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Enabling X-to-the-xth: the Operational Secret Behind Uber's Explosive Growth

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For five days in October 2015, 4,800 tech employees commandeered the Las Vegas strip. There to attend a retreat dubbed only "private tech conference," they stayed in the Paris, Planet Hollywood, Bally, Linq, and the Quad. *Everything* was on the company dime, including prepaid VISA vouchers, open bars, and lavish buffets. Sure, there were some meetings during the days on topics like "biz dev," finance, and teambuilding, but the attendees spent more time poolside in the 95-degree heat: not a laptop in sight, just mainly young people lapping up the sun on chaises, lined up at the bar, playing ball games in the turquoise pools. All they needed for access to events was a wristband that was imprinted only with X^X. Each after hours X^X entertainment upped the ante of the one before.[1] The final night provided a crescendo no one could foresee. Inside the Palms hotel, a woman in a glittering red jumpsuit came out onto a smoke-filled stage. Neon light beams pierced the fog as she stepped through it, and she belted out "Got me looking so crazy right now, your love's …". The company had managed to score a private concert by Beyoncé, whose husband, rapper Jay-Z, sat casually in the shadows puffing on a cigar as the crowd went wild. Even more crazy? The host company's CEO took the stage and announced that the "Bey" was now a shareholder to the tune of $6 million—an amount that would increase by 50% in the following year.[2]

X^X (X to the xth) meant exponential growth—10^{10} total trips served by Uber, the company that made it possible to hail a ride at the touch of a button on your phone. Founded by Travis Kalanick and Garrett Camp in 2009, Uber had a tradition of holding all-expenses-paid company-wide retreats to celebrate important milestones, specifically ones that correlated to exponents of ten. In 2013, upon reaching $1 billion in gross bookings, Uber celebrated in Miami, Florida; the Vegas event marked the company reaching $10 billion in revenue in just one year. By 2015, Uber was valued at a little over $50 billion and was like a gangling adolescent kid undergoing a growth spurt—and who sometimes behaved like one. (See Exhibit 1 for a timeline of Uber's revenue growth from 2013 to 2030.) The company's

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phenomenal growth was powered by three main forces, which we sketch out below: excellent *product market fit*; rapid, extensive *geographic expansion*; and the creation of a strong *network effect* or *virtuous circle*.

Like many brilliant products, Uber was created when its founders were frustrated by a common predicament. Theirs was the inability to get a cab in densely populated San Francisco. While attending a LeWeb conference in Paris in December 2008, Travis Kalanick, then president of Red Swoosh, and his buddy Garrett Camp, then CEO of StumbleUpon, walked out into a snowstorm as they left the conference center. It was impossible to get a cab. "What if you could summon a cab just by tapping a button on your phone?" Camp asked Kalanick. It was an idea he had been thinking about for some time. The advent and increasing availability of smartphones, which put a computer with geolocation capabilities in every pocket or purse, brought that idea within reach. Back home, Camp bought the UberCab domain name and bugged anyone who would listen to him about it, especially Kalanick. Within a year, Camp and Kalanick had founded UberCab (Uber), a technology platform that let riders hail a black car or Lincoln Town car with no cash changing hands and an amazingly accurate ETA of pickup and destination arrival times. Customers paid using information stored in the application, and Uber charged a commission of 20%–25% of the fare.[3]

Product–Market Fit

In 2009 the alternative to Uber was the antiquated and highly regulated taxi industry. In order to operate, taxi owners in major cities like New York, Chicago, and San Francisco had to purchase an expensive medallion (in Manhattan in 2011, a medallion cost $1 million), so the market was based on scarcity and exclusivity. In 2014, for instance, there were a little over 13,000 licensed taxis in New York City—not a significantly higher number than the 12,000 that were licensed in 1937 when the medallion system was created.[4] So the supply of taxis could never meet burgeoning demand, and the price of a taxi ride only surged higher. Taxis also massed in urban areas, so there were entire markets with unmet needs, from tech workers in California like Garrett Camp, who wanted to get from Mountain View or San Jose to their homes in San Francisco, to late-night revelers loathe to select a designated driver, to elderly riders in the suburbs who needed to come into the city to shop and see their doctors. On the side, when UberCab started as essentially a chauffeur service, black-car drivers endured long empty stretches of waiting in garages or side streets for the next call driver from the dispatcher.

Yet in order to stimulate demand from both riders and drivers, UberCab needed to get the product into their hands. It was easy to convince the tech savvy youth of San Francisco to use the application, especially when it became available on their phones. But to gain a wide range of customers, Uber showered riders with incentives, giving away free rides at first and then a 50% discount on the first ride—something Uber still does—all the while soliciting valuable customer feedback to hone its nascent product. To woo livery drivers—notably *not* tech savvy—UberCab handed out free iPhones, preprogrammed with the company's software;

they'd made a deal with AT&T to buy thousands of iPhones in bulk at a discount. Almost immediately, new UberCab drivers poured into the San Francisco market.[5]

Geographic Expansion

After Uber's San Francisco launch in 2010, the taxi industry's response was fierce. The San Francisco MTA and the California Public Utilities Commission put out a cease and desist letter arguing that then named UberCab was illegal. UberCab argued in a statement that "UberCab is a first to market, cutting edge transportation technology," and that as such, city and state regulatory bodies haven't written laws "with these innovations in mind."[6] Then UberCab promptly dropped Cab from its name, in order not to be conflated with the taxi industry, and kept operating in the face of considerable penalties. In 2011 the company expanded to New York, Seattle, Boston, Chicago, and Washington, DC, and its first overseas outpost, Paris (somewhat fittingly, since it was the legendary city of Uber's birth). Two years later, Uber was operating in 42 additional cities, and by the end of 2014 it had brought 146 more online (see Exhibit 2).[7] Notably, however, Uber was unable to beat entrenched local competitors in China, Southeast Asia, India, and Russia.

One reason Uber was able to move quickly into new national and global markets is that the company was almost assetless, with riders using their own phones, and drivers leasing or owning their cars. But it was 24-year-old intern Austin Geidt, one of Uber's first employees, who masterminded the company's lightning-speed expansion. Geidt personally set up shop in each new city, holding focus groups, scouring Yelp for drivers, nabbing communications PR people to drum up interest, and hiring freshly minted MBAs to manage supply and demand among the constantly fluctuating population of drivers and riders. With its coffers brimming with Venture Capital (VC) funding—billions raised by 2015—Uber could burn through the cash required for Geidt to get the service up and running in a new location within three months. From her 11 months on the road as "Queen of Launch" in the United States, Geidt created an iterative "launch playbook" (see Exhibit 3) that new hires, usually McKinsey consultants, used to oversee the start of 400 global markets.[8] While Uber's core offering and playbook remained the same for launches from Budapest to Bogotá, the ridesharing app adapted its main services to the unique qualities of each market—from letting India's riders pay with cash or ride credits stored in a digital wallet to luring Singapore's wealthy upper class with UberSupercar, which let users hail Maseratis or Lamborghinis.

Yet, in every city where Uber launched, especially those, such as London and Berlin, with the most entrenched and highly regulated taxi industries, the company was confronted by opposition. In 2014 thousands of London taxis brought traffic to a standstill in a protest against Uber. From the start, Kalanick had taken an overtly aggressive stance to city and local transportation regulators around the United States and the world. He called this approach "principled confrontation"; others had stronger language for it. Uber countered sometimes tremendous resistance by moving swiftly to be operational. In doing so, the company won

over enough riders to turn the fight for their unregulated existence into a cause, with local politicians even giving speeches on Uber's behalf.

Matching Supply and Demand

There is one distinctive aspect of ridesharing markets that makes them particularly attractive from an operational perspective: the operator's ability to control demand (and to some extent, supply) for rides in a very granular fashion by modulating prices (known as dynamic pricing).

Dynamic pricing has taken different forms over time. Initially, companies used surge multipliers, through which the base fare was increased by a certain multiplier at the end of the ride. More recently, they have moved to upfront pricing, in which riders are quoted a price before they accept a ride. This price can be scaled upward or downward to decrease or increase demand from riders, respectively.

Unpopular as the mechanism might be, there is no doubt that dynamic pricing serves its function well. Famously, on January 1, 2015, Uber's surge-pricing algorithm broke down due to a bug, and the company lost its ability to control demand. The result was astonishing—the number of requests for rides that Uber was able to fulfill plummeted.[9]

The ability to control prices gives ridesharing a tremendous amount of power, but with great power comes great complexity. What demand should the platforms aim for to ensure the system runs smoothly? At first glance, the answer is obvious: the demand should be set to immediately match supply at any given time. If more drivers come online, prices can be decreased to push demand up and match the new supply. Conversely, if drivers became inactive, prices can be raised to reduce demand.

Astonishingly, this strategy is too simplistic. Understanding why requires us to dive into a phenomenon at the very core of ridesharing operations that explains not only the operational dynamics of these platforms but also why they need to aggressively expand to succeed.

The Network Effect

In light of the robust opposition to Uber's muscular tactics, it is worth asking why the company had always insisted on pushing so strongly into each of its new markets. Why not take a gentler approach, slowly but surely capturing increasing market share with a superior product without antagonizing the incumbents?

Part of the answer lies in the network effect, also called the virtuous circle or the expansion flywheel. This effect lies at the very heart of Uber's genesis and value proposition. It refers to the self-sustaining, exponential benefit attained when a company fully dominates an entire market.

To avoid having long idle periods, drivers want to be part of the ridesharing network with the most riders. To minimize wait times for pickup and take advantage of lower fares, riders want

to use the ridesharing service with the most drivers. By flooding a city with supply (drivers), Uber ensured that pickup times would shorten, demand from both satisfied and new riders would increase, and drivers would stay busy and profitable. Then, enticed by the earning potential and flexible hours, more drivers would enter the market, and as the urban center becomes saturated, drivers will start picking up riders in the outlying suburbs, thus expanding the market from the center outward.[10] In 2019, when Uber filed for its long-awaited IPO, it included a diagram of the network effect powering its growth (see Exhibit 4) and said, "Our strategy is to create the largest network in each market so that we can have the greatest liquidity network effect, which we believe leads to a margin advantage."[11]

One simple metric that goes some way to quantifying this network effect is the ratio of the number of drivers in a system to the maximum throughput (rides per hour) of the system. In a system with no network effect, this ratio will be constant; each additional driver will increase the system's throughput by the same amount (i.e., there will be constant marginal throughput). In a system with the network effect, each additional driver creates *increasing* marginal throughput.

All this begs a simple question: how much volume is required to create this network effect? Does it depend on the characteristics of the city in question? Is it possible to construct a mathematical model of these network effects to better understand them? How does the extent of this network effect inform the level at which the platform should set demand? Such considerations are crucial in understanding what it would take to launch in a new city, and in identifying likely targets for expansion.

Network effects are not unique to ridesharing. They exist in many service-based platforms, all of which experience congestion and effects of scale. In this case, we will develop intuition about what is behind these network effects, and understand why they might occur in *some* systems and not in others.

As we will discover, the key to understanding these effects in ridesharing markets is realizing that they have an unusual feature: pickup times. When a driver is matched to a rider, the minutes the car takes to pick up the rider is dead time; the driver earns no money during that period and, because they can't accept any other rides, does no productive work, but is still "busy." Long pickup times are also a poor experience for riders. This simple fact has profound implications for the nature of the network effects in these markets.

Classical Service Systems

Before diving into ridesharing systems, it is worth spending a few minutes on more classical service systems that lack the element of pickup time. Consider, for example, a company that has a chat interface on their website to allow customers to contact a rep.

This situation has one aspect in common with our ridesharing application: the ability to control demand. In particular, the website can stop offering the chat option when demand is greater

than supply, and direct customers to other options. Similarly, when demand is smaller than supply, the website can display the chat option more prominently, and potentially close off other options in order to increase demand.

There is also, however, one big difference between the two systems: there is no pickup time on the chat interface. As soon as a customer is assigned to a rep, they are immediately connected. Each rep is either free or busy with a customer and doing productive work. There is no time during which the rep is occupied but not doing productive work.

Let us now ask two simple questions. First, at what level should the company choose to set demand for this chat system? And second, does this system exhibit any network effects?

To answer the first question, consider a situation in which the company has 50 reps, and each customer-rep interaction lasts six minutes on average. We now use Little's Law, which states that the average number of units in a system is equal to the rate at which units arrive into the system, multiplied by the amount of time the units spend in the system. In this case, units are customers, there can be 50 in the system at any given time (because there are 50 reps), and the customers spend 0.1 hours (the length of the interaction) in the system on average. Thus, the system can handle 50/0.1 = 500 customers per hour.

This, therefore, is the average incoming demand the company should aim for in its system. Achieving this demand will also ensure that every rep is constantly occupied.

The answer to the second question seems trivial in this case. As more chat reps are added, the capacity of the system to process new customers increases linearly with each rep. Thus, there are no obvious network effects in this simple system. (There might, of course, be economies of scale associated with hiring a greater number of reps, but these are quite separate from the network effects we discuss here.)

(It is important to realize that this case assumes there is no variability in the system – in particular, we assume every call takes exactly the same amount of time, and that calls arrive at regular intervals. Similarly, in the next section, we will assume every ride takes the same amount of time, and that requests for rides arrive at regular intervals. The presence of variability would require additional agents *over and above* the number discussed in this case, but the two phenomena are independent, so everything discussed here remains relevant in the presence of variability.)

Ridesharing Systems—Cracking the Network Effect

Let us now consider ridesharing systems. Suppose there are 50 drivers in the system, and each ride lasts six minutes on average: at what level should the company aim to set demand when modulating its prices?

To analyze this system, there is now one additional piece of information we need: the time required to pick up riders. Initially, it might seem as if we can treat the pickup time like the ride time and use an average number (e.g., three minutes average wait time). Unfortunately,

this is too simplistic because unlike the ride time, the pickup time strongly depends on the number of drivers who are free at any given moment (known as density of open supply). If all 50 drivers are waiting to be matched with a rider, the pickup time is likely to be quite low. On the other hand, if all 50 drivers are busy, the pickup time is likely to be much longer. Any complete analysis of the system will need to include an estimate of this open supply density effect.

Together with this case, you should have received historical data sets in which each row corresponds to a specific point in time in a given ridesharing network. The data set gives the number of open drivers in the system at that time and the average time riders had to wait to get a ride. **How might you use this data to model the relationship between the number of drivers in the system and the wait time? Does this effect seem constant across cities, or does it vary geographically?**

In the simple customer service chat system we discussed in the previous section, it was clear that the company should modulate demand to match supply exactly and ensure that all reps are kept busy. It turns out this is no longer true in a ridesharing system because of the wait times. **Why might that be? Should a ridesharing platform aim for a demand that is higher than in a system without dead times, or lower? (Hint: what would happen if demand was chosen to make sure all drivers were busy at all times?)**

Next, think of how these dynamics might result in a virtuous cycle or network effect. In particular, based on these complex dynamics, what advantages might a larger system enjoy as compared to a smaller system?

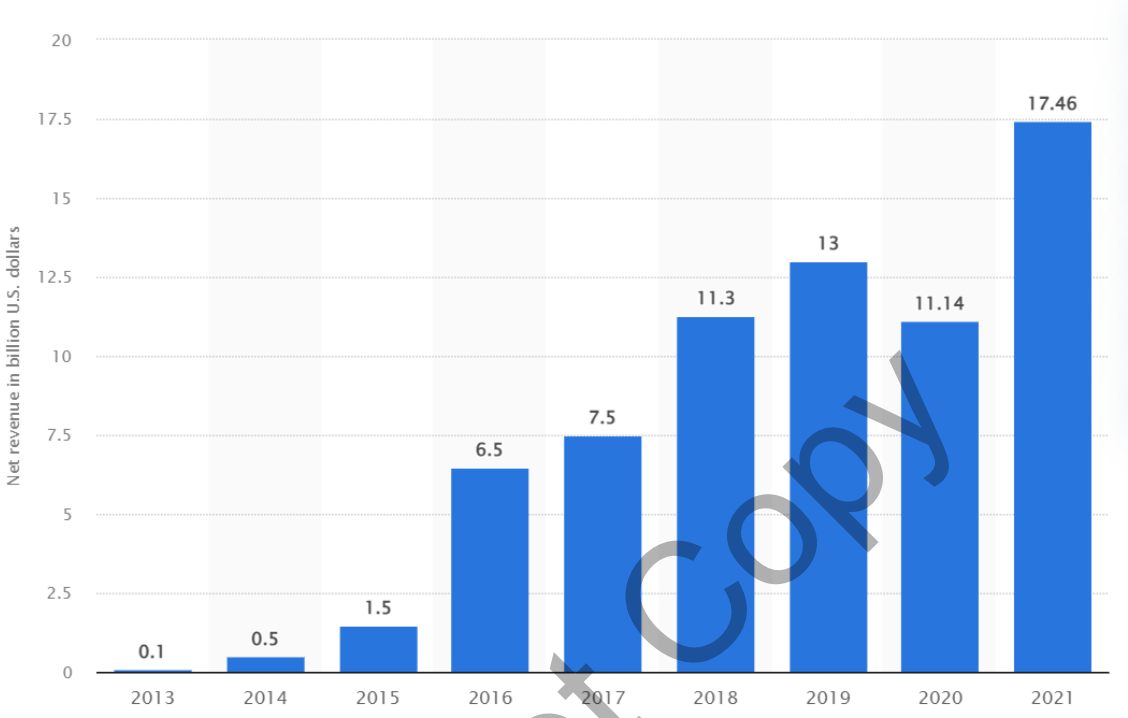
Finally, how might this network effect lead to some cities being more desirable than others from a ridesharing perspective? Exhibit 5 lists key information about various cities in the United States. How might an analysis of operational dynamics in ridesharing systems help inform which of these cities are most desirable as entrants into a ridesharing platform?

Other than ridesharing platforms, can you think of other systems that might exhibit this phenomenon?

Exhibits

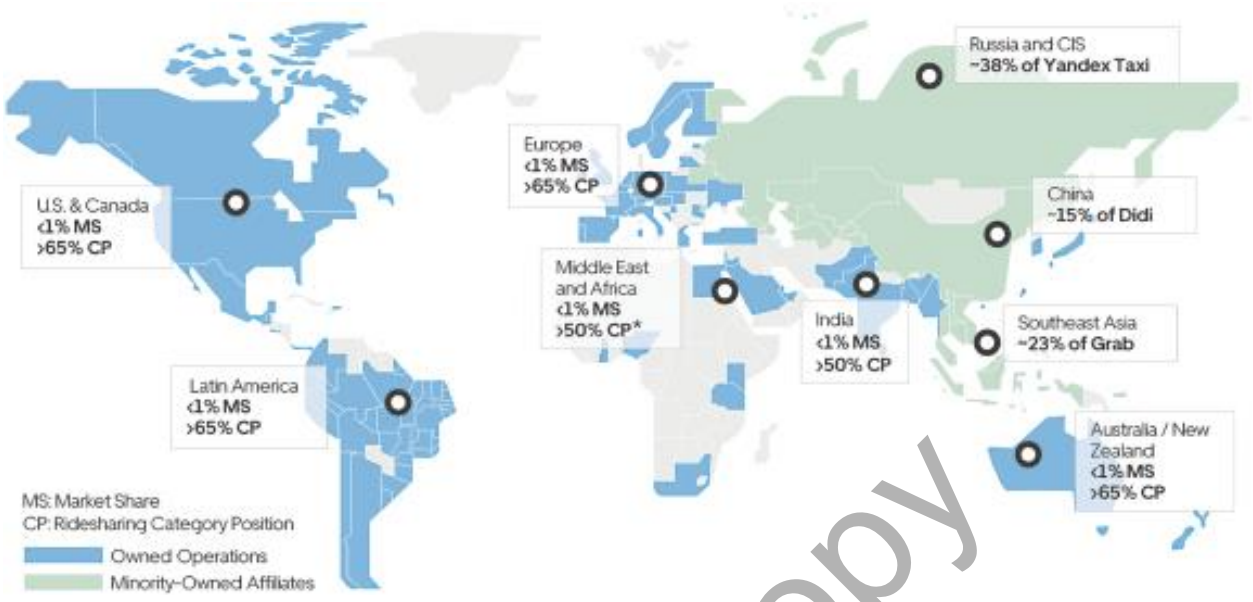
Exhibit 1

Global Net Revenue of Uber from 2013 to 2020 ($bn USD)



Source: Eric Burgueno Salas, "Global Net Revenue of Uber from 2013 to 2021," Statista, April 4, 2022, https://www.statista.com/statistics/550635/uber-global-net-revenue/.

Exhibit 2
Uber's Global Ridesharing Footprint (2019)



Source: Uber Technologies, *United States Securities and Exchange Commission Form S-1* (filed April 11, 2019), https://www.sec.gov/Archives/edgar/data/1543151/000119312519103850/d647752ds1.htm

Exhibit 3

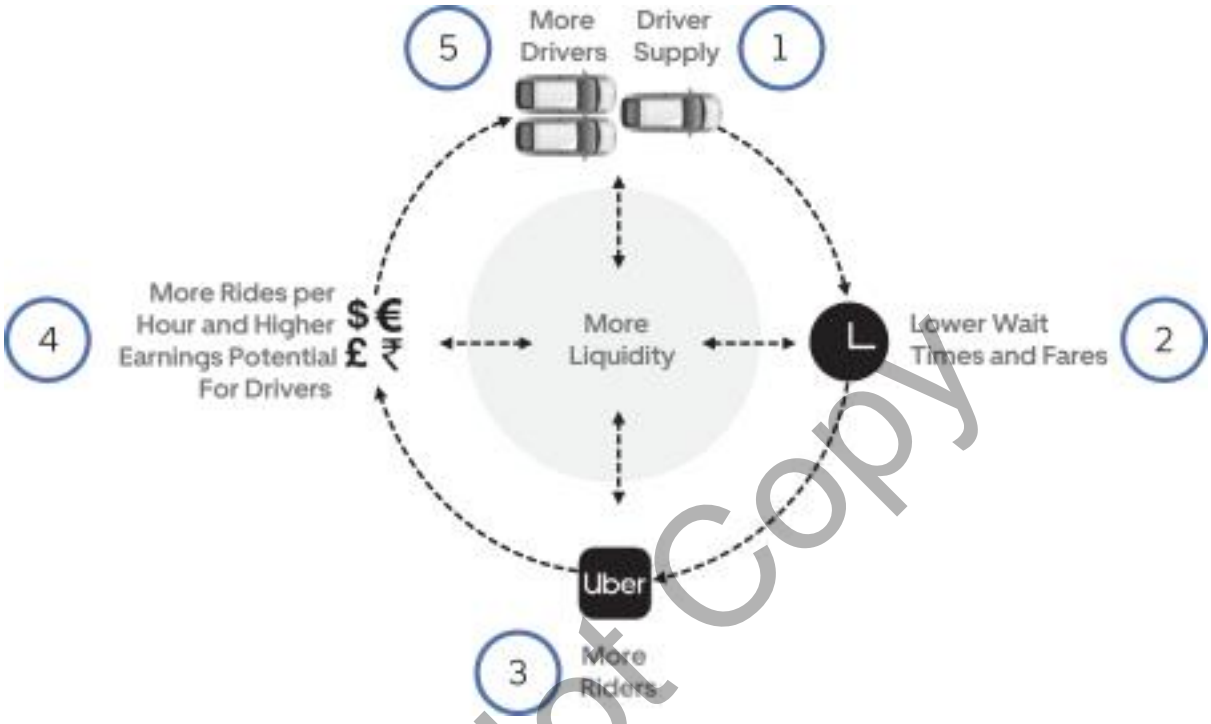
Uber's Launch Playbook

1. **Secretly enter a new market with brand ambassadors.** Brand ambassadors offered incentives to both riders and drivers. Incentives included free rides for first-time customers and phones, financing, and $1,000 cash incentives for drivers
2. **Ignore threats of legal action and government sting operations.** Ousted CEO Kalanick pioneered and perfected this strategy, and it served the company well at the time.
3. **Push for local political influence** Once step 1 was completed successfully and Uber gained traction, dedicated company employees lobbied local politicians and partnered with local nonprofits and celebrities to garner support.
4. **Dominate the market.** Uber was able to monopolize the market by burning through its ample VC funds to hire more drivers. The company's PR stunts, such as delivering puppies or kittens, gained it notoriety.
5. **Undermine the competition.** Uber recruited drivers from competing ridesharing services, even hiring riders using burner phones to request rides from competitors, and then recruited those drivers.

Source: Adam Henshall, "The Aggressive Processes Uber Is Using for Global Expansion," process.st, April 21, 2017, https://www.process.st/global-expansion/.

Exhibit 4

Uber's Network Effect



Source: Uber Technologies, *United States Securities and Exchange Commission Form S-1* (filed April 11, 2019), https://www.sec.gov/Archives/edgar/data/1543151/000119312519103850/d647752ds1.htm

Exhibit 5

City Characteristics

City	Population	Area (miles^2)	Minimum wage	Average trip distance (miles)	Average travel speed (miles/hr.)	Taxi initial charge ($)	Taxi price per mile ($/mile)
NYC	8,922,908	300.38	$14.20	3.0	26.0	2.5	2.5
San Francisco	894,584	46.90	$15.50	5.5	25.0	3.5	2.75
Boston	693,062	48.34	$15.00	4.4	26.0	2.6	2.8
Chicago	2,366,119	227.37	$13.00	5.5	29.0	3.25	2.25
Washington DC	715,891	61.14	$16.50	5.9	22.0	3.25	2.16
Los Angeles	3,930,586	468.96	$15.50	6.7	38.0	2.85	2.7
San Diego	1,410,791	325.88	$15.50	7.2	49.0	2.8	3
Dallas	1,336,347	339.74	$7.25	8.9	49.0	2.25	1.8
Phoenix	1,656,892	517.67	$13.85	7.7	44.0	5	2.3

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Notes:

1) Average trip time is calculated as (Trip distance/average speed) × 60

2) To calculate target ridesharing price, first calculate the average price per taxi ride using this formula: Initial Charge + (Trip distance × Price per mile) and then divide the result by the average trip time. Finally, discount by 40% to target a considerably lower price than that charged by taxis.

Appendix 1

Uber in Context and in Competition

Backing up to place Uber in the context of similar start-ups, note that the company was not only part of a wave of on-demand app businesses facilitated by the iPhone's debut, but also part of what is now called the platform or sharing economy. Like Airbnb, the vacation rental giant, and Task Rabbit, the company that put customers who wanted odd jobs done together with gig workers, Uber, its closest competitor, Lyft, and other ridesharing services cut out the middleman. In the case of ridesharing services, the taxi dispatcher is replaced by a tech platform that seamlessly matches each side of this double-sided market (See Exhibit 6). The demand side consists of passengers who can't get a cab and want to get from point A to point B quickly, and the supply side is made up of drivers with downtime and extra capacity in their cars. The tech platform acts as an aggregator between these two markets and uses predictive algorithms to map and track all available cars within a given area, give accurate ETAs, and set prices, which are based on a dynamic model that varies with supply and demand. While Uber got flack for increasing fares when demand was high—i.e., using surge pricing—that strategy pushes up prices and consequent payout to drivers when supply is low, incentivizing more drivers to be on the road picking up passengers.[12] In fact, Uber board member Bill Gurley reported that when the company first tested dynamic pricing in 2012 in Boston, the on-the-road supply of drivers increased by 70% to 80%.[13] Surge pricing also helps regulate demand, creating a smaller pool of riders willing to pay steeper fares during holidays or adverse weather events.

While Uber is now the market leader in ridesharing, it was actually Lyft (an offshoot of parent company Zimride) that pioneered the idea of moving from ride-hailing to ridesharing by using ordinary drivers with a C-class license instead of licensed livery drivers and using regular cars, owned by the driver, instead of black cars and limos. Lyft created a warm fuzzy image, in part by having drivers plaster giant fuzzy pink mustaches to the grilles of their cars, give fist bumps to riders, and invite passengers to sit in the front seat. Lyft's strategy caught on, especially with young people who didn't want to be chauffeured but just wanted, well, a lift.

When Lyft entered Uber's home city of San Francisco in 2012, Uber's leadership decided they would leave this more plebeian approach to their competitor. They also felt that Lyft's ridesharing scheme would run afoul of regulations. When the service took off and regulators left Lyft alone, Uber swooped in, sans fuzzy mustaches, and used Lyft's approach. The company started UberX, offering inexpensive rides in fuel-efficient hybrid cars and, as Lyft had, by 2013 Uber began recruiting drivers with class-C licenses. Later on, when Lyft introduced a service for carpooling with other riders at lower fares, Uber started UberPool. While Lyft had been first to market with its peer-to-peer model and carpooling, Uber had a much more extensive network and relied on the same ruthlessness that had fueled its exponential growth to try to quash Lyft's. In 2014 the *Verge* published an exposé revealing

Uber had hired temp workers with burner phones to request Lyft rides and then recruit drivers.[14]

Uber's schemes to undermine Lyft were at the center of many controversies, including protests from Uber drivers who wanted the status and benefits of employees rather than the conditions of gig workers, that shifted public sentiment against the ridesharing giant. But Uber's most damaging PR came from within. In 2017, a female Uber employee wrote a blog about the company's sexist "baller" culture, which came from the top down. A #deleteuber campaign became viral, and Kalanick and 20 of Uber's top employees resigned after shareholders revolted. Dara Khosrowshahi, former CEO of Expedia, was brought in as CEO.[15]

In 2021, Uber and Lyft were the largest ridesharing players in the United States, and riders switched between the two platforms just as drivers did. Yet even though Lyft took quite a bite of the first mover's market share, Uber still dominates North America, Europe, and Latin America. As mentioned above, Uber was not able to top competitors in China (Didi Chuxing), Southeast Asia (Grab Taxi), India (Ola) and Russia (Yandex). These local players reap support from their communities and from the state. From 2013 to 2016 Uber poured billions into China, trying to overtake Didi, but it ended up selling its China business to its rival in exchange for a 12% stake in the company. In 2020, Didi had 15 million drivers across 15 countries, compared to Uber's five million worldwide.[16]

Endnotes

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