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Gathering round Big Tech: how the market for acquisitions reinforces regional inequalities in the US

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Abstract

Are the agglomeration economies of technology hubs augmented by a localized market for start-ups – acquisitions, and IPOs? How does this affect the ability of places outside of those hubs to foster digital startups as a tool of local economic development?

We study this with a particular focus on acquisitions by the seven largest American digital platforms – Amazon, Alphabet [Google], Apple, Microsoft, Facebook, Oracle and Adobe, which we call, collectively, Big Tech. We cover the years 2001-2020.

We show that firms acquired by Big Tech are, disproportionately to the sectors in which they operate, concentrated in major tech clusters, and particularly in the Silicon Valley (San Francisco/San Jose). Foreign acquisitions by Big Tech also show a marked concentration in a few countries, and particular places in those countries. NASDAQ IPOs of firms in relevant sectors are similarly concentrated.

Acquisition, or the less common alternative, IPO, is the second major phase of financing for a digital start up. The first phase is commonly associated with venture capital (VC), and location proximate to venture capital companies has often been seen as a motivation for locating in a tech cluster. We find, however, that neither VC funding, nor funding an investor located in the Silicon Valley, predicts either acquisition by Big Tech, or IPO. Funding by any of the VCs that helped launch the Big Tech firms, however, is strongly associated with Big Tech acquisition. This suggests an important role for social networks in both the first and second phases of financing, but not necessarily a geographical role in the first phase.

We argue that the acquisition market – and its effects on both the major tech hubs and the left behind rest – depends crucially on the proprietary control of access to various digital network products. Regulation of these markets, particularly in the form of common carrier status and open standards, could achieve a considerable re-balancing.

Keywords: tech giants, market power, start-ups, acquisitions, regional inequality

JEL Classification: L1, O3, R12

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1. Introduction

Digital start-ups are often seen as a promising vehicle for local economic development, yet as they become established many are pulled away to relocate in major tech clusters. This locational choice is often treated as being explained by agglomeration economies which boost the productivity of tech workers (Duranton and Puga 2004; Nathan 2015; Adler et al. 2019; Gazel and Schwienbacher 2020); others have pointed, additionally, to proximity to venture capital financing (Kenney 2011; Florida and Mellander 2016). It contributes to the growing gulf between prosperous tech clusters and "left behind" places – a gulf seen in incomes, housing prices, age profiles, education levels and voting behavior – which has become central to our understanding of social and political polarization (Rodriguez-Pose 2018; Iammarino, Rodríguez-Pose, and Storper 2019; Rodríguez-Pose and Storper 2020).

We argue that one important factor in many digital start-ups' choice to locate in major tech hubs – and the Silicon Valley in particular – is that proximity to the largest digital firms makes it more likely that the start-up will be acquired by one of the latter. We study acquisitions by the seven largest American digital platforms – Amazon, Alphabet [Google], Apple, Microsoft, Facebook, Oracle and Adobe (we refer to these collectively as Big Tech). As others have shown (see e.g. Rikap and Lundvall 2020), acquisition of smaller companies is, for Big Tech, a major source of new technologies, ideas and talent. The ability of Big Tech to exploit the monopoly power conferred by positions in control of critical digital platforms has given these companies extraordinary financial resources; continuing acquisition of start-ups and, with them, new features and capabilities, both makes use of these financial resources, and extends and cements Big Tech's control of its markets.

The other side of the acquisition market – *being* acquired – is a critical part of the business model of digital start-ups. This is due to the scale economies – low marginal costs and network properties – of many digital products. Success – even survival – in markets for these products requires rapid scaling in order to secure a decisive, often winner-take-all, first mover advantage. Growth therefore requires substantial infusions of equity investment, which typically comes in two distinct stages. In the first, an investor such as a venture capitalist or business angel will take a large, often controlling, interest in the firm. In the second, part or all of the first-round stakes will be sold, either through a stock market flotation (initial public offering, or IPO), or through acquisition by another firm. Either of these routes can represent financial success for a start-up, but acquisition is far more common. Since many start-ups fail to reach the second round of financing, making it happen is an important business objective.

In an earlier paper, we argued that the divide between wealthy and poor places is deepened by monopoly power, and in particular by the power of the large digital platform companies (Feldman, Guy, and Iammarino 2020). Among the reasons we gave for this is that the power of these companies amplifies the centripetal pull of agglomeration economies. It does so for two reasons. One is that the productivity of labor is augmented by monopoly rents, some portion of which is shared in the form of high remuneration for a stratum of skilled workers. The other is that, for smaller digital firms, part of the attraction of major tech hubs is the market for acquisitions: proximity makes it more likely that a particular start-up will be chosen as the latest augmentation of a major digital platform, with the result that some sliver of the platform's rents will be shared among the owners and key employees of the startup. In this paper, we develop the second of these claims, about the market for acquisitions.

Why does it matter if the productivity-enhancing characteristics of a tech cluster – the familiar Marshallian properties – are being amplified by monopoly power? Simply, because the welfare implications of the two sources of agglomeration are different. If an agglomeration grows large and wealthy purely for Marshallian productivity reasons, then any efforts to redistribute benefits from that agglomeration to places left behind, must face the question of whether a spatially-targeted economic development policy may kill the goose that is laying golden eggs. But if the agglomeration has grown still larger and wealthier due to the monopoly power of firms based there, then familiar remedies such as anti-trust enforcement and regulation may mitigate *both* the problems typically associated with monopoly, *and* regional disparities in income and opportunity.

In this paper, we develop evidence for the market for the acquisition of start-ups. Section 2 places our main arguments in the literature. Section 3 provides data sources and descriptive evidence on the acquisitions. Section 4 describes our reference groups of companies in the same sectors. Section 5 presents regression analysis that supports the finding from the US descriptive statistics. Section 6 discusses implications and concludes with future directions for research.

2. Start-ups and the geography of Big Tech acquisitions

Theories of cluster dynamics have often addressed the relationships between large and small firms (e.g. Feldman, Francis, and Bercovitz 2005; Feldman and Lowe 2015). It has been common to see large firms as anchors to a cluster, with smaller firms present to serve them, typically as suppliers, and with large firms connecting the cluster to distant markets and sources of knowledge. Such have variously been labelled hub-and-spoke cluster, solar cluster, or industrial complex serving the needs of larger client firms (Markusen 1996; Piore and Sabel 1984; Gordon and McCann 2000). Small firms may also be clustered close to a large one because the small ones were founded by former employees (Klepper 2011; 2015).

We are interested here in a different spatial dynamic between large and small firms: not a stable set of small suppliers to the large firms, nor small firms founded on exit from large ones, but a marketplace for acquisition of the small firms by the large firms.

Start-ups may be drawn to tech clusters by productivity-enhancing agglomeration economies; by better access to financing for growth (we include being acquired as financing); or a combination of the two. Against these are factors encouraging digital start-ups to locate elsewhere. As Dahl and Sorenson (2012) show, entrepreneurs, even more than workers, prefer to grow their business in a place they already know – in other words, they would rather stay home (see also Florida and Hathaway 2018; Sorenson 2018). The product of the digital start-up seems well suited to this: it is weightless, something that in technical terms can be shipped anywhere in the world as easily as across the street; the infrastructure requirements for operating such a firm are easily satisfied in a developed country – a reliable broadband connection and electric power; state and local governments offer incentives to stay; and, while most places do not have the large pool of talent available in a major tech hub, skills of programming and software engineering are taught universally. Notably, programming skills are taught and researched at a high level in places such as Urbana-Champaign, Illinois, and Ann Arbor, Michigan, and dozens of other rustbelt or southern universities with fine engineering schools. Some of these places figure prominently in the world ranking of start-up hubs (Florida and Hathaway, 2018); yet, as we see below, these places are negligible as home bases for start-ups *at the time of acquisition* by platform giants.

Digital start-ups[1] are likewise producing highly scalable products – sometimes tools or features to augment existing platforms, sometimes platforms on their own (e.g. Ruggieri et al. 2018). The commercial logic of proprietary digital products is that they *must* be scaled, because a successful first mover will dominate a market segment (Schilling 2002). This winner-take-all market structure means that scaling must occur quickly, depriving digital firms of the option of organic growth from retained earnings: external financing is needed. Moreover, starting up in a winner-take-all market is very risky, so the external financing must be equity financing, from investors with pockets deep enough to sustain some years of losses at best and to lose all at worst. The same technological features which make unregulated proprietary platforms into monopolies thus drive small digital companies to prioritize relations with equity investors. In what we can call the venture capital stage, this investment typically comes in the form of private equity, often from a firm specializing in venture capital; sometimes, it will come from an individual "angel" investor (Kenney 2011; see also Table 4, below). Such equity investors habitually acquire controlling stakes in the company, and usually intend to sell the company at a later stage. Sale may either entail the start-up being floated on the stock market in an initial public offering, or its acquisition by another firm. The IPO route comes with the prospect of wealth and fame for the founders as principals in an independent company; it is, however, by far the less common of the two routes. An acquisition by Big Tech is among the most lucrative outcomes (Dwoskin 2020).

Guzman (2019) considers two competing explanations of US start-ups' location – agglomeration economies and social embeddedness and concludes that agglomeration economies are far more important than social networks. He finds selection of high quality start-ups, particularly from lower agglomeration regions, into Silicon Valley, and shows that moving results – among other financial and market benefits – in a higher likelihood of being either acquired and offered an IPO or, in other words, of achieving "extreme" growth (see also Andrews et al. 2020). Guzman is silent on any role the market power of the acquiring firms might have in raising the likelihood of takeover, simply treating the greater likelihood of

[1] We should note here that in general – that is, not only in digital or tech - the term "start-up" is employed in a way which assumes scalability. One would not call a new car repair garage a start-up, except ironically or as a pun in the name; one would not call a new café a start-up, unless it was designed and organized with an eye on franchising. Although digital products are among the most scalable, we can say in general that a start-up is a new small firm seen as having potential market power, either as its own company or as a new tool in the kit of an existing company.

financing for extreme growth as one of the benefits of agglomeration. We see the same in Kerr and Robert-Nicoud's (2020) otherwise exhaustive review of the character of tech clusters, and of the frantic attempts of places to brand themselves as "Silicon Something": consideration of market power is absent.

There is now considerable public scrutiny[2] of acquisitions by tech giants. There is also a growing body of research. This literature does not ignore market power, but it does ignore geography, location in space. "Space" needs the qualifier because the literature is full of references to "space", "cluster" or "zone", but these refer to "spaces" of products or technologies.

The secular growth of market power in the US since 1980 is now widely recognized (De Loecker and Eeckhout 2017; Eggertsson, Robbins, and Wold 2018; Hsieh and Rossi-Hansberg 2019), and has been particularly great in digital sectors (Calligaris, Criscuolo, and Marcolin 2018). It is an era which dawned with the de-regulation of old network industries, and singularly failed to come to terms with the opportunities for market power presented by proprietary digital platforms. The market power of giant technology firms has become, belatedly, a matter of concern for, among others, the US Congress (anti-trust hearings), the government of Australia (clamping down on Google and Facebook's free-riding on newspapers), the DG Competition of the European Commission (new proposal for the Digital Market Act) and legislators in states like North Dakota (taking aim at Google and Apple's monopsonies on apps using their respective phone platforms). Meanwhile, a handful of Silicon Valley and Seattle companies operating digital platforms have far and away the highest market valuations of any corporations on Earth.

Platforms connect users as a network. Networks benefit from increasing returns, which creates economies of scale and results in lock-in as a source of their advantage (Kenney and Zysman 2016; Rikap 2020). Our Big Tech companies control particularly large platforms, and often control more than one network (Ducci 2020; Stallkamp and Schotter 2021). For example, Alphabet and Apple both control phone operating systems, which are platforms for apps – most phone apps in the world go through the online "stores" of these two companies; Adobe, Microsoft and Oracle all sell general purpose software which produces user files in proprietary

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[2] Some examples (last accessed on 11/01/2021): https://www.nytimes.com/2020/06/13/technology/facebook-amazon-apple-google-microsoft-tech-pandemic-opportunity.html; https://www.washingtonpost.com/technology/2020/07/29/apple-google-facebook-amazon-congress-hearing/; https://www.ft.com/content/04a62a26-42aa-4ad9-839e-05d762466fbe

formats, making users dependent on the platform in order to ensure full inter-operability; Alphabet and Facebook dominate online advertising in much of the world; Amazon's "marketplace" connects hundreds of thousands of vendors with hundreds of millions of customers; Facebook and Microsoft operate social media platforms; and so on.

Digital platform business models serve networks, but they are unlike the relatively static networks of the 19th and 20th centuries. Owners of an electric power grid, once it is in place, have little to fear from competitors; for a digital platform, maintaining market position, and monetizing that position, demand ongoing innovation, refinement of features, addition of services (Hindman 2018). The major platforms have considerable internal research capabilities but, compared with the industrial giants of the previous century – General Electric, IBM, and such – they source more innovation through acquisition (Lazonick 2009; Rikap and Lundvall 2020). And, because of the financial resources which their market power confers, the major platforms are always in a position to acquire.

Gautier and Lamesch (2020) review five tech giants' (Google, Amazon, Facebook, Amazon and Microsoft, or GAFAM) acquisitions during 2015-17. They find that acquisitions mostly fall in the firms' core markets segments or product spaces. Similarly, Argentesi, Buccirossi, Calvano, Duso, Marrazzo and Nava (2019), in a study of acquisitions by Amazon, Facebook and Google (AFG) in the decade 2008-2018, conclude that acquired products and services are largely complementary to those already supplied by the three companies. This is supported by Lopez Giron and Vialle (2017) in their study of Microsoft's acquisitions in the period 1992-2016, focussing on acquired resources and competences: the largest share of acquisitions complements (rather than diversifies) Microsoft's core businesses. Gautier and Lamesch (2020) find that most of the acquired products are discontinued post-acquisition, implying that the acquisitions are largely motivated to gain intangible assets such as intellectual property rights and talent.

This pattern of acquisitions has implications for innovation. Bryan and Hovenkamp (2020) find that start-ups which aim to be acquired are biased toward inventions that improve the leader's technology, rather than offering an alternative to it.

Tech giants may acquire companies to suppress competition. This is well documented in other information-based sectors, such as pharma and microprocessors (Feldman et al. 2020). Cunningham, Ma and Ederer (2021), for instance estimate (conservatively, they say) that between 5.3% and 7.4% of US acquisitions between 1989 and 2010 were "acquire to kill", and thus harmful for both innovation and competition.

Moreover, even without any deliberate suppression of a competing product, a tech giant's acquisition or development of a product tends to create a "kill zone", in which competing projects struggle to get both users and capital (Kamepalli, Rajan, and Zingales 2020). Rival start-ups offering substitutes for an acquired product find themselves starved of both capital and customers; notice that this describes a winner-take-all market, in which the winner is the first to be acquired by a tech giant. Wen and Zhu (2019) find that when Google appears likely to develop a new app or capability for Android internally, its smaller competitors reduce innovation and raise prices.

Argentesi et al. (2019), Bryan and Hovenkamp (2020), and Kamepalli, Rajan and Zingales (2020), Motta and Peitz (2020), Katz (2020) and Cabral (2020) all draw conclusions about implications for competition and innovation policies. Abstracting from the considerable differences in methods and disciplines there are common themes. One is the deleterious effect platform acquisitions can have on innovation. Another is the fact that the vast majority of acquisitions by platform-based tech giants evades investigation, often because the turnover of the acquired digital start-ups falls below the threshold required to trigger government intervention. The consensus is that legal restraints on merger activity are not doing the job, and that tightening these restrictions could improve both innovation and competition. Kamepalli, Rajan and Zingales (2020) stress, however, that more effective measures would be ones which directly attack the exclusivity of platforms: open standards; controls on data ownership; and – for countries outside the US – restrictions on global, US-based platforms to make room for national alternatives (policies in China and India are offered as examples here).

Acquisition is usually a financially desirable outcome for the shareholders of a small firm; for firms in the winner-take-all digital platform economy, it may be the only route to survival. The home bases of the platform giants are geographically concentrated: the seven Big Tech we study are located in just two metropolitan areas, San Francisco-San Jose (the Silicon Valley), and Seattle. If physical proximity to the acquirer makes a successful acquisition more likely, this provides a motivation for start-ups to move to a major tech hub, and to the Silicon Valley in particular. This centripetal pull of the tech clusters for precisely those start-ups which have the greatest growth potential, can impose a low glass ceiling on local economic development initiatives based on developing digital technologies: the product may be weightless, but the market for the company is elsewhere.

3. Data and descriptive analysis

Our empirical investigation relies on all acquisitions made in the US by the seven largest digital platforms in terms of market capitalization[3]: Alphabet (Google), Adobe, Apple, Facebook, and Oracle headquartered in Silicon Valley, Amazon and Microsoft located in Seattle, from their inception to the current time.[4] In choosing these firms we are excluding a number of neighboring categories: non-US platforms (China has at least two that would qualify on the basis of market valuation, Alibaba and Tencent Holdings); payment platforms (had we included American payment platforms with market valuations in the neighborhood of the companies that we did include, it would have changed the geographical picture little, with two in the Silicon Valley (Visa and PayPal), and one in New York (Mastercard)); hardware (the standards of Intel or Nvidia can be regarded as platforms); telecommunications (mobile phone networks); and entertainment (Netflix, for instance, is a digital platform).

Each of our seven firms began as an entrepreneurial start-up. Most received venture capital financing (Oracle leveraged federal procurement contracts), grew rapidly, and went public. The phenomenal growth of these firms, together with that of hundreds of smaller digital platform companies, contributed to the belief that "tech", specifically, digital technology, offers an attractive building block for local economic development.

Table 1 provides an accounting of acquisitions, by acquiring company, from their earliest acquisition through 2020. We include all full (100%) acquisitions made by Big Tech and their subsidiaries. Data are drawn from three databases, Zephyr-Bureau van Dijk, Capital IQ-S&P and SDC Platinum-Refinitiv, and then cross-checked and verified through manual searches. Acquisitions which cannot be verified through either mention on the company website or news articles are not included in our sample on the assumption that these are likely "acqui-hires" with no substantial start-up company involved. The Appendix details the laborious procedure used to construct this list, and shows statistics for the various data sources.

[3] As of 30 April 2020.
[4] Oracle has, however, announced that it will move its headquarters to Austin, Texas.

In total, the seven Big Tech acquired 940 firms worldwide, with 674 acquisitions based in the US. Notably, all of the tech giant firms started acquiring of other firms in the years following their own IPO. Alphabet completed the largest number of acquisitions to date (237), closely followed by Microsoft (235). Acquisitions occur consistently over time, with the annual average number of acquisitions ranging from 12 a year for Alphabet, to two for Adobe.

[Table 1 about here]

For all of the Big Tech, the majority of acquisitions were sourced from the United States; 266 (28%) were acquisitions of firms based outside the US (Table 2). The largest number of acquisitions are from the UK (50), Canada (42) and Israel (32). Acquisitions within countries are also geographically concentrated. This pattern broadly reflects the distribution of major high tech clusters, and their linguistic and political affinities with the United States, identified in Arora and Gambardella (2005). However, out of all of Asia and the developing world the only country with more than two of the takeover targets was India (6) while China, Japan and Korea – all major locations for digital technology – are under-represented.

[Table 2 about here]

Caution is required in comparing countries. "Acquiring a company" does not mean the same thing everywhere; in some countries it comes with much greater obligations to employees and other stakeholders, than it does in others (Hall and Soskice 2001). The tax implications may also differ. The Big Tech acquisitions are largely about acquiring skilled employees and intangible assets, rather than operations and physical assets. Hiring the employees, or purchasing the intangible assets, can be alternatives to acquiring the firm as a whole, and differences in national institutions may weigh in the choice.

This caution does not, however, hinder within-country comparisons. In most countries for which the numbers are large enough to generalize, we see an overwhelming concentration in the country's financial capital – London, Tel Aviv, Paris, Stockholm, Dublin; however, in Canada and Germany – both federal, polycentric states – the pattern is more geographically dispersed.

We limit our further analysis to the acquisition targets with known locations in the United States for the two decades 2001-2020.[5] Table 3 gives a breakdown of the Big Tech acquisitions by metropolitan statistical areas (MSAs) and the percentage that received venture capital investment. Investor (vendor, to Zephyr) data are from Zephyr and includes the majority owners

[5] There were 80 (1.1%) US acquisitions for which the location of origin could not be reliably identified.

at the time of acquisition, which are similar to the ownership information that would be provided in an IPO prospectus: reliable data are only available after 2001. While VC is the largest source of financing, businesses' founders, angel investors and other entities such as banks, and wealth and investment management firms were mentioned. There was only one public-private equity investment from the New York City Investment Fund LLC, now known as Partnership Fund for NYC. Individual investors include founders and angel investors. Two universities were listed: Stanford (in the Silicon Valley) and the University of Washington (in Seattle).

Of the 603 US acquisitions about half of them received venture capital investment. For non-US acquisitions only one quarter received venture capital investment. Note the extreme concentration in the Silicon Valley, which we define as the combined San Jose-Sunnyvale-Santa Clara and San Francisco-Oakland-Berkeley MSAs. The largest number of firms (291 or almost half of the US Big Tech acquisitions) were located in Silicon Valley at the time of acquisition, with 54% of the companies receiving VC investment. Four other MSAs form a distinct second tier for acquisitions: New York, the financial capital of the US; Boston and Los Angeles, both of which are important centers of both technology and private equity finance; and Seattle, the home of Microsoft and Amazon. In all, there were 18 cities with two to five acquisitions. There were 25 MSA's with one acquisition each and one third of these companies received VC investment. Overall, 49% of the acquired companies received VC investment: the percentage is slightly higher, among the main hubs, in Silicon Valley, New York and Boston.

[Table 3 about here]

We compare the spatial distribution of Big Tech acquisition targets to the distribution of four different sets of firms seeking finance in relevant industries.

Three-quarters of the seven Big Tech acquisitions are attribute to three SIC codes: 7371 – computer programming services, 7372 – prepacked software, and 7374 – computer processing and data preparation and processing services. The remainder of the acquisitions were dispersed across many sectors. Our four comparison groups are limited to these three SICs, using the sources and definitions described in Table 4.

[Table 4 about here]

The broadest of the four comparison samples consists of 6,213 firms in the three SIC codes that received Small Business Administration (SBA) 7(a) loan guarantees. This is a government guaranteed loan that is made to firms who are seeking investment funding and have demonstrated their credit worthiness. A narrower sample consists of the 3,005 firms listed in the Zephyr database as having been fully acquired, but with a purchaser *other* than one of our seven Big Tech (All Other Acquisitions). The narrowest sample consists of the 196 firms which had Nasdaq IPOs, Nasdaq being the leading exchange for tech company stocks (IPOs). Finally, we also compare with a subset of the All Other Acquisitions sample: 1,030 firms sold by VC firms which also sold firms to Big Tech. Just as the map of international Big Tech acquisitions is not the global map of digital technology, neither is the US acquisitions map the same as the map of the sectors involved.

[Table 4 about here]

Table 5 examines the geographic distribution of the comparison data sets. Silicon Valley has the highest count of firms for all the categories except SBA loans, which has a larger geographic reach. Firms that receive SBA loans have the human capital and organizational capabilities required to establish start-ups in these industries and are widely geographically distributed. Indeed, the counts of firms applying for SBA loans encompass a much larger set of cities and suggests that public financing may be an alternative substitute when VC funding is not available. New York City, the largest metropolitan area is more heavily represented by SBA loans.

[Table 5 about here]

The maps in Figure 1 show the distribution of the first three comparison groups, and their number relative to Big Tech acquisition targets. The size of circles indicates the number of firms in the comparison group, while the shading indicates the number of Big Tech acquisitions relative to that. Circles in the darkest shade of red indicate that there were a larger number of Big Tech acquisitions in that place than companies in the comparison group. Empty (white) circles indicate an MSA with cases from the relevant comparison group but no Big Tech targets.

[Figure 1 about here]

The top panel shows the distribution of firms from the selected tech industries that received SBA 7(a) loans. Most large cities had a substantial number of SBA loan recipients but small places also have firms that received these loans. This does not mean that the latter are evenly geographically distributed: cities known to be tech hubs had a larger share, as we would expect. In most MSAs, the number of Big Tech acquisitions is less than 25% of the number of firms receiving SBA loans. The number exceeds this level only in a few small cities that are secondary tech hubs (the most substantial being Boulder, Colorado), and the Silicon Valley, where the number of Big Tech acquisitions exceeds the number of SBA loans.

The comparison group for the second map is all other acquisitions of firms in relevant industries. An acquisition is a relatively rare event, so there are overall fewer circles than in the SBA case. Compared with SBA loans, acquisitions are more concentrated on the West Coast and in the Northeast; still, they remain far more widely distributed than Big Tech acquisitions. Of large cities, the ones with the higher ratios of Big Tech acquisitions to other acquisitions are all on the West Coast: Seattle, Silicon Valley, Los Angeles, San Diego.

The third map compares Nasdaq IPOs. In most locations that have IPOs, there are only a few, and the number of Big Tech acquisitions is at a comparable, or even higher level.

Finally, we compare the growth in geographical concentration of Big Tech Acquisition to that observed in the four comparison samples, using the share of targets located in Silicon Valley and the Herfindahl-Hirschman index by MSA (Figure 2). The extent and increase in concentration of tech giants' targets is striking. In the first period, other businesses sold by investors that sold to Big Tech were actually more concentrated on both measures. However, this changed by 2011-2020, where almost 30% of Big Tech US-based targets were located in the Silicon Valley, compared to less than 10% of all acquisition targets in the relevant industries.

[Figure 2 about here]

4. Differential Outcomes: Probit Analysis

We estimate probit models to provide additional descriptive analysis. Table 6 presents definitions for the variables we use in our regression along with summary statistics.

[Table 6 about here]

How are the odds of being acquired by a Big Tech affected by the location of the acquired firm? If being acquired is an objective for a start-up and if location affects the likelihood of being acquired, this would be a factor in drawing such firms to certain locations, above and beyond any productivity advantages. Moreover, the digital tech sector is not homogeneous; an acquisition is the outcome of a matching process. Some start-ups have products, intangible assets or personnel that offer better potential matches than others for our tech giant firms, and for that reason would be more likely to locate in a place which makes acquisition by one of the Big Tech firms more likely.

The likelihood of being acquired by Big Tech may also be affected by the source of external financing in the first stage, however. Proximity to venture capital, in particular, is often claimed as an advantage to locating in the Silicon Valley (Saxenian 1994; Kenney and Florida 2000; but see Lerner 2009). A variant of this claim stresses the role of certain specialist investors – most but not all of them VCs, and many but not all of them located in the Silicon Valley – which have strong ties to the tech giant companies dating back to the first-round financing of the latter: initial backing from a member of this small group may bring a start-up into the right networks, and improve its chance of being acquired by one of the Big Tech. These early investors in Big Tech are listed in the Appendix (Table A.3); they include such well-known firms as Venrock, Sequoia Capital, and Greylock Partners.

Finally, it is possible, from what we have seen in our description of the data, that Big Tech targets are disproportionately – that is, compared with other acquisitions in the relevant industries – not just from the Silicon Valley, but from major digital tech clusters (e.g. Boston, Seattle, New York, Los Angeles) overall. To check this, and also to control for this agglomeration effect in our estimate of the Silicon Valley effect, we include a variable for the number of SBA loans in the three focal industries and in the MSA in which the target is located.

Any of these same factors – Silicon Valley location, VC funding, the location of the VC, and a backer in the group of initial Big Tech funders, size of digital tech agglomeration – could also affect the likelihood that second stage financing will take the form of IPO rather than acquisition. In the IPO case we do not have strong priors on what these effects would be, but are interested in what the comparison will tell us.

We estimate two sets of probit models. In the first set (Table 7), the data consists of all Big Tech US acquisition targets in the years 2001 to 2020, together with all other acquisition targets in our three focal industries. In the second set (Table 8), the data consists of firms in the focal industries that went to IPO, versus all acquisition targets other than the Big Tech targets. All models include Target in Silicon Valley (binary), SBA Loans (continuous), and a dummy for the year. Other variables, depending on the model, are Investor Venture Capital, Investor in Silicon Valley, and Investor Early Investor in Big Tech (all binary).

We see in Table 7 that a Silicon Valley location for the target has a positive and statistically significant effect; with all covariates included, the marginal effect of a Silicon Valley location is 0.17, which is to say a 17 percentage point increase in the probability of being acquired by a Big Tech. The investor being a venture capitalist actually makes it more likely that the firm will be acquired by a non-Big Tech firm; in contrast to the target's location, the investor's location in the Silicon Valley has no discernable effect on whether the acquirer is a Big Tech. On the other hand, the investor being an early backer of one of the Big Tech companies has a positive and statistically significant effect on the likelihood of a Big Tech matchup; with a marginal effect of 0.16, it is essentially the same as the effect of a Silicon Valley location for the target.

SBA loan numbers have a positive and statistically significant effect, indicating that in MSAs with fewer digital tech SMEs the ratio of Big Tech acquisitions to acquisitions by other firms is lower.

[Table 7 about here]

Table 8 considers the same factors for the IPO outcome. Again, we see a strong positive effect from Silicon Valley location – at 0.19, about the same as for Big Tech acquisitions. If an IPO is the big prize for founders of a start-up – the attraction of growing while staying independent – this suggests one more attraction of the Silicon Valley. Having a venture capitalist for an investor has (again) a negative effect; having an investor located in the Silicon Valley is now significantly negative; having an investor who was one of the early Big Tech backers has a statistically insignificant effect after controlling for other variables. As with Big Tech acquisitions, more SBA loans – which is to say, greater size of the digital tech agglomeration in the MSA where the target is located – raises the likelihood that second round financing will come in the form of an IPO rather than acquisition.

[Table 8 about here]

5. Conclusion

The conditions which link digital platform monopoly and the pull of start-ups to the major tech hubs, may be summarized as follows. Digital products are scalable; some can be scaled as platforms, which connect users as a network, creating lock in. For the platform giants this has been the basis for monopoly power. The monopoly power of the Big Tech (as for other giants, in other IPR-, network-based industries) is never secure. They are Schumpeterian (Schumpeter 1942), innovating to maintain and extend their market power. However, unlike the manufacturing giants of the twentieth century, much of the platform giants' innovation is essentially outsourced to start-ups, which the Big Tech may then choose to acquire. The latter compete in a sort of tournament in which being acquired is the prize. The tech giants have vast financial resources, putting them in a position to make an offer for any smaller firm they might find useful.

Many who start new firms might prefer independence, rather than being acquired. Digital start-ups are, however, producing something which is scalable, with very low marginal costs. This puts them in a winner-take-all market, where the first mover into a particular platform function or a new technical standard can have an overwhelming advantage. Start-ups thus require infusions of equity, which we can think of as coming in two phases. It is common, in the first stage, for this to come from investors who expect to sell the company on if its product proves successful. The second stage is either and IPO or acquisition by a larger company. We regard either of these second stage outcomes as infusions of capital for the start-up, though in the acquisition case the start-up may lose its identity altogether. From the standpoint of shareholders in the start-up, completion of the second phase represents success.

For the start-up, there is no certainty in this path to being acquired: even if the start-up's product ("product" here might be a new platform, but it can also simply be some IPR, or a team's demonstrated ability to solve a particular kind of problem) is a good one, another start-up may have something similar, or the large firm may develop something internally. Start-ups will therefore be motivated to position themselves ways that improve the likelihood of being acquired.

Is moving to Silicon Valley one of those ways? Although our seven Big Tech do acquire firms throughout the US and in many other countries, some places see far more than their share of acquisitions. Certain foreign countries (Canada, UK, Israel), certain foreign cities (London, Paris, Bangalore, Tel Aviv), certain cities in the US (New York, Boston, Seattle, Los Angeles) and, far above even those, the Silicon Valley itself. Within the US, we are able to compare this with the distribution of all acquisitions, and with the distribution of SBA loans, in the relevant industries. By both measures, Big Tech acquisitions lean far more heavily to the major tech clusters and, again, far far more to the Silicon Valley. Big Tech may be able to source its weightless acquisitions globally, but it tends to make most of its purchases in a few very familiar shopping malls.

To what extent are these acquisitions driven by the market power of Big Tech? Market power gives Big Tech the means, in the form of piles of cash. It also gives Big Tech the motive: just as Schumpeter described, the monopoly is maintained, extended and renewed through innovation – albeit, now, innovation is to a large extent initiated outside the monopoly firms themselves.

Actions on both sides of acquisition transaction – the need for the start-up to scale up, and the means and motive of Big Tech – grow out of the proprietary control of access points to digital networks.

The problem of network monopoly has been faced before. In the late 19th and early 20th centuries, for instance, then-new network industries such as electric power, telephones and railways developed huge power, and were subsequently brought either under public ownership, or public regulation, almost everywhere in the world. The various modes of regulation are beyond the scope of this paper – suffice it to say that in technical terms this is not an unknown problem. In political terms it is perhaps a bigger problem than that faced with the old network industries, because the geography of digital platforms is different. An electric power network or a railway has assets and employees distributed around the limited territory it serves; those who are harmed by the monopoly are in roughly the same place as the monopoly's assets and employees, which makes the regulation of the monopoly a distributional matter within a well-defined polity. Twentieth century American regulation of public utilities and banks actually enforced this by keeping the companies within state lines.

The geography of a digital platform firm is much different, and that different geography makes for a different politics of regulation. The platform firm typically has assets and employment concentrated in a few locations. For those locations, it is an important export industry – that is precisely why state and local governments seek to foster tech clusters. Big platform firms exercise market power nationally in the United States, and internationally. Within the US, the economic interests of the major tech clusters are in conflict with those of the places left behind; internationally, the maintenance of Big Tech's monopolies has become a central pillar of US trade policy (Guy 2007; Rodrik 2018).

Should this situation change – following, perhaps, the sorts of measures outlined by Kamepalli et al. (2020) – the consequent decline in the acquisition market should make it more feasible to foster the growth of digital start-ups in what are now left-behind places. It would also remove one factor which drives the seemingly endless growth in size and housing costs in the major technology clusters.

What we have observed here, in the case of seven large digital platform companies, raises a bigger question about the geography of market power and of acquisitions. What goes for digital platforms may, or may not, go for other types of information-based product with extreme increasing returns and wide geographical reach, such as pharma, biotech, and digital media. Moreover, with digital platforms and with others, how much of the acquisition market is held by giant firms, as opposed to merely large? In the first instance, both questions could be addressed through a mapping of takeover relationships – locations, distances – in relevant industries.

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Tables & Figures

Table 1: Background on Big Tech Acquisitions

Big Tech	Year founded	Year of IPO	Year of first acquisition	Number of world-wide acquisitions	Average number of acquisitions per year (Standard Deviation)	Number of US-based acquisitions (% of all acquisitions)
Microsoft	1975	1986	1987	235	8 (5)	69%
Apple	1976	1980	1988	109	5 (4)	61%
Oracle	1977	1986	1997	135	6 (4)	84%
Adobe	1982	1986	1990	49	2 (1)	73%
Amazon	1994	1997	1998	94	5 (3)	70%
Alphabet	1998	2004	2001	237	12 (9)	74%
Facebook	2004	2012	2007	81	6 (3)	68%
Total				940		674 (72%)

Source: Compilation by authors of Big Tech acquisitions from: Bureau van Dijk’s Zephyr, S&P’s Capital IQ and Refinitiv’s SDC Platinum. Additional verification of acquisitions was carried out through manual search. Included are all 100% acquisitions.

Table 2: Big Tech acquisition targets beyond the US: Regions within countries with concentrations of acquisitions, 1987-2020

United Kingdom	**50**		**Germany**	**9**	
London		34	**Netherlands**	**8**	
South East		9	Utrecht		3
North West		3	Zuid-Holland		2
Canada	**42**		Helsinki-Uusimaa, Finland		7
Vancouver		12	Dublin, Ireland		7
Toronto		12	**India**	**6**	
Waterloo		6	Karnataka		5
Montreal		5	**Switzerland**	**6**	
Ottawa		4	Zurich		4
Israel	**32**		Hovedstaden, Denmark		5
Tel Aviv		20	**Spain**	**5**	
Central		8	**Australia**	**4**	
France	**15**		**Italy**	**3**	
Ile-De-France		11	**Brazil**	**2**	
RhôNe-Alpes		3	**Portugal**	**2**	
Sweden	**11**				
East Sweden - Stockholm		7			
South Sweden		3			

Note: Regions with 2 targets each: East of England, United Kingdom; North & Jerusalem, Israel; Berlin, Germany; Zuid-Holland, Netherlands; Madrid, Spain; New South Wales, Australia; Lombardia, Italy; Minsk, Belarus; Tokyo, Japan; Auckland, New Zealand; Bucharest, Romania; Dubai, United Arab Emirates

Regions with 1 target each: Andalusia, Spain; Baden-Wuerttemberg, Germany; Basel-City, Switzerland; Bayern, Germany; Brandenburg, Germany; Bretagne, France; Catalonia, Spain; Central Bohemian Region, Czech Republic; Edmonton, Canada; Flevoland, Netherlands; Guangdong, China; Hessen, Germany; Kuala Lumpur, Malaysia; Lisbon, Portugal; Lucerne, Switzerland; Luxembourg; Minas Gerais, Brazil; Noord-Brabant, Netherlands; Noord-Holland, Netherlands; Norte, Portugal; North Rhine-Westphalia, Germany; Ostlandet/Viken/Baerum, Norway; Pomorskie/Gdansk, Poland; Quebec City, Canada; Queensland, Australia; Reggio Emilia, Italy; Regina, Canada; Santa Catarina, Brazil; Schleswig-Holstein, Germany; Scotland, United Kingdom; Seoul, South Korea; Singapore; South West, United Kingdom; Telangana, India; Thuringia, Germany; Valencia, Spain; Vastra Gotaland, Sweden; Victoria, Australia.

Table 3: Top US MSAs for Big Tech acquisitions, 2001 - 2020

	Number of Acquisitions (share of total)	Companies with VC investment
Total	846 (100%)	42%
Non-US	243 (28.7%)	25%
Total US	**603**	**49%**
Silicon Valley, CA	291 (34.4%)	54%
New York-Newark-Jersey City, NY-NJ-PA	60 (7.1%)	55%
Boston-Cambridge-Newton, MA-NH	39 (4.6%)	51%
Los Angeles-Long Beach-Anaheim, CA	37 (4.4%)	41%
Seattle-Tacoma-Bellevue, WA	30 (3.5%)	37%
Chicago-Naperville-Elgin, IL-IN-WI	11 (1.3%)	27%
Austin-Round Rock-Georgetown, TX	10 (1.2%)	60%
San Diego-Chula Vista-Carlsbad, CA	10 (1.2%)	20%
Washington-Arlington-Alexandria, DC-VA-MD-WV	9 (1.1%)	44%
Boulder, CO	8 (0.9%)	50%
Pittsburgh, PA	7 (0.8%)	43%
Atlanta-Sandy Springs-Alpharetta, GA	6 (0.7%)	50%
Baltimore-Columbia-Towson, MD	5 (0.6%)	80%
Dallas-Fort Worth-Arlington, TX	5 (0.6%)	40%

Note: MSAs with 1 target each: Albuquerque, NM, Charleston-North Charleston, SC, Charlotte-Concord-Gastonia, NC-SC, Cheyenne, WY, Cleveland-Elyria, OH, Durham-Chapel Hill, NC, Eugene-Springfield, OR, Fargo, ND-MN, Grand Rapids-Kentwood, MI, Indianapolis-Carmel-Anderson, IN, Kingston, NY, Memphis, TN-MS-AR, Ogden-Clearfield, UT, Orlando-Kissimmee-Sanford, FL, Oshkosh-Neenah, WI, Palm Bay-Melbourne-Titusville, FL, Phoenix-Mesa-Chandler, AZ, Providence-Warwick, RI-MA, Raleigh-Cary, NC, Reno, NV, Rochester, NY, Santa Rosa-Petaluma, CA, St. Louis, MO-IL, Tampa-St. Petersburg-Clearwater, FL.

Table 4: Comparison groups, 2001-2020

Comparison group	Definition	Source	Number of Firms
US Big Tech Acquisitions	Acquisitions of the 7 Big Tech Firms	Multiple sources (see Appendix)	603
Small Business Administration 7(a) loans	Start-up firms that received a loan, in one of the three relevant SIC codes: 7371 – computer programming services, 7372 – prepacked software, and 7374 – computer processing, data preparation & processing services	Small Business Administration	6,213
All Other US Acquisition	Acquisitions in the US, excluding those of Big Tech, in one of the three relevant SIC codes: 7371 – computer programming services, 7372 – prepacked software, and 7374 – computer processing, data preparation & processing services	Zephyr	3,005
Businesses invested in by the same VCs who sold firms to Big Tech	Subsample of the above	Zephyr	1,031
Nasdaq IPOs	Initial public offerings (IPOs) of US-based companies in one of the three relevant SIC codes: 7371 – computer programming services, 7372 – prepacked software, and 7374 – computer processing, data preparation & processing services	Zephyr	196

Table 5: Geographical distribution of comparison datasets, 2001-2020

All acquisitions in relevant industries		Businesses sold by Big Tech VC investors		Nasdaq IPOs		SBA 7(a) loans	
Silicon Valley	320	Silicon Valley	115	Silicon Valley	23	New York	404
New York	264	New York	89	Boston	22	Los Angeles	268
Boston	157	Boston	49	New York	9	Washington	255
Los Angeles	115	Los Angeles	41	Los Angeles	9	Silicon Valley	237
Washington	106	Seattle	32	Washington	8	Chicago	199
Seattle	89	Washington	32	Chicago	7	Dallas-Fort Worth	183
Atlanta, GA	83	Austin	25	Atlanta	6	Boston	166
Chicago	70	Chicago	16	Austin	5	Minneapolis	162
Austin, TX	67	Philadelphia	15	Dallas-Fort Worth	5	Atlanta GA	141
Dallas, TX	63	Dallas	12	Seattle	4	Miami, FL	127
…	…	…	…	…	…	…	…
Total	3005	Total	1031	Total	196	Total	6213

Table 6: Summary statistics, variables used in the regression analysis, 2001-2020

		Big Tech acquisition targets	**Nasdaq IPOs**	**All other acquisitions in relevant industries**
Target in SV	Dummy Variable = 1, if acquired firm is located in Silicon Valley	0.46	0.26	0.19
		(0.50)	(0.44)	(0.39)
Investor VC	Dummy Variable = 1, if acquired firm received VC investment	0.50	0.083	0.52
		(0.50)	(0.28)	(0.50)
Investor in SV	Dummy Variable = 1, if investing entity is located in Silicon Valley	0.42	0.039	0.33
		(0.49)	(0.19)	(0.47)
Investor invested in Big Tech	Dummy Variable = 1 if the investor was an original investor in Big Tech	0.14	0.0098	0.039
		(0.35)	(0.099)	(0.19)
SBA loans in MSA last 3 years	Measure of Agglomeration: Count of firms that received SBA loans in the last 3 years	14.5	21.2	11.4
		(24.9)	(26.7)	(21.5)
N		331	205	4421

Note: Mean value, Standard deviations in parentheses.

Table 7: Probit regression results: effect on probability of acquisition by Big Tech

	Coef/SE	Mfx	Coef/SE	Mfx	Coef/SE	Mfx	Coef/SE	Mfx
Target in SV	0.94***	0.18	0.87***	0.16	0.79***	0.14	0.92***	0.17
	(0.079)		(0.085)		(0.071)		(0.089)	
Investor VC	-0.27***	-0.037					-0.34***	-0.046
	(0.069)						(0.068)	
Investor in SV			-0.073	-0.0098			-0.041	-0.0054
			(0.077)				(0.077)	
Investor invested in Big Tech					0.64***	0.12	0.78***	0.16
					(0.11)		(0.12)	
SBA loans in MSA last 3 years	0.0078***	0.0011	0.0069***	0.00093	0.0068***	0.00091	0.0081***	0.0011
	(0.0013)		(0.0012)		(0.0012)		(0.0013)	
N	4167		4167		4167		4167	
Pseudo R2	0.092		0.085		0.098		0.11	
Chi2	202		205		244		250	
p(Chi2)	4.2e-31		1.5e-31		2.1e-39		1.9e-39	
Baseline predicted probability	0.079		0.079		0.079		0.079	

Note: The dependent variable is a dummy of acquisition by Big Tech vs by another firm. Mfx is the marginal effect. Robust standard errors are provided in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

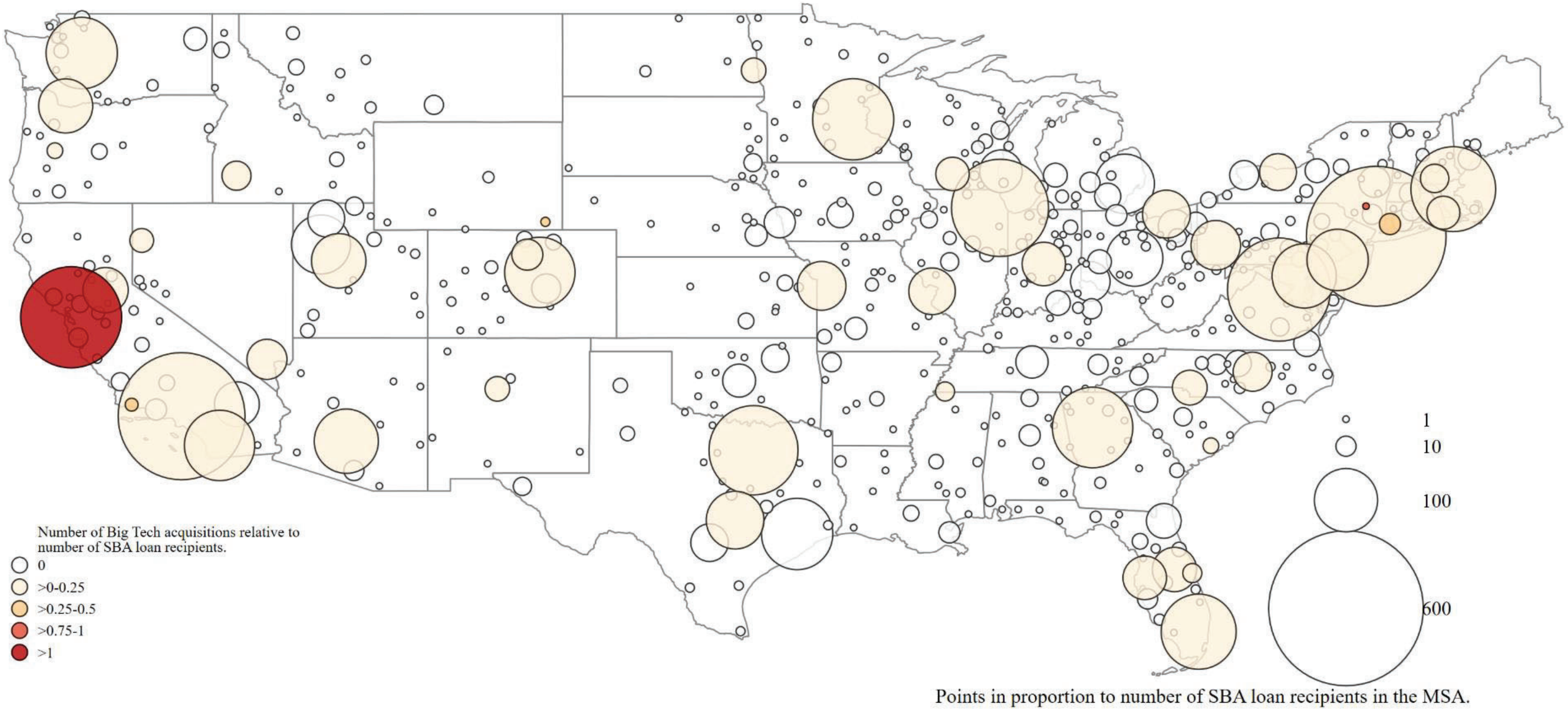
Table 8: Probit regression results for Nasdaq IPO

	Coef/SE	Mfx	Coef/SE	Mfx	Coef/SE	Mfx	Coef/SE	Mfx
Target in SV	0.95***	0.12	1.01***	0.15	0.47***	0.058	1.31***	0.19
	(0.11)		(0.11)		(0.089)		(0.14)	
Investor VC	-1.41***	-0.11					-1.22***	-0.083
	(0.13)						(0.13)	
Investor in SV			-1.42***	-0.083			-1.12***	-0.060
			(0.17)				(0.19)	
Investor invested in Big Tech					-0.66**	-0.040	0.10	0.0092
					(0.29)		(0.35)	
SBA loans in MSA last 3 years	0.014***	0.0012	0.0088***	0.00080	0.0087***	0.00085	0.013***	0.0011
	(0.0014)		(0.0013)		(0.0013)		(0.0015)	
N	4041		4041		4041		4041	
Pseudo R2	0.20		0.15		0.063		0.24	
Chi2	211		166		93		199	
p(Chi2)	9.7e-33		3.8e-24		1.0e-10		2.0e-29	
Baseline predicted probability	0.051		0.051		0.051		0.051	

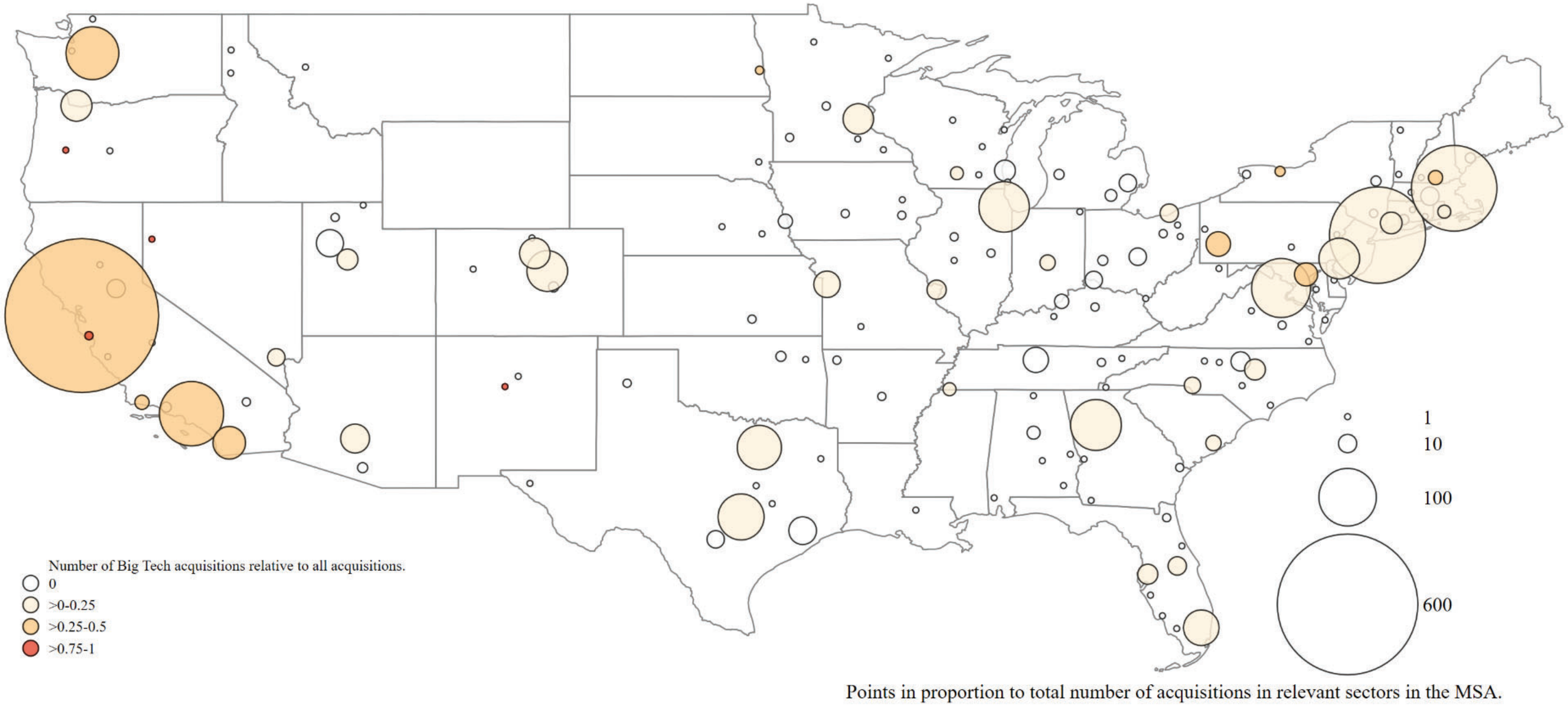
Note: The dependent variable is a dummy of Nasdaq IPO vs acquisition by another firm. Mfx is the marginal effect. Robust standard errors are provided in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Figure 1: Spatial distribution of Big Tech acquisition targets in relation to comparison samples, whole period 2001-2020

A: SBA loans



B: All acquisitions



C: Nasdaq IPOs

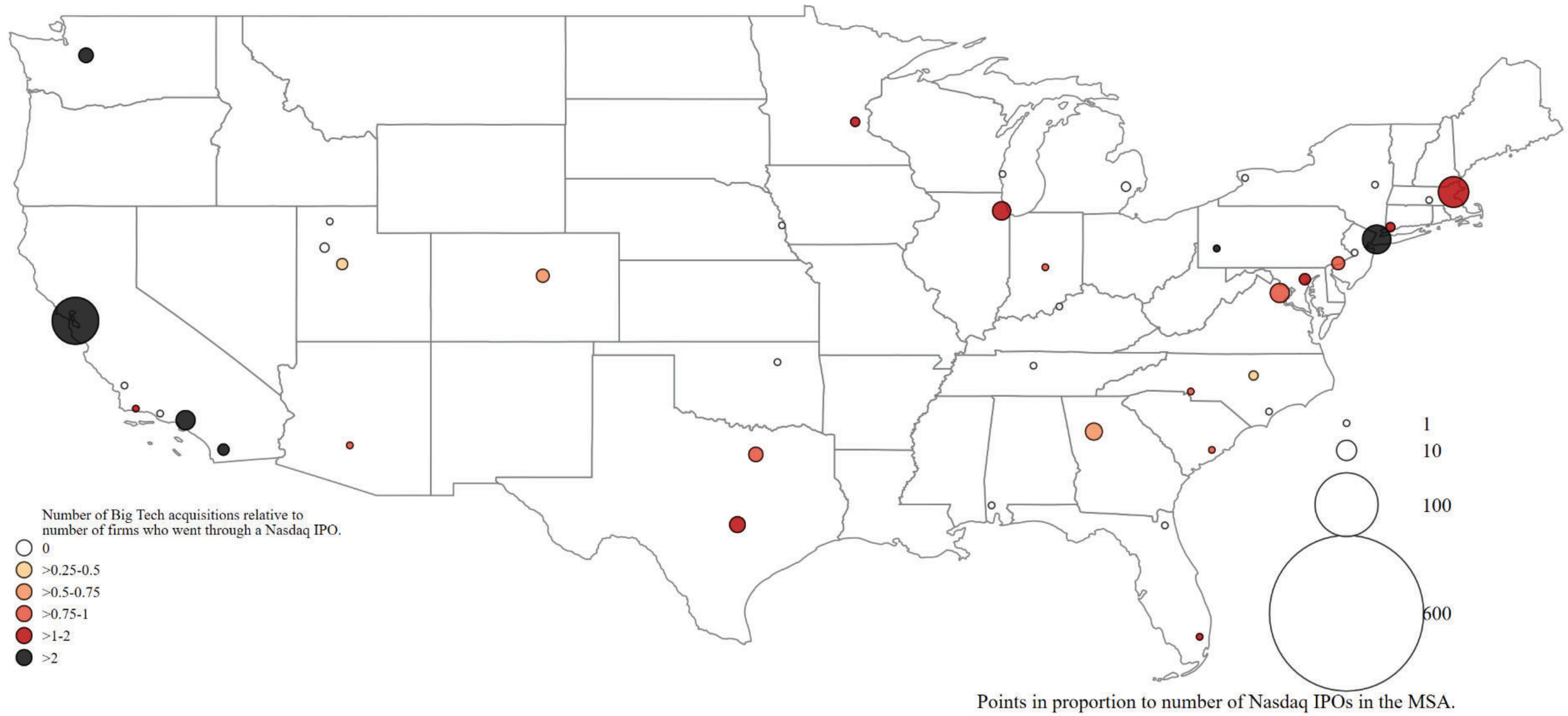
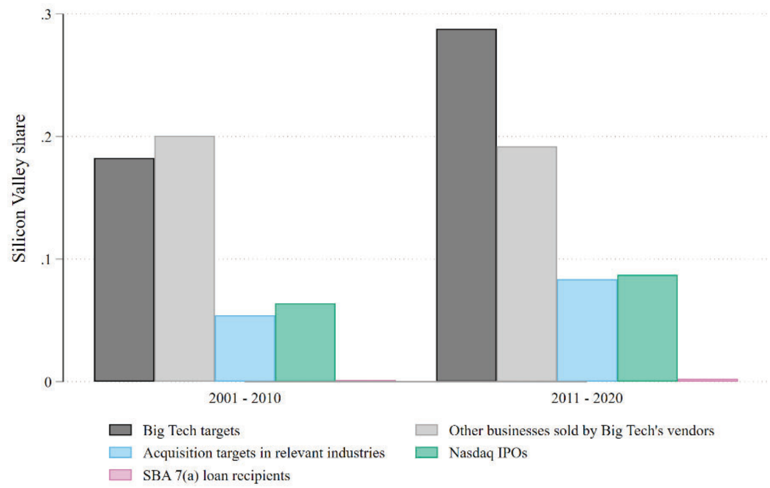
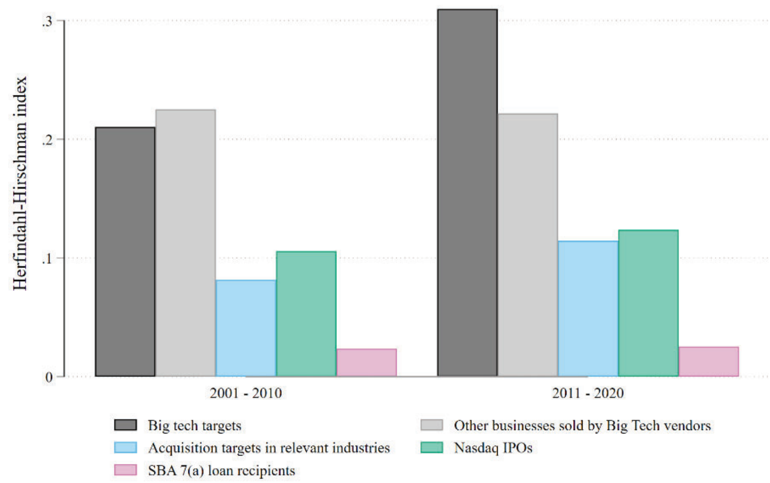


Figure 2: Geographical concentration of Big Tech acquisition targets and comparison groups

Share in Silicon Valley



Hirschman-Herfindahl index



Appendix

The dataset used in this paper draws on several sources. Quantitative analysis relies on data from Zephyr, Capital IQ and SDC Platinum databases. All of these provide data on mergers and acquisitions and were searched for acquisitions by the seven Big Tech. Additionally, we built a bespoke dataset to gain more information about the acquisitions. We limit the dataset to 100% acquisitions only, and include acquisitions by subsidiaries of Big Tech. We combine different data sources to confirm information and fill in data gaps. While some tech giants, such as Microsoft and Oracle tend to announce acquisitions through press releases and maintain lists of acquisitions on their websites, others such as Facebook, Alphabet and Apple keep a veil of secrecy around their M&A activity, leaving also commercial databases with limited information to draw on, unless transactions require formal public disclosure.

As information on the commercial databases is sometimes missing or imprecise, we only include businesses in the final database that can also be found by manual search from news sources or the companies' own websites. Some businesses are taken over through "acqui-hires", whereby the Big Tech hires the targets founders of its staff and may also buy its intellectual property. Instead of being formally acquired, the business ceases to exist. While such deals are sometimes listed as acquisitions on the commercial databases, these were excluded from the analysis. After confirming the full list of acquisitions, duplicates from the different datasets were cleaned. This was particularly challenging since many businesses trade under a different name, often the name of their app or product, rather than the registered business name. Finally, the databases were cross-checked to add any missing transactions.

Table A.1 summarizes the reconciliation of the different datasets. Reassuringly, a large number of acquisitions can be found on all four datasets. In total, we record 940 distinct transactions both in the US and elsewhere in the world.

Table A.1: Match results

Zephyr & CapIQ & SDC & manual search	376
CapIQ & SDC & manual search	176
Zephyr & CapIQ & manual search	130
CapIQ & manual search	111
SDC & manual search	66
Manual search only	30
Zephyr & SDC & manual search	27
Zephyr & manual search	24
Total number of businesses	940

As a quality check, Table A.2 shows the share of matching attributes for businesses that can be found on multiple databases. Reassuringly, the values are high throughout. Note that SDC Platinum does not record cities, so only the match between Zephyr and Capital IQ is considered. Some of the gaps here can be explained by differences in spelling. The same goes for the subnational level, as different databases use different levels of geographical breakdown outside the US. Some of the differences occur also because of missing data.

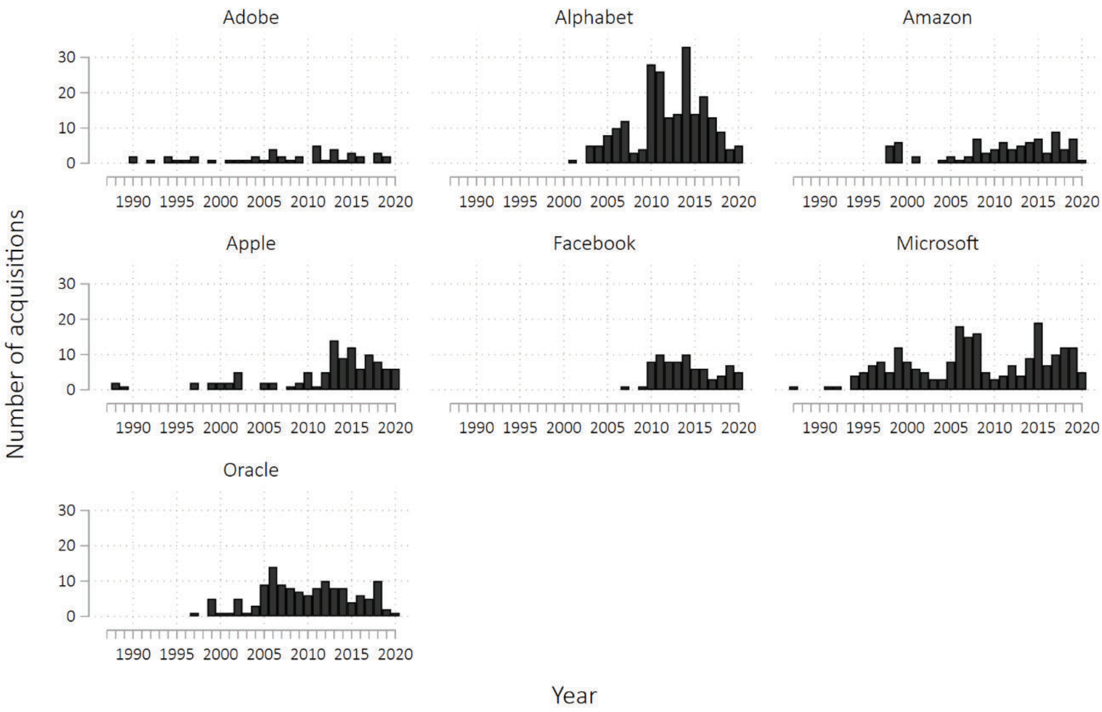
Table A.2: Reconciling information across Zephyr, Capital IQ and SDC Platinum

	3 matching values	2 matching values
City	-	68%
Country	97%	99%
Year of incorporation	-	44%
Region	92%	85%
SIC code	73%	87%
Subsidiary	-	80%
Acquisition year	95%	98%

Note: Share of matched firms, where also the listed attributes match across databases.

Figure A.1 shows the number of acquisitions per year. All of the Big Tech were active in the acquisition market almost from the start, albeit to varying extent. Alphabet made the most acquisitions overall, with increased activity from 2010. Both Amazon and Apple have become more active recently. Microsoft and Oracle had periods of growing and declining activity. Adobe did not make as many acquisitions as the others but maintained a constant level of activity throughout.

Figure A.1: Number of acquisitions per year



We also consider the vendors that sold startups to Big Tech. Often, these are early investors such as venture capitalists, but sometimes they are also the businesses' founders. This information is only available from Zephyr. The investor is not known for every acquisition – in 13% of deals they are not. This is a particularly the case for earlier transactions, as Figure A.2 shows.

Figure A.2: Share of vendors that are unknown

Lists compiling historical M&A for each of the Big Tech were found on Wikipedia, techwyse.com and cbinsights.com and used as a starting point for research. Information on company websites about acquisition activity was also used when available. Crunchbase and Pitchbook databases were used to gather information about the original geographic location of the acquired companies, date of acquisition, value of transaction if available, and history of venture capital backing if applicable. Internet research was conducted to learn more about each individual acquisition. Details about the talent, technology, and intellectual property that was acquired and plans for the future of each acquired company including integrating it into the acquiring company were specific interests. Sources including the New York Times, Washington Post, The Wall Street Journal, Business Insider, Reuters, and Techcrunch were preferred and used when available. News articles on other sites including Forbes, Fortune, cnet.com, zdnet.com, CNBC, and Venturebeat were used to gather information as well.

Table A.3: Original VC Investors for Big Tech

Tech Giant	Year founded	Original Venture Capital Investors					**Corporate VC ARM (year est.)**
Microsoft	1975	Technology Venture Investors (TVI)					M12 (2016)
Apple	1976	Venrock	Sequoia Capital	Morgenthaler	Matrix Partners	Brentwood VC	N/A
Oracle	1977	N/A					Oracle VC (2002)
Adobe	1982	Accel	Redpoint Ventures	Auriga Partners (Paris)	Ridge Ventures	Store Ventures	Adobe Ventures (2006)
Amazon	1994	Kleiner- Perkins, Caufield & Byers					Amazon Alexa Fund (2015)
Alphabet	1998	Kleiner- Perkins, Caufield & Byers	Sequoia Capital				GV (2009)
Facebook	2004	Accel Partners	Greylock Partners	Meritech Capital			Facebook VC (2020)

Source: Compiled by Authors. Oracle did not raise VC investment but was able to bootstrap and use US federal government contracts to scale.