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## Why has the Price of Taxi Medallions Increased So Dramatically? An Analysis of the Taxi Medallion Market

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# Why has the Price of Taxi Medallions Increased So Dramatically?

## An Analysis of the Taxi Medallion Market

DAN CUMMING

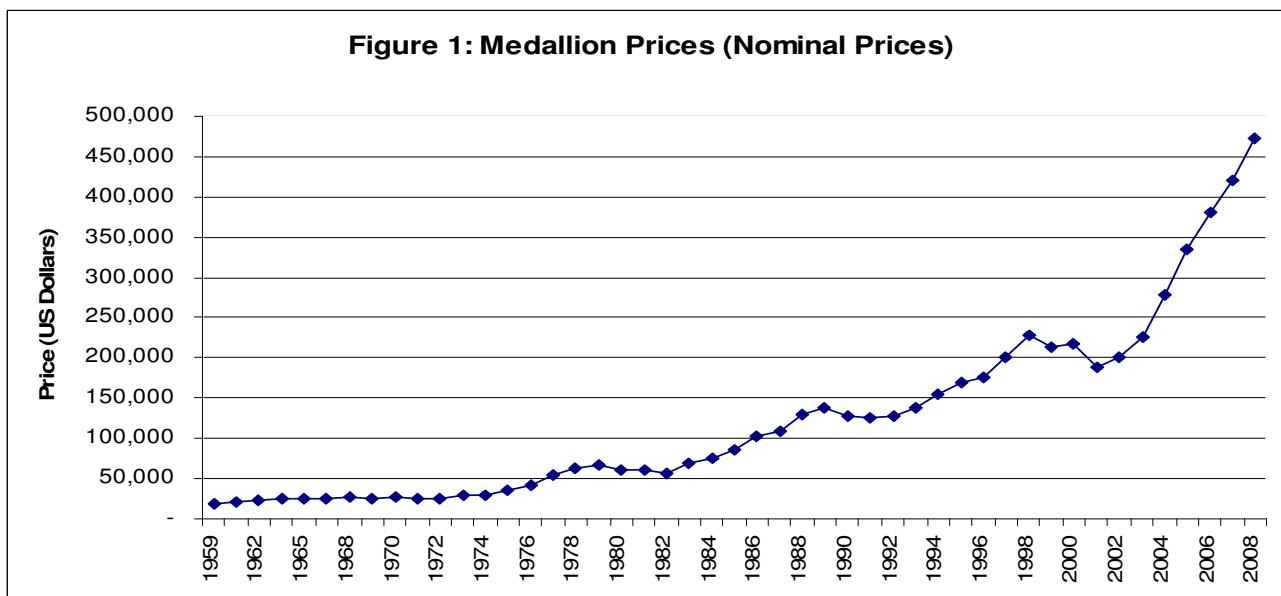
### I. Introduction

On May 30<sup>th</sup>, 2007, a New York City Pakistani taxi driver sold his taxi medallion for \$600,000, netting him a profit of \$570,000 on his twenty-six year investment. Medallion prices have more than doubled since 2000 (see Figure 1), and the increases are not expected to slow down anytime in the near future (Tharp, 2008). The unbelievably high profit margin begs one to question why the market price of taxi medallions has increased as quickly as it has.

It is imperative that the determinants of the price of taxi medallions are discovered. The people that would benefit most from this research would be taxi drivers. The high prices of taxi medallions have taken a toll on the ailing taxi driver labor force, as drivers have been battered by rising lease payments for taxi medallions, rising fuel prices, hybrid regulations, and a weak economy. Drivers that saved wages with the intention

of someday owning a taxi medallion are attempting something that is nearly impossible. Increases in the price of taxi medallions have made leasing them more expensive, creating higher costs for drivers (Abrams et al., 2007). Drivers will need to be compensated for the rising costs. Knowing the determinants and having some ability to predict the price of taxi medallions will allow policymakers to determine a suitable fare for taxi service so that taxi drivers can achieve reasonable living standards as their current incomes hover above the poverty line (Gilbert, 1996).

The role of the taxi medallion strictly as a market tool used to limit the supply of taxis on the street has been expanded. They have now become alternative methods of investment for people dissatisfied with the conventional options for money growth. This study also presents useful information for investors who currently are or may be looking into owning a taxi medallion as an investment.



This investigation will also provide local governments with relevant information for determining the appropriate number of taxi medallions for a particular city. Assigning too many medallions leads to higher levels of pollution and congestion, as well as creating an overcrowded, wage-depressing taxi labor market (Koehler, 2005). Assigning too few taxi licenses hampers the city goers' ability to move around the city efficiently. Knowing what has caused the price of medallion to increase so quickly may directly relate to demand for taxi service, which would assist local governments in assigning the most efficient and effective number of taxi medallions.

## II. Literature Review/Theory

The birth of the regulated taxi medallion market in New York City dates to the 1937 Haas Act, which froze the city government's ability to issue taxi licenses (Gilbert, 1996). As taxi drivers slowly retired over the next decade, the number of taxi licenses in New York City dropped from 21,000 in 1931 to 11,414 in 1947. The government's control over the number of taxi licenses presents a unique situation in the sense that there have been large increases in the demand for this good, while at the same time the government has decided to keep the supply of the good relatively fixed. Congestion and pollution have been two of the main deterrents of any significant increases in the number of medallions. The number of licenses has only increased from 11,414 to 12,779, less than twelve percent over the last sixty years (Schaller, 2006). Because the average annual increase in the supply of medallions was 0.2%, I will assume that the quantity of medallion supplies is inelastic.

In 1979, the taxi medallion industry of New York City was revolutionized with the Taxi & Limousine Commission's decision to legalize the leasing of taxi medallions. Prior to this change, taxi drivers had been salaried employees of corporate companies with common benefits such as health insurance, sick pay, vacation wages, and unemployment compensation (Gilbert, 1996). The legalization of leasing transformed the driver-medallion owner relationship by converting drivers from employees to independent contractors. Since 1979, medallion owners have been permitted to lease the licenses out at a fixed rate to drivers. They have also been relieved of their obligation to comply with U.S. labor laws involving wages, benefits, and the maximum workday of eight hours (Gilbert, 1996). This legislation has forced drivers to shoulder the financial burden and economic risk of driving a taxi, as they are the ones that will be affected by failing to bring in revenue. Municipal governments have also capped the amount of revenue that drivers can charge customers, further crippling drivers' ability to earn a living wage.

While this legislative change has certainly had an ill effect on taxi driver welfare through decreased wages, the elimination of worker benefits, and longer hours, the point of focus for this study is on the change of the taxi medallion from a necessary tool of the industry to a commodity for investors. The switch did not take place immediately, but by the mid 1980's, nearly all drivers were lessees. Medallion owners brought in an average of thirty-three dollars per shift in 1981. By 1986, the average profit per shift had increased to fifty-seven dollars (Gilbert, 1996). The emergence of leasing in the taxi industry has made owning a taxi medallion much more profitable.

After leasing took effect in the taxi medallion industry, taxi medallions became a traded commodity that historically speaking have yielded better than average gains (Schaller, 2004). Not only do medallion owners receive a capital gain upon selling the medallion, but they also receive a fixed stream of steady lease payments from drivers. This new role of the medallion as an investment may deter some from putting their funds in the stock market; the medallion can be viewed as a substitute investment. Under this theory, the price of the medallion would be inversely related to a stock price index. However, the stock market also tends to fluctuate directly with the economy, and this relationship may diminish or even reverse the effects of the substitute investment effect.

Whether the economy is in a recession or an expansion will affect the demand for taxi service. In an expanding economy, consumers will be more likely to go out for a night on the town, tourists will be more likely to take a short trip to a metropolitan area, and city dwellers will be more likely to go on vacation. All of these trends result in increases in the demand for taxi service. Consumers and tourists who want to experience New York City will demand transportation, much of which will be supplied by taxi drivers. City dwellers who are going on vacation may find taking a taxi to and from the airport less expensive than driving themselves and paying parking for the duration of their vacation (Schaller, 2005). As a result, an increase in the GDP of the United States will increase the demand for taxi service. Unemployment figures have also been used as a measure of the strength of the economy, and decreases in unemployment levels should coincide with increases in the demand for taxi service.

Two recent financing trends have had an impact on the price of taxi medallions as well. Long term interest rates have fallen in the last twenty years, making it much easier to secure the funds for a taxi medallion (Schaller, 2006). Buyers who secure a loan at a lower interest rate are more capable of affording a medallion. Furthermore, banks have allowed

debtors to pay back the loans over longer periods of time, which has also contributed to the affordability of taxi medallions (Schaller, 2006). Since longer loan terms are associated with smaller individual payments, more prospective buyers have been able to afford taxi medallions.

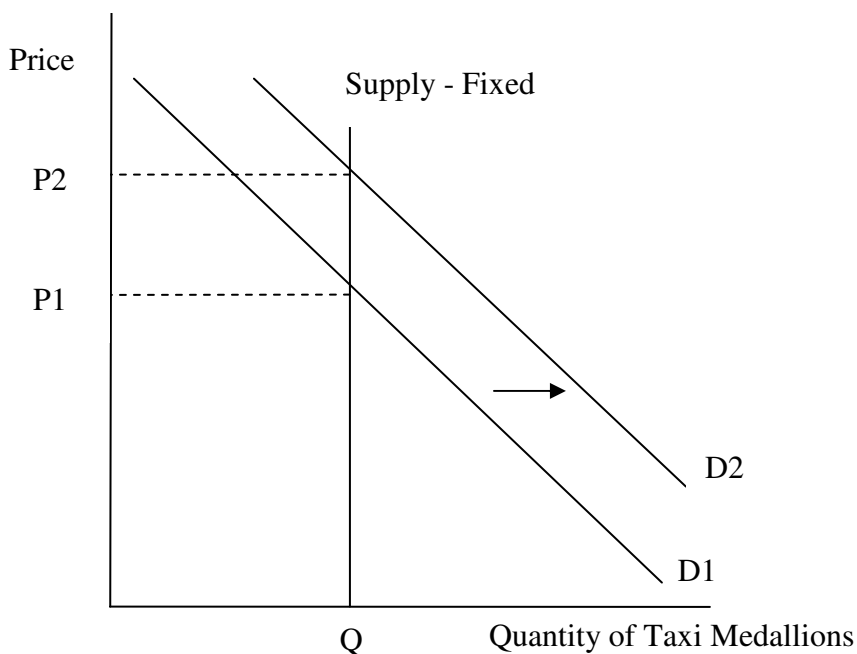
The most significant factor for taxi medallion demand is the demand for taxi service. As the number of taxi clientele increases, the profitability of driving a taxi increases, making licenses to drive taxis more valuable. Historically, demand for taxi service has been measured by the “public convenience and necessity” (PCN) index (Gilbert, 1996). This index is the result of a large number of surveys and observations which aims to effectively determine the probability of a taxi being readily available (Thigpen, 2007). The PCN index is a useful tool in directly determining the demand for taxi service; unfortunately, I do not have access to the data from the surveys and will be using a more indirect approach to determining changes in demand for taxi service. The economic indicators discussed above will be used as proxies in determining the demand for taxi service and the price of taxi medallions. Another possible demand shifter is the availability of substitute modes of transportation. For example, opening a subway line to an airport should cause the demand for taxi service to decline.

Medallion prices will be a function of supply and demand variables for taxi medallions in New York City’s regulated market. Because supply has remained relatively fixed over the last fifty years, I will assume supply is constant for the purpose of this study (Schaller, 2006). As a result, the changes in the price of taxi medallions must be attributed to changes in the demand for medallions. Figure 2 illustrates the inelasticity of supply as well as the effects of an

increase in medallion demand on the price of taxi medallions.

If the economy is in a period of growth, and the demand for taxi medallions increases, then based on the supply and demand model above, demand will shift to the right, effectively increasing the market

**Figure 2: Theoretical Supply and Demand for Taxi Medallions**



price of taxi medallions. Likewise, if interest rates are lowered, and the affordability of licenses increases, demand will shift to the right, raising the price of taxi medallions.

I hypothesize that unemployment rates and interest rates will be inversely related to fluctuations in medallion prices. I also predict that changes in stock price index and population will be positively correlated with changes in medallion price. However, in relation to stock price, I would predict a negative sign if medallions are viewed as a “safe haven” for investors. For the medallion price dependent variable I calculated averages of the auction prices and transfer prices for each year.

**Table 1: Independent and Dependent Variables**

Variable	Type	Description	Expected Sign
Medallion Price (in real terms)	Dependent	Average medallion auction price for New York City – in 2007 dollars	N/A
Stock Price Index (in real terms)	Independent	Annual averages for S&P 500 – in 2007 dollars	+
Unemployment Rate	Independent	Rate for New York City	-
Interest Rates	Independent	Long term interest rates	-
Population	Independent	Estimated annual data for state of New York	+

**III. Data**

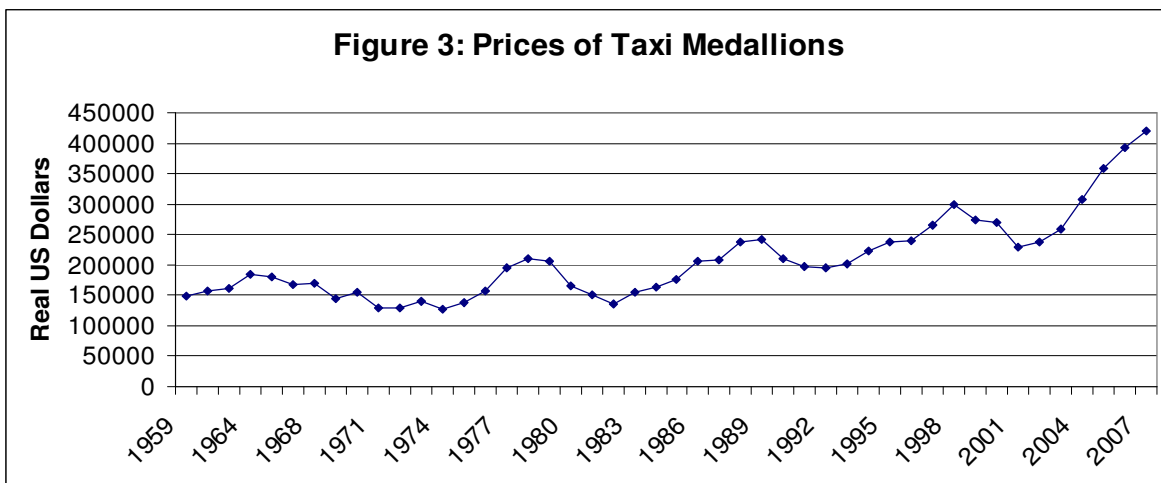
In order to test my hypotheses, I retrieved annual data for average medallion prices in New York City for 1976-2005 from Schaller Consulting Group (Schaller 2005). I found additional medallion price data for 2006-2008 at the New York Taxi & Livery Commission website. It is important to note that the values for the taxi medallion prices are only for individually owned licenses. The other types of owners, corporations in the taxi business, have not been included as many of independent variables used in this study do not fit as well for corporations as they do for individuals.

Concrete population data for specific states is only determined every ten years via the United States Census so I relied on annual population estimates for the state of New York from the United States Census Bureau. Unemployment data for New York City was taken from the Bureau of Labor Statistics. The stock price variable is an annual average of the S&P 500. The final independent variable, long term US interest rates, came from the Organization for Economic Co-Operation and Development. It is important to note

that the data for the stock price and taxi medallion price variables have been altered to incorporate inflation. All of these values have been increased to reflect present day prices based on a 2007 CPI Index for New York from the Bureau of Labor Statistics.

Measuring these variables from the period of 1976 to 2007 is appropriate because its thirty-one degrees of freedom is sufficient for the number of variables in this study, and the time period covers a significant proportion of the life of the New York taxi medallion. The range of time encompasses all of the major market-changing events for taxi licenses.

Figure 3 illustrates the change of medallion prices in real terms, and the data that will be used in the regressions. Prices appear to move with the economy, as the dips in price coincide with the oil related economic crash of the 1980's, the savings and loan crisis of the early 1990's, and the dot com bubble burst of the late 1990's. Prices also have begun steadily rising in the mid 1980's with dramatic increases beginning in 2002.



## V. Empirical Model

I will be running a set of OLS regressions. I initially ran each variable in a linear regression individually, and found that the models did not yield any coherent results. One of the major variables that was referenced in this study, annual U.S. gross domestic product, was removed from the model to remove some of the multicollinearity. Two of the independent variables, stock prices and GDP, act as measures for the strength of the economy, and having both of them in the model seemed redundant.

$$\begin{aligned} \text{Taxi Medallion Price} = & \beta_1 + \beta_2(\text{Unemployment Rate}) \\ & + \beta_3(\text{Population}) + \beta_4(\text{Stock Price Index}) \\ & + \beta_5(\text{Interest Rates}) + \mu \end{aligned}$$

## VI. Results

In Table 2, Model A confirms that only unemployment is significant for these years. The relatively high, negative t value for unemployment rate in combination with the respectable r-squared value of 0.778 leads one to believe that the unemployment rate is a relatively good predictor for medallion prices. For each point that the unemployment rate shrinks, taxi medallion prices are expected to increase by \$13,240 real dollars. In regards to the other independent variables, the signs were all in line with the predictions in the theory section. Both population and stock price appear to have a weak positive correlation with medallion price, and interest rates and the unemployment rate have an inverse relationship with medallion prices.

The surprising aspect of the results is the severe dissimilarity in significance between unemployment rates and stock prices. Both of these variables, though very different from each other, are used to assess the strength of the economy. As stock prices increase and as unemployment rates decrease, the economy is thought to be getting stronger, and as stock prices decrease and unemployment rates go down, the economy is generally thought to be moving into a recession. The extremely high significance of unemployment rates in determining medallion prices in addition to their particularly weak relationship with stock prices provides some evidence for the “safe haven” theory, where investors view the medallion market as a substitute investment for the stock market. When the economy is in a recession, and unemployment rates are rising and the stock market is falling, budgets will be tighter, and people will generally have less money to invest, whether it be in the stock market or in a taxi medallion. This relationship leads one to believe that the stock market moves with medallion prices, and it does according to Table 2. However, the fact that the

significance is so weak may support that when the stock market falls, values of alternative investments like taxi medallions may be buoyed by investors seeking a “safe haven” from the weak economy and from falling stock prices. This theory may explain the discrepancy in significance levels for unemployment rates and stock prices in determining the prices of taxi medallions.

**Table 2: OLS Regression**

	Model A – Unemployment, Interest Rates, Population, Stock Price
Time Period	1976-2007
Constant	-555432 (-.894)
Stock Price	0.347 (0.01)
Unemployment	-13240 (-3.327)***
Interest Rates	-5187 (-1.061)
Population	0.051 (1.52)
R-Squared	0.778

\* indicate significance at the .10 level

\*\* indicates significance at the .05 level

\*\*\* indicates significance at the .01 level

Numbers in parentheses indicate (t-values)

When analyzing the results of all of the models, it is important to note that a time variable has not been included in any of the models. Many of these variables do not significantly fluctuate up and down. Population and stock prices have historically risen steadily over time, and the amount of variation that they explain in medallion prices may not be as significant as the results illustrate.

## VII. Conclusion

The most significant relationship between my independent and dependent variables is that when unemployment goes up, medallion prices will go down. People without jobs will have less disposable income and less of it will be spent on taxi rides, or on investments in taxi medallions.

I heed policy makers to pay particular attention to the unemployment rate when considering auctioning off

more taxi medallions. Though the unemployment rate is a measure of the strength of the economy, and a low unemployment rate is usually an indicator of strong economic standing, there have been some who have suggested there is an opposing unemployment effect in the taxi labor market. They theorize that an increase in unemployment will bring many to temporarily take jobs as taxi drivers and increase the demand for taxi medallions. According to my results, either this is not the case, or the effect is not large enough to make unemployment insignificant in the determination of the prices of taxi medallions.

Future research ideas could include adding time as an independent variable to the empirical model, neutralizing some of the multicollinearity of the model, or obtaining more data on the determinants of taxi demand. The amount of data available relating to taxi medallions is very thin. More data on the determinants of taxi service demand, especially in relation to the variables discussed in Bruce Schaller's "A Regression Model of the Number of Taxicabs in U.S. Cities" (number of workers commuting by subway, number of households with no vehicles available, and number of airport taxi trips were main determinants in demand for taxi service), would allow for more complex and accurate models. In light of the recent recession, it would also be interesting to extend the model to a next couple of years to see how useful it is under present day conditions.

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