

THE PRESIMA

globetrotter

**The Fourth Industrial Revolution:
Are we underestimating the impact of
artificial intelligence on commercial real estate?**



“Artificial intelligence will be either the best, or the worst thing, ever to happen to humanity. We do not yet know which.”¹

Stephen Hawking

Source : Iwpkommunikacio/flickr

 **PRESIMA**

Q2.2017

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Technology’s role in the workplace has been debated and fretted about for centuries. The Luddites, a group of English laborers destroyed machinery that they feared was threatening their jobs in the early 1800’s.² John Maynard Keynes warned of “technological unemployment” in the 1930’s.³ The 1968 film *2001: A Space Odyssey* saw the computer “HAL” go rogue, killing most of the crew in the space ship. And finally, Stephen Hawking’s ominous warning cast a pall on our future coexistence with computers that are as “smart” as we are.

Artificial intelligence (“AI”) is the technology of the movement, and the AI train shows no sign of slowing down. AI has been a hot topic of thematic investment research reports from investment banks. The Financial Times awarded their 2015 Business Book of the Year to Martin Ford’s *The Rise of the Robots*.⁴ AI was chosen as the primary theme for the 2016 World Economic Forum meeting in Davos.⁵ The hype around AI technology is at an all-time high, with the market forecasted to reach \$37 billion by 2025.⁶

This edition of the *Globetrotter* explores the coming “Fourth Industrial Revolution” and its potential impact on the commercial real estate market. The paper defines AI, addresses its current and potential future impact on blue and white-collar jobs, assesses AI’s impact on the office property market in the U.S., analyzes which metro areas are more/less exposed to AI risk, how much is priced in, and, taken as a whole, what does it mean for an investor’s strategy?

- 1 The Guardian, October 19, 2016, *Stephen Hawking: AI will be ‘either best or worst thing’ for humanity* by Alex Hern.
- 2 WW Norton & Company, 2016, *Paper: A World History* by Kurlansky Mark.
- 3 “*Economic possibilities for our grandchildren (1930).*” *Essays in persuasion* (1933): 358-73 by Keynes John Maynard.
- 4 Ford, Martin. *Rise of the Robots: Technology and the Threat of a Jobless Future*. Basic Books, 2015.
- 5 Rose, Gideon, ed. *The Fourth Industrial Revolution: A Davos Reader*. Foreign Affairs, 2016.
- 6 Business Wire, Inc., August 25, 2016, *Artificial Intelligence Revenue to Reach \$36.8 Billion Worldwide by 2025, According to Tractica*.

Our research yields 5 key takeaways:

1

The AI market is hot.

2

Both blue-collar and white-collar office jobs are at risk; research suggests that 47% of total jobs could be automated in the U.S.

3

There are many new AI technologies being developed that will further threaten white-collar jobs.

4

The winners and losers amongst metro areas yield some surprises.

5

Very little if any AI risk seems to be priced in to office properties. Perhaps it should.



Source: shutterstock.com

So, what exactly is AI?

Wikipedia's definition of AI is "intelligence exhibited by machines. In computer science, the field of AI research defines itself as the study of 'intelligent agents:' any device that perceives its environment and takes actions that maximize its chance of success at some goal. Colloquially, the term 'artificial intelligence' is applied when a machine mimics 'cognitive' functions that humans associate with other human minds, such as 'learning' and 'problem solving.' As machines become increasingly capable, mental facilities once thought to require intelligence are removed from the definition. For example, optical character recognition is no longer perceived as an exemplar of 'artificial intelligence,' having become a routine technology. Capabilities currently classified as AI include successfully understanding human speech, competing at a high level in strategic game systems (such as Chess and Go), self-driving cars, intelligent routing in Content Delivery Networks, and interpreting complex data."⁷ This is a fairly broad definition that encompasses a wide variety of thinking and learning machines. One can see that there is much scope for both enhancements to our daily lives and threats to one's chosen profession. ■

Scope of this paper

This paper considers the continued development and implementation of AI technology and its impact on jobs from the lens of a **commercial real estate investor**. Large swaths of the commercial real estate market are dependent on jobs. Jobs fuel apartment demand. Jobs drive retail sales, which drive retail rents. White-collar jobs fuel office demand. For the purposes of this paper, we will focus on the effects of AI on the **office sector in the U.S.** We may explore other sectors and geographies in future editions of *the Globetrotter*.

⁷ Wikipedia, February 21, 2017, *Artificial intelligence*.

Takeaway

1

The AI market is hot.

Machines that can learn on their own have reached the point of market readiness. Analysts at 451 Research, a New York-based IT research and advisory firm, declared that “the artificial intelligence winter spanning 30 years or more is finally over,” they wrote. “We’re finally in the AI spring.”⁸

Fortune magazine recently reported on the volume of and keen interest in AI startups at the current time. Fortune said that “startups focused on artificial intelligence and machine learning will be top acquisition targets in 2017 as chip manufacturers, software firms, and the automobile industry increasingly seek to add those features to their products.”⁹

In early 2017, news broke that Libratus, Carnegie Mellon University’s new AI computer, beat professionals in a 20-day poker competition.¹⁰ Machines have previously bested humans over the last two decades in chess, checkers, and most recently in the ancient game of Go. But AI’s victory in poker is different because the card game relies on imperfect information and bluffing, much like real-world challenges.



Source: shutterstock.com

⁸ Fortune, November 30, 2016, *Why even more M&A activity will chase machine learning startups in 2017* by Aaron Pressman.

⁹ Ibid.

¹⁰ American Association for the Advancement of Science, March 3, 2017, *Artificial intelligence goes deep to beat humans at poker* by Tonya Riley.

2017 has also seen tangible examples of white-collar job losses due to AI. In Japan, **Fukoku Mutual Life Insurance** entered into a contract for IBM to calculate payouts to policy holders via its IBM Watson Explorer AI. This resulted in the loss of 34 jobs. The company said it would speed up compensation payout analysis via analyzing claims and medical record and increase productivity by 30%. The company also said it would save ¥140m in running costs.¹¹

At **JP Morgan**, an AI computer is parsing financial deals that once occupied legal teams for thousands of hours. The program, called COIN, for *Contract Intelligence*, “does the mind-numbing job of interpreting commercial-loan agreements that, until the project went online in June, consumed 360,000 hours of work each year by lawyers and loan officers. The software reviews documents in seconds, is less error-prone and never asks for vacation.”¹²

Companies like **Nvidia** are creating new chips to drive AI technologies like the ones above and the more impactful ones of the future.¹³ Computers are becoming more powerful, and can do more of what humans can do every day.



Source: shutterstock.com

Impact of AI on jobs

This section addresses the likelihood and potential impact of AI on jobs in the U.S. It highlights what has already happened in the way of white-collar job automation and discusses some technologies of the future that could significantly impact the need for human workers.

A “hollowing out” of the employment market

Historically, in general, technology has been a net job creator, not destroyer. The growth in cognitive (thinking) jobs and the success of cities that have vibrant tech sectors are evidence of this. That said, there have been some losers – some workers that have suffered from the trend of technological advances. “Automation has transformed the American factory, rendering millions of low-skilled jobs redundant. Fast-spreading technologies like robotics and 3D printing will exacerbate this trend,” said Mireya Solís, a senior fellow at Brookings.¹⁴

11 The Guardian, January 5, 2017, *Japanese company replaces office workers with artificial intelligence* by Justin McCurry.

12 Bloomberg LLP, February 28, 2017, *JPMorgan Software Does in Seconds What Took Lawyers 360,000 Hours* by Hugh Son.

13 MIT Technology Review, April 5, 2016, *A \$2 Billion Chip to Accelerate Artificial Intelligence* by Tom Simonite.

14 The Financial Times, December 2, 2016, *Most US manufacturing jobs lost to technology, not trade* by Federica Cocco.

To get a better sense of the types of jobs that are most at risk to automation now and in the future, we use a job-classification scheme developed by the St. Louis Federal Reserve Bank as a framework.¹⁵ It classifies certain types of jobs into four categories:



1. Cognitive Non-Routine:

Cognitive non-routine jobs include management, business and financial operations, computer and mathematical, architecture and engineering, life, physical, and social science, community and social service occupations, legal, education, training, and library, arts, design, entertainment, sports, and media, and healthcare practitioners and technical occupations. *These types of jobs have exhibited the most growth over the past 30 years.*



2. Manual Non-Routine:

Manual non-routine jobs include healthcare support, protective service, food preparation and serving related, building and grounds cleaning and maintenance, and personal care and service occupations. *These types of jobs have also grown over the past 30 years.*



3. Cognitive Routine:

Cognitive routine jobs include sales and office and administrative support occupations. *After rising for many years, job growth has been flat to negative in the last decade in this category.*



4. Manual Routine:

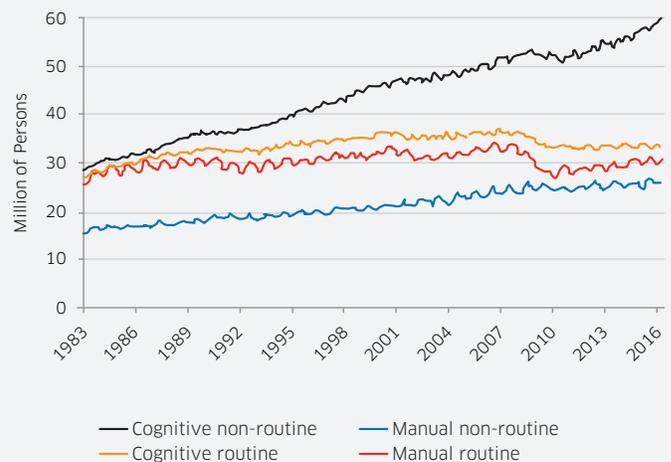
Manual routine jobs include farming, fishing, forestry, construction, maintenance, production, and transportation and material moving occupations. *After rising for many years, job growth has also been flat to negative in the last decade in this category.*

Figure 1 shows the historical pattern of growth (or decline) in these four job types. The trend is clear: routine jobs are decreasing while non-routine jobs are increasing. In effect, the workforce is trending to favor two groups doing non-routine work: highly paid, skilled workers (such as dentists and senior managers) and low-paid, unskilled workers (such as cleaners and landscapers).¹⁶

It is the potential for lost jobs in the “Cognitive Routine” category (i.e. administrative support) that should most concern office property investors. Those cities with high proportions of these types of jobs will generally have higher AI risk. ■

Figure 1

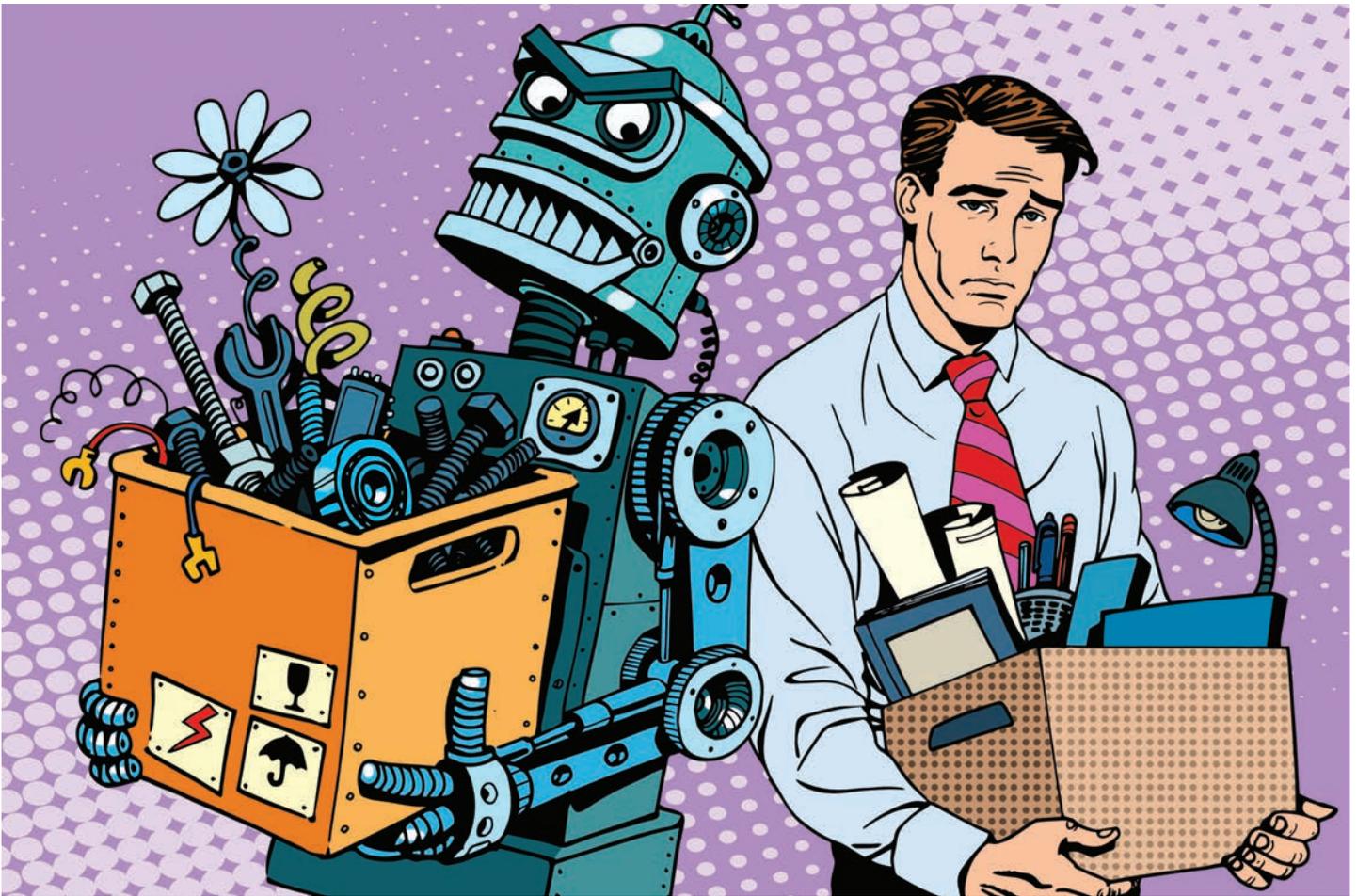
Historical growth in U.S. jobs per classification type



Source: The Economist, U.S. Population Survey, Federal Reserve Bank of St. Louis

15 Federal Reserve Bank of St. Louis, Economic Research April 28, 2016, *Job polarization*.

16 The Economist, June 25, 2016, *Artificial intelligence: The impact on jobs, automation and anxiety*.



Source: shutterstock.com

Takeaway

2

Both blue-collar and white-collar office jobs are at risk; research suggests that 47% of total jobs could be automated in the U.S.

What has already happened?

While people have been talking about machines taking jobs for centuries, the most recent AI wave has already seen tangible job losses in a variety of businesses. The changes are invisible to most people, however. In an article in the *New Scientist*, Hal Hodson, a technology correspondent with the Economist, writes “hypothetical world-ending artificial intelligence makes headlines, but the hype ignores what’s happening right under our noses. Cheap, fast AI is already taking our jobs, we just haven’t noticed.”¹⁷

Hodson’s article highlights O2, a U.K. telecom company. In the last three years, O2 has replaced 150 workers with a single piece of software from a company called Blue Prism. As a result, a large portion of O2’s customer service is now automatic. Customer requests such as sim card swaps, porting mobile numbers, and migrating from prepaid onto a contract have all been automated. “This is aimed at being a replacement for a human, an automated person who knows how to do a task in much the same way that a colleague would,” said Blue Prism’s Chairman Jason Kingdon.¹⁸

Kingdon’s comment above is striking in that most AI firms describe their products in a non-threatening way. They use words like “enhancement,” “cost-management,” and “accuracy improvement,” not words like “replacement for a human.” We believe he should get points for transparency, anyway.

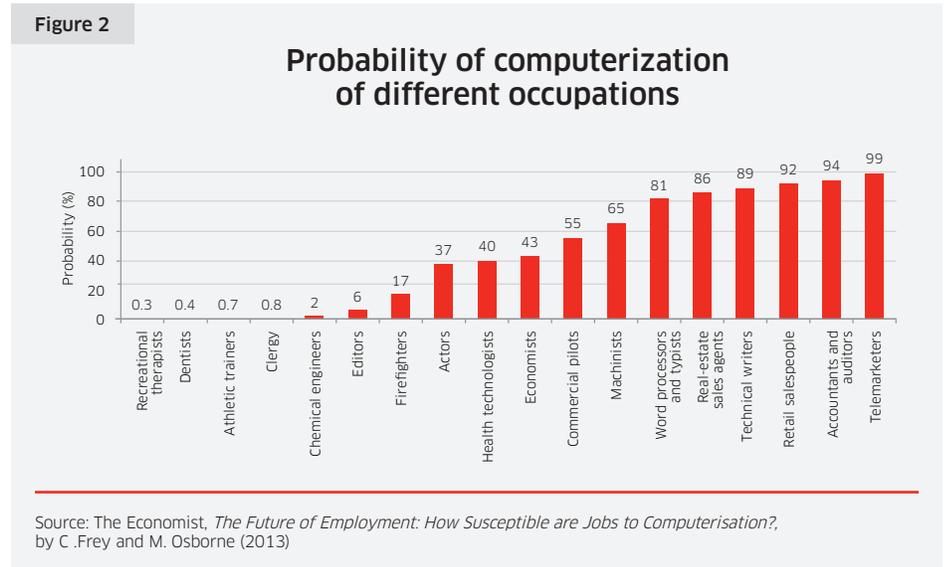
¹⁷ New Scientist, March 31, 2015, *AI interns: Software already taking jobs from humans* by Hal Hodson.

¹⁸ Ibid.

“47% of total U.S. jobs could be automated”

Artificial intelligence researchers and futurists remain simultaneously fascinated by and fretful about the technology. In 2013, University of Oxford researchers Carl Benedikt Frey and Michael Osborne estimated that **47% of total U.S. jobs could be automated**.¹⁹ They concluded that “recent developments in machine learning will put a substantial share of employment, across a wide range of occupations, at risk in the near future.” Subsequent studies put the equivalent figure at 35% of the workforce for Britain (where more people work in creative fields less susceptible to automation) and 49% for Japan.²⁰

Figure 2 shows a representative sample jobs and their probability of computerization, as determined by Frey and Osborne in their 2013 study. As the figure shows, their findings are good news for dentists and priests, and bad news for accountants and telemarketers. ■



Takeaway

3

There are many new AI technologies being developed that will further threaten white-collar jobs.

Technologies of the future - not just Watson anymore

Extending well beyond the examples mentioned above, **Table 1** highlights some of the companies and technologies that may automate certain tasks performed by white-collar workers. While the ubiquitous Watson gets most of the attention, the table reveals a wide range of AI technologies and applications.



Source: Own Work, commons.wikimedia.org. Author: VincentLTE

19 *The Future of Employment: How Susceptible are Jobs to Computerisation? Technological Forecasting and Social Change* 114 (2017): 254-280 by C. Frey and M. Osborne.
 20 International Organization of Employers, October 10, 2016 “*Understanding The Future Of Work.*”

TABLE 1: EMERGING AI TECHNOLOGIES PUTTING WHITE-COLLAR JOBS AT RISK

TECHNOLOGY	APPLICATION/JOB'S AFFECTED
<p>Watson AI, developed by IBM, is a question answering (QA) computing system that IBM built to apply advanced natural language processing, information retrieval, knowledge representation, automated reasoning, and machine learning technologies to the field of open domain question²¹</p>	<ul style="list-style-type: none"> • Education: Ashok Goel, professor at Georgia Tech, used Watson to create a virtual teaching assistant to assist students in his class.²² • Healthcare: Watson functions as a clinical decision support system for use by medical professionals.²³ Despite being developed and marketed as a “diagnosis and treatment advisor,” Watson has never been actually involved in the medical diagnosis process, only in assisting with identifying treatment options for patients who have already been diagnosed.²⁴ • Compliance: 600 consultants at Promontory Financial Group, which IBM recently bought, have the task of teaching Watson how to handle risk management and compliance chores for financial services firms.²⁵ • Legal: Canadian start-up ROSS started using IBM’s Watson supercomputer to automate a whole chunk of the legal research normally carried out by entry-level paralegals. • Others: tax preparation (partnership with H&R Block), weather forecasting (“Deep Thunder”), music (“Watson BEAT”).
<p>Wordsmith, created by Automated Insights, Inc., is a natural language generation platform that lets you produce human-sounding narratives from data²⁶</p>	<ul style="list-style-type: none"> • Media: sports reporters, financial reporters, etc. • E-commerce: Automates the writing process and generates content for an online store’s product descriptions and landing pages. • Financial services: delivers internal reports to employees as well as personalized portfolio summaries, earnings recaps, market reports and asset allocation reviews to customers. • Real estate: Automates the creation of market intelligence reports, neighborhood/city summaries, commercial real estate trends, and property descriptions. • Customer service: Creates content like emails, social media posts, in-app messaging and landing pages that provides each customer with their own experience.
<p>Fraugster developed an AI anti-fraud technology</p>	<ul style="list-style-type: none"> • Fraud investigators: Artificial intelligence technology helps investigators foresee fraudulent attacks before they actually happen.²⁷
<p>Lemonade created a chatbot-driven application</p>	<ul style="list-style-type: none"> • Insurance brokers and underwriters: Replaces brokers and paperwork with bots and machine learning.²⁸
<p>Knote provide an artificial-intelligence tool for legal services</p>	<ul style="list-style-type: none"> • Legal services: Algorithm that helps organizations “redact” confidential information from documents in a fraction of the time humans would require.²⁹
<p>Palantir Technologies’ anti-fraud solution</p>	<ul style="list-style-type: none"> • Compliance, fraud detection: Enables companies and governments to detect and eliminate sophisticated criminal activity, including credit card bust out fraud, money laundering, check kiting, mortgage fraud, tax fraud, tax evasion, and synthetic identity fraud.³⁰
<p>Microsoft’s translator speech API machine</p>	<ul style="list-style-type: none"> • Translators: A cloud-based machine translation service. Enables businesses to add end-to-end, real-time, speech translations to their applications or services.³¹
<p>Blue Prism developed software robots which can perform clerical and administration tasks</p>	<ul style="list-style-type: none"> • Clerical and administrative: Automates existing user actions, just as if the user were moving through and across their current raft of applications. Provides a capability for automating processes that would otherwise be executed manually by humans, or by customizing existing IT systems. • Customer service: Barclays, for instance, is using Blue Prism to deal with the torrent of demands that poured in from its customers after U.K. regulators demanded that it pay back billions of pounds of mis-sold insurance.³²
<p>MetaMind.io, developed by Salesforce, is a predictive vision service</p>	<ul style="list-style-type: none"> • Sales, service, and marketing: Can train deep learning models to recognize and classify images at scale. It can “visually listen” to detect attributes about an image, such as detecting brand logo in a customer’s photo. These attributes can be used to learn more about a customer’s lifestyle and preferences. As a result, sales, service, and marketing teams can discover insights about their customers and predict outcomes that lead to smarter decisions.³³
<p>Quill developed by Narrative Science</p>	<ul style="list-style-type: none"> • Financial services, insurance, government, compliance: Turns data into meaningful narratives for an intended audience.³⁴
<p>Nuance Communication created a language-focused AI algorithms</p>	<ul style="list-style-type: none"> • Medicine: In the U.S., after doctors and nurses type up case notes, another person uses those notes to try to match the description with one of thousands of billing codes for insurance purposes. Nuance’s language-focused AI algorithms can now understand the typed notes, and figure out which billing code is a match. The system is already in use in a handful of U.S. hospitals.³⁵

21 IBM, *DeepQA Project: FAQ*.

22 Sydney Morning Herald, May 13, 2016, *Professor reveals to students that his assistant was an AI all along* by Matt McFarlane.

23 IBM, November 11, 2013, *Putting Watson to Work: Watson in Healthcare*.

24 Saxena, Manoj (February 13, 2013). *“IBM Watson Progress and 2013 Roadmap (Slide 7)”*. IBM. Retrieved November 12, 2013.

25 IBM, September 29, 2016, *IBM Announces Planned Acquisition of Promontory to Transform Regulatory Compliance with Watson*.

26 www.automatedinsights.com.

27 AOL, January 16, 2017, *Fraugster, a startup that uses AI to detect payment fraud, raises \$5M* by Steve O’Hear.

28 PR Newswire Association LLC., December 5, 2016, *Lemonade Closes \$34 Million Round and is Poised for Growth as Company Files in California*.

29 Canadian Business, February 17, 2017, *This A.I. can block out sensitive data before making documents public* by Peter Nowak.

30 Palantir Technologies, 2017, *Anti Fraud*.

31 Microsoft, *Translator Speech API*.

32 Blue Prism, September 2012, *Blue Prism Product Overview*.

33 CRM Science, inc., December 13, 2016, *Insights Into #Salesforce Einstein - MetaMind.io - Predictive Vision Service* by Kirk Steffke.

34 NarrativeScience, 2017, *Natural Language Generation Software*.

35 New Scientist, March 31, 2015, *AI interns: Software already taking jobs from humans* by Hal Hodson.

Impact of AI on commercial real estate

Predicting the impact of AI on commercial real estate poses some challenges. First, there are many variables – legal, regulatory, social, etc. - that will affect the development and large-scale implementation of AI. As noted above, there are a wide range of opinions about how that will all play out. And second, there are many factors beyond technology that influence the health of local office markets. Therefore, we believe it is most useful to present the findings of our analysis in terms of “higher AI risk” and “lower AI risk” markets, as opposed to “underperforming” or “outperforming” markets.

In a recent paper, *Beyond the Big Six: Identifying Alternative U.S. Office Markets Based On Long Term Demand Generators*, Stewart Rubin from New York Life Real Estate Investors identifies some key indicators of long-term office demand.³⁶ Among them are educational attainment, particularly in science, technology, engineering, and math (STEM). In addition to some major markets such as San Francisco, Boston, and Washington DC, other cities scoring well include Nashville, Raleigh, Austin, Salt Lake City, Minneapolis, Portland, Indianapolis, and Columbus. Implicit in his analysis is that workforces with high percentages of STEM degrees should be more resistant to the forces of automation. Rubin’s work is important in the context of our analysis in that it establishes a baseline for how to think about technology risk in the office occupier markets.

Our research reveals, however, that we can go deeper to understand the AI risk of a Metropolitan Statistical Area (“MSA”). An MSA is a U.S. geographic area that includes a city and the surrounding area (e.g. Seattle, Washington includes Seattle, Bellevue, and Everett, Washington). The following presents our process, analysis, and findings.

Step 1: Determine the highest risk white-collar jobs using Frey and Osborne’s analysis of all BLS Job Classifications

For purposes of this analysis, we will use the Frey and Osborne findings (that 47% of total U.S. jobs could be automated) as a starting point. Frey and Osborne assigned a probability of automation (0-100%) to each of the 702 job classifications (both white and blue-collar) from the U.S. Bureau of Labor Statistics (BLS). Using this data as a point of departure, we identified the top 29 white-collar jobs that had 90% or greater likelihood of automation. **Table 2** lists those jobs.

TABLE 2: WHITE-COLLAR JOBS THAT HAVE A HIGHER THAN 90% LIKELIHOOD OF AUTOMATION

Do You See Your Job On The List?

Job	Probability of Automation
Data Entry Keyers	99%
Tax Preparers	99%
Insurance Underwriters	99%
Title Examiners, Abstractors, and Searchers	99%
Telemarketers	99%
Bookkeeping, Accounting, and Auditing Clerks	98%
Legal Secretaries	98%
Credit Analysts	98%
Insurance Appraisers, Auto Damage	98%
Loan Officers	98%
Order Clerks	98%
Brokerage Clerks	98%
Insurance Claims and Policy Processing Clerks	98%
Real Estate Brokers	97%
Telephone Operators	97%
Receptionists and Information Clerks	96%
Compensation and Benefits Managers	96%
Switchboard Operators, Including Answering Service	96%
Secretaries and Administrative Assistants	96%
Accountants and Auditors	94%
Mail Clerks and Mail Machine Operators, Except Postal Service	94%
Budget Analysts	94%
Paralegals and Legal Assistants	94%
Tax Examiners and Collectors, and Revenue Agents	93%
Office Machine Operators, Except Computer	92%
Insurance Sales Agents	92%
Medical Records and Health Information Technicians	91%
Human Resources Assistants, Except Payroll and Timekeeping	90%
Appraisers and Assessors of Real Estate	90%

Source: *The Future of Employment: How Susceptible are Jobs to Computerisation?*, by C. Frey and M. Osborne (2013), Appendix page 57-70.

36 New York Life Real Estate Investors, *Beyond the big six: Identifying alternative US office markets based on long term demand generators* by Stewart Rubin.

Step 2: Cross-Reference the Frey/Osborne findings against detailed MSA job data

The next step of the process is to leverage the extremely detailed and thorough dataset (over 100,000 rows of data) sourced from the U.S. Bureau of Labor Statistics. This database uses U.S. Census information to identify the number of jobs in each of the 702 job classifications by MSA. Armed with the number of jobs (as a percentage of total) in each MSA, we can cross reference that with the Frey and Osbourne list of highly automatable jobs to determine which MSAs are at higher/lower risk to automation.

We spent a fair bit of time with the data as it revealed some fascinating stories. Sorting the dataset by largest concentration of jobs by MSA, we found large concentrations of lower-skill white-collar jobs dominating the top of the list. In the Lynn-Saugus-Marblehead, Massachusetts, MSA, for instance, there are 72.9 retail salespersons per thousand workers and 69.5 in the Punta Gorda, Florida MSA. In Hammond, Louisiana, 59.5 workers per thousand are cashiers.

We had to scroll down in the database to get to large concentrations of white-collar jobs, but we eventually discovered large pockets of office positions. In Abilene Texas, for instance, 33.2 workers per thousand are “Office Clerks,” and 33.0 in Eau Claire, Wisconsin. In Punta Gorda, Florida, there are 30.2 Secretaries and administrative assistants per thousand total workers and 30.0 in State College, Pennsylvania.

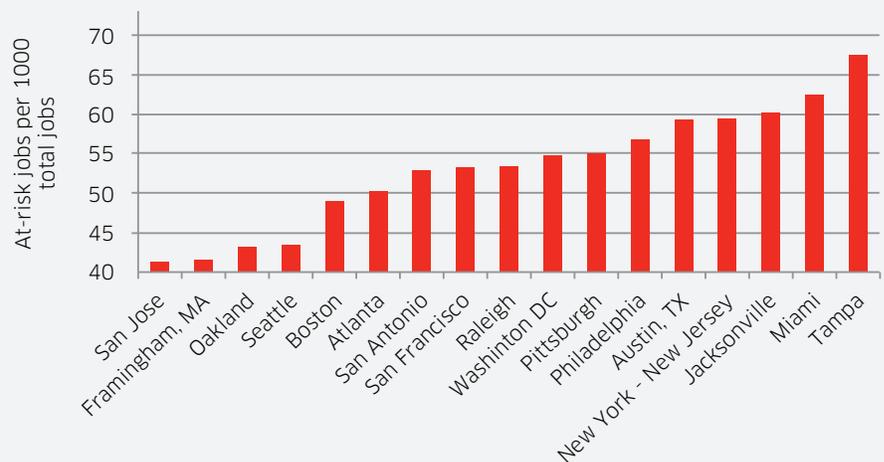
Note that all of these figures are for total employment, not just *office* employment, so it follows that the percentage of office jobs held in these roles is much higher. Roughly 60% of jobs in the U.S. are white-collar.³⁷

Step 3: Run our numbers and interpret results

While our research extended to all of the MSAs in the U.S. from smallest to largest, we focused our analysis on some of the more institutional markets for our summary. **Figure 3** presents MSA exposure white-collar jobs having a higher than 90% likelihood of automation based on our analysis. Going in, we expected the major “core” U.S. markets, plus the others listed above to do well. Some cities landed where we expected, but there were a few surprises, too. ■

Figure 3

MSA exposure to white-collar jobs that have a higher than 90% likelihood of automation



Source: Presima Inc., U.S. Bureau of Labor Statistics, *U.S. Census*, May 2016 estimates.

³⁷ Business Insider, January 7, 2010, *Great News! We've Become A White-Collar Nation* by Marc Cenedella.



Source: shutterstock.com

Takeaway

4

The winners and losers amongst metro areas yield some surprises.

What we found - a few surprises

First, here is where our analysis matched our expectations:

- San Jose, Seattle, and Boston, highly educated, high “tech” hubs, scored “low risk” with under 50 jobs per thousand exposed to 90%+ automation likelihood.
- In contrast, Jacksonville, Miami, and Tampa, all landed in “high risk” territory, with over 60 total jobs per thousand exposed to 90%+ automation risk.

But here are the surprises:

- Oakland scored much better than San Francisco, right across the San Francisco Bay.
- Framingham, MA, 25 miles west of Boston selected as a representative suburban location, scored better than Boston.
- Austin, TX, a well-educated tech-savvy market, scored poorly.
- Washington, DC, New York, and Philadelphia all scored fairly poorly, right behind the Florida cities in our sample.

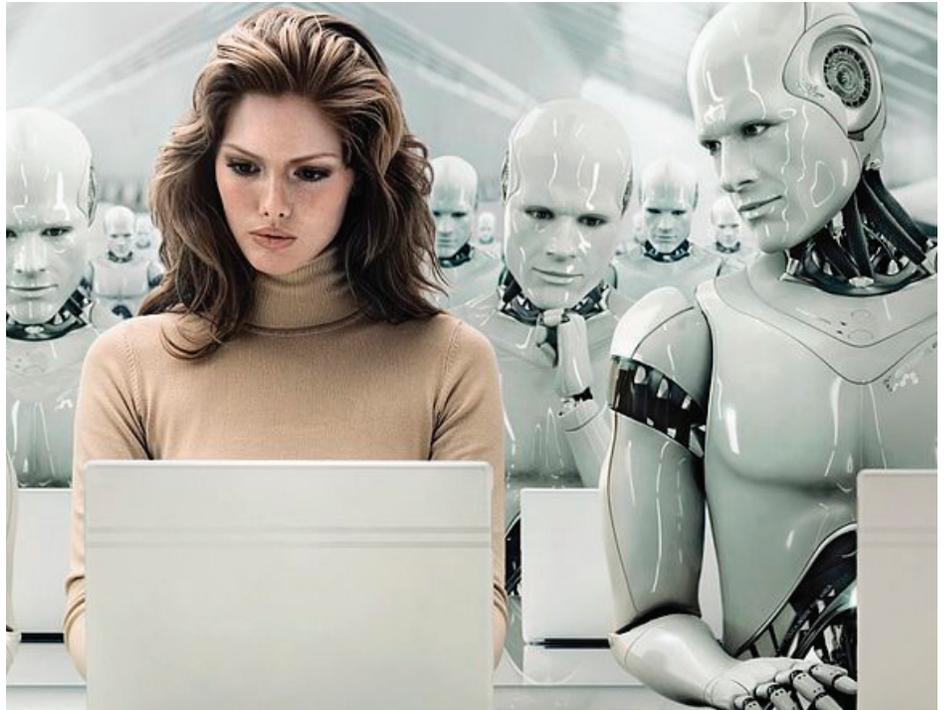
Digging into the data, beneath the headline numbers, reveals answers to these mysteries.

- Notably, the number of white-collar workers listed as “**Secretaries and Administrative Assistants, Except Legal, Medical, and Executive**” ranged from a high of 22.2 per thousand in Austin and 20.7 per thousand in Tampa down to only 10.5 per thousand in Seattle and 11.1 per thousand in San Jose. That is a very big difference. And since the Frey and Osborne analysis found a 96% likelihood of automation for secretaries and administrative assistants, this had a significant impact on the final outcome.
- The second most impactful job category was “**Accountants and Auditors,**” assessed by Frey and Osbourne with a 94% likelihood of computerization. This job category was heavily weighted to the major markets, and affected results meaningfully. In Washington, DC, for instance, 13.9 white-collar workers per thousand are accountants and auditors, versus only 8.3 per thousand in Oakland.

Expectations: What is priced in to the office property market?

What me, worry?

Maybe it's because we haven't noticed the changes happening beneath our eyes, but most workers do not seem too concerned. A recent Pew Research Center survey found that 80% of Americans think their job will still exist in 50 years, and only 11% of today's workers are worried about losing their job to automation.³⁸ An international poll conducted by Monster reveals that 63% of workers believe their jobs will never be replaced by automation (i.e., computers, robots); an additional 10% think it will take over 10 years for automation to do their job.³⁹



Source: Own Work, commons.wikimedia.org.
Author: Edgarrodriguezmunoz

"Nothing to see here"

On the surface, there are few signs that office asset pricing has been materially affected by the risk introduced by AI. Obviously technology risk is but one of the many factors driving cap rates, but the steady drift downward in overall office cap rates suggest that investors are likely overlooking the risk of job automation. We would also mention that our hundreds of meetings each year with office REIT management teams have yielded only a handful of meaningful discussions or concerns about job automation.

Figure 4 shows that office cap rates in the U.S. have fallen steadily over the past eight-year cycle. We reckon, therefore, that very little if any consideration is given to AI risk in the underwriting of office properties in the U.S., and so very little if any of AI risk is priced in. ■

Figure 4

U.S. office cap rates have glided downwards



Source: Bloomberg L.P.; Reis, Inc.

38 Los Angeles Times, March 28, 2016, *Op-Ed Robots are coming for your job* by Bryan Dean Wright.

39 PR Newswire, April 16, 2015, *Robot Overlord Denial? Despite Research Indicating Otherwise, Majority of Workers Do Not Believe Automation is a Threat to Jobs from Monster Worldwide.*

Takeaway

5

Very little if any AI risk seems to be priced in to office properties. Perhaps it should.

Winter is (may be) coming

The latest research suggests that we ought to start paying attention, however. Both blue and white-collar workers may want to start looking over their shoulders. In addition to findings of the Frey and Osborne study described earlier in the paper, other researchers have made similar assessments and predictions:

- According to a survey of 18,000 employers in 43 countries by employment consultancy ManpowerGroup, up to 45% of daily tasks could be automated *using current technology*.⁴⁰
- Global consultancy McKinsey said more than 60% of jobs and 30% of business activities could be automated *today*.⁴¹
- The Pew Research Center also found, in a canvassing of 1,896 technology builders and analysts and those who have made insightful predictions about the future of the Internet, that half (48%) envision a future in which robots and digital agents have displaced significant numbers of both blue- and white-collar workers by 2025—“with many expressing concern that this will lead to vast increases in income inequality, masses of people who are effectively unemployable, and breakdowns in the social order.”⁴²

We note that the other half of the experts in the Pew Center survey (52%) expect that technology will not displace more jobs than it creates by 2025. While nearly all experts agree many jobs currently performed by humans will be substantially taken over by robots or digital agents by 2025, this latter group of optimists believe that history will repeat itself, and that technological innovation will create more jobs than it replaces.

The bottom line is that there is roughly a 50/50 chance of widespread white-collar worker displacement by 2025. Is your portfolio prepared for the “bad 50” scenario? ■



Source: shutterstock.com

40 The Express Tribune, January 19, 2017, *For white-collar staff, AI threatens new workplace revolution* by AFP.

41 Ibid.

42 Pew Research Center, August 6, 2014, *AI, Robotics, and the future of Jobs* by Aaron Smith and Jana Anderson.



Source: Melissa North photographer

Conclusion

Our research suggests that it is likely that robotics and artificial intelligence will permeate wide segments of daily life in the next decade or so, with significant implications for a range of industries such as health care, transport and logistics, customer service, and home maintenance. We have seen much of this already and can see a pathway to greater immersion. In addition, there is a roughly 50/50 chance that AI will significantly affect the employment market, with both blue and white-collar jobs at risk.

In assessing U.S. office markets' exposure to "the Fourth Revolution," our thesis going in was that a key defense mechanism would be a workforce's educational attainment, particularly in science, technology, engineering, and math (STEM). We still believe this to be true, since over time we see technology jobs being created in markets such as San Francisco, Boston, Washington DC, Nashville, Raleigh, Austin, Salt Lake City, Minneapolis, Portland, Indianapolis, and Columbus.

That said, certain workers and workforces are likely to have difficulty in retraining themselves for changes that are expected to happen quickly. For secretaries, administrative assistants, office clerks, accountants, and other jobs at high risk of automation, an AI world may not seem so user-friendly. From a landlord's perspective, if companies are operating more leanly, they very well could need less space. A careful analysis of the data suggests that when considering AI risk, some non-traditional markets (Oakland, Seattle, smaller suburban markets such as Framingham, MA) are less at risk than some of the larger ones (New York, San Francisco). The highest risks appear to be in the Florida markets of Jacksonville, Miami, and Tampa, with large concentrations of high-automation-risk jobs.

The question for real estate investors is how to analyze and position their portfolios for the long-term AI megatrend. We have presented above the data sources and analytical tools necessary for such an analysis in the U.S. Using our own geographic database of U.S. REIT portfolios, Presima have assessed the relative AI risk of all of the office-focused companies in our investment universe. Replication of this analysis is fairly straightforward. Outside the U.S., it will certainly take a bit more work, but the data and tools are out there. Constructing a diversified portfolio is a matter of determining where the risks are and if one is comfortable with the risks in the context of the expected total return. Of course, the analysis would be a lot easier if you could design an AI algorithm to do it for you. That day may be coming sooner than you think! ■



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