 1 in 10 MSAs had a worse shock), and compare this “hard-hit” MSA to one that experienced a 10th percentile shock (so that 1 in 10 MSAs had a milder shock).

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# The 2008 Economic Stimulus Payments Increased Emotional Well-Being

Marta Lachowska

Over the past few decades, economists have become more interested in understanding the determinants of subjective well-being (SWB).<sup>1</sup> For example, SWB has been used to study the welfare trade-off between inflation and unemployment (Di Tella, MacCulloch, and Oswald 2001), welfare costs of business cycles (Wolfers 2003), the need to interact with others (Krueger and Schkade 2008), and mental costs of job loss (Clark and Oswald 1994). However, perhaps the best-known application of SWB in economics has been to answer the question, “Does more income make you happier?”

This article highlights findings recently published in the *Journal of Human Resources*, in which Lachowska (2017) estimates the effect of income on SWB using exogenous variation in the timing of the 2008 economic stimulus tax rebate payments. Because the rebates were disbursed using a close-to-random schedule of payment, the tax rebate program offers an attractive setting for identifying the effect of a medium-sized income change on SWB, measured as life satisfaction, health satisfaction, or emotional well-being (also known as affect).

As the United States entered the Great Recession in February 2008, the Bush administration proposed an economic stimulus package that included tax rebates to low- and middle-income families with the goal of increasing household spending. Eligibility for the tax rebates was determined by the previous year’s tax returns. The payments ranged between \$300 and \$600 for individual tax filers and between \$600 and \$1,200 for joint filers, and the average value of the tax rebate payment was about \$1,000.

An interesting feature of the economic stimulus package was that the U.S. Treasury did not disburse the rebates all at once, but instead opted for a sequential payment schedule that depended on the last two digits of the filer’s Social Security number (SSN). As these two digits of the SSN are assigned randomly, the timing of when someone received a payment was also as good as random.

The randomized timing of rebate disbursement is valuable for at least two reasons. First, it allows me to estimate if rebates actually cause well-being to increase. Second, several papers have shown that the rebates had a positive effect on household

### ARTICLE HIGHLIGHTS

■ *This research estimates the effect of income on emotional well-being using the close-to-random variation in the timing of the disbursement of the 2008 tax rebate payments.*

■ *The findings show that receiving the rebate had a very positive effect on emotional well-being, mainly stemming from a reduction in stress and worry.*