Empirical Investigation of the Effect of Anti-Price-Gouging Law on Post-Disaster Reconstruction Wages

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ABSTRACT

Anti-price-gouging laws are enforced by a disaster declaration to control reconstruction labor and material costs in the wake of disasters. Reconstruction costs provide an important signal in the post-disaster reconstruction resource market, enabling consumers, suppliers, and policymakers to understand the post-disaster situations and prepare reconstruction strategies. However, the impact of anti-price-gouging law on post-disaster reconstruction costs has not been examined in the literature. The objective of this study is to investigate the effect of the anti-price-gouging law on post-disaster reconstruction wages at the U.S. County level following major disasters declared by the Federal Emergency Management Agency (FEMA). Panel data models with a difference-in-differences (DID) specification were implemented to quantify the effect of the anti-price-gouging law on post-disaster reconstruction wages. The DID specification was used to compare the pre and post-changes in reconstruction wages in the U.S. counties subject to the state-level anti-price-gouging law relative to the wages in the U.S. counties not subject to the law, controlling for endogenous county-specific heterogeneities. It is found that the anti-price-gouging laws reduced quarterly reconstruction wages by 2.5 percent in disaster-stricken counties. This finding indicates

the effectiveness of anti-price-gouging laws as a price control to mitigate post-disaster reconstruction cost inflation. The U.S. counties subject to the anti-price-gouging law enforcement have experienced less expensive reconstruction labor costs compared to the U.S. counties not subject to the anti-price-gouging law enforcement. The findings of this research provide empirical evidence about the function of anti-price-gouging laws as a reconstruction cost control and present policy implications about the wage effect of anti-price-gouging laws in the post-disaster reconstruction market.

INTRODUCTION

Price gouging occurs when retailers or other suppliers exploit surges in demand by imposing excessively high prices on essential goods and services, typically following a disaster or a state of emergency (Lee 2015). Thirty-seven states, along with Guam, Puerto Rico, the U.S. Virgin Islands, and the District of Columbia, have established statutes or regulations against price gouging during times of disaster or emergency as illustrated by Figure 1 (NCSL 2023; Warkentin 2021). Anti-price-gouging laws impose civil or criminal penalties for price gouging classified as unfair or deceptive trade practices (Beatty et al. 2021).

Reconstruction resources often experience significant cost inflation due to a demand surge following a disaster (Arneson et al. 2020; Kim and Shahandashti 2022b). Construction material costs increased by as much as 30 percent in Louisiana after Hurricane Katrina struck (Khodahemmati and Shahandashti 2020). Roofer wages in Miami inflated by 20 percent after the 2004 hurricane season in Florida (Hallegatte 2015). After Hurricanes Irma, Maria, and Harvey, the residential roofing service costs increased by 41 percent more than the estimated cost in Puerto Rico due to post-disaster roofer wage inflation (Arneson 2019). Construction labor costs have inflated by approximately 10 percent due to a demand surge following weather-related disasters (Ahmadi and Shahandashti 2020).

Reconstruction labor, which is one of the major resources for reconstruction, often experiences drastic increase in cost because its supply is less flexible than the reconstruction material supply in the wake of disasters (Felsenstein and Grinberger 2020; Kim et al. 2022a). Thus, it is difficult to quickly adjust the amount of labor available to meet demand, resulting in higher cost. Labor costs can account for around 50 percent of the total reconstruction costs in the aftermath of disasters because commercial and residential construction is a highly labor-intensive industry (Barbosa et al. 2017). Construction wages are frequently used as proxies for post-disaster reconstruction costs (Farooghi et al. 2021). Therefore, examining and quantifying construction wage fluctuations is crucial to better understand post-disaster reconstruction market situations and prepare effective reconstruction strategies (Kim et al. 2022b).

Significant cost inflation following disasters can slow down the reconstruction process in economically disadvantaged communities (Kim and Shahandashti 2022a; Peacock et al. 2022). The construction cost inflation is often identified as a major cause of project delays (Gebrehiwet and Luo 2017). When cumulative price increases surpass the limits set by insurance policies after catastrophes, policyholders face delays in post-disaster repairs as they need to cover the additional costs themselves (Döhrmann et al. 2017). The National Association of Home Builders has urged the federal government to protect consumers from lumber price gouging, as affordable construction materials are crucial for disaster recovery (Wallisch 2017). Rapp (2005) examined anti-price-gouging laws and suggested that these laws could enhance economic efficiency by tackling pricing failures. Oladosu (2022) pointed out that these laws could mitigate unwarranted spikes in gasoline prices following hurricanes, which are not rooted in genuine market factors.

Warkentin (2021) emphasized the need for anti-price-gouging laws to protect consumers against inflated and predatory prices during crises and emergencies. Chang et al. (2011) noted that price controls following disasters can stabilize building material prices and streamline reconstruction efforts in regions hit by earthquakes. Tarrant (2015) examined the deleterious impact of anti-price-gouging laws on economic growth in hurricane-stricken coastal counties of the United States.

Anti-price-gouging laws have come into effect during a declared disaster or emergency to address the price spikes of reconstruction resources and protect consumers from exorbitant pricing (Tabe 2019). Although the effect and implications of anti-price-gouging laws have been discussed, the effect of anti-price-gouging laws on post-disaster reconstruction costs as a price control have yet to be elucidated. This study aims to examine whether state-level anti-price-gouging laws function as a price control in the reconstruction labor market of the U.S. counties in the aftermath of disasters.

RESEARCH METHODOLOGY

Data Collection

Construction wages are published quarterly at the U.S. county level by the U.S. Bureau of Labor Statistics. Quarterly construction wages were collected for 3,579 counties in fifty U.S. states and the District of Columbia for ten (10) years from 2013 to 2022. Table 1 summarizes the data used in this study. All the major disasters declared by FEMA were collected to estimate and control for the wage effect of disasters for 10 years, from 2013 to 2022. The number of employment and establishment counts in the U.S. construction industry were included to monitor the changes in construction wages and control confounding effects (Ahmadi and Shahandashti 2018; Barth and Dale-Olsen 2011; Blanchflower and Oswald 1995; Green et al. 2021). The positive relationship between employment and wages was found in the U.S. construction industry (Farooghi et al. 2020). Also, a negative relationship between wages and establishment counts was examined in the literature (Benmelech et al. 2022; Kim et al. 2022; Rinz 2022).

Panel Data Models with a Difference-in-Differences (DID) Specification

Panel data models with a DID specification were used to evaluate the impact of an anti-price-gouging law on post-disaster county-level reconstruction wages in the U.S., as represented by Eq. 1.

$$\ln WAGE_{it} = \beta_0 + \beta_1 APG_{it} DIS_{it} + \beta_2 APG_{it} + \beta_3 DIS_{it} + \beta_4 \log EMP_{it} + \beta_4 \log EST_{it} + \alpha_i + TREND + \varepsilon_{it} \qquad \text{Eq. 1}$$

where $WAGE_{it}$ denotes the average weekly wages in the construction industry in county *i* and time t; APG_{it} is a dummy variable that is equal to one if county *i* at time *t* had an anti-price-gouging state-level statute and zero otherwise; DIS_{it} is a dummy variable that is equal to one if county *i* at time *t* experienced a major disaster declared by FEMA and zero otherwise; EMP_{it} is the number of employees in the construction industry in county *i* and time *t*; EST_{it} is the number of establishments in the construction industry in county *i* and time *t*; α_i is the unobservable time-invariant county fixed effects; $TREND$ is a time trend variable, which starts at one in the first year and hereafter increases by one each year, controlling for the time-specific common shocks or institutional changes; ε_{it} is the time-varying idiosyncratic error; β_1 is the coefficient of interest, which is an estimate of the effect of an anti-price-gouging law triggered by a major disaster declaration on county-level construction wages in the counties subject to the law.

Breusch-Pagan and Hausman Tests for Model Selection

The Breusch-Pagan (1980) and Hausman tests (1978) were used to identify the appropriate panel data model for the analysis. The Breusch-Pagan test was conducted to investigate whether the unobservable time-invariant county-specific effects (α_i) exist. The null hypothesis of the Breusch-Pagan test is that there are no time-invariant unobservable factors (i.e., var(α_i) = 0). A failure to reject the null hypothesis would support using the ordinary least squares (OLS) regression.

However, if the null hypothesis of the Breusch-Pagan test is rejected, the Hausman test should be implemented to determine whether the unobservable time-invariant county-specific effects (α_i) are correlated with the independent variables. The null hypothesis of the Hausman test is that the unobservable effects (α_i) are not correlated with the independent variables. If the null hypothesis is rejected, it is recommended to use the fixed effects model instead of the random effects model because the fixed effects model will yield unbiased and consistent estimates. Otherwise, it is suggested to use the random effects model. When there is no correlation between the unobservable effects (α_i) and independent variables, the random effects will produce both consistent and efficient estimates.

EMPIRICAL RESULTS

Table 2 shows the descriptive statistics of the data. Over three thousand counties in fifty U.S. states and the District of Columbia were covered in this study. Average weekly construction wages decreased in the quarter when a disaster occurred. This statistic aligns with the finding in previous studies that reconstruction wages would increase a quarter after a disaster occurred due to an increase in reconstruction demand. This increase in wages was not seen in the quarter when the disaster occurs. (Kim et al. 2022b). Also, the U.S. counties with anti-price-gouging laws (APGL) have higher weekly construction wages on average than the counties without APGL.

Table 3 shows the results from the estimation of Eq. 1 using panel data models. The results from all panel data models (i.e., pooled OLS, fixed effects, and random effects models) show that the anti-price-gouging laws have a significantly negative impact on post-disaster construction wages. According to the results from the fixed effects (FE) model, the anti-price-gouging law triggered by FEMA's major disaster declaration has decreased county-level average weekly construction wages by 2.5 percent. This indicates that the average weekly wages declined by 2.5 percent in the U.S. counties where the anti-price-gouging law was triggered by a major disaster declaration compared to the U.S. counties without the anti-price-gouging law in the post-disaster recovery process. According to the pooled OLS model results, the negative effect of anti-price-gouging laws on construction wages was 7.2 percent. According to the random effects (RE) model results, anti-price-gouging laws have resulted in a decrease of 2.3 percent in construction wages in the U.S. counties where major disasters were declared. The difference in estimates of the effect of anti-price-gouging laws is likely attributed to unobservable county-specific factors that are correlated with both wages and treatment variables. Since the pooled OLS model does not control for county-specific heterogeneities, it can lead to biased treatment effects (Papke 1994; Tesfaye and Tirivayi 2020). Although the RE model can control for county-specific time-invariant unobservable factors, it assumes the unobservable factors do not correlate with the treatment variable. Thus, the RE model can lead to biased and inconsistent estimates if the treatment assignment is endogenous due to these unobservable factors. The FE model can control for the endogeneity of the treatment variable due to time invariant unobservable factors and thus yields unbiased estimates.

The results also show that disaster has a statistically significant positive effect on the average weekly construction wages regardless of the existence of the anti-price-gouging law. The disaster occurrence increased average weekly wages in the construction industry by 2.4 percent. This result seems plausible because of the increasing reconstruction demand in the aftermath of a disaster (Dikmen and Elias-Ozkan 2016). The positive relationship between employment and wages in construction industry is statistically significant. This positive relationship between employment and construction wages is consistent with the findings in the previous studies (Barth and Dale-Olsen 2011; Blanchflower and Oswald 1995; Green et al. 2021). Establishment counts in the U.S. construction industry show a statistically significant negative relationship with average weekly construction wages. The findings in the previous studies explain that the increase in the number of establishments representing the market supply can reduce wages (Barth and Dale-Olsen 2011; Benmelech et al. 2022).

Results of the Breusch-Pagan Tests

The null hypothesis of no individual effects was rejected according to the results of the Breusch-Pagan tests in Table 4. In other words, statistically significant individual heterogeneities exist among the county-level construction wage data. The null hypothesis of no individual fixed effects was rejected at the one percent significance level. Therefore, the OLS estimator may not provide a consistent estimate for the wage effect of anti-price-gouging laws under a cross-sectional correlation between wages (Halunga et al. 2017).

Results of the Hausman Test

The results of the Hausman test rejected the null hypothesis that the independent variables and fixed effects (α_i) are not correlated at the one percent significance level in Table 5. Therefore, it is preferred to use the FE model to control for endogeneity due to county-specific heterogeneities.

DISCUSSIONS OF RESULTS

The negative wage effect of anti-price-gouging laws was found in this study. The economic theory can explain the negative impact of anti-price-gouging laws on post-disaster reconstruction wages, as illustrated in Figure 2. The anti-price-gouging law places a price ceiling on reconstruction costs to regulate sudden cost inflation in the aftermath of disasters, as represented by a red line in Figure 2. Construction market equilibrium before a disaster occurs is described by Point 1. Disaster increases construction demand, moving the downward construction demand curve to the right. Therefore, post-disaster construction market equilibrium is determined at Point 2 when no anti-price-gouging law enforcement exists. In the aftermath of disasters, the U.S. counties without anti-price-gouging law (control group) at Point 2 are expected to experience an increase in reconstruction costs compared to the pre-disaster construction market equilibrium (i.e., Point 1).

However, the anti-price-gouging law controls reconstruction costs by setting the maximum reconstruction cost as described by the red line in Figure 2. Therefore, the U.S. counties under anti-price-gouging law enforcement (treatment group) have a post-disaster market equilibrium at

Point 3. Post-disaster reconstruction wages are lower in the U.S. counties with the anti-price-gouging laws compared to the U.S. counties without the anti-price-gouging law enforcement. Shortly, point 1 in Figure 2 represents the pre-disaster construction market equilibrium. Point 2 illustrates the post-disaster construction market equilibrium for the control group (i.e., counties without anti-price-gouging law), and Point 3 represents the post-disaster construction market equilibrium for the treatment group (i.e., counties with anti-price-gouging law). Anti-price-gouging law enforcement can mitigate reconstruction cost inflation by regulating the free market prices in the post-disaster reconstruction market.

This study first investigated the effect of anti-price-gouging law triggered by emergencies or disaster declarations on reconstruction wages in the disaster recovery process. The anti-price-gouging laws were legislated in a majority of the states to protect consumers from exploitative pricing practices in the wake of disasters, considering fairness or handling consumer anger (Jiang et al. 2022). While the intent behind anti-price-gouging laws may be laudable, their impacts on the reconstruction market require careful consideration. The findings of this study provide the policy implications associated with these laws.

Anti-price-gouging laws are intended to shield consumers from exorbitant pricing during times of emergency. By capping prices or setting limits on permissible price increases, these laws aim to ensure that essential goods and services remain affordable and accessible to affected communities. According to the results of this study, anti-price-gouging law successfully decreased quarterly county-level construction wages following disasters in the United States, presenting its effectiveness to control market prices in the construction industry.

Although the anti-price-gouging laws can address concerns about exploitative practices, these laws do not necessarily ensure a smooth recovery process. One potential consequence of anti-price-gouging laws is the risk of supply shortages. When businesses are unable to charge higher prices to reflect increased costs, they may be discouraged from entering the reconstruction market or may choose to allocate their limited supplies to other regions with more favorable pricing conditions (Kim et al. 2023). This can exacerbate the scarcity of essential reconstruction resources in disaster-affected areas, hindering the recovery process (Culpepper and Block 2008; Richards 2022; Wilson 2014).

Also, price controls imposed by anti-price-gouging laws can create distortions in the market. By interfering with the market price signals of supply and demand, these laws can disrupt the efficient allocation of resources. The consensus among economists highlights that anti-price-gouging laws may result in misallocation, inefficiencies, and unintended consequences such as black markets or the emergence of unregulated alternative markets with higher prices, disrupting a post-disaster supply chain (Jiang et al. 2022).

It is crucial to balance protecting consumers and ensuring the smooth functioning of the reconstruction market in the disaster recovery process. Policymakers need to recognize the effectiveness and effect of anti-price-gouging laws in the post-disaster reconstruction process. Rather than controlling a price which is a crucial signal about market situations, policymakers may consider policies facilitating market supply, quickly rebuilding disrupted supply chains, and promoting partnerships or collaborations to improve long-term supply chain resilience. For example, governments can provide subsidies or incentives to increase the market supply in the reconstruction resource market. The increased market supply can mitigate the reconstruction cost inflation. Also, policymakers can encourage disaster insurance as a preemptive measure for managing disaster risks and mitigating financial losses resulting from unexpected disasters. Last but not least, partnership and collaboration with market players can discover more efficient and faster disaster recovery strategies. For instance, public-private partnerships can expedite supply chain restoration and secure long-term supply chain resilience by leveraging expertise, resources, and funding from government entities and private sector stakeholders (Diehlmann et al. 2021).

CONCLUSIONS

Suppliers subject to anti-price-gouging laws or regulations cannot freely determine prices. They can rather be penalized by the increasing litigation risks in the disaster recovery process. Price increases after a disaster receive huge attention from the public and law enforcement. The motivation for anti-price-gouging enforcement is to protect consumers from exorbitant pricing to secure fairness and equity and address consumer anger and concerns (Jiang et al. 2022). However, the effectiveness of anti-price-gouging laws regulating post-disaster reconstruction cost inflation has not been thoroughly investigated. This paper examines the wage effect of anti-price-gouging laws and presents empirical evidence at the U.S. national level. The study found that the anti-price-gouging laws triggered by a major disaster declaration decreased county-level reconstruction wages by 2.5 percent, achieving its purpose as a price cap.

Panel data models with a difference-in-differences (DID) specification were implemented to quantify the wage effect of anti-price-gouging laws, comparing the wage differences between the U.S. counties with anti-price-gouging laws triggered and those without the laws. The result from all the estimators, including the pooled OLS, fixed effects, and random effects, consistently showed that the anti-price-gouging laws reduced quarterly reconstruction wages in disaster-stricken U.S. counties. In other words, anti-price-gouging laws accomplished their purpose, placing a price ceiling in the post-disaster reconstruction labor market.

Most states (38 out of 51) regulate price gouging in the wake of disasters. Therefore, in practice, it is possible that suppliers do not price-gouge against their self-interest because they assume that price-gouging is illegal in the locations where the anti-price-gouging law is not legislated. The study also identified time-invariant county-specific heterogeneities through Breusch-Pagan tests, suggesting the use of fixed effects or random effects estimators to control for such heterogeneities. The Hausman test favored the FE model, which provides unbiased and consistent estimates while controlling for endogenous county-specific heterogeneities. ~~Future research in this line of study can explore additional explanatory variables, such as the scale of a disaster or spatial proximity to affected communities. Moreover, further investigation into different disaster policies and legal interventions can add valuable insights for policymakers and decision-makers, enhancing strategies and processes for post-disaster reconstruction.~~

DATA AVAILABILITY STATEMENT

All data, models, or codes supporting this study's findings are available from the corresponding author upon reasonable request.

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Table 1. Data Collection

Data	*Frequency*	*Level*	*Period*	*Source*
Dependent variable				
Construction Wages	Quarterly	County-level	Q1 2013 – Q4 2022	Bureau of Labor Statistics
Independent variables				
Anti-price-gouging Law	-	County-level	2013 – 2022	National Conference of State Legislatures
Disaster Occurrence	Daily	County-level	Jan 1, 2013 – Dec 31, 2022	FEMA
Control variables				
Employment	Quarterly	County-level	Q1 2013 – Q4 2022	Bureau of Labor Statistics
Establishment Count	Quarterly	County-level	Q1 2013 – Q4 2022	Bureau of Labor Statistics

Table 2. Descriptive Statistics

Descriptive statistics	*All*	*Counties with APGL*	*Counties without APGL*
Number of states (including the District of Columbia) in the sample data	51	38	13
Number of counties in the sample data	3,579	2,943	636
Number of the pre-disaster sample data	128,144	106,296	21,848
Number of the post-disaster sample data	10,691	8,879	1,812
Mean (Dollars):			
Average weekly construction wages in the quarter that a disaster did not occur	847.59	857.91	797.35
Average weekly construction wages in the quarter that a disaster occurred	810.43	822.76	750.02

Table 3. Impact of the anti-price-gouging law on construction wages: Difference in Differences Approach with county-level panel data

Data	*Dependent Variable: ln(Average Weekly Construction Wages)*		
Variables	**Pooled OLS**	**FE (Fixed effects)**	**RE (Random effects)**
$APG_{it}*DIS_{it}$	-0.072***	-0.025**	-0.023**
	(0.019)	(0.011)	(0.011)
APG_{it}	-0.138***	-0.011	-0.071***
	(0.005)	(0.016)	(0.015)
DIS_{it}	0.047**	0.024**	0.021**
	(0.019)	(0.010)	(0.010)
$log(EMP_{it})$	0.982***	0.989***	0.988***
	(0.001)	(0.001)	(0.001)
$log(EST_{it})$	-0.842***	-0.243***	-0.682***
	(0.001)	(0.010)	(0.005)
Constant	3.296***	0.454***	2.479**
	(0.013)	(0.046)	(0.028)
Time Trend Variable	Yes	Yes	Yes
Observations	138,835	138,835	138,835
R-squared	0.88	0.89	0.88
Number of Counties	3,579	3,579	3,579

Notes: Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 4. Results of the Breusch-Pagan Test

Breusch-Pagan Test	**Chi-squared statistics**	***p*-value**
Cook–Weisberg test for heteroskedasticity	166,025.41 (1)	0.00

Notes: The number in parenthesis represents a degree of freedom.

Table 5. Results of the Hausman Test

Hausman Test	**Chi-square statistic**	***p*-value**
fixed effects vs. random effects	2817.88 (43)	0.00

Notes: The number in parenthesis represents a degree of freedom.