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THE SHORT-RUN EMPLOYMENT EFFECTS OF RECENT MINIMUM WAGE CHANGES: EVIDENCE FROM THE AMERICAN COMMUNITY SURVEY

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This paper presents early evidence on the employment effects of state minimum wage increases enacted between January 2013 and January 2015. As of 2015, we estimate that relatively large minimum wage increases (defined as those exceeding $1) reduced employment among low-skilled population groups by just over 1 percentage point. Smaller minimum wage increases, as well as increases linked to inflation indexation provisions, appear to have had much smaller (and possibly positive) effects on employment over our sample period. The estimates thus raise the potential importance of nonlinearities in the minimum wage's effects, which are consistent with standard models of the labor market. (*JEL* H11, J08, J23)

I. INTRODUCTION

Recent state policy changes offer an attractive opportunity for analyzing the minimum wage's effects on the labor market. Historical variation in the minimum wage has been suitable primarily for analyzing the short-run effects of relatively modest minimum wage increases (Sorkin 2015). The literature analyzing these historical minimum wage changes has generated much debate and little consensus (Allegretto et al. 2017; Neumark, Salas, and Wascher 2014). The debate suffers from the fact that alternative research designs have opaque, and hence difficult to evaluate, implications for what variation underlies economists' preferred estimates (Neumark 2017). Recent policy developments offer an opportunity to generate estimates of the effects of minimum wage increases that are relatively transparent regarding the economic and policy variation at work. These developments offer an opportunity to compare labor market outcomes across states that, after a period of policy stability, embarked on quite different policy paths.

In the years following the Great Recession, there was a lull in both state and federal efforts to increase minimum wages. Following the federal minimum wage's July 2009 rise to $7.25, few states enacted new statutory minimum wage changes through the end of 2012. In more recent years, however, a significant number of state-level minimum wage policy changes have taken place. On a January-to-January basis, one-time or multiphase statutory minimum wage changes were enacted by 1 state from 2012 to 2013, 4 from 2013 to 2014, and 17 from 2014 to 2015. Across these states, the average increase enacted between January 2012 and January 2015 was $0.92 (12%). Over this same time period, the minimum wage rose by an average of $0.74 (9%) across the nine states that indexed annually for inflation. Many additional minimum wage changes have since taken effect, including 19

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ABBREVIATIONS

ACS: American Community Survey
BEA: Bureau of Economic Analysis
CPS: Current Population Survey
DOL: Department of Labor
FHFA: Federal Housing Finance Agency

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state-level changes implemented in January 2017.[1]

The policy environment described above offers an opportunity to conduct relatively transparent analyses using standard program evaluation methods. In that spirit, this paper uses the American Community Survey (ACS) to develop short-run estimates of the recent employment effects of minimum wage increases. In Sections II, III, and IV, we set the stage for our empirical analysis. Section II provides further background regarding the minimum wage changes we analyze. Section III discusses the primary data sources we utilize. Section IV then describes the regression specifications we implement.

Our analysis follows a standard difference-in-differences strategy in which we compare employment changes in states that increased their minimum wage rates to employment changes in states that did not.[2] The key threat to this research strategy is the possibility that broader economic factors affected employment in ways that differed across these groups of states. Within the difference-in-differences framework, we thus explore the sensitivity of our estimates to controlling directly for macroeconomic variables that proxy for several dimensions of economic activity. The controls we consider include aggregate income per capita, an index of median house prices, and employment among skill groups that are unlikely to be affected directly by the minimum wage. We further explore the timing of the employment changes we estimate to guard against potential biases associated with preexisting trends. We also augment our difference-in-differences approach with a triple-difference analysis in which we use relatively high-skilled individuals to construct "within-state control" groups.

Section V presents our short-run estimates of the effects of state minimum wage changes implemented between January 2013 and January 2015. Our overall reading of the evidence is that, through 2015, recent minimum wage increases have modestly held back employment among low-skilled population groups. Our best estimate is that minimum wage increases exceeding $1 reduced employment by just over 1 percentage point among groups including teenagers, individuals ages 16–21, and individuals ages 16–25 with less than a completed high school education. By contrast, smaller minimum wage increases (including those linked to inflation indexation provisions) appear to have had much smaller (and possibly positive) effects on employment. The estimates thus point to the potential importance of nonlinearities in the minimum wage's effects. Further analyzing such nonlinearities will be important in coming years, as states' scheduled minimum wage increases significantly exceed historical increases. In a precommitment plan developed in a companion working paper (Clemens and Strain 2017), we set out a framework for pursuing this line of analysis over coming years.[3]

The estimates we present are divided in the extent to which they are distinguishable from zero at conventional statistical significance levels. Limitations in the estimates' precision thus make us reluctant to draw strong qualitative conclusions. As discussed in Section VI, the uncertainty underlying the estimates highlights the need for future analysis on longer-run effects.

II. BACKGROUND ON STATE MINIMUM WAGE CHANGES BETWEEN 2011 AND 2015

Our analysis investigates the effects of state minimum wage changes enacted between January 2013 and January 2015. Table 1 shows our division of states into those that have been indexing their minimum wage rates to inflation, those that enacted small statutory minimum wage changes, and those that enacted statutory minimum wage changes totaling at least $1 between January 2013 and January 2015. Using Department of Labor (DOL) data on states' prevailing minimum wage rates, we code eight states

1. Note that slightly different counts of states are obtained when making year-over-year rather than January-to-January comparisons. We classify the District of Columbia as a state for these tabulations. We do not include New Jersey in our list of "indexers" because it had not begun indexing its minimum wage rate for inflation until 2014.

2. Our strategy is similar to that employed in a recent analysis by Black et al. (2016). We analyze samples selected on the basis of age or both age and education, while Black et al. (2016) analyze industries that disproportionately employ low-skilled workers. Our analysis follows the mold of analyses including Sabia, Burkhauser, and Hansen (2012), Hoffman (2014), and Clemens and Wither (2014).

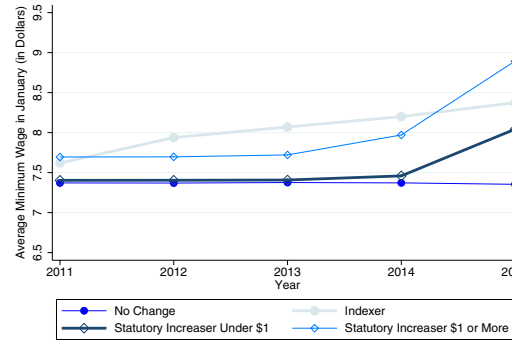
3. Because the companion paper and this paper describe and implement the same basic empirical research design, there is significant overlap in the text of the two papers. This is particularly true of their descriptions of states' minimum wage changes and of the regression specifications. The empirical analysis of the companion paper is conducted using the Current Population Survey, while the empirical analysis of this paper is conducted using the American Community Survey.

TABLE 1
List of States with Statutory Minimum Wage Increases and Inflation-Indexed Increases

Statutory Increasers of $1 or More	Statutory Increasers Under $1
Alaska	Arkansas
California	Connecticut
District of Columbia	Delaware
Massachusetts	Hawaii
New Jersey	Maryland
New York	Michigan
Rhode Island	Minnesota
South Dakota	Nebraska
	West Virginia
Indexers	
Arizona	
Colorado	
Florida	
Missouri	
Montana	
Ohio	
Oregon	
Vermont	
Washington	

Notes: Data on minimum wage indexing provisions come from the National Council of State Legislatures. The states labeled as Indexers link annual updates to their effective minimum wage rates to a measure of inflation. Data on minimum wage changes come from the U.S. DOL. States are counted as statutory increasers of under $1 if the combined statutory increase in the minimum wage from January 2013 through January 2015 was under $1. States are counted as statutory increasers of $1 or more if the combined statutory increase in the minimum wage was $1 or more.

FIGURE 1
Average Minimum Wage across Policy Regimes



Notes: This figure plots the average annual effective minimum wage for states in each of our four policy categories from January 2011 to January 2015. States are defined as statutory increasers under $1 if the combined statutory increase in their minimum wage between January 2013 and January 2015 was under $1. States are defined as statutory increasers of $1 or more if the combined statutory increase in their minimum wage was $1 or greater. Indexers are states that index their minimum wage to inflation. The effective minimum wage is defined as the maximum of the state and federal minimum wage. Data on minimum wage rates come from the U.S. DOL. Data on minimum wage policies come from the National Conference of State Legislatures. Averages are weighted by state population.

as states that enacted minimum wage increases of $1 or more, nine states as states that enacted minimum wage changes less than $1, and nine states as states that have indexed their minimum wage rates to inflation since early in our analysis period. We assign each state to one of these three groups or to the control group.[4] Table S1 in Appendix S1, Supporting Information itemizes the full set of statutory minimum wage changes we analyze, including information on the dates they were signed into law and the dates each change was enacted.

Figure 1 shows the time paths of the average effective minimum wages in the states to which we apply each designation. From January 2011 to January 2013, the figure shows that minimum wage changes were quite modest and were concentrated primarily among states with inflation indexing provisions. Several states implemented nontrivial minimum wage changes between January 2013 and January 2014. Substantially more minimum wage raising activity took place between January 2014 and January 2015.

The timing of the minimum wage changes we analyze motivates the regression specifications we ultimately implement. Specifically, we estimate the minimum wage's effects from a base period including 2011, 2012, and 2013 through subsequent years. We interpret 2014 as a "transition" year during which modest increases were implemented and future changes were legislated. We interpret 2015 as the year during which this period's minimum wage changes took effect.

III. DATA SOURCES

Our primary data source is the ACS, which is the largest publicly available household survey data set containing the information required for our analysis. Kromer and Howard (2011) provide detailed documentation of differences between the sampling procedures and employment questions posed in the ACS relative to the smaller

4. States' designations will increasingly overlap in future years. In 2014, for example, New Jersey introduced an inflation indexation provision. Several states with longstanding inflation indexation provisions (e.g., Washington and Oregon) have more recently joined the ranks of the states with statutory minimum wage changes.

and more commonly analyzed Current Population Survey (CPS). The sampling universes of the ACS and CPS differ in that the ACS includes individuals residing in institutionalized group quarters while the CPS does not. The inclusion of these individuals in our primary analysis samples does not materially affect our results. Respondents to both surveys answer questions describing their employment status over the course of a reference week. In the ACS, the reference week is the previous calendar week; in the CPS, the reference week is the week containing the 12th day of the month. Kromer and Howard (2011) document that improvements to the ACS's employment questions, first implemented in 2008, significantly improved the comparability of estimates generated using the two surveys. Over the time period we analyze (2011–2015), the employment rate for the noninstitutionalized population ages 16–64 averaged 68.3% in ACS data and 67.7% in CPS data.

We supplement the ACS with data on macroeconomic covariates that may be relevant as control variables. In the analysis presented below, we control for variations in the recovery of the housing market using a state-wide median house price index from the Federal Housing Finance Agency (FHFA). We similarly control for data on aggregate state income per capita from the Bureau of Economic Analysis (BEA). Finally, we account for variations in broader labor market developments by controlling for employment among skill groups that are not directly affected by the minimum wage.

Table 2 presents summary statistics on the primary ACS samples we analyze. The first sample, described in columns 1 and 2, consists of individuals ages 16–25 with less than a completed high school education. The second sample, which is described in columns 3 and 4, consists of all individuals ages 16–21. Columns 1 and 3 present summary statistics for the base period, namely 2011–2013, while columns 2 and 4 present summary statistics for the "post" period in our analysis, namely 2015.

Wage data from the Outgoing Rotation Group files of the CPS confirm that the skill groups we analyze have relatively high potential exposure to minimum wage changes. Specifically, we estimate the fraction of individuals in the skill groups we analyze whose wage rates in 2011–2013 were below their states' January 2015 minimum wage rates. Among individuals in states that increased their minimum wage rates, this applies to 15% of the population ages 16–21, 13% of the teenage population, and 12% of the population ages 16–25 with less than a completed high school education. These population shares account for 44% of employed individuals ages 16–21, 53% of employed teenagers, and 55% of employed individuals ages 16–25 with less than a completed high school education.

The baseline employment rate for the sample of individuals with less than a completed high school education is 22.5%, while the baseline employment rate for the sample of all individuals ages 16–21 is 37.4%. Comparable employment figures from the CPS were 23.4 and 36.0%, respectively. The relevance of our analysis period's economic expansion is apparent in the employment increases, house price increases, and income growth that can be seen in Table 2. Employment rates among individuals in both skill groups expanded by between 2 and 3

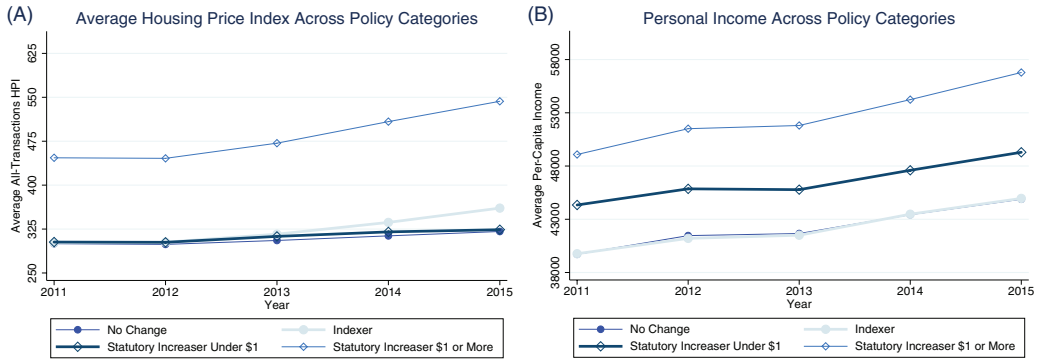
TABLE 2

Sample Summary Statistics: ACS and Supplemental Data for 2011–2013 and 2015

Years	(1) 2011–2013	(2) 2015	(3) 2011–2013	(4) 2015
Skill Groups	Ages 16–25 w/ < High School		Ages 16–21	
Employment	0.225	0.247	0.374	0.407
	(0.417)	(0.431)	(0.484)	(0.491)
Age	17.90	17.76	18.58	18.56
	(2.444)	(2.371)	(1.704)	(1.710)
Black	0.166	0.158	0.153	0.148
	(0.372)	(0.364)	(0.360)	(0.355)
High school degree	0	0	0.343	0.350
	(0)	(0)	(0.475)	(0.477)
Some college education	0	0	0.247	0.247
	(0)	(0)	(0.431)	(0.431)
House price index	326.9	371.8	331.4	377.8
	(100.5)	(114.1)	(102.2)	(116.9)
Income per capita (1000s)	43.48	47.79	43.72	48.13
	(6.264)	(6.950)	(6.360)	(7.087)
Effective minimum wage	7.531	7.949	7.536	7.975
	(0.422)	(0.710)	(0.424)	(0.719)
Observations	346,135	107,821	774,438	248,962

Notes: This table reports summary statistics for our two sample groups. Columns 1 and 2 report averages and standard deviations (in parenthesis) of each of the variables for our subsample of low-skill individuals, defined as individuals ages 16–25 with less than a high school education. Columns 3 and 4 report averages and standard errors (in parenthesis) for our subsample of young adult individuals, defined as individuals ages 16–21. Entries for employment, age, race, and education summarize data from the ACS. The house price index variable uses data from the FHFA. The income per capita variable uses data from the BEA. The effective minimum wage variable uses data from the Bureau of Labor Statistics.

FIGURE 2
Evolution of Macroeconomic Covariates across Minimum Wage Policy Regimes



Notes: Panel A plots the average housing price index variable for each of our four policy categories from 2011 to 2015. Housing price index data come from the Federal Housing Finance Agency. Panel B plots average per-capita income for each of our four policy categories from 2011 to 2015. Data on average per-capita income come from the BEA. States are defined as statutory increasers under $1 if the combined statutory increase in their minimum wage between January 2013 and January 2015 was under $1. States are defined as statutory increasers of $1 or more if the combined statutory increase in their minimum wage was $1 or greater. Indexers are states that index their minimum wage to inflation. Averages are weighted by state population.

percentage points. Aggregate income per capita rose by around $4,000 in nominal terms.

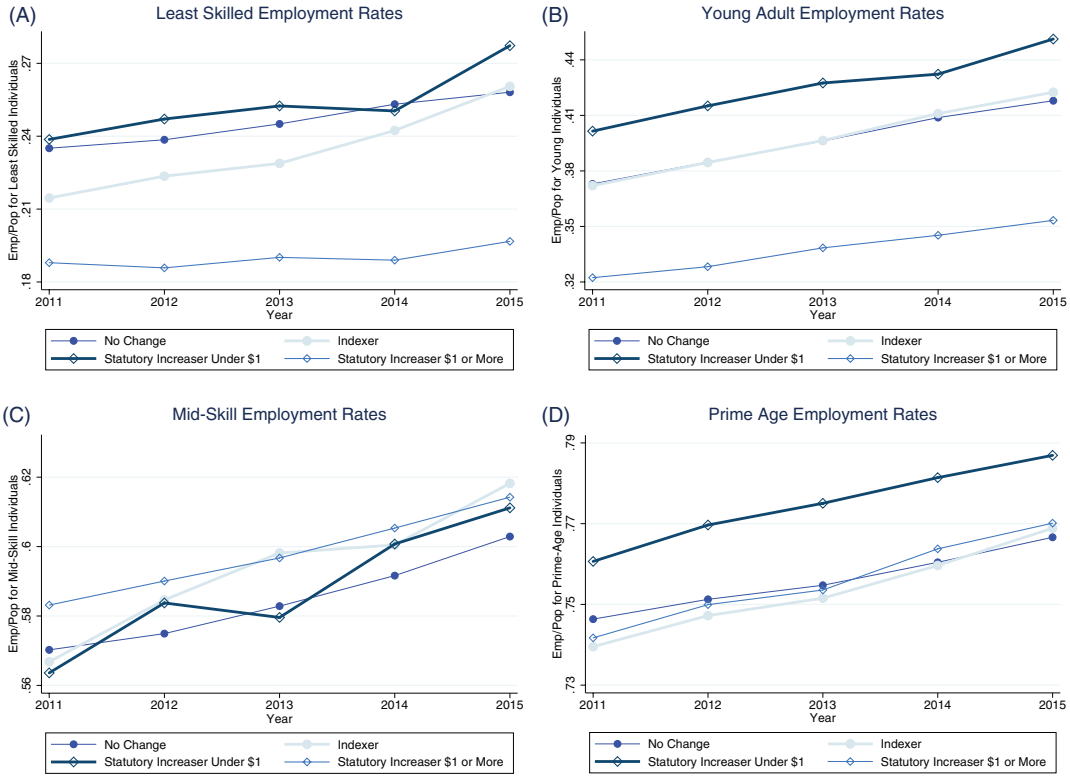
With respect to demographics, the average age of the individuals in the samples described in columns 1 and 2 is just under 18, while the average age of the individuals in the samples described in columns 3 and 4 is 18.5 years. Just over 15% of the individuals across our analysis samples are black. By construction, no individuals in the samples described in columns 1 and 2 have obtained a high school degree, while roughly one third of the individuals in the broader sample of young adults have done so.

Figure 2 presents time series on the median house price index (Panel A) and aggregate income (Panel B) separately across the policy regimes we analyze. That is, it presents these series separately for states that enacted large minimum wage increases, small minimum wage increases, inflation indexed wage increases, and no minimum wage increases. The figure, which we discuss momentarily, thus presents two series that are relevant for gauging differences in the macroeconomic conditions facing the groups of states we analyze. Figure 3 presents additional evidence on the evolution of employment among prime aged adults (Panel D) and among a group consisting of young individuals with high school degrees and individuals over age 30 with less than a completed high school degree (Panel C). The latter individuals thus have education and/or experience modestly beyond that obtained by most minimum wage workers. Additional tabulations of the data underlying Figures 2 and 3 can be found in Table 3.

The house price index reveals that the housing recovery was quite strong in states that enacted minimum wage increases exceeding $1. Median house prices rose by roughly 20% in this group of states from the 2011–2013 base period through 2015. They also rose by roughly 20% in states that index their minimum wage rates for inflation. Across states that either did not increase their minimum wage rates or that enacted small minimum wage increases, median house prices rose by an average of roughly 10%. The BEA's income data show that per capita incomes grew roughly $2,000 more in states that enacted minimum wage changes exceeding $1 than in all other groups of states. Macroeconomic conditions thus appear to have improved to a greater degree in states that enacted large minimum wage changes than in other states.

The employment series similarly suggests that economic conditions were moderately stronger in states that enacted minimum wage increases relative to other states. Prime age employment, for example, grew by an average of 2.3 percentage points in states that either enacted minimum wage changes exceeding $1 or that index their minimum wage rates for inflation. Across states that enacted no minimum wage increases, prime age employment increased by a more modest average of 1.6 percentage points.

FIGURE 3
Evolution of Employment across Minimum Wage Policy Regimes



Notes: This figure plots average annual employment rates for each of our four policy groups, broken out across four subsamples, from 2011 to 2015. Panel A plots employment rates for least-skilled individuals, defined as individuals ages 16–25 without a completed high school education. Panel B plots employment rates for young adults, defined as individuals ages 16–21. Panel C plots employment rates for mid-skill individuals, defined as individuals ages 22–30 years old with a high school degree and high school dropouts between the ages of 30 and 65. Panel D plots employment rates for prime age individuals, defined as individuals between the ages of 26 and 54. Employment data come from the ACS. States are defined as statutory increasers under $1 if the combined statutory increase in their minimum wage between January 2013 and January 2015 was under $1. States are defined as statutory increasers of $1 or more if the combined statutory increase in their minimum wage was $1 or greater. Indexers are states that index their minimum wage to inflation. Averages are weighted by state population.

The remaining panels of Figure 3 display employment trends among the skill groups in our primary analysis samples. As summarized in Table 3, employment among individuals ages 16–25 with less than a completed high school education expanded 1 percentage point less in states that enacted minimum wage changes exceeding $1 than in states that enacted no minimum wage increase. A similar pattern emerges in employment among all individuals ages 16–21. Comparisons involving states that enacted either small increases or inflation indexed increases are qualitatively different. Most notably, employment among individuals ages 16–25 with less than a completed high school education grew faster in these states than in states that enacted no increases. This fact pattern foreshadows our eventual conclusion that large minimum wage increases had negative employment effects while small minimum wage increases had modest and potentially positive employment effects over the time period under analysis.

IV. FRAMEWORK FOR ESTIMATING THE EFFECTS OF RECENT MINIMUM WAGE CHANGES

This section presents our regression framework for estimating the effects of recent minimum wage increases. We take a standard

TABLE 3
Unadjusted Differences across Minimum Wage Policy Regimes

	(1) 2011–2013	(2) 2015	(3) Change	(4) Change Relative to Nonincreasers
Young Adult Employment				
Nonincreasers	0.385	0.418	0.033	
Indexers	0.384	0.422	0.038	0.005
Increase < $1	0.415	0.451	0.036	0.003
Increase ≥$1	0.330	0.353	0.023	−0.010
Low-skilled employment				
Nonincreasers	0.239	0.258	0.019	
Indexers	0.222	0.261	0.039	0.020
Increase < $1	0.246	0.277	0.031	0.012
Increase ≥$1	0.188	0.197	0.009	−0.010
Prime-aged employment				
Nonincreasers	0.751	0.767	0.016	
Indexers	0.746	0.769	0.023	0.007
Increase <$1	0.768	0.787	0.019	0.003
Increase ≥$1	0.748	0.770	0.022	0.006
Mid-skill employment				
Nonincreasers	0.576	0.603	0.027	
Indexers	0.583	0.618	0.035	0.008
Increase <$1	0.576	0.611	0.035	0.008
Increase ≥$1	0.590	0.614	0.024	−0.003
House price index				
Nonincreasers	274.5	304.1	29.6	
Indexers	291.3	351.1	59.8	30.2
Increase <$1	303.0	335.4	32.4	2.8
Increase ≥$1	457.2	546.4	89.2	59.6
Income per capita ($1,000s)				
Nonincreasers	40.64	44.63	4.0	
Indexers	40.68	44.76	4.1	0.0
Increase <$1	44.52	48.48	4.0	−0.1
Increase ≥$1	50.10	56.14	6.0	2.0

Notes: This table reports employment rates for each our of our four policy groups (non-increasers, indexers, increase <$1, and increase ≥$1) broken out across four types of individuals: young adults, low-skill, prime-age, and mid-skill. Young adults are defined as individuals ages 16–21. Low-skill adults are those ages 16–25 without a completed high school education. Prime age adults are defined as individuals between the ages of 26 and 54. Mid-skill individuals are those ages 22–30 years old with a high school degree, or high school dropouts between the ages of 30 and 65. This table also reports mean values of economic control variables (house price index and income per capita) for each of our four policy groups. The employment variables are constructed using ACS data, the income per capita variable uses BEA data, and the house price index variable uses FHFA data. Data sources are more fully described in the note to Table 2. Column 1 reports the average value between 2011 and 2013 for each row, column 2 reports the 2015 average, and column 3 reports the difference between the two. Column 4 reports the change in the average value for each row relative to the relevant nonincreaser value. Averages are weighted by state population.

program evaluation approach in which we divide states into groups based on the policy changes they have implemented over this time period. We then estimate standard difference-in-differences specifications to identify differential changes in employment among low-skilled individuals across groups of states. The basic structure of the analysis is quite similar to that employed in Sabia, Burkhauser, and Hansen (2012), Hoffman (2014), and Clemens and Wither (2014).

Our basic difference-in-differences specification is presented in Equation (1) below:

$$(1)\quad Y_{i,s,t} = \sum_{p(t)\neq 0} \beta_{p(t)} Policy_s \times Post_{p(t)} + \alpha_{1s}\, State_s + \alpha_{2t}\, Time_t + X_{i,s,t}\,\gamma + \varepsilon_{i,s,t},$$

where $Y_{i,s,t}$ is a binary indicator of the employment of individual i, living in state s, in year t. We estimate Equation (1) on samples restricted to the population groups most likely to be affected by the minimum wage. These groups consist of young adults (individuals ages 16–21), teenagers, and individuals ages 16–25 with less than a completed high school education.

Like any standard difference-in-differences specification, Equation (1) controls for sets of state and time fixed effects. The vector $\boldsymbol{X}$ contains sets of control variables that vary across the specifications we estimate. In various specifications, it contains the median house price index, the log of aggregate personal income per capita, the employment rate among individuals with moderately higher skill levels than the individuals in the analysis sample, and individual-level demographic characteristics.

We use $Policy_s$ to represent binary indicators for whether a state fits into a given policy group. As discussed above, we differentiate between states that increased their minimum wage rates due to inflation indexing provisions, states that enacted statutory increases totaling less than $1, and states that enacted statutory increases totaling $1 or more.

The coefficients of interest are the $\beta_{p(t)}$ on the interaction between $Policy_s$ and $Post_{p(t)}$. For the analysis presented below, $Post_{p(t)}$ is a single indicator for observations that occur in 2015. Because we treat 2014 as a transition year, and thus exclude it from the sample, the coefficient $\beta_{p(t)}$ describes differential changes in employment from a base period consisting of 2011, 2012, and 2013 through 2015.

The coefficient $\beta_{p(t)}$ is an estimate of the causal effect of states' minimum wage policy changes under standard, but nontrivial, assumptions. The key assumption is that employment among low-skilled groups would, in the absence of the minimum wage changes we analyze, have evolved similarly across the various groups of states. We investigate threats to this assumption in several ways. First, we investigate the robustness of our estimates to changes in the variables used to control for variations in economic conditions. That

is, we examine whether our estimates are robust to including no such controls, to controlling for the housing market's evolution, to controlling for the log of per capita income, and to controlling for changes in employment among individuals in moderately higher skill groups. Second, we estimate a triple-difference extension of Equation (1). Third, we more flexibly probe the dynamics of the employment changes we estimate to guard against potential biases associated with preexisting trends. The results of the latter two exercises are reported in Appendix S1.

V. REGRESSION ESTIMATES OF RECENT MINIMUM WAGE CHANGES' EFFECTS

This section presents our estimates of the short-run effects of minimum wage changes implemented between January 2013 and January 2015 on employment among individuals ages 16–21, among teenagers, and among individuals ages 16–25 with less than a completed high school education. We present the estimates in Tables 4–6.

Table 4 presents estimates of Equation (1)'s difference-in-differences model on the sample described in columns 1 and 2 of Table 2, which consists of individuals ages 16–25 with less than a completed high school education. For states that enacted minimum wage increases exceeding \$1, the estimates range between −1.0 and −1.4 percentage points, but are in no cases statistically distinguishable from zero at even the 10% level. The estimates associated with smaller minimum wage increases are of similar magnitude, but opposite sign. The evidence thus points to the potential importance of nonlinearities in the minimum wage's effects.

Estimates from Table 4 reveal that employment among individuals ages 16–25 with less than a completed high school education increased by around 2 percentage points more in states that index their minimum wage rates for inflation than in states that enacted no minimum wage changes over this time period. The evidence is thus suggestive that the employment consequences of forecastable minimum wage increases differ from those of one-time or multiphase statutory minimum wage changes. As highlighted by Strain and Brummund (2016), any negative employment effects of indexation provisions may be concentrated over the years immediately following their implementation. The responses of forward-looking firms should not be expected to coincide with each year's modest and forecastable inflation adjustment.[5]

Table 5 presents estimates on samples that consist of all individuals between the ages of 16 and 21. On this group, the estimated effects of minimum wage increases exceeding \$1 range from −1.0 to −1.9 percentage points. The point estimate is largest in the specification that incorporates the most expansive set of controls for variations in macroeconomic conditions and demographic characteristics. In that specification, the point estimate is statistically distinguishable from zero at the 5% level. Table 6 presents comparable estimates on samples restricted to teenagers. The estimates are essentially the same as those in Table 5. By way of comparison with Table 4, the estimated effects of small and/or inflation indexed minimum wage changes are uniformly less positive; they range from 0 to 0.7 percentage point across specifications. Like the evidence in Table 4, the evidence in Tables 5 and 6 thus support the hypothesis that there are nonlinearities in the effects of this period's minimum wage increases.

We formally test for differences in the effects we estimate across policy groups by conducting standard F-tests for the equality of the coefficients within each specification. Across the specifications in Tables 4–6, equality of the coefficients associated with large increases and inflation indexed increases is regularly rejected at the $p < .05$ level. Equality of the coefficients associated with large increases and small increases is sometimes above and sometimes below the boundary of significance at the $p < .10$ level. We further test for nonlinearities by replacing our policy indicator variables with linear and squared terms in the size of each state's minimum wage change (results not reported). Taken together, the coefficients on these terms tend to imply modestly positive employment effects of minimum wage changes less than \$1 and negative employment effects of minimum wage changes exceeding \$1.

In Tables 4–6, the predictive power of the macroeconomic covariates is less pronounced than we anticipated. Controlling for these covariates tends to have modest implications for

5. Dynamic considerations of this sort are consistent with recent insights from work by Sorkin (2015) and Aaronson et al. (2017). These authors emphasize that some of the minimum wage's effects will arise through the forward-looking choices of new firms, which must make decisions regarding their production technologies' mix of low-skilled labor, high-skilled labor, and capital.

TABLE 4

Relationship between Minimum Wage Increases and Employment of Individuals 25 and under with Less than a High School Education (D-in-D Estimates)

	(1)	(2)	(3)	(4)	(5)	(6)
Large statutory increaser × post	−0.0106	−0.0137	−0.0104	−0.0105	−0.0098	−0.0118
	(0.008)	(0.008)	(0.011)	(0.007)	(0.007)	(0.009)
Small statutory increaser × post	0.0113	0.0123	0.0113	0.0108	0.0091	0.0094
	(0.013)	(0.012)	(0.013)	(0.012)	(0.012)	(0.010)
Indexer × post	0.0203**	0.0199**	0.0204**	0.0180**	0.0161**	0.0137*
	(0.008)	(0.009)	(0.009)	(0.008)	(0.008)	(0.008)
Ln(income per capita)		0.1477				0.1223
		(0.101)				(0.099)
Housing price index divided by 1,000			−0.0044			−0.0072
			(0.086)			(0.087)
State mid-skill employment-to-population ratio				0.2521**		0.2443**
				(0.125)		(0.121)
Age and education controls	No	No	No	No	Yes	Yes
Observations	453,956	453,956	453,956	453,956	453,956	453,956
R^2	.015	.015	.015	.015	.101	.102

Notes: This table reports difference-in-differences estimates for which the policy indicator variables distinguish between states in which the minimum wage was increased by less than $1 and states that increased their minimum wage by $1 or more. The sample is from the ACS and includes individuals ages 25 and younger with less than a completed high school education. Variable definitions and sources are discussed in the note to Table 2 (and in the paper). All specifications include year and state fixed effects. Age and education controls consist of a dummy variable for each education group and age (included in columns 5 and 6 as indicated within the table). Standard errors are clustered at the state level.

*$p < .1$; **$p < .05$; ***$p < .01$.

TABLE 5

Relationship between Minimum Wage Increases and Employment of Individuals Ages 16–21 (Difference-in-Difference Estimates)

	(1)	(2)	(3)	(4)	(5)	(6)
Statutory increaser large × post	−0.0098	−0.0124	−0.0150*	−0.0097	−0.0123	−0.0186**
	(0.007)	(0.007)	(0.008)	(0.007)	(0.008)	(0.009)
Statutory increaser small × post	0.0028	0.0036	0.0026	0.0027	0.0032	0.0033
	(0.011)	(0.010)	(0.010)	(0.010)	(0.011)	(0.010)
Indexer × post	0.0048	0.0045	0.0020	0.0042	0.0064	0.0030
	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.006)
Ln(income per capita)		0.1224*				0.0699
		(0.069)				(0.071)
Housing price index divided by 1,000			0.0969			0.0884
			(0.067)			(0.071)
State mid-skill employment-to-population ratio				0.0800		0.0728
				(0.092)		(0.080)
Age and education controls	No	No	No	No	Yes	Yes
Observations	1,023,400	1,023,400	1,023,400	1,023,400	1,023,400	1,023,400
R^2	.014	.014	.014	.014	.146	.146

Notes: This table reports difference-in-differences estimates for which the policy indicator variables distinguish between states in which the minimum wage was increased by less than $1 and states that increased their minimum wage by $1 or more. The sample is from the ACS and includes all individuals ages 16–21. Variable definitions and sources are discussed in the note to Table 2 (and in the paper). All specifications include year and state fixed effects. Age and education controls consist of a dummy variable for each education group and age (included in columns 5 and 6 as indicated within the table). Standard errors are clustered at the state level.

*$p < .1$; **$p < .05$; ***$p < .01$.

TABLE 6
Relationship between Minimum Wage Increases and Employment of Teenagers
(Difference-in-Difference Estimates)

	(1)	(2)	(3)	(4)	(5)	(6)
Statutory increaser large × post	−0.0092	−0.0124	−0.0137	−0.0091	−0.0118	−0.0164*
	(0.007)	(0.008)	(0.009)	(0.007)	(0.007)	(0.010)
Statutory increaser small × post	0.0057	0.0067	0.0056	0.0055	0.0052	0.0056
	(0.011)	(0.010)	(0.011)	(0.010)	(0.011)	(0.009)
Indexer × post	0.0070	0.0066	0.0046	0.0056	0.0073	0.0045
	(0.007)	(0.007)	(0.008)	(0.007)	(0.007)	(0.007)
Ln(income per capita)		0.1506*				0.1185
		(0.081)				(0.083)
Housing price index divided by 1,000			0.0823			0.0406
			(0.085)			(0.088)
State mid-skill employment-to-population ratio				0.1639		0.1528
				(0.110)		(0.103)
Age and education controls	No	No	No	No	Yes	Yes
Observations	696,430	696,430	696,430	696,430	696,430	696,430
R^2	.019	.019	.019	.019	.105	.105

Notes: This table reports difference-in-differences estimates for which the policy indicator variables distinguish between states in which the minimum wage was increased by less than $1 and states that increased their minimum wage by $1 or more. The sample is from the ACS and includes all individuals ages 16–19. Variable definitions and sources are discussed in the note to Table 2 (and in the paper). All specifications include year and state fixed effects. Age and education controls consist of a dummy variable for each education group and age (included in columns 5 and 6 as indicated within the table). Standard errors are clustered at the state level.

*$p < .1$; **$p < .05$; ***$p < .01$.

our estimates of this period's minimum wage changes' effects. On average across specifications, estimates of $\beta_{p(t)}$ become modestly more negative (or less positive) when the macroeconomic covariates are included. This is consistent, though not strongly so, with the concern that the overall economic performance of states that enacted large minimum wage increases may bias estimates toward positive values.

Table 7 presents estimates in which we take an alternative approach to categorizing states that enacted statutory minimum wage changes. Specifically, we distinguish between those that had enacted their first increase before the end of January 2014 and those that enacted their first increase after January 2014.[6] Three of the four states in the former category, namely New Jersey, New York, and Rhode Island, are a subset of the states whose total increases exceeded $1. The fourth, namely Connecticut, increased its minimum wage by $0.90. The table shows that employment declines among low-skilled individuals in states that enacted statutory minimum wage increases were concentrated among states that implemented their first minimum wage increases relatively early in our analysis period. This raises the potential importance of lags in minimum wage changes' effects, which it will be important to monitor in coming years.

Appendix S1 presents the results of two additional pieces of analysis. First, Table S2 presents results from a triple-difference framework that is described in the text of the online appendix. The triple-difference point estimates are quite similar to the estimates presented in Tables 4–6, while the standard errors are modestly smaller, allowing for the coefficients to be distinguished from 0 at conventional levels of statistical significance. Table S3 of Appendix S1 presents results in which we more flexibly allow for dynamics in the effects of minimum wage changes implemented at different points in time. The estimates reveal that the employment declines estimated in Table 7, which occurred primarily among states that had increased their minimum wage rates as of January 2014, began to occur during the 2014 calendar year.

VI. DISCUSSION AND CONCLUSION

This paper uses the ACS to generate early estimates of the employment effects of state minimum wage increases implemented between

6. We thank an anonymous referee for suggesting our investigation of this division of the states.

TABLE 7

Relationship between Minimum Wage Increases and Employment among Low-Skilled Groups (Difference-in-Difference Estimates)

	(1)	(2)	(3)	(4)	(5)	(6)
	Ages 16–25 w/ Less than High School		Ages 16–21		Teenagers	
First increase before January 2014 × post	−0.0242***	−0.0238***	−0.0262***	−0.0300***	−0.0263***	−0.0297***
	(0.006)	(0.006)	(0.007)	(0.007)	(0.008)	(0.009)
First increase after January 2014 × post	0.0044	0.0116	0.0023	0.0056	0.0043	0.0092
	(0.010)	(0.008)	(0.006)	(0.008)	(0.007)	(0.007)
Indexer × post	0.0203**	0.0187***	0.0048	0.0083*	0.0070	0.0101
	(0.008)	(0.006)	(0.005)	(0.005)	(0.007)	(0.006)
Ln(income per capita)		0.1184		0.0654		0.1160
		(0.101)		(0.069)		(0.082)
Housing price index divided by 1,000		−0.1814**		−0.0949		−0.1550*
		(0.079)		(0.069)		(0.079)
State mid-skill employment-to-population ratio		0.2481**		0.0727		0.1520
		(0.113)		(0.076)		(0.097)
Age and education controls	No	Yes	No	Yes	No	Yes
Observations	453,956	453,956	1,023,400	1,023,400	696,430	696,430
R^2	.015	.102	.014	.146	.019	.105

Notes: This table reports difference-in-differences estimates for which the policy indicator variables distinguish between states who enacted their first statutory minimum wage increase before January 2014 and those who enacted their first increase after January 2014. Data come from the ACS. The sample in columns 1 and 2 consist of individuals ages 25 and younger with less than a completed high school education. The sample in columns 3 and 4 consist of all individuals ages 16–21. Variable definitions and sources are discussed in the note to Table 2 (and in the paper). All specifications include year and state fixed effects. Age and education controls consist of a dummy variable for each education group and age (included in columns 2 and 4 as indicated within the table). Standard errors are clustered at the state level.

*$p < .1$; **$p < .05$; ***$p < .01$.

January 2013 and January 2015. Through 2015, our best estimate is that minimum wage increases exceeding $1 resulted, on average, in an employment decline just over 1 percentage point among teenagers, among individuals ages 16–21, and among individuals ages 16–25 with less than a completed high school education. Smaller minimum wage increases and inflation indexed minimum wage increases had much smaller (and possibly positive) effects on these groups' employment. We find similar results in a companion working paper (Clemens and Strain 2017) that analyzes data from the CPS.

Due to the short time horizons we analyze, our estimates provide short-run evidence on the effects of the minimum wage increases enacted after the Great Recession. Data on the longer-run effects of this period's minimum wage changes will be essential for arriving at strong conclusions regarding their effects. Our companion working paper (Clemens and Strain 2017) lays out an analysis plan for a medium- to long-run analysis of precisely this sort. Complementary analyses of recent city-wide minimum wage changes (e.g., Jardim et al. 2017) will provide additional valuable information regarding recent minimum wage changes' effects.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Appendix S1 Appendix A: Details on Recent Minimum Wage Legislation; Appendix B: Additional Results