# *THE IMPACT OF GASOLINE PRICES ON DRIVING BEHAVIORS OF NYC TAXI DRIVERS*

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## Overview

Increasing fuel efficiency has been a major trend in the automotive industry stimulated primarily by several environmental policies and high gas prices. Similar to private vehicles, commercial transportation vehicles have improved in efficiency. Many studies point out that vehicle usage increases according to reduction of fuel costs In the commercial transportation sector, increasing vehicle usage implies increasing supply, especially in the New York City (NYC) taxi industry, where the number of vehicles is fixed by the medallion system and fares do not change according to fuel cost variation. However, most analyses of these vehicle usage issues (Yatchew and No (2001), Knittel and Sandler (2010), Gillingham (2014), Li, Linn, and Muehlegger (2014), and Langer, Maheshri, and Winston (2016)) have focused on private vehicles, even though fuel cost is the most important element of variable costs in commercial transportation. Labor participation in the taxi industry also has been researched widely, but the focus of these studies has not been on vehicle operating costs. In this paper, I focus on how the supply of labor in the taxi industry changes in relation to improvements in fuel efficiency. Two types of analysis are conducted. First, I estimate how shift-use outcomes change according to vehicle efficiency level based on the impact of gas prices. Second, I estimate how drivers' optimal shift-quitting decisions change according to vehicle efficiency level based on the impact of gas prices.

The NYC yellow cab trip level data is used for estimation. The impact of gas price fluctuation could affect on both demand and supply of taxi. By increasing own vehicle operation cost, customers tend to use taxi. By increasing fuel costs, drivers tend to decrease drivings. Thus, estimation of gas price impact on demand and supply separately is difficult without well designed instruments. Thus, this paper focuses on the different supply response rather than identification of demand and supply effects. Drivers who operate low efficiency vehicles are used as a baseline group to calculate impact of increasing fuel efficiency. To support this argument, I assume customers' preference of fuel efficiency of taxi is not changed by gas price fluctuation. With this assumption, change of demand from gas price fluctuation affect equivalently on taxi drivers regardless of vehicle efficiency. In this analysis, I divide vehicles as high and low efficient vehicles. The criterion set as 30 MPG which are almost median and division point between hybrid and traditional vehicles.

The Taxi and Limousine Commission of NYC (TLC) provided yellow cab's entire trip level data, which was collected automatically. I use the rich dataset that covers the entirety of NYC taxi driver trips in 2013 and includes vehicle and driver identification numbers. This material provides distance, fares, and longitude/latitude of pickup and drop-off locations per trip. Fuel efficiencies (MPG), model years, and vehicle change dates are collected on each medallion number by scraping from the Vehicle Information Number information website. Twelve million trips are observed in each month.

## Methods

First, the shift level regression model is conducted. By decreasing vehicle operating cost, drivers will spend more time or efforts. Efforts is correlated with the distance of searching customers. Thus, the total distance of searching customers and total time of shift are used for dependent variables. For control average variation of demand, several fixed effects (month, day of week, and hour) are included. The individual fixed effect is also included to control personal driving pattern. The key variable is efficiency vehicle dummy and gas price. These variable parameters captures a different impact of gas price between high and low efficiency vehicle.

Second, the binary choice model of stopping shift is estimated base on Farber's (2005) approach. At end of each trip, drivers decide to quit shift or keep driving. Probit model is used for estimation. Total time spend and renue until decision period is used for control variables. Individual driver and time dummies are also used for the same reason with shift level analysis. The location dummy is used for control spatial deffrent demand. Census tract is used for dividing Manhattan area. The key variable is efficiency vehicle dummy and gas price. From this estimation, how much high efficient vehicle driver spend more time in the shift.

## Results

In the shift level model, the average searching distance and shift time decrease as gas prices increase. The impact on high efficiency vehicle drivers is higher than that on lower efficiency vehicle drivers. . However, inefficient drivers tend to drive more constantly on shift and when searching for customers.

In the optimum quitting decision model, use of an efficient vehicle decreases the likelihood of ending a shift early. In addition, the coefficient of gas prices is negative and the interactive variable of a dummy efficient vehicle with gas prices is positive.

## Conclusions

The results show that the improvement of taxi fuel efficiency stimulates increased supply and influences drivers to put more effort into searching for customers. Buchholz (2016) calculated the welfare loss of searching friction for the NYC taxi industry as $422M per year. An effective approach to reducing this loss without issuing medallions is to improve vehicle efficiency. For reducing carbon emission, the NYC TLC has already created a policy to focus on improving the fuel efficiency of its taxis: the TLC made a list of 12 approved high-efficiency vehicle models for new taxis. An unexpected side effect of this policy has been to increase supply.

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