

# Fall Research Newsletter

## ARA Research and Strategy

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## Tech Disruption and Commercial Real Estate – Invest Where Technology is Creating, Not Constraining Jobs

### Key Takeaways

- > Markets driven by the companies creating the disruptive technologies will thrive while markets anchored in jobs most exposed to disruptive technologies will not
- > Invest where technology is creating, not constraining jobs
- > Contrary to today's conventional wisdom, in the event of significant adoption, self-driving cars and ride-sharing services will increase the relative appeal of public transit as riders seek to avoid worsening congestion
- > Self-driving cars will not lead to a wholesale and instantaneous abandonment of dynamic urban cores in favor of suburban environments

"The most important disruption will be the shift in composition of America's employment base."



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### A Key Ingredient in Investment Strategy Development

Keeping pace with and understanding how technological innovations will shape the future is both an essential and challenging component of developing a successful, forward thinking investment strategy. Evaluating how today's technology disruptors might impact life in the future enables investors to better frame the risks and opportunities for real estate associated with each innovation. Given the expeditious pace of technological innovation, this practice is more important now than ever.

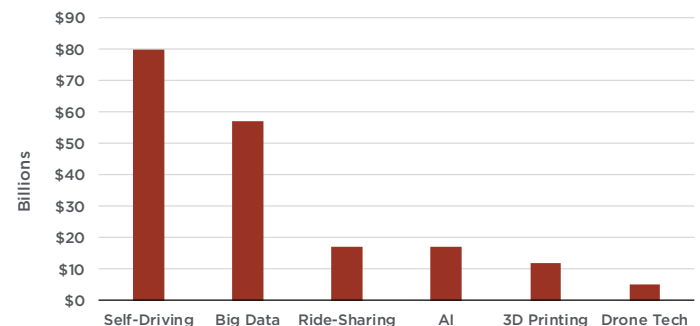
In this newsletter we first identify the inevitable shift in the composition of America's employment base as the primary risk and opportunity associated with the current batch of technology disruptors, then examine how emerging technologies are already impacting commercial real estate companies, analyze ways self-driving cars and ride share services may impact commercial real estate more broadly, and conclude with a brief review of other emerging technologies.

The importance of this analysis will only increase as hundreds of billions of dollars<sup>1,2</sup> have already been invested in emerging technologies having the potential to impact where we work, how we work, where we live, and how we purchase and consume goods and services. Said another way, these technologies have the potential to impact all types of commercial real estate in some fashion. A short, non-exhaustive list includes the following: self-driving cars, artificial intelligence (AI), 3D printing, pre-fab construction, ride-sharing, and drone delivery.

### Invest Where Innovation Is Creating, Not Constraining Jobs

While it is interesting to dig into the whiz bang capabilities and technical aspects of the universe of new technologies, it is the impact on jobs that is the key. Additionally, while it is difficult to know the exact impacts of the technologies on where and how we live, work and play, what is known is that markets populated with the companies creating the technologies will see

### > Amount Invested/Market Size\*



\*Measures for Ride-Sharing, Drone Tech and 3D Printing are 2017 Revenue estimates, other figures are investment estimates

Source: Brookings, Forbes

employment gains while those populated with industries disrupted by the technologies will lose employment. Accounting for this variation in impact on employment across markets should be a primary consideration in shaping investment strategy.

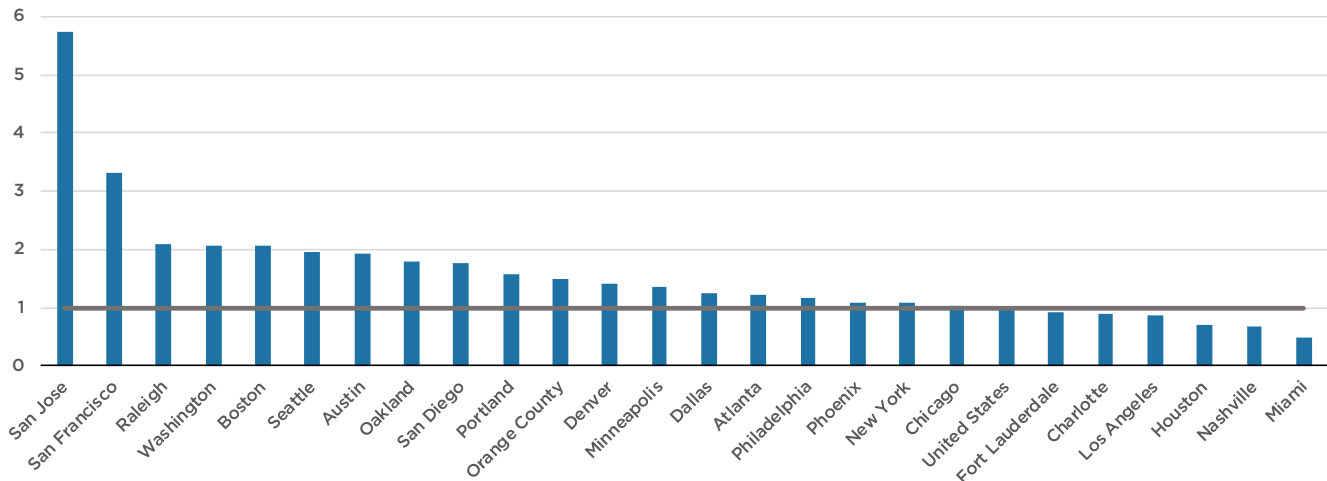
The Bay Area and Seattle are established tech hubs that will continue to flourish and maintain their status as innovation centers. The Bay Area is the dominant cluster bar none for companies pioneering disruptive self-driving technology. Uber, Alphabet's Waymo unit, Zoox, Tesla, Apple, and GM's Cruise, are all based in either San Jose or San Francisco. On the Careers page for GM's Cruise there are two openings in Pasadena, CA, two in Phoenix, AZ, and one hundred and forty-two in San Francisco, CA.

As these technologies reach high levels of adoption, these companies and divisions will grow and likely spread their roots as their hiring needs become more substantial and availability of tech talent becomes more difficult to secure in these established hubs. Major markets with huge labor pools such as New York, Los Angeles, Washington DC, and Chicago have been able to attract the presence of the largest tech firms like Google, Amazon, Microsoft, and Apple while smaller markets such as Austin, Portland and Denver have also had success in this regard.



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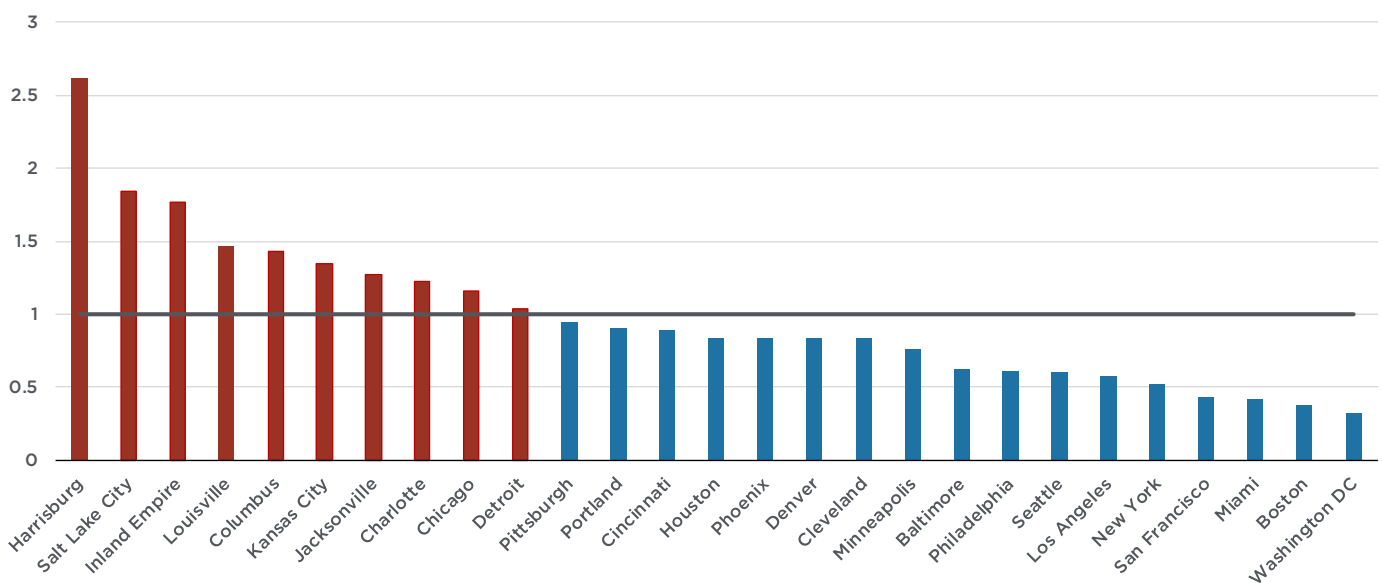
### > High Tech Location Quotient (A Value of 1 = U.S. Average)



Source: Moody's Analytics, Bureau of Labor Statistics

The flipside to this technology driven employment growth is employment destruction. Self-driving technology has the capacity to revolutionize the transportation industry, potentially eliminating broad swaths of jobs.

### > Truck Transportation Location Quotient (A Value of 1 = U.S. Average)



Source: Moody's Analytics, Bureau of Labor Statistics



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The chart on the previous page shows the relative concentration of trucking jobs. Not surprisingly, many of the traditional distribution markets have higher concentrations of trucking jobs making them the most vulnerable in the event of a broad industry adoption of self-driving trucks. While this likely wouldn't materially impact warehouse demand in these markets given that many are distribution hubs serving broad geographic areas, the net effect on local employment and wages could have significant impact on other property types within these markets as a loss in transportation jobs also means a loss in local services jobs. Add to this the possibility of increasing warehouse automation and markets with elevated trucking employment concentration levels would at best face a shift in employment composition and at worst outright reduction. The second takeaway is that markets having positive exposure to self-driving car technology via programming and engineering jobs are also the least exposed to the types of transportation jobs that are potentially at risk of automation. An overweight to high-tech, high-education markets is also an underweight to high-transportation dependent markets.

### Segmenting the Disruption



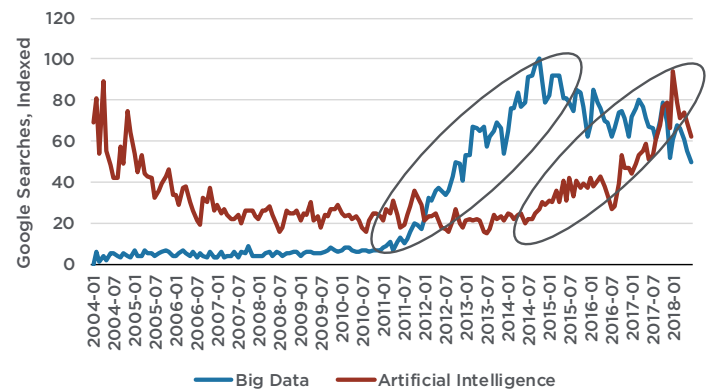
There are two broad categories of potential commercial real estate disruptors. The first is the group of startups that are actively vying to disrupt the commercial real estate industry itself<sup>3</sup>. The second is the group

of innovations occurring outside of the industry that have the potential to disrupt other industries, economy overall and as a result commercial real estate space demand- self-driving cars being the chief example<sup>4</sup>.

### Commercial Real Estate Industry Disruption

The Big Data and Artificial Intelligence (AI) movements that have already impacted a variety of other industries are now working their way through the commercial real estate industry<sup>5</sup>.

#### > Google Trends Results for Big Data and A.I.



Source: Google

Looking at the crowded commercial real estate startup field it is hard not to notice how many of the companies are leveraging data and analytics to drive value for end-users<sup>6</sup>. The aspects of the real estate industry they touch are varied and include:

- Workplace Experience & Design
- Market Intelligence and Analysis
- Crowd Funding
- Asset Management
- Office Leasing
- Location Analytics
- Investment Management

Insights gleaned about how employees move and work throughout the day in their office can help drive space efficiencies by eliminating underutilized space. Likewise,



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data on employee interactions can help employers better position employee work stations to improve productivity and collaboration among key departments. Smart sensors in buildings enable landlords to provide tenants with an environment that is not only satisfactory but is geared towards employee happiness and well-being. For example, Comfy is a workplace app that allows the user to adjust the lighting and temperature of a room, book conference rooms, fill out work orders and leave general feedback<sup>7</sup>.



Comprehensive asset management platforms allow brokers, on-site managers and landlords to seamlessly communicate and track data on current and potential tenants to reduce inefficiency, improve the tenant experience, and boost occupancy.

What is unifying among these companies is their use of analytics to drive improved decision making and reduce inefficiencies. Another unifier is that in many cases their technology has already been widely adopted by major incumbents across the industry. View The Space, an asset management platform for landlords and agency brokers has a client roster that includes all of the major brokerage firms as well as some of the largest landlords<sup>8</sup>. The impact of these technologies will only grow over time as they continue to penetrate the industry.

The takeaway here is not that big data and A.I. are currently disrupting the industry per se. Rather, they are making it better overall, giving a myriad of key stakeholders the tools to make better informed decisions. While our view is not of a dystopian outlook where incumbent firms are bankrupted by tech-savvy up and comers leading

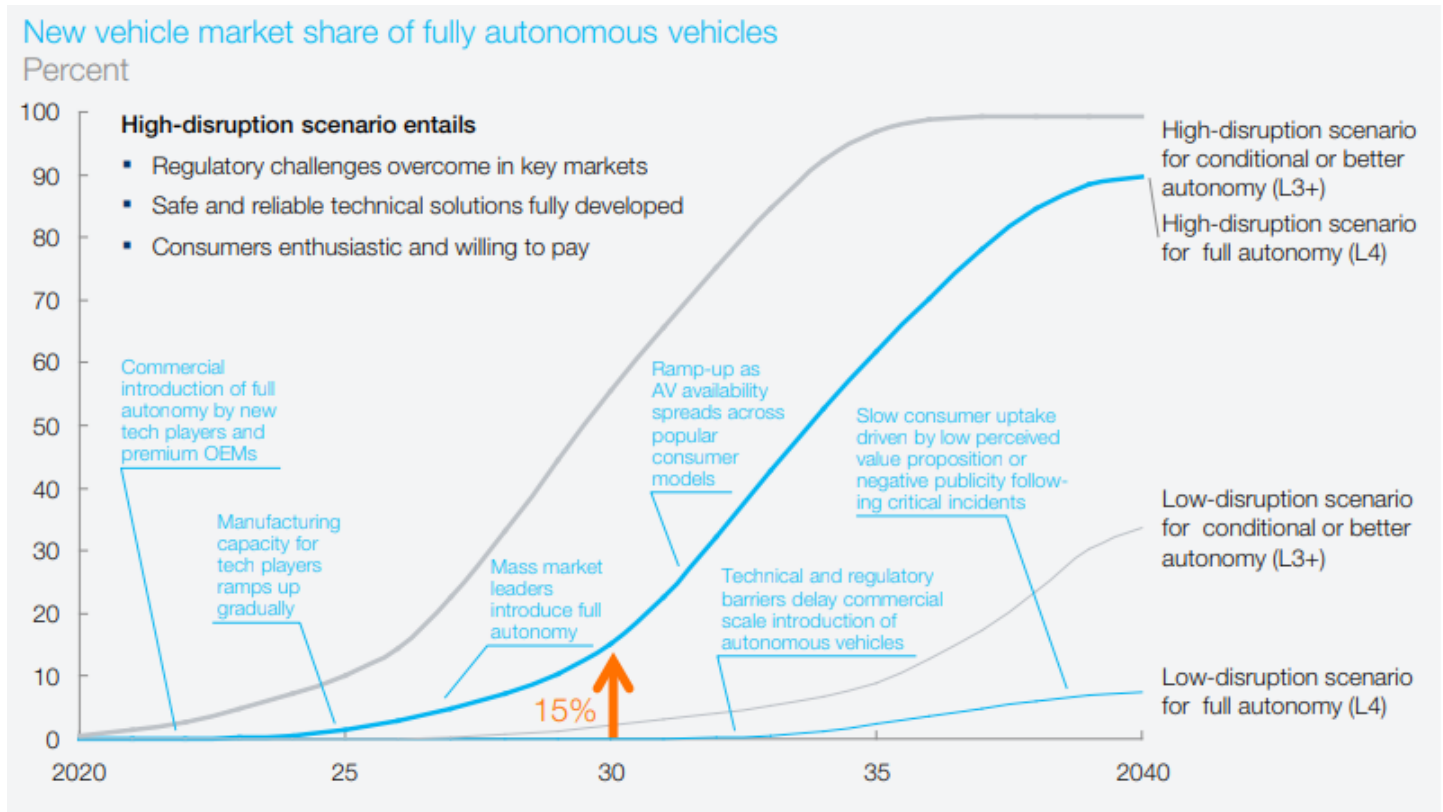
to massive job losses, some dislocation cannot be ruled out with challengers benefiting to some degree at the expense of the incumbents reacting too slowly to the changing landscape. Customers will likely benefit not only through lower costs enabled by the technology driven efficiency gains but in returns. In the case of investment management, this means more data, and more efficient analysis of it, which may act as a potential tailwind for returns moving forward<sup>9</sup>. Ten-X, an online marketplace for commercial and residential assets, leverages machine learning to quickly match seller's assets with a buyer and streamline the acquisition process which has the potential to lower acquisition costs industry wide as the concept becomes more prevalent<sup>10</sup>.

And what about in the next few years when most competitors have adopted these technologies and have access to similar data and insights? The bar for analysis will have been raised, but with everyone once again on the same playing field, intellect and the ability to parse signal from noise will differentiate.

Self-driving car technology has been among the most widely discussed. This is for good reason; the market potential is enormous. There are 260 million cars, motorcycles and buses in the U.S.<sup>11</sup> and in 2016, \$2.25 trillion was spent on car ownership, public transportation, rental cars and taxis, limousines and black cars<sup>12</sup>. When thinking about the likely adoption timeline for self-driving cars it is important to understand that most predictions from industry experts and global automakers are light on acknowledging the significant potential for disparity between their assumptions and what actually happens while using aggressive language – phrases like “fully developed” or “full adoption” - that can give a reader the impression that a world where everyone is driving in a fully autonomous car is just around the corner. A sensible range of estimates comes from McKinsey which puts forth a range of time lines that is intuitive and most importantly, shows just how varied the range of outcomes could be. Despite all the potential promise offered by self-driving technology, there are real challenges posed such as legislation hurdles, cybersecurity risks and push back from incumbents like Insurance providers.



## Marchetti's Constant and Induced Demand



Source: McKinsey

What does an Italian Physicist named Cesare Marchetti have to do with the potential impact of self-driving cars on real estate? Plenty, because he just may help us understand how far people are willing to commute. Marchetti's Constant is the average time spent by a person commuting each day, which is approximately an hour. Marchetti posits that although forms of urban planning and transport may change, people gradually adjust their lives to their conditions (including location of their homes relative to their workplace) such that the average travel time stays approximately constant<sup>13,14</sup>. Originally formulated in 1994, this constant holds true today.

Many may make the assumption that once fully autonomous self-driving cars reach a high level of adoption, there will be efficiency gains with respect to commutes as self-driving cars are hypothesized to in effect be better drivers than human. It's also argued that self-driving cars will increase worker productivity during commutes as passengers are able to catch up on emails and perform other tasks just as if they were in the office. Because of these efficiency and productivity gains, it is assumed people will relocate further away from the city center and into the suburbs and commute times as well as productivity will stay constant.

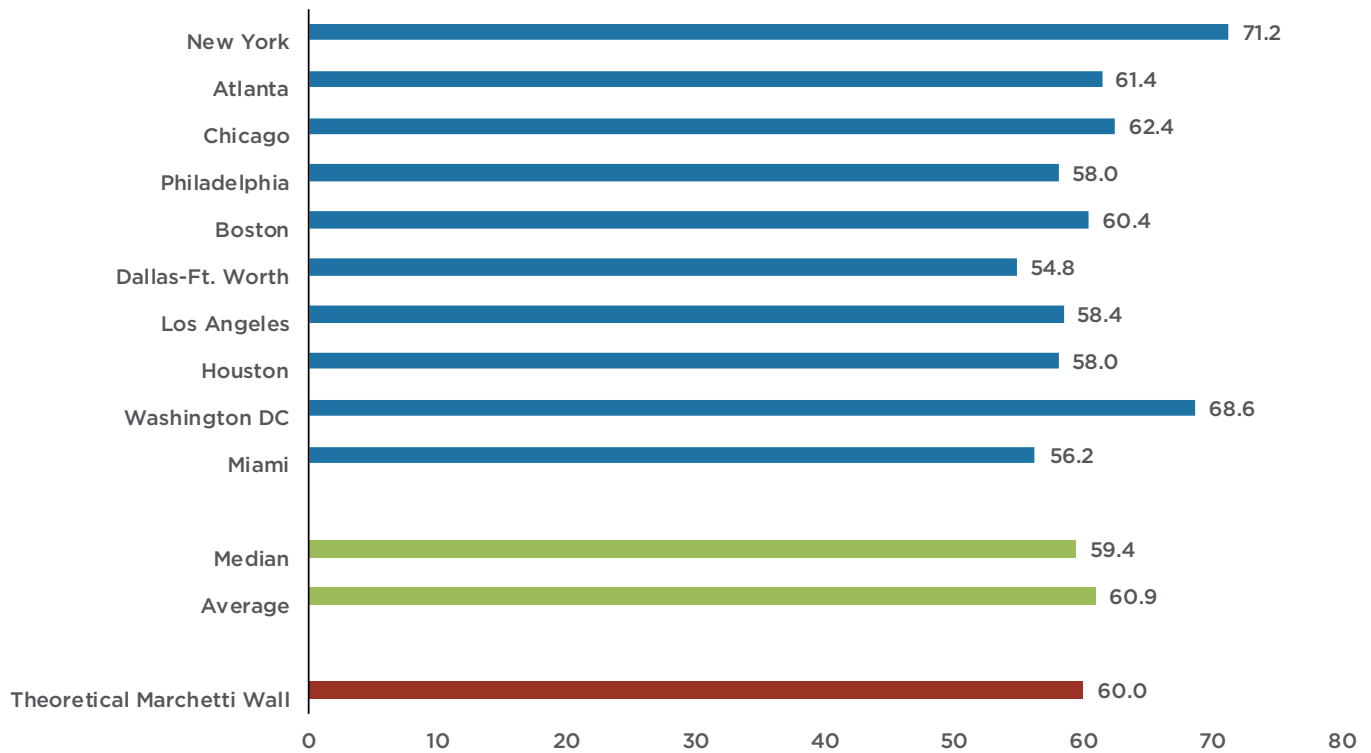




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### > Mean Roundtrip Commute (Minutes) 10 largest urbanized areas

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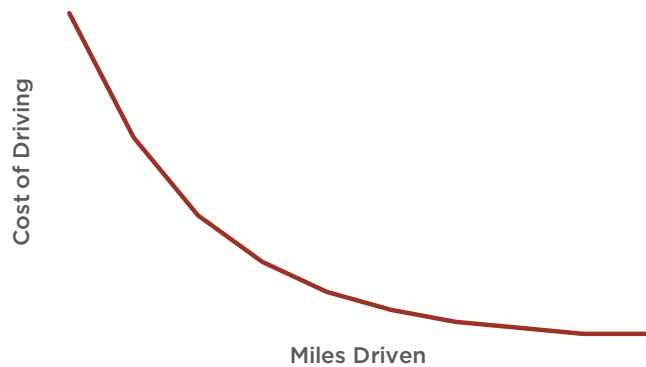
Source: Census Bureau, 99mph Consulting

As it relates to the posited efficiency gains, to the extent they materialize, they might be quickly mitigated for the same reason lane widening on freeways doesn't lead to improved traffic times. In economics, the concept of Induced Demand, also known as Jevons Paradox, occurs when technological progress increases the efficiency with which something is used (reducing the amount necessary for any one task), but the rate of consumption rises because of increasing demand<sup>15,16</sup>.



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### > When Car-Centric Commuting Gets Easier, More People Commute



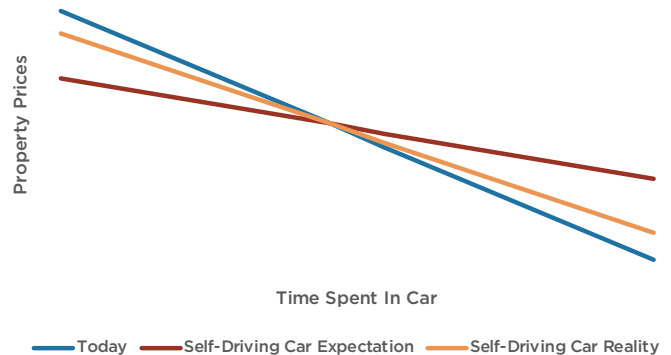
Source: ARA

This dynamic is omnipresent in transportation and has even been referred to as the Iron Law of Congestion. Thus, while Marchetti's constant would tell us self-driving cars will cause sprawl, Jevons Paradox tells us this sprawl will be mitigated to an extent due to more people commuting on roadways.

As it relates to increasing productivity during commutes allowing commuters to locate further from their work environment, the key question is the following: While productivity could increase, do workers really want to spend more time away from home? Said another way, while productivity could increase, the fact remains that commuters still won't be able to engage in non-work activities such as spending time with family and friends or engaging in outdoor activities as an example while in their cars. Will workers really want to spend more time away from home in the car working?

Self-driving cars will have sizeable impacts, but they will be neither as positive nor as negative as many current predictions would make them out to be. Going back to the self-driving adoption timelines proposed by McKinsey, the full-scale adoption of these technologies is potentially 20+ years away. Impacts will be felt over several years.

### > Expectations vs. Reality



Source: ARA



### Conventional Wisdom Regarding Property Sector Impacts

For office space, it's theorized that much less parking space will be required as cars will zip around shuttling people elsewhere instead of sitting idle while employees work<sup>17</sup>. Optimists point out that this will free up a great deal of land and space that has been previously underutilized, while pessimists will point to the potential loss of NOI for office landlords as income from parking is often a significant component of total income.

For multifamily, pessimists posit that self-driving cars will induce urban sprawl, negatively impacting the relative





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value of urban properties and punishing investors that over-allocated investments to urban cores. Optimists argue that with reduced parking requirements, the potential for additional housing density and commercial property will create ever-more vibrant built environments and future development will be less costly thanks to reduced parking requirements.

For retail and industrial, shuttered suburban retail assets will be reborn, either as retail or last-mile distribution centers, thanks to increased sprawl. Investors that bet heavy on urban in-fill will miss a wave of industrial demand catering to such sprawl. Self-driving trucks will be a compounding factor making it feasible for companies to stretch their logistics networks, taking advantage of cheaper, more plentiful land for warehouses<sup>18</sup>.

More broadly, transit-oriented assets will suffer as people rely less on public transit<sup>19</sup>. The automated nature of self-driving technology and its wide-spread application (trucks, ships, rail) will eliminate or transform millions of jobs, disrupting the entire U.S. labor market<sup>20,21,22</sup>.

At least that is the conventional wisdom. But how sure are we that any of these scenarios are likely to play out? It's important to note that these are all guesses. There is still a great deal of dispute over the timeline of self-driving rollout, regulatory adoption, and consumer adoption. Even the opinion of supposed experts should be taken with a large grain of salt as the performance of their past predictions is often poor<sup>23</sup>.

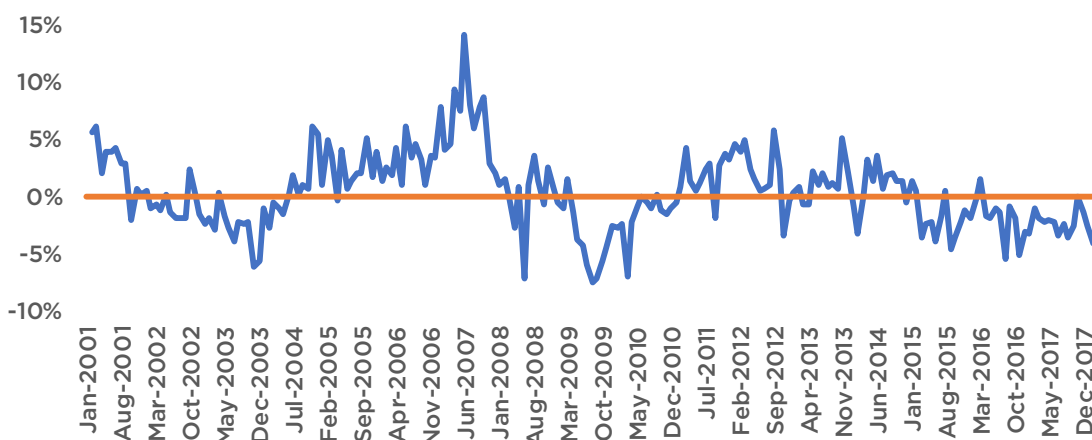
While the prevailing sentiment in the industry and among futurists is that it will change the values and best uses of real estate across the board and that may be the case, the timing is highly uncertain.

### Ride Sharing

#### *Transit Oriented Developments and Ride-Sharing Myths*

There is a lot of conflicting information about the impacts of ride-sharing on the demand for public transit. It is especially important to seek clarity in this arena as a lot of prevailing analysis calls for a future scenario where increased ride-sharing dramatically reduces the need for public transit, in turn reducing the value premium enjoyed today by transit-oriented developments (TODs). Much of the negative sentiment surrounding public transit stems from two sources of information. First, at a high level, public transit ridership is falling in the U.S.

#### > YOY% Change Public Transit Ridership



Source: Bureau of Transportation Statistics



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This has stoked fears that ride-sharing has already been meaningfully cannibalizing public transit ridership but if we take a closer look at ridership growth we see that this narrative doesn't add up. There were ridership declines in the early and mid-2000s to go along with declines for most of the last decade. Uber didn't launch until 2009 and Lyft came several years later in 2012. Meaningful adoption occurred even later.

More recently, a working paper released in late 2017 from the UC Davis Institute of Transportation Studies made headlines for finding an association between increased ride-sharing use and decreased transit ridership<sup>25</sup>. Reporting on the study made it seem that ride-sharing increases were associated with major declines in transit ridership, but the results of the study were more modest and mixed. The study found that when survey respondents increased their use of ride-sharing, they decreased their use of bus and light rail services by 6 and 3 percent respectively, while commuter rail usage actually increased 3%.

The study also acknowledges two other key points. The first is that the authors concluded 49-61% of ride-hailing trips would not have been made at all, by any other means of transportation, and that ride-hailing will likely contribute to more vehicle miles traveled in the large cities surveyed. This means more overall trips and more traffic in major cities which would increase the relative appeal public transit has as riders seek to avoid worsening congestion. The other is that two similarly designed survey studies found ride-sharing and public transit to be complementary, meaning an increase in use in one led to an increase in use in the other.

The most recent and cutting-edge research, published in June 2018 by researchers at McGill University, offers further explanation for declining ridership<sup>26</sup>: Declines are driven by reductions in bus and train routes as well as deferred maintenance across transit modes which make their adoption less compelling for riders. Not significant: the presence of ride-sharing or bike-sharing. It's no surprise then that two of the cities where public ridership grew in 2015-2016 were Houston and Seattle,

both of which have undergone bus network overhauls. No matter how automated cars become, they will still take up a lot more space per passenger than a bus or a train. This scale, and the public nature of buses and trains, lowers the cost per rider significantly, making them an ideal choice for lower-income workers. If planners can maintain and modernize existing public infrastructure, public transit will continue to be viable into the future.

Uber and Lyft aren't eliminating the viability of public transit and therefore transit oriented development, and it's important to remember that well designed and located TOD, especially in larger metros, derives much of its value from factors that might have nothing to do with proximity to transit. A 2017 research note from CBRE Econometric Advisors analyzing the factors driving multifamily rent premiums in the Denver market found that proximity to light rail had no statistical significance on rent levels and that TOD assets tended to derive their rent premium because they were (a) newer, (b) more proximate to the CBD, and (c) tended to have more retail density within a half-mile radius<sup>27</sup>.

The takeaway: Invest in newer TOD assets in dense areas with solid surrounding amenity bases; preferably close to the CBD. This finding is consistent with American Realty Advisor's house view and approach to multifamily investing. Even our multifamily suburban investment thesis calls for an emphasis on inner suburban assets proximate to quality schools, day-time employment and transit.

### Other Potential Industry Disrupters

Pre-fabricated construction and drone delivery are additional technologies that show promise. While 3D printing is another potential disruptor which shows a great deal of potential, it is still nowhere near being commercially viable<sup>28</sup>, with mass commercial adoption likely decades away.



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### Pre-fabricated Construction

Pre-fabricated construction shows promise in reducing the cost of housing construction, a welcome relief valve for a nation amid a chronic affordable housing shortage. Pre-fabrication has been discussed for years so it is important to note that this has been a technology that has been touted with little to show for it for some time but that has begun to change, at least with respect to the multifamily sector. Google “pre-fabricated construction multifamily” and you will find dozens of companies that specialize in it. Within this space Katerra stands out as a potential model for the future. The company’s main selling point is that it aims to keep costs low not just by building more efficient buildings, but by bringing the entire construction supply chain in-house from design, to the supply of raw materials, to on-site assembly. Katerra has over 1500 employees in four countries, a VC backed valuation over a billion dollars and can be attributed to two dozen multifamily projects across the country. Yet, for all pre-fabs promise, it doesn’t solve the core problems associated with land-use restriction and NIMBYism, which keep asset values elevated and supply growth depressed in major coastal markets<sup>29</sup>. Pre-fab construction helps solve for increasing materials and labor costs, but not for land.

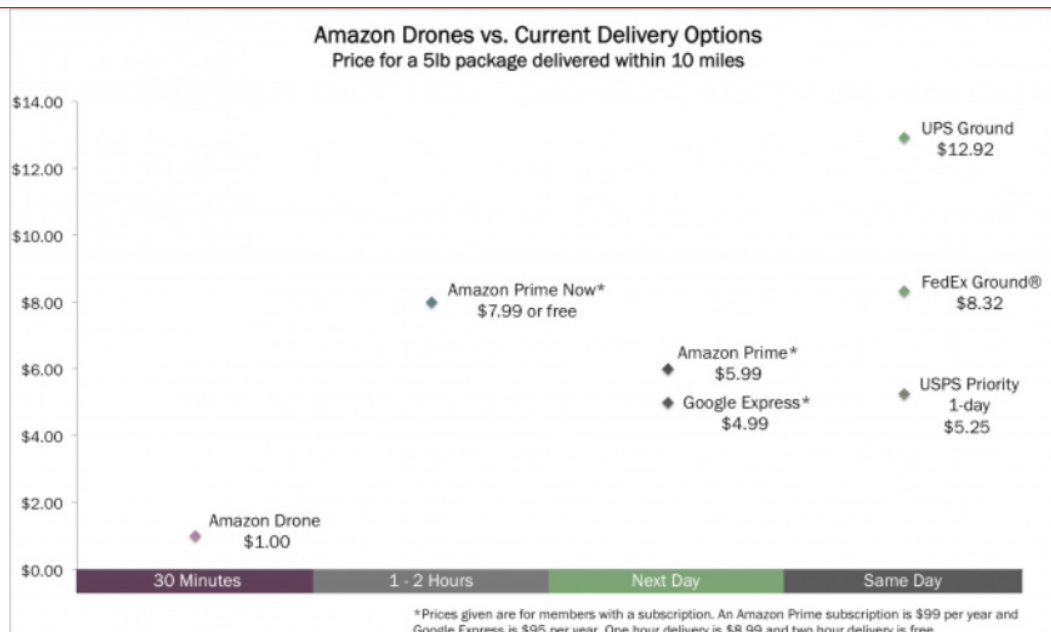
### Drone Delivery

Drone delivery has a host of logistical problems<sup>30</sup>. Tempting as it is to stop there and brush this potential innovation aside due to the myriad of near-term challenges, history has shown that poo-pooing supply chain innovations is a big mistake; especially when Amazon, Google, Walmart, UPS, and others are involved. These companies are investing heavily in the technology because of its cost saving potential. Drone delivery can reduce costs through two mechanisms:

1. More direct travel pathway to destination reducing delivery time and therefore cost
2. Being able to automate aspects of drone delivery

According to analysis firm ARK Invest, an Advisor Services and Fund provider, Amazon Prime Air delivery could significantly reduce costs<sup>31</sup>.

### > Amazon Drones vs. Current Delivery Options Price for a 5lb packages delivered within 10 miles



Source: ARK-Invest



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It's important to note the analysis done to reach the numbers in the above chart is largely speculative, but the key takeaway is that the cost saving potential is very real.

There are other factors at play here as well. Roads are becoming an increasingly messy and congested mode for transportation as public spending on infrastructure has lagged. Worsening climate patterns could depreciate infrastructure more rapidly in certain parts of the country - most notably in the Sun Belt and Northeast. This issue is something delivery companies could bypass completely for certain types of packages. Lighter deliveries in dense areas appear to be the low hanging fruit which implies more, not less infill industrial with retail in dense areas benefitting as well.

### Conclusion

With every new promising technology there are bold proclamations and both pessimistic as well as optimistic prognostications regarding how said technology will impact the future of everything often leading to either irrational exuberance or fear. The same is true with the current crop of promising new technologies. Looking only at headlines some might conclude that congestion is going to be a thing of the past as self-driving cars significantly increase efficiency, workers are going to gleefully spend more time commuting, public transportation is going to be a thing of the past, parking garages are going to be obsolete, cities are going to be abandoned and this is all going to happen tomorrow. While bold forecasts grab headlines, not only are they often wrong, they are typically not very useful.

Technology's greatest impact, as it has always been, will be on the composition of jobs. Rather than getting mesmerized by the intricacies of the next big thing and either fretting over doomsday headlines or fairy tale outlooks, understand the employment composition of the markets you are investing in and how technology might impact those jobs. In the end, markets with companies creating the disruptive technologies will thrive while those subjected to the negative employment effects will not.

<sup>1</sup><https://www.brookings.edu/research/gauging-investment-in-self-driving-cars/>

<sup>2</sup><https://www.forbes.com/sites/blaquemorgan/2018/06/06/how-much-money-has-poured-into-ai-and-customer-experience/#31e393c37ed2>

<sup>3</sup> <https://angel.co/commercial-real-estate>

<sup>4</sup><https://medium.com/99-mph/1-trillion-of-real-estate-is-on-the-move-heres-why-94ee9233e5eb>

<sup>5</sup> <https://www.cbinsights.com/research/artificial-intelligence-emerging-industries/>

<sup>6</sup> <https://angel.co/commercial-real-estate>

<sup>7</sup> <https://www.comfyapp.com/product/>

<sup>8</sup> <https://www.vts.com/about-us>

<sup>9</sup> Macro factors will still dominate the level and direction of returns and this statement assumes all else is held equal.

<sup>10</sup> <https://www.ten-x.com/commercial/>

<sup>11</sup> Transportation and logistics data from Statista

<sup>12</sup><https://www.forbes.com/forbes/welcome/?toURL=https://www.forbes.com/sites/laurengensler/2017/01/04/us-auto-sales-2016/&refURL=https://www.google.com/&referrer=https://www.google.com/>

<sup>13</sup> [https://en.wikipedia.org/wiki/Marchetti%27s\\_constant#cite\\_note-mar94-1](https://en.wikipedia.org/wiki/Marchetti%27s_constant#cite_note-mar94-1)

<sup>14</sup> [http://www.cesaremarchetti.org/archive/electronic/basic\\_instincts.pdf](http://www.cesaremarchetti.org/archive/electronic/basic_instincts.pdf)

<sup>15</sup> [https://en.wikipedia.org/wiki/Jevons\\_paradox](https://en.wikipedia.org/wiki/Jevons_paradox)

<sup>16</sup> [https://en.wikipedia.org/wiki/Lewis%E2%80%93Mogridge\\_Position](https://en.wikipedia.org/wiki/Lewis%E2%80%93Mogridge_Position)

<sup>17</sup><https://www.curbed.com/2017/5/16/15644358/parking-real-estate-driverless-cars-urban-planning-development>

<sup>18</sup><https://www.ge.com/reports/the-moneys-really-in-self-driving-trucks-trains-and-ships-not-cars/>

<sup>19</sup><https://www.forbes.com/sites/elyrazin/2018/03/11/how-driverless-cars-could-disrupt-the-real-estate-industry/#798a56df13c1>

<sup>20</sup><http://www.dailymail.co.uk/sciencetech/article-5301497/Self-driving-cars-leave-people-unemployed.html>

<sup>21</sup><https://www.makeuseof.com/tag/self-driving-cars-endanger-millions-american-jobs-thats-okay/>

<sup>22</sup><https://qz.com/1059142/autonomous-vehicles-will-impact-more-than-10-of-all-jobs-in-the-us/>

<sup>23</sup> <https://www.equities.com/news/a-look-at-mckinsey-company-s-biggest-mistakes>

<sup>24</sup><https://medium.com/fifth-wall-insights/self-driving-cars-will-transform-the-real-estate-market-e809b3cbaa61>

<sup>25</sup> <https://steps.ucdavis.edu/new-research-ride-hailing-impacts-travel-behavior/>

<sup>26</sup> [http://tram.mcgill.ca/Research/Publications/Transit\\_Ridership\\_overtime.pdf](http://tram.mcgill.ca/Research/Publications/Transit_Ridership_overtime.pdf)

<sup>27</sup><https://www.cbre-ea.com/publications/deconstructing-cre-post/deconstructing-cre/2017/07/07/how-much-do-transit-access-proximity-to-downtown-and-retail-density-influence-multifamily-rents>

<sup>28</sup> <https://www.futurity.org/3d-printing-disruptive-1645272-2/>

<sup>29</sup> <https://faculty.chicagobooth.edu/chang-tai.hsieh/research/growth.pdf>

<sup>30</sup><https://techcrunch.com/2017/08/15/separating-fiction-from-feasibility-in-the-future-of-drone-delivery/>

<sup>31</sup> <https://ark-invest.com/>



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### Forward-Looking Statements

This newsletter contains forward-looking statements within the meaning of federal securities laws. Forward-looking statements are statements that do not represent historical facts and are based on our beliefs, assumptions made by us, and information currently available to us. Forward-looking statements in this newsletter are based on our current expectations as of the date of this newsletter, which could change or not materialize as expected. Actual results may differ materially due to a variety of uncertainties and risk factors. Except as required by law, ARA assumes no obligation to update any such forward-looking statements.



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