Transportation **26: 283-297,** 1999.

Elasticities for taxicab fares and service availability

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Accepted 24 November 1998

Abstract. This study utilizes a unique dataset from New York City to examine the effects of taxi fare increases on trip demand and the availability of taxi service. The elasticity of trip demand with respect to fares is estimated to be –0.22; the elasticity of service availability with respect to the taxi fare is 0.28; and the elasticity of service availability with respect to total supply of service is near 1.0. These results have important implications for taxi regulatory decisions. First, fare increases do substantially increase industry revenues but at a lesser rate than the percentage increase in the fare. The implication for policy-makers is that fare elasticities must be carefully considered to obtain desired improvements in drivers' earnings. Second, service availability—an important aspect of service quality that is generally overlooked during fare policy debates—should be a central consideration in fare setting, given the considerable impact of fares on availability. Finally, where the supply of cabs needs to be expanded, the number of cabs can be significantly increased without harming the revenue stream of existing operators. This finding alleviates a major industry objection to issuing additional taxicab licenses.

Introduction

Two central issues for taxi regulation are: (1) What should be the rate of fare? (2) How many taxicab licenses should be issued? With the failure of deregulated taxi industries to provide satisfactory service in a number of North American cities, (Teal and Berglund, 1987), the tasks of setting fares and service levels remains in the laps of municipal agencies (Dempsey, 1996).

In making decisions about these issues, government regulators need to know elasticities for fares and service availability. The elasticity of taxi revenue with respect to the fare is critical to determining the size of fare increases required to generate a target level of taxi revenue. The elasticities of service availability with respect to the fare and industry size are critical to ensuring adequate service levels for the public.

Unfortunately, because of insufficient data regulators are often unable to anticipate how their policies will affect taxi revenues and cab availability. Previous attempts to estimate fare elasticities have not produced statistically conclusive results. A 1978 study funded by the U.S. Department of Transportation sought to estimate fare elasticities in 24 cities across the U.S. using time-series data for periods that encompassed a fare increase. Only five cities produced statistically significant elasticities (at a 95 percent confidence level). The estimated fare elasticities for these five cities ranged from 1.35 to –1.55, with the other three in the range of -0.18 to -0.45. (Fravel and Gilbert, 1978)

A 1990 cross-sectional study of 26 Canadian cities found a slight fare elasticity of –1.12. (Hickling Corporation, 1990.) This result had a marginally-acceptable confidence level of 91.8%. Other limitations were the study's use of the number of taxis as a proxy for demand, and its assumption that regulators set the number of taxis and fares at market-clearing levels where supply and demand are balanced.

This paper develops elasticities for fare revenue and service availability in New York City. Elasticity estimates are based on a large dataset capturing information on taxi revenues, supply and demand. The data used in this analysis comprise the only known time-series data directly measuring these variables and produce the first reliable estimates of taxicab fare elasticities. Results from analysis of this data show how changes in taxi fares, service levels and economic activity affect taxi industry revenues, the demand for taxi trips and the availability of cabs to the public.

Specification Of Models

Econometric equations are developed for each of the central issues outlined above—fares and fare revenues, and cab availability.

Fare elasticities are estimated in an equation in which the dependent variable is *taxicab fare revenue per mile.* This variable directly measures industry fare revenue (gross revenue) gained by a given level of work effort (captured by total mileage). Revenue per mile is probably the most important overall income figure for taxi drivers because it translates directly into the revenue generated by an average shift of driving. Revenue per mile also parallels service demand. Increases in revenue per mile mean that drivers are finding passengers more quickly. Likewise, reductions in revenue per mile reflect a fall in passenger demand.

The impact of the fare and industry size on cab availability is estimated in a second equation in which the dependent variable is *total taxi industry mileage operated without passengers.* These "dead miles" are spent cruising for passengers. This variable measures how readily would-be taxi passengers can hail a cab on the streets of Manhattan. As cruising miles increase, a person standing at a given street corner is more likely to encounter an available cab. Similarly, a decrease in cruising miles decreases the availability of service.

It should be noted that these two equations cannot be combined into a simultaneous two-equation system modeling supply and demand. This is partly because the dependent variable in the first equation is not full trip demand. Revenue per mile measures only "met demand" manifested by passengers who <u>successfully</u> hail a cab. Unfulfilled demand (passengers fruitlessly attempting to hail a cab) is not recorded by this variable.

A more fundamental impediment to creating a two-equation system is that the conditions in New York City do not reflect normal supply and demand conditions. The City government's cap on the overall number of taxicabs prevents taxi companies from adding cars to their fleets to meet rising demand. Thus, the feedback implicit in a two-equation model, in which supply expands to satisfy rising demand, is absent.

In addition, individual taxi operators often <u>reduce</u> the amount of service they offer when demand quickens. These drivers engage in income targeting, so that when they can meet their income goal more quickly, they work shorter days. Thus, within this segment of the industry, an increase in demand can produce a <u>contraction</u> in supply.

These non-market conditions make it likely that revenue per mile and supply are not related. As shown below, this is in fact the case. Thus, there is no utility to specifying a simultaneous two-equation system.

Equation 1: Revenue per mile

New York taxi passengers are primarily people living and/or working in Manhattan and traveling to and from work, home and entertainment, shopping and other leisure pursuits. Business travelers and tourists also generate a significant portion of the taxi industry's business (Schaller, 1993). Thus, fare revenues (and trip demand) are closely related to employment levels and the levels of business, leisure and tourist activity in Manhattan.

A second influence on revenue and demand is the taxi fare. Taxicabs are one of several transportation options that include buses, subways, nonmedallion car services, walking and, to a limited extent, private autos (Schaller, 1993). A rise in the taxi fare should reduce demand for taxi service as patrons elect other means of transportation or forego their trips altogether.

The bus/subway fare may also influence demand for taxi rides, as buses and subways are a main transportation alternative to taxicabs for Manhattan travelers.

Finally, it is desirable to test whether changes in the supply of taxi service affect taxi revenue and demand. Does an expansion in industry size reduce the number of passengers obtainable in an individual driver's shift?

Thus, the initial specification for revenue and demand is:

Revenue per mile = f (economic activity; taxi fare; bus/subway fare, supply)

After testing, the supply variable is dropped from the final equation because it is not a significantly related to revenue per mile.

Equation 2: Service availability

Like fare revenue, availability is a function of economic activity, taxi fares, bus/subway fares and supply. In each case, the influence is the opposite of that expected for revenues. As economic activity rises more people seek to use taxicabs and service availability declines. A taxi fare increase should expand availability as fewer people desire to take cabs. Conversely, a bus/subway fare increase may reduce availability as passengers switch away from public transportation. Finally, an expansion of supply should improve availability.

The specification for service availability is:

Availability = f (economic activity; taxi fare; bus/subway fare; supply)

After testing, the bus/subway fare is dropped from the equation.

Data

The data used in this analysis comprise the only known dataset on taxicab revenues and supply. Fare revenue and service availability are estimated from taximeter and odometer readings gathered during taxicab inspections conducted at the New York City Taxi and Limousine Commission's (TLC) centralized inspection facility. Each cab is inspected three times a year. One group of taxis is inspected in January, May and September of each year; a second group in February, June and October; a third group in March, July and November; and a fourth group in April, August and December. Comparing taximeter and odometer readings from consecutive inspections yields each cab's total trips, total revenue and total miles for the intervening four-month period. (See Appendix.)

TLC provided taximeter and odometer readings for all initial inspections from January 1990 to December 1996. Data were checked for completeness and consistency. Results for revenue, mileage or revenue per mile that are incomplete, inconsistent or that fall outside a normal range of values were excluded from the dataset. There were 89,039 inspection records with usable data, or an average of 1,113 valid records per month over 80 months of inspections.

Data are weighted by industry segment to prevent the bias that would occur in an unweighted dataset because some industry segments (e.g., owner-driven cabs) are replaced less often—and thus have more valid readings—than other segments (e.g., fleet cabs).[1]

Dependent variables

Revenue per mile. Revenue is measured as metered fares, excluding the 50 cent per trip evening surcharge that is not captured in the taximeter data. Revenue is divided by miles driven to control for changes in work effort. Revenue per mile is adjusted downward by 20 percent after the 1996 fare increase to produce the variable used in the equation (ADJ. REVM). This variable measures met demand—essentially the number of trips provided—as well as revenue.

ADJ. REVM fluctuates seasonally, hitting annual lows while New Yorkers are on vacation in July and August. The secular trend shows ADJ. REVM decreasing by a total of 2.8 percent from 1990 to 1992 as a deep recession substantially cut employment, business activity and tourism. The economic recovery helped lift ADJ. REVM by a total of 9.4 percent from 1992 to 1995.

[1] Revenue data from inspections are also adjusted upward starting in February 1996 to incorporate flat-rate fares originating at Kennedy International Airport, based on taxi dispatch data provided by the Port Authority of New York and New Jersey. Prior to February 1996 trips originating at JFK were charged on the meter and are included in meter revenue figures.

Growth was particularly strong from Fall 1994 to Spring 1995. After the March 1996 fare increase, ADJ. REVM declined slightly (0.8 percent) compared with the same months in 1995.[2]

Table 1. Annual Average Change in Model Variables

	Adjusted Revenue per Mile (ADJ. REVM)	Service Availa-bility (AVAIL)	Economic Activity (E&D)	LAYOFFS	Total Taxicab Mileage (MILES)	Real Taxicab Fare (TAXI-FARE)	Real Bus/Sub-way Fare (BUS-FARE)
1990-91	-2.0%	5.8%	-8.7%	317.8%	2.5%	-4.3%	-4.3%
1991-92	-0.9%	4.5%	-2.6%	4.3%	2.8%	-3.5%	4.9%
1992-93	2.4%	-2.6%	1.1%	0.0%	0.2%	-2.9%	-2.9%
1993-94	2.5%	-6.0%	5.3%	0.0%	-1.7%	-2.3%	-2.3%
1994-95	4.2%	-6.4%	4.2%	0.0%	-0.1%	-2.4%	0.0%
1995-96*	-0.8%	-0.1%	2.6%	0.0%	-0.7%	16.6%	13.3%

* 1995-96 comparison is for March-December of each year to show comparable periods before and after the effect of the March 1, 1996 fare increase.

Service availability (AVAIL) is measured as the number of miles spent cruising for passengers, which equates to the amount that taxis are available for street hail. AVAIL is calculated based on trips, units and mileage data from inspection records.

AVAIL jumped by 10.6 percent from 1990 to 1992, reflecting both the decrease in ADJ. REVM and an increase in total miles of operation. AVAIL then dropped by 14.5 percent from 1992 to 1995 with the growth in taxi demand. AVAIL was essentially unchanged after the March 1996 fare increase.

Independent variables

Economic activity is measured by insured employment[3] at Manhattan eating and drinking places (E&D). E&D captures overall Manhattan

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[2] The 0.8 percent averages the year-over-year changes in ADJ. REVM for inspection data for 4-month periods ending July through December. Note that for most of the period, the drop-off was greater. This is because of an anomalous figure from July inspections (showing higher ADJ. REVM compared with a year earlier). In later months, ADJ. REVM decreased by up to 4 percent compared with a year earlier.

[3] These employment data are based on “insured” payrolls, counting workers covered by

employment levels and level of leisure and visitor activity, the main sources for taxi demand.

E&D fell sharply during the recession of the early 1990s, plummeting 13.2 percent from the peak of 1989 to 1992. (These declines are nearly identical to reductions in overall Manhattan employment.) E&D rose steadily thereafter, increasing 10.9 percent from 1992 to 1995 and 2.7 percent in 1996 for the period after the taxi fare increase. E&D's growth from 1992 to 1996 reflected a combination of much more modest growth in overall employment and increases in leisure and visitor activity.

E&D's rapid decline in the early 1990s appears to overstate the reduction in economic activity. Some workers laid off in corporate downsizing and restructuring became self-employed and thus are not recorded in the insured employment series. These workers appear to have created a demand for taxi service that is important to account for in the model. Therefore, the cumulative drop in Manhattan private insured employment during the early 1990s (LAYOFFS) is added as a second economic variable in the demand equation. LAYOFFS jumped from virtually zero in January 1990 to 168,661 in September 1991.

Taxi supply is measured as total odometer miles of operation (MILES). MILES grew by 5.4 percent from 1990 to 1992 as more cabs were double-shifted and some drivers worked longer hours to compensate for falling revenue per mile. Mileage has declined slightly since 1992.

The taxi fare (TAXIFARE) is computed for an average trip of 2.64 miles and 5.1 minutes of wait time. The fare increased by 12 percent on January 7, 1990, at the start of the study period, and by 20 percent on March 1, 1996. The bus/subway fare (BUSFARE) represents the price of the main transportation alternative to taxis. Bus/subway fares are charged on a flat per-trip basis—there is no variation in fares by distance traveled. BUSFARE increased from $1.00 to $1.15 in January 1990, then to $1.25 in January 1992 and $1.50 in November 1995.

Also included in the model is a dummy variable for July (SUMMER) to capture reduced summer demand not reflected in E&D.

E&D, LAYOFFS and MILES are computed as four-month averages to match the months reflected in ADJ. REVM and AVAIL. TAXIFARE and

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the state unemployment insurance program. Coverage is not required for self-employed workers.

BUSFARE are adjusted for inflation and computed as four-month averages. SUMMER is computed as a four-month average. The logarithmic form of equation is employed.

Estimation Results

Fare Revenue

The first equation takes the following form:

$$Log(ADJ.\ REVM) = \beta_0 + \beta_1{*}log(E\&D) + \beta_2{*}log(LAYOFFS) + \beta_3{*}log(TAXIFARE) + \beta_4{*}log(BUSFARE) + \beta_5{*}log(MILES) + \beta_6{*}SUMMER$$

It should first be noted that the coefficient for MILES is small and not statistically significant (elasticity of -0.027, t-statistic is 0.41). This means that revenue of existing taxi owners and drivers is not affected by changes in supply. This finding applies to the fairly large magnitude of changes experienced in the study period—fluctuations over a range of 9 percent—but not necessarily for very large changes in supply.

Since MILES is not a significant factor, it is dropped from the equation. Results for the revised equation are shown in Table 2. The equation explains 94 percent of the variation in ADJ. REVM. The Durbin-Watson test for serial correlation produces an acceptable result.

Figure 1 shows actual and estimated ADJ. REVM by month.

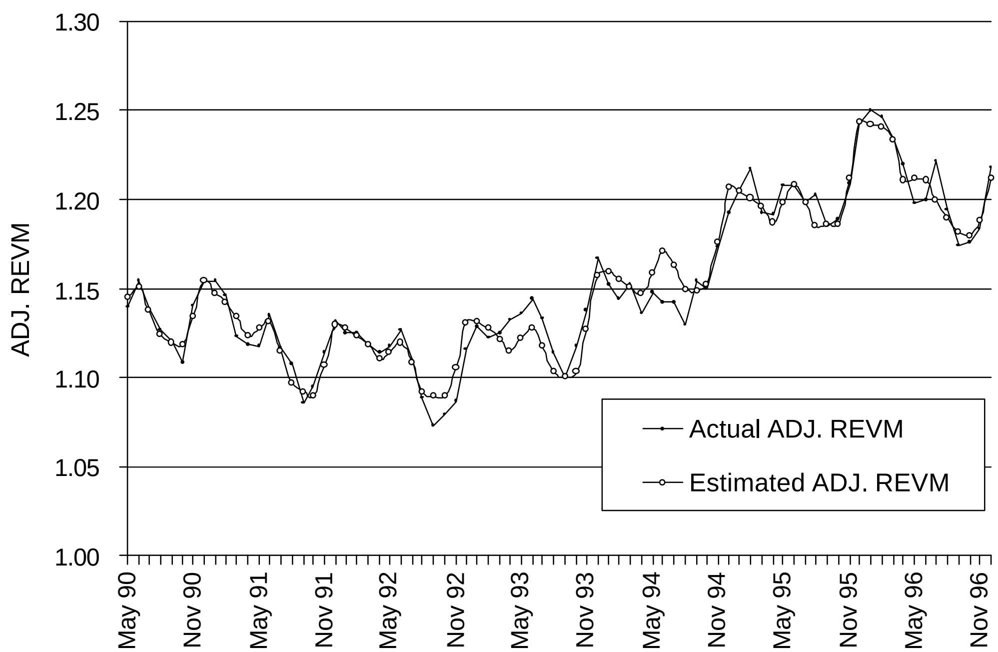
E&D is the largest influence on ADJ. REVM, reflecting the importance of changes in the economy on changes in taxicab fare revenues. The coefficient of 0.65 is the elasticity, meaning that a 1.0 percent increase in E&D produces a 0.65 percent increase in revenue per mile, assuming no change in other variables. The very large t-value indicates that the relationship between E&D and ADJ. REVM is highly significant.

Table 2. Revenue Model Results

	Coefficient	Standard error	t-statistic
Constant	(3.03)	0.13	(22.62)
E&D	0.65	0.02	27.01
LAYOFF	0.02	0.00	6.94
TAXIFARE	(0.22)	0.03	(7.75)
SUMMER	(0.03)	0.00	(7.96)
BUSFARE	0.04	0.03	1.45

$R^2 = 0.94$ F-statistic: 256.58 Durbin-Watson test: 1.80

Figure 1. Actual and Estimated ADJ. REVM



Laid-off workers also affect revenue. The elasticity of 0.02 is deceptively small given the dramatic increase in this variable in the early 1990s. Variation in LAYOFFS produces about one-third the impact on demand as does variation in E&D in the model as a whole[4] and a greater impact in the early 1990s (see simulation section below).

The fare coefficient of -0.22 indicates that demand falls in response to a taxi fare increase. The estimated elasticity of met demand with respect to the fare is -0.22. In terms of revenue, a 1.0 percent increase in the taxi fare reduces ADJ. REVM by 0.22 percent. It can thus be estimated that the 20 percent fare increase of 1996, by itself, increased *unadjusted* revenue per mile by 16.0 percent (the 20 percent increase being offset by 4.0 percent from the reduction in demand).

Conversely, a 10 percent decrease in the real fare (representing about 3 years worth of inflation) produces a 2.1 percent rise in revenue per mile.

The dummy variable indicates that revenue per mile falls by 3 percent in the summer over and above the falloff accounted for by seasonality in E&D and LAYOFFS.

At 0.04, the elasticity for the bus/subway fare is small and statistically significant at only a 85 percent level of confidence, so there is inadequate basis to conclude that changes in the bus/subway fare affect taxi demand. BUSFARE is retained in the equation to ensure an accurate specification of the model, given the fairly high correlation between BUSFARE and TAXIFARE.[5]

No real differences between short-term and long-term elasticities are evident in the data. Dynamic formulations in which ADJ. REVM is added as a lagged dependent variable indicate that 94 percent of the long-term changes in revenue occur in the first four months. Long-term elasticities are the same as in the static model. It should be noted that long-run effects may not be evident because of the relatively short period between the taxi fare increase and end of the dataset (March to December 1996).

Service Availability

The availability equation takes the following form:

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[4] The standardized beta is .28 for LAYOFFS compared with .90 for E&D.

[5] The BUSFARE and TAXIFARE correlation is 0.49. With BUSFARE omitted from the revenue/mile equation, the coefficient for TAXIFARE drops from 0.22 to 0.20.

*Log(AVAIL) = ß0 + ß1*log(E&D) + ß2*log(LAYOFFS) +*
*ß3*log(TAXIFARE) + ß4*log(BUSFARE) +*
*ß5*log(MILES) + ß6*SUMMER*

BUSFARE is not a significant influence on AVAIL (coefficient of -0.05 and t-statistic of 0.91) and so is dropped from the equation.

Table 3 shows results. The adjusted R-square is 0.95 and the Durban-Watson test of serial correlation is acceptable. Figure 2 shows actual and estimated AVAIL by month.

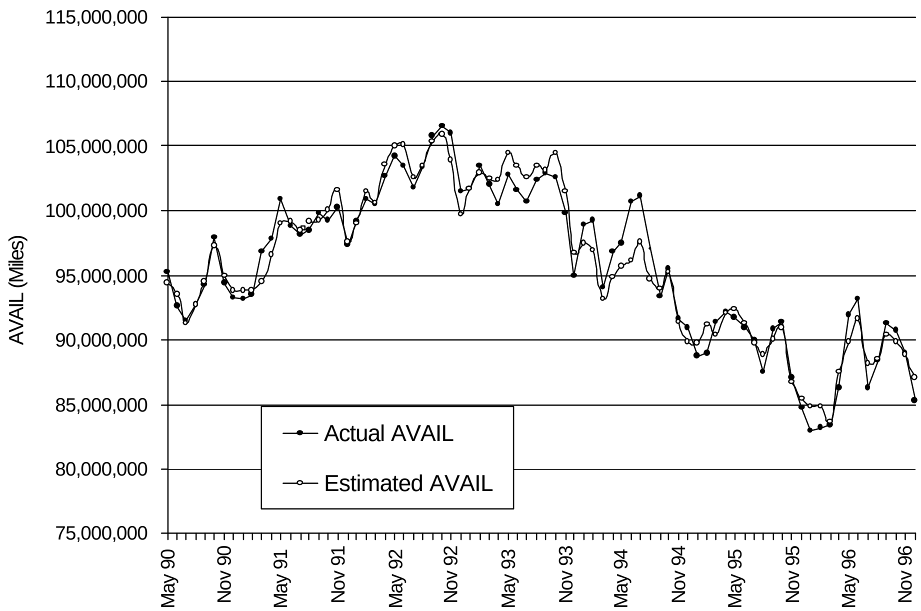
As expected, the elasticity of availability with respect to supply is very close to one (1.14). Given a standard error of 0.11, the elasticity is not significantly different from one. Thus, availability changes at virtually the same rate as industrywide mileage, assuming no change in other variables. An increase in cabs does not glut the market with empty cabs.

Table 3. Service Availability Model Results

	Coefficient	Standard error	t-statistic
Constant	3.55	0.98	3.61
MILES	1.14	0.11	10.62
E&D	(1.06)	0.04	(28.28)
LAYOFF	(0.04)	0.00	(8.08)
TAXIFARE	0.28	0.04	7.28
SUMMER	0.04	0.01	5.06

R^2 = 0.95 F statistic: 287.74 DurbIn-Watson test: 1.78

Figure 2. Actual and Estimated Service Availability



Economic activity has a large impact on service availability. A growing economy reduces the availability of service, as shown in the 1980s and mid-1990s. A shrinking economy frees up cabs for hailing passengers, as experienced in the early 1990s. The elasticity of 1.06 indicates that a 1.0 percent increase in E&D produces a 1.06 percent decrease in AVAIL—or vice versa. Taxi ridership by those laid off from their jobs in the early 1990s partially offsets the impact of the employment losses.

The real taxi fare also affects availability, with an elasticity of 0.28. An increase in the taxi fare increases availability as some passengers turn away from using cabs after a fare increase. Conversely, more people want to take cabs as inflation erodes the real cost of a trip.

Summer seasonality slightly affects availability (cabs are more easily found in the summer).

Simulations

Regression results can be used to quantify how changes in the economy and fares affect demand and availability. Four "what if" scenarios show the effects of changes in fares and economic activity:

No 1996 fare increase. The econometric model indicates that, had there been no fare increase, fare revenues would have increased because of economic growth and a continued decline in the taxi fare in real dollars. Service availability would have shrunk for the same reason. The model indicates that without a fare increase, revenue per mile would have grown by 3.3 percent between 1995 and 1996.[6] Thus, of the actual revenue increase of 19.2 percent, 3.3 percent is attributable to rising demand and the effect of inflation and 16.0 percent to the fare increase. Without the fare increase, service availability would have shrunk by 4.7 percent, hitting the lowest level in over 7 years, rather than being essentially unchanged.

No recession. Taxi fare revenues were depressed by the 1990-92 recession. The model indicates that had economic activity remained unchanged over this period, revenues would have grown by 1.8 percent instead of falling by 2.8 percent. (The model predicts an increase in service availability, but this is questionable since much of the increase is driven by a growth in overall industry mileage, which was probably precipitated by the declining revenues.)

Laid off workers "disappear." Taxi demand would have fallen more rapidly in the early 1990s had employees who left insured employers stopped using cabs. From 1990 to 1992 revenue per mile shrank by 2.8 percent; had no laid off workers used cabs, revenue per mile would have shrunk by 5.2 percent.

No economic recovery. Between 1992 and 1995, the growing economy helped produce a 9.3 percent increase in fare revenue per mile and 14.3 percent decrease in availability. Without any economic growth, revenue per mile would have increased by only 1.5 percent, and availability would have shrunk by 3.0 percent.

Conclusions

This paper provides estimates of fare and service elasticities for New York City taxicabs. These estimates are based on a longitudinal dataset with a large number of observations and coverage of all industry segments. The period

[6] The comparison is between March-December 1996 and March-December 1995. Other comparisons in this section are for full one-year periods.

1990 to 1996 includes significant variation in key variables: a downturn in the local economy and the subsequent recovery; a significant erosion of the taxi fare in real dollars and a 20 percent fare increase; and an increase in taxi service supply (primarily due to existing cabs logging more mileage).

The fare elasticity of 0.22 indicates that the value of a fare increase to the taxi industry is somewhat reduced by the concurrent decline in trip demand. The good fit of the model over both pre- and post-fare increase periods indicates that fare elasticities apply both when the fare goes up and when the fare is eroded by inflation.

There is no evidence that a fare change's impact on demand diminishes over time—i.e., no evidence of a "sticker shock" that wears off. A caveat should be offered, however, because the fare increase occurred only 10 months before the end of the study period.

Service availability elasticities indicate that changes in economic conditions significantly affect availability. Availability contracts with an improving economy and expands during economic downturns. Availability also grows and shrinks at about the same rate as changes in supply. Thus, at least for the fairly significant increases in supply experienced during the study period, excess demand readily absorbs additional supply. This finding is particularly notable because additional supply was successfully absorbed during a recession when one might expect demand to be weakest.

These findings fill in key gaps for taxicab regulators facing decisions on fare increases and service levels. Although the dataset is specific to New York City, the following policy implications should be of general interest, both for their substance and to show how fare revenue and service availability data should be vital parts of policy-making.

The most direct implication concerns how regulatory actions affect taxi owner and driver incomes. When increasing the taxi fare regulators should take account of the simultaneous drop-off in demand in calculating how much revenues will rise. The New York City results indicate that regulators can expect that a 20 percent fare hike will increase fare revenues by about 16 percent, other factors such as the economy being unchanged.

Failure to take fare elasticities into account can seriously erode the amount of money reaching taxi drivers from a fare increase, often a primary concern of regulators. For example, regulators may permit lease rates to increase by the same percentage as the fare with the expectation that drivers' take-home income will also rise by that percentage. In fact, given a fare elasticity of 0.22 driver income would rise by only about six-tenths of the anticipated amount.[7]

In adjusting lease rates, regulators should also take into account the ongoing effects of inflation and changes in economic activity. Fare revenue and lease rates are generally focused on only when a fare increase is under consideration. Results from New York City, however, show that fare revenue may grow or decline considerably between fare increases. Thus, lease fee regulation needs to be an ongoing enterprise, not one confined to when the rate of fare is changed.

Finally, an important implication for the public's most tangible concern—ease of getting a cab—is how the economy and fare increases affect service availability. Service availability fluctuated over a 22 percent range in New York in the 1990 to 1996 period. This fluctuation can cause cabs to be too scarce at times and too plentiful at other times. Cab shortages mean that many passengers have difficulty finding a cab and that some passengers are outright refused service. On the other hand, an overabundance of service is problematic for both the industry (which experiences a drop in revenues) and public safety, setting up dangerous competition for passengers among cabbies (see Sims, 1991).

To maintain availability within an acceptable range, municipal governments can adjust the fare and/or the number of cabs in their jurisdiction. Econometric results indicate that the number of cabs can be increased without reducing the revenues of existing operators.

[7] An example illustrates this issue. Suppose that fleet drivers gross $220 per shift and net $103 after paying a $100 lease fee and $17 for gasoline. With a 20 percent fare increase and 20 percent rise in lease fees, drivers' take-home would increase by 23 percent if their fare revenue rises by 20 percent, but only by 15 percent if fare revenue increases by 16 percent, as predicted by the econometric results.

Appendix: Note on Data Source

The structure of the dataset used in this paper is a bit confusing because of the overlapping nature of observations from continuous tri-annual inspections. This Appendix shows how the taxi revenue and mileage data are derived from vehicle inspections.

In New York City, taxicabs are inspected on a four-month cycle. For the purposes of the dataset, taxicabs are segmented based on inspection month within each cycle. Thus, Group A cabs are inspected in January, May and September of each year; Group B cabs are inspected in February, June and October; Group C cabs in March, July and November; and Group D cabs in April, August and December.

Taximeter and odometer readings collected at each inspection are compared with readings from the same cab's previous inspection to calculate revenue and mileage for the intervening four months. Taking Group A as an example, the table below shows the observations produced by this methodology and the label used for each observation in Figures 1 and 2 in the text.

Observation #	Data covers this period	How month is labeled in Figures 1 & 2
1	Jan. 1990-May 1990	May 1990
2	May 1990-Sept. 1990	Sept. 1990
3	Sept. 1990-Jan. 1991	Jan. 1991
4	Jan. 1991-May 1991	May 1991
…	…	…
19	Jan. 1996-May 1996	May 1996
20	May 1996-Sept. 1996	Sept. 1996

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