People versus machines: the impact of minimum wages on automatable jobs

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People versus Machines

The Impact of Minimum Wages on Automatable Jobs

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For decades, economists have studied the effects of the minimum wage on employees in the United States. These studies have largely focused on the employment effects for low-skilled workers—with the principal focus on teenagers. Overall, there is some controversy regarding whether disemployment effects exist, with some studies finding no effects, although with more—and more diverse kinds of studies—finding evidence of effects.

We explore the extent to which minimum wages induce substitution away from workers whose jobs are more easily automated. For instance, employers may replace labor with technological innovations—such as supermarkets substituting self-service checkout for cashiers, and assembly lines in manufacturing plants substituting robotic arms for workers. At the same time, firms may hire other workers who perform new tasks that are complementary with the new technology. For example, a firm using more robots may hire individuals to service, troubleshoot, and maintain these new machines. It seems reasonable to expect that the workers more likely to be replaced following minimum wage increases are those who are low skilled, earning wages affected by increases in the minimum wage, while workers who "tend" the machines are higher skilled. This suggests that there is a potential for labor reallocation away from jobs that are automatable following increases in the minimum wage, that low-skilled workers in automatable jobs are particularly vulnerable to minimum wage increases, and that the net disemployment effects may be smaller than the gross effects that workers in automatable tasks experience.

We choose to focus on automation because it has been one of the major forces threatening low-skilled jobs in the United States in recent decades, presumably because of both technological advances and reductions in the cost of technology that can substitute for low-skilled labor. Minimum wages can exacerbate these changes when they raise the price of low-skilled labor in automatable jobs for which machines can be substituted.

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Our main aim is to provide a richer understanding of how minimum wage policies have been shaping the type of employment held in the United States, within industries and for particular demographic groups. Specifically, we empirically assess whether the share of employment that is automatable declines in response to minimum wage increases. We focus on jobs that tend to be held by low-skilled workers, given that these are the jobs for which labor costs increase the most in relative terms following a minimum wage increase, which can prompt firms to replace people (low-skilled ones, in particular) with machines. We complement our analyses of how the share of employment in automatable jobs responds to minimum wage increases with analyses of employment impacts for individual workers, estimating whether the probability that low-skilled workers in automatable jobs lose their jobs is greater following a minimum wage increase.

Our analysis is related to concurrent research by Daniel Aaronson and Brian J. Phelan, who, for the period 1999–2009, analyze the susceptibility of low-wage employment to technological substitution in the short run. They find that minimum wage increases lead to job losses for cognitively routine jobs, but not manually routine or nonroutine jobs. Their study provides some evidence that firms may automate routine jobs in response to a minimum wage increase, reducing employment opportunities for workers in routine jobs.

We add value beyond this analysis in a number of ways. First, whereas Aaronson and Phelan are concerned with an average individual's job loss, we focus on quantifying how shares in the employment of automatable tasks change following a minimum wage change, to provide more evidence on how the task composition of the workforce is affected.

Second, we expect that automation is a viable and likely substitute for certain types of low-skilled jobs, and therefore also certain types of low-skilled labor, implying that average effects may mask significant heterogeneity. Therefore, our second contribution is to provide a comprehensive picture of labor-market adjustments across industries and a variety of demographic groups, which can uncover these important differential responses. This may be of particular interest within the broader minimum wage literature. While that literature has largely focused on teenagers (and more recently restaurant workers), we take a broader perspective, expanding the analysis to subgroups of workers not usually considered in the minimum wage literature, who may be adversely affected by minimum wages because they tend to be employed in automatable jobs.

Third, for those who lose their jobs to automation following a minimum wage increase, we expect that the risk of not being able to find a similar job is greater for some groups as compared to others, and that an inability to do so has longer-term adverse consequences for earnings (and reemployment). Hence, we also analyze the effects of minimum wage increases on whether particular types of low-skilled individuals working in automatable jobs are more or less likely to stay employed, or stay employed in the same occupation, following a minimum wage increase.

Together, our analyses provide the first evidence on how the shares of automatable jobs change following a minimum wage increase, and on the effects of minimum wages on groups that are very often ignored in the minimum wage literature, such as effects on older, less-skilled workers who are in jobs where it is easier to replace people with machines.

Our work is timely given that many U.S. states have continued to regularly raise their minimum wages, and a large number of additional states have newly implemented minimum wage laws (all higher than the federal minimum wage), with a number of states now indexing their minimum wages. As of January 7, 2017, 30 states (including the District of Columbia) had a minimum wage higher than the federal minimum wage of $7.25, ranging as high as $11.00 in Washington State, and $11.50 in the District of Columbia. Moreover, many U.S. cities have implemented minimum wages, with the minimum wage in Seattle (and nearby Sea-Tac) reaching $15. Policy debate regarding these increases frequently references the literature on disemployment effects discussed above (a literature from which advocates on either side can pick evidence to support their views). But this literature largely focuses on teenagers, for whom employment effects are either irrelevant, or at best very tangentially related, to the more important policy question of whether higher minimum wages help low-income families. If employment changes in response to higher minimum wages mask larger gross effects for subgroups of low-skilled workers in automatable tasks—and in particular subgroups ignored in the existing minimum wage literature—then the reliance of policymakers on evidence for teenagers may be ignoring potentially adverse effects for older workers more likely to be major contributors to their families' incomes. Our empirical analysis draws on Current Population Survey data from 1980–2015.

Overall, we find that increasing the minimum wage decreases significantly the share of automatable employment held by low-skilled workers. Our estimates suggest that an increase of the minimum wage by $1 (based on 2015 dollars) decreases the share of low-skilled automatable jobs by 0.43 percentage point. However, these average effects mask significant heterogeneity by industry and by demographic group.

In particular, minimum wage increases have large effects on the share of automatable employment in manufacturing, where we estimate that a $1 increase in the minimum wage decreases the share of automatable employment among low-skilled workers by 0.99 percentage point. Within manufacturing, the share of older workers in automatable employment declines most sharply, and the share of workers in automatable employment also declines sharply for women and blacks.

Our analysis at the individual level draws many similar conclusions. We find that a significant number of individuals who were previously in automatable employment are unemployed in the period following a minimum wage increase. These effects are among the largest for individuals employed in the manufacturing industry and are larger for the oldest and youngest workers, for females, and for blacks. Overall, our analysis points to important heterogeneity in the employment effects of minimum wages, and highlights potentially adverse consequences of higher minimum wages for groups of workers that have not typically been considered in the extensive research literature on the employment effects of minimum wages. That is, the main message from our work is that groups often ignored in the minimum wage literature are in fact quite vulnerable to employment changes and job loss because of automation following a minimum wage increase.

In the future many more occupations that employ low-skilled workers are on track to be automated. These include, for example, taxi drivers, cashiers, and bricklayers. Therefore, it is important to acknowledge that minimum wage increases can give incentives for firms to adopt new technologies that replace workers earlier. While these adoptions undoubtedly lead to some new jobs, there are workers who do not have the skills to do the new tasks who will be displaced. Our analysis has identified workers whose vulnerability to being replaced by machines has been amplified by minimum wage increases. Such effects may spread to more workers in the future.

NOTE:

This research brief is based on Grace Lordan and David Neumark, "People versus Machines: The Impact of Minimum Wages on Automatable Jobs," NBER Working Paper no. 23667, August 2017, http://www.nber.org/papers/w23667.