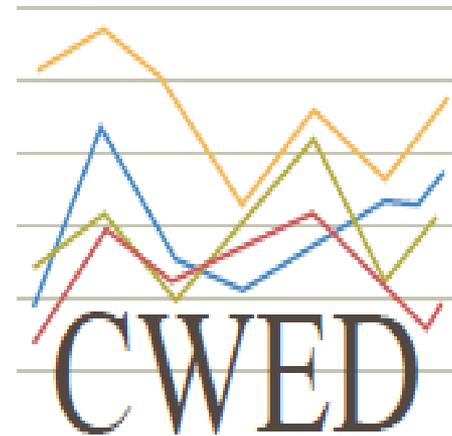# Employment effects of a $15 federal minimum wage in the U.S. and in Mississippi: A Simulation Approach

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Outline

- **2017 analysis of the Raise the Wage Act of 2017– phases in federal $15 MW by 2024. [Raise the Wage Act of 2019 has same end date and MW level]**

- **Number and percent of workers who would get increases; effect on wage bill**

- **Minimum wage model: scale, substitution, income, macro and other effects on employment; model dynamics**

- **Calibrate model at $9.25 MW– benchmark to estimated effects of recent MW policies (in-sample for MW impact studies)**

- **Estimate effects out of sample -- $13 MW in 2021 and $15 in 2024**

- **Summary**

Preview of main results

- **Average pay increase–** (before behavioral responses and excluding enacted state increases):
  - **17.3 percent for 29.2 percent of U.S. workers = $144 Billion**
- **MW model**
  - Positive effects of stimulus to aggregate consumer spending versus negative substitution and scale effects => **net effect uncertain**
- **Model at very high MW >>$15**
  - Substitution and scale effects grow and stimulus effects shrink => **negative employment effect**
- **Model estimates for $15 in 2024**
  - **Real economy-wide wage bill increases 1.9 percent**
  - **Employment increases 0.01 percent**; much of this increase is in middle-wage industries
  - **Labor demand elasticity = .005**
- **Economy-wide benefits**
  - Productivity increases 1.2 percent-- for workers with raises
  - Worker turnover costs fall 7 percent-- for low-wage employers
- **Distribution effects**
  - Large net gain to low-wage workers
  - Affluent consumers pay 0.6 percent higher prices
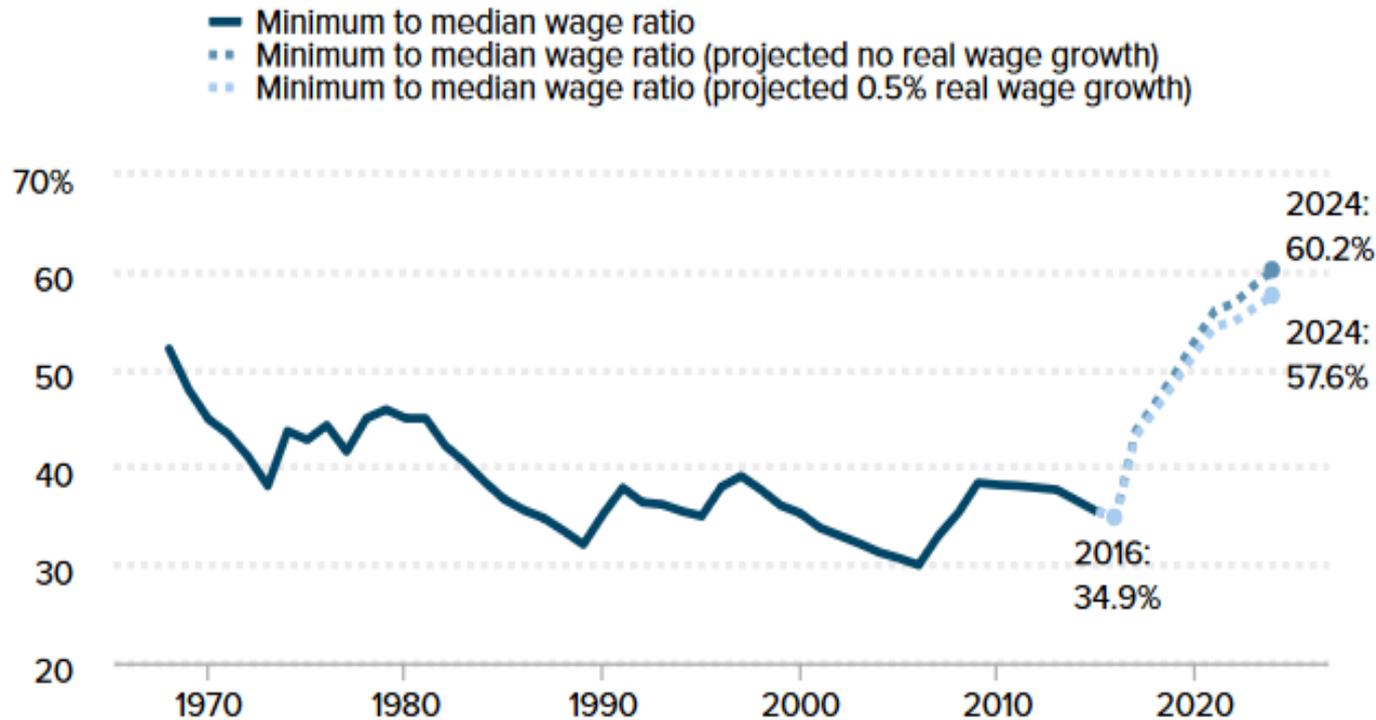
Proposed minimum wage schedule

Date	Minimum wage	Minimum wage ($2016)
July 1, 2017	$9.25	$9.04
July 1, 2018	10.10	9.65
July 1, 2019	11.00	10.27
July 1, 2020	12.00	10.95
July 1, 2021	13.00	11.58
July 1, 2022	13.50	11.75
July 1, 2023	14.25	12.12
July 1, 2024	15.00	12.46

Source: Raise the Wage Act of 2017. The start date in the bill is slightly later than shown here.

How large is an increase to $15?

- **Mandated nominal increase** ranges from zero (in $15 states-- CA, NY, DC) to 106.8 percent (in 21 states at $7.25)

- **National average mandated increase** (employment-weighted by states, Cooper 2017) = 63.2 percent

- **Baseline for comparison:** Annual wage and price growth without the policy = 2.4 percent each (CBO 2017)

- **Increase in average wage floor, relative to baseline**, in constant dollars = 43.2 percent, or 5.4 percent per year

- **Estimated increase in U.S. wage bill:** 1.9 percent

Federal minimum wage as a share of the median wage, 1968–2015 and 2016–2024 (projected under the Raise the Wage Act of 2017)

Legend:
- Minimum to median wage ratio
- Minimum to median wage ratio (projected no real wage growth)
- Minimum to median wage ratio (projected 0.5% real wage growth)

2024: 60.2%

2024: 57.6%

2016: 34.9%

Note: Inflation is measured using the CPI-U-RS. Minimum wage is projected for 2016, hence the minimum wage to median wage ratio is a projected value.

Source: EPI analysis of the Fair Labor Standards Act and amendments and the Current Population Survey Annual Social and Economic Supplement microdata

Economic Policy Institute

Pay increases by 2024

Percent of all workers receiving pay increases	29.2
Number of workers receiving increases (millions)	41.5
Average hourly wage increase, workers getting increases ($2016)	$2.08
Annual pay increase, workers receiving increases ($2016)	$3,470
Percent pay increase, workers receiving increases (real)	17.3
Total aggregate wage increase ($2016 billions)	$144

Source: Cooper (2017) analysis of CPS data.

Minimum wage model

- **Substitution effect --** automation (capital-deepening)
- **Productivity growth** -- staffing and hours reductions, fairness, experience, efficiency wage, business turnover
- **Savings on nonwage labor cost --**lower worker turnover
- **Scale effect --** higher prices reduce sales
- **Income effect --** increase in consumer spending
- **Capacity constraints --** at full employment
- **Effects on interest rates --** Taylor rule reaction function
- **Effects on tradables**

Other features of the model

- **Effect of higher payroll costs on prices of other inputs**

- **Monopolistic competition** (Dixit-Stiglitz) => cost pass-through to prices; robust to including a competitive sector and falling profits

- **Interactions among model components**, such as greater productivity effects reduce scale and income effects

- **Minimal labor supply effect**, per McLellan et al. (2015), Borgschulte and Cho (2017)

- **Negligible substitution of skilled L for unskilled L**, per Dube et al. (2016) and Cengiz et al. (2017)

- **No change in composition of output** – would require knowing individual product demand elasticities

Model as a flow diagram
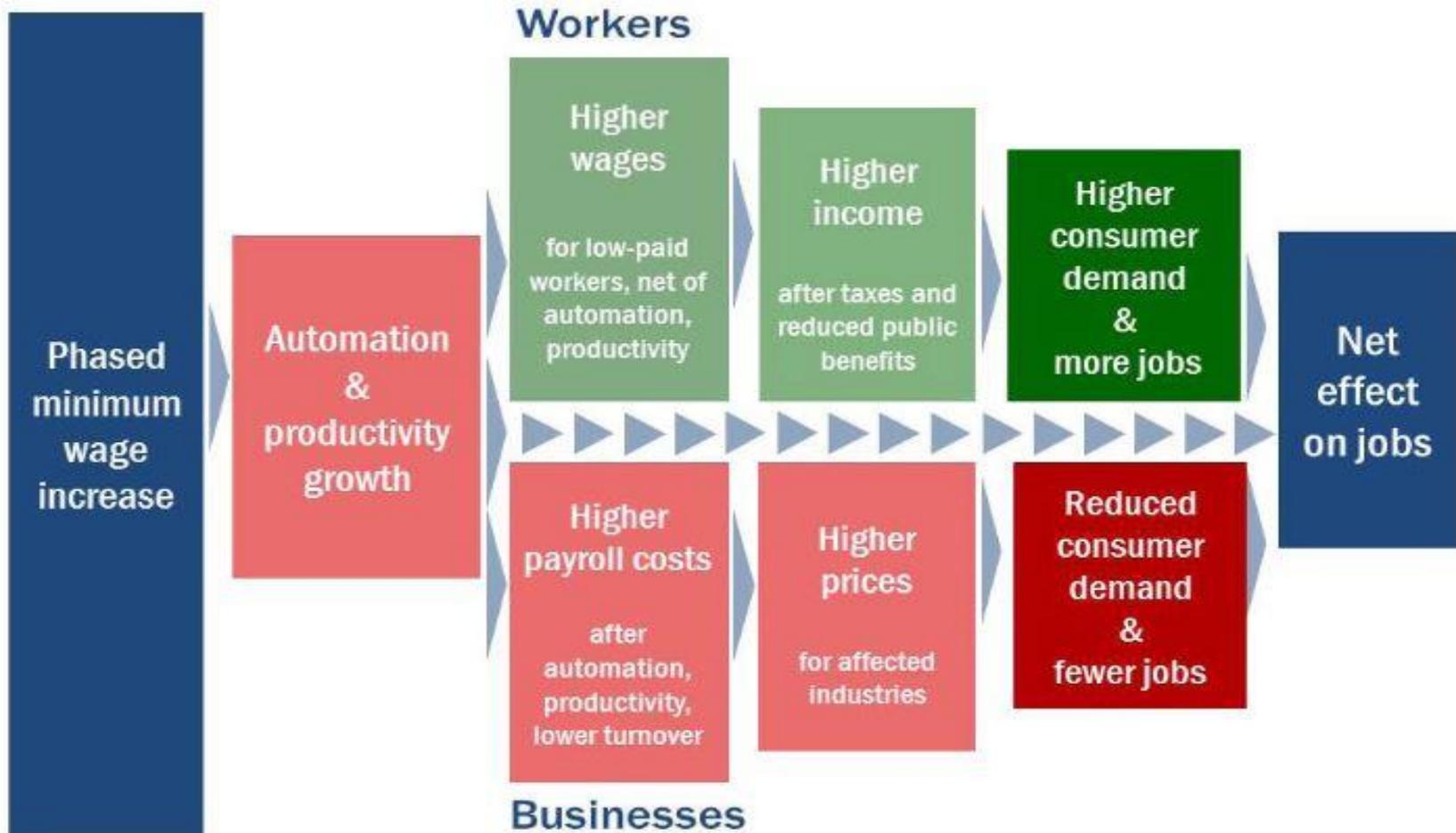
Calibrating the model-- four steps

- **Baseline**: Draws upon forecasts (from CBO and Fed) of changes in wages, prices, UE, GDP without the policy

- **Obtain parameters** for each model component-- from both MW and non-MW literatures

- **Benchmark check at $9.25**: Does calibrated in-sample model match labor demand elasticities in the literature?

- **Estimate employment effects** out-of-sample for $13 and $15

Substitution effect: automation

- **Automation effect elasticity = K-L substitution elasticity (σ) times profit share of gross output (= 0.14)**
  - Short-run σ = 0.33 (Chirinko and Mallick 2007)
  - Long-run σ= 0.65 (Knoblach et al. 2016 meta-analysis); 0.5 (Chirinko and Mallick 2017)

- **σ increases with average industry wage**
  - σ = very low for non-routine low-wage jobs: customer service, food prep and delivery, care work, nursing assistants (Aaronson and Phelan 2015; Cengis et al. 2017)
  - σ somewhat higher for clerks and cashiers, agricultural labor
  - σ in mfg > 0.5 (Chirinko and Mallick 2017)

- **We use σ = 0.2 for MW at $9.25, 0.3 at $13, and 0.4 at $15**
- **These are very conservative assumptions!**
- **Substitution effect elasticity = [-0.03, -0.06]**

Substitution effect: productivity

Productivity also grows through other channels

- **Less down time** -- .005 elasticity (Burda et al 2017)

- **Efficiency wage effects** --work smarter/harder

- **Staffing reductions to offset payroll costs** -- if declining returns to scale

- **Longer job tenure** -- more experience and training

- **Increased use of incumbent workers' skills and organizational improvements**-- 3 percent elasticity (Riley and Brondibene 2017)

- **Business exits versus new entries** (Aaronson et al. 2017, Luca and Luca 2017)

We use a 0.03 percent productivity gain among workers getting increases

Scale effect: higher prices reduce consumption and demand for labor

- **Scale effect elasticity** = percent price increase multiplied by product demand price elasticity (η)

- **Operating cost increase** = percent actual wage increase (.173) multiplied by average labor share of operating costs (sL = .29) = .041

- **Costs passed on fully to prices–**
  - Restaurants and grocery stores: Allegretto and Reich 2017; Cooper, Luengo-Prado and Parker 2017; Renkin et al. 2019
  - Cost increases much smaller in other industries

- η = -0.72 (Taylor and Houthakker 2010; Blundell et al. 1993)

- **Scale elasticity therefore** = -0.03 (-0.04)

Income effect: higher consumer demand

- **Scale and substitution effects are the main adjustment channels only when wages increase in one industry**

- **But MW applies in all industries => add an economy-wide income effect channel**

- **Households treat MW increases as permanent** => higher consumer spending (Aaronson et al. 2013; Alonso 2016)

- **Lower-income households have higher spending propensities**

- **IMPLAN model calculates income effect --** uses spending propensities for nine household income bins, net of higher taxes and reduced receipt of public benefits

- **Estimated income effect at $15: employment elasticity = 1.1**

IMPLAN multipliers

Household income   ($2012)

< $10K	1.21		50 - 75	1.07
10 - 15	1.21		75 - 100	0.96
15 - 25	1.24		100 - 150	0.88
25 - 35	1.21		> 150	0.55
35 - 50	1.16			

- Actual increase in consumer spending (Alonso 2016) matches our predictions

- These spending multipliers fall within the range of fiscal multipliers estimated by Chodorow-Reich 2017, Auerbach and Gorodnichenko 2014.

Income effect: capacity constraints

- **Estimates of full employment and potential output growth vary widely** (Auerbach and Gorodnichenko 2017)

- **Probability of full employment over each of next eight years therefore also difficult to forecast**

- **We draw on the historical record**
  - Probability of UE rate < 4.0 in past 60 years
  - Four years in late 1960s and two years in late 1990s => 10 percent of past 60 years

- Likelihood of Fed raising interest rates to prevent UE < 4.0 is higher today than in either of these two periods

- **Implies chance of *not* reaching capacity constraint = .9 to .95**

Effect on interest rates

- **Use the Taylor rule** to estimate the Fed's response to inflation

- **Fed interest rate increase of about 0.3 –**implied by a cumulative price increase of 0.60 by 2024

- **Or .037 percent per year**, spread over eight years

- **Too small to have significant effect**, even if interest rates remain low (Laubach and Williams 2015)

Effects on trade

- Most low-wage industries do not produce tradables

- Exceptions: food manufacturing and fruits and vegetables

- Very low price increases in other tradable industries

Dynamics of MW model

- **As MW increases from $7.25 to $9.25 and then to $15 and beyond**

- **Substitution effect increases**: σ increases gradually—more of pay raises are in higher σ industries and other productivity effects grow

- **Scale effect increases** at same rate as MW

- **Income effect :** At higher pay mandates, income effect first increases, then decreases when more of the workers with increases are in households with higher saving propensities

- **Model => employment effect becomes negative at some MW level**

- **Gradual change in employment effect** – no cliffs

Key model parameters

Working age population growth, 2017 to 2024 (percent)	0.04
Substitution effects and productivity gains	
Capital-labor substitution elasticity	0.2- 0.4
Capital share in gross output (excluding depreciation)	0.14
Productivity gains from efficiency wage/rent-sharing– in levels	0.005
Scale effects: increase in consumer prices reduces consumer spending	
Labor share of gross output	0.29
Materials share of gross output in restaurants	0.51
Materials share of gross output in retail	0.78
Percent of wage costs for Medicare, Social Security and worker compensation (employer side)	0.10
Turnover reduction (as share of payroll increase)	0.07
Price elasticity of demand	-0.72
Share of household consumer spending in GDP	0.588
Income effects: higher pay increases consumer spending	
Percentage offset from reduced benefits , lower health premiums, higher taxes	14.35
Reduced EITC payments	0.20
Reduced SNAP benefits	4.20
Lower health premium tax credits under the ACA	2.30
Higher payroll taxes	7.65

Model: estimated effects

	$9.25	$13	$15
Percent employment change			
Substitution	-0.20	-0.35	-0.41
Scale	-0.04	-0.30	-0.65
Income	0.12	0.65	1.07
Total	**-0.12**	**-0.15**	**0.01**
Percent wage change	**0.22**	**1.13**	**1.81**
Labor demand elasticity	**-0.06**	**-0.04**	**0.006**

Labor demand elasticity range = [-0.06, 0.006] is consistent with LDEs estimated from pre-2016 MW increases

Employment effects, by 2024, U.S.

Substitution effects: Reduced wage bill from automation and productivity gains

Reduced number of jobs (thousands)	-490
Percent reduction in number of jobs	-0.28%

Scale effect: Reduced consumer spending

Reduced number of jobs (thousands)	-940
Percent reduction in number of jobs	-0.7%

Income effect: Increase in consumer demand

Increase in number of jobs (thousands)	1,520
Percent increase in number of jobs	1.1%

Cumulative net employment change

Net employment change (thousands)	90
Net employment change, as a percent of total employment	0.1%

Pay increases by 2024, MS

Before behavioral adjustments	
Percent of all workers receiving pay increases	44.4
Number of workers receiving increases (thousands)	504
Number of workers affected directly (thousands)	342
Number of workers affected indirectly (thousands)	162
Average hourly wage increase ($2016), workers getting raises	$2.74
Annual pay increase, workers getting raises ($2016)	$4,950
Percent earnings increase, workers getting raises	24.6

Source: Cooper (2017) analysis of CPS data.

Note:. Directly affected workers earned between 80 percent of the old minimum wage and 100 percent of the new minimum wage. Indirectly affected workers earned between 100 percent and 115 percent of the new minimum wage. Earnings are per worker, not per job. Assumes wages increase 2.0 percent per year without the policy.

Employment effects, by 2024, MS

Substitution effects: reduced wage bill from automation and productivity gains

Reduced number of jobs	-6,000
Percent reduction in number of jobs	-0.7%

Scale effect: reduced consumer spending

Reduced number of jobs	-9,000
Percent reduction in number of jobs	-0.8%

Income effect: increase in consumer demand

Increase in number of jobs	17,000
Percent increase in number of jobs	1.3%

Cumulative net employment change

Net employment change	2,000
Net change, as a percent of employment	0.1%

Summary: $15 minimum wage by 2024

- Substantial increases for large percentage of U.S. workforce
- Net employment effect extremely small
- Positive effect on overall earnings of low-wage community
- Some increased business turnover: exits among weakest businesses, entrants with stronger business models
- Slightly higher prices for consumers
- Caveat: no estimates of precision– for future work

Bonus slides

- Characteristics of workers getting increases, U.S.
- Cost increases by industry, U.S.
- Key model parameters, MS
- Characteristics of workers getting increases, MS
- Cost increases by industry, MS

Demographic characteristics of workers getting raises, by 2024, U.S.

	Percent of all workers	Percent of all workers getting raises	Percent of group getting raises
Male	52.0	44.4	24.9
Female	48.0	55.6	33.8
Over 20	96.4	90.2	27.3
Under 20	3.6	9.8	79.4
16 to 24	13.8	29.9	63.2
25 to 39	34.5	32.3	27.4
40 to 54	31.3	21.8	20.3
55-64	20.5	16.1	22.9
White (not Latino)	58.7	53.5	26.5
Black (not Latino)	12.2	16.7	40.1
Latino/a	19.7	22.7	33.5
Asian (not Latino)	7.1	4.2	17.2
Other	2.3	3.0	38.3

Source: Cooper (2017) analysis of CPS data.

Demographic characteristics , continued

	Percent of all workers	Percent of all workers getting raises	Percent of group getting raises
Less than High School	9.2	17.7	56.2
High School or G.E.D.	26.4	35.8	39.5
Some College	18.5	23.9	37.7
Associate's Degree	10.5	9.9	27.6
Bachelor's Degree or Higher	35.4	12.7	10.4
Married parent	25.9	17.2	19.4
Single parent	7.7	10.8	40.8
Married parents with no kids	27.0	19.7	21.3
Single parents with no kids	39.3	52.3	38.8
Part-time (fewer than 20 hours)	5.3	11.0	60.1
Part time (20-34 hours)	13.6	26.0	55.9
Full-Time (35 Hours per Week and more)	81.1	63.0	22.6

Source: Cooper (2017) analysis of CPS data.

Payroll costs, major industries, U.S., by 2024

	Percent of all workers getting raises	Percent of industry workers getting raises	Percent change in industry's payroll costs
Agriculture, forestry, fishing	1.5	42.6	4.8
Mining	0.2	10.7	0.5
Construction	4.2	20.7	1.3
Manufacturing	8.5	22.8	1.3
Wholesale trade	1.7	20.5	1.2
Retail Trade	18.2	47.0	4.2
Transportation, warehouses, utilities	3.9	21.0	1.3
Information	1.1	17.1	0.7
Financial activities	3.7	16.1	0.6
Professional, scientific, management	2.2	9.5	0.3
Administrative and waste management	5.8	40.2	3.7
Educational services	6.8	20.5	1.2
Health services	10.5	25.5	1.5
Social assistance	2.8	38.9	3.8
Arts, entertainment, recreation, accommodations	4.9	46.2	4.6
Food services	15.6	67.8	11.3
Other services	5.9	38.9	3.8
Public administration	2.5	14.3	0.7
Total	100	29.2	1.9

Source: Percent change in payroll costs includes payroll taxes and workers' compensation as well as turnover reduction offsets. Percent change in payroll costs presented here does not account for reduction in total wage bill due to substitution and productivity-based job losses. These effects are integrated into the calculations in our model.

Costs for businesses, by industry, U.S.

	Payroll costs – percent change	Labor costs as percent of operating costs	Operating costs — percent change
All sectors	1.9	29.1	0.6
Agriculture, forestry, fishing and hunting	4.8	16.8	0.8
Mining	0.5	16.8	0.1
Construction	1.3	33.7	0.5
Manufacturing	1.3	17.4	0.2
Wholesale Trade	1.2	8.8	0.1
Retail trade	4.2	12.0	0.5
Transportation, warehousing and utilities	1.3	28.3	0.4
Information	0.7	21.2	0.2
Financial activities	0.6	16.1	0.1
Professional, scientific and management	0.3	47.6	0.2
Administrative and waste management	3.7	44.6	1.7
Educational services	1.2	56.2	0.7
Health services	1.5	49.8	0.8
Social assistance	3.8	49.8	1.9
Arts, entertainment, recreation and accommodations	4.6	34.3	1.6
Food services	11.3	38.3	4.3
Other services	3.8	44.5	1.7
Public administration	0.7	52.4	0.4

Key model parameters, MS

Working age population, percentage growth, 2015 to 2024 (percent)	0.03

K-L substitution and productivity gains

Capital-Labor substitution	0.2; 0.4*
Capital share in gross output (excluding depreciation)	0.14
Productivity gains - in levels	0.005

Increase in consumer prices, reduced consumer demand

Labor share of gross output	0.30
Materials share of gross output in the restaurant industry	0.51
Materials share of gross output in retail trade	0.78
Percent of wage costs for Medicare, Social Security, and worker compensation (employee side)	0.10
Turnover reduction (as share of payroll increase)	0.07
Price elasticity of demand	-0.92
Share of consumer spending in GDP	0.588
Percentage offset from reduced benefits, lower ACA premium tax credits and payroll taxes	14.35
Reduced EITC	0.20
Reduced SNAP benefits	4.20
Lower ACA premium tax credits	2.30
Higher payroll taxes	7.65

Demographic characteristics of workers getting raises, by 2024, MS

	Percent of all workers	Percent of all workers getting raises	Percent of group getting raises
Male	49.5	43.0	38.5
Female	50.5	57.0	50.1
Over 20	97.2	94.2	43.0
Under 20	2.8	5.8	91.2
16 to 24	13.1	24.0	80.9
25 to 39	34.1	36.4	47.3
40 to 54	33.9	25.9	33.9
55-64	18.8	13.7	32.4
White (not Latino)	54.4	42.9	35.0
Black (not Latino)	39.4	49.1	55.3
Latino/a	3.6	4.6	57.8
Asian (not Latino)	1.5	2.0	58.0
Other	1.1	1.3	53.5

Source: Cooper (2017) analysis of CPS data.

Demographic and job characteristics of workers getting raises by 2024, MS

	Percent of all workers	Percent of all workers getting a raise	Percent of group getting a raise
Less than high school	10.2	17.0	73.7
High school or G.E.D.	30.5	38.1	55.3
Some college	19.9	23.4	52.3
Associate's degree	14.0	11.0	34.9
Bachelor's degree or higher	25.4	10.5	18.4
Married parent	26.3	19.4	32.7
Single parent	10.7	14.6	60.7
Married parents with no kids	26.1	17.9	30.5
Single parents with no kids	36.9	48.1	57.8
Part-time (fewer than 20 hours)	3.7	6.1	72.6
Part time (20-34 hours)	11.9	21.0	78.2
Full-time (35 hours per week and more)	84.4	73.0	38.4

Source: Cooper (2017) analysis of CPS data.

Payroll effects, by major industries, MS, 2024

	Percent of eligible workers getting raises	Percent of industry getting raises	Percent change in payroll costs
Agriculture, forestry, fishing, hunting	2.1	64.8	13.5
Mining	0.1	7.6	0.3
Construction	4.3	35.4	3.6
Manufacturing	14.3	39.5	3.8
Wholesale trade	1.8	39.9	3.0
Retail trade	19.6	66.0	12.0
Transportation, warehousing, utilities	2.9	21.8	1.8
Information	1.0	36.3	2.1
Financial activities	2.7	29.5	2.2
Professional, scientific, management	1.5	26.9	1.2
Administrative and waste management services	4.3	61.8	10.5
Educational services	7.2	29.6	3.4
Health services	10.2	36.4	3.5
Social assistance	2.6	62.2	10.8
Arts, entertainment, recreation, accommodations	3.6	63.7	13.3
Food services	13.3	82.8	21.5
Other services	4.6	49.1	5.0
Public administration	3.9	31.6	3.0
Total	100	44.4	5.2

Costs for businesses, MS

	Payroll costs– percent change	Labor costs as percent of operating costs	Operating costs – percent change
All sectors	5.2	29.1	1.5
Agriculture, forestry, fishing, hunting	13.5	16.8	2.3
Mining	0.3	16.8	0.1
Construction	3.6	33.7	1.2
Manufacturing	3.8	17.4	0.7
Wholesale trade	3.0	8.8	0.3
Retail trade	12.0	12.0	1.4
Transportation, warehousing, utilities	1.8	28.3	0.5
Information	2.1	21.2	0.4
Financial activities	2.2	16.1	0.4
Professional, scientific, management	1.2	47.6	0.6
Administrative and waste management	10.5	44.6	4.7
Educational services	3.4	56.2	1.9
Health services	3.5	49.8	1.8
Social assistance	10.8	49.8	5.4
Arts, entertainment, recreation, accommodations	13.3	34.3	4.6
Food Services	21.5	38.3	8.2
Other Services	5.0	44.5	2.2
Public Administration	3.0	52.4	1.6

Source: Authors' calculations using 2015 BEA accounts and US Census Annual Retail and Wholesale Trade Report.

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