Bricks, mortar, and proptech

The economics of IT in brokerage, space utilization and commercial real estate finance

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Abstract

Purpose – Digital and information technologies (IT) are becoming silently pervasive in old-fashioned real estate markets. This paper focuses on three important avenues for the diffusion of IT in commercial real estate: online brokerage and sales, the commoditization of space and Fintech in mortgage and equity funding. We describe the main new markets and products created by this IT revolution. The focus is on the pioneering US market, with some attention devoted to the specific firms and institutions taking these innovations into the mainstream. We also carefully analyze the economic underpinnings from which the new technologies can expect to generate cash flows, thus becoming viable—or not. Finally, we discuss their likely impact on established players in the commercial real estate arena.

Design/methodology/approach – In this paper, the author chooses to focus on three separate arenas where the IT revolution—sometimes referred to as Proptech, as applied to real estate—is having discernible impacts: sales and brokerage, space commoditization and online finance platforms. The author invites the reader to think seriously about the economic fundamentals that may—or may not—sustain new business models in Proptech. Real estate economists and investors alike need to be critical of new business models, especially when they are being aggressively marketed by their promoters. Trying to avoid any hype, the author provides thoughts about the likely impact of the innovations on their markets, guided by economic and finance theory, and previous experience.

Findings – The author evaluates the evolution of commercial real estate brokerage. While innovations will, no doubt, have an impact on the ways in which we buy and lease commercial properties, the lessons from the housing market should make us skeptical about the possibility of the new technologies dramatically facilitating disintermediation in this market. In fact, new oligopolies seem to be emerging with regard to market data provision.

Practical implications – Proptech will change some aspects of the real estate industry, but not others!

Originality/value – As change pervades the property industry, only a relatively few research pieces are illustrating or—more importantly—providing insights about the likely economic and financial impacts of IT penetration. Similarly, only a few papers have so far addressed the economic viability of the alternative business models of tech startups targeting real estate markets and transactions.

Keywords IT, Fintech, Coworking, Future of real estate, Online brokerage, Proptech

Paper type Conceptual paper

1. Introduction: IT disruption and real estate

The information technology (IT) revolution is having a profound impact on the economy and the ways in which we produce and distribute goods and services. IT has helped create new consumption items and replaced workers in the production of other goods. While the process may eventually lead to a more efficient economy and allow humans to undertake more engaging tasks, it is not without growing pains.

Acemoglu and Restrepo (2018) argue that recent technological innovations have a dual impact in the economy: on the one hand, automation and artificial intelligence (AI) replace humans with hardware and software, thereby decreasing the demand for labor. This, in turn, could have a negative impact on wages in the sectors where technological penetration is increasing. On the other hand, new technologies create innovative products and news tasks that could increase the demand for labor.

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The speed and depth of the two processes need not coincide. According to these authors, we are experiencing a period of acceleration of the former *human-replacement* effect. This process is creating tensions that are surfacing in the form of income stagnation among workers whose tasks are easily replaced by machines or software.

A solution to the labor-market problem of automation in the short- to medium-term—according to Levy and Murnane (2013)—involves retraining these workers so that they can compete with highly-educated employees for new opportunities.

Some technological innovations are hard to measure, and generate new activities that cannot be monetized, thus situating themselves outside of the realm of economic measurement. By following instructions on YouTube, it is now easy to figure out how to grow a vegetable garden, brew beer or learn French-style cooking. Social media is substantially changing our leisure time. Similarly we can now devote ourselves to reading blogs and other unpriced online resources. The implications of the widespread proliferation of such unmonetized innovations on GDP and consumer welfare are as-of-yet unagreed upon. A team of economists (Brynjolfsson *et al.*, 2019) have recently assigned large economic values to the use of Facebook and other innovations. While a consensus about the accuracy of such valuations will take time to emerge, an even more difficult question to answers is: does the consumption value of these innovations compensate for the loss of jobs IT generates in other arenas?

Economic tensions are also surfacing in real estate markets. Many older industrial regions are struggling to adapt to the new economy, and commercial real estate (CRE) and housing values there lag behind those in more dynamic areas. On the flip side, metropolitan areas that specialize in IT, media, the medical sector and biotech are booming.

Besides the obvious ebb and flows of the local economies that sustain real estate cash flows, technology is changing the sector from the inside out. After all, buildings provide basic economic services, the delivery of which is itself subject to technological change. Countless innovations are reaching the market every year, in a process of creative destruction. Without being exhaustive, software and online real estate applications are now available for: property and asset management, leasing, monitoring and security, site selection, zoning, design, 3D-visualization, building-operations management, financial underwriting, price benchmarking and indexing, legal and accounting work and so many more areas. Some of the numerous new applications, products and online platforms will not survive the market test. And yet, a few of them will have tremendous impacts in the ways we experience, finance, operate and transact commercial properties. In addition to these software products and online platforms—on a parallel track—big data is also starting to change practice in urbanism and real estate (Hughes, 2017; Barkham *et al.*, 2018).

As change pervades the property industry, only a relatively few research pieces are illustrating or—more importantly—providing insights about the likely economic and financial impacts of IT penetration. Similarly, only a few papers have so far addressed the economic viability of the alternative business models of the tech startups targeting real estate markets and transactions.

In this paper, I choose to focus on three separate arenas where the IT revolution—sometimes referred to as Proptech, as applied to real estate—is having discernible impacts: sales and brokerage, space commoditization and online finance platforms. I describe some of the most salient emerging firms and market niches, with a focus on the United States. The United States is pioneering many of the innovations, so that lessons learnt here can actually be useful to an international audience of researchers and practitioners.

In the paper, I invite the reader to think seriously about the economic fundamentals that may—or may not—sustain new business models in Proptech. Real estate economists and investors alike need to be critical of new business models, especially when they are being aggressively marketed by their promoters. Trying to avoid any hype, I provide thoughts

about the likely impact of the innovations on their markets, guided by economic and finance theory, and previous experience.

I start, in Section 2, by evaluating the evolution of CRE brokerage. This is a really interesting application, because the Internet and information technologies have already become so prevalent in residential real estate. I therefore examine the economic impact of the online revolution on home sales, and its implications for CRE. While innovations will, no doubt, have an impact on the ways in which we buy and lease commercial properties, the lessons from the housing market should make us skeptical about the possibility of the new technologies dramatically facilitating disintermediation in this market. In fact, new oligopolies seem to be emerging with regard to market data provision.

Section 3 is devoted to technologies and business models that result in changes in the use of space, with an emphasis on the trend of commoditization of space–time. I discuss the new ways in which space can be shared or utilized more intensively. Work from home—implicitly redeploying residential space for tertiary-sector activities—open office designs and hot-desking in corporate environments are trends worth looking at. In addition, a number of firms are emerging that propose using space in yet-smarter ways. What is the economic base sustaining these new markets for space–time?

Section 4 is devoted to the forays of Fintech into the real estate sector. While the focus of the paper is on CRE, the phenomenal growth of the Fintech home-mortgage originators provides us with invaluable lessons. This section also examines the different business models of online real estate finance platforms, both on the debt and on the equity side.

Finally, Section 5 concludes with an overview of some of the main lessons that can—arguably—be derived from the paper.

2. Real estate tech, sales and brokerage: a silently pervasive revolution

In the last two decades, the worlds of commercial and residential real estate have experienced a silent technological revolution. Its stealth and pervasiveness astounding. It has very recently become fashionable for those in the know to utter neologisms such a Proptech, automated valuation model (AVM) and coworking. Yet—unnoticed by most—space users, investors, sellers and buyers of real estate have been riding the crest of the IT innovation wave for a much longer time. Starting with the development of websites to advertise rentals or to look for a roommate (such as *Apartments.com* or *Craiglist*)—or through the development of residential Multiple Listing Services (MSL)—the ways in which we sell, buy and lease real estate have been transformed forever.

While the role of the broker is still important, no one thinks nowadays about transacting or leasing a property without first using the Internet to gather information, check on comps or obtain sale/buy leads. The Internet has even allowed parties to effect transactions sight unseen.

Scores of Americans daily log into *Zillow* to snoop on the characteristics of their neighbors' homes, or perhaps to check on the market value of their own properties. *Zillow*'s subscription model also facilitates the obtention of sales leads or preferential placement by paying brokers.

In the commercial space, the use of *LoopNet* and similar platforms has become commonplace. A similar trend is to be observed in the financial brokerage industry: agents can now underwrite a property using devoted software and sell their originations to third parties at the click of a mouse. Googling for a rental, a new home, or in order to find space for a new venture have become ingrained in the way participants in the market operate.

In this section, I describe and analyze the trends that led to this silently pervasive revolution. I review existing and intriguing new developments in residential and CRE. It is interesting to examine the role of new IT platforms on disintermediation in the industry: Is the traditional brokerage system in danger? And what will be the role of large real estate services companies providing brokerage and other integrated services?

2.1 Pioneers: IT in residential real estate transactions

While the real estate industry is usually though of as slow on the uptake of innovations, this certainly cannot be said about its brokerage and transactions activities. I will argue that the broader impacts of their rapid and ubiquitous adoption of technology depended on the initial industrial organization of the brokerage industry. In market spaces with substantial initial concentration and/or large network economies, transactional tech has actually facilitated the role of the broker. In atomized markets where network economies are absent, disintermediation turned out to be the most likely outcome.

In the residential arena, the potential for the Internet to centralize real estate listing was quickly seized by different regional MLS. In earlier days, computerized MLS were simply databases with standardized property data fields and photos, which brokers did not necessarily share with their customers. Regional firms franchising local real estate brokerages—federated into local MLS exchanges—had obvious incentives to share and disseminate the information to their broker bases, in order to increase sales and turnover. The current Internet marketing data infrastructure for residential sales was thus quick-started and guided by the Nation al Association of Realtors (NAR).

Websites such as or *Zillow*, *Homefinder.com*, *Homes.com*, or *ZipRealty.com* aggregate data from regional MLS, facilitating ubiquitous access to present and past listings. These aggregator services combine the listings with other publicly available information about each home and neighborhood. In the future we will likely see more integration of listing records with other data and audiovisuals (e.g. *Matterport's* 3D renderings), thereby facilitating property analysis and statistical research of housing trends. Nevertheless, existing platforms ultimately lead consumers to the properties' listing realtors. Whenever prospective buyers approach them directly, sell-side realtors can realize the additional opportunity to act as dual agents.

In the 1990s, observers thought that the Internet marketing revolution had the potential to greatly increase the for-sale-by-owner (FSBO) market. Under the FSBO model, sellers list their properties themselves on the Internet and buyers approach them directly, no intermediation required. Platforms such as *ForSaleByOwner.com*, *FSBO.com*, or *HomesByOwner.com* greatly facilitate the job. Owner-sellers simply need to input the home's information and upload photos—perhaps taken by a professional—on to the FSBO website or phone application. Yet only 7 percent of recent home sales were FSBO in 2018 as reported in NAR's "*2018 Profile of Home Buyers and Sellers*." The market share of FSBOs thereby reached a reported minimum since NAR started collecting data in 1981.

Redfin's model of discount brokerage—combining online and offline services—has experienced more success, and the company is growing. However, the promise of massive disintermediation in the very large and lucrative residential real estate market has clearly not come to fruition. In fact, the IT revolution has provided brokers with more sophisticated marketing tools and increased the productivity of realtor franchises. For instance, *Apartmentocean.com* provides chatbot capabilities to realtors' offices. Using AI algorithms to imitate human conversational skills, chatbots can field and answer thousands of simple questions around unit availability and monetary terms. And they do so around the clock, without fatigue.

In the residential apartment sector, the IT marketing revolution developed differently. Many landlords had historically targeted customers directly, via newspaper ads or devoted magazine-like publications. The market was atomized and local, without the full consolidating strength of an organization as large as the NAR. In this environment, the Internet furthered disintermediation. Advertising and searching for apartments is now easier than ever, thanks to listing aggregators such as *Craigslist*, *Abodo.com*, *Apartments.com*, *hotpads.com*, *rent.com*, *forrent.com*, *apartmentguide.com*, and many other websites or phone apps. In fact, even strictly local Internet platforms have emerged in the largest markets.

Rental advertisement has now become a crowded field in the real estate tech arena, with new entrants looking for ways to differentiate themselves. For instance, *Zumper.com* offers direct and fast online rental applications, while *Sumu.io* and *Rental-Beast.com* use machine-learning techniques to help improve the matching process between apartment seekers and landlords. *RentCafe.com* specializes in connecting apartment-seekers to vacancies in large rental buildings and in providing them with local services as they become tenants.

A similar trend has revolutionized the markets for residential sublets and roommate matching. Websites and/or phone Apps abound: such as *Roomi*, *Padmapper*, *Roomiematch*, *Roommate*, *Roomster*, and others. New market niches are sprouting up: *Nesterly*, for instance, specializes in intergenerational housing. The app matches elderly home owners with younger roommates, who enjoy discounted rents in exchange for some light household work. The explosion of alternatives has certainly helped to increase the frequency of apartment sharing and the quality of matches, all in an extremely decentralized way.

2.2 Brokerage and real estate services in CRE

Experiences in the residential real estate market are illuminating for the future evolution of the CRE brokerage sector. After all, the large market size of the former has contributed to the accelerated adoption of IT technologies in leasing and transactions. With a bit of caution, we can therefore use the housing market as a harbinger to identify relevant prospective trends in the CRE space.

Both CRE sales and leasing are probably more similar in economic structure to the home-sales market, rather than the apartment-leasing one. They started with relatively high levels of concentration. And the services provided by CRE brokers are more important, because user needs are much more specific and heterogeneous. The largest global brokerage firms—such as Jones Lang Lasalle, CBRE, Cushman and Wakefield, Colliers, Newmark Knight Frank, Marcus & Millichap, or Sperry Van Ness—handle a not unsubstantial proportion of office and industrial listings. And some of them have been acquiring and absorbing large competitors. Integrated CRE services companies (ICRESC) effectively bundle brokerage with the provision of other critical offerings: marketing, PR, research, financing, investments, asset management, custodial, technology, site selection, planning, consulting and advisory. CRE buyers and tenants establish long-term relationships with professionals across ICRESC departments, allowing for substantial cross-pollination.

Therefore, as I have argued elsewhere (Saiz and Salazar, 2017) the IT revolution may actually beget new opportunities for ICRESCs. Multiple Proptech startups have popped up to provide services in construction management, marketing, tenant representation, property management, smart buildings, asset management, underwriting and valuation, investments, legal, contracts, accounting and other processes required by the CRE industry. The lack of compatibility of the slew of competing apps in this universe will require some consolidation, and ICRESCs are well-positioned to provide it. They may be able to do so by acquiring existing startups, or by teaming up with software companies in order to provide proprietary one-point-of-entry IT solutions for CRE developers, professionals and investors.

An important example of the emergence of more centralized market-making in the CRE arena—thanks to the IT revolution—is provided by *LoopNet*. *LoopNet*'s holding company, *CoStar*, has become one of the major repositories of CRE data.

LoopNet serves a parallel role to that of the MLS in the residential market. However, its marketing and listings website and app are used both in property transactions and commercial leases. Sell-side brokers—either leasing or selling commercial properties—have incentives to list with *LoopNet*. *CoStar* supplements the listings with information from an extensive property record database. CRE brokers have also the ability to pay for premium placement of their listings. The market-making characteristics of Loopnet are difficult to reproduce by potential entrants. The explanation for this lies in the existence of network

economies. Their concept can be easily grasped through the aphorism: "*it is more fun to go to parties that attract more guests like me*." *LoopNet* has a fist-mover advantage: sell and buy-side brokers want to be there because most customers and other brokers already are.

CoStar shrewdly bundled the listing service—acquired in 2011—with their existing CRE data platform. Other players, such as *Xceligent*, *42 Floors*, and *Real Massive*, have entered the market space over the years. But *CoStar* has proven a tough nut to crack as a competitor. There are large fixed costs of achieving the degree of data integration they already possess. *CoStar* has also been aggressive in pursuing legal action against challengers. For instance, *Xceligent* was driven out of business after a series of costly legal battles—involving suits and countersuits regarding alleged copyright infringement of *CoStar* proprietary data.

The relatively small numbers of successful competitors in the CRE-transactions-data space have thrived by specializing in their distinctive core competencies. For instance, *Real Capital Analytics* displays extraordinary strength in the collection of data about transactions of institutional-grade properties. *Reonomy* specializes in providing property and ownership information using algorithms that sort through extant and new data sources. *Compstak* deploys an interesting crowdsourcing model. Landlords, tenants and brokers offer information about existing leases or recent transactions, in exchange for limited access to other comps. Broader access can be obtained by subscription. *RE Meter* focuses on providing predictive models of lease defaults or early termination of potential tenants. To do so, they apply AI algorithms to databases capturing the past performance of similar firms.

In the near future, we will see more integration between marketing apps and other data—such as legal information (mortgages, liens, regulatory action), electricity and water consumption, verified income generated by tenants, pedestrian traffic, financial intelligence about tenants and other.

Arguably, such innovations in CRE Tech could be empowering, rather than replacing, traditional brokerage firms and ICRESCs. That is especially true for those intermediary companies that have been proactive in incorporating IT platforms and data in their processes. Or for those using data and IT to increase the menu of service offerings to clients. Such firms are becoming more productive and efficient in their intermediary roles, reducing costs and potentially increasing their market share. The question of whether these increments in the productivity of the brokerage sector are being translated into less hiring—and therefore lower employment—is a fascinating one, to which we do not have an answer yet. Note that the impact of IT on market concentration need not be the same as its impact on employment—potentially increasing the former, but decreasing the latter.

Some of the most promising avenues for IT-driven disintermediation lie in the subletting of commercial space—short or long term—or in finding tenants to assume unexpired leases. Such transactions are smaller and less specific by nature. The landlord base—companies subletting space and whose primary business is not real estate—is much more diverse and less institutionalized. The market here is more reminiscent of the apartment rentals or room-sharing ones in the residential arena and is now facilitated by online platforms such as *Flip.com* and *Real Massive*.

Other apps are allowing for space to be sublet for only very short periods of time. For instance, *Spacious* can be used to lease working and meeting space in bars and restaurants before they open for regular meal hours. *Breather*—another shared-economy company—facilitates renting working and meeting space on an hourly or daily basis. *Spaceus*' app helps transform vacant and underutilized retail spaces into temporal collective artist studios and galleries. This startup matches a landlord's occasional excess capacity with artists' demands for space.

In conclusion, IT innovation in the CRE sublet space is certainly helping spur decentralized business-to-business transactions, and bringing space into the market that had hitherto been underutilized. Nevertheless, disintermediation is very unlikely to accelerate

in CRE brokerage sector *at large*, as illustrated by the limited reach of online FSBO operators in the housing market.

3. Innovations in the use of commercial space

As in other economic spheres, the impact of technological change in the real estate industry is diverse and nuanced. And while leasing transactions are important, changes in the economic and physical use of space are likely to have the furthest reach.

In my view, most innovations with regard to the economic utilization of space can be examined along three main dimensions. The first dimension is a quantitative one. Does the new product, innovation or process increase or reduce the need for space? The impact of an innovation may sometimes have an unambiguously negative impact on real estate demand. In many circumstances, however, it may have an expansionary impact on some typologies while having a contractionary one on others. For instance, the growth of e-commerce is increasing the demand for warehousing and logistics in areas close to major centers of population. On the other hand, the need for retail space in malls and strip malls may be decreasing.

The second dimension to describe change in real estate innovation is a qualitative one: is the use of space changing? Are new spaces needed, or old ones used in different ways? New requirements for the use of real estate may demand increased investments. For instance, data centers and server farms need to be equipped with expensive cooling systems. In other cases, technology may facilitate the occupation of underutilized space at low or no additional cost.

The third economic dimension of technological change in real estate has to do with the ability to generate cash flows. Can the innovations be monetized: sold, rented, collateralized or otherwise pledged in a financial transaction? Some innovative practices and technologies in real estate may generate new business models, allowing entrepreneurs to invest, hire, pay creditors and fulfill payroll obligations. Other innovations may come to be expected by space users, but may not directly carry an associated cash flow: these innovations may not generate new jobs and firms, but will have to be defensively provided by space owners or widely available in an open format.

The emerging sharing economy poses interesting challenges in the three dimensions. The IT revolution has opened the possibility of using capital more intensively. While the search for cost reductions and the intensification of capital use have been characteristics of our economic model for a long time, new software and statistical algorithms make it possible to extend their reach directly to the consumer. For instance, new apps and firms, such as *Lyft*, *Uber*, and *Zipcar*, are making it easier to share auto vehicles. The real estate industry is ripe for the sharing revolution, due to its capital intensity and relatively low utilization rate. Properties that had hitherto remained vacant during substantial portions of time can now be used more intensively. I will make reference to this basic phenomenon as the growing commoditization of space–time in CRE. Rather than focusing on square footage alone, real estate entrepreneurs are starting to think about leasing alternative combinations and packages of space-and-time to the final user.

It is a good time to brainstorm about the overall potential impacts of the sharing economy on the office market. The industry segment is still relatively incipient and growing.

Current attention is being devoted to the financial woes of one of the earliest innovators in this arena. But cyclical gyrations should not take our whole attention: long-time trends are at least as important. While we may not have all answers at this point, I believe it is germane to consider the three dimensions discussed earlier: quantity of space demanded, quality of space and economic monetization models. Does coworking increase or reduce the demand for office space in central locations? Do hot-desks and open layouts constitute new real estate products, or Dilbert-like attempts at cramming more people into ever-shrinking invisible cubicles? What are the financial revenue models sustaining the shared economy in CRE?

3.1 Shared real estate economy: third places, coworking, and the commoditization of space–time

While the IT revolution has provided us with new tools to make more intensive use of space—on the supply side—it has also shaped a new economy of flexible jobs and changed user expectations—on the demand side. A more mobile work force—tied only to their portable phones and laptops—may approach the use of space, and its associated costs, differently. In addition, increasing the productivity of creative workers may require different types of social and environmental stimuli. The 2018 Capital One Work Environment Survey[1] makes this need for vibrant workspaces clear, finding that "*significant majorities of office employees reported that more design-forward workplaces help them to be not only more creative and innovative, but also increase their productivity.*"

One of the first manifestations of these new space demand trends is in the growth of workers who perform tasks at home. According to data from the Census Bureau (Kopf, 2018) the share of people working from home was already at 5.2 percent in 2017, up from 3.3 percent in 2000. Bloom *et al.* (2014) have argued that employees working from their homes tend to be more productive *on average*. However, these researchers also identified considerable heterogeneity in this effect, with some people being more productive at an office setting or expressing the need for more social connection, at least with some regularity. The optimal policy for firms that are able to manage a distant workforce seems to involve letting employees flexibly choose their work environment and to facilitate forms of social connection for those who work from home more often.

In a number of growing service occupations—such as programming, design, marketing, customer and personal services and media—the current trends of increasing work from home will continue unabated. In a way, such workers are sharing their living spaces with their firms. This trend unambiguously reduces the demand for office space per worker in these occupations, other things being equal. Nevertheless, the number of workers in these occupations is growing rapidly, especially in a few selected cities where their sectors are important. Therefore, the impact of an increasingly work-at-home labor force on office demand in these popular large markets is masked by sheer employment growth, and will only come to be more appreciated as older service-oriented firms exit and are replaced by others with more flexible workforce arrangements—a gradual process.

A second manifestation of the increasing flexibility of the workspace is in the growth of so-called third spaces. These are places that serve alternatively as transition spaces, buffers or connectors between work and home. Their role had hitherto been exclusively served by America's historically most-beloved third space: the local public library. *Starbucks* was an early innovator in monetizing the concept. Their spaces are inviting and customers do not only get coffee, but check their email, finish up slide presentations or conduct light business talk over their beverages. Mark-ups for coffee can perhaps be thought of the small lease payments that *Starbuck*'s users pay for their short-term occupancy of the space.

New startups are entering the third-place business, intent on commoditizing more aggressively space–time units that had heretofore remained dormant. Under this model, space is rented by the hour or the day. *Regus* was an early innovator, but their business model has been increasingly facilitated by IT and the ability of customers to make meeting-space reservations by-the-hour online. New enterprises have sprouted. For instance, the startup Spacious can be used to lease working and meeting space in bars and restaurants before they open for regular meal hours, and a similar model is adopted by *WorkBar* in Boston. *Breather*—another shared-economy company—facilitates renting, working and meeting space on an hourly- or daily-basis, and so do some of its competitors, *Sharedesk* and *EVenues*.

The trend of space–time commoditization had already flourished at the intersection of residential real estate and hospitality, with the exponential growth of *AirBnB* and

Homeaway. These companies facilitate homeowners to list rooms in their properties for very short-term rentals, as a hotel would. An interesting intersection between the room-rental model and the business services one is provided by *Recharge*, a third-space app that allows business travelers to rent rooms by the hour in order to take a nap, a shower, make calls or prep their meetings.

A third manifestation of the shared economy in CRE is happening inside the confines of the firm. Large employers—especially in the creative economy—are increasingly opening up their office layouts and flexing their work spaces. Even more dramatic is the concept of "hot-desking:" workers do not own a fixed desk, but are assigned a new spot online as they arrive in the office. The flexible workplace incorporates shared productivity tools—meeting rooms, breakout spaces, phone booths—and shared amenities—kitchens, gyms, lounges.

One of the explicit goals of the flexible workplace is fostering collaboration. However, recent research has questioned whether open working spaces do that. Bernstein and Turban (2018) have shown that open layouts may also lead to reduced social interaction: people may feel less comfortable, or more likely to feel judged by others, wherever each interaction can be publicly observed. Some pundits also argue that hot-desking generates a degree of daily stress and makes it hard for workers to store and comfortably use their belongings at work.

On the qualitative side, I think the jury is still out as to the productivity effects of open spaces. As in many other social interventions, it is likely they may be positive in some circumstances and environments, and not so much in others. The job of workspace designers and managers is how to incorporate the positive aspects and discard the negative ones, *as tailored to the specific workflow at hand*. It also seems like a good idea to let workers have a degree of agency about their preferred use of space.

On the quantitative dimension, flexible configurations do have the ability to reduce space usage per worker and hence overall costs of occupancy. A substantial amount of space in conventional office layouts remains empty at any point in time: meeting spaces are not always used; workers take vacations and fall sick; 9-to-5 workspaces remain unoccupied after hours, and employees with an assigned desk spend time off-site talking to clients or performing their services. These redundancies may be getting more salient for firms in which a substantial portion of employees work from home at any point in time.

A fourth manifestation of the shared economy in CRE has to do with new applications that allow firms to share their office or sublet excess space. *Pivotdesk*, for instance, facilitates for firms with excess capacity to share their existing office space with another business. *Flip*, *Real Massive*, and *LiquidSpace* allow a current space user to sublet or assign—pass on—leases on their current space. The increased ease and transparency of the subletting process have the ability to reduce so-called shadow inventory: space that is currently leased but not utilized by the renter. By accelerating the time to market for a larger proportion of currently leased shadow space, these applications may be competing for absorption with regular landlords.

A fifth realization of the shared economy in the workplace has to do with the short-term repositioning of retail space. Indeed, the retail landscape is changing so dramatically that it will take some time to figure out how to recycle some of the existing assets and deploy them into alternative uses. As described above, *apple* is facilitating the leasing of underutilized urban retail space to local artists. Empty storefronts are transformed into beautiful art galleries, and the retail space therein used to create new art. Their application allows for such artistic uses to beautify the space via short-term leases, so that the property owners have a degree of positive cash-flows and extra time to find long-term tenants for a property that will now look vibrant and attractive.

The sixth phenomenon of the shared economy in real estate is perhaps the most salient one: the emergence of coworking office space operators. Coworking takes the open-office, hot-desking idea to the maximum. Here, freelancers and firms do not even sign on to long-term leases but just use space as needed using short-term service contracts. Companies such as

WeWork —currently experiencing financial woes—, *Carr Workplaces*, *the Yard*, and *RocketSpace* assume the main payment on the property's lease and some of the required expenditures on improvements. In turn, they design, manage, and maintain the spaces, providing space–time services to thousands of short-term sublessees.

Saiz and Salazar (2017) showed that there are at least three different economic models through which coworking space–time entrepreneurs can monetize their commodities. In this piece, I will argue that a fourth model is now starting to crystallize.

The first economic model is the simplest one: space that had hitherto remained underutilized—perhaps because of a crooked architectural layout or due to the underutilization of public spaces in a building— is "put-to-work" as shared office facilities. Such spaces are net additions and become directly competitive to conventional existing CRE for lease. However, for the real estate alchemists who summon office square footage out of thin air, the additional space is simply adding to their cash flows.

The second coworking model is geared to providing flexible space–time services to corporations or smaller firms, such as startups. The operator here tends also to be the owner/investor of the property. Such is the model adopted by *WaveOffice*, which provides business with branded private suites with short-term, simplified, all-inclusive leases. These types of flexible leases allow companies to ramp up quickly as needed or deliver room for limited engagements. The office spaces they rent include access to a host of high-level amenities, such as meeting space, kitchens and fitness centers. Conventional coworking operators are also becoming more active in this model. It basically entails the operator taking most of the risk associated with flexibility away from established non-real estate firms, presumably in exchange for a rental premium. This model may increase the complexity of space–time transactions, bringing financial engineering aspects to lease negotiations: hundreds of different contracts may be simultaneously signed on within a "flex" building. We will see an explosion in the typologies of such contracts. The major issue in this model involves how to manage risk from the shorter leases, the pricing of the financial options involved and how to deal efficiently with turnover. Tenant improvements are likely to become rarer, as commoditized space–time will have to be taken "as is" by the final users.

The third economic model for coworking is based on lease arbitrage. The idea is similar to that of securitization in mortgage markets. Rather than with regard to credit cash flows, tranches here are made of real estate space–time. Value is created for the operator by taking on large, durable leases and then atomizing space–time in order to sell it—under very straightforward and standardized membership contracts—to hundreds of smaller, short-term occupants. Wheaton and Karsikov (2019) have analyzed the financial underpinnings of such contracts. In their analysis, they show that—for this model to work— space utilization per worker by contracting firms has to be smaller and with a degree of required synchronicity. If worker requirements were completely asynchronous, firms would just simply need a conventional smaller lease, and let workers use the office at different points in time. Under these circumstances, users will be willing to pay a premium per square foot and hour of space, compared to conventional lessees. Another potential arbitrage opportunity may be realized for very small firms, for which the cost of setting up a conventional lease may be high relative to their space requirements: they are willing to pay more per foot-and-hour in exchange for avoiding such fixed costs.

Now, the issue is that such relative arbitrage conditions may change in time. For instance, space that was leased by the coworking operator in the recession may now command higher rents under conventional leases. Or perhaps, the quality of the neighborhood where a coworking facility is located may change, also affecting the trade-off between short- and long-term business needs. Or yet, the relative premium for space–time subdivision may decrease—or for all we know, increase—during recessions. The short-term nature of the contracts implies that these changes in the direction of space–time arbitrage will immediately

show up into operating cash flows. While these gyrations may represent a fascinating phenomenon to observe by academic economists, they may be followed with some trepidation by coworking operating firms and generate downright panic motions to stock market participants if said firms ever get to trade publicly—as we have recently seen with *WeWork* potential market valuation.

For this reason, I believe, we are seeing coworking space operators devote more time and effort to economic models one and two—repositioning of under-used space that does not conform to typical layouts, and complex corporate flex services—together with a fourth economic approach.

My view of this fourth incipient sharing-economy model in the office arena is as follows: coworking firms may be becoming active in the creation of vibrant spaces that firms and workers want to be in. In this fourth model, coworking firms are really specializing in space design for the contemporaneous user. Their comparative advantage in this area may arise from the large amount of data that they can gather from their large, mobile and experimental base of customers. Coworking operators can experiment with virtually infinite combinations and iterations of: space layout, space user mix, amenities, environmental conditions, location, lighting, views, decoration, "vibe" and so on. They can thus follow a scientific, data-driven approach to tailor physical office requirements to what new market entrants are looking for. In this fourth economic model, coworking operators create value by designing spaces that increase the productivity of users, which in turn justifies higher average rents per square foot and hour. We are also seeing this trend play out in the emergence of boutique coworking firms, such as *Fuse Coworking* in Lincoln, Nebraska and the *Beauty Shoppe* in Pittsburgh, Pennsylvania, which tailor office environments and services to the specific productivity needs of their local base of startup entrepreneurs.

4. At the interaction of Fintech and proptech: new business models in real estate finance

American investors and consumers participate in what is probably the most-liquid and best-diversified financial market in the world. Ease of access to capital and technological advances are two of the most important forces driving the US economy. At the dawn of the 21st century, both forces are coalescing to create a whole new economic sector. Because the United States has the most sophisticated financial market, the adoption of IT and the pace innovation has been very fast. The emergence of increasingly-complex financial products and investment strategies—such as synthetic assets and high-frequency trading—has accelerated, following the contemporaneous growth in computer power and connectivity. A number of firms—sometimes called Fintech companies—have emerged that assign a central role to the use of technology in credit underwriting and financial transactions. Some of the Fintechs do not even have physical offices for customers or counterparties: most of their transactions happen automatically online.

Capital One was an early adopter of Fintech, with their introduction of sophisticated credit-card and auto-financing businesses that are heavily reliant on data analysis and machine learning. *Capital One*'s initial expansion largely eschewed setting up an extensive network of branches, as most of their business was originated over the phone or online[2].

Data analytics have allowed firms that rely on Fintech to build customer profiles, and thereby to better target their products. Statistical technologies have also been effective in helping early innovators reduce their exposure to credit losses, enabling them to offer cheaper financing rates and to increase their market share. In addition, the smaller reliance of Fintech companies on physical offices or branches has permitted them to reduce their labor and rental costs.

It was "natural evolution" for Fintech companies to move in to the real estate credit and equity markets. US housing and CRE markets largely run on credit. Consequently, their

financing volumes are staggering. According to calculations from the Federal Reserve, the total debt mortgage outstanding in the US amounted to 13.8 trillion dollars in 2019—compared to a GDP of 19 trillion[3]. The size of this market makes it into fertile ground for cost-saving and competitive innovations. Technology empowers firms to capture part of the profits afforded by such big volumes. In addition, Fintech has the ability to increase the transparency, speed and—arguably—reliability of real-estate asset-backed credit markets.

Proptech—the bevy of technologies deployed to improve the design, operations and transaction of real property—has been slower to roll up. We are at a critical junction, however. Innovations from Proptech and Fintech companies are now reinforcing each other, and coalescing into a new market for business solutions and data analytics. Below, we critically review the major areas of penetration of Fintech into the real estate sector.

4.1 Fintech home mortgage lenders

In the real estate finance sector, the use of big data, automated valuation and complex underwriting models are increasingly transforming the ways in which lenders and equity vehicles operate. In recent years, the penetration of Fintech companies in the residential mortgage market has been nothing short of spectacular. Fintech lenders equip customers with fully automated online mortgage application and approvals processes.

These lenders are unlike traditional brick-and-mortar players in the banking system. They quickly originate mortgages and sell them back to third parties for securitization. The buyers of these electronically originated mortgages are oftentimes the Government Sponsored Enterprises (GSE)—Freddie Mac and Fannie Mae—which themselves use standardized software and documentation databases. By closely tailoring their online application data and document uploads to the requirements of the GSEs, Fintech lenders can turn around new originations very quickly. Their internal predictive models—including both estimates of the value of the underlying real estate asset and of the solvency of the applicant—may also help them minimize foreclosures, and hence to obtain better spreads from the securitization vehicles. For instance, *Rocket Mortgage* from *Quicken Loans*—a website application started in 2015—standardizes and uploads all necessary information and documents about the borrower's income, home values, wealth and credit history. Approval decisions based on this standardized data can be made in next to real time.

A recent study by Fuster *et al.* (2019) sheds light on the impact that the new Fintech operators are having on America's residential mortgage market. These researchers found that a loan by a Fintech lender is processed in about 10 days faster than those of conventional banks—resulting in a 20 percent shorter procedure. Their results are not driven by differences in the characteristics of the borrowers, but simply by increased efficiency. In addition, the study finds that Fintechs are much nimbler in accepting and processing increasing volumes of applications in periods with high demand, resulting in smaller denial rates. Furthermore, convenience and speed do not seem to come at the expense of loan quality: in fact, mortgages originated by the Fintech lenders display a 25 percent lower probability of default.

This new breed of mortgage originators thus seems to be performing extremely well at basic metrics, which may account for their rapid growth. In addition, Fintech lenders are establishing relationships with the largest home builders. Nowadays, home buyers can nimbly check loan terms on their phones while they are at the building site's sales office, and negotiate with the home seller unburdened by a trip to the bank or the subsequent wait time. All of these factors seem to forecast that Fintech lenders—such *Caliber*, *Guaranteed Rate*, *Quicken*, *Loandepot*, *Sofi*, or *Reali Loans*—will keep on increasing their market share. Alternatively—or complementarily—traditional lenders will have to adapt in order to compete. It is not hard to envision banks and other financial companies progressively moving their origination businesses online.

A way by which traditional mortgage lenders are getting their feet wet into the Internet mortgage origination business is by contracting the services of IT-focused third parties. For instance, *Blend* supplies traditional lenders with standardized, single point-of-entry, cloud-based software. Their system enables customers to quickly fill in online applications and upload documentation. Their software then securely transfers the relevant parameters to the lender's computer systems, allowing for faster approvals.

Naturally, a nontrivial portion of lending in the near future will still be originated at bank branches, but this share is bound to decline as aging customers exit the market and are replaced by yet-more computer- and internet-savvy borrowers. The advisory and consulting roles that mortgage officers in banks currently play may come to be replaced by: experts in calling centers, chatbots, in-call mobile agents or local mortgage brokers who are familiar with the software and application processes of the different online platforms.

An issue of policy and business interest here is the impact of this trend on the employment of low and middle-level workers in the residential mortgage industry. Prospects do not look very positive for them, but new jobs are emerging that complement the automation process. Yet the questions remain: How many new jobs? And will these new jobs require specialized programming and statistical skills at the reach of a few only, thereby further widening income inequality?

4.2 Fintech home mortgage brokers

Another way by which IT is helping borrowers and lenders connect is through online home-mortgage brokerage applications. These applications collect information about loan terms from national and regional lenders. They then apply filters to the characteristics of the loans desired and the financial information provided by potential borrowers, in order to match customers to the best financing offers. These online tools—such as *Bankrate*, *Credible*, or *Lending tree*—are playing the role of a mortgage broker. They standardize customer documents and information and send them to the lenders in exchange for a match-making commission.

LendingHome has come up with an interesting innovation in this area. Their online software platform creates a virtual market-place for bridge loans to house-flippers. Small contractor/investors who want to buy old homes, renovate them and sell them at a profit get connected to institutional lenders. Lenders can also choose to participate in credit syndications based on such originations, obtaining diversified exposure to a risky—but high-yield—market. Recently, the firm has announced its first revolving securitization of home-flippers' mortgages, issuing approximately $208 million of non-rated asset-backed securities. This will enable small investors to participate in their loans, a model that approaches the crowdfunding ones that we will examine later.

4.3 Fintech direct lending in CRE

CRE lending is different from residential credit in, *at least*, four substantive dimensions that explain the much slower pace of direct-to-borrower Fintech lending.

First, CRE products are much more heterogeneous. While suburban housing and urban condos can be parameterized in a manageable number of dimensions, differences across CRE assets are much larger. These differences involve fundamental heterogeneity in economic uses—hotel, industrial, logistics, Central Business District office, suburban office, labs, multifamily. They also encompass geographic, managerial and institutional aspects (e.g. who owns the asset).

Second, the size of commercial debt requirements is typically much larger than in residential transactions. This makes it difficult for lenders to use the statistical laws of large numbers, which allow financial institutions to cross-collateralize risks across thousands of loans. On the contrary—for many institutions—a single large commercial loan may come to represent a substantial amount of total lending in any given quarter.

Third—except for standardized office space in a few global cities—CRE assets are much less liquid than residential ones. While it may take a discount to sell a home in an illiquid market, the residual values of CRE assets—and therefore value-at-risk for the lender—are typically much more uncertain. Consider, for example, the question: what is the residual value of a retail box just vacated by *Macy*'s in suburban Cincinnati (OH)? Of course, it is very difficult to answer.

Fourth, the complexity of underwriting a commercial loan of any size is much higher, because repayment probabilities critically depend on a combination of: the size of the cash flows generated by the property; the volatility of such cash flows; the financial structure of the deal; and the solvency, reputation and financial position of the borrower. Underwriting CRE therefore requires considerable skill and contextual experience.

Any efforts by Fintech companies to increase the automation of the CRE mortgage origination process will have to surmount the abovementioned four barriers to entry. It is thus quite unlikely that we will see 2-h approval/denial processes in the CRE arena any time soon. What we will likely observe is the continuation of a pattern of growing use of data analytics for internal lender purposes. The deepening of the Commercial Mortgage Backed Securities (CMBS) market at the turn of the century already spurred the deployment of sophisticated statistical techniques to quantify CRE mortgage risk. *Trepp*—founded in 1979—has become a leader in the provision of CMBS loan information. Their data includes the underwriting parameters of each loan, updates about net income and assessed property value and data on loan performance from master and special servicers. *Trepp* also provides data research capabilities through its platform *TreppAnalytics*.

Fintech startups are emerging—or developing—based on "big data" approaches to CRE, including—but going beyond—the CMBS market. For instance, *CrediFi* has consolidated itself as a dataset provider, currently tracking 5 million loans, 7 million properties and 10,000 lenders across the United States. Their data includes both balance-sheet and securitized loans backed by CRE properties. Their business model is now expanding—via their platform *CredifX*—into market-making, assisting loan counterparties in their matching process. Their online CRE loan brokerage operation uses data intensively to assist lenders with the initial screening of credit opportunities.

Only a few bold firms are venturing beyond data provision or market-making and into the business of online lending. *Money360* "*is a vertically-integrated, nationwide direct lender sources, underwrites, closes and services small- to mid-balance loans ranging in size from $3 million to $25 million.*" Their focus is on the fast approval of short- to medium-term loans. They use standardized terms and a common IT platform to process all relevant information—financials and documentation. The jury is still out on this model. Nevertheless, the combination of IT, standardization and a team of experienced professionals has allowed them to expand quite rapidly. Evan Gentry—*Money 360's* CEO—has advocated for their business model in debanked.com (a specialized news outlet): "*You put all those things together (speed, efficiency and competitive pricing) and that's what borrowers are looking for.*" (Winokur-Munck, 2017).

Another of *Money360*'s innovations consists in the linkage of their online CRE lending platform to a private equity vehicle, participated by international institutional investors eager to acquire a US exposure. Their funds can ultimately assume some of the credit originated by Money360, and/or extend more permanent credit facilities as the online lender's perm loans come to maturity.

4.4 Fintech CRE lending mediator platforms

A more common emerging Fintech business model is that of the online broker or market-making online app, connecting potential borrowers to lenders. These platforms aim to standardize and speed up the loan application process for borrowers, to empower them with

more choices, and to feed commercial lenders with actionable leads. There is now a proliferation of such companies—for example, *Commloan*, *CREFCOA*, *Magilla Loans*, *Remissary*, *and Stacksource*.

There is no doubt that these applications have the potential to increase transparency in the commercial CRE lending arena, where shopping for mortgages was relatively costly.

An interesting question relates to the role of CRE loan brokers: will they be replaced by online operators? While the pressures on the broker model are evident, the complexity of many CRE finance deals may partially protect them. True, the shopping and market-making abilities of software platforms may replace some brokers. Nonetheless, new technologies may enable others to better deploy their skills, either by working on contract for the new Fintech companies or by empowering them to better cater to customer needs. Be as it may, it is difficult to envision a future where CRE credit brokers are not associated in some way or another to the Fintech platforms.

4.5 Crowdfunding: equity

The increasing regulatory constraints imposed by Basel III have clear disincentive effects on some types of CRE lending by banks and insurance companies. Nevertheless, markets will find alternative ways to channel eager capital into the financing of real estate development and investment projects. One such innovative avenue is crowdfunding.

Crowdfunding is a reincarnation of the old idea of syndication. This time, however, investors access projects in need of funding via the Internet. IT platforms have the potential to facilitate transparency and the verification of cash flows. Cash investors in crowdfunding vehicles can also diversify into hundreds of different investments. On the other side of the transactions, real estate value-add entrepreneurs can access a global pool of investors. One way in which the latter can attract funding is by offering equity in the properties they are buying/developing/redeveloping.

Some of the crowdfunding vehicles—such as *Crowdstreet* and *Real Crowd*—focus on attracting high-net-worth accredited cash investors seeking to invest capital into real estate opportunities around the nation. *Cadre*—another player in this arena—focuses on facilitating large-asset, equity syndication deals. Their investors are high-net-worth individuals, private equity funds and investment bank funds. They carefully curate the composition of the equity investors in the deal, who are more concentrated and have a more active role than the hundreds of smaller investors in a conventional crowdsourced syndication.

Other operators—such as *Fundrise* and *Realty Mogul*—allow non-accredited investors to pledge relatively small contributions toward their online equity syndications.

Saiz and Salazar (2017) argued that "*the proliferation of such web-based investment platforms means that we are in the midst of a battle for reputation and credibility. The most consistent players, accruing a track record of successful investments, will endure and become large capital exchange platforms. But we will also hear some bad stories about failed investments by a few of these websites before their inevitable ex*it." This scenario has effectively come to pass, as we have seen both exit and consolidation of startups in this arena. We would not be surprised to see future crowdfunding efforts arising from established institutional players in the finance industry themselves, who can pledge their reputation to new platforms.

It is difficult to know how much the crowdsourcing universe will eventually come to represent as a share of the CRE investable market. Institutional funds and affluent investors—representing the lion's share of invested dollars—may prefer vehicles with exposure to larger properties, in order to minimize transaction and management costs as a percentage of capital. They may also favor vehicles that afford them more control and direct reports. Smaller investors have access to the REIT market as a liquid alternative and to the traditional stock funds managed by reputable institutions. Therefore, crowdsourced

platforms seem better adapted to mid-level investors who need exposure to B-class assets or to properties in less-well-known markets. Due to the smaller asset sizes, the percentual management and transaction costs of direct ownership in these niches may already be rather high, so that crowdfunding may stand as a competitive alternative. We are already seeing the emergence of niche equity crowdsourcing platforms. For instance, *AcreTrader* specializes in investments in farmland, providing a diversification outlet for investors that may not otherwise have had the opportunity to get their feet wet in this market.

Nonetheless, the impact of Fintech on equity syndications will likely be much larger than that implied by the market share of the crowdsourcing platforms. Some of the data-analytics technology now deployed by the online crowdfunding syndications—affording investors the possibility to follow the financial evolution, metrics and even visuals of the properties in real time—will very likely make it into more conventional CRE investment funds managed by private-equity shops and investment banks. New generations of investors will not be satisfied with receiving a quarterly or annual PDF prospectus from the sponsors, but will insist in obtaining due-diligence data, ongoing performance metrics, photos, and updated lease documents online.

4.6 Redeemable equity crowdfunded e-REITs

Saiz and Salazar (2017) also contended that "*a future potential path for this industry is securitization. Some investors may be willing to take on larger notes ($1-10 million) backed by dozens or hundreds of participations in crowdfunded projects. Since such investors would be playing the laws of large numbers, they may allow for a bit more risk-taking on each particular project, probably in exchange for lower transaction costs. The trend toward the minimization of management fees, as applies for most other investment vehicles, will inexorably take off once the main industry players are consolidated.*"

This trend has also effectively materialized, with the emergence of e-REITs sponsored by the most solid crowdsourcing platforms: *Fundrise* and *Realty Mogul*. These funds—managed by the sponsoring companies—are registered as private REITs. The structure allows non-accredited investors to enjoy tax advantages and the—limited—ability to redeem their shares. In the United States, this model is limited to vehicles with a total equity investment of $50 million.

It remains uncertain if such constraining regulations will ease in the future. It also remains to be seen if private funds will adopt alternative—but parallel—Fintech innovations in new vehicles catering to accredited investors. For instance, the startup *Abstract Tokenization* is vying to deploy blockchain technology in order to make cash flows to and from the investment properties transparent to fund investors in real time. Distributed ledgers can potentially also be used to record transactions in fund shares among investors.

4.7 Debt crowdfunding

Fintech debt crowdfunding oftentimes takes the form of peer-to-peer (P2P) applications—such as *Prosper.com*—which allow individual investors to fund personal loans. Each borrower may receive credit from dozens of investors who, in turn, can diversify their portfolio by participating in large numbers of high-yield personal credit originations. *Prosper* is expected to enter the home equity line of credit (HELOC) market in 2019.

Crowdfunding strategies have also arrived—albeit in a limited fashion—to the CRE mortgage market: companies such as *PeerStreet*, *Instalend*, and *Crowdstreet*'s are now active in this area.

In my view, the combination of current economic and financial factors does not augur well for the expansion of this model. The likely transaction costs of credit crowdfunding seem high in an era of very low interest rates. In this environment, a few basis-point cost differential

may render a lender uncompetitive. In addition, as discussed earlier, CRE lending requires more intensive underwriting skills, which may make it less attractive for small investors.

Furthermore, the well-developed and institutionalized CMBS market already allows investors to obtain exposure to CRE credit. Finally, experiences from the CMBS market in the last two decades have shown us that asymmetric information and moral hazard are bound to become problems whenever credit risk is quickly shifted on to third parties. In this context, it may only make sense to be an online CRE micro-lender if sufficiently high yields justify the credit risk, which in turn means that only very risky borrowers—without recourse to cheaper alternatives—will want to use these applications—an adverse selection problem.

In fact, some of the most intriguing applications of credit crowdfunding have to do with high-yield investments that are not always competitively covered by lending institutions. *Groundfloor* and *Fund That flip* both offer P2P platforms allowing investors to extend hard, short-term, bridge loans to entrepreneurs flipping homes. Similarly, *Patch of Land* focuses on financing development or redevelopment projects by the way of short-term loans.

4.8 Other Fintech products in real estate

The defining characteristic of the Fintech revolution is its ability to unleash the creativity of startup entrepreneurs. Their ceaseless efforts are bringing new products and concepts to the market at an astounding speed. As in any creative-destruction process, only a fraction of these concepts will—and should—pass the mass-market test. Some intriguing examples follow.

The company *1,031 Xchange*, for instance, facilitates the exchange of properties under section 1031 of the tax code—used to eschew capital gains taxation. The platform makes it easy for investors to find comparable assets that suit better each investor's profile.

Roofstock provides online tools to small investors for evaluating, buying and selling single-family rental homes. They source single-family leased properties from other investors, who may have a hard time selling their properties through regular Multiple Listing Services. The platform provides the acquiring investor with a 12-months rental income guarantee.

Knock functions as a combination of a real estate agent and a short-term lender. Homeowners who want to move typically experience uncertainty with regard to the timing of the transactions. Many cannot move out until their current sale is finalized, at which time the property they were interested in may be gone from the market. *Knock* provides short-term liquidity by buying upfront the new homes on behalf of its customers. The firm also handles the sale of their customers' old homes. Once the latter are sold, customers can finalize their new purchases from *Knock* directly. The company profits by collecting agent commissions on both transactions.

Patch Homes, *Point* and *Unison* provide a very interesting alternative to a conventional HELOC. Rather than issuing a plain-vanilla second mortgage, these platforms become co-investors in their customers' homes. The loan's principal and interest can be returned to the companies at any point—no periodic payments are necessary. Alternatively, these firms obtain their money back—together with a share of the home's appreciation—when the property is sold or at the termination of the contract. The Fintech's profits depend on the difference between the assessment value at origination and the market price at liquidation, so they are effectively sharing in the risk of depreciation. This model represents a hybrid between conventional home credit and equity investments.

5. Conclusions

The IT revolution harbored the potential of generating a more horizontal economic structure. A decentralized ecosystem of IT innovations emerged, encompassing: email, texting, cell-

phone apps, the World Wide Web, blogs, peer-to-peer apps, social media, bit-torrent technology and blockchain. Many had hoped that these innovations would impulse a more competitive, less institutionalized economy.

On the contrary, giant players emerged that control a substantial portion of the transactions in this new economy. Amazon, Alphabet-Google, Apple, Facebook and Microsoft have become all-encompassing, powerful players.

Analogously, the introduction of IT motivated some observers to announce the proverbial writing in the wall for the traditional brokerage system in residential and CRE. In Section 1 of this piece I have argued that such predictions are unlikely to come to pass anytime soon.

In the segments of the real estate industry where the position of intermediaries was strong, IT has probably increased the productivity and reach of conventional brokerage firms. The emergence of regional MLS for home sales was catalyzed and coordinated by the NAR. In CRE, existing large real estate brokerage and integrated-services companies may be able to realize the opportunities to cross-pollinate their marketing and sales platforms with other IT-intensive offerings. CRE users display more specialized and heterogeneous needs, which have so far cemented the position of brokers as market-makers. Moreover, the data-driven platforms that make exchanges possible tend to display network economies, where bigger is better.

Of course, there will be winners and losers emerging from the upheaval. Firms that are not proactive in facilitating access to transactional innovations will perish. Brokers on the ground, lessors and lessees will come to expect property data, floorplans, contracts and records of past interactions to be available 24/7 at the touch of a phone screen. Companies that effectively integrate CRE software to solve many needs at once—deploying simple one-point-of-entry solutions—will capture greater market shares.

In the few areas where markets were atomized to start with—or with regard to transactions that had been hitherto not possible—IT and Proptech firms have more of an opportunity to facilitate disintermediation away from traditional players. We have seen this process unfold in the cases of apartment rentals, roommate matching, commercial sublets and workspace sharing.

While the news are positive for CRE intermediary companies, I am less sure that they can be unambiguously seen with optimism by workers in the sector. Robotization and globalization, both enabled by IT, have already had a negative impact on the demand for labor in manufacturing. The new wave of IT penetration in services—of which Proptech is an example—is likely to have a positive an impact on the productivity of CRE firms, but might also reduce their hiring needs. Uncertainty is rife with regard to this issue.

In Section 2, I have discussed some new directions in the economics of space utilization. The real estate industry is high in capital requirements and some of its assets have the potential to be used more intensively. Therefore, the shared economy—encompassing software, new contracts and financial transaction platforms that facilitate more intense use of existing assets—is making headways in the sector. Focusing on changes in the workplace and on office spaces, we have identified at least six avenues for the advance of the shared economy into CRE: (1) growing use of home space for work; (2) emergence of third spaces; (3) corporate open layouts and hot-desking; (4) sublet applications and websites that facilitate and speed up the reabsorption of shadow inventory; (5) repositioning of retail space for work; (6) coworking spaces.

These innovations are allowing for the commoditization of space–time. While they all are certainly bound to play a role in the real estate industry, an honest appraisal of their quantitative reach must admit to considerable uncertainly. We simply do not know if these innovations will eventually take on a 3, 5, 10, or 20 percent share of the office market. However, they all move us in the same direction of reducing the required average space-per-office worker. In the short- to medium-term therefore, increased efficiencies in space

utilization seem to forecast a significant decrease in the rate of absorption of new office space *relative to employment growth*.

Nevertheless, this process of increased capital usage intensity has physical limits: at some point no further efficiencies can be obtained from the very same square foot of space. Thereafter—in the longer term—other forces will take over. For instance, workers seem to be becoming choosier about the quality of their office environment. If this trend keeps increasing, skilled workers may eventually require larger office suites with more amenities than currently provided—thereby increasing space imprint per worker again.

Regardless, it seems certain that we will keep on seeing a flight to quality from tenants. Conventional landlords will come to be expected to provide similar amenities to those perceived as available in open layout or coworking spaces. Competition from shared-economy space—including working at home—or shadow inventory means that landlords will need to provide attractive spaces worth commuting to. Emerging coworking and flex space operators are well positioned to deliver innovations in office space design and layout, as they can experiment with the mix of users and services. They can also collect data and deploy it in order to make more targeted space decisions and to reduce tenant improvement expenditures. Indeed, I think that one of the economic models of coworking operators will be based on providing superior employee productivity to tenants by the way of research and development in workspace design.

A more conventional monetization model is based on space–time arbitrage: atomized units of such a commodity may command a premium, compared to conventional five-year leases on larger whole spaces. This model may fluctuate in popularity depending on relative prices of space–time in alternative uses and locations.

A third financial model for coworking spaces is based on providing flexibility services to corporations. Lease contracts between space operators and corporate users under this model will become more complex and unique, in a process akin to financial engineering. Such contracts may imbed space "call" and "put" options, contingent rents and tenant improvements and space swaps. Space operators will charge a premium in exchange for such flex services.

Finally, we will keep on seeing entrepreneurial efforts devoted to turn empty or underutilized buildings into coworking space whenever alternative repositioning options are no better.

In Section 4, I have provided a view of innovation in the CRE finance arena. Fintech is revolutionizing Wall Street and the Banking industry. At the intersection of Proptech and Fintech, a number of platforms and technologies are also changing the way in which homeowners and investors finance their real estate holdings. Because the amount property wealth represents such a large share of the US total, this trend is well worth understanding well.

I would like to conclude by red flagging four issues that I think will be relevant to the success of each individual Fintech platform or business model. While answers are unclear, the questions they raise are of consequence to the evolution of this sector.

(1) Relationship-based lending and investment strategies are still very important in the CRE arena. They may be less relevant to homeowners, who transact very rarely. However, face-to-face interactions with known counterparties are perceived as important by many players in the industry. To what degree will borrowers and entrepreneurs feel comfortable with sharing critical information and business plans with a person sitting on a distant call center? Moreover, the person responding to the call may be different each time: is this an efficient process, or does critical information dissipate across the separate calls? Does relationship-based lending add intangible value that accumulates over the relationship's life span?

(2) In order to acquire scale and justify investments on fixed costs, the Fintechs typically need to expand quickly. Will rapid expansion be possible in all specific business models? Alternatively, new companies may start at a market niche that is currently underserved and—if the opportunity arises—move gradually into larger markets. Is gradualism better than aggressive growth in a sector that relies so much on trust and fiduciary duty? When and where does each strategy have an advantage?

(3) Even in cases where the underlying Fintech business ideas are good, correct tactical implementation and day-to-day execution are bound to be very important. Is it harder to execute with attention to detail in periods of extraordinary growth? How do the challenges of attracting, quickly training and retaining a skilled labor force come into play?

(4) Some of the online platforms' strategies are predicated on opening high-risk investment niches to yield-hungry investors. In these cases: how will the balance of risks and rewards play out in a down-market? How resilient is each of the platforms to downward pressure on real estate prices, low liquidity and increased delinquency/foreclosures?

Satisfactory answers to these questions—and many, many others—should be important to investors and entrepreneurs working at the intersection of the Proptech and Fintech emerging sectors.

Notes

1. https://www.capitalone.com/about/newsroom/wps-survey/. Last accessed as of 10/20/2019.
2. For full disclosure, please note that Capital One has funded this research.
3. https://www.federalreserve.gov/data/mortoutstand/current.htm.

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