Zoning: A Barrier or Solution to Truck Parking Infrastructure Shortages?

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Abstract

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1 Institutional Setting

The Federal Motor Carrier Safety Administration (FMCSA), maintains a comprehensive database known as the Crash File. This dataset records all reported motor vehicle crashes in the United States, providing detailed insights into the nature and conditions of each accident. Key attributes include the type of vehicle involved (e.g., trucks, motorcycles, or buses), the circumstances of the crash (e.g., involving a parked vehicle), the number of vehicles involved, any fatalities or injuries, and relevant weather conditions, and observations. Our data is (1990-Present) FMCA Crash file from USDOT (Appendix A).

Our dataset spans from 1990 to the present, with a focus on records from 1993 to 2016. A unique feature of this dataset is its ability to distinguish trucks as a specific variable, allowing for a granular analysis of truck-involved collisions. Furthermore, it offers detailed information on accident circumstances, such as whether a truck was illegally parked, a distinction not commonly found in other datasets.

We also incorporate a digitized data set tracking truck stop creation from 2006 to 2016. This data set enables us to analyze the impact of new truck stops on accident patterns at the county level. Notably, this period lacks significant policy reforms or major events that could confound our analysis.

Additionally, we utilize the Wharton Land Use Regulation Index (WLIURA) dataset by Gyourko et al. (2008), which measures the zoning restrictiveness of various locations. This dataset allows us to examine the influence of local zoning laws on crash patterns. We further refine our analysis by incorporating zoning classifications from Puentes et al. (2006), which categorize land use regulations into four distinct zoning types. These classifications serve as control variables in our study.

2 Event Study Model

The change in the number of truck stops from 2006 to 2016 is modeled as:

$$\Delta \text{NumTruckStop}_{t=[2006-2016]} = \sum_{i=1993}^{2006} \beta_{t=i} \text{Accident}_{t=i} \cdot \text{Fatalities}_{t=i} + \gamma_t X_t + \epsilon_t$$

where year t represents time i, $\Delta\text{NumTruckStop}_t$ denotes the change in truck stops, Accident_i is an event dummy indicating the presence of an accident, and Fatalities_i represents associated fatalities. X_t consists of control variables, including zoning categories: Traditional (zoning unchanging), Exclusion (zoning difficult), Reform (zoning friendly), and Wild Wild Texas (no zoning). Finally, ϵ_t represents the error term for year t. We also add 2 dummy controls for counties with high and low zoning restriction. More possible controls would include,region, county budget, county weather patterns and population. In this model, we assume that the occurrence of accidents and their severity are uncorrelated with the error term, ensuring that any estimated effect of these variables on the change in truck stops is not biased by omitted factors. In addition, the model includes several zoning measures specifically the categories Traditional, Exclusion, Reform, and Wild Wild Texas, as well as dummy controls for high and low zoning restrictions. It is assumed that these zoning variables are not perfectly collinear, allowing for valid coefficient estimation and clear identification of each variable's effect. Furthermore, the model is based on the assumption of unidirectional causality, meaning that changes in the number of truck stops do not lead to an increase in accidents. This assumption is critical to ensure that the estimated relationships truly reflect the impact of accidents and severity on truck stop changes, rather than the reverse.

The identification assumption is that in the absence of designated truck parking, trucks will resort to illegal parking, leading to observable accidents. In response, counties, driven by public safety concerns and the goal of reducing accidents, are incentive to increase truck parking availability. This, in turn, results in the creation of additional truck stops. The causal mechanism can be summarized as follows:

Insufficient Truck Parking $\rightarrow$ *Illegal Truck Parking* $\rightarrow$ *Observed Accidents* $\rightarrow$ *Increased Demand for Truck Parking* $\rightarrow$ *Observed Increase in Truck Parking Capacity.*

We can test this assumption by observing the coefficients surrounding, each zoning category and high/low restriction coefficient. We expect to see Traditional (zoning unchanging) with a insignificant coefficient, Exclusion (zoning difficult) with a negative coefficient, Reform (zoning friendly) with a positive coefficient, and Wild Wild Texas (no zoning) with a positive coefficient. High restriction places will have

Potential sources of bias would be overestimation of accidents. It is really difficult for a truck to legally park anywhere. It could be well the case that the truck did every reasonable measure to park properly but would still get into a accident. This would overestimate accidents and underestimate our coefficient. Another source of bias would be underestimation of severity of accidents. Counties have a incentive to maintain a safe public image, which would include minimizing severity of accidents, underestimating our coefficient estimate. Furthermore, zoning classifications literature, support the idea that time variation of counties overtime follow their zoning categories. For example, Exclusion (zoning difficult) would become more difficult over time and vice versa(McLaughlin 2012). This would overestimate our coefficient estimates as t increases.

We will cluster standard errors at the state level because different regions exhibit distinct accident and trucking profiles. Some states may have a more prominent trucking culture than others, leading to systematic differences in accident rates and truck stop availability. Additionally, regional weather conditions may influence both the frequency of accidents and the feasibility of truck stop construction.

By clustering at the state level, we assume that observations within each state are correlated, while observations across different states remain independent. This accounts for within-state dependencies, such as shared infrastructure, regulations, and economic conditions. Clustering at this level also ensures a sufficient number of clusters, which is crucial for obtaining reliable standard error estimates.

References

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