Minimum Wage and Sectoral Price Inflation

Ahsan, Ishmam

McMaster University

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ISHMAM AHSAN*

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Abstract

Albeit being a fiscal policy tool, any federal or regional minimum wage hikes during an inflationary economic environment can have strong policy implications for the Federal Reserve. This paper seeks to explain the relationship between minimum wage hikes and sectoral price dynamics in the United States for two sectors: (i) restaurant sector and (ii) technology sector. I examine the overall relationship between sectoral price inflation and binding minimum wage changes by using a panel data regression model. Estimates suggest that there exists a small, positive and statistically significant relationship between minimum wage hikes and price inflation in the restaurant sector. The share of minimum wage workers in the technology sector is considerably lower and I find a statistically insignificant relationship.

Keywords: Minimum wage, inflation, firm behavior

JEL Classification: J30, E31, D21

* Department of Economics, McMaster University. 1280 Main St W, Hamilton, ON L8S 4L8
email: ishmamahsan@gmail.com

The minimum wage is one of the most popular and frequently adjusted economic policies in the United States (Cooper et al, 2018). This longstanding national campaign recently gained traction after newly elected President Joe Biden proposed to raise the federal hourly minimum wage from $7.25/ hr to $15/hr. At the national level, the federal minimum wage has been raised twenty-two times since its introduction in 1938, and across the fifty US states, minimum wage changes have occurred more frequently - in 2018 alone eighteen states raised their respective minimum wages.

The macroeconomic impacts and policy implications of a minimum wage hike are significant for the American economy and its policymakers. In 2020, the US labour force consisted of 73.3 million workers working at hourly rates and 1.1 million workers earning the federal minimum wage of $7.25/hr. Therefore, any changes in the minimum wage have strong implications for establishments that are more likely to pay the minimum wage, as evident in Aaronson et al (2008). This phenomenon is also present across other advanced economies such as France and the UK. Fougere et al (2009) found a positive and statistically significant impact of minimum wage hikes on French restaurant prices and Wadsworth (2010) results have shown that prices have risen significantly faster in the minimum wage sectors of the UK, particularly in the food industry.

Relative to the vast amounts of empirical studies on the unemployment effects of a minimum wage hike, little research has been conducted on its price implications (Aaronson, 2001). Therefore, one of the main motivations for my paper is to understand the price implications and how they affect policy making, particularly monetary policy. From a current monetary policy standpoint, the US ‘expected’ inflation rate has been increasing steadily following the US Federal Reserve’s expansionary monetary policies such as lowering the Fed

Funds rate, Quantitative easing (QE), and Asset Purchase initiatives. Figure 1 shows the trajectory of the forward inflation expectation rate, which is expected to climb past the Fed's inflation target of 2%.

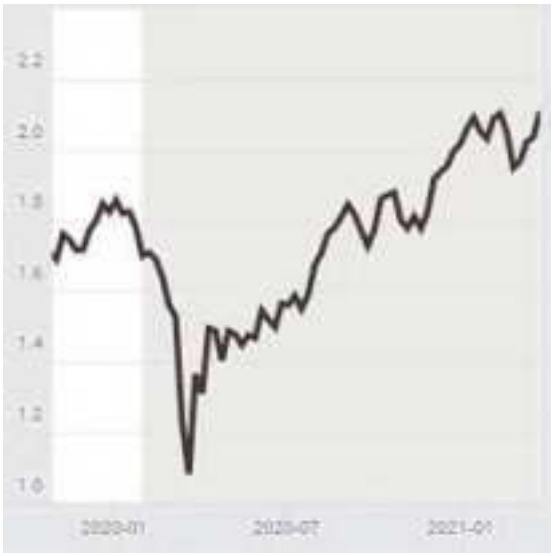


Figure 1 Source: FRED

Albeit being a fiscal policy tool, any federal or regional minimum wage hikes during an inflationary economic environment can have strong policy relevance for the Federal Reserve and US monetary policy. By definition, the Federal Reserve's 'dual mandate' aims to achieve maximum employment and stable prices, with an inflation targeting policy of 2%. Given the broad nature of both mandates, in terms of policy implications of wage shocks, my paper aims to investigate the stable prices component, particularly the sectoral inflation component of the Consumer Price Index (CPI), which is the most widely used measure of U.S inflation.

For this paper, the sectoral inflations to be closely investigated are the restaurant sector and the technology sector of the US. Both the sectors are components of the US Headline Consumer Price Index (CPI), which measures the average change in the prices for a market basket of consumer goods and services, including food and energy. Similar to Aaronson et al

(2008) and Basker et al (2016) analysis of restaurant price inflation, I use the 'Food away from home' component of the CPI in Table A, which includes full-service restaurants where food is served by waiters and waitresses directly to tables, and also includes takeouts and delivery options.

Table A. Percent changes in CPI for All Urban Consumers (CPI-U): U.S. city average

	Seasonally adjusted changes from preceding month						
	Aug. 2020	Sep. 2020	Oct. 2020	Nov. 2020	Dec. 2020	Jan. 2021	Feb. 2021
All items	.4	.2	.1	.2	.2	.3	.4
Food	.1	.1	.2	.0	.3	.1	.2
Food at home	.0	-.3	.1	-.2	.3	-.1	.3
Food away from home (1)	.3	.6	.3	.1	.4	.3	.1
Energy	.9	1.4	.6	.7	2.6	3.5	3.9
Energy commodities	2.1	1.4	.7	.5	5.1	7.3	6.6

Source: BLS Table A

The Technology component can also be found under the Information technology, hardware, and services component of the CPI. The subcomponent – Computers, peripherals, and smart home assistant devices contains prices of smartphones, tablets, desktop computers, home security devices and smart home appliances. To have an aggregate measure I use a novel approach of using a Technology Price Index that tracks the prices of all such hardware devices.

Conceptual Framework

I provide a brief discussion of economic theories linked to my study of minimum wage hikes and price changes. The majority of the previous studies such as Card (1995) focused on the standard competitive model or the dynamic monopsony models with a strong focus on the level of employment. Therefore, I also consider the putty-clay model as in Sorkin (2015) that does not incorporate employment adjustments as immediate and directly measures the full pass-through of

minimum wages to prices in the short run. The putty-clay model can also be interpreted as a model with time-dependent adjustment costs that are relevant to my analysis of sectoral price inflation. For a minimum-wage sector such as the restaurant sector, when restaurants are faced with a wage shock such as minimum wage hikes, not all restaurants can install new technologies such as payment kiosks, mobile ordering and delivery apps (e.g Uber Eats, Skip the Dishes). Labour demand takes time to respond to any changes in the equilibrium and profit-maximizing restaurants will typically pass on any higher labour costs in the form of higher prices. Therefore, the model allows a complete pass-through of a wage shock to the final product prices.

Applying this conceptual framework to a natural experiment of a wage-shock among low-wage labour sectors (Aaronson and MacDonald, 2000), I hypothesize there to be a positive relationship between minimum wage hikes and full-service restaurant sector price inflation in the United States. As discussed earlier, the United States has 73.3 million workers working at hourly rates and 1.1 million workers employed at the federal minimum wage of $7.25/hr. Therefore, a minimum wage shock will have strong implications for the restaurant sector.

Building upon the same conceptual framework, but applying it to a high-wage labour sector, Technology, I hypothesize there to be a statistically insignificant relationship between minimum wage and prices. Relative to the restaurant sector, the share of minimum wage workers in the technology sector is considerably lower in the United States, as shown in Table B.

	Employed at hourly rates (Wage)	Employed at minimum wage
Total, 16 years and older	73.3 million	1.1 million
Restaurant sector	5.6 million	605,000
Technology sector	877,000	5,600

Table B

Data

Similar to Aaaronson et al (2006), I use observational data from the Bureau of Labor Statistics (BLS) and the United States Department of Agriculture (USDA) to construct the time series of full-service restaurant sector prices, measured quarterly at the census division level, from 1999 – 2012. I use the quarterly food-away-from-home prices (QFAFHP) data set produced by USDA's Economic Research Services (ERS), using BLS CPI microdata. QFAFHP contains quarterly average prices at the census divisional levels for different products such as entrees and meals at full-service restaurants, nonalcoholic beverages at full-service restaurants, wine away from home, etc. The final products of the full-service restaurant that we measure are entrees, main-course and combo meals, which are typically served directly to tables but also offered as takeouts and online delivery.

For the macroeconomic data, Federal Economic Data (FRED) provides an extensive list of quarterly time-series data for US inflation, interest rate (Fed Funds Rate), unemployment rates, age and employment demographics, etc. These variables are important additional regressors for our empirical model and allow us to take advantage of several sources of variation while also minimizing any omitted variable bias errors.

Since there are no available regional-level data for certain variables such as the Fed Funds Rate, Tech Price Index and Trade-weighted US Dollar index, the macroeconomic data are categorized by national level and regional (census division) level data, as shown in Table C. Fed Funds Rate is the target interest rate set by the Federal Reserve which influences short-term interest rates such as home loans, auto loans and credit cards. Liabilities such as interest expenses are an important component of restaurants and technology sector companies' balance sheets and can eventually influence pricing strategies of the final products in such sectors.

National Level	Regional (Census Division) Level
Fed Funds Rate	Full-Service Restaurant Prices
US Inflation(including food)	Minimum Wage
Percentage of Restaurant/Tech workers on Minimum wage	Unemployment Rate
Tech Price Index	Percentage of Minimum Wage workers
Trade-weighted US Dollar Index	Population 15-54-year-olds

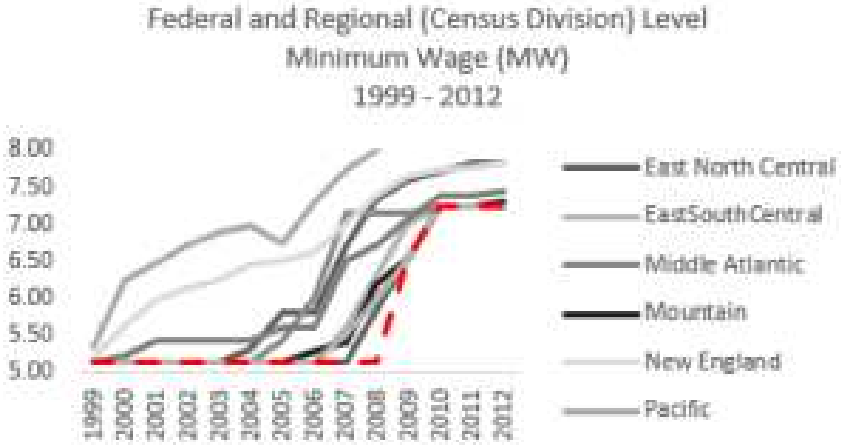
Table C

To measure the overall inflation rate in the US economy, instead of Core CPI, I use Headline CPI that includes food prices and allows the measurement of food-away-from-home prices. The percentage of restaurant and tech workers on minimum wage is an important measure that accounts for the substantial heterogeneity of minimum wage employment present in the two sectors. The unemployment rate is included to capture the regional-level labour market condition and is complemented by the percentage of the overall workforce employed at the regional-level minimum wage. To further quantify the economy and factor in another demand-side variable into the model, I incorporate adults and teenagers (15-54-year-olds). The theory behind this addition is to account for a representative consumer group that consumes the technology products most in the United States and maximizes their utility.

Binding Minimum Wage

In the US, the federal government issues a nationwide Federal minimum wage that was first introduced in 1938. Each state, however, can enforce a state minimum wage that need not be identical to the federal minimum wage. Hence, a ‘binding’ minimum wage is introduced to account for the difference in minimum wages across states, similar to Aaronson et al (2008). For

a given entity in our model, a binding minimum wage is the higher of the two minimum wages.



Recent history of the federal minimum wage

Sep. 1, 1997	$5.15
July 24, 2007	$5.85
July 24, 2008	$6.55
July 24, 2009	$7.25

Figure 2

Although 1999 – 2012 is a relatively small sample size, the time frame still accounts for a significant amount of minimum wage activity in the United States. As shown in Figure 2, the federal government raised the minimum wage on three different occasions between 1999 – 2012, and the changes were more frequent at the regional level.

Data for federal minimum wage is collected from the U.S Department of Labor's (DOL) table of 'Federal Minimum Wages Under The Fair Labor Standards Act, 1938 – 2009'. The federal data is then collaborated with regional minimum wage data collected from DOL to produce the binding minimum wage variable used in my analysis. The table reports some descriptive statistics of the trends in the federal and regional minimum wages for 1999 – 2012.

To prepare the dataset for empirical analysis, a panel dataset is constructed from the individual time-series data of the economic variables. Instead of analyzing at the city or state level, I focus on the 9 US census divisions: New England, Middle Atlantic, East North Central,

West North Central, South Atlantic, East South Central, West South Central, Mountain and Pacific. Table D provides a breakdown of the 9 US census divisions and their constituent US states.

Division	**State**
New England	Maine, New Hampshire, Vermont, Massachusettes, Connecticut, Rhode Island
Middle Atlantic	New York, Pennslyvania, New Jersey
East North Central	Wisconsin, Michigan, Illinois, Indiana, Ohio
West North Central	North Dakota, South Dakota, Minnesota, Iowa, Nebraska, Kansas, Missouri
South Atlantic	Maryland, Delaware, Washington, DC, West Virginia, Virginia, North Carolina, South Carolina, Georgia, Florida
East South Central	Kentucky, Tennesee, Alabama, Mississippi
West South Central	Arkansas, Louisiana, Oklahoma, Texas
Mountain	Montana, Wyoming, Idaho, Utah, Colorado, Arizona, New Mexico, Nevada
Pacific	Washington, Oregon, California

Table D

Empirical Strategy

The empirical strategy of my paper is twofold. At first, by adopting a similar econometric strategy in Aaronson et al (2008), I examine the overall relationship between sectoral price inflation and binding minimum wage changes by using a Panel data regression model that allows sufficient variation within the model and further adjusts for a relatively small sample size of 1999 – 2012.

My analysis will compare two different sectors – Restaurants and Technology. As discussed earlier, the restaurant sector in the United States is low-wage labour intensive that makes up a substantial share of total costs, whereas the technology sector is a high-wage sector

with some of the highest-paying jobs in the country. Secondly, by introducing an interaction term in the panel regression, I will attempt to provide estimates of the heterogeneous impacts of minimum wage shocks across the nine U.S census divisions. Along with varying levels of binding minimum wage across the country, there also exists considerable heterogeneity in the labour market conditions and age demographics in those regions.

1. Overall Effect of Minimum Wage on Sectoral Inflation

A. Restaurant Sector

$$RSI_t^s = \beta_0 + \beta_1 (MW_t^s) + \beta_2 (MW_{t-1}^s) + \beta_3 \text{(Fed Funds Rate)} + \beta_4 \text{(Headline CPI)} + \beta_5 \text{(Share of Employment at MW)} + \beta_6 \text{(Regional Unemployment Rate)} + \beta_7 \text{(Share of Restaurant workers at MW)} + SFE + TFE + e$$

Here, RSI is the dependent variable that measures the quarterly percentage change in sectoral inflation for a given change in the binding minimum wage. I use a 'within' specification that captures time and state-invariant differences across regions and time periods. Aaronson (2001) noted that the effects of minimum wage hikes might not be immediate and therefore a lagged minimum wage, MW^s_{t-1} is added to capture persistence. Fed funds rate and headline CPI control for monetary conditions. To check for multicollinearity within these two variables, I perform a Pearson correlation coefficient test and find a weak correlation (0.35) between the two variables, shown in the correlation matrix Table. Share of Employment at MW, regional Unemployment rate and share of restaurant workers at MW control for labour market conditions. Similar to estimates as in Card (1994), the additional regressors in the panel regression are small and statistically insignificant and add little to the model (Table E).

Table E	Fed Funds Rate	US Headline CPI	Share of Employment at MW	Regional Unemployment Rate	Share of Restaurant Workers on MW
Fed Funds Rate	1.00	0.35	0.00	-0.25	0.18
US Headline CPI	0.35	1.00	0.00	-0.22	0.22
Share of Employment at MW	0.00	0.00	1.00	0.01	0.00
Regional Unemployment Rate	-0.25	-0.22	0.01	1.00	-0.13
Share of Restaurant Workers on MW	0.18	0.22	0.00	-0.13	1.00

Empirical Findings and Discussion – Restaurant Sector

The coefficient of interest in Table F is **β1** which captures the effect of minimum wage increases on full-service restaurant sector inflation. The coefficient estimates for 1992 – 2012 indicate that the effect of minimum wage hikes is positive and statistically significant at the 5 percent significance level. Overall across all nine U.S census divisions, a unit increase in 'binding' minimum wage raises restaurant sector inflation by a small, but statistically significant 0.136 units. The statistically positive estimate is also evident in Aaronson et al (2008) where the author found a 12 percent increase in restaurant price levels in the two months immediately after a minimum wage hike. Similarly, Aaronson et al (2006) reported small and positive effects of minimum wage hikes in 1996 and 1997 for full-service restaurants.

Table F. Magnitude of Full-service Restaurant Sector Inflation to Minimum Wage Increase

Variable	Description	Coefficients (Standard Errors)	t-stat
MW_t	Change in the minimum wage in state i, period t	0.136 (0.022)	5.955
MW_{t-1}	Change in the minimum wage in state i, period t-1	-0.129 (0.014)	-9.329
Fed Funds Rate	Change in Federal Funds Rate	-0.004 (0.010)	-0.424
Headline CPI	Change in US Headline CPI	0.004 (0.007)	0.584
Share of Employment at MW	Change in employment of workers at MW	-0.091 (1.170)	-0.503
Regional Unemployment Rate	Change in regional unemployment	-0.037 (0.014)	-0.508
Share of Restaurant workers at MW	Change in employment of Restaurant workers at MW	0.0098 (0.073)	0.123

B. Technology Sector

$$TSI_t^s = \beta_0 + \beta_1 (MW_t^s) + \beta_2 (MW_{t-1}^s) + \beta_3 (\text{Fed Funds Rate}) + \beta_4 (\text{Headline CPI}) + \beta_5 (\text{Share of Employment at MW}) + \beta_6 (\text{Regional Unemployment Rate}) + \beta_7 (\text{Share of Tech workers at MW}) + \beta_8 (\text{Trade-weighted USD Index}) + \beta_9 (\text{Adult-teen Population}) + SFE + TFE + e$$

Here, TSI is the dependent variable that measures the quarterly percentage change in Technology sector inflation for a given change in the binding minimum wage. Again, I use a 'within' specification that captures time and state-invariant differences across regions and time periods. To have an aggregate measurement of prices for Technology products in the United States, I use a novel approach of using a Technology Price Index that tracks the prices of everyday hardware devices used in the country. BLS collects price information for smartphones,

tablets, desktop computers, home security devices and smart home appliances and constructs the price index that eventually becomes a subcomponent of the information technology, hardware, and services category of the US Consumer Price Index (CPI).

The United States is an open economy and the final prices of technology products are influenced by price fluctuations in the global supply chain, foreign exchange markets and economic and political ties with its trading partners. To account for that, I introduce a trade weighted US Dollar index, which measures the weighted average of the foreign exchange value of the USD against currencies of a broad group of US trading partners such as China, Canada, Brazil, European Union, Chile, South Africa, etc. The adult-teen population variable accounts for the demands of technology products of a representative consumer.

Empirical Findings and Discussion – Technology Sector

As I discussed earlier, Wadsworth (2010) found evidence of prices in minimum wage sectors rising significantly faster than the prices of goods in non-minimum wage sectors. My results show that changes in minimum wage fail to explain the price changes of Technology products. The coefficient of interest on Table G is **β1** for 1992 – 2012 indicates that the effect of minimum wage hikes is negative and statistically insignificant at the 5 percent significance level.

This could be due to various reasons. Firstly, as discussed earlier in my hypothesis, the technology sector has some of the highest-paid jobs in the country. Therefore, the share of minimum wage workers in this sector is significantly lower than the labour-intensive restaurant sector. Compared to minimum wage, the new variable Adult-teen population seems to better explain the price dynamics. As hypothesized earlier, this age group consumes the greatest portion of technology products in the United States.

Table G. Magnitude of Technology Sector Inflation to Minimum Wage Increase

Variable	Description	Coefficients (Standard Errors)	t-stat
MW_t	Change in the minimum wage in state i, period t	-0.034 (0.020)	-0.0019
MW_{t-1}	Change in the minimum wage in state i, period t-1	0.029 (0.0012)	0.008
Fed Funds Rate	Change in Federal Funds Rate	0.033 (0.009)	0.034
Headline CPI	Change in US Headline CPI	-0.020 (0.006)	-0.0063
Share of Employment at MW	Change in employment of workers at MW	-0.332 (0.345)	-0.001
Regional Unemployment Rate	Change in regional unemployment	0.007 (0.008)	0.056
Share of Tech workers at MW	Change in employment of Technology workers at MW	-0.002 (0.0002)	-0.0042
Trade-weighted USD Index		0.039 (0.081)	0.0023
Adult-teen Population		0.0002 (0.001)	0.112
		0.090 (0.018)	1.95

2. Regional estimates

I introduce an interaction term MW X SFE that explains how the prices respond to minimum wage changes across the 9 census divisions. Table H reports the regional estimates. Column A reports estimates for the restaurant sector and column B reports estimates for the technology sector. The estimates are statistically insignificant for both sectors and my 'within' fixed effect regression model fails to explain the regional heterogeneity of price responses from minimum wage shocks.

	(A)		(B)	
Interaction term	Regional estimate	t-value	Regional estimate	t-value
MW × East South Central	-0.0042	-0.211	-0.0191	-1.061
MW × Middle Atlantic	-0.0421	-1.232	-0.0117	-0.653
MW × Mountain	-0.025	-1.340	-0.0174	-0.966
MW × New England	-0.0364	-0.675	-0.0161	-0.820
MW × Pacific	-0.013	-0.213	-0.0208	-1.086
MW × South Atlantic	-0.0194	-0.801	-0.0190	-0.877
MW × West North Central	-0.0337	-1.422	-0.0109	-0.513
MW × West South Central	-0.0506	-1.091	-0.00894	-0.389

Table H

Conclusion

I consider the effects of the minimum wage on price levels in the restaurant and technology industry of the United States with observational data from 1999 – 2012. I estimate the effect of the wage shock on sectoral inflation levels by using a 'within' fixed effects regression that includes lagged minimum wage effects, macroeconomic conditions, interaction terms and state and time fixed effects. By running two separate regressions, my estimates suggest that there exists a small, positive and statistically significant relationship between minimum wage hikes and price inflation in the restaurant sector. One interpretation of these findings is that in the restaurant sector, labour demand lags and takes time to respond to any changes in equilibrium. Therefore, profit-seeking full-service restaurants adjust by raising prices of entrees, main-course, combo and takeout meals.

However, for the technology sector, I find a statistically insignificant relationship. Minimum wage shocks fail to explain variance in the prices of computers, smartphones, smart home appliances due to the sector employing a lower share of minimum wage workers. In addition, there have been significant advances in the technology sector that have enabled firms to enjoy increasing returns to scale and produce more affordable products for consumers of all ages.

From the perspective of monetary policy-makers, sectoral inflation has important implications for the Federal Reserve Bank and its dual mandate of price stability and maximum employment in the United States. Food-away-from-home prices, that include restaurant prices, are a component of the CPI and any inflationary trends will subsequently affect the overall inflation of the U.S economy, measured by Headline CPI. Given the current economic slowdown and persistent inflationary pressures, as well as strong momentum towards increasing the federal minimum wage from policymakers, the Federal Reserve will have to assess if further heating up of the US economy from a future minimum wage hike, a fiscal policy shock, can be tamed by using its existing monetary policy tools.

From the perspective of future research, certain improvements in the model can produce more accurate estimates. For our first model, the overall effect of minimum wage on sectoral inflation, adding price rigidity in the model, as in Aaronson et al (2006) could certainly help to better gauge the 'stickiness' of prices from wage shocks. For the regional estimates, developing an alternate empirical strategy that measures the heterogeneous effects across U.S census regions more accurately would be a proposed replacement to the existing strategy used in this paper.

Overall, the price results from our first model seem to be fairly consistent with the textbook definition of price changes from minimum wage shocks.

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