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Economics of the Taxi Industry: An Uber Shake-up

Steven Rahel

Spring 2016

Honors Thesis

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University of Wyoming

Introduction

The taxicab has long been one of the dominant forms of transportation in cities around the world. By the late 1930s, most cities had placed government regulations on the taxi industry to combat the oversupply of taxis. This was meant to stabilize prices, ensure the safety and quality of taxis, and give drivers a livable wage. However, these government regulations restricted entry through capping the supply of taxis, leading to the creation of local taxi monopolies in some cities (Snead, 2015). Taxi companies have been benefitting from a lack of competition in the for-hire transportation market until recently. The major challenge that the taxi industry is currently facing is the technological innovation of ride-sharing applications. Ride-sharing companies, namely Uber and Lyft, operate by using a smartphone app to match consumers requesting rides with drivers that will take them there. Since its inception in 2009, Uber has gained significant market share in the United States and worldwide (Uber, 2016).

Downs (2015) writes about a key distinction between ride-sharing app's and taxi's, "Uber doesn't provide its own vehicles or operators, but works with existing licensed drivers" (p. 1). This distinction allows Uber to be viewed as a matchmaker rather than a transport provider, which has kept Uber unregulated, much to the displeasure of the taxi industry. Additionally, Downs talks about how the incumbent taxi companies are demanding that local and state regulators ban Uber or at the very least apply stricter regulations on the ground that such service providers violate unlicensed ride service laws. In less than a decade, Uber has managed to disrupt the long-untouched taxi industry. This paper will argue that the regulations on the taxi industry are outdated, leading to the creation of an inefficient for-hire transportation market. First, the paper will examine the background of the taxi industry and ride-sharing applications. Next, it will discuss problems found in the current situation with the for-hire transportation

market. In the policies section, the paper proposes that government impose more progressive regulations to better match the realities of the 21st century. Lastly, the paper will conclude by recommending alternatives to the current situation that could foster a more efficient for-hire transportation market.

Background

When looking back at the history of the taxi industry, it is easy to see similarities between events that happened nearly a century ago and what is currently going on between taxi companies and ride-sharing companies. The more complex issue is whether the conclusions that were reached in the past are still applicable to the present-day taxi industry.

Taxi Industry

The first form of taxis can be traced back to London, in 1605, with the horse-drawn hackney carriages (Gilbey, 1903). Over the next two hundred years, taxis did not change much. Horse-drawn carriages became smaller and more mobile (called hansom cabs), but the major innovation came in 1897 and the years that followed. Horses were replaced with electric-powered taxis, which in turn were quickly superseded by gas-powered taxis as early as 1899 in Paris. The first gas-powered taxis appeared in New York City in 1907 when Henry Allen imported 65 Darracq metered taxis from France. This made horse-drawn carriages obsolete and began what many now consider the modern taxi service in the United States (Weekend Sunday Edition, 2007). The taxi industry gained momentum in the late-1920s when affordable automobiles (Henry Ford's Model T) entered the market and mixed with low interest rates to make acquiring taxis cheaper. This ushered in a new batch of low-price taxi companies (Lephardt and Bast, 1985, p. 5). This posed a serious threat to previously established companies because the lower price could attract a bigger portion of the market. The established companies

threatened a taxicab war in Milwaukee if regulators did not bar new entry to the market. Threats were also being made in other cities like New York and Chicago and violence against new competition was occurring.

Snead (2015) notices similarities in the taxi industry between the present situation and the past. Uber being the low-price new competition in town, while the incumbent and established taxi companies remain basically the same. In both cases, the established companies are doing everything possible to get regulators to help them by stopping new entry into their market. The resemblance of the two time periods is uncanny. There were the taxi wars back then and now, “the horrifying recent demonstrations of mob violence in France against Uber drivers” (para. 15). The Milwaukee City Council went on to pass a statute in 1928 that required them to refuse taxi permits if transportation availability met the public’s need. Lephardt and Bast (1985) reported that in 1931, the City Council further amended the statute so only one taxicab could operate in the city per two thousand people. It is highly improbable that this ratio could have accurately matched the real supply and demand of Milwaukee at the time. The authors go on to find a Federal Trade Commission (FTC) report that says, “It appears that taxi regulation has often been designed to protect public transit systems and existing taxi firms from competition” (p. 6). These findings suggest that regulations are not in the best interest of the consumer and only benefit a select few existing producers. Even at the time of their creation, it seems the regulations were not put in place to form a more efficient market, but rather to provide existing firms with monopolistic power. Moreover, if the past is any indicator for the future, Uber might be facing significant regulation.

Although a few cities dabbled in regulating the taxi industry, the largest taxi market, New York City, was still largely unregulated. With the Great Depression in full swing, many of the

unemployed turned to the taxi industry to try to earn a living. Snead (2015) talks about a period of massive oversupply of taxis in New York City in 1932. This led to fares collapsing as drivers participated in a race to the bottom for each additional customer. The quality of drivers and cars deteriorated and the oversupply made congestion worse on the streets of New York City. To combat all of this, the Haas Act was passed in 1937, which established the medallion system. The new system required a medallion for every taxi in the city (attached to the hood) and made it illegal to operate a taxi without one. The number of medallions was tightly controlled so the number of taxis is tightly controlled as well. This restricts the supply of taxis the city has.

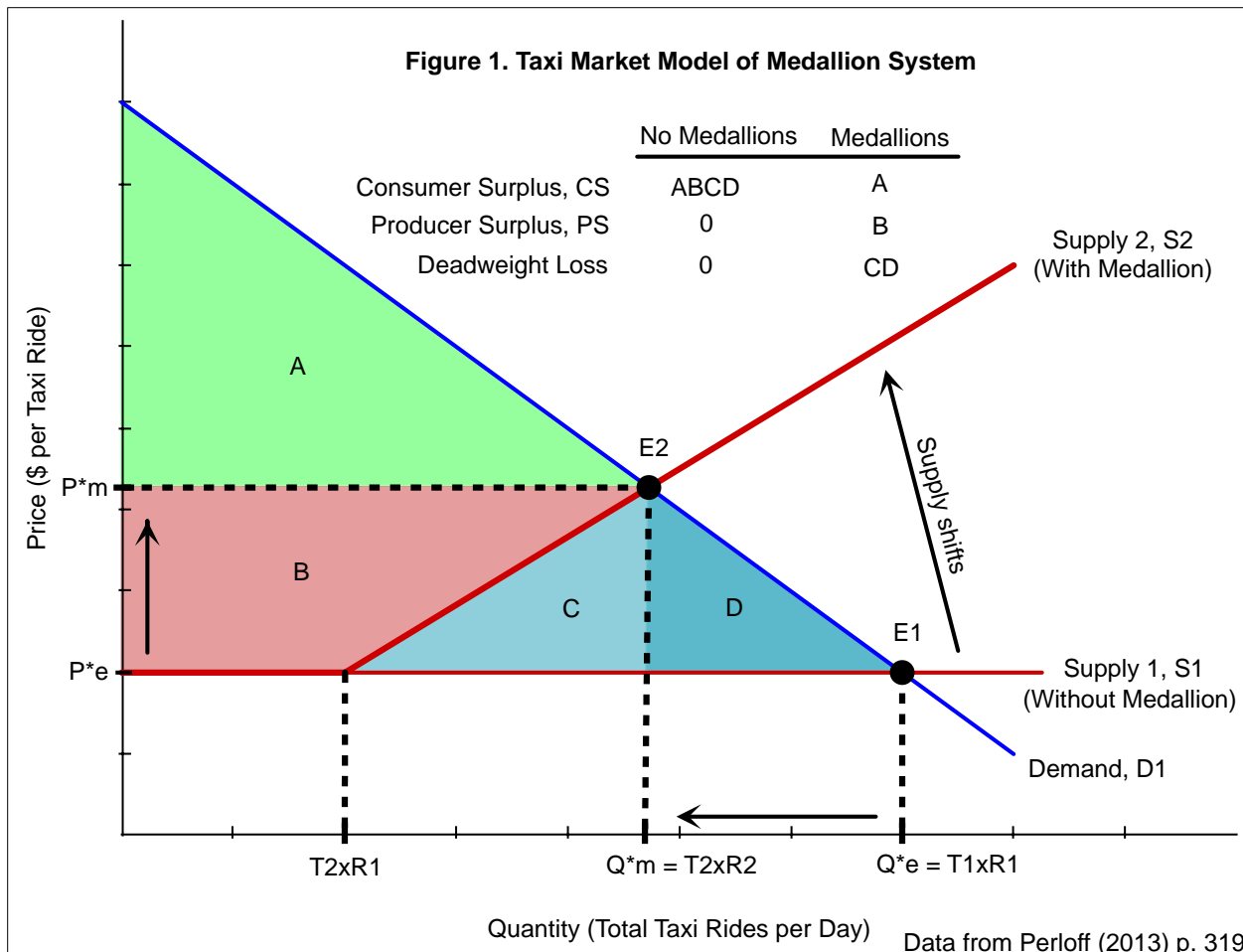
According to the New York City Taxi & Limousine Commission (2014),

Originally it set a limit of 16,900 taxi medallions. However, that number was decreased to 11,787 after World War II. It remained unchanged until 1996 when it was increased by 133 medallions to a total of 11,900. As of now [2014], there are 13,437 total taxi medallions in New York City. (p. 12)

Since the medallion system's beginning to the present, the total number of medallions available is less than the initial amount offered. This means that there are fewer taxis in New York now, than there were in 1937. It does not seem intuitive to decrease supply over time as the city population grows. Instead, this information seems to coincide with Lephardt and Bast's (1985) FTC findings that regulations protect public transit and incumbents from competition (p. 6)

Figure 1 models the relationship between supply and demand when a medallion system is put into effect. The medallion restriction of entry moves the equilibrium point from E1 to E2. Supply is capped at a specific amount of medallions (13,437 in New York City) and shifts the supply curve to S2. The total ride quantity is the product of the number of taxis, T_i , and the average rides per day for the average taxi, R_i . The reduction of taxis reduces the total quantity of rides from equilibrium quantity (Q^*e) to the medallion quantity (Q^*m). This shift also forces the

price upward from P^*e to P^*m . Consumers are the ones who lose out most with the regulations as their consumer surplus goes from areas ABCD to just A.



Area B is the extra profits gained by producers (those lucky enough to receive medallions). Area C is the taxi trips that still occur but at higher cost to consumers. While area D is the taxi rides that no longer occur due to the higher price and reduced supply. Together areas C and D are deadweight loss, which in this model is the daily welfare loss due to the medallion system (Frankena and Pautler, 1984, p. 116).

Lastly, the taxi industry has developed into three main segments that operate differently and function best in different situations. First, there are cruising taxis, also known as street hail

taxis. This segment is how most people imagine taxis; they cruise around cities and customers flag them down off the street. Cruising taxis are most profitable in cities, where there is a large concentration of people looking for rides in a relatively small area. The next segment is taxi stands. Taxi stands act as a meet-up point in locations that have a steady flow of customers. They are most profitable in places like airports, hotels, and nightlife areas. The third segment is the pre-booked taxis, where taxis are assigned to ride requests that have come in. This service is offered in nearly every city and is most popular in smaller cities without public transportation. Due to ride-sharing's similarities to the third segment, electronic hails (e-hails) will be considered part of the third segment as well.

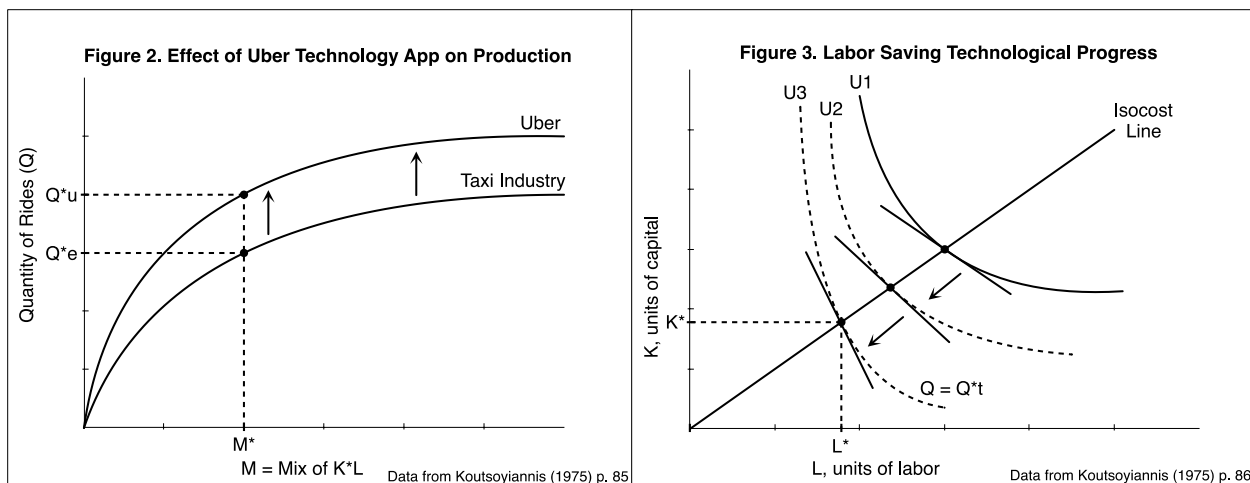
Ride-sharing

The two biggest companies in the ride-sharing space are Uber and Lyft. However, if compared head to head, Uber is far and away the more dominant company in ride-sharing. This paper will therefore focus solely on Uber since it is the main competition to the taxi industry. Currently, Uber operates in 400 cities in 53 countries around the world with the majority of the cities being in the United States (Uber, 2016). In the six years since the company started, it has seen exponential growth and was recently valued at \$62.5 billion (Issac and Picker, 2015). Uber is met with many different reactions when it enters a new market. In some markets the company is met with open arms, while other markets choose to ban the company's operations entirely.

One of the biggest arguments against Uber and the ride-sharing industry is the lack of regulations imposed upon the companies. Quinton (2015) of The Pew Charitable Trusts discusses the current situation of ride-sharing companies, "Ride-hailing companies, which connect paying passengers and drivers through a mobile app, deliver rides like a taxi service. But they're not taxi companies, and states and cities are beginning to regulate them differently"

(para. 3). Quinton's point supports why these companies remain mostly unregulated. The connecting the apps do is the main reason ride-sharing companies have been treated as technology companies. Regulators have come up with the name transport network companies (TNC) for ride-sharing companies. TNC companies do have some regulation, however they are much less strict than the ones on the taxi industry. The biggest concerns that regulators want to address are safety, insurance, and taxes. For example, in California, TNCs are required "to get a permit and commercial insurance coverage for drivers while they're working for them and to run criminal background checks on drivers" (para. 5). Most states seem to employ largely similar regulations. In contrast, the taxi driver's background check requires fingerprint checks while TNC drivers just have their name and social security number checked in criminal databases. Taxi drivers argue regulations should be added to ride-sharing or removed from the taxi industry to allow "fair business competition" (para. 2). Quinton ends her article with the point that, "strict rules that once kept competitors out of the taxi industry have become a straitjacket for taxi companies" (para. 23). The regulations that are holding the taxi industry back right now are the same regulations that taxi companies begged for in the 1920s. The taxi industry loved the regulations when they were profiting from lack of competition, but now they view such regulations as unfair because they're losing out on profits.

Aside from the differences in regulation, another large reason for Uber's success is its technological innovation, the matchmaking application. This allows the company to produce more efficiently through reductions in transaction costs, specifically search costs. Regulated or not, the taxi industry is at a disadvantage because of this labor saving technological change that ride-sharing companies have created.



Figures 2 and 3 are simplified models that assume the taxi industry and Uber, without the app, would have the same production and mix of inputs. They show two different possible effects from the app process innovation. First, the app could allow Uber to produce a higher output (quantity of rides) using the same mix (M) of inputs, capital (K) and labor (L), as the taxi industry. This occurs from the production function shifting upward in figure 2. The other option is shown in figure 3 by the production isoquant shifting inward from U_1 to U_3 . The inward shift means that Uber could use less capital and much less labor to produce the same amount of output as the taxi industry. This mostly affects the pre-hail taxi market since Uber only picks up pre-booked customers.

It turns out in reality the effect might fall somewhere in the middle of the two models. A report from Cramer and Krueger (2016) looking at utilization rates of UberX (Uber's cheapest type) vs. taxis, says "...our findings have implications for the efficiency of for-hire drivers.... Ignoring fixed costs, if fares are linear, this implies that UberX drivers could charge 28 percent ($=1-1/1.38$) less than taxis and earn the same amount of revenue per hour" (p. 10-11). Cramer and Krueger measured capacity utilization by looking at both fraction of time and fraction of distance traveled with a paying passenger in the taxi or UberX. They find that on average, UberX's rates were 30% higher when measuring time and 50% higher when measuring distance

(p. 2). So these findings support that Uber is using their labor more effectively than taxis because of the innovation.

However, there are some things to note about Cramer and Krueger's study. First, the taxi data used was from the year before the Uber data. It is always best to match identical time periods, but one could argue this would only raise taxi utilization rates higher because the data is from before Uber made major progress into the market. Second, there was no way to isolate just the effects of technology in the study. Other possible factors listed were Uber's larger supply of drivers and inefficient taxi regulations hindering drivers from picking up customers in locations not in their jurisdiction. While there is no way to rank the factors, it is possible to infer that the technology change did have some effect by comparing two cities. New York City has low search costs for taxis (especially cruising taxis) because of its high population density, while Los Angeles has much higher search costs for taxis due to its more sprawling city layout. So if the application indeed were more efficient at reducing transaction costs, then we would expect Los Angeles to have a much larger gap between utilization rates of UberX and taxis than we see in New York City. And this is what the study finds. New York City has the lowest gap between rates, while Los Angeles has the highest ratio gap of the five cities listed (p. 6-10). Therefore, although the models are simple, they do seem to accurately explain part of Uber's success.

There are many reasons for the success Uber has experienced, but perhaps the most important factor is its business model. Its model has allowed the company to provide additional supply to an undersupplied market. Since Uber avoids regulations, it is able to provide the rides that were forgone due to the medallion system. In figure 1, the deadweight loss (between Q^*m and Q^*e) is where Uber was able to start supplying rides and gain customers. Its growing popularity then helped it cut into the rides that taxis provide.

Table 1 shows all the types of rides Uber currently offers. Drivers are paid 80% of the total fare and Uber receives the remaining 20%. UberT is a type that stands out because it uses actual medallion taxis in that specific city and the customers pay the taxi driver, Uber just takes a \$2 booking fee for their service. UberX is the main competitor to taxis as it can be a cheaper alternative to taxis.

Table 1. Uber Types and Price in NYC (Uber, 2016)		Base Fee	Per Min	Per Mile	Min Fare/ Cancel Fee
Type	Description				
UberX	Lowest Cost/Regular Cars	\$2.55	\$0.35	\$1.75	\$7.00/\$10.00
UberBLACK	Original/Pro Drivers/Upscale Cars	\$7.00	\$0.65	\$3.75	\$15.00/\$10.00
UberXL	Low Cost/Large Groups/Regular SUVs	\$3.85	\$0.50	\$2.85	\$10.50/\$10.00
UberSUV	Large Groups/Pro Drivers/Upscale SUVs	\$14.00	\$0.80	\$4.50	\$25.00/\$10.00
UberPOOL	Newest type/Flat rate to a location/share the ride and the cost with other people (strangers)				
UberT*	Medallion taxis or boro taxis (\$2 book fee)	\$2.50	\$0.50	\$2.50	\$2.50/\$5
*Prices from NYC taxi. Uber does not set UberT prices just uses est. prices and takes \$2 book fee.					
Data from Uber, 2016 and New York City Taxi and Limousine Commission					

One big factor that Table 1 does not cover is tipping. Tipping in general seems to be a gray area; it is not always clear who should be tipped or how much. This gray area becomes more uncertain in the taxi industry, especially in comparing Uber and taxis. The New York Taxi and Limousine Committee (2016) suggests to “please tip your driver for safety and good service.” In contrast, hidden in the help pages, Uber (2016) says, “you don’t need cash when you ride with Uber. . . . your fare is automatically charged to your credit card on file – there’s no need to tip.” Generally, people assume they need to tip their taxi whereas a common belief is that the tip is calculated into the Uber fare, it is not. This is an information failure that benefits Uber. These differing thoughts about tipping create a huge disparity in cost as it could add around 15-

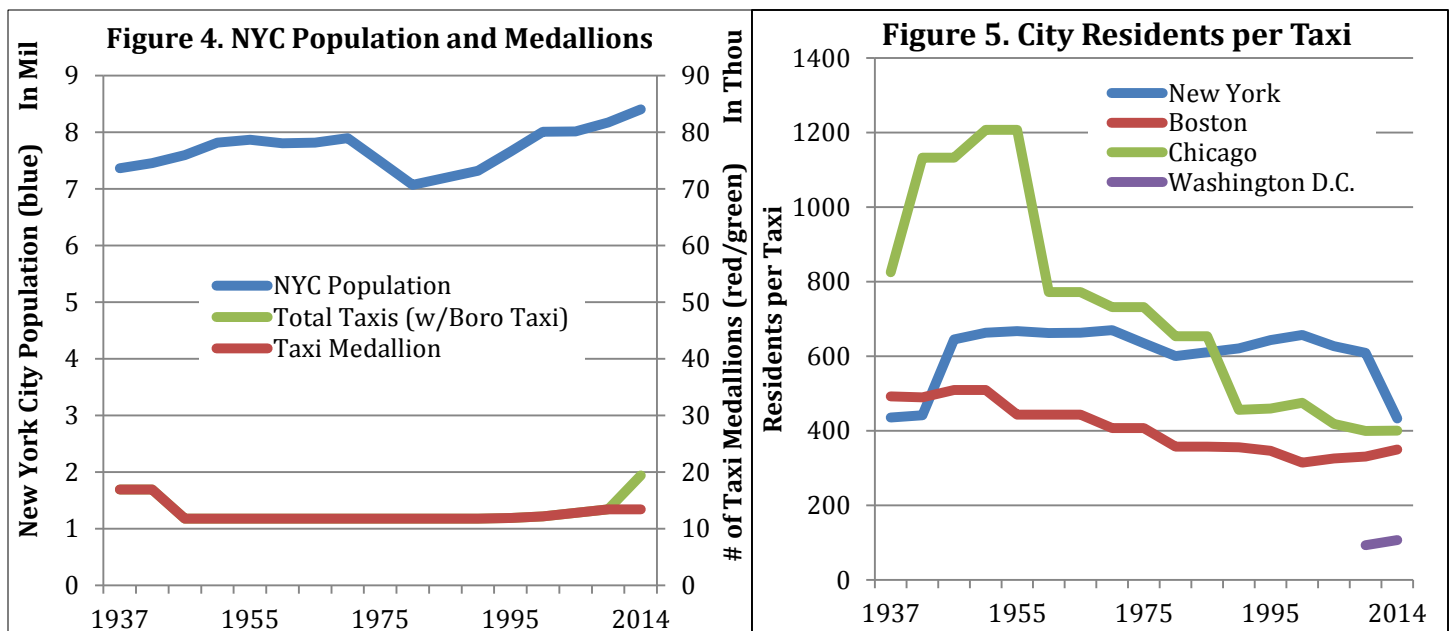
20% to the total of your taxi ride. Other apps like Lyft have a built-in feature that allows riders to add a tip after their ride. Uber's app has no features to add tips. Since one of Uber's main selling points is that no cash is needed, many times riders do not have cash to tip the driver even if they wanted to. Uber has an incentive to keep its tipping practice confusing because it makes taking an Uber more appealing to riders at the expense of reduced income for the drivers.

Current Problem

The regulations that have protected the taxi industry for almost a century are now putting the taxi industry at a disadvantage when faced with the new innovation of ride-sharing. During the time that these regulations have been in place, our society has evolved through advancements in technology and production processes. Cars have become more efficient and the Internet has brought massive change. Yet, with all this innovation and change, the taxi regulations have stayed the same. They are similar if not identical to the ones put in place 80 years ago. There are valid concerns over the safety and liability of new ride-sharing technologies that need to be addressed. However, these new companies should not be penalized and strictly regulated for using modern day technology to create a more efficient system. Instead, the government should update outdated regulations to better fit the reality of our modern technological world. There is evidence that government intervention is needed in the industry, but the rules should aim to create more efficient markets that account for the technology that is available.

The most problematic regulation is the restriction on entry. New York City's medallion system has decreased the supply of medallions by a few thousand over the last 79 years. Over the same time period, New York City's population has increased by more than one million people. This means that the supply of taxis has not been adjusted to keep up with the demand for taxis. Figure 4 shows the somewhat volatile population growth New York City has experienced since

1937. If the medallion system were to reflect real supply and demand of the taxi market, then we would expect to see the taxi medallion supply (red line in figure 4) correlate with the population, assuming that larger populations demand more taxi rides. But this is not the case. While population experienced its most volatile changes between 1945-1996, the supply of taxi medallions stayed unchanged at 11,787. This would support figure 1’s medallion model outcomes of under supply and deadweight loss. The green line in figure 4 represents the 6,000 Boro taxis New York City added in 2012. This would appear to better match demand for taxis, except that these special cabs are not allowed to work in Manhattan, where 90% of pick-ups occur (New York City Taxi & Limousine Commission, 2014, p. 1).



Data from New York City Taxi and Limousine Commission (2014), Barlett & Yilmaz (2013) and Cohen (2015)

Figure 5 shows the residents per taxi for four cities. This is a good indicator of the supply of taxis in each city. Interestingly enough, the three cities with the highest residents per taxi ratios also happen to be the three cities with medallion systems in place. This is expected, as restricting entry should decrease the supply of taxis. Washington D.C. on the other hand does not set caps on its supply of taxis and as a result it has have a much lower resident-to-taxi ratio. The

lower the residents-per-taxi ratios, the less successful Uber will be because the markets are not as undersupplied. However in three cities, the ratios rarely drop below one taxi per 400 residents so it is easy to see why Uber has had success operating in these undersupplied markets. However, in the only city with a ratio of around one taxi per 100 residents and a market that's more accurately supplied, Uber has struggled.

Table 2. UberX Prices Across U.S.	Booking Fee	Base Fare	Per Mile	Per Min	Min Fee/Cancel Fee
City					
New York City	\$0.00	\$2.55	\$1.75	\$0.35	\$7.00/\$10.00
Boston	\$1.20	\$2.00	\$1.24	\$0.20	\$5.15/\$5.00
Chicago (*incl. \$0.50 fee to city)	\$1.70*	\$1.70	\$0.90	\$0.20	\$4.20/\$5.00
Washington D.C.	\$1.35	\$1.15	\$1.02	\$0.17	\$5.35/\$5.00
San Francisco	\$1.55	\$2.00	\$1.15	\$0.22	\$6.55/\$5.00
Data from Uber, 2016					

The company has had to cut prices in Washington D.C. to try to gain traction in the more competitive market. Table 2 shows prices of UberX, Uber's most popular option, in some of the major cities in the United States. Washington D.C. has some of the lowest prices of the five cities listed. New York City has the highest resident-to-taxi ratio at around 1 to 430 (around 1 to 600 excluding boro taxis – newer non Manhattan operating taxis) and also the highest prices across the board. There are other variable that likely factor into Ubers prices; such as city size, traffic speeds, and population. But in a simplified model like in figure 1, a reduced supply results in higher prices. From the figures and tables, there's no question that the medallion system reduces supply of taxis. The restriction is creating a loss of economic efficiency that is hurting the consumer and reducing total welfare.

In figure 1, consumer surplus decreases while producer surplus gains some of that area. The medallion system benefits the producers that are lucky enough to have a medallion; however

the taxi drivers themselves are rarely seeing these benefits. When the New York City medallions started in 1937, they sold at \$10 (\$171 in 2016 adjusted terms). Now the current value is around \$580,000 (New York City Taxi and Limousine Commission, 2016). That is over a 10% return per year for 79 years. Furthermore, that is after medallion prices have basically crashed due to threat of Uber. In May 2013, medallions were selling for \$1.32 million (Meyer, 2015).

According to Horwitz and Cumming (2012), in 1937, a few drivers owned and operated their own taxis while the rest were unionized employees. The employees were paid on commission while receiving full employee benefits. In this structure, the owners (not operators) of the medallions bore much risk; if gas prices went up, the owner would have to pay. If the driver had a bad shift, both the driver and the owner of the medallion shared the loss. This all changed in 1979 when the New York's Taxi and Limousine Commission changed its structure of operations so that medallions could be leased out for 12-hour shifts. Even worse, the taxi drivers were classified as independent contractors under federal labor laws. This meant drivers lost their benefits, had to pay the gas price increases, and still make the daily lease payments. With this new system, currently only around 18% of taxis are owner-operated, a 22% decrease from 1937 (New York City Taxi & Limousine Commission, 2014). The rest were in the hands of large taxi fleets or brokers who leased them out.

Drivers suffer from diminishing returns because every time they ask the Taxi and Limousine Commission (TLC) for a fare increase, the TLC increase the fare, but also increases the lease rate by a percentage of the fare hike. Table 3 shows the fare hikes and corresponding lease rate hikes. This is partially responsible for the drivers' wage slips. In 2006, a 12-hour shift averaged \$158 in driver take-home pay. Five years later, the same 12-hour shift was calculated to

be \$96 (Horwitz and Cumming, 2012). Sadly the take-home pay has likely slipped further due to the growth of Uber taking work from taxi drivers.

Table 3. Diminishing returns on fare increases due to lease rate increases		
Year	Fare Rate Increase	Lease Rate Increase
1996	26%	8%
2004	20%	14%
2012	20%	20%
Data from Horwitz and Cumming, 2012		

If drivers complain to leasers, they are easily replaced with another driver due to the oversupply of willing drivers. The medallion system now provides the 82%, who own but do not operate taxis, with monopoly rents, most of whom do not desperately need the money. The medallion system set out to improve conditions in the taxi industry and provide drivers with a livable wage. Unfortunately, along the way the original purpose of the medallion system got lost in all the lease profits. The leasing of medallions seems to create as much of a problem as the medallions themselves.

Safety Question for Uber

Regulation can hold back innovation, but there are serious issues concerning the safety of Uber that need to be addressed. While this paper argues that regulations are outdated and need reform, this logic pertains to the regulations that restrict entry rather than the ones that promote safety. When it comes to a service that is used so frequently by people, assuring passenger safety should be a top priority. The ride-sharing applications allow users to rate their drivers. This creates incentives for the drivers to provide high quality as drivers with ratings below 4.6 are at risk of being deactivated off the app (Cook, 2015). This has created a high quality standard for the ride-sharing companies that the taxi industry seemed to be lacking. However, the quality of

drivers is much more perceptible than the safety of the drivers and this is where Uber's performance has been lacking. It took a lawsuit for a wrongful death on New Year's Eve for Uber to add liability coverage for drivers searching for rides (Levin, 2016, para. 9). The company has a history of entering markets and breaking regulations and laws (albeit outdated ones), then asking for forgiveness and paying fines in court. The company has been sued for over \$61.9 million since 2009 (para. 1). The company benefits from an asymmetric information problem, where customers using the application are unaware of the company's less strict background checks on drivers. While taxi drivers are required to do a fingerprint background check, Uber drivers must only provide names and social security numbers. In fact, Quinton (2015) says, "San Francisco and Los Angeles district attorneys found that 25 Uber drivers in the two cities had criminal records" (para. 10). Uber even adds to the asymmetric information, as those San Francisco and Los Angeles attorneys were part of a case against Uber for using false marketing language calling themselves "'safest ride on the road'.... [and describing] its drivers' background checks as 'the gold standard'" (Levin, 2016). Because Uber has to bear the full cost of the safety measures, but receives little benefit from doing so, it is Uber's dominant strategy to underinvest in safety. This would change if all potential customers knew Uber's safety details because it would decrease ridership. Uber would be inclined to invest more in safety. From past history and actions, even lawsuits do not seem to change Uber's behavior, so government intervention might be needed to regulate safety.

Policies

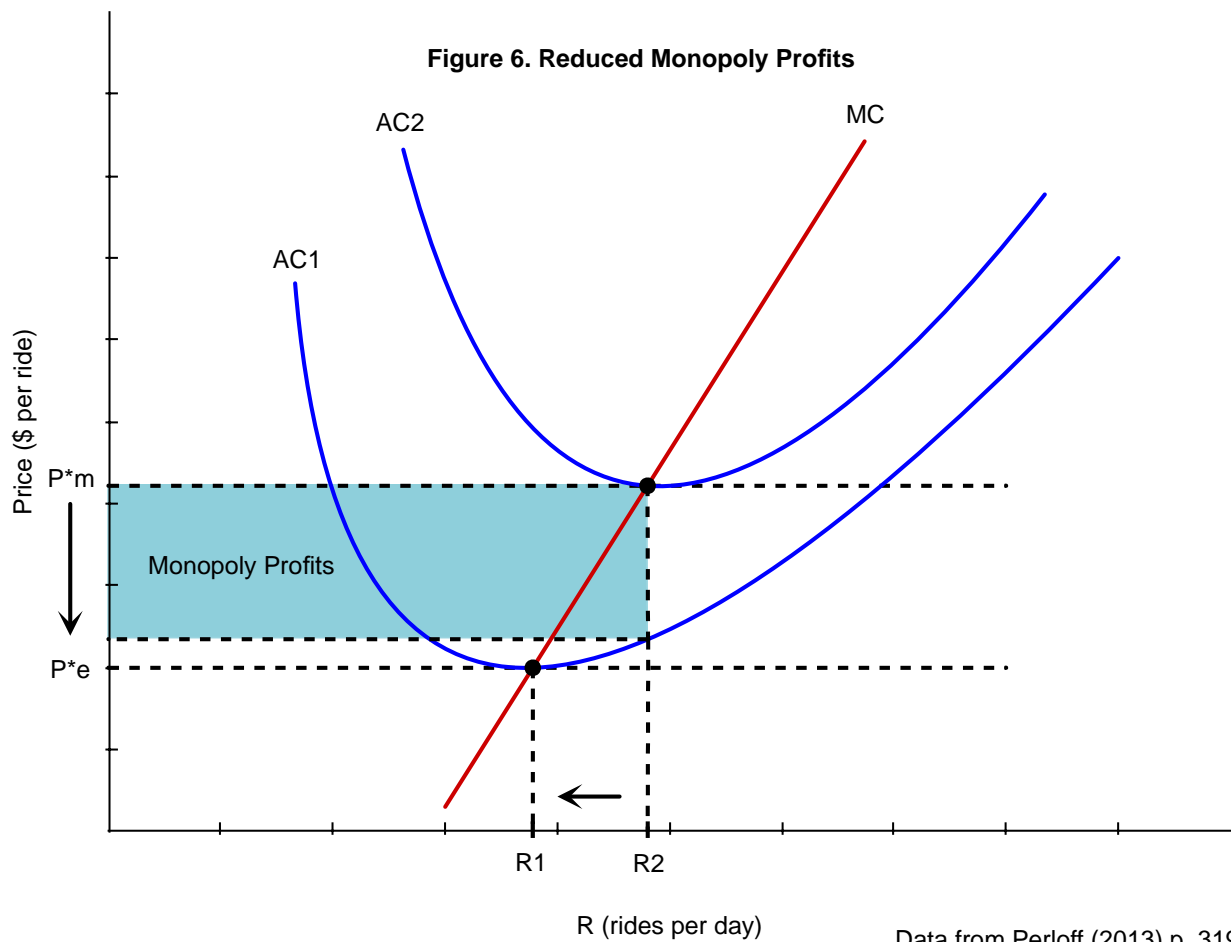
Changing Entry Controls

One way to eliminate two big issues with the taxi industry, medallions and leasing, is to remove the current entry restriction regulations. The addition of ride-sharing applications already

adds to the supply of for-hire transportation and high medallion prices would suggest there is still demand to drive a taxi. But by removing the entry restrictions on the taxi industry, all the players in the for-hire transportation market are placed on an even playing field. Now, regulators can look at regulations that could help foster a more efficient market instead of trying to choose which side should have an advantage. In the place of the medallion system, I would propose a two category licensing system, T and N licenses, which would give potential drivers two options on the type of service they want to offer. The first license, called the T license, would be for taxi drivers. It would be the more expensive of the two licenses, but also would have the opportunity for more profits. The T license would allow drivers the ability to operate in all segments of the for-hire transportation market whereas the N license would be for drivers who want to operate in the pre-booked segment. The main advantage of the T license over the N license is the option to pick up any customer, allowing operation in the street hail and taxi stand segments of the market. This would increase the potential profits of T licenses, justifying the higher price that the drivers would have to pay for it. The license would have all the same requirements of the current taxi license and the driver would be required to operate a vehicle that fits the requirements for a taxicab (lights, meter, etc.). The T license would cost \$10,000 to \$20,000 per year depending on the city. Cities with smaller street hail segments, like Los Angeles, would charge less while cities with large street hail segments would be more expensive. The price may seem high, but in comparison, the leasing fees for medallion taxis can end up well over \$30,750 per year for a driver – \$123 average lease rate for 12 hour shift x 5 shifts per week x 50 weeks (New York City Taxi & Limousine Commission, 2016, p. 3).

By unrestricting entry into the taxi market, the monopoly profits that medallion owners receive would be eliminated. In figure 6, the shaded area is the profits that the medallion owners are able

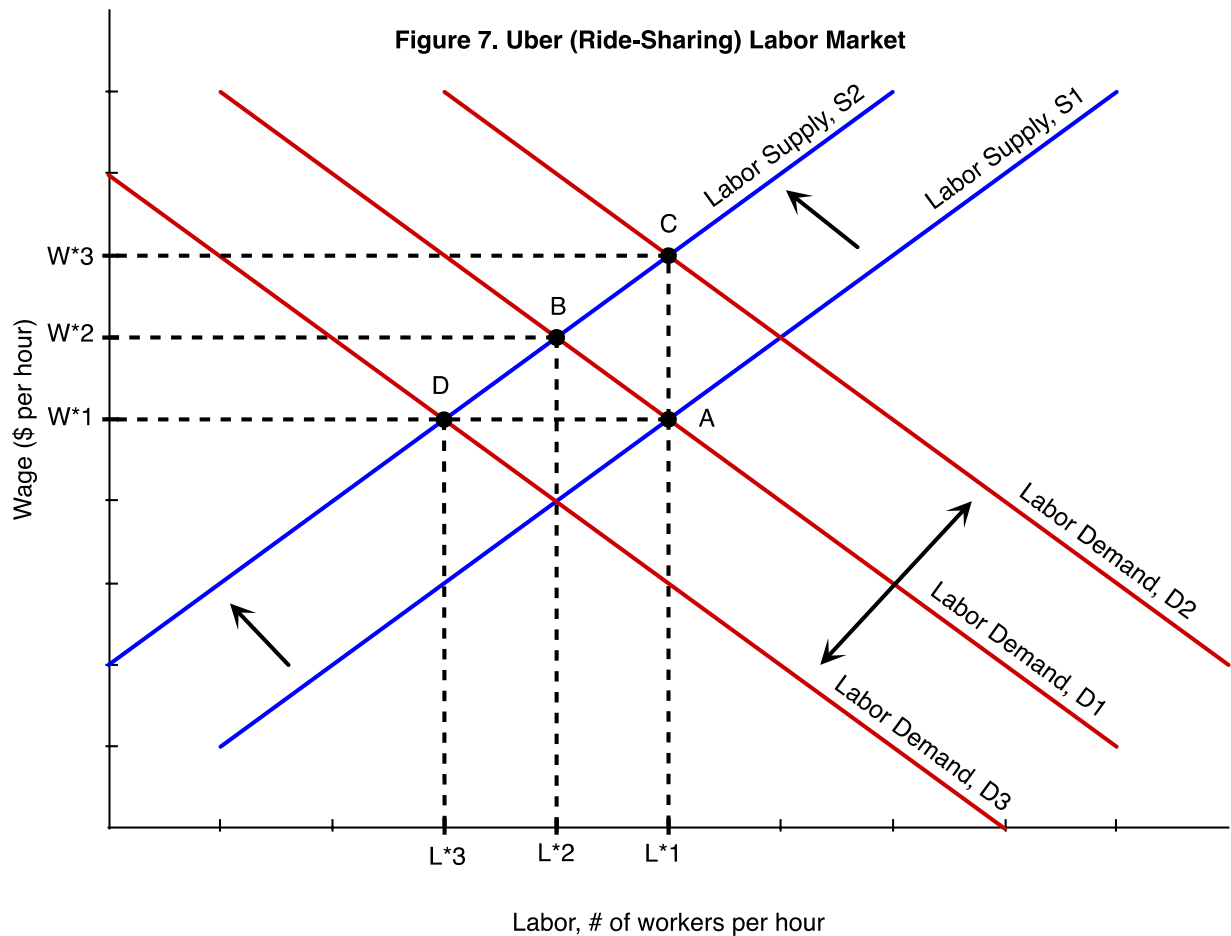
to receive from having the system in place. By adding the T license, the government could collect rents from the annual license fee. Those rents could be spread to more people than just the few who own medallions. In the short-run, removing restrictions would cause a significant increase in the supply of taxis. This would eliminate the economic profit that taxi drivers receive, but figure 6 shows us that taxi drivers already do not receive economic profits due to the high leasing prices.



Overall, it is hard to say whether taxi drivers would be better off or not. As figure 6 shows, unrestricting entry would reduce rides each taxi performs, however with better technology proposed in the second policy, the utilization rate of each taxi could increase so that they would

be more efficient. In both cases they are not receiving economic profits, but at the very least removing the restrictions would allow drivers more freedom and a better ability to compete with the ride-sharing companies.

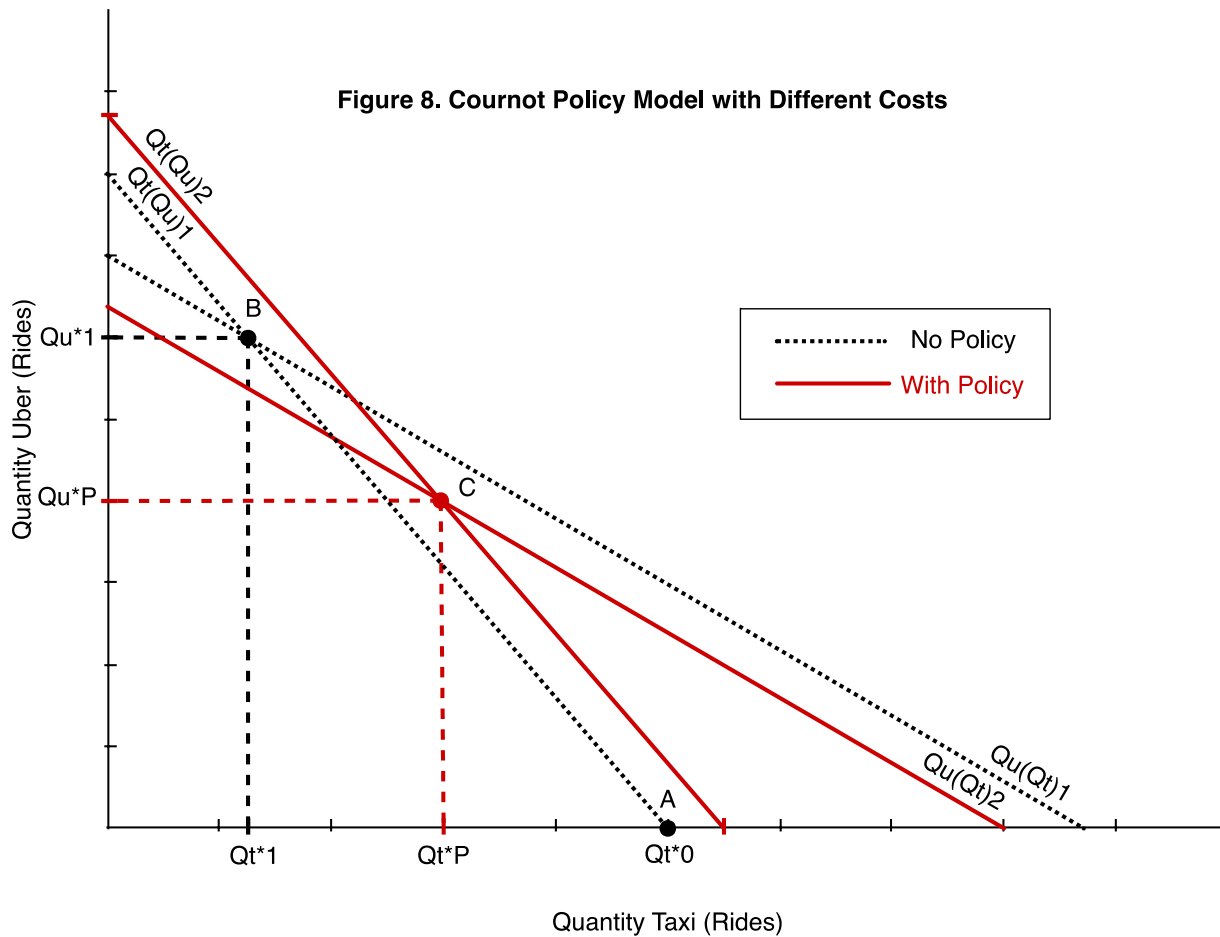
The N license would be for drivers who want to operate in the pre-booked segment. This license would be required for all drivers who want to work as a pre-booked driver, including for Uber or any other ride-sharing company. The N license requirements would be less strict than the Uber or any other ride-sharing company. The N license requirements would be less strict than the T license, but would include all of the same safety measures as the T license, such as finger printing and drug testing. This would assure that all drivers have been safely vetted and would resolve all the safety problems with Uber’s process. The N license would cost between \$250 to \$1000 and this fee would cover the cost to the city of the testing while also creating rents for the government. This would indirectly reduce the large cost advantage Uber has over the taxi industry, as shown by figure 7.



By adding the N licensing cost for drivers, it would shift the labor supply curve left, from S_1 to S_2 . This is because the driver's willingness to work for a given wage would go down with the added cost. The new equilibrium point would shift from point A to B, where Uber pays slightly higher wages and suffers a small reduction in supply. Uber could also either choose to increase wages further to keep their labor the same at point C, or reduce its amount of labor by keeping its wages the same at point D. This increased cost of labor would likely stop Uber from trying to significantly undercut taxi prices once the entry restrictions were removed. This is because cutting prices would lower the wages and drastically reduce their supply of drivers past even the quantity P^*3 in figure 7.

The biggest effects of this policy would be in the pre-hail market. Since Uber drivers can only take e-hails and cannot pick up passengers off the street, Uber mainly takes from the pre-hail segment. The efficiency of the app does convince some street hails to use ride-sharing services instead of taxis, but the biggest share of customers are the ones that would have used pre-booking for a taxi and now instead use Uber. The cost advantage Uber has gives the company the ability to serve more rides in the pre-hail segment than taxis. This is displayed at point B in figure 8. Before Uber was introduced, taxis served the segment at point A, but since then the cost advantages has allowed Uber to gain market share and produce rides at Q_u^*1 while taxis have lost significant market share and produce rides at Q_t^*1 . With the proposed policy, the cost advantage that Uber has would be reduced. This would shift the response curves $Q_t(Q_u)$ and $Q_u(Q_t)$ to their new points, the red lines. The new equilibrium point would move to point C. At point C, the quantity of rides that can be produced is much more equal in size. The magnitudes of the changes in reality would be unknown but the policy would reduce the quantity that Uber provides while increasing the

quantity that taxis provide. In the model, Uber still produces more rides than taxis with the policy and in reality this is likely to occur.



While the policy does reduce Uber’s cost advantage, it does not make taxis and Uber have common costs. Therefore Uber would still have a small cost advantage, which would allow it to continue to produce more rides. The goal of the policy is to allow taxi drivers to compete more fairly with Uber so that both can continue to operate in the long-term.

City Taxi App

The second proposed policy is to develop an app similar to the ride sharing apps but have it run by cities or contracted out and overseen by cities. The long-term benefits for consumers, taxis, and the city itself far outweigh the cost. The taxi commission of the city would be the most

logical choice to oversee the app. There would be all the structuring costs to create the app and the reorganization costs for administrating it, but most of the actual technology and infrastructure after the app is created is already in place. There is already a large supply of taxis and drivers available for the app to use. Washington D.C. would be a prime example as it has an unrestricted taxi market and recently they unveiled a D.C. taxi app. The cost of that app was \$479,000 so it is reasonable to expect similar costs to employ such an app in other cities (Lazo, 2016).

By having an e-hail app of their own, taxis would be able to benefit from the reduction in transaction costs that is currently enjoyed by the ride-sharing companies. The app would allow taxis to experience the same shift out in labor productivity as discussed in the ride-sharing background section. An advantage that taxis would have over ride-sharing is that they could still do street-hails. Street-hails still make up a large part of the market so by having access to both, this would hopefully increase the utilization rates of taxis. One condition of allowing access to both types of hail is that there must be adequate incentive put in place for the driver to deliver on an accepted e-hail. One of the biggest problems with pre-hail taxis now is that a large portion goes unfilled because there is small incentive on either side of the transaction to make sure it happens. If drivers see a street hail, they may take it. Or if customers who made the request see another empty taxi go by, they take it since there is no penalty. However, the app could fix this by placing incentive on both sides through adding cancellation fees to both rider and driver. This means once the driver accepts a request on the app, even if they see a street-hail, they are motivated enough to overlook it and fulfill their e-hail.

One of the advantages for cities is the big data to which the city would gain access to. The taxi commission already has quite a bit of data from taxis, but it pales in comparison to the amount of data Uber gains with the GPS tracking the app does. Cities could gain insight into

congestion and other externalities to help improve their transportation infrastructure. The app would help serve the outer areas of the city better as well because it reduces drivers' incentives to stay in high demand areas because drivers can easily be requested for a e-hail by being in different areas. The New York City Taxi and Limousine Commission (2016) found that 27% of ride-sharing drivers served outer New York boroughs compared to 3% of taxi medallion drivers (p. 6). This data supports that the app could help increase taxi service to these areas. Especially with unrestricted supply, taxi drivers might have better luck finding fares outside the central part of the city.

The last benefit that the app brings is the ability to solve some of the problems that unrestricting entry has created in the past. In Dempsey's paper (1996), he finds the problems that the app could solve include declines in service quality and declining operational efficiency (p. 106). In unrestricted entry, the biggest issues were with lowering service quality offered by drivers and increased no-shows in the pre-hail segment. The city application like Uber's would include a rating system and this would increase driver quality. The rating system would allow drivers to be rewarded for offering high quality service. The app would also give warnings if a driver's rating fell too low and after enough problems, the driver would be removed from service. This would force drivers to offer great service to passengers. If the driver decided the service quality required was too much for the wage they were being paid, then they would drop out or be removed from the labor supply. Second, the app would solve the no-shows issue because the cancellation fees would be applied to drivers and passengers adding a cost to forgoing a ride (p. 111). The operational efficiency problem arises from an oversupply of taxis lowering the productivity of each additional taxi. The increased utilization rate that the apps

create would apply to an increased supply of taxis so taxi productivity would stay about the same.

Evaluation

Overall, the taxi app proposal would be needed in combination with the license policy proposal to help solve the issues that come with unrestricting entry. The issues that have been raised with unrestricting entry would likely occur again if the taxi app were not created simultaneously. The biggest issue of unrestricting entry is the oversupply of taxis that slowly erodes profits, thereby leading to decreases in quality and safety of the industry. However, there are examples of unrestricting entry working in Ireland even without the benefits the technological innovation of the apps offers. In that case, taxis increased by 255% in the two years following deregulation (Barrett, 2010, p.1). Cities would likely see an initial surge of new entrants into the markets similar to Ireland, but the high license cost could limit that initial surge as the license prices suggested in the policy are considerably higher ranging from \$3,000 to \$13,000 more depending on the price the city sets. In past deregulation examples, instead of drivers dropping out of the labor supply when earnings became depressed, drivers would lower their quality of service. This meant no equilibrium was reached in the labor supply and the whole industry suffered from low wages. However, adding the quality requirements of the app could help the taxi supply reach equilibrium by removing or forcing out the lower quality drivers instead of allowing them to offer a low quality ride. Removing restrictions has historically proved problematic for the reasons discussed above. However, there are also examples of it working and bringing benefits. In Barrett's paper, he finds that outer areas were better served and customers had reduced waiting times by deregulating entry. He concludes his paper by stating that "[n]ine years after the High Court deregulated entry to the sector, taxis in Ireland continue to

expand output and generate significant benefits for consumers” (p. 65). That success came without any app helping to solve the problems that arise.

The application of the license proposal would be challenging, as it would face much opposition. Medallion owners with deep pockets have lots of incentive to lobby regulators to keep the industry the same. Look no further than the medallion systems that have not changed much in the last 80 years. A policy to remove the medallions would certainly not be supported by the owners. The high prices investors have paid for the medallions came with risk that those profits would evaporate should the medallions no longer be needed. Those investors were speculating that the industry would never change. One way to find a middle ground would be to give the medallion holders a payment for the medallion. The licensing costs could be used in the first few years to provide these payments to holders. If they felt the end of the medallions were inevitable with Uber, they might support the payment. Uber would also not be supportive and would continue to use its fan base to sway regulators. It would increase Uber’s cost of acquiring labor and allow the taxis to compete more fairly with them. However, in comparison to outlawing Uber or applying the same regulations as the taxi industry has, this proposal would be much less costly to ride-sharing companies. Both sides are convinced that they have the right to provide their service, but these proposals would allow both entities to exist and provide a more efficient for-hire market for consumers with lower waiting times and higher quality and safety.

Conclusion

The taxi industry’s innovation has been non-existent in recent years as technology has advanced. Perhaps taxi companies thought medallions offered them so much protection from competition that the industry would stay the same forever. Maybe the multi-medallion owners were too busy watching medallion prices skyrocket to notice times were changing. Whatever the

case, the taxi industry became complacent and the innovation of ride-sharing apps took the industry by storm. Instead of regulators looking to limit innovation, they should take advantage of the opportunity presented by the current situation to provide a more efficient system for the general public. This paper has shown that the taxi industry created an inefficient market by restricting supply. Uber's massive success has shown that there is an undersupplied market that has been addressed because of more than just being unregulated, but rather innovation that has made for-hire transportation more efficient. The proposal in this paper aims to provide a more efficient for-hire transportation market than is currently in place, while addressing the safety and quality concerns that should be inherent when paying for transportation by a stranger. Both sides (taxi and ride-sharing) argue that the other is unfair and they have the right to provide transportation. Through examining both, this paper concludes that neither is absolutely right, both provide benefits the other does not. This policy changes recommended in this paper aims to find middle ground that would create a more efficient for-hire transportation market for consumers. It does so by reforming some of the outdated regulations with taxis and addressing some of the regulation concerns of ride-sharing. In the end, the proposal would allow both entities to coexist and their combined benefits would provide a more efficient for-hire transportation market.

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