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The Effects of a $15 Minimum Wage in New York State

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CONTENTS

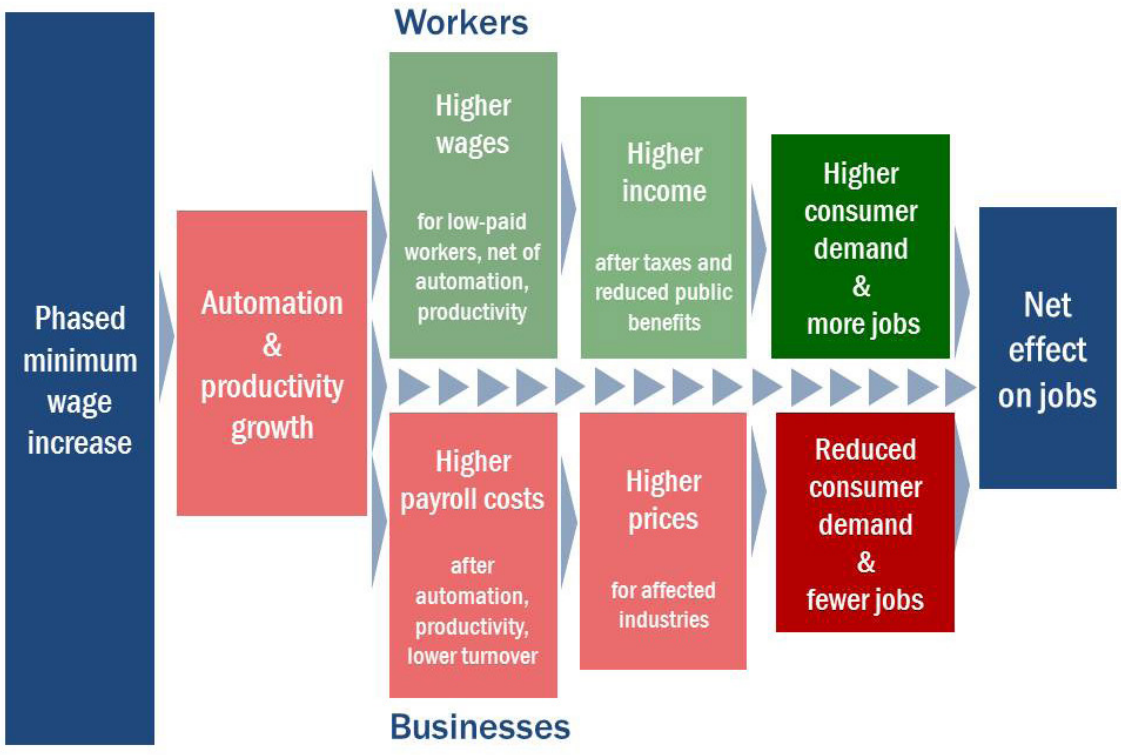
INTRODUCTION AND KEY FINDINGS

Governor Andrew Cuomo of New York has proposed economy-wide minimum wages of $15 in New York City by 2019 and in the balance of the state by mid-2021. In this prospective study, we assess the impact of the proposal on workers, businesses, and consumers to estimate the net effect of the policy proposal on employment over the phase-in period.

Critics of minimum wage increases often cite factors that will reduce employment, such as automation or reduced sales, as firms raise prices to recoup their increased costs. Advocates often argue that better-paid workers are less likely to quit and will be more productive, and that a minimum wage increase positively affects jobs and economic output as workers can increase their consumer spending. Here we take into account all of these often competing factors to assess the net effects of the policy.

Our analysis applies a new structural labor market model that we created specifically to analyze the effects of a $15 minimum wage. We take into account how workers, businesses, and consumers are affected and respond to such a policy and we integrate these responses in a unified manner. In doing so, we draw upon modern economic analyses of labor and product markets. As we explain in the report, the main effects of minimum wages are made up of substitution, scale, and income effects. The figure below provides a guide to the structure of our model.

UC Berkeley IRLE minimum wage model



Source: UC Berkeley IRLE Minimum Wage Research Group

Our data are drawn from the Census Bureau's American Community Survey and from other Census and U.S. Bureau of Labor Statistics datasets. We also make use of the extensive research conducted by economists—including ourselves—in recent years on minimum wages, and upon research on related economic topics.

Our estimate of the effects of a $15 minimum wage is also based upon existing research on labor markets, business operations, and consumer markets. Our estimate compares employment numbers if the policy is adopted to employment numbers if the policy is not adopted. Other factors that may affect employment by 2021 are therefore outside the scope of our analysis. We have successfully tested our model with a set of robustness exercises. In order to make our study manageable, we include in our analysis the sectors that have already been granted pay increases by executive orders.

Key Findings:

Effects on workers by mid-2021

- As Cooper (2016) reports, increasing the state minimum wage from $9 to $15 will increase earnings for 3.16 million workers, or 36.6 percent of the statewide workforce.
- As Cooper (2016) also reports, among those getting raises, annual pay will increase 23.4 percent, or $4,900 (in 2015 dollars) on average. These estimates include a ripple effect in which some workers who already earn $15 will also receive an increase.
- Three industries account for nearly half of the private sector workers getting increases: retail trade (17.6 percent), health care and social assistance (18 percent), and restaurants (13.5 percent).
- 79.6 percent of workers in the restaurant industry in the private sector will receive a wage increase, compared to 19.6 percent in finance, insurance and real estate.

Effects on businesses and consumers by mid-2021

- Payroll cost increases will average 3.2 percent over the entire for-profit economy. This increase is much smaller than the minimum wage increase because many businesses already pay over $15 and many workers who will get pay increases are already paid over $9, the current minimum wage.
- Employee turnover reductions, automation, and increases in worker productivity will offset some of these payroll cost increases.
- Businesses could absorb the remaining payroll cost increases by increasing prices slightly—by 0.14 percent per year over the phase-in period. This price increase is well below annual inflation of nearly 2 percent over the past five years.
- Price increases will be much smaller than labor cost increases because labor costs average about one-fourth of operating costs.
- The consumers who would pay these increased prices range across the entire income distribution.

Net effect on New York employment by mid-2021

- Our estimate projects a cumulative net gain in employment of 3,200 jobs by mid-2021, which corresponds to 0.04 percent of projected 2021 employment. On an annual basis, the net effect corresponds to a gain of 0.01 percent in employment in New York State. By comparison, New York State employment growth has averaged 2.0 percent per year over the past five years.
- Our robustness tests support our main finding. The net employment effects remain very small, especially in relation to the 3.16 million low-paid workers getting a 23.4 percent boost in earnings, and the overall size of the New York State job market.

Limits to our study

- Any prospective impact study involves an inherent level of uncertainty. Actual effects may differ from our estimates if future economic conditions vary from current forecasts.
- We estimate the net effects on jobs in the state. The effects will vary within industries and across geographic regions. We discuss these differences but a detailed analysis is beyond the scope of our study.
- We do not take into account the effects of higher wages on worker health and on worker training, which are likely to be positive. Also, although higher parental earnings have well-documented effects on children's health, educational outcomes, and future earnings, these long-run effects are beyond the time scope of our study.
- A separate analysis is needed to examine effects on state and local employees and nonprofit human services sector, in which funding is dependent on public policy.
- These results cannot be generalized to minimum wages higher than $15. Our model predicts negative effects would occur at some higher minimum wage. However, it is beyond our scope here to determine the level at which negative effects would become detectable.

Conclusion

- Our results indicate that a $15 statewide minimum wage would generate a 23.4 percent average wage increase for 3.16 million workers in the state. This improvement in living standards would greatly outweigh the small effect on employment. And the increase in wages would help reverse decades of wage declines for low-paid workers.
- How can such a major improvement in living standards occur without adverse employment effects? While a higher minimum wage induces some automation, as well as increased worker productivity and higher prices, it simultaneously increases worker purchasing power. In the end, the costs of the minimum wage will be borne by turnover reductions, productivity increases and modest price increases.

PART 1. THE POLICY CONTEXT

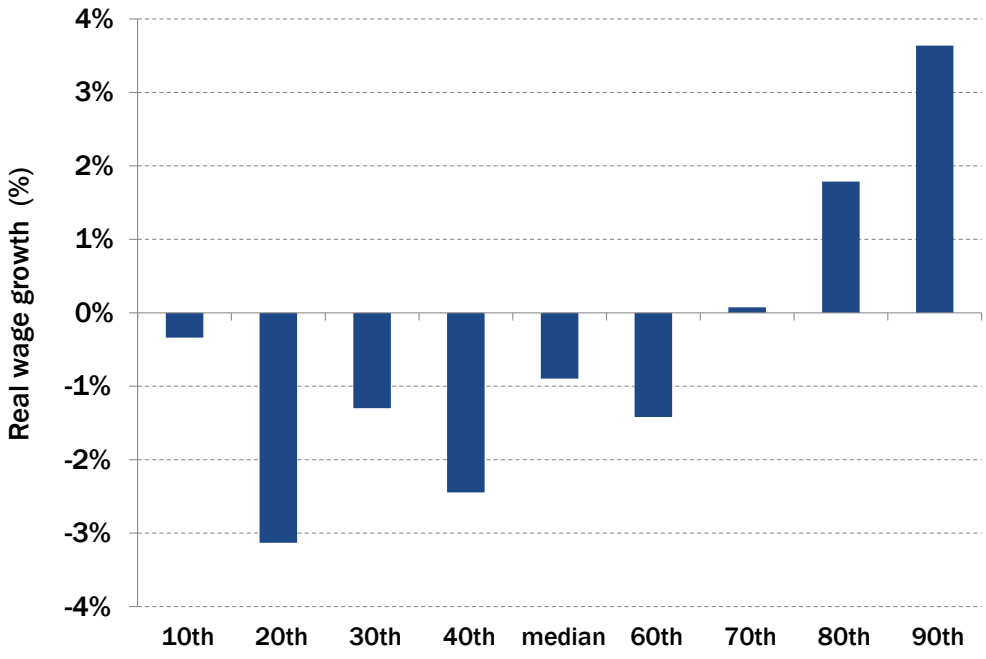
Governor Andrew Cuomo recently proposed a minimum wage increase to $15, phased in by 2019 in New York City and by mid-2021 in the rest of the state. Those wage levels translate into $13.98 and $12.91 in 2015 dollars, respectively, and are comparable to the 1970 minimum wage in 2015 dollars. This policy would substantially increase the incomes of many low-wage workers and their families. We address here whether it would do so without imposing unintended harm on the intended beneficiaries and/or on employment in New York more generally. Our study provides a prospective analysis of the impact of the Governor's proposal on New York State's workers, businesses, and consumers, and calculates the expected net effect on employment.

1. The economic context

In this section we review the current economic context in New York State. We focus on three measures of the state's economy since the end of the Great Recession in mid-2009: wage growth by percentile, state and metropolitan unemployment rates, and state and metropolitan employment growth. Each provides a somewhat different perspective on the nature of the current recovery.

Figure 1 shows that recent wage trends have been remarkably uneven. Despite six years of official economic recovery, workers' real wages (adjusted for inflation) fell for the bottom 60 percent of the state's workforce and real wage gains were limited to those at the 80th percentile and above. In short, the vast majority

Figure 1. Real wage growth in New York State by wage percentiles, 2010-2014



Source: Authors' analysis of Current Population Survey data provided by the Economic Policy Institute. CPI-U-RS is used to translate nominal wages into 2014 dollars.

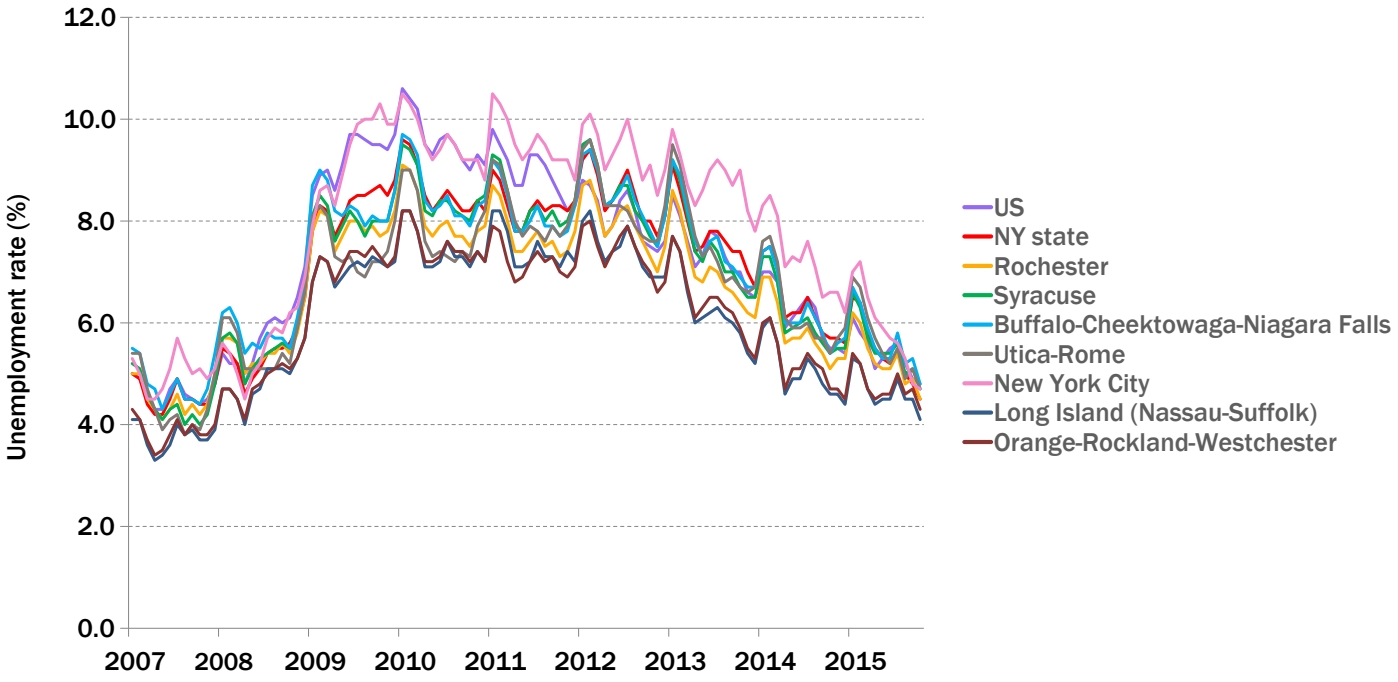
of workers have not received any increase in their real wages. For the bottom 20 percent of workers, real wages are no higher than they were 35 years ago, even though these workers are more skilled and productive than their counterparts were then.

In the past, real wages typically increased during recoveries. As the unemployment rate fell, employers would compete for workers by raising pay. But real wage increases in recoveries are no longer the rule—except for the highest paid workers. This lack of wage growth has also contributed to a slowdown in productivity growth during the current recovery (Bernstein 2016).

Indeed, a decline in wages during a recovery can limit the strength and duration of the recovery, as wage declines reduce both consumer demand and incentives to increase productivity. These are among the reasons why minimum wage policies have become so important in today's economic discourse.

The economic recovery that began in mid-2009 was slow at the start. More recently, the recovery has been strengthening. Figure 2 shows that New York's unemployment rate has been steadily falling since 2010—the first full year of the recovery. State unemployment has also tracked very closely to the decline in the national unemployment rate. And unemployment rates in the state's various metropolitan areas have declined at about the same rates and are very close to the state level.

Figure 2. Unemployment rates in the U.S., New York State, and metropolitan areas

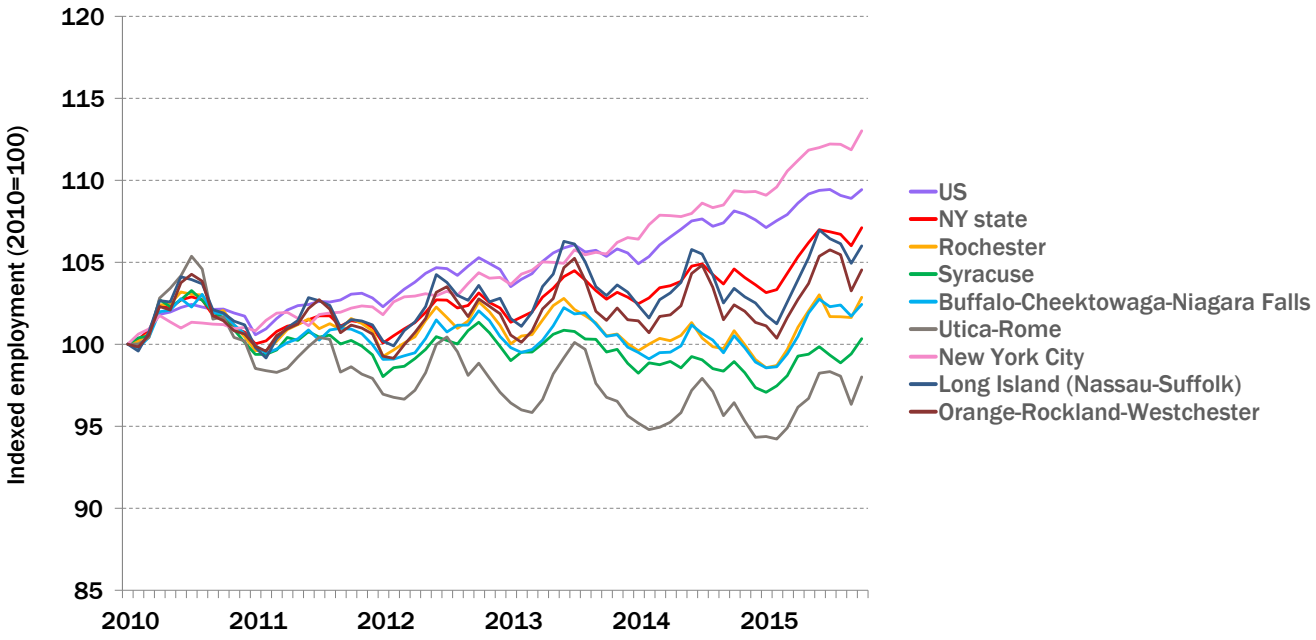


Source: Bureau of Labor Statistics, Current Population Survey, not seasonally adjusted.

As is frequently pointed out, however, the official unemployment rate provides an incomplete measure of the strength of the recovery. In particular, employment to population ratios, which declined especially sharply during the recession, still have not regained their previous peaks in most of the state.

The mixed picture of the current recovery is evident in the rate of job growth in the state overall and in its major metropolitan areas—as reported in Figure 3.

Figure 3. Job growth in the U.S., New York State, and selected metropolitan areas



Source: Bureau of Labor Statistics, Current Employment Statistics, not seasonally adjusted.

At the national level, from 2010 to 2015, employment increased 9.4 percent. New York State has shared in this national employment recovery, growing by 7.1 percent over the same time frame. In the New York City, job growth was 8.8 percent, close to the national average. Employment growth in other parts of the state has been slower and more uneven. However, job growth from January 2015 to October 2015 (the most recent data available) have been increasing throughout the state.

The uneven growth in jobs by metropolitan areas reflects differences in economic structure in different areas of the state as well as public policy. The state has been shedding traditional manufacturing jobs for several decades, and lower job growth in some parts of the state may be related to remaining concentrations of manufacturing in those areas. The weakness in upstate employment growth is also related to declines since the recession in state and local government jobs. However, as we show in this report, minimum wage increases have relatively small impacts on manufacturing industries and on public sector employment.

2. The minimum wage increase schedule

The Governor's proposal would phase in minimum wage increases over five years, reaching $15 in New York City by 2019, and $15 in the balance of the state in mid-2021. The scenario in this report, but not in the Governor's proposal, also includes indexation of the minimum wage in New York City between 2018 and 2021. When we conducted our analysis it was not clear whether such indexation would be a part of the Governor's proposal. By including it in our estimates here we are likely to slightly overstate the policy's effects on employment.

Table 1 shows the wage levels for the intervening years. By 2021, the minimum wage will be $16.25 in New York City and $15 in the balance of the state.

Table 1. Wage schedule of the proposed policy in New York

Year	Date	Minimum wage (nominal dollars)	Percent increase from previous year	Minimum wage (2015 dollars)	Percent increase from previous year (2015 dollars)
New York City					
2015	December 31	$9.00		$9.00	
2016	April 1	10.50	16.7	10.29	14.4
2016	December 31	12.00	14.3	11.77	14.3
2017	December 31	13.50	12.5	12.91	9.8
2018	December 31	15.00	11.1	13.98	8.2
2019	December 31*	15.41	2.7	13.98	0.0
2020	December 31*	15.82	2.7	13.98	0.0
2021	July 1*	16.25	2.7	13.98	0.0
Balance of New York State					
2015	December 31	$9.00		$9.00	
2016	April 1	9.75	8.3	9.56	6.2
2016	December 31	10.75	10.3	10.54	10.3
2017	December 31	11.75	9.3	11.24	6.6
2018	December 31	12.75	8.5	11.88	5.7
2019	December 31	13.75	7.8	12.48	5.0
2020	December 31	14.50	5.4	12.81	2.7
2021	July 1	15.00	3.4	12.91	0.8

Source: Order of New York Labor Commissioner on the Report and Recommendations of the 2015 Fast Food Wage Board, September 2015, the proposed bills and author's calculations. http://assembly.state.ny.us/leg/?bn=S06406&term=2015

*Note: *For the final three steps (2019-2021), the NYC minimum wage is indexed to inflation. These projections use New York State Budget Office forecasts for the Consumer Price Index (CPI) for consumers in New York State. The initial date in the Governor's proposal is July 1, 2016, not April 1, 2016. This change will not have a visible effect on our calculations.*

Table 1 shows that the yearly percentage increases in nominal dollars become smaller during the seven steps of the phase-in schedule in New York City and in the balance of the state. For New York City, the

biggest increase occurs from December 31, 2015 to April 1, 2016 in New York City (16.7 percent) and the smallest in the last year, from December 31, 2020 to July 1, 2021 (2.7 percent). In the balance of the state, the biggest increase occurs from April 1, 2016 to December 31, 2016 (10.3 percent) and the smallest in the last year, from December 31, 2020 to July 1, 2021 (3.4 percent).

Table 1 also shows the proposed wage increase schedule after adjusting for inflation, that is, in constant 2015 dollars. From the standpoint of workers and employers, this version of the wage increase schedule is more relevant, reflecting the actual value of the minimum wage in the context of a given year's prices. For example, a nominal 2021 wage of $15 is worth $12.91 in 2015 dollars.

3. Comparisons to cities and states with $15 minimum wages

In the face of federal inaction, cities and states have moved to become the forefront of minimum wage increases. The largest approved increases in major cities to date are in San Francisco, Seattle, and Los Angeles, all of which have enacted gradual increases of their minimum wage to $15 an hour. Seattle will reach this level on January 1, 2017, for large businesses (more than 500 employees) and in 2021 for all employers. San Francisco's $15 minimum wage will be fully implemented on July 1, 2018. Los Angeles will reach $15 on July 1, 2020, for large businesses (more than 25 employees) and in 2021 for small businesses.

A number of states are following these cities' lead. An initiative to raise the California minimum wage to $15 by 2021 has qualified for the state's November 2016 election ballot.

The median wage of full-time workers varies substantially among these cities and states. For this reason, economists have long used the ratio of the minimum wage to the median full-time wage both as a measure of inequality in an area and as a measure of how easily the minimum wage can be absorbed by the local labor market. For the federal minimum wage, this ratio reached a high of .55 in 1968 (Dube 2014).

A related minimum wage metric is the percent of the workforce that will obtain pay increases. This metric tells us the reach of the policy in the labor market.

Table 2 compares New York with these cities and states using both metrics. As Table 2 shows, at the time of full implementation of their $15 minimum wages, the Los Angeles minimum to median full-time wage ratio will be .67, Seattle's will be .53, and San Francisco's will be .46. California's ratio would be .65. The figure for New York State as a whole will be .59—well within the range of these other cities and state.

The second column of Table 2 provides the proportion of workers who will get pay increases. Among the cities listed, this figure ranges from 23.4 percent for San Francisco to 41.3 percent for Los Angeles. The proportion of workers who would get increases would be very similar in New York and California.

What about geographic variation within New York State? The ratio of the minimum wage to the median wage would be .57 in New York City and .63 in the balance of the state. In the poorest areas of the state, generally those that are rural, the minimum to median wage ratios will be even higher. Compared to higher wage areas, the minimum wage increases in these areas will have greater positive effects on workers and greater negative effects on low-wage businesses. The net effect in poorer areas is likely to be less positive.[1]

Table 2. Summary metrics for selected cities and states at $15 minimum wages

	Minimum wage to median wage ratio	Percent of workers getting pay increases
New York State		
New York City	0.57	34.8
Balance of New York State	0.63	38.3
Other states and localities		
California	0.65	34.4
Los Angeles City	0.67	41.3
Seattle	0.53	29.0
San Francisco	0.46	23.4

Sources: New York: Authors' calculations for $15 by 2021 using 2014 ACS data and Cooper (2016); California: Authors' preliminary estimates for $15 by 2022 using OES and ACS data for California; Los Angeles and Seattle: Reich et al. (2015) for a $15.25 minimum wage in Los Angeles by 2019 and $15 in Seattle by 2021; San Francisco: Reich et al. (2014c) for a $15 minimum wage by 2018.

Notes: The figures refer to the end point of phased minimum wage increases. The end point is 2019 for Los Angeles, not 2021—as the minimum wage increase simulated in Reich et al. (2015) differed from the one that was enacted. The minimum wage to median ratio for Los Angeles corresponds to the mid-range scenario, as simulated in Reich et al. (2015). The Seattle percent of workers getting pay increases refers to employees who live and work in Seattle.

4. The scope of this study

The remainder of this study consists of an analysis of the impact of a $15 minimum wage by 2021 in New York State.

Our wage and operating cost increases take into account separate timing for New York City and the balance of New York State, as is outlined in the Governor's proposal. Following Cooper (2016), we assume indexing, which was not included in the Governor's proposal. Our model uses Cooper's (2016) estimates of pay increases that workers will obtain as a result of the minimum wage policy. In this analysis we do not separate out workers who are covered by executive orders that have already been issued—such as fast-food and state workers. The conclusions of this report reflect the overall average effects for New York State and not separately by region or city—where there may be different outcomes. Finally, we do not examine effects of minimum wages on business investment. We will suggest that the effects on business profits are likely to be small; effects on investment are therefore likely to be smaller still.

PART 2. EMPLOYMENT IMPACT ANALYSIS

1. Previous minimum wage research

In the past two decades economists have conducted numerous econometric studies of the effects of minimum wages. The overwhelming majority have focused on the employment effects (Belman and Wolfson 2014, 2015; Schmitt 2015). Typically these studies make use of panel data on workers or firms from standard government sources such as the Current Population Survey or the Quarterly Census on Employment and Wages.

Most extant research on minimum wages does not detect significant effects on workers age 20 and over. Some observers attribute the lack of visible effects to the relatively small proportion of adults who were affected by past minimum wage increases in the U.S.[2] These observers argue that minimum wage effects should be detectible by examining groups that are more affected, notably teens and restaurant workers (Brown 1999).

Economists have therefore focused on these two groups. After two decades of methodological controversy among researchers, the literature has produced some areas of agreement. In particular, recent studies of the effects on restaurant workers by researchers with opposing methodological views have arrived at a consensus: the employment effects are either extremely small or non-existent.[3] The effects of minimum wages on teen employment remain somewhat controversial. Some researchers find significant but not large negative effects (e.g., Neumark et al. 2014) while others find effects that are much smaller, close to zero (e.g., Allegretto, Dube, Reich and Zipperer 2015).

The remaining controversy over effects on teens has become less relevant than it once was. While teens once represented one-fourth of all workers affected by minimum wages nationwide, their importance has fallen to less than half that level today. Cooper (2016) finds that teens represent only 5.2 percent of the workers who would be affected by the proposed $15 New York State minimum wage. Moreover, compared to teens, the rest of the low-wage workforce is older and has more work experience and schooling than was the case in previous decades. Results that are specific to teens are therefore not informative for the effects on the workforce as a whole.

An advantage of the minimum wage research is that it uses quasi-experimental methods, exploiting time and state variations between 1979 and 2012 in federal and state minimum wages. This research also applies state of the art statistical controls to insure that the comparisons are apples to apples. However, the minimum wage changes in these past experiences, which peak at about $10, generated increases for at most 8 percent of the workforce. In contrast, approximately 37 percent of all workers would receive a wage increase under the $15 New York proposal, far higher than is the case in the minimum wage research literature to date. As a result, previous research is at best only suggestive of the effects of the proposal we consider here.

Moreover, this quasi-experimental econometric approach does not tell us whether employment effects are the result of automation, or price increases, or other possible mechanisms. Instead, it incorporates the results of all these mechanisms without identifying which are at work.

Since the quasi-experimental econometric approach is not appropriate for our study, we draw here upon the other major empirical method used by economists—building and calibrating a structural model. Thus, in order to better understand the impacts of a larger minimum wage increase, we model how the minimum wage policy works its way through New York's workers, businesses, and consumers. We incorporate outcomes from economists' best research on labor markets, business practices, and consumer spending to construct a structural, multi-iterative model to estimate the effects of New York's proposed policy.

2. The UC Berkeley IRLE minimum wage model

In 2015, the UC Berkeley Institute for Research on Labor and Employment (IRLE) minimum wage group developed a structural model to study the prospective impacts of a $15 minimum wages in Los Angeles.[4] The current report uses an enhanced version of that model. In this new version we incorporate more of the direct and indirect effects of minimum wages on workers, businesses, and consumers, with more attention to possible automation and to the effects of higher wages on productivity growth. We also adapt the model to apply to New York State in particular. To test the model's various parameter assumptions, we deploy a range of model parameters.

Our estimates draw on standard government data sources, the large body of economic research on the minimum wage, other research studies, and a standard regional economic model (IMPLAN). These data sources and models are fully documented in the text, accompanying endnotes, and in the appendix.

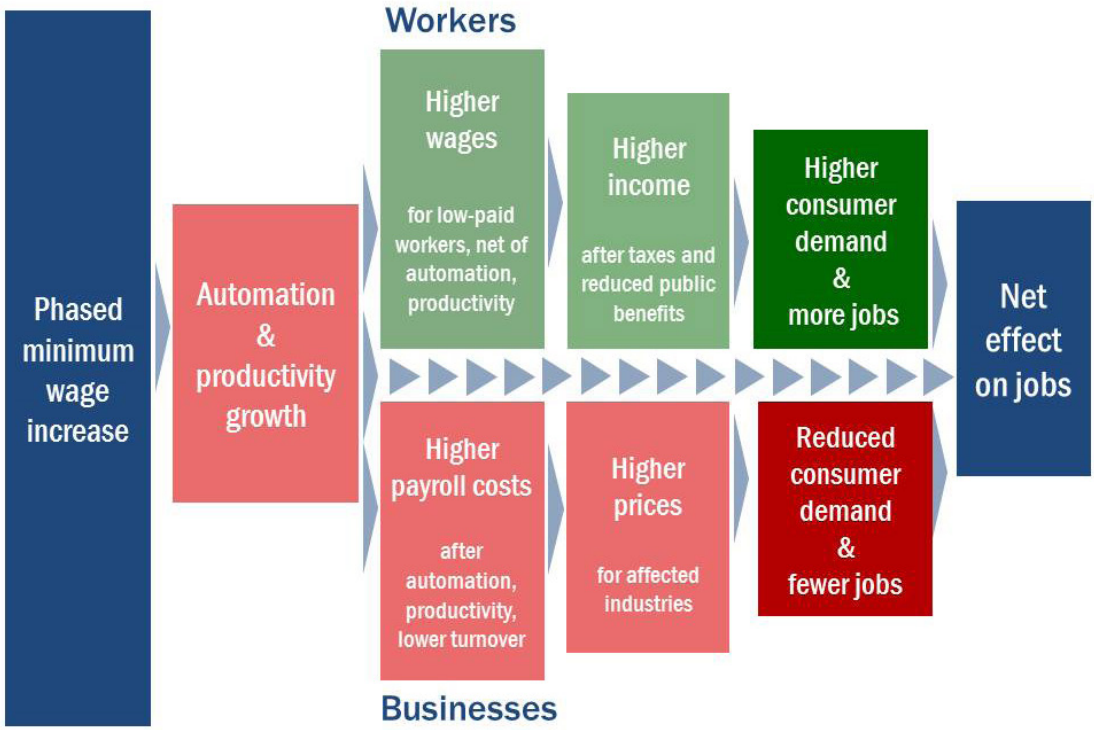
Our structural model recognizes that higher minimum wages will affect labor supply and labor demand. Adjustments to labor supply include lower employee turnover and lower job vacancy rates. Adjustments to labor demand include possible substitutions of capital for labor and skilled labor for unskilled labor, greater worker productivity when wages rise, reductions in employment because higher prices reduce sales, and increases in employment because workers' spending out of their higher income will increase sales and employment. The net effect depends upon the magnitudes of the individual adjustments, again taking into account interactions among them.

The inspiration for the model derives from Marshall's Laws, a famous set of propositions about the labor market first developed by the great English economist Alfred Marshall in 1890.[5] These laws, which are featured in every labor economics textbook, examine how employer demand for workers will respond to an industry-wide wage increase. Marshall worked out the effects by examining "substitution" and "scale" effects in labor, capital, and goods markets. (For a formal version of this labor demand model, see Cahuc, Carcillo and Zylberg (2014), ch. 2). Since our concern here is on the effects of an economy-wide minimum wage, we add an "income effect" to Marshall's Laws. This effect accounts for Keynesian-style effects on the level of economic output obtained when pay increases lead to increased consumer demand.

Model structure

Figure 4 summarizes our model qualitatively in a flow diagram. The green boxes refer to the effects on workers and the red boxes refer to the effects on businesses. The automation and productivity box is placed first to highlight how businesses will respond to a minimum wage. Automation here refers only to capital-labor substitution that is induced by the minimum wage, not to the much larger degree of automation that has taken place for decades. Productivity growth can come from automation, from workers working harder

Figure 4. UC Berkeley IRLE minimum wage model



Source: UC Berkeley IRLE Minimum Wage Research Group.

or smarter when pay is high, and from workers having more experience, as when minimum wages reduce employee turnover.

Examine next the effects on workers, shown in the green boxes and move from left to right. The first green box refers to the higher wages received by lower-paid workers. The next green box accounts for the net effect of taxes and reduced receipt of public benefit programs on workers' income. Workers will pay more in taxes as their wages increase and eligibility for public benefits will decline. The third box refers to how workers' increased spending power out of their higher net income translates into higher consumer demand and more jobs. We will refer to this mechanism as the *income effect* of minimum wages.

Examine now the effects on businesses and again move from left to right. The higher minimum wage will increase businesses' payroll costs, but some of these higher costs will be offset because employee turnover will fall, generating savings in recruitment and retention costs. Firms may also find that higher-paid and more experienced workers will be more productive, which could also offset payroll cost increases. In other words, one effect of a higher minimum wage is to induce more efficient management practices.

Higher payroll costs (net of turnover and productivity savings) will lead firms to increase prices, leading to reduced consumer demand. We will refer to this adjustment mechanism as the *scale effect*, as it identifies reductions in the scale of output that will reduce the demand for workers.

As we have already mentioned, businesses may also respond to higher minimum wages by increasing their investment in equipment. This *substitution effect* (think automation) also reduces their demand for workers.

The income effect has a positive effect on employment, while the scale and substitution effects each have negative effects on employment. The sum of the income, scale, and substitution effects determines the net employment effect of the minimum wage, as shown in the blue box on the right side of Figure 4.

Figure 4 is useful for understanding the basic structure of our model. But it leaves out some important details. First, the effects on businesses and workers in the red and green boxes of the model occur simultaneously, not sequentially. The effects in reality are therefore captured only by examining the net effects on the economy and employment. These net effects are symbolized by the blue box at the right of the diagram. Second, Figure 4 omits some feedback loops that would make the figure unwieldy, but which are included in our calculations.

Model calibration and dynamics

The net effect of minimum wages on employment equals the sum of the income, scale, and substitution effects. The income effect will always be positive, while the scale and substitution effects will always be negative. Whether the net effect is positive, zero, or negative therefore depends upon the relative magnitudes of its three components.

These relative magnitudes in turn depend upon the quantitative responses of workers and businesses to a minimum wage increase. We refer to the model's *parameters* as the inputs that determine these multiple quantitative responses. Some of these parameters, such as the propensity to substitute capital for labor, may not vary with the magnitude of the minimum wage increase. Other parameters, such as turnover cost savings, are likely to vary with the size of the increase. As with any economic model, we calibrate our model using the best data and research findings available. The details are presented in Section 4 below and in Appendix A3.

The model's parameters and dynamics must be consistent with two conditions. First, the model must be consistent with the very small effects that researchers find for the smaller pre-2015 increases in federal and state minimum wages. Second, although labor demand in low-wage labor markets may be much less responsive to wages than is commonly thought, labor demand is not completely unresponsive. The model must therefore be consistent with growing negative effects if minimum wages were to reach extremely high levels, such as at $25 or $40 per hour. The big unknown, of course, is: At what level do the effects become visibly negative and how quickly do they become more negative?

In a forthcoming paper, Reich (2016) shows that our calibrated model predicts extremely small effects for minimum wage increases of up to 25 percent, to a minimum wage of $10. At this minimum wage, the income, scale, and substitution effects are each very small. As the minimum wage reaches to higher levels, the (positive) income effect weakens since the propensity to consume of higher-paid workers is lower than that of lower paid workers. At the same time, the (negative) scale effect strengthens because turnover cost savings diminish and the price elasticity of consumer demand becomes higher for higher-priced goods.[6] Our model is thus consistent with growing negative employment effects at higher minimum wage levels.

We have tested our model's calibration by undertaking a series of robustness tests. The tests show that this net effect changes by small amounts, when we vary the model's parameters (Reich 2016). In the next sections, we discuss how we quantify the effects in each of the boxes in Figure 4.

3. Effects on workers

We begin with the effects on workers, shown in the green boxes in Figure 4. To quantify these effects we begin with the estimates in a recent report by David Cooper on the number of workers who would receive pay increases under Governor Cuomo's proposal. Cooper (2016) applies the minimum wage proposal to the current New York wage distribution and estimates the number of workers who will receive a wage increase, as well as the size of those wage increases. To do so, Cooper's model simulates changes in New York's wage distribution in future years, under two scenarios. In the first scenario, the proposed minimum wage policy is not adopted, but wages increase in line with recent trends; in the second scenario, the policy is adopted.

Cooper compares the two scenarios and estimates, for each yearly phase-in step, the number of workers who would be affected by the law and the additional wages they would receive as a result. In constructing these estimates, Cooper's model adjusts for expected growth in employment, real wages, and inflation over time. His estimates also take into account what is often referred to as an "indirect" or "compression" effect: workers who make slightly more than the new proposed minimum wage level are also likely to receive wage increases.

3.1 Number of workers receiving pay increases

Table 3 draws from Cooper's results to show the estimated number of workers in New York who will receive a wage increase from the proposed minimum wage policy.

Table 3. Cumulative number and percent of workers receiving pay increases

Date	Number of affected workers (millions)	Percent of covered workforce
New York State		
April 1, 2016	2.06	24.1
December 31, 2016	2.40	28.0
December 31, 2017	2.68	31.2
December 31, 2018	2.90	33.8
December 31, 2019	3.02	35.0
December 31, 2020	3.10	35.9
July 1, 2021	3.16	36.6

Source: David Cooper (2016).

Notes: Includes both directly and indirectly affected workers. Directly affected workers were paid hourly wages lower than the new minimum wage. Indirectly affected workers were paid wages greater than or equal to the new minimum wage, but less than 115 percent of the proposed increase. This cutoff point reflects Wicks-Lim (2006) and Dube, Giuliano and Leonard (2015), who each observed minimum-wage spillover or "ripple" effects for workers earning up to 15 percent above newly implemented minimum wages.

Cooper (2016) estimates that 3.16 million workers will receive a wage increase by the end of 2021, comprising 36.6 percent of the workers covered by the policy. This total includes both directly affected workers—those who earned less than the new minimum wage prior to implementation of the policy—and indirectly affected workers who receive wage increases through a spillover or "ripple" effect. We refer to the two groups together as the affected workers.

3.2 Size of pay increases

Table 4 provides estimates, again from Cooper (2016), of the size of the earnings increase (compared to projected earnings under current law) that affected workers would receive as a result of the proposed policy. The rows in the table display four measures: the cumulative increases in affected workers' hourly wages, annual earnings and percentage change in annual earnings, as well as the total earnings increase for all affected workers in the state.

Table 4. Cumulative increases in worker pay (2015 dollars)

	April 1, 2016	2016	2017	2018	2019	2020	2021
New York State							
Hourly earnings	$0.72	$1.36	$1.89	$2.41	$2.59	$2.73	$2.92
Annual earnings	$1,186	$2,253	$3,147	$4,028	$4,319	$4,541	$4,854
Percent annual earnings	8.2	14.3	18.2	21.7	22.2	22.4	23.4
Total cumulative earnings (billions)	$2.44	$5.41	$8.44	$11.69	$13.03	$14.06	$15.4

Source: Authors' calculations using Cooper (2016).

Note: In Cooper (2016), the initial pay increase is scheduled for April 1, 2016. In the submitted bill the initial increase is scheduled for July 1, 2016. Subsequent pay increases are scheduled on December 31 of the year shown. These figures do not incorporate changes in employment analyzed later in this report.

Cooper (2016) estimates that affected workers will, on average, receive an hourly wage increase of $2.92 by mid-2021. On an annual basis, this increase amounts to an estimated additional $4,900 per year—or a 23.4 percent increase in earnings. In the aggregate, affected workers in New York State will earn an additional $15.4 billion in earnings by mid-2021. (These figures are all in 2015 dollars.)

In the next section, we will use the results in Tables 3 and 4 to estimate the increase in payroll expenses for businesses. We will then use the results in Tables 3 and 4 to estimate how much workers' net incomes will increase—after reductions from higher taxes and reduced public benefits—and how much their increased net incomes translate into higher consumer spending.

4. Effects on businesses

How a higher minimum wage affects a firm depends on how much the firm's operating costs change and on how the firm responds to these increases. In this section we first analyze the impact on operating costs in selected industries. We then turn to the variety of ways that businesses may absorb these increases.

4.1 Payroll increases by industry

Minimum wage increases do not affect all industries equally. We therefore begin by describing the impact of the proposed minimum wage law on workers at the industry level. Table 5 displays the major industries in New York's economy, as well as some selected detailed industries indented under each major industry group.[7] The first column presents the percentage of the overall New York State workforce in each industry. We then show our estimates of (a) *the distribution across industries* of workers getting a raise under the

Table 5. Percent of workers getting a raise, by sector and by industry

	Percent of covered workforce	Percent of all workers getting a raise	Percent of industry's workers getting a raise
A. Private, for-profit sector	**72.5**	**82.8**	**41.9**
Agriculture, fishing, forestry, hunting, and mining	0.4	0.6	62.8
Construction	4.4	4.2	34.4
Non-durable manufacturing	2.6	2.8	38.8
Food Manufacturing	0.6	0.9	50.1
Durable manufacturing	3.7	3.1	30.8
Wholesale trade	2.3	2.0	32.7
Retail trade	10.9	17.2	57.7
Grocery stores	2.3	4.2	67.8
Transportation, warehousing, and utilities	3.6	3.9	40.3
Information	2.8	1.5	19.7
Finance, insurance, and real estate	7.6	4.1	19.6
Professional services	6.6	2.9	16.1
Administrative services	3.3	4.5	49.5
Employment services	0.5	0.5	41.4
Building services	0.9	1.3	54.7
Educational services	2.7	2.6	34.8
Health and social assistance	10.4	12.1	42.4
Ambulatory care	4.3	5.6	48.2
Hospitals	3.1	2.0	23.6
Residential care	1.6	2.0	46.0
Social assistance	0.8	1.3	57.8
Child day care services	0.7	1.2	65.7
Arts, entertainment, and recreation	1.5	1.9	47.2
Accommodation	1.0	1.4	52.0
Restaurants	6.1	13.3	79.7
Other services	2.5	4.8	69.0
Personal services	1.4	3.1	79.7

Table 5. continued

	Percent of covered workforce	Percent of all workers getting a raise	Percent of industry's workers getting a raise
B. Private, nonprofit sector (selected industries)	**11.2**	**9.6**	**31.3**
Educational services	2.5	1.8	26.0
Health and social assistance	4.5	4.0	32.4
Ambulatory care	0.6	0.6	37.0
Hospitals	1.8	0.8	16.0
Residential care	0.8	1.0	50.4
Social assistance	1.0	1.1	39.1
Child day care services	0.3	0.5	51.8
Other services	1.7	1.7	35.0
Personal services	0.1	0.1	65.6
Religious organizations	0.6	0.7	44.4
Civic and social organizations	0.8	0.7	32.1
C. State and local government	**14.6**	**7.6**	**19.1**
Local government	9.9	5.4	20.1
State government	4.7	2.2	16.9
D. All New York workers	**100.0**	**100.0**	**36.6**

Source: Authors' calculations using Cooper (2016).

Note: The total workforce includes federal workers, although they do not benefit from minimum wage increases in our simulations.

proposed law by 2021 and (b) the percentage of workers getting a raise *within each industry*. Again, these estimates include both directly and indirectly affected workers (i.e., those receiving a wage increase via the "ripple effect").

The large majority of affected workers are employed in the private, for-profit sector. While affected workers are employed in a broad range of industries, they are concentrated in just a few. Three industries account for almost half of the private sector workers that would receive increases: retail trade (17.6 percent of all workers getting a raise), restaurants (13.5 percent), and health care and social assistance (16.1 percent).

This picture changes when we examine the percentage of each industry's workforce that will be affected by the proposed policy. These percentages are shown in the third column of Table 5. The restaurant industry in the private for-profit sector will experience the largest impact: 79.7 percent of its workers will receive a wage increase by 2021. Agriculture, fishing, forestry, hunting, and mining will also experience a large impact, although this industry makes up only 0.4 percent of affected workers overall. Other high-impact industries include retail trade, accommodation services, and arts, entertainment, and recreation.

As a whole, the proposed policy will have varying impacts on different industries. Not surprisingly, these more modest effects will be in higher-wage industries, such as finance, insurance, and real estate; information; professional and scientific services; transportation, warehousing, and utilities; durable manufacturing; and city government employees.

4.2 Changes in operating costs by industry

Given the high shares of workers affected in a number of the industries in Tables 5, we next analyze the impact of the proposed minimum wage on firms' payroll costs and operating costs.

Changes in a firm's operating costs due to a minimum wage increase are determined by the share of workers receiving wage increases, the average size of the wage increases, and the labor share of operating costs within the firm. As we show in Table 6, in most industries only a minority of workers will receive a wage increase from the proposed law. Among workers who will obtain an increase, some already earn more than the current minimum wage. Therefore, the average wage increase will be less than the statutory increase of the minimum wage itself.

Table 6 displays our calculations of changes in payroll costs and operating costs stemming from the proposed minimum wage policy for select industries—the largest industries in the state and the industries with the greatest share of workers receiving increases.

Table 6. Cumulative change in operating costs for selected industries (for-profit only), 2021

	Percent change in payroll costs in 2021	Labor cost percent of operating costs in 2016	Percent change in operating costs in 2021
All industries	3.3	22.1	0.7
Nondurable manufacturing	3.9	6.9	0.3
Food manufacturing	7.6	10.7	0.8
Wholesale trade	2.7	6.2	0.2
Retail trade	8.1	10.8	0.9
Grocery stores	14.1	12.2	1.7
Administrative services and waste management	6.0	61.1	3.7
Health care and social assistance	3.6	48.4	1.8
Ambulatory care	5.4	52.9	2.9
Hospitals	1.2	44.1	0.5
Residential care	5.9	52.2	3.1
Restaurants	23.1	30.7	7.1
Other Services	12.8	33.8	4.3

Source: Authors' calculations using Cooper (2016).

Note: Percent change in payroll costs includes payroll taxes and workers' compensation as well as turnover offsets. In this table, the percent change in payroll costs does not take into account the reduction in total wage bill due to substitution and productivity gains job losses. Those effects are, however, integrated in the calculations we perform in our model.

As column 1 of Table 6 shows, for all industries combined (in the private for-profit sector), the proposed minimum wage would increase payroll costs by a cumulative 3.3 percent by 2021, after accounting for the savings from reduced turnover described above. This estimate of payroll cost increases includes wages, employer payroll taxes, and workers' compensation insurance.[8]

Column 2 of Table 6 indicates that labor costs as a percentage of operating costs will be 22.1 percent by 2021 (see Appendix A2 for details on estimation of operating costs). Multiplying the first two rows yields an estimated increase in operating costs for all industries combined of 0.7 percent by 2021.

Turning to specific industries, the largest increase in payroll costs would be in restaurants (23.1 percent by 2021), followed by grocery stores (14.1 percent by 2021). The smallest increases in payroll costs are in hospitals and nondurable manufacturing services.

The labor share of operating costs also varies significantly across industries, from 61.1 percent in administrative and waste management services (which includes temp agencies and janitorial and security services) to 6.2 percent in wholesale trade (figures are for 2021).

Column 3 of Table 6 shows that the greatest impact on operating costs will occur in restaurants (7.1 percent by 2021); followed by other services (4.3 percent); administrative and waste management services (3.7 percent); residential care (3.1 percent); and ambulatory care (2.9 percent). For the other industries, the increases in operating costs would be below 2 percent. For example, operating costs for health care and social assistance would increase by 1.8 percent, retail trade by 0.9 percent, and nondurable manufacturing as a whole by 0.3 percent (all by 2021).[9]

5. Effects on employment in New York

A principal goal of the proposed minimum wage policy for New York is to raise the earnings of low-wage workers in the state, while minimizing the tradeoffs in economic costs. In previous sections, we have assessed the benefits to low-wage workers as well as the impact on businesses' operating costs in particular industries. In this section we consider whether the proposed policy would generate net gains or losses to the state's economy.

In Section 5.1, the key issues concern how much employers will substitute equipment or skilled labor for unskilled labor and how much of their cost increases employers will pass on in the form of higher prices. In Section 5.2, we discuss who might pay the costs of the higher minimum wage. Higher prices reduce consumption demand, which translates into reductions in employment and economic activity.

Section 5.3 examines the increased spending that derives from the higher income of low-wage workers. We take into account the effects of taxes and reduction in public benefits on the affected workers' take-home pay and the rate at which their households spend income compared to others. Greater spending from consumers increases economic demand, which translates into increases in employment and economic activity.

The net effects on the state's economy will then depend upon the sum of the effects estimated in each of these three sections. Section 5.4 estimates these net impacts on economic activity and employment.

5.1 Automation, productivity and substitution away from unskilled labor

It is often argued that a higher minimum wage will lead firms to reduce their use of workers. This reduction in labor demand can occur through two different channels: one involves substituting capital for labor, i.e., automation or mechanization of jobs while keeping sales at the same level; the other involves lower demand for workers when prices increase and sales fall. We discuss here the automation channel and consider the effect on sales in the following section.

Automation: economic theory and measurement

Mechanization does not necessarily lead to a net loss of jobs. As David Autor (2014a, b) points out, machines (including smart robots) do not just substitute for labor; they are also complements to existing jobs and they can lead to the creation of new jobs and industries. Indeed, previous rounds of automation and computerization have created more jobs than they destroyed. Moreover, automation does not involve only the replacement of labor by machines. It also involves the replacement of old machines (think manual cash registers) with newer ones (think electronic cash registers and electronic screens like iPads).

In general, the effect of automation on employment depends upon the elasticity of substitution of capital for labor (sigma)—the change in the relative prices of capital and labor—and the share of profits in revenue. The lower sigma is, the more difficult it is to substitute capital for labor. Robert Chirinko, the leading economist specializing in estimates of sigma, finds an economy-wide sigma of about 0.4 (Chirinko and Mallick 2016). Lawrence (2015) also finds that the economy-wide sigma is less than 1 and that it is lower still in low-wage manufacturing industries than in high-wage manufacturing industries.

Alvarez-Cuadrado, Van Long and Poschke (2014) estimate substitution elasticities separately for manufacturing and services using data on 16 countries. They find that service sector elasticities are considerably lower than in manufacturing. However, their study does not examine low-wage services separately.

Aaronson and Phelan (2015) have carefully studied the short-run impact of minimum wages on the automation of different kinds of low-wage jobs. Their study is the first to examine automation within low-wage industry contexts. Aaronson and Phelan find that minimum wage increases do reduce routinized low-wage jobs (such as cashiers) and increase the number of less-routinized low-wage jobs (such as food preparation). As it turns out, the changes offset each other almost equally, resulting in no net change in employment. Thus, Aaronson and Phelan (2015) find that sigma is essentially zero in low-wage occupations.

Aaronson and Phelan's findings also suggest very little substitution of highly skilled workers for lower skilled workers. Dube, Lester and Reich (2016) obtained a similar result. Consequently, we do not include any effect of skilled labor being substituted for unskilled labor in our model.

Automation in practice

Machines that process automated transactions—at airports and in airplanes, banks, self-checkout stations in retail stores, parking garages, and gasoline stations—have become particularly widespread over the past 30 years. During this period, the price of computer-related machines has rapidly declined. Labor-saving

automation will occur even when wages do not rise, insofar as the technological change continues to push down the price of equipment, making investments in new equipment and software profitable.

The effects of a rising minimum wage on actual automation depend in part upon whether new labor-saving technology that has not yet been adopted continues to become available. We suggest that much of existing labor-saving technological change has already been embodied in low-wage industries, in equipment and software such as smart electronic cash registers, remote reservations, and ordering systems. An increase in the minimum wage is likely only to generate small increases in the adoption of more automated systems.

Equally important, the rate of adoption of technical change depends on changes in the relative prices of capital and labor, not just on the price of low-wage labor. Although the prices of computer-related equipment and software have fallen dramatically, by approximately a factor of ten in the past several decades, the decline in the past five years is much smaller. Meanwhile, median wages have stagnated and real minimum wages remain lower than they were in the early 1970s.

The declining cost of capital is also reflected in declines in long-term interest rates in recent decades. Five-year and ten-year inflation-protected interest rates have also fallen dramatically. These changes in relative prices have been the main impetus to increased automation. Even a doubling of the minimum wage policy, which would imply (according to Allegretto et al. 2015) an average wage increase of about 22 percent, would have very little impact in comparison. However, interest rates are unlikely to fall further. It is therefore likely that actual automation in low-wage industries is slowing.

To summarize, empirical estimates of the elasticity of substitution of capital for labor in low-wage industries, range between 0 and 0.4. We use 0.2, the midpoint of this range.

Reductions in paid hours relative to working hours

Some commentators assert that a higher minimum wage will lead employers to cheat workers of a portion of their wages. However, such practices already exist; the question at hand is how much the minimum wage increase will increase their prevalence and intensity. Although it is difficult to measure changes in wage theft, we know that employee-reported increases in pay (to a census surveyor) after a minimum wage increase match up well to employer-reported increases in pay on administrative reports that determine payroll taxes (Dube, Lester and Reich 2010). These results suggest that most employers comply about as much after the increase as before.

Effects on employee turnover

The correlation between low wages and high employee turnover is well known (Cotton and Tuttle 1986).[10] Over the last decade, annual employee turnover in accommodation and food service averaged 70 percent a year, compared to 41.4 percent in other services, 30.5 percent in health care and social assistance, and 32 percent in non-durable manufacturing (Bureau of Labor Statistics, 2014).[11] Quits are higher in low-wage occupations because workers leave to find higher-wage jobs or because they are unable to stay in their jobs due to problems such as difficulties with transportation, child care, or health.

Recent labor market research has gone beyond establishing a correlation between pay and turnover. We now know minimum wage increases have well-identified *causal* impacts that reduce worker turnover. Dube, Naidu and Reich (2007) found that worker tenure increased substantially in San Francisco restaurants after the 2003 minimum wage law, especially in limited service restaurants. Dube, Lester and Reich (forthcoming, 2016) found that a 10 percent increase in the minimum wage results in a 2.1 percent reduction in turnover for restaurant workers and for teens. Jacobs and Graham-Squire (2010) reviewed studies of the impact of living wage laws on employment separations and found that a 1 percent increase in wages is associated with a decline in separations of 1.45 percent.

Turnover creates financial costs for employers (Dube, Freeman and Reich 2010; Hinkin and Tracey 2000; Blake 2000). These costs includes both direct costs for administrative activities associated with departure, recruitment, selection, orientation, and training of workers, and the indirect costs associated with lost sales and lower productivity as new workers learn on the job. Hinkin and Tracey (2010) estimate the average turnover cost for hotel front desk employees at $5,864. A study of the cost of supermarket turnover by the Coca Cola Research Council estimates the replacement cost for an $8 an hour non-union worker at $4,199 (Blake 2000). Boushey and Glynn (2012) estimate that the median replacement cost for jobs paying $30,000 or less equals 16 percent of an employee's annual salary.

Pollin and Wicks-Lim (2015) estimate that 20 percent of the increased costs from a minimum wage increase are offset by reductions in turnover. Similar estimates can be found in Fairris (2005) and Jacobs and Graham-Squire (2010). In a small case study of quick service restaurants in Georgia and Alabama (Hirsch, Kaufman and Zelenska 2011), managers reported they offset 23 percent of the labor cost increases through operational efficiencies.

For our calculations below, we assume that 17.5 percent of the increase in payroll costs is absorbed through lower turnover in the early years of the proposed minimum wage increase.[12] However, these turnover savings do not continue to grow at higher wage levels. Dube, Lester and Reich (forthcoming 2016) find that most of the reduction in turnover occurs among workers with less than three months of job tenure.

This result suggests that the effect of higher wages on increasing tenure dissipates as wage levels increase. We therefore assume that the increases in wages after 2018 no longer result in turnover reductions, yielding an overall lower rate of savings from turnover of 13.4 percent in 2021.

Impact of higher wages on worker performance

Paying workers more can also affect worker performance, morale, absenteeism, the number of grievances, customer service, and work effort, among other metrics (Reich, Jacobs and Dietz 2014; Hirsch, Kaufman and Zelenska 2011; Ton 2012; Wolfers and Zilinsky 2015).

Efficiency wage models of the labor market argue that wage increases elicit higher worker productivity, either because when employers pay workers more, workers are more willing to be more productive, or because they remain with the firm longer and thereby gain valuable experience, or because higher pay tends to reduce idleness on the job. This theoretical result holds whether one company raises its wage above the market-clearing level, or whether all do (Akerlof and Yellen 1986).

Reduced employee turnover means that workers will have more tenure with the same employer, which creates incentives for both employers and workers to increase training and therefore worker productivity. A large scholarly literature makes this point, and it has been emphasized recently by firms such as Walmart, TJ Maxx, and The Gap as principal reasons underlying their announced policies to increase their minimum wages nationally to $10. However, because of the lack individual- or firm-level productivity data, the earlier efficiency wage literature does not provide a reliable quantitative assessment of the importance of the effect on worker productivity among low-wage workers.

A new paper by Burda, Gedanek and Hamermesh (2016) does just that. Using microdata for 2003-2012 from the American Time Use Study, Burda et al. find that idleness while on the job falls when wages are higher. Their results imply that an increase in hourly pay from $10 to $15 increases the level of productivity by 0.5 percent. This is a substantial effect, since U.S. productivity growth has fallen to just over 1.0 percent per year in the current economic recovery.

Burda et al.'s estimate may be too high, given the difficulty of disentangling cause from effect in their loafing data. On the other hand, they do not have measures of worker engagement while working, which could make the actual worker productivity improvement potentially twice as large. To capture this range of productivity effects in our model, we use the Burda et al. estimate of 0.5 percent.

A recent study by John Abowd et al. (2012) demonstrates the substantial room for productivity and wage growth in low-wage industries in the U.S. Using longitudinally linked employer-employee data, Abowd et al. disentangle wage differentials among industries that are attributable to individual heterogeneity (such as the demographic, educational, and work experience characteristics of workers in the industry), which they label person effects, from the characteristics of the product market and bargaining power of firms in the industry, which they label industry effects.

Abowd et al. can observe wage changes when individual workers move from one employer to another. They find very strong industry average firm effects, particularly for industries that have high average pay and low average pay. Among restaurants, for example, they find that 70 percent of the relatively low wages in the industry are attributable to firm effects, and only 30 percent to person effects. These findings suggest that a change in an industry's environment can have large effects on worker pay.

Effects on prices

As we have seen, previous prospective studies have made different assumptions on how much costs will affect prices—and therefore also profits. Card and Krueger (1995, ch. 10) provide an extensive discussion of this issue. As they point out, from the point of view of an individual employer in a perfectly competitive industry, profits would be unaffected only in the extreme case in which firms can costlessly replace low-wage labor with high-skill labor and/or capital, and without cutting output. Since such substitutions are costly, from this perspective a minimum wage increase would have to reduce profits. Firms do not envision a price increase as a solution, as it fears losing sales to its competitors.

A different result emerges when Card and Krueger consider the point of view of an industry as a whole. This perspective is necessary since the minimum wage increase applies to all the firms in an industry. Now, when individual firms respond to the prospect of reduced profits by raising their prices, they find that other firms are doing the same. Some of the price increases will stick and the industry will recapture some

of the reduced profits. However, since demand for the industry's product is not fixed, this increase in price entails some reduction in product demand, implying that industry output (and therefore employment) will fall. In other words, the price increase will permit employers to recover only a portion of their reduced profits. Card and Krueger do not, however, take into account the income effect that will increase sales when a minimum wage applies to an entire economy, not just a single industry.

The evidence on whether profits do fall is extremely scant. The most important study remains the one in Card and Krueger (1995). These authors obtained mixed results when examining the effects of minimum wage changes on shareholder returns for fast-food restaurant chains. Using British data, Draca et al. (2011) find a small negative effect on profits. However, one segment of this study uses data for firms in the British residential care industry. Firms in this industry were not permitted to increase prices, making the results not very useful for other sectors. Harasztosi and Lindner (2015) examine a large (60 percent) and persistent increase in the Hungarian minimum wage, which affected much of manufacturing. These authors find that cost increases were entirely passed through, but employment did not change and profits did not fall. Of course, the relevance of the British and Hungarian studies for the U.S. is highly uncertain.

In our model, employers pass all of the increase in operating costs stemming from a minimum wage increase onto prices, after accounting for the above-mentioned turnover savings, automation, and productivity growth. Studies of price effects of minimum wages are consistent with this model. These studies generally examine data on restaurants. Aaronson (2001) and Aaronson, French and MacDonald (2008) both find complete pass through of costs. However, their data come from a period of much higher inflation, are based on a handful of observations per metro area, and they do not correct their standard errors for clustering. In contrast, Allegretto and Reich (2015) collected a large sample of restaurant price data in and near San Jose, before and after a 25 percent minimum wage increase in 2013 (from $8.00 to $10.00). Their results indicate that most of the costs are passed through to consumers in higher prices.

Effects on profits and rent

Some economists have argued that many firms have captured above-normal profits in recent decades. An increase in the minimum wage could therefore reduce such economic rents. We attempted to include such an effect in our model, but were stymied by limited data on the proportion of reduced profits that would be borne within New York State.

Our simulations did confirm that insofar as payroll cost increases are partly absorbed by profits, then the scale effect is smaller. The reduced profits have much less effect on the income effect because propensities to spend are low among shareholders and managers, and because much of the profit decline affects capital owners outside of New York State. As a consequence, including a fall in profits in our model would have led to more positive effects on employment.

Minimum wage increases will likely affect the composition of businesses within and among industries. Aaronson, French and Sorkin (2015) find that minimum wage increases raise both exit and entry rates among restaurants, suggesting that entering firms arrive with a business model that is more oriented to the higher wage minimums. These higher-wage firms could be instituting business methods that improve productivity or improve product quality, or both. It is not possible for us to quantify these secondary effects, as they require more data on such adjustment mechanisms than are available.

Franchisee-franchiser relationships and commercial rental leases could also be altered by minimum wage increases. Franchises are particularly important among restaurants. In principle, franchisees could pass their increased costs to franchisers, either through a relaxation of fees or land rent. However, data on such changes are not available, to our knowledge. Effects on commercial rents are also difficult to detect, in part because of the lack of data and in part because such leases are typically of longer duration.

5.2 Scale effects of increased prices on reduced sales of consumer goods

Economists use the term price elasticity of consumer demand to refer to the effect of an increase in prices on reducing consumer demand. Taylor and Houthakker (2010) report price elasticities for six categories of goods and services that together cover all of consumption. We adjust their health care elasticity to -0.20, to take into account changes in the structure of health care provision since the 1990s, and then compute a weighted average elasticity across the six categories using personal consumption expenditure shares from the U.S. Consumer Expenditure Survey (McCully 2011). The result is a price elasticity of consumer demand of -0.72.[13]

This estimate is compatible with, but somewhat larger than, price elasticities estimated from aggregate panel data. Hall (2009), for example, obtains a price elasticity of -0.50. On the other hand, our estimate is very close to that of Blundell et al. (1993).

How well does our consumption elasticity of -0.72 apply to New York State's economy? A primary concern arises with financial services and visitor services, which by definition are sold not to local residents but to visitors to New York, whether from elsewhere in the U.S. or abroad. Visitor services—which largely overlaps with tourism—is not broken out separately in Table 7, as the industry data reported by government censuses and surveys make it difficult to do so. Nonetheless, New York City is a major tourist destination.

The importance of tourism thus introduces some uncertainty into our calculations. Consider restaurants, one of the tourist sector's major components. The tourist segment of the industry is arguably less sensitive to prices than the local segment. But the price elasticities of demand for restaurant meals that make up a part of the Taylor-Houthakker overall consumption elasticity estimates draw from national data sets. We cannot estimate how much error this contributes, especially as existing price elasticities of demand for tourism are very imprecisely estimated. Since we cannot make such an adjustment, we may overestimate how much an increase in the minimum wage reduces restaurant sales in a tourist destination such as New York.

Effects of reduced consumption on economic activity and jobs

We use the 2012 IMPLAN model to estimate the direct and indirect effects of the reduction in consumer spending on economic activity and employment in New York. We assume that any reductions in consumer spending will be borne within the state. As noted above, this may be an overstatement of the impact on spending if tourism is less price elastic.[14]

We summarize the discussion thus far in Table 7.

Table 7. IRLE minimum wage model with parameters

Variable	
Capital-labor substitution	0.2
Turnover reduction (share of payroll increase)	0.13
Price elasticity of demand	-0.72
Productivity gains (reduction in idleness and other sources of productivity gains)—in levels	0.005
Profit share of revenues (taking into account share going to intermediate inputs and materials)	0.15
Percent of payroll costs for Medicare, Social Security, and Workers' Compensation	9.49
Average percent wage increase of workers getting increases	0.27
Share of consumer spending in GDP	0.588
Payroll percent of operating costs in 2016	22.1
Percent reduction in benefits, taxes, credits	7.30
Offset from reduced payroll taxes	7.65
Total demand change for each additional dollar in household income, by household income group (categories are in $2012)	
Less than $10,000	$1.21
$10,000—$14,999	$1.21
$15,000—$24,999	$1.24
$25,000—$34,999	$1.21
$35,000—$49,999	$1.16
$50,000—$74,999	$1.07
$75,000—$99,999	$0.96
$100,000—$149,999	$0.88
$150,000 or more	$0.55

Source: Authors' calculations using Cooper (2016) for the average wage increase of workers getting increases, and IMPLAN for the demand change by household income group. (See the appendix for more details.)

Note: The demand change by household income group measure incorporates taxes and other adjustments to income as well as multiplier effects.

5.3 Income effects of increased pay on consumer demand

The income effect calculation requires fewer additional assumptions. We use IMPLAN to estimate the multiplier effects of increased household spending as a result of the minimum wage increase, taking into account taxes and declines in income from reduced eligibility for public benefits programs and ACA subsidies.

Table 7 shows how IMPLAN estimates, by household income level, the addition of each dollar of additional household income to consumer demand. The IMPLAN calculation also draws upon the distribution of minimum wage recipients across household income levels, as provided in Cooper (2016), Appendix Table A2.

Using data from the 1990s, Aaronson, Agarwal and French (2012) found a large spending effect of minimum wage increases. Their observed income effect was amplified beyond the actual increase because low-paid workers took on increased debt to purchase consumer durables, such as used cars. This increased debt would be repaid back in future years, reducing the strength of the income effect in the longer run. For an increase to $15, however, a larger component of the income effect occurs among households that are not credit-constrained. The longer run income effects are thus likely to be greater for larger minimum wage increases.

5.4 Model calculations and net effects on employment

Table 8 displays the results of our model for 2021. Note that *the estimates are cumulative.* They are estimated relative to the state's minimum wage in each year, and therefore capture the full effect of increases in the proposed city minimum wage in previous years.

Panel A: Reduction in employment due to capital-labor substitution and productivity gains

Panel A in Table 8 shows our estimates for the reduction in the number of jobs due to both capital-labor substitution effects and productivity gains. With an assumed capital-labor substitution elasticity of 0.2 and a productivity effect of 0.005, we find a negative employment effect of about 41,600 jobs.

Panel B: Scale effects due to reduced consumer spending

Panel B in Table 8 presents our estimates of the reductions in consumer spending from the higher payroll costs that are generated by the proposed minimum wage law in 2021. Row 3 restates the total net percentage increase in payroll costs from the proposed policy, accounting for savings from reduced turnover costs. This number comes from the top line of Table 6, using the same assumption that expected savings from reduced turnover will be 17.5 percent in 2018 and 13.4 percent in 2021. Similarly, Row 4 in Table 8 restates the percentage change in prices from Table 6. Percentage changes in prices are equal to the percentage change in operating costs (after accounting for savings from turnover).

Row 5 presents our estimate of the reduction in consumer spending in New York from the price increase. As previously discussed, we estimate that each 1 percent increase in consumer prices results in a -0.72 percent decline in consumer spending. We apply this price elasticity of demand to the percentage increase in prices and then multiply by annual consumer spending in New York.[15]

The result is an estimate of $5.34 billion cumulative reduction in consumer spending by 2021. We then use IMPLAN to estimate the total reduction in consumer demand, including multiplier effects.[16] Row 6 then translates these results into numbers of jobs.

Panel C: Cumulative increases in wages from proposed minimum wage increase

Panel C of Table 8 presents the estimated income effect: increases in consumer demand deriving from increased incomes of low-paid workers.

Row 7 shows the total wage increase from the proposed law for all affected workers. These estimates are taken from Table 4, converted to nominal dollars in 2021. Row 8 adjusts the total wage increase for an estimated loss of 14.95 percent due to reduced eligibility for public assistance programs, as well as lost worker income due to reductions in consumer spending from Panel A.[17] The result is an estimated net income increase of $14.4 billion by 2021. We then use IMPLAN to estimate the increase in employment for New York resulting from the increased household spending triggered by the income increase, accounting for multiplier effects and spending leakage outside the state.[18] Row 9 shows the employment change associated with this increase in income.

Panel D: Net effect

As we have previously mentioned, the substitution productivity, scale, and income effects in Parts A to C occur simultaneously, not sequentially. It is thus not correct to infer that the employment changes in Parts A to C actually occur. Net employment changes occur only to the extent that is registered after we add Parts A to C together to obtain the net effects.

Panels A to C do tell us that the net effects will likely differ by job wage rates. In particular, the automation and productivity effects in Part A will occur entirely among low-wage jobs. The scale and income effects of Parts B and C, however, will affect jobs throughout the state's consumer demand industries and among a much broader wage distribution. We have not been able to quantify these differences, as they depend on the relative concentration of scale and income effects in low-wage industries.

In Panel D of Table 8, we present our estimate of the net change in employment from New York State's proposed minimum wage policy. We estimate a cumulative net gain in employment, due to the policy, of 3,180 jobs by 2021, or 0.04 percent of total employment in New York State. To put this estimate in context, the New York State Labor Department projects that employment in New York State will grow annually by 1.37 percent from 2012 to 2022. (For more details see Appendix A3.) Clearly, the net effect on employment are small.

We emphasize again that our cumulative estimate will be spread over the preceding years of the minimum wage increase—the 2021 estimate includes effects in 2016, 2017, 2018, 2019, 2020, and the first half of 2021.

The key point in Table 8 is that a $15 minimum wage has a very small net effect on employment.

Table 8. Cumulative net changes in employment in New York State, 2021

A. Cumulative reduction in the wage bill due to capital-labor substitution and productivity gains	
1. Reduction in number of jobs from capital-labor substitution effects and productivity gains	-41,590
2. Reduction in wage bill due to substitution effects (in billions)	-0.86
B. Scale effect: Cumulative reduction in consumer spending	
3. Net percentage increase in payroll costs from proposed minimum wage law, accounting for savings from reduced turnover costs, substitution effects and productivity gains	3.2
4. Percentage increase in prices resulting from net percentage increase in operating costs (labor costs are only a portion of a firm's operating costs)	0.7
5. Reduction in consumer spending in New York State from price increase (billions)	-$5.34
6. Reduction in number of jobs due to the scale effect	-36,764
C. Income effect: Cumulative increase in consumer demand	
7. Total wage increase for all workers in New York State (both residents and commuters) after reduction in wages due to substitution and productivity job losses (billions)	$16.97
8. Net income increase after reductions in public assistance and consumer spending (billions)	$14.43
9. Increase in number of jobs due to the income effect	81,532
D. Cumulative net change in employment	
10. Net change in employment	3,178
11. Net change in employment, as a percent of total employment	0.04
12. Annual net change in employment	636
13. Annual net change in employment, as a percent of total employment	0.01

Source: Authors' calculations using the UC Berkeley IRLE minimum wage model. All figures in 2021 dollars. Further details are in the appendix.

Note: Substitution, scale, and income effects in Parts A to C occur simultaneously and are additive.

CONCLUSION

The proposal to increase the statewide minimum wage to $15 by 2021 will generate a series of benefits and costs for workers and businesses in New York State.

The proposed policy would result in substantial benefits to low-wage workers and their families. As Cooper (2016) estimates, the policy will raise wages for 3.16 million workers by 2021. On average, for workers getting increases by 2021, their annual earnings will increase by 23.4 percent or $4,900.

These large increases in pay will raise overall payroll costs in for-profit businesses by only 3.3 percent. This amount is surprisingly small because many businesses already pay more than $15 and because many of the workers who are now paid below $15 are already paid above $9, the current minimum wage.

Businesses will absorb the additional 3.3 percent in payroll costs partly through savings on employee turnover costs, higher worker productivity gains, and some automation (the substitution effect). Most of the increase in costs will likely be passed on to consumers via increased prices. Since labor costs make up only about one-fourth of operating costs, consumer prices will increase only slightly—about 0.14 percent per year over the phase-in period.

These higher prices by themselves would reduce consumer sales in New York by about 0.5 percent and reduce the demand for labor (the scale effect). But simultaneous positive effects on increased consumer spending from workers receiving wage increases will offset the scale and substitution effects.

After taking into account all of these factors, we estimate that the proposed minimum wage policy would increase overall net employment (as a percent of total employment) in the state by 0.04 percent by 2021. This estimate is cumulative (and so will be spread over several the phase-in period). In comparison, employment in the state is projected to grow 1.37 percent annually in the same time period.

In sum, it is possible for New York State to effect a vast improvement in living standards for over a third of its workforce without generating a net adverse employment effect. It can do so through induced efficiencies (more automation, productivity gains, turnover savings) and slight price increases borne by all consumers. Based on our analysis, we conclude that the proposed minimum wage will have its intended effects in improving incomes for low-wage workers. Any effects on employment and overall economic growth are likely to be small. The net impact of the policy will therefore be very positive.

APPENDIX: DATA AND METHODS

In this appendix, we document the data and methods we use in this study. Section A1 details how the Census' American Community Survey was used both to estimate pay increases for affected workers and the median full-time wages in New York. Section A2 describes how we calculate the minimum wage to median full-time wages, as presented in Table 2 in the report. Section A3 describes the data and methods we use to calibrate the UC Berkeley IRLE minimum wage model.

A1. Datasets and sample definition

The American Community Survey (ACS) and the estimation of the hourly wage variable

The American Community Survey is the dataset used by Cooper (2016) to assess the number of workers affected by the proposed minimum wage increases in New York State and the average pay increases per affected worker that we both use as inputs to calibrate our model. We document below the main steps Cooper follows to define the sample and to perform those calculations. A full documentation is available in Appendix B: Technical documentation and methodology in Cooper (2016). We also use the American Community Survey to estimate the median wages in New York State in 2021 to compute minimum wage to median full-time wage ratios (see Section A2) using similar adjustments.

The American Community Survey is the largest annual survey conducted by the U.S. Census Bureau, and interviews more than 2.3 million households throughout the United States. This dataset is better than the Current Population Survey (CPS) to conduct analyses on labor market policies at the state or sub-state level for two main reasons: first, the ACS sample size is much larger than the CPS; and second, the ACS contains place of work data, while the CPS data are limited to place of residence. This allows Cooper (2016) and us to disaggregate wage and employment data for sub-state geographical units. All the calculations are based on the 2014 American Community Survey, published by the U.S. Census Bureau and harmonized by Ruggles et al. (2015) at the Minnesota Population Center.

However, because the ACS only records workers' annual income and wages, it is necessary to compute an hourly wage variable to perform simulations on the effects of minimum wage increases. The hourly wage is imputed using wage information for all workers in the sample using their reported annual wage income, usual hours of work per week and weeks worked in the previous year. The "number of weeks worked in the previous year" variable is a categorical variable of intervals of weeks worked (such as 14–26 weeks or 50–52 weeks). This variable is converted to a discrete variable for each worker in the sample (such as 15, 16, 17 weeks, etc.).[1] The annual earnings measure includes wages, salaries, commissions, cash bonuses, and tips from all jobs, before deductions for taxes. The ACS hourly wage variable is computed as annual earnings divided by the product of the number of weeks worked in the previous year and usual hours worked per

[1] To do this, Cooper (2016) used the Annual Social and Economic Supplement to the Current Population Survey (CPS-ASEC) to predict workers' discrete weeks in the previous year. In our analysis of the American Community Survey to estimate the median wages in New York State in 2021, we converted the "number of weeks worked in the previous year" variable into a continuous variable by setting the number of weeks worked to the midpoint of each interval.

week. This imputation necessarily introduces measurement error in the hourly wages. However, there is no better other publically available data source to conduct analysis on labor markets at the state level.

Sample definition

We make two adjustments to our ACS sample:

1. We restrict the sample to individuals age 16 and older, who had positive wage and salary income in the previous 12 months, who worked in the previous 12 months, and who were not self-employed, or unpaid family workers.[2]

2. Federal government workers are not eligible for state minimum wage increases because state legislatures have no jurisdiction over federal employees. As a consequence, there are no federal government workers in the count of directly or indirectly affected workforce. However, they are included in counts of the total workforce.

We also do not control for workers already scheduled to receive pay increases as a result of the executive orders to raise wages for some state and local employees or the fast-food wage order. Finally, workers in occupations that receive tips as the majority of their earnings are coded with hourly wage values equal to the "tipped minimum wage" (see Allegretto and Cooper 2014).

A2. Ratio of minimum wage to full-time median wage

The ratio of the minimum wage to the median full-time wage provides a standard metric used by economists to measure inequality and how easily the minimum wage can be absorbed by the local labor market. We present this ratio in Table 2 above.

To estimate the full-time median wage in 2021, we first use the 2014 American Community Survey to estimate median wages in 2014. We detail our sample definition as in Section A1 above. We then inflate the median full-time wage from 2014 to 2021 dollars using the New York State core inflation index. This index excludes volatile food and fuel components. Core inflation is forecast to be 16.4 percent over this period.

Our ratios of the minimum wage to the median wage may err on the high side because we include federal employees who are not covered by the proposed policy. Since federal employees are more likely to be paid above rather than below the median full-time wage, a measure of the median wage for *covered* workers only would be lower than the median wage we use.

[2] In addition, Cooper (2016) restricts the sample to workers whose imputed wage values are greater than $0.93 and less than $185. In our analysis of the ACS data for the calculation of the median wages, we make additional restrictions to this sample: we select individuals age 18 to 64, and select only respondents who worked more than 13 weeks in the previous 12 months and who usually worked 35 hours per week or more. We also trim outliers by dropping individuals with wages less than $0.50 or greater than $100 in 1989 dollars. The omission of 16- and 17-year-olds will not affect our median wage calculations, as very few are full-time workers.

A3. Calibrating the UC Berkeley IRLE minimum wage model

A3.1 Structure of the model, and calculations step by step

Table A1 summarizes the structure of our model. The table has four components. The top part describes the number of workers in the state who will receive pay increases by 2021. Part A describes the effects of automation and worker productivity gains. Part B describes how much consumer prices will increase and how much those increases will reduce consumer demand and employment. Part C describes how we calculate the income effect: how pay increases will increase consumer spending and employment. Part D describes how we calculate the net effect on employment. In this section we document in detail the data and methods that we use in each part of Table A1. In section A3.2, we document the source of the key parameters used to calibrate our model.

Top part: Workers affected and wage increases

Lines [1]-[3] in Table A1 use estimates from Cooper (2016) on how the labor force will grow and how the proposed minimum wage increase would affect the wage distribution of workers in New York State. The wage estimates include the number of workers directly and indirectly affected by the proposed minimum wage increase, and their nominal wages with and without the policy. We also use his estimate that the total wage bill by 2021 would be $523 billion with the proposed minimum wage increases and $505 billion without the proposed minimum wage increases.

Part A: Impact of capital-labor substitution and productivity gains

Part A calculates the impact of capital-labor substitution and productivity gains on employment and the total wage bill. Our estimates are calculated as follows:

- The reduction in number of jobs from substitution effects (line [5] in Table A2) is calculated by multiplying four components: (i) the capital-labor substitution elasticity (see section A3.2) (ii) the average wage increase of workers getting increases, estimated to be 27 percent based on Cooper (2016), (iii) the profit share of revenues (see section A3.2), and (iv) the total number of affected workers, from Cooper (2016).
- The reduction in number of jobs from productivity gains ([6]) is calculated by multiplying two components: (i) the productivity gains (see section A3.2 for a description of the values we use to calibrate the model) and (ii) the total number of affected workers (estimated to be 3.2 million, based on Cooper 2016).
- The reduction in wage bill due to substitution effects and productivity gains ([7]) is calculated by multiplying the reduction in number of jobs due to capital-labor substitution and productivity gains ([8]) by the nominal average annual earnings of workers who would otherwise remained employed ([9]).

Table A1. Structure of the UC Berkeley IRLE minimum wage model

Top part: Workers affected and wage increases	
Total employment	[1]
Total number of workers receiving pay increases by 2021	[2]
Working age population growth from Dec 31 2013 to July 1 2021	[3]
A. Impact of capital-labor substitution and productivity gains	
Reduction in number of jobs from substitution effects and productivity gains	[4]=[5]+[6]
Reduction in number of jobs from substitution effects in 2021	[5]
Reduction in number of jobs from productivity gains in 2021	[6]
Reduction in wage bill due to substitution effects and productivity gains (in millions)	[7]=[8]*[9]
Reduction in number of jobs	[8]=[4]
Nominal average annual earnings of affected workers without the policy	[9]
B. Scale effects: increase in consumer prices and reduction in consumer demand	
Percentage increase in consumer prices	[10]=[11]
Percentage increase in operating costs	[11]=[12]*[13]
Labor share of operating costs	[12]
Net percentage payroll increase, accounting for savings from reduced turnover, substitution effects and productivity gains	[13]
Annual reduction in consumer demand from price increase (millions)	[14]=[15]*[16]
Percentage reduction in demand from price increase	[15]
Annual aggregate consumer spending in New York State (millions)	[16]
Reduction in number of jobs from in-state consumer spending reduction	[17]
Reduction in number of jobs, as a percentage of total employment	[18]
C. Income effects: effects of pay increases on consumer spending and employment	
Net change in compensation for workers in New York State (millions)	[19]=[20]-[21]
Total wage increase for workers in New York State (millions)	[20]
Offsets from benefit reductions and payroll tax increases	[21]
Increase in number of jobs from wage increase in New York State	[22]
Increase in number of jobs, as a percentage of total employment	[23]
D. Net effects	
Cumulative net change in number of jobs in New York State	[24]
Cumulative net change in number of jobs, as a percent of total employment	[25]=[24]/[1]
Annual net change in number of jobs in New York State	[26]=[24]/5
Annual net change in number of jobs, as a percent of total employment	[27]=[25]/5

Source: UC Berkeley IRLE minimum wage model.

Part B: Scale effects: increase in consumer prices and reduction in consumer demand

Part B of Table A1 estimates the percentage increase in consumer prices due to an increase in operating costs for firms and the annual reduction in consumer demand from price increase. We use the 2012 IMPLAN model to calculate the impact of this reduction in consumer spending on employment. Our estimates are calculated as follows:

- The percentage increase in consumer prices ([10]) is assumed to be equal to the percentage increase in operating costs ([11]), following the widely-used Dixit-Stiglitz model of monopolistic competition (Dixit and Stiglitz 1977).
- The percentage increase in operating costs ([11]) is obtained by multiplying the net percentage payroll increase ([13]) by the labor share of operating costs ([12]).
- The net percentage payroll increase ([13]) includes savings from reduced turnover and the reduction in wage bill due to substitution effects and productivity gains. Cooper (2016) estimates the increase in the total wage bill ($17.8 billion). We subtract the reduction in total wage bill due to substitution effects and productivity gains ([1]). We also account for the increase in payroll costs that corresponds to Medicare, Social Security, and Workers' Compensation costs. This share equals 9.49 percent in 2021 (see section A3.2 for the source).To compute the net percentage increase in payroll costs, we apply a partial offset for turnover cost savings (see section A3.2 for the source).
- The labor share of operating costs ([12]): we estimate the economy-wide labor share of operating costs to be 22.1 percent in 2016 (see section A3.2 for the source).
- The reduction in consumer demand from price increase ([14]) is obtained by multiplying the percentage reduction in demand from price increase ([15]) by the annual aggregate consumer spending in New York State ([16]). The estimated reduction in consumer demand due to higher prices equals $5.34 billion. The key components of this calculation are:
    - The percentage reduction in consumer demand from price increase ([14]). It depends on two parameters: (i) the percentage increase in consumer prices as calculated in line [10], and (ii) the price elasticity of demand (see section A3.2 for the source). The bigger the price elasticity of demand is, the more sensitive the consumers are to a price change and the greater the percentage reduction in demand from price increase is.
    - Annual aggregate consumer spending ([16]) is obtained by multiplying the projected annual GDP for New York State in 2021 by an overall estimated share of consumer spending in GDP. We use the Fiscal Policy Institute estimate of the New York GDP ($1.79 trillion in 2021; see section A3.2), and we estimate that the share of consumer spending in GDP is 58.8 percent (see section A3.2). We estimate that the annual aggregate consumer spending is $1,050 billion in 2021.
- The annual reduction in jobs resulting from price increases is estimated using the 2012 IMPLAN model (see Day (2013) for documentation on this software). We adjust those estimates by working age population growth from December 2012 to July 2021, estimated to be 1.37 percent for the overall period (see section A3.2).

Part C: Income effects

Part C of Table A1 estimates the income effects resulting from pay increases for low-wage workers, the resultant increase in consumer demand, and its impact on employment. Our estimates are calculated as follows:

- The net change in compensation for state workers ([19]) is calculated as the total wage bill increase for state workers ([20]) minus the wage bill reduction from a reduction in the Supplemental Nutrition Assistance Program (SNAP) and in premium tax credits under the Affordable Care Act benefit reduction ([21]).
- The offset from SNAP and premium tax credits ([21]) under the ACA is estimated to be 14.95 percent of the total wage increase (see Appendix A3) and is applied to the total wage bill increase for all households, as there is no easy way to separate this out by income brackets.
- The annual increase in jobs resulting from higher consumer demand is estimated using the 2012 IMPLAN model. We adjust those estimates by the working age population age growth from December 2012 to July 2021, estimated to be 1.37 percent for the overall period (see section A3.2 for the source).

Part D: Net effects

Part D of Table A1 estimates the cumulative net effect on employment ([24]), simply by subtracting the reduction in employment due to substitution effects, productivity gains ([4]), and scale effects ([17]) from the employment gains due to income effects ([22]). We compute the annual estimates by dividing the cumulative effects on employment by five, to account for the number of years needed for the policy to be fully phased in. These numbers are therefore approximate annual averages.

A3.2 Key parameters and assumptions used in the model

Our key parameters are drawn from the best available evidence. We vary some of them in our robustness tests. We explain and document below the range of those parameters and the sources we used. The values of the key parameters used in the model are summarized in table A2.

Table A2. Key parameters of the model

		Robustness parameters	
Workers affected and wage increases			
Working age population growth from Dec 31 2012 to July 1 2021	1.37	1.37	1.37
A. Impact of capital-labor substitution and productivity gains			
Capital-labor substitution elasticity	0.2	0.0	0.4
Profit share of revenues (taking into account share going to intermediate inputs and materials)	0.15	0.15	0.15
Productivity gain—in levels	0.005	0.000	0.010
B. Scale effects: increase in consumer prices and reduction in consumer demand			
Labor percent of operating costs	22.1	22.1	22.1
Percent of wage costs for Medicare, Social Security, and Workers' Compensation	9.49	9.49	9.49
Turnover reduction (as share of payroll increase)	0.13	0.16	0.10
Price elasticity of demand	-0.72	-0.52	-0.92
Annual GDP for New York State (trillions)	$1.79	$1.79	$1.79
Share of consumer spending in GDP	0.588	0.588	0.588
C. Income effects: effects of pay increases on consumer spending and employment			
Offsets from benefit reductions and payroll tax increases	14.95	14.95	14.95
Reduced EITC	0.80	0.80	0.80
Reduced SNAP benefits	4.20	4.20	4.20
Lower premium tax credits under the ACA	2.30	2.30	2.30
Reduced payroll taxes	7.65	7.65	7.65
D. Net effect			
No additional parameters used in this section			

Source: UC Berkeley IRLE minimum wage model.

Note: Robustness tests are reported in Reich (2016)

Working age population growth from 2012 to 2021

We assume a population growth of 0.16 percent per year, consistent with the estimate of the total 2021 workforce in Cooper (2016). This estimate is based on projected annual New York State population growth rate from 2015 to 2020 (Cornell University Population Center 2011); we use the same annual growth rate of 0.16 for 2012 to 2015. The overall growth is prorated by the number of months that occur between December 2012 and July 2021, when the last wage increase is scheduled.

Capital-labor substitution

For a discussion about capital-labor substitution and the sources we used, see section 4.2 in the main report.

Profit share of revenues

We use Table 1.14. "Gross Value Added of Domestic Corporate Business in Current Dollars and Gross Value Added of Nonfinancial Domestic Corporate Business in Current and Chained Dollars" of the National Income and Product Accounts Tables (NIPA) published by the Bureau of Economic Analysis to estimate the labor and capital share of national income. Using the 2014 data, we estimate that the labor share of national income is 62 percent and the capital share of national income (including capital depreciation) is 38 percent. Knowing that the labor share of operating costs is 22.1 percent in 2016, we apply the growth rate of payroll costs to estimate the labor share of operating costs in 2021. We estimate that this labor share (which accounts for reduction in turnover costs, substitution effects and productivity gains) is 24.3 percent in 2021 in our preferred scenario (scenario 1). The profit share of revenues is therefore estimated to be 0.15 in 2021. The remainder of businesses revenues is composed of materials, intermediate inputs and rent.

Productivity gains

For a discussion of productivity gains and the sources we used, see section 5.1 in the main report.

Labor share of operating costs

Net payroll cost increases for businesses are a function of three factors: (1) the total wage bill increase, after reduction due to substitution effects and productivity gains; (2) Medicare, Social Security, and Workers' Compensation increases, and (3) turnover costs savings. The payroll costs increase as total compensation increases and decrease with turnover costs savings.

- The total wage bill increase from 2016 to 2021 is taken from Cooper (2016). For each year, we calculate the reduction in wage bill due to job losses from substitution effects and productivity gains, assuming that capital-labor substitution and productivity gains are constant over the years. For example, in scenario 1, we assume capital-labor substitution is equal to 20 percent every year, and that productivity gains are equal to 5 percent every year.
- Employers' costs for Medicare, Social Security, and Workers' Compensation will equal 9.49 percent of wages from 2016 to 2021. We estimate the three components—Medicare (1.45 percent), Social Security (6.2 percent), and Workers' Compensation costs—separately. Since we are estimating only the effects of a minimum wage increase, we assume the Medicare and Social Security rates will not change between 2016 and 2021. For Workers' Compensation costs, we draw from a report of the National Academy of Social Insurance (2013). Table 14 (p. 37) of this report indicates that Workers' Compensation employer costs in 2013 amounted to $1.50 per $100 of covered wages. These costs increased $0.11 cent increase a year over 2011–2013, slightly more than the 2009–2011 change. To account for these cost increases, we adjust the 2013 cost by $0.34. Consequently, we estimate that Workers' Compensation costs will equal 1.84 percent of wages in New York State from 2016 to 2021.
- Turnover costs savings are based on the estimates of Pollin and Wicks-Lim (2015), Fairris (2005), Dube, Freeman and Reich (2010), Dube, Lester and Reich (2016), Boushey and Glynn (2012), and Jacobs and Graham-Squire (2010) (see section 5.1 in the main report).

The labor share of operating costs by industry

For each industry, we estimate labor costs as the sum of the annual wage costs, payroll taxes and employer paid insurance premiums (except health insurance), and other benefits (other than contributions to pension plans). The labor share is estimated using 2012 Census Bureau surveys—the most recent year available. We use these surveys only for select individual industries: retail trade; food services; wholesale trade; manufacturing; administrative and waste management services; health care and social assistance (including ambulatory care, hospitals, and long-term care); and other services. We document here our sources and methods for these individual industries as well as for our estimates of the labor share of operating costs in the overall economy.

- Retail trade (including grocery stores): The 2012 U.S. Census *Annual Retail Trade Reports* provides data on retail sales, payroll costs, merchandise purchased for resale, and detailed operating expenses. We add operating expenses and purchases together to determine total operating costs. We add the costs of payroll taxes, employer paid insurance premiums, and employer benefits (excluding health insurance and retirement benefits) to annual payroll to estimate total labor costs. Health and retirement benefits are excluded since, unlike payroll taxes and Workers' Compensation insurance, the costs of the benefits will not change if wages are increased. Dividing labor costs by operating costs gives us the labor share in retail trade.

- Food services industry: Industry data on gross operating surplus are available from the Bureau of Economic Analysis *Input-Output Account Data, before Redefinitions, Producer Value*. We subtract gross operating surplus from sales to obtain total restaurant operating costs, and then proceed as we did for retail to obtain labor cost data.

- Wholesale trade: Data are from the U.S. Census *Annual Wholesale Trade Report*. We follow the same methods as with retail trade.

- Manufacturing: Data are from the 2012 Economic Census (Table EC1231I1). To determine operating expenses we add together payroll costs and benefits, total cost of materials, total capital expenditures, depreciation, rental or lease payments, and all other operating expenses. To determine labor costs we add together payroll costs and payroll taxes, employer paid insurance premiums, and employer benefits (excluding health insurance and retirement benefits).

- Administrative and waste management services, health care and social assistance (including ambulatory care, hospitals, and long-term care), and other services: Data are from the U.S. Census A*nnual Services Report*, which provides data on payroll and operating expenses. Total operating expenses are reported directly in the data. To determine labor costs we add together payroll costs and payroll taxes, employer paid insurance premiums, and employer benefits (excluding health insurance and retirement benefits).

- Overall economy: We sum the total labor and operating costs across all industries with available data, and then divide the aggregate labor costs by the aggregate operating costs. In addition to the industries listed above, we are able to use the *Annual Services Report* to gather data on the following industries: utilities; transportation and warehousing; information; finance and insurance; real estate and rental and leasing; professional, scientific, and technical services; educational services; and arts, entertainment, and recreation. We are missing data for the following industries, and as a result they are not included in our calculation: agriculture, forestry, fishing, and hunting; mining, quarrying, and oil and gas

extraction; construction; accommodation; and public administration. Overall, we estimate that the labor share of operating costs is 22.1 percent in 2012, and assume it is constant between 2012 and 2016.

Share of payroll costs for Medicare, Social Security and Workers' Compensation

The share of Medicare, Social Security, and Workers' Compensation is assumed to continue to be 9.49 percent from 2016 to 2021. We estimate the Medicare, Social Security, and Workers' Compensation costs separately. Employers are liable for 6.2 percent Social Security taxes and 1.45 percent Medicare taxes. We estimate that the Workers' Compensation employer cost is 1.84 percent of wages in New York State. This estimate uses the National Academy of Social Insurance Workers' Compensation report (2013). In Table 14 p. 37 of this report, employer costs for Workers' Compensation are $1.50 per $100 of covered wages in 2013. We increase this figure by $0.34 to account for the increase in these costs. In 2011–13 these costs increased $0.11 cent increase per year, slightly more than the 2009–2011 change.

Turnover reduction

For a discussion on savings generated by turnover reduction and the sources we used, see section 5.1 in the main report.

Price elasticity of demand

The price elasticity of demand measures the effect of a price increase on reducing consumer demand. We use a price elasticity of 0.72. This estimate is based on Taylor and Houthakker (2010), who report price elasticities for six categories of goods and services. We adjust their estimates to account for changes in the elasticity of health care spending attributable to the Affordable Care Act and other changes in the health care system.

GDP for New York State in 2021

The 2021 GDP used in our model has been forecasted by the Fiscal Policy Institute, using the latest information from the Congressional Budget Office and the New York State Division of the Budget. It is estimated to be $1.79 trillion by 2021.

Share of consumer spending in GDP

Our estimate of the share of consumer spending in GDP includes only consumer spending that flows through households. We therefore reduce the BEA's estimate of the consumption share by 14.1 percent.

Offsets from benefit reductions and payroll tax increases

We estimate that the total offset from reduced EITC to be 0.6 percent, the offset from reduced SNAP benefits to be 4.20 percent, the offset from lower premium tax credits under the ACA to be 2.3 percent, and the offset from reduced payroll taxes to be 7.65 percent (the remaining personal income taxes are removed by IMPLAN). These estimates have been calculated using Congressional Budget Office (2012, Table 6). These results are for the year 2012, and we assume they will remain constant until 2021.

ENDNOTES

[1] For further geographical detail, see New York State Department of Labor (2016).

[2] However, Aaronson, Agarwal and French (2012), Table A-3, report a positive earnings effect for adults and nonetheless find no detectable effect on employment.

[3] Neumark, Salas and Wascher (2014), the best-known researchers who find negative effects, report a 0.06 minimum wage employment elasticity for restaurants, very close to the findings in Allegretto et al. (2015).

[4] The study was prepared for the Los Angeles City Council; see Reich, Jacobs, Bernhardt and Perry (2015).

[5] To recognize Hicks' 1932 formulation of these laws in mathematical form, they are also known today as the Hicks-Marshall laws of derived demand. See Cahuc et al. (2014), ch. 4.

[6] The capital-labor substitution elasticity is not likely to be higher or lower at higher minimum wage rates.

[7] Detailed industries were selected on the basis of sufficient sample size, as well as sizeable percentage of workers affected by the proposed minimum wage increase.

[8] We use a payroll tax rate of 7.65 percent (6.2 percent for Social Security and 1.45 percent for Medicare). Workers' compensation insurance rates vary by industry (Table 6: www.wcirb.com/sites/default/files/documents/state_of_the_wc_system_report_140815.pdf).

[9] Since some restaurant inputs come from outside New York State, including from industries with higher wages, any additional impact would be small.

[10] Since workers often increase their wages by moving from one employer to another, we cannot assume that the correlation between wages and turnover indicates that low wages are causing higher turnover. As we discuss below, however, policy experiments with living wages and minimum wages have provided the evidence needed to determine that wages do, in fact, affect turnover.

[11] These averages include the low-turnover period of the Great Recession, and can be expected to increase towards higher pre-recession levels as the labor market tightens.

[12] The estimate of 17.5 percent represents the midpoint between the 20 percent estimate of Pollin and Wicks-Lim (2015) and a 15 percent (unpublished) estimate that draws upon Dube, Freeman and Reich (2010) and Dube, Lester and Reich (forthcoming).

[13] Taylor and Houthakker's industry elasticities are based on regressions of U.S. panel data across over 300 cities and pooled over 1996-99. As we discuss below in Section 5.5, we do not expect that a substantial component of consumer sales will move outside the state's borders. Liu and Chollet (2006)'s review essay suggests that the price elasticity of demand for out-of-pocket individual healthcare expenses is -0.2. Our health care elasticity recognizes that employers shift their cost of health care on to employees. We also recognize that for those with subsidized coverage, increases in premium costs for lower-income families—who are more price-sensitive—are borne by the federal government.

[14] An alternative approach estimates the total reduction in economic activity from reduced consumer spending, and then uses multipliers from the new economics research on the employment effects of the

2009 American Recovery and Reinvestment Act (ARRA) to estimate reductions in employment. This literature uses exogenous variation in ARRA programs across states or counties to identify a causal effect of a given stimulus on employment (Wilson 2013). However, these methods have produced a wide range of estimates, rendering this literature not helpful for our purposes here.

[15] Annual consumer spending for New York is estimated at 58.8 percent of IMPLAN's estimated GDP for New York. This percentage excludes the government share of health care costs.

[16] IMPLAN household spending model (proportional to city consumer spending patterns by household income level), using reduced consumer spending in Row 3 and forcing IMPLAN to apply 100 percent of the reduction in the state; see the appendix for details on IMPLAN modeling.

[17] This includes an offset of 4.20 percent for reduction in SNAP, and 2.3 percent in lower premium tax credits and cost sharing subsidies under the ACA (CBO 2012). We also reduce the aggregate increase in wages by lost earnings due to estimated job loss in Panel A. This offset may be too high. According to Chodorow-Reich and Karabarbounis (2015), the consumption expenditures of the unemployed equal 75 percent of the consumption expenditures of the employed, even after taking into account the limited duration of unemployment insurance benefits. Their result echoes a similar result by Aguiar and Hurst (2005) for food expenditures only.

[18] IMPLAN household income model for New York State, using net wage increase from Row 5 and subtracting net wage increase going to affected workers who live outside New York State; see Appendix A3 and Day (2013) for more details on IMPLAN. The net wage increase is distributed across household income categories by the household distribution of increased wages from the minimum wage increase. Our wage simulation model estimates that 6.6 percent of increased wages will go to workers living outside the state.

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