

The effect of Intrastate Trucking Industry Deregulation

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March 19, 2021

Abstract

We assess the impact of intrastate trucking industry deregulation on the for-hire sector market. In 1980s several states removed regulation on intrastate truck transportation, which intensified competition, and had a tremendous impact on the market structure of the trucking industry and the labor market of truck drivers. Truck drivers earn more than workers in the similar occupation because of the strong bargaining powers of the union which allows drivers to capture a significant share of the monopoly rent. We use the difference in difference specification to identify the effect of deregulation of intrastate trucking industry on the trucking market and for-hire sector drivers wage. We found that the deregulation reduced truck drivers wage by 7.64% and drivers whose wage is near the median of the wage distribution are affected the most severely, their wage was reduced by 12% – 15%. We also found that about 66.54% for-hire sector drivers either switched to other occupations or lost their job and 69% of companies were forced out of business.

1 Introduction

Deregulation has been an exciting research field for decades, by the early 1970s the federal government began the process of deregulating a series of major industries. In the rest of the 20th century, transportation, energy, and communication, etc., were deregulated to remove entry barrier, price restriction, and any other forms of limits that could have reduced efficiency of the market. Even though there are some exceptions, lots of research have shown that deregulation could have enormous benefit from intensified competition. Blair et al. [1986] demonstrated that removal of state regulations on trucking transportation in Florida resulted in an average reduction in freight rate of 14%. Beck and Levkov [2010] showed that banking branch deregulation could reduce income inequality by increasing the average incomes of the bottom quarter of the income distribution by 5%.

1.1 Regulation and Trucking Industry

There are two different sectors in the trucking industry, private carriage sector and for-hire sector. The private carriage sector was not restricted by intrastate regulation; they only ship their goods and their main business is not transportation, for example, Walmart has a fleet, but its main business is retail not trucking. The for-hire sector was regulated by intrastate authority; they provide truck transportation of goods and make profits from it.

Typical forms of intrastate trucking regulation include entry barrier, service areas restriction, tariff and freight rate regulation, and commodity and routes limitations. These regulations often serve to protect existing carriers by restricting new applicants from directly competing for a given route or commodity. The intrastate trucking industry is so heavily regulated that it was very inefficient in the 1980s. Most trucking companies were small so they cannot enjoy the benefits of the economies of scale. There is no competition among them because every route is designated to a specific carrier, and it is almost impossible to buy right from other companies, not only because it is very expensive but also the procedure of application and approval was complicated. Therefore, there were no motivations for companies to upgrade their trucks, operation and marketing strategies. The regulation also generated lots of redundant capacity. For example, some states did not allow carriers either load or unload goods at the middle of a route; it made the trucking more like a point to point transportation which is not efficient. Also, if a carrier desire to operate on a specific route then they must agree to regular services even though sometimes they only had one shipment. It also prohibited carriers backhaul anything from the destinations.(Bill Mongelluzzo [1994]) The empty backhaul is still a big problem today for both intrastate and interstate trucking transportation.

Even though the freight rate is very high, companies may not be able to make a profit

from it because they had to pay all kinds of fee and tax. In California, some carriers even relocated their warehouse to Nevada because an interstate haul of 200 miles proved to be cheaper than a haul of only 15 miles between San Francisco and Oakland. (Bill Mongelluzzo [1994]) Another reason that trucking companies are unprofitable is they have to pay drivers very high wage. The driver's union was powerful at that time, and most companies were small, so they did not have the bargaining power even to set a reasonable wage.

The Interstate Commerce Commission (ICC) deregulated the interstate trucking transportation in 1980, but there were forty-two states still regulated their intrastate trucking industry until 1995 the ICC Termination Act removed most remaining intrastate regulations. There are eight states which either deregulated before 1995, for example, Maine, Arizona, and Wisconsin deregulated in 1982 or never have regulation on their trucking industry such as Delaware and New Jersey. The deregulation removed all of these restrictions, and we expect the intrastate trucking market to be more competitive. Generally, we expect to see more companies enter the market after the deregulation; however, the intrastate trucking may not be the case. Without the protection of regulation, companies would compete with each other, eliminate the redundant capacity, and need fewer drivers. There would be fewer but bigger companies which had stronger bargaining power in setting wages; therefore, they did not have to pay drivers such high wages. In other words, the labor market of truck driver became more like an oligopsony rather than monopoly. As for the trucking market, each route was a monopolistic market because the only designated carrier can run businesses on that route. The deregulation brought in more competition, and the market structure would be severely affected.

In this paper, we use the for-hire sector driver's wage and the number of companies of each state as indicators to explore the effect of the deregulation on the intrastate trucking industry. If the mechanism we proposed is correct, then we should see fewer companies and a decrease in both driver's wage and the total number of drivers. The remainder of the paper proceeds as follows. Section 2 introduces data sources and econometric methodology. Section 3 presents the main results and event study. Section 4 concludes and discuss the next step of this research.

2 Data and Methodology

To estimate the effect of intrastate trucking deregulation on for-hire sector drivers' wage, we need data on timing of deregulation, truck drivers' wage and characteristics, and state level macroeconomic data. This section presents more background information about the labor market of truck drivers, data sources, and econometric methods.

2.1 Labor market of Truck Drivers and Data

Some Trucking companies operate both interstate and intrastate business, but according to Allen W. Bruce [1990], approximately two-thirds of all truck tonnage shipped in the United States is intrastate traffic. In some states, the percentage of intrastate shipping make up more than half of the total truck shipping, for instance, in California 83% of the motor carriage is shipped intrastate, Texas 64%, Arizona 71%, and Florida 80%. Therefore, the labor market of truck drivers is relatively regional since most drivers operate intrastate fixed routes, in other words, trucking companies recruit drivers within the state. If this is not the case, then only six states deregulated their intrastate trucking industry may not have a significant effect on drivers.

Allen W. Bruce [1990] provided data on the timing of deregulation; Florida deregulated in 1980, Arizona, Wisconsin, and Maine deregulated in 1982, Alaska deregulated in 1984, and Vermont deregulated in 1986. Since New Jersey and Delaware never regulated their intrastate trucking, we exclude them from our analysis. Truck drivers data comes from CPS and trucking company data comes from the Federal Motor Carrier Safety Administration (FMCSA). We will also use some state-level data from Beck (2010) such as population density, population dispersion, GSP, etc. as control variables.

The CPS data contains truck drivers from different sectors, and there is no variable indicate which sector each driver belongs to; therefore, we applied the following criteria to classify different sector drivers. If an individual's occupation is truck driver and industry is truck transportation, then we classified this individual as for-hire sector driver. If the industry is not transportation but other industries such as mining, textile, food, etc., then we classified this individual as private carriage sector driver.

According to U.S. Bureau of Labor Statistics [2017], the mean hourly wage of truck drivers is \$21.39, and the median is \$20.42; some experienced or specialized drivers could make more than \$40, (American Trucking Associations [2018]). However, trainees and owner-operators are main outliers of our data. Owner-operators could make more than \$160,000 each year, but that is the gross income, after paying for insurance, maintenance, repair, fuel, etc., they might only take home less than half of their gross income. Another case of outliers is trainees who might only make \$28,000 – 35,000 in their first year, (American Trucking Associations [2018]). The reason is some new drivers attended company-sponsored driving school, in return they need to enter a contract with the sponsors that they will work for them after getting the commercial driver's license for a certain period which is usually one year. The company will deduct the tuition of attending driving school from their salary. According to the U.S. office of personnel management, we could compute the hourly wage of trainees and owner-operators by dividing the annual income by 2087 hours. Therefore, in our data, drivers whose wage is higher than \$50 could be classified as owner-operators or specialized drivers; drivers whose wage is lower

than \$15 could be classified as trainees.

Table 1: Summary statistics

Variable	Mean	Std. Dev.	N
Forhire Before Treatment	27.8	8.21	198
Forhire After Treatment	23.91	7.09	968
Forhire None-treated states	24.39	6.82	12943
Private Before Treatment	24.95	8.94	333
Private After Treatment	22.12	6.94	1463
Private None-treated states	22.49	6.12	17018
Blue Before Treatment	25.04	8.29	8246
Blue After Treatment	23.89	7.36	26900
Blue None-treated states	24.18	7	339685

This table summarized the adjusted hourly wage of the treatment group and different control groups before and after the policy change. This table shows that compare to any other groups, the for-hire sector drivers from treated states experienced a drastic decrease in wage after the deregulation. We can see that their hourly wages decreased from \$27.8 to \$23.91 which is 14.0%. Theoretically, the private carriage sector is not supposed to be affected by the policy change directly. However, we can notice that they also experienced some decreasing of wage, from \$24.95 to \$22.12, which is \$2.83 or 11.3%. We also find that after deregulation, the average wage of private sector drivers of deregulated states, which is \$22.12, is almost as same as un-deregulated states, which is \$22.49. Therefore, it is reasonable to assume that the private carriage sector could have been affected by the deregulation indirectly. Blue collar worker are the least possible group that was affected by trucking industry deregulation, even though deregulation might have boosted the economy and have a positive effect on blue collar worker. We can see that workers in deregulated states also experienced some decrease in wages, their average wage decreased from \$25.04 to \$23.89, which is \$1.15 or 4.6%.

One way to explain the wage differential between the for-hire sector and private carriage sector is that for-hire sector drivers could have captured some of the monopoly rent Hirsch et al. [1998], and earn a higher wage than other drivers. Hence, in order to retain their drivers, the private carriage sector has to increase the wage. This could explain why private carriage sector drivers of treated states in pre-treatment periods earn more than private carriage sector drivers of non-treated states in pre-treatment periods. We can see from the summary that after the deregulation, the private sector drivers in deregulated states have almost the same wages with private sector drivers of non-deregulated states.

2.2 Specification

In order to estimate the effect of deregulation, we apply the difference in difference specification which allows us to estimate the treatment effect even though the treatment assignment process is not random; we can also eliminate the group fixed effect and the time trend; therefore we do not mistakenly attribute all the change to the policy change. We can write the regression as

$$\log(Y_{it}) = \beta_0 + \alpha T_{s(i)t(i)} + \gamma g(i) + \mathbf{A}_t + \mathbf{B}_s + X'_{s(i)t} \beta_1 + Z'_{it} \beta_2 + \epsilon_{it} \quad (1)$$

In equation (1), $t(i)$ is the year when we observe individual i and $s(i)$ is the state where we observed i . \mathbf{A}_t is a vector of year dummies that capture the time trend, and \mathbf{B}_s is a vector of state dummies that capture the state fixed effect. $T_{s(i)t(i)}$ is a dummy variable that equals one only if $s(i)$ is deregulated states and $t(i)$ is a year equals or after the deregulation year of state $s(i)$. Z'_{it} represents the vector of individual level control variables and $X'_{s(i)t}$ is the vector of state level control variables.

This equation represents the general form of our regression and $g(i)$ is a dummy variable which equals 1 if individual i belongs to the treatment group and 0 otherwise. Since we will be using three different control groups the meaning of $g(i)$ could vary, but in general, it can be interpreted as the fixed effect of for-hire sector drivers.

The coefficient α indicated the impact of intrastate deregulation on the hourly wage of for-hire sector drivers. A positive and significant α indicates that deregulation has a positive effect on the wage of for-hire sector drivers, while a negative and significant α suggests that deregulation decrease the wage of for-hire sector drivers. We cluster the standard error by state year because we believe errors are correlated within the cluster but independent across the cluster. One essential assumption of difference in difference specification is the trend of the treatment group and control group should be parallel in pre-treatment periods. In order to examine this assumption and investigate the dynamic impact of deregulation we also apply the event study framework.

3 Deregulation and Drivers Wage

In this section, we present the DiD estimates of using three different control groups and discuss why different control group gives us different results. This section also includes the event study and quantile analysis which help us to understand the dynamic effect of the deregulation and how the deregulation affected different income percentiles.

The treatment group always consists of for-hire sector drivers from states that deregulated their intrastate trucking industry in the 1980s. However, choosing a control group is essential when implying the difference in difference specification and it is almost impossible to find a perfect control group. Therefore, we constructed three control groups

in this research and compared the result of using different control groups. From Table 1 we can see that the wage decreasing is an overall trend among truck drivers and blue collar workers. Therefore, choosing a control group is even more important since we need to use the control group to simulate the time trend of the treatment group in the absence of deregulation. The first control group includes for-hire sector drivers of un-deregulated states. The second control group consists of private carriage sector drivers of deregulated states. The third control group consists of blue-collar workers in other manufacture industries of deregulated states.

3.1 Result

Table 2: Effect of Deregulation on for-hire sector Drivers' Wage

	(1)	(2)	(3)
Treatment Group	For-hire	For-hire	For-hire
Control Group	For-hire	Private	Blue-Collar
Effect	-0.0608*** (0.0227)	-0.0471* (0.0264)	-0.0931*** (0.0218)
Observations	14,080	2,100	24,471
R-squared	0.079	0.329	0.272

Clustered standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2 shows the difference in difference estimates of the impact of deregulation on the log wages of for-hire sector drivers. For convenient, we only show the estimated effect here, and the full table can be found in the appendix. The first column is the result of using for-hire sector drivers of other un-deregulated states as the control group. It shows that deregulation exerted a negative influence on for-hire sector drivers' wage, reduced drivers wage by 6.08%. The second column is the result of using private carriage sector drivers from the same states as the control group, and it shows that deregulation decreased the for-hire sector drivers' wage by 4.71%. The third column is the result of using blue-collar workers from other industries of deregulated states as the control group. It shows that deregulation decreased the for-hire sector drivers' wage by 9.31%.

As shown in the second column of the table, when using private carriage sector drivers of deregulated states as the control group, the estimated magnitude is less than when using the other two control groups and only significant at 10% level. The reason for this could be that, as we mentioned in section 2, the deregulation also affected the wage of

private sector drivers. There is no essential difference in skill requirement between the for-hire sector and private sector drivers, and therefore, if the deregulation had a negative effect on for-hire sector drivers, then they could have switched job to private sector drivers and force down the wage of private sector drivers. For a similar reason, if the deregulation of intrastate trucking industry boosted the economy, then the blue-collar worker's wage could be affected.

To see if the private sector and blue collar workers were also affected by the policy change we conducted another analysis. First, we use private sector drivers of the deregulated state as the treatment group and private drivers of un-deregulated states as the control group to explore if the deregulation affected private sector drivers. Then, we use blue collar workers of deregulated states as the treatment group and blue collar workers of the un-deregulated state as the control group to see if blue-collar were affected. The result showed in the following table.

Table 3: Estimates for Trucking Industry Deregulation on Private sector and Blue Collar

	(1)	(2)
Treatment Group	Private of Deregulated	Blue of Deregulated
Control Group	Private of Un-deregulated	Blue of Un-deregulated
Effect	-0.0475*** (0.0164)	-0.00886 (0.00617)
Observations	17,624	344,060
R-squared	0.113	0.127

Clustered standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The above table only shows the estimated effect of deregulation on private sector drivers and blue collar workers, the full able can be found in appendix. As shown in the table, the private sector drivers are also affected by the deregulation. We found that the wage of private sector drivers decreased by 4.75% at 5% significant level. As we expected, blue collar workers are not affected by the deregulation; we can see the estimated effect is really small and statistically insignificant. Therefore, if we use the private carriage sector drivers of deregulated states as the control group to estimate the effect of deregulation on for-hire sector drivers, then the result would be underestimated. This could explain why the magnitude and significant level of the result of using the private sector as the control group is less than using the other two control groups.

3.2 Number of drivers and companies

The deregulation of intrastate trucking industry could have affected the structure of the transportation market. The deregulation removed the regulatory entry barrier and price restriction, therefore, could have induced companies to enter this industry or forced some companies out of business. In this paper, we simply estimated how the deregulation affected the number of companies, number of drives hired by each company, and the total number of drivers of each state. These variables represent the structure of the intrastate trucking market and drivers' labor market. From the changes of these variables, we can roughly understand what happened in the trucking industry after the deregulation.

We use the difference in difference specification to estimate the effect on the number of companies in each state. We obtained data from the Federal Motor Carrier Safety Administration (FMCSA). If a company only has one truck, then we classify it as an owner-operator and drop it from our analysis.

$$\log(Y_{st}) = \beta_0 + \alpha T_{st} + \gamma g(s) + \mathbf{A}_t + \mathbf{B}_s + X'_{st}\beta + \epsilon_{st} \quad (2)$$

In the above equation, \mathbf{A}_t is a vector of year dummies account for year fixed effect, \mathbf{B}_s is vector of state dummies account for state fixed effect, Y_{st} is the total number of trucking companies in state s in year t , X'_{st} is vector of state level control variables. T_{st} equals one in years after state s deregulated and zero otherwise. We also use this specification to estimate the effect of deregulation on the total for-hire sector drivers of each state. In this case, Y_{st} represents the total for-hire sector drivers of state s in year t . The deregulation could have affected the number of drivers hired by each company, and we estimated this effect using the specification in section 2. We only need to change the dependent variable to the number of drivers hired by each company. The following table only shows the estimated effect, and the full table with control variables can be found in the appendix. Since we take the natural logarithm of dependent variables, we recalculate the estimated effect so that we can interpret it as a percentage change, and what we showed in the table is $e^{\hat{\alpha}} - 1$.

Table 4: Estimates for Deregulation on number of Drivers and companies

VARIABLES	(1) Drivers of each company	(2) Number of companies	(3) Total number of drivers
Effect	0.469 (0.292)	-0.6654** (0.411)	-0.6902*** (0.276)
Observations	5,951	562	562
R-squared	0.045	0.728	0.598

Clustered standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The first column is the result of how deregulation affected the number of drivers hired by each company. The second and third column are the results of how deregulation affected the number of companies and the total number of for-hire drivers of each state. As the table show, the number of drivers hired by each company did not change significantly; however, the total number of companies and for-hire sector drivers decreased. The deregulation forced about 66.54% companies out of business or merged, and 69.02% of for-hire drivers either lost their job or switched to private carriage sector or other industry.

The first column is the estimated effect of deregulation on the number of drivers hired by each company, and the result is insignificant, therefore, probably most companies just went out of business rather than merged.

As we expected, the number of companies drastically decreased after the deregulation. The reason of this could be that entry barrier has not played such an essential role in the overall regulation, which means that if the authority only removed the entry barrier, we would not see any significant change. What affected trucking companies the most is the restriction of routes, commodity, freight rate, and backhaul. These restrictions generated redundant capacities as we demonstrated in section 1. When these restrictions were removed, these redundant capacities vanished, and lots of companies went out of business. Therefore, the decrease in demand for drivers is a reason why wage went down, and it could be more influential than the change of the union's bargaining power which helped drivers to capture a significant share of companies' monopoly rent. Even though many papers agreed on that deregulation of intrastate trucking industry reduced the monopoly power of companies; however, none of them explicitly demonstrated by how much the monopoly power was reduced. More importantly, since there are fewer companies, the monopoly power has not necessarily been decreasing after the deregulation.

3.3 Event Study

In this section, we examine the dynamic effect of deregulation on for-hire sector truck drivers' wage. We decompose the effect into several years and see how it change along time. The specification of the event study framework we applied is as follows, the only difference from the equation (1) is we decomposed the interaction term of group dummy and year dummy, $T_{s(i)t(i)}$, into specific years.

$$\log(Y_{it}) = \beta_0 + \sum_{j=-3}^{j=10} \alpha_j T_{s(i)t(i)}^j + \gamma g(i) + \mathbf{A}_t + \mathbf{B}_s + X'_{s(i)t} \beta_1 + Z'_{it} \beta_2 + \epsilon_{it} \quad (3)$$

where the deregulation dummy variables, $T_{s(i)t(i)}^j$ equals one only when individual i is in deregulated states and $t(i)$ is $-j$ th year before deregulation when j is negative or j th year after deregulation when j is non-negative, otherwise, $T_{s(i)t(i)}^j$ equals zero. If the estimated coefficients of $T_{s(i)t(i)}^j$ is statistically insignificant when $j < 0$ then the pre-treatment parallel trend assumption is fulfilled. We use the third control group that make up of blue collar workers of deregulated states in this event study.

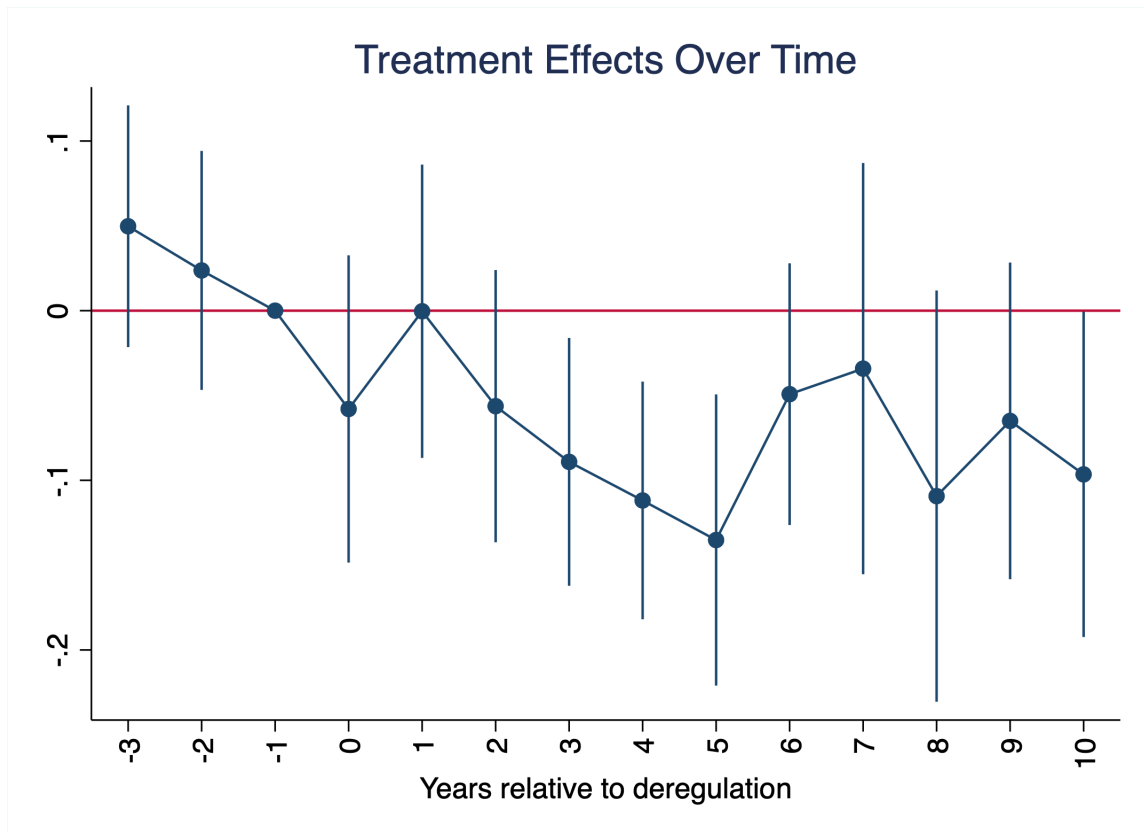


Figure 1

The graph plots the effect of deregulation on the natural logarithm of truck driver's wage. We use a 14 years time window, spanning from 3 years before deregulation until 10 years after deregulation. The vertical lines represent 95% confidence interval, and the

horizontal line represents zero. If the vertical lines interact with the horizontal line, then it means the effect of deregulation in that year is insignificant. We also normalized the effect of one year ahead of the deregulation to zero so that we can compare how the effect of each year changed over time.

From this graph, we can see that three years after the deregulation the effect became significant and last for three years and the magnitude has been increasing during that periods. After then, the magnitude of the effect had been decreasing and became insignificant. We do not see significance in the first three years after deregulation because the market needs some time to react to it, and companies did not go out of business immediately even though some of them may not be able to make profits anymore.

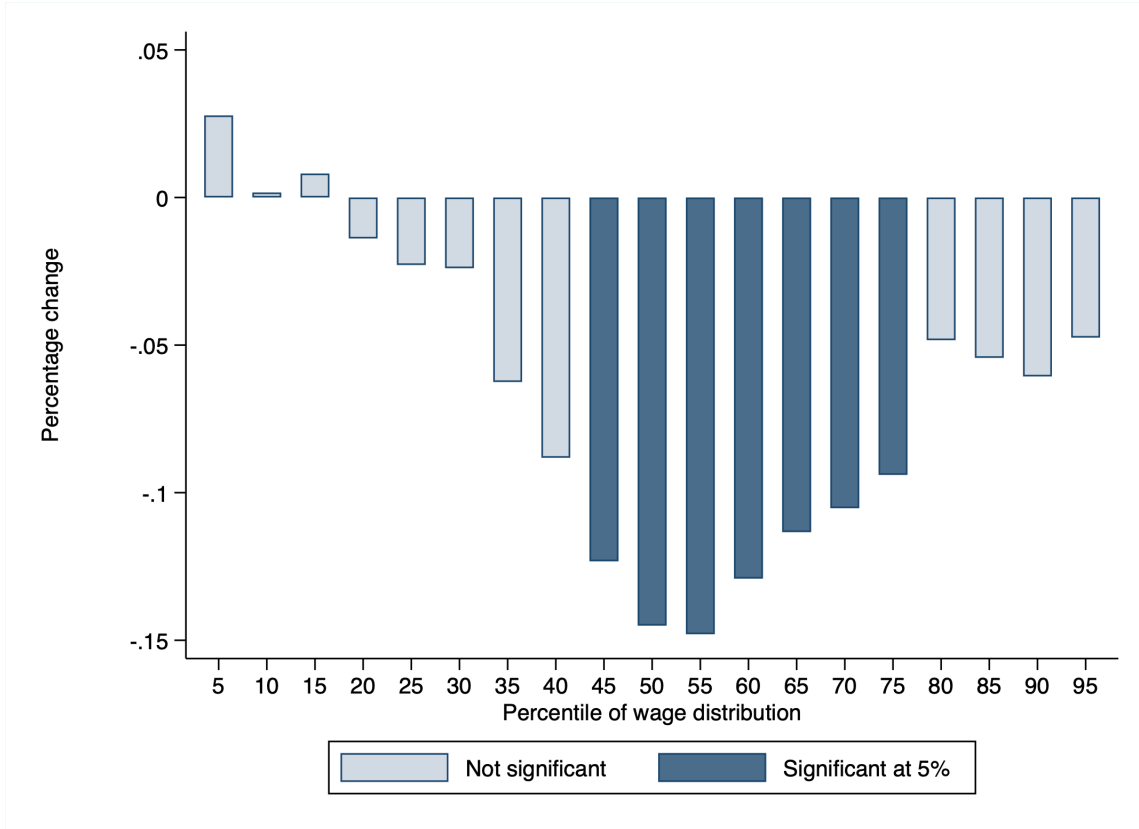
We considered the deregulation as a treatment, however, if some unobserved variables affected the treatment assignment process and the outcome variable then this could cause the endogenous problem. “Ashenfelter Dip” is a classic example, job training program participants always experienced an income drop before they enroll in the program. In our case, states that decided to deregulate may have relatively inefficient intrastate trucking market or have a more progressive party in office. From the event study graph we can see that the pre-treatment parallel trend assumption is fulfilled, even though this could not rule out the possibility that the policy change is endogenous, it is less of a concern.

The deregulation could have affected the for-hire sector truck drivers differently, for example, drivers in the low or high percentile of the wage distribution could have been affected less intensively because the union coverage could guarantee a certain level of minimum wage and experienced truck drivers are less substitutable. To explore the effect of deregulation on different percentiles of the wage distribution; we run 19 different quantile regressions from 5 percentile to 95 percentile, each time we increase the percentile by 5.

$$\log(Y(n)_{it}) = \beta_0 + \alpha T_{s(i)t(i)} + \gamma g(i) + \mathbf{A}_t + \mathbf{B}_s + X'_{s(i)t} \beta_1 + Z'_{it} \beta_2 + \epsilon_{it} \quad (4)$$

where the $\log(Y(n)_{it})$ is the natural logarithm of n th percentile of wage distribution of state s in year t . Other notations are as same as our difference in difference estimator. Then we plot the result as the following graph.

Figure 2: Treatment effect on different percentile of the wage distribution



Each bar in the graph represents the estimated effect of deregulation on the logarithm of a specific percentile of the income distribution. Light bars represent statistically insignificant estimates. Dark bars represent estimates significant at 5%. As shown in the graph, the deregulation only has a significant effect on 45 percentile to 75 percentile of the wage distribution. Drivers near the median are affected the most; their hourly wage decreased by 12%–15%. For-hire sector drivers at both ends of the distribution, however, were not significantly affected by the deregulation. The reason is that low wage drivers are most trainees and protected by the minimum wage, and the high wage drivers are more experienced or specialized, so they are less substitutable. That wage range of these affected drivers is 20.86 – 27.35\$. According to American Trucking Associations [2018], this is the typical range of truck drivers.

3.4 DDD and Robustness

In the previous section we use three control group separately; however, we cannot use different states and occupation at the same time. Therefore, potentially, we ignored the systematic difference across states and attributed the effect of the federal level change to the intrastate trucking deregulation. In this section, we present the result of using the difference in difference in difference (DDD) which is a more robust analysis. It includes two control groups and accounts for the changes of both for-hire sector drivers in un-

deregulated states and blue collar workers in deregulated states. The DDD estimator first starts with the average change of for-hire sector drivers in deregulated states then subtracts the average change of for-hire drivers of un-deregulated states and the average change of blue collar workers of deregulated states.

The result shows in the following table:

Table 5: DDD Estimator

VARIABLES	(1)	(2)
	DDD	DDD with Interaction Terms
Effect	-0.0740*** (0.0235)	-0.0764*** (0.0236)
Observations	377,870	377,870
R-squared	0.123	0.129

Clustered standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

As usual, we only show the estimated effect of deregulation in the above table, the full table with all control variables is in the appendix. The first column shows the result of general DDD estimator. We can see that compare to the standard difference in difference estimator, the result is still significant and does not change much. The second column is the result of including state and year interaction terms to account for the state-year specific change. The result does not change significantly compared to the first column. From the results of DD and DDD, we can tell that, as we expected, the deregulation reduced for-hire sector drivers wage and our finding should be robust.

4 Conclusion and Further Research

In this research, we explored how the intrastate trucking industry deregulation affected the for-hire sector of the intrastate trucking industry. We found that deregulation intensified competition and eliminated redundant capacity by forcing a big proportion of companies out of business. Truck driver's wage decreased because of the decrease in demand for drivers. Even though we found the number of drivers hired by each company did not change significantly, we cannot say that companies just went out of business because if companies merged, they probably dismissed some of their drivers.

The reason that for-hire sector drivers have higher wages than private sector drivers and blue collar workers in other industries is not being a truck driver requires more human capital but because, under the coverage of the union, truck drivers could capture a significant share of companies' monopoly rent. Therefore, when the deregulation reduces

the bargaining power of the union, both for-hire and private sector drivers' wage decreased significantly. This is the second channel that deregulation affected the for-hire sector drivers. We also found that for-hire driver whose wage is near the median of the wage distribution were affected the most. For-hire sector drivers and private sector drivers are substitutable to each other; therefore, when the for-hire sector drivers wage decreased, the private carrier did not need to pay a premium to retain their drivers this could be the way that deregulation affected private drivers indirectly.

We use CPS data in this research, and some drawbacks might bias our result. First, we cannot directly identify if a driver belongs to the for-hire sector or private carriage sector. We determine the sector of each driver based on the industry and occupation information. The second concern is we cannot distinguish interstate and intrastate truck drivers, even though most drivers operate fixed intrastate routes this could potentially bias our result downward since interstate truck drivers are not affected by this policy change. Florida is the first state that deregulated its intrastate trucking industry in 1980. Wisconsin, Maine, and Arizona deregulated in 1982. However, our dataset begin from 1979, so we do not have many observation of pre-treatment periods. More pre-treatment observations could help us to conduct a better event study and improve the overall accuracy of our research.

We have three control groups; however, none of them is perfect. The private sector drivers were affected by the deregulation as we demonstrated in section 3. The for-hire sector drivers of un-deregulated states could have been the best control group if there is no trucking related policy change in these states. Unfortunately, some states implemented ambiguous policy change. Allen W. Bruce [1990] found that California has vacillated between liberal and strict rate regulation, Pennsylvania has loosened its regulation without a statutory change. Indiana voted in 1988 to deregulate effective 1990, however, in 1989 the Indiana legislature reversed the 1988 deregulatory action. Georgia has passed a bill to loosen entry; Texas has allowed a zone of flexibility and some new entry. Idaho, Kansas, Michigan, New York, and North Dakota enacted partial or limited deregulation laws; almost every state had some legislative activities regarding the intrastate trucking regulation. The last control group makes up of blue collar workers of manufacture industries. Even though we see pre-treatment parallel between treatment and control group, we still cannot say anything about if there is some difference between deregulated and un-deregulated states that may cause some state to choose to deregulate.

In order to accommodate the three control groups and for the purpose of robustness check we also apply the DDD specification. This would have given us a more robust result. Again, we confirmed our finding that deregulation reduced the for-hire sector driver's wage.

In general, deregulation has a positive effect, Beck and Levkov [2010] showed that banking industry deregulation reduced the inequality by increasing the average income

of the bottom quarter of the income distribution. However, Kim and Singal [1993] and Goetz [2002] showed that airline deregulation in 1978 made consumer worse off because of the price collusion. Even though the trucking industry is very different from the airline, the same negative impact could have been exerted on consumers.

The deregulation had a tremendous effect on the intrastate trucking industry, on both of the trucking market and the labor market of drivers. We roughly testified the mechanism proposed in section 1. The next step of this research is to explore more about the market structure of both trucking and drivers, freight rate, efficiency, and whether this deregulation benefits consumers. A more precise structural model is needed.

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.1 Tables

Estimates for Trucking Industry Deregulation on for-hire sector Drivers' Wage

	(1)	(2)	(3)	(4)
Treatment Group	For-hire	For-hire	For-hire	For-hire
Control Group	All	For-hire	Private	Blue-Collar
effect	-0.0157 (0.0134)	-0.0608*** (0.0227)	-0.0471* (0.0264)	-0.0931*** (0.0218)
group	0.00474 (0.00310)	0.0367 (0.0577)	0.130*** (0.0230)	0.0770*** (0.0174)
wbho	-0.0325*** (0.00141)	-0.00753* (0.00406)	-0.0166* (0.00964)	-0.0202*** (0.00398)
age	0.0247*** (0.000323)	0.0179*** (0.00152)	0.0271*** (0.00384)	0.0264*** (0.00138)
age2	-0.000251*** (3.70e-06)	-0.000168*** (1.78e-05)	-0.000272*** (4.49e-05)	-0.000269*** (1.60e-05)
female	-0.119*** (0.00362)	-0.00577 (0.0228)	-0.0517 (0.0369)	-0.130*** (0.0129)
area	3.92e-07*** (1.76e-08)	4.22e-07*** (5.09e-08)	6.16e-07*** (3.45e-08)	5.98e-07*** (1.68e-08)
educ	0.0478*** (0.000862)	0.0380*** (0.00308)	0.0317*** (0.00836)	0.0361*** (0.00319)
gsp	1.42e-07*** (1.78e-08)	5.59e-08 (3.86e-08)	2.71e-07 (6.48e-07)	-5.18e-07* (2.88e-07)
vet	0.0117*** (0.00104)	-0.0114** (0.00493)	0.0144 (0.0129)	0.0128*** (0.00392)
married	0.0320*** (0.00119)	0.0238*** (0.00569)	0.0377*** (0.0124)	0.0515*** (0.00457)
Constant	2.552*** (0.0122)	2.698*** (0.0607)	2.360*** (0.0786)	2.383*** (0.0246)
Observations	375,764	14,080	2,100	24,471
R-squared	0.138	0.079	0.329	0.272

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Estimates for Trucking Industry Deregulation on Private sector

	(1)	(2)
VARIABLES	Private vs Private	Blue vs Blue
effect	-0.0475*** (0.0164)	-0.00886 (0.00617)
group	-0.158*** (0.0293)	0.270*** (0.0108)
wbho	-0.0207*** (0.00336)	-0.0305*** (0.00144)
age	0.00296*** (0.000204)	0.00391*** (7.10e-05)
area	7.52e-07*** (3.91e-08)	-0.00208 (0.00147)
educ	0.0224*** (0.00281)	0.0517*** (0.000879)
married	0.0242*** (0.00529)	0.0524*** (0.00130)
vet	0.00725 (0.00452)	0.0209*** (0.00115)
female	0.0381 (0.0259)	-0.118*** (0.00372)
Constant	2.955*** (0.0244)	2.922*** (0.0163)
Observations	17,624	344,060
R-squared	0.113	0.127

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Estimates for Trucking Industry Deregulation on number of Drivers

	(1)	(2)	(3)
VARIABLES	driver_total-FMCSA	Comapnies-FMCSA	Forhire-FMCSA
effect	0.469 (0.292)	-1.095** (0.411)	-1.172*** (0.276)
group	0.507 (1.049)	-6.501 (3.996)	-3.033 (5.837)
gsp	-2.38e-06*** (6.05e-07)	5.69e-06* (2.84e-06)	1.14e-07 (3.69e-06)
unemploymentrate	-0.00612 (0.0177)	0.00589 (0.0363)	-0.00698 (0.0513)
population	9.50e-08** (4.01e-08)	-2.75e-07 (1.73e-07)	-1.75e-08 (2.42e-07)
gsp_pc_growth	0.768 (0.470)	-1.523 (1.222)	-0.846 (1.421)
area	-0.00252 (0.107)	0.905** (0.423)	0.648 (0.630)
Constant	1.298** (0.632)	-5.916*** (1.841)	-3.668 (2.780)
Observations	5,951	562	562
R-squared	0.045	0.728	0.598

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

	(1)	(2)
VARIABLES	For-hire vs Blue Collar	For-hire vs Blue Collar
ddd	-0.0740*** (0.0235)	-0.0764*** (0.0236)
effect	-0.0342*** (0.00821)	-0.0322*** (0.00821)
effect2	0.00126 (0.00634)	-0.0278*** (0.000806)
effect3	0.0883*** (0.0184)	0.0869*** (0.0186)
forhire	0.00582* (0.00315)	0.00596* (0.00314)
treatstate	0.236*** (0.0125)	-0.0171*** (0.000603)
wbho	-0.0304*** (0.00137)	-0.0304*** (0.00137)
age	0.00395*** (6.72e-05)	0.00398*** (6.69e-05)
female	-0.116*** (0.00325)	-0.118*** (0.00326)
area	0.000918 (0.00164)	0.224*** (0.000619)
educ	0.0518*** (0.000838)	0.0518*** (0.000847)
gsp	1.30e-07*** (1.66e-08)	4.47e-07*** (6.11e-09)
vet	0.0189*** (0.00112)	0.0190*** (0.00112)
married	0.0507*** (0.00125)	0.0511*** (0.00125)
Constant	2.915*** (0.0166)	0.421*** (0.00941)
Observations	377,870	377,870
R-squared	0.123	0.129

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1