

WORKING PAPER:

World Cities of Ride-Hailing

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Abstract

This paper examines the economic geography of eleven digital ride-hailing firms, each with a market valuation in excess of \$1B. With reference to the literatures on world cities and contemporary connections between world cities, innovation and agglomeration, the paper explores headquarter and secondary office location patterns that characterize ride-hailing. As a relatively nascent yet significant component of the digital platform economy, tracing the rapid growth, urban concentration and urban impact of ride-hailing as an industry highlights the ways in which particular features of urban economies contribute to a reconfiguration of world cities characteristic of the twenty-first century. The economic geography of these powerful firms also has implications for how we think about the global cities literature, the platform economy and the larger challenges of innovation and inequality in the global urban economy.

Keywords: Ride-hailing, world cities, platform economy, innovation

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World Cities of Ride-Hailing

Cities and urban transportation are currently undergoing dramatic change. This includes the emergence of ride-hailing as a relatively new, disruptive mobility option. Initially, it seemed that ride-hailing was focused on decimating the taxi industry, but it is now evident that disruptions associated with ride-hailing are connected to wide ranging transformations in urban mobility. These include a move towards mobility as a service, efforts to reduce reliance on private automobiles and associated negative environmental impacts, and the convergence of ride-hailing with autonomous vehicle technology. While these matters are the subject of a growing literature (see: Clewlow and Mishra, 2017; Sumantran, Fine and Gonsalvez, 2017; Sperling, 2018; Stocker and Shaheen, 2017), far less attention has been paid to the rapid growth of ride-hailing as an urban industry with global reach. The location patterns of ride-hailing firms and related investment and talent attraction strategies present an opportunity to assess the new ways in which economic activities concentrate in cities around the world. It also presents an opportunity to rethink the global cities literature and its methodological and epistemological limitations.

As is well known, the world cities literature illuminates the role of a small set of cities around the world, predominantly in the global north, as the world's key centres of economic and political power. These world cities, it is argued, play a disproportionately significant role as centres of concentration for multinational headquarters (Hall, 1966), corporate decision making (Cohen, 1981; Friedmann, 1986); and as sites in which producer services firms agglomerate (Sassen, 1991). Beaverstock, Smith and Taylor's (1999) study of world cities moved beyond the notion of a single tier of world cities, towards a world cities hierarchy. By examining world cities – as defined by the concentration of global finance, insurance and real estate; law; advertising and accounting firms – Beaverstock et al (1999) both acknowledge and raise the challenge of examining a wider economic geography of world cities, albeit one that as recently as twenty years ago remained concentrated in the global north.

The challenges of a world cities model was the subject of intense debate in the early stages of the twenty-first century. World cities are not only identified as places in which globally oriented firms concentrate investment, jobs and connections to the broader benefits associated with participating in locally embedded agglomeration economies (Sassen, 1991; Storper and Scott, 2016), they are also places of growing intra and interurban disparity (Hamnett, 2003; May et al, 2007). Notably, these are challenging times for world cities which appear to be in the midst of a

crisis of growing income inequality and polarization (Sassen, 2001; Glaeser et al, 2009; Hulchanski, 2010) alongside concerns regarding the future of work and prospects for employment in an increasingly digital world (OECD, 2018). Introduced nearly four decades ago, Rosen's (1981) conceptualization of superstars as applied to seemingly outsized earnings of select individuals, now applies to distinctions between cities too. At an interurban scale, investment decisions that continue to concentrate firm activity in a select number of nationally recognized superstar cities have an unintended but nevertheless negative impact on the prospects for rejuvenation of cities experiencing decline (Badger, 2018). Furthermore, these challenges are understood to be aggravated by the influence, practices and activities of technology firms and the increasing concentration of wealth in a small number of firms (Bessen, 2017; Florida, 2017; Galloway, 2017).

Through an exploration of ride-hailing's emergent economic geography, this paper provides a nuanced examination of functional city classifications amid expansion and extension of a global map of economic activity. In this regard, it contributes to literature connecting world cities, economic transformation, and innovation. At the same time, it underscores deepening divides characterizing our urban systems. A relatively new and disruptive sector, ride-hailing is a global industry that presents an opportunity to study whether and how the forces at play in agglomeration and concentration of firm headquarters and economically significant office locations contribute to patterns of urban change.

Since 2012, 11 startup digital ride-hailing firms have reached a market valuation of \$1B or more, leading to their characterization as unicorns². These ride-hailing unicorns are contextualized as urban actors and influencers through an examination of the brief history of ride-hailing and its connection to innovation, regulation and cities. This research suggests that the global economic geography of ride-hailing is one in which headquarters and R&D activities are highly concentrated. The results of a case study approach indicate that emerging innovation-driven service-oriented industries such as ride-hailing are characterized by greater and different geographic variation than previous rounds of industrialization and associated world cities hierarchies. Finally, the paper concludes by addressing the manner in which ride-hailing may be emblematic of relational shifts in existing and emerging global cities. Ride-hailing as a case study illuminates the challenges and tensions between economic development in late stage twenty-first century capitalism vis a vis the challenges and tensions associated with twenty-first century cities.

World cities, innovation & the urban century:

² A unicorn is a privately held technology firm with a market valuation of \$1B or more.

Two strands of research are particularly relevant to understanding and explaining the features underlying the emergence and economic geography of ride-hailing's unicorns. First, the world cities literature, and specifically in its turn towards understanding world cities through a tiered roster of cities (Beaverstock et al, 1999; Kratke and Taylor, 2004; Benton-Short, Price and Friedman, 2005) contributes a lens through which to interpret the spatial patterns and urban economic geography of a new, technology-driven industry with a penchant for urban concentration. Second, scholarship connecting innovation theory with theories about the causes of urban growth provides insight as to why ride-hailing firms, employment and investment are increasingly concentrated in a small subset of cities while the operations of these firms remain steadfastly global in reach (Storper and Scott, 2009; Florida and Hathaway, 2018).

The world cities literature is based on decades of work stemming from economists, geographers, sociologists and others demonstrating the spatial concentration of economic activity in a select number of cities around the world. The concept signifies in and of itself the (contested) notion that only an exclusive group of cities are the sites of advantage in terms of concentrated power and wealth (Smith, 2014). Until the turn of the twenty-first century, scholarship on the concept of world cities focused on a small and select number of cities that typically included: New York, London, Paris, Hong Kong and Tokyo. Swaths of the world with the largest absolute populations, including China and India, were completely off the map in these earliest iterations focused on mapping and understanding global cities as centres of global economic concentration and political power. One of the key contributions of Beaverstock et al's (1999) work was the development of a global map of world cities identifying cities according to a three-tiered hierarchy that included 55 cities, rather than focusing exclusively on the top tier. This approach fundamentally opened up thinking about the role of world cities and the opportunity for participation in economic command and control functions to a much broader range of cities around the world. Since its publication, debate on world cities has expanded to include the development of alternate types of rosters – including examinations of world cities of culture (Kratke and Taylor, 2004), world immigrant cities (Benton-Short, Price and Friedman, 2005), and the concept of 'ordinary cities' (Robinson, 2002).

The world cities literature is one of the most enduring in urban economic geography, and has generated robust critique, especially of the dominant world cities approach (Abu Lughod, 1995; Brenner, 1998; Robinson, 2002). While Robinson's (2002) postcolonial critique implores us to think deeper about some of the underlying developmentalism acceptance, there is ample room for further investigation on how technology is changing the dominant discourse associated with the concept of the world city.

Enquiry regarding the cost and human impacts associated with growing world city stature is captured in research findings that examine the underbelly of world cities as capitalism and neoliberally-oriented policies proceed apace. This includes a range of troubling findings related to the implications for low-skilled labour, increasing employment precarity, gender- and race-based inequality and a move towards increasing intraurban polarization and inequality within world cities (May et al, 2007). The risks of capitalism unchecked and decisions to disable government policies that redirect and redistribute wealth are evident in the rise of social, physical and economic challenges (May et al, 2007; Wills et al, 2009).

Another key element associated with the world cities literature as it characterizes twenty-first century cities, is the intersection with scholarship on innovation and technology. As cities continue to solidify their role as the economic engines of nations, policy and investment driven by national, state and local decision-makers has the potential for both positive and negative impacts. In the tech era, the economic geography of superstar firms and superstar cities can be understood through an examination of the processes of concentration, agglomeration, and knowledge spillovers; government policy impacts; firm-level market concentration; and the all-encompassing need for access to highly specialized pools of talent.

Economic geographers have continued to establish that innovative firms and industries benefit from being in close proximity to one another, taking advantage of agglomeration economies (Glaeser, 2010). Particular urban locations provide a number of supports in this regard, especially with respect to the presence of a strong network of actors and associations, or ecosystem. That ecosystem typically includes shared knowledge and specialized labour pools, research activity and training programs stemming from universities, supportive institutions and a governance structure that encourages or facilitates continued economic development. While density of firms and relatively high wages go hand in hand, case studies and analysis suggest that the benefits of proximity and the opportunity to share knowledge, talent, amenities and other resources makes it worthwhile for firms to pay a premium to locate in the most desirable, most expensive locales (Glaeser, 2010). Despite their need to compete for talent, capital and access to space, firms also benefit from localized ties to one another. Strong, vibrant, resilient ecosystems do not thrive by serendipity alone. Wolfe (2010) highlights the embeddedness of local institutions and civic leadership and the ways in which the intentional, strategic combination of these factors can contribute to the elevation of regional knowledge assets. McNeill (2016) describes San Francisco's makeover as a city of venture-capital supported unicorns, emphasizing the role that purposeful associative action plays in shaping political change through such means as relationship-building, philanthropic giving and lobbying. And importantly, the growth of technology firms does not emerge from the work and talent of successful entrepreneurs alone. In fact, extensive benefits arise to many of the world's leading

tech firms as a result of action and investment led by governments, with industry-led results often arriving decades after initial government investments (Mazzucatto, 2018).

While innovation is touted as a harbinger of urban economic growth, increased innovative activity can also lead to negative spatial outcomes, including inequality (Lee and Rodríguez-Pose, 2013). Observations of the conditions in which capital and wealth continue to concentrate in a smaller number of firms and a select group of cities, is problematic from the perspective of policies and efforts meant to address inclusivity, openness and opportunity (Lee, 2018). Galloway (2017) questions the ways in which four firms exercise an astonishing command of advertising, online shopping, online search and computer hardware, and refers to these firms as the ‘four most powerful firms on the planet’. In extending their reach across the globe, the actions and impacts of Amazon, Apple, Facebook and Google on government, society, competitors and individuals is all-encompassing. Governments, policy leaders and academics are challenged by efforts to understand the implications of concentrated wealth and capital and at the same time, the spatial impacts of superstar firms on widening divides amongst cities (Muro and Whiton, 2018; Florida, 2017).

Another area of inquiry is the impact that technology companies with massive valuations are having on competition and wage growth, further amplifying inequality (Phillips, 2018). Though there is disagreement on the underlying causes, there is general consensus that twenty first century capitalism is characterized by increasing market concentration in a smaller number of multinational firms. Grullon, Larkin and Michaely (2018), find that more than 75 percent of US-based industries experienced greater market concentration over the past two decades. The authors conclude that shifts in market concentration may actually lead to weakened competition within these markets. This finding is significant because it suggests that, with weakened competition, may also come weakened wage increases – thus contributing to slower wage growth and greater inequality amongst earners. Bessen (2017) and Bessen and Frick (2018) however, contend that observations of increasing market concentration in a smaller number of firms is the result of these firms’ development of successful, proprietary information technology systems rather than representative of an overall decline in competition amongst firms. Heightened polarization in terms of size, productivity, profitability, market concentration and wages (Bessen and Frick, 2018), characterizes distinctions between firms.

In addition, the convergence of world cities and innovation-led urban growth means that high-skilled human capital is the new oil. Access to talent, cultivation of talent and sufficient numbers of skilled people are cited with frequency by governments, firms and institutions as one of the most critical pieces in contemporary economic development and location strategies. At the highest level of the world cities roster, specialized, highly-skilled talent and high wages

are justified on the basis of participation in a global labour market (Beverstock, Smith and Taylor, 2000). Furthermore, the finding that productivity is enhanced in innovative firms, as well as in firms located in cities and regions in which talent is concentrated (Wolfe and Bramwell, 2016), matters for the ability of firms and places to sustain and increase economic growth.

At the same time, there is notable division and inequality within cities and firms. In examining the pace of tech sector growth in San Francisco, McNeill (2016) affirms that rising wages for the highest earners leads to exacerbated challenges at an urban ecosystem level in terms of wages, housing prices, affordability for service workers and firms' ability to attract talent to all but the highest paid jobs. In the US, discussion of the expanding locational strategies of tech firms and office location decisions that leverage new locations while providing access to the right kinds of talent, at the right wage scales has ensued, and is often focused on North American office expansion strategies (CBRE, 2018). Beyond the US, there is also a shifting global pattern of firm location that benefits from skill-specific talent in a range of locations. The location strategies of multinational firms, particularly with respect to expansion in the global south, is no longer strictly a mechanism to benefit from low-wage labour. Rather, firms are actively seeking out new locations outside of their home country base, in order to access talent pools across a range of wage and skill levels. Indeed, Branstetter, Glennen and Jensen (2018) find that the talent pool in the US is no longer sufficient to meet demand, and firms are actively shifting high value-added activities including R&D to previously non-traditional locations such as China, India and Israel.

Ride-hailing: A brief history

The birth of ride-hailing and its continued evolution is tied to the conditions described above: namely, a shifting geography of economically powerful global cities; emphasis on innovation in products, processes, and policy; growing digitization; continued concentration of wealth in a relatively small number of firms focused on advanced technologies; and increasing ability for globally oriented firms to develop multinational location strategies that enable them access to highly skilled talent.

As a business concept, ride-hailing became possible as a direct result of the convergence of wireless networks, GPS technology and software applications in combination with the widespread adoption of smartphones. By 2012, new ride-hailing firms such as Uber began to disrupt established ground transportation services, through the creation of a platform that facilitated a digital match between nonprofessional drivers of private vehicles with paying passengers. Ride-hailing firms leveraged the digital trifecta of wireless, GPS and smartphone saturation to develop new, highly scalable models that frequently circumvented existing

regulations and constraints associated with both geographic and political boundaries. Since 2012, ride-hailing has expanded and scaled rapidly as a result of: aggressive business practices by upstart firms; associated consumer and producer benefits linked to cost savings, efficiency, and customer service improvements associated with digital hailing; and the rewriting of municipal regulations to enable ride-hailing firms to legally operate as part of a municipality's ground transportation system (Brail, 2017).

As a practice, ride-hailing is notably urban in nature. Estimates suggest that urban transportation accounts for 60% of all miles travelled at a global scale (Van Audenhove, Korniiichuk, Dauby, & Pourbaix, 2014). It is posited that urban settings are crucial to the contemporary proliferation of digital platform economy activities such as ride-hailing as a result of industrial clustering, spillover effects, dense populations, and proximity of large groups of producers and consumers (Davidson and Infranca, 2016). Furthermore, the global mobility sector is estimated to be worth more than \$5T annually (Tillemann, 2018). Thus, leveraging ride-hailing models to address urban transportation needs portends both an opportunity to address challenges in urban mobility while also presenting financial promise for successful firms.

As an emergent and maturing sector, ride-hailing has raised the ire of critics on an expansive number of issues. These range from the notion that: ride-hailing takes advantage of a precarious, underpaid labour force (Slee, 2015); firms employ questionable business practices including the use of algorithms to induce driver behavior that benefits firms over drivers (Scheiber, 2017; Rosenblat, 2018); ride-hailing firms wield undue influence over policy and regulation setting (Levintova, 2016); it contributes to added congestion and emissions in cities (Schaller, 2017); ride-hailing is a deterrent to public transit use (Clewlow and Mishra, 2017), and leads to induced demand for travel that otherwise would not have taken place (Clewlow and Mishra, 2017). On the flip side, however, evidence also demonstrates that the introduction of ride-hailing extends service to underserved areas (Brown, 2018); has the potential to reduce automobile ownership and vehicle miles travelled (Sperling, 2018); and, unexpectedly, can increase public transit use in large cities with extensive public transport networks (Hall et al, 2018).

Multi-firm studies of ride-hailing are limited and largely concentrate on single city or country studies. Common findings include an emphasis on congestion impacts (eg: Schaller, 2017), labour implications (Slee 2016, Rosenblat, 2018); impacts on existing ground transportation, especially taxi and public transit (Hall et al, 2018) and concerns related to governance (Ranchordas, 2015; Davidson and Infranca, 2016). Ride-hailing is a dynamic, evolving industry. In less than a decade, ride-hailing has gone from non-existent to a sector that operates at a

global scale, attracts the largest component of venture capital funding, is embedding itself in a select number of urban innovation and startup ecosystems, and is contributing to some of the most dramatic change in urban transportation that cities have witnessed in decades, possibly since the widespread introduction and adoption of the automobile.

While the growth and regulation of mobility services and various future scenarios has played out on the public stage of cities, the creation and expansion of a new set of firms operating under a novel set of circumstances, at a global scale, is relatively unexamined. And yet, the location patterns of ride-hailing firms and the wider ways in which these patterns suggest linkages to a changing roster of world cities along with the growth of urban tech, suggests that ride-hailing and ride-hailing firms are impacting cities in ways that deserve greater scrutiny.

Ride-Hailing's Global Unicorns

An analysis of the urban economic geography of ride-hailing's largest firms provides insight into the ways in which cities are engaged as economic actors in this sector. Since Uber's founding in 2009, a total of 11 ride-hailing firms have emerged with a market valuation of \$1B or more. Table 1 presents an overview of the 11 ride hailing unicorns, highlighting their market valuation, year in which they reached unicorn status, headquarters location and the number of cities and countries in which each operates. Collectively, these 11 firms have a market valuation of \$171.1B USD. Uber and Didi-Chuxing's market valuations of \$72B and \$56B respectively, represent nearly 75 percent of the total market valuation for the 11 firms. These two firms dwarf the market valuations of the remaining firms which range from \$15.1B (Lyft) to \$1B (99 and Taxify).

Uber leads ride-hailing unicorns not only in terms of market valuation, but also with respect to being the first ride-hailing firm to achieve a \$1B valuation in 2013, followed by Didi-Chuxing, Lyft, and Grab in 2014. Two firms (Go-Jek and Careem) entered the list of unicorn ride-hailing firms in 2016, one (Ola) in 2017. In 2018, the remaining four firms became ride-hailing unicorns (Cabify, Gett, 99, Taxify). Uber and Didi-Chuxing, while joined by these nine firms on the list of unicorns, hold special status not only because of their valuations, but also with respect to their extensive networks of investment and partnerships with other ride-hailing firms. Uber, through negotiations covering mergers and exits from China and Southeast Asia, holds ownership shares in Didi-Chuxing and Grab. In addition, Uber exited Russia and the former Soviet Union in a merger with Russian ride-hailing firm Yandex.taxi that was finalized in early 2018. Yandex.taxi, valued at approximately \$3.8B is a subsidiary of Yandex, a publicly-traded firm based in Moscow (Sawers, 2017). Didi-Chuxing, has invested in Careem, Grab, Lyft, Ola, Taxify and acquired a majority share of 99 in early 2018. This means that Cabify and Go-Jek are the only ride-hailing unicorns that do not have a relationship with either Uber or Didi-Chuxing.

TABLE 1: Global Ride-Hailing Unicorns³

Firm	Market Valuation (\$B USD)	Reached \$1B Valuation	Headquarters Location	# of cities	# countries	Geography
TOTAL	\$174.8			2600+	85	
Uber	\$72	2013	San Francisco	685	66	Global
Didi-Chuxing	\$56	2014	Beijing	710	3	China
Lyft	\$15.1	2014	San Francisco	648	2	US / Canada
Grab	\$10	2014	Singapore	160	8	Southeast Asia
Ola	\$7	2017	Bangalore	109	2	India
Go-Jek	\$5	2016	Jakarta	50	1	Indonesia
Cabify	\$1.4	2018	Madrid	39	11	Spain, South America
Gett	\$1.4	2018	Tel Aviv	103	4	Israel, Europe, North America
Careem	\$1.2	2016	Dubai	77	14	Middle East (excluding Israel)
99	\$1	2018	Sao Paulo	572	1	Brazil
Taxify	\$1	2018	Talinn	43	27	Europe, Africa

³ Data accurate as of August 2018

World Cities of Ride-Hailing

A database was built to enable analysis of the location patterns of ride-hailing firms. It was created through the extensive compilation of data from a variety of sources, including ride-hailing company websites, news media, research reports and company profiles produced by business intelligence firms. Data collection took place from February to December 2018. The timing of data collection is significant due to the rapid pace of change that characterizes firms operating in this space. Compiled in this way, data provides firm, sector and city-specific insights that builds new knowledge about the geography of ride-hailing operations from a spatial perspective. Furthermore, the database creates an understanding of the significance of city-level location decisions and the role of agglomeration and knowledge spillovers in particular cities. The primary weakness of the database is the potential for incomplete location information in terms of capturing the intermediate activities of firms including R&D, engineering, marketing and strategy activities. However, given intense interest in the activities of ride-hailing firms and subsequent reporting, the database captures the majority of significant activity undertaken by the firms. In addition, interviews with four of the six largest ride-hailing unicorns carried out by the author between 2016 - 2018 provide additional context and further qualitative insight on location patterns, firm strategy and decision-making.

Analysis of this material demonstrates a number of key features that characterize the economic geography of ride-hailing. First, the global reach of ride-hailing is indisputable. Collectively, these 11 firms provide ride-hailing services in 85 countries and in more than 2600 municipalities⁴ around the world (see Map 1). Second, while cities in which ride-hailing operates are abundant, operations activities alone are not considered to comprise a significant economic opportunity in terms of investment or job creation. Third, the location of high-level activities in ride-hailing, including headquarters, R&D and engineering (see Map 2) and to a lesser extent regional and national operations, are highly concentrated. Table 2 identifies the cities that fall under each of these categories.

⁴ It should be noted that there are limitations with respect to calculating the number of municipalities in which these firms operate. First, the list is undergoing near-constant change, particularly as firms continue to expand, as well as in some cases, contract. Second, it is challenging to accurately collect names of all of the cities of operation for some firms, particularly those operating in non-English speaking countries. Third, for the most part firms list the names of municipalities in which they operate, however in some cases, the name of the city represents a metropolitan area and not a municipality.



Cities of Operations

The 11 ride-hailing unicorns collectively produce ride-hailing services in 85 countries around the world, spanning more than 2600 municipalities. Geographically, the leading ride-hailing firms are distinguished by their global reach. With the exception of 99, which operates only in Brazil (albeit in 572 Brazilian cities), all of the remaining ride-hailing unicorns operate outside the borders of their headquarters nation.

Operationally, cities across the globe are served by ride-hailing firms, with new cities being added to the rosters of ride-hailing firms with such regularity that keeping the database up to date represents a challenge on its own. From the perspective of service provision, ride-hailing's global reach is generally lauded. For instance, when Dubai-based Careem launched in Khartoum, Sudan in September 2018 a news story emphasized the hiring of ten local employees to manage its Sudanese services (Reuters, 2018). However, it is problematic at best to make the case that real economic benefits in the form of job growth, talent development and local investment accrue to cities in which the only investment made by a ride-hailing unicorn is a local office that recruits drivers, conducts marketing campaigns and employs a handful of office staff. The types of local offices that are established are typically small, connected locally but not necessarily connected globally. Uber, the largest ride-hailing firm employed 16,000 people directly at the end of 2017 (Bhuiyan, 2018). That same year, it was reported that there were over 2 million drivers (Camp, 2017), none of whom were considered or treated as employees of the firm. While the research presented in this paper does not examine labour issues in ride-

hailing, it nevertheless is crucial to acknowledge that ride-hailing's impacts include difficult and sometimes destructive consequences for labour.

MAP 2: World Cities of Ride-Hailing



Table 2: World Cities of Ride-Hailing – Headquarters, R&D / Engineering

City	Headquarters	R&D / Engineering
Aarhus		
Amsterdam		
Bangalore*		
Beijing*		
Berlin		
Bucharest		
Dubai*		
Ho Chi Minh City		
Jakarta*		
Karachi		
Kuala Lumpur		
Lahore		
London		
Madrid*		
Moscow		
Munich		
New York		
Palo Alto		
Paris		
Pittsburgh		
San Francisco*		
São Paulo*		
Seattle		
Singapore*		
Sofia		
Tallinn*		
Tel Aviv*		
Toronto		
Vilnius		

*= headquarters city

Headquarters Cities

Whereas ride-hailing operations are expansive and distributed, headquarters activities are limited to ten cities. Locations of ride-hailing headquarters are characterized by one or more of the following: established or emerging world cities for technology startups (San Francisco, Beijing, Singapore); national or regional policies geared towards attracting innovation-oriented firm formation (Bangalore, Singapore, Tel Aviv, Tallinn); and locations that can be described as gateway cities which benefit from cultural, linguistic and/or region-specific qualities including access to large populations (Bangalore, Beijing, Dubai, Jakarta, Madrid, Sao Paulo, Singapore).

The headquarters locations of ride-hailing unicorns are spread across five continents: North America, South America, Europe, Asia and the Middle East. From these 11 firms, stem ten headquarters cities: San Francisco is the lone North American city and the only city that is home to more than one headquarters; Sao Paulo is the only city hosting a ride-hailing unicorn headquarters in South America; Madrid, and Tallinn represent Europe; while Tel Aviv and Dubai emerge as ride-hailing headquarters cities in the Middle East. Four ride-hailing unicorn headquarters are located in Asia: the cities of Bangalore, Beijing, Jakarta and Singapore are each home to one ride-hailing unicorn.

Significantly, the global headquarters locations of ride-hailing unicorns lends support to the notion that the geography of world cities is dynamic. This sector emphasizes the ways in which the concentration of global cities has shifted over the past two decades. In comparing ride-hailing headquarters cities to the list of alpha world cities identified by Beaverstock et al (1999), Singapore is the only ride-hailing headquarters city that was ranked as an alpha world city in 1999. Three world cities of ride-hailing were classified as secondary or beta world cities twenty years ago: Madrid, San Francisco, and Sao Paulo (Beaverstock et al, 1999). A further two cities were identified as third tier or gamma world cities (Jakarta and Beijing), and three cities – Tel Aviv, Dubai and Bangalore were identified as demonstrating evidence of world city formation but could not at the time be classified as world cities (Beaverstock et al, 1999).

An updated list of global world cities developed in 2016 by the GaWC (2017), emphasizes the scale, shift and expansion of cities between 1999 and 2016. The location of ride-hailing firms in newly emergent alpha cities is in line with the expansion of world cities as illuminated in recent scholarship. Based on the GaWC 2016 world cities classification, the headquarters locations for nine of eleven ride-hailing unicorns are located in alpha world cities. Two firms - Ola and Taxify, located in Bangalore and Tallinn, respectively – are beta and gamma world cities based on this same classification. The presence and growth of ride-hailing unicorns in these places may signal increased prominence of both cities as global centres of growing significance.

Further evidence of world cities of ride-hailing as significant centres of innovation and technology-focused industry can be found in examining recent concentrations of venture capital investment. In comparing data on world cities of ride-hailing with a study of leading cities worldwide with respect to their roles as global headquarters locations for firms receiving venture capital investment (Florida and Hathaway, 2018), five of the top 20 cities ranked by venture capital attraction between 2015-2017 are also headquarters to ride-hailing unicorns: San Francisco, Beijing, Bangalore, Tel Aviv, Singapore. Eight of the ten ride-hailing world city headquarters locations are ranked within the top 50 cities of venture capital investment. Madrid and Tallinn are the only two headquarters cities that are not ranked amongst the top 50 centres of venture capital.

Intentional government policy at local, regional and national levels further contributes to and solidifies the role of headquarters cities in terms of their attractiveness to innovative and growing firms. For instance, Grab's founders moved their headquarters from Kuala Lumpur, Malaysia to Singapore to benefit from a variety of advantages including: government subsidies and tax breaks, an established, internationally-oriented ecosystem of startups, and a strong reputation for economic stability (Correspondent, 2017). San Francisco and the Bay Area continue as dominant players and the site of headquarters locations for technology-based firms in part because, as Saxenian (1983) and Mazuccato (2013) remind us, large waves of government investment in research and development precipitated the rise of the region as a centre of innovative firms and industries thus setting the stage for continued concentrations of innovation and entrepreneurship.

The presence of ride-hailing unicorns in places such as Tallinn, Estonia and Tel Aviv, Israel appear connected to the role of innovation-focused policies led through intentional government initiatives and supports in the largest cities of these two relatively small countries. What may be key to Tel Aviv's strength in spawning startups is an intentional set of state-led R&D and innovation policies (Breznitz, 2007) as well as significant military spending and training that has prompted the growth of post-military service entrepreneurship (Avnimelech and Teubal, 2004.) In the case of Taxify, Estonia has embarked on an intentional strategy to become one of the most digitally advanced countries in the world. Over the past two decades the Estonian government has developed regulations, e-government services and innovation-focused investment attraction strategies following the country's independence from the former Soviet Union (Hammersley, 2017).

While most headquarters cities are also home to secondary offices of competing firms (see next section), four ride-hailing headquarters cities are home only to their homegrown unicorns: Dubai, Madrid, Tallinn, and Tel Aviv. In part, these headquarters locations may reflect a firm's

strategic positioning to access specialized consumer markets as defined by language, culture and politics. Dubai-based Careem exemplifies a regionally-focused strategy: the firm launched in 2012 and emphasizes its services in the Middle East, North Africa, Pakistan and Turkey. Lead investments and partnerships with regional firms and governments include those in Dubai, Saudi Arabia and Egypt and more recently a strategic partnership with Didi-Chuxing. With the exception of an R&D office in Berlin, all of Careem's secondary offices are located in the Middle East and Pakistan.

R&D and Engineering

In addition to the ten cities that serve as home to headquarters of ride-hailing's unicorns, an expanded subset of cities act as gateways to providing a venue for research activities, technology and software development, access to engineering talent and government lobbying and advocacy.

Analysis of the list of cities that are the sites of R&D activities as well as engineering expertise, includes replication of headquarters cities as well as another layer of cities that host offices of one or more ride-hailing firms. Table 2 highlights the 29 cities in which ride-hailing firms have strategically situated headquarters and secondary offices that include efforts related to R&D, engineering and new product development. Each of the 11 firms situates engineering and R&D activity in their headquarters location. This table demonstrates that there are strong indicators to suggest that firms are benefitting from agglomeration economies as well as knowledge and talent spillovers in cities based on location patterns. This finding is also confirmed through interviews. Of the 29 cities hosting secondary offices, five are headquarters locations to other ride-hailing firms: Bangalore, Beijing, Jakarta, San Francisco and Singapore. Interviewees acknowledged that situating secondary locations in the headquarters cities of other firms is a strategy through which they access a wider pool of specialized tech talent as well as access to startup ecosystems. For instance, Jakarta-based Go-Jek has research offices in Singapore and Bangalore. Both cities provide Go-Jek with access to engineering talent pools – at different wage points – and access to each city's tech ecosystem, recent university graduates and spillovers in the form of talent.

Fifteen of the 29 cities are also amongst the top 50 cities of venture capital investment globally (Florida and Hathaway, 2018). The concentration of venture capital in select cities and the concentration of ride-hailing activity in a subset of those cities is not particularly surprising or unexpected. Nevertheless, this result exemplifies the mutually reinforcing effects of entrepreneurship, venture capital and talent on a select number of cities, often to the exclusion of other places.

For the most part, ride-hailing unicorns locate their offices in cities where they also operate ride-hailing services. Eleven cities however, are the sites of secondary offices in which the firm does not have ride-hailing operations (see Table 3). Four of these cities (Bangalore, Beijing and San Francisco/Bay Area and Singapore) are headquarter locations of competitor ride-hailing firms. The remaining cities are Aarhus, Berlin, London, Munich, Seattle, Sofia and Toronto. Each of these cities is attractive for unique reasons, predominantly related to specialized talent. Careem has an engineering and technology office in Berlin that employs over 100 people. The firm chose to locate in Berlin to access global talent and be relatively close to the head office in Dubai in terms of the time zone (Careem, 2018). In November 2018, Didi-Chuxing announced the opening of a lab in Toronto, Canada, their second international location, following Mountain View, California. Didi-Chuxing highlights the “city’s inclusive environment for innovation and entrepreneurship,” as well as connections to the University of Toronto’s strengths in artificial intelligence and smart transportation (Financial Post, 2018). Lyft acquired London-based Blue Vision Labs in fall 2018, thus expanding their autonomous vehicle efforts (Rudgard, 2018) to that city. And Uber’s roster of offices includes two relatively small engineering-focused locations in Aarhus, Denmark and Sofia, Bulgaria.

TABLE 3: Offices / No Operations

City	Firm(s)
Aarhus	Uber
Bangalore	Go Jek, Grab
Beijing	Grab
Berlin	Careem
London	Lyft
Munich	Lyft
San Francisco	Didi Chuxing
Seattle	Grab
Singapore	Go-Jek, Uber
Sofia	Uber
Toronto	Didi Chuxing

Sassen (1991) suggests that advanced services firms prioritize locations in close proximity to other specialized businesses, over and above proximity to consumers. The selection of a city as host site, especially in instances where firms do not also have operations in place, signals that firms are selecting sites for strategic purposes, outside of their market base. The above examples lend support to the notion that knowledge spillovers matter. Through their locational strategies, firms leverage the presence of other ride-hailing firms and highly skilled talent.

Interviewees suggest that access to specialized talent is a key motivating factor. For firms selecting secondary locations in non-headquarters cities, a common thread tying these decisions together is co-location in a city with highly ranked university engineering programs. Pittsburgh and Toronto provide examples of cities where ride-hailing firms have chosen to locate in large part due to access to leading university researchers and students working in the fields of artificial intelligence, transportation engineering and computer science. Evidence from interviews, documentary analysis and scholarship suggests that connection to an established ecosystem including access to talent, universities and public sector investment opportunities and priorities matters. Galloway (2017, 202) concurs that proximity to universities with excellent reputations is significant and notes as an example that “three of the Four Horsemen – Apple, Facebook, and Google – have outstanding relationships with, and are a bike ride away from, a world-class engineering university, Stanford and short drive to another, UC Berkeley.”

Regional / National Operations

Access to large, urban markets underlies the operation and success of ride-hailing as a component of urban mobility. As such, there is a connection between ride-hailing as a mobility option and the location of ride-hailing firms’ offices, particularly those focused on regional and national governance and policy. Due to the complicated and often hyper-local nature of local ground transportation, ride-hailing firms are compelled to work closely with government decision-makers in order to succeed. While Uber is well known for a launch strategy that initially saw the firm using what has been described as guerrilla tactics wherein the firm would surprise cities with the launch of their services (Lashinsky, 2017), this is no longer their approach. Furthermore, it is also not an approach used by competitors, many of whom have carefully curated relationships with local and national governments with the understanding that government permission is at the heart of successful ride-hailing operations.

It bears noting that information on local and national offices focused on government relations activities is the most incomplete component of the database. Some firms, such as Grab and Cabify, identify national offices in their office listings. Grab’s operations throughout Southeast Asia appear to be anchored by offices in the capital city of each country of operation: Bangkok, Manila, Jakarta, Phnom Penh, and Yangon. Others, such as Uber, the most global of all the firms with operations in 66 countries, identifies five US cities and four international cities as major office locations, in addition to their headquarters. While news stories and reports with respect to office locations that work on flying cars or self-driving vehicles, or offices that hire dozens or hundreds of engineers are regularly available, there is far less material publicly available that provides accurate details of national or regional offices which serve specific markets. Furthermore, for the most part, this category of offices tend to have relatively few staff and are supported by each firm’s centrally located government relations professionals.

When ride-hailing firms establish only a cursory national office focused on operations and government liaison, the national capital is the most common site of this office location. The significance of locating in the national capital is tied to the need for access to politicians and policy-makers through regular lobbying and advocacy. Ride-hailing firms operate in a sector in which government permission and regulation has experienced deep uncertainty and undergone drastic, rapid change. For instance, in November 2015, Indonesia's Minister of Transportation banned ride-hailing but was subsequently overruled by the President of Indonesia shortly afterwards (Johnson, 2016). Lobbying efforts by Uber in the US are also well-documented (Flores and Rayle, 2017) and credited for the implementation of municipal and state regulations that permit ride-hailing operations.

Conclusion

The economic geography of ride-hailing illustrates a contemporary approach to understanding the shifting dynamics of world cities in the digital era. As an activity that is less than a decade old, ride-hailing has rapidly emerged as a global urban force with disruptive impacts. Based on a case study of ride-hailing, this paper sets out the parameters for studying an emergent industry that is characterized by a focus on urban, innovation-oriented platform economy activities. Though global in terms of operations, knowledge and talent-intensive strategic decision making and engineering focused activities undertaken by ride-hailing's unicorns are concentrated in a small, select number of cities. In this respect, the case of ride-hailing mirrors observed shifts taking place across cities and industries in the twenty-first century. These include the: increasing global spread of world cities (GaWC, 2017); inclusion of cities located in less developed regions with large and growing populations – particularly evident in the emergence and continued development of centres in Asia (DeRudder and Taylor, 2005); concentration of economic activity in a small number of superstar urban centres (Muro and Whiton, 2018); and the continued emphasis of cities as leaders in the digital economy, and especially with respect to digital platform economy activities (Davidson and Infranca, 2016). The location of ride-hailing unicorns appears to provide further evidence that processes of concentration in world cities of ride-hailing are connected to factors associated with agglomeration including the role of government policy, knowledge spillovers, and access to talent.

From a policy perspective, there is both good and bad news. The good news for cities is that there is no singular route to capturing knowledge-based jobs and investment activity that goes along with the growth of ride-hailing. Rather, there appear to be diverse paths to success in growing and hosting a ride-hailing unicorn. Analysis of firm location patterns suggest that established centres with high concentrations of tech firms and talent are ideal locations for ride-hailing firms. Yet, patterns of firm location also show that emerging tech centres and

aspiring cities with innovation-oriented policies, and centres that can capitalize on unique cultural features, are also potential leaders. Furthermore, the spread of ride-hailing's 11 unicorn headquarters across ten cities, ten countries and five continents, highlights opportunities for firm distribution at a truly global scale.

On the flip side, however, there are a limited number of participants, both in terms of the number of cities and in terms of the total number of high-wage, high-skilled jobs being created. The future of work and prospects for greater and shared prosperity looks bleak from this perspective (OECD, 2018). Additionally, the concentration of nearly 75 percent of the market value of ride-hailing's unicorns in just two firms is concerning from the perspective of competition and the prospect of near-monopoly. Given the investments, networks and assorted partnerships that tie together nine of the 11 ride-hailing unicorns, the likelihood of mergers and acquisitions appears strong. Nevertheless, the effects of increased industry concentration within a small number of firms could be tempered with the entrance of new ride-hailing startups and the movement of established automotive firms and tech firms into the ride-hailing arena – provided that the network effects of first mover advantage can be overcome.

Analysis of global ride-hailing cities helps to highlight, from an economic geography perspective, the significant implications associated with the current phase of innovation, transformation and reorientation in urban ground transportation. As the sector matures, early centres of investment, research, development, design, testing, and manufacturing stand to benefit from first mover advantage and the effects of clustering and concentration of activity.

Notably, the key findings in this paper are in line with a series of broader urban economic shifts. The expansion of world cities from established to emerging regions is clearly represented in the economic geography of ride-hailing with the inclusion of cities such as Bangalore, Jakarta and Sao Paulo on the list of headquarters cities. However, the continued absence of African cities as centres of significant investment, entrepreneurship and innovation marks a challenge that deserves further attention, especially given the presence of ride-hailing operations in many African countries including Kenya, Nigeria, South Africa, Tanzania and Uganda.

In a digital world, ride-hailing firms are pursuing talent acquisition strategies that create pipelines to talent through global office location. This pattern is in line with Brenstetter et al's (2018) finding that between 1998-2014, US-based firms expanded investments in R&D to a far greater number of locations, in large part because of the need to access distinct talent ecosystems in particular places.

The concentration of ride-hailing activities in a select number of world cities also contributes to a growing concern that a small number of superstar cities are absorbing an increasing proportion of investment, employment and wealth creation at the expense of other places. The implication for cities and people not included in this bounty however include rising inequality at the inter and intraurban scale. Calls for policy interventions that help to spread economic opportunity are one attempt to redress imbalances, and extend well beyond the scope of ride-hailing (Lee, 2018).

This research suggests that the digital platform economy, and ride-hailing in particular, has led to expanded opportunities for participation in the global economy for a select group of cities and a select cohort of talent. As such, the economic geography of ride-hailing is emblematic of the twenty first century: highly concentrated, highly uneven, driven by talent and innovation, dynamic and challenging.

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