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How Wealth Fuels Growth

The Role of Angel Investment

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EXECUTIVE SUMMARY

The role of wealth in the economy is the focus of much policy debate. This study examines wealthy individuals as "angel" investors, who fund startup businesses. Angel investors provide a unique source of support for America's entrepreneurs, particularly in leading-edge industries.

Many people are familiar with the idea of angel investors from the television show *Shark Tank*. As the show portrays, angels provide their money, effort, and experience to help new businesses grow. Many of the most successful businesses in American history got off the ground with the help of angel investors.

Today, there are 335,000 wealthy angels across the nation who take large risks to fund a diversity of startup businesses. Angel-backed startups often pioneer breakthrough products and technologies that create broad-based benefits to society, a role that goes back to the Industrial Revolution. Young companies funded by angels are making advances today in biotechnology, energy, transportation, financial services, space travel, and many other industries.

Some policymakers complain that wealthy people and big corporations rig the economy and deny opportunities to others. But wealthy angels do the opposite: they fund startups that pry open rigged industries and generate competition. The best check on big corporations is vigorous competition in deregulated markets from well-funded startups.

Angel investment is crucial to the economy, but there are storm clouds in Washington. Democrats are proposing to sharply raise capital gains taxes. If applied to startup investing, that would kill incentives for angels and starve cash from the virtuous cycle in technology hubs of successful investors and entrepreneurs generating wealth and then plowing it back into new businesses.

America needs diverse sources of funding for innovative businesses, and wealthy individuals are a crucial source. Wealth is central to the nation's entrepreneurial ecosystem, which has spawned so many great companies and advances over the decades.

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WEALTH IS BUSINESS OWNERSHIP

A 2019 *Washington Post* editorial lamented the "ever-higher concentration of national wealth at the top."[1] That same year, *New York Times* columnist Paul Krugman wrote that we are "living in an era of extraordinary wealth concentrated in the hands of a few people."[2] During the 2020 campaign, presidential candidate Joe Biden said "no one is supporting billionaires" and Sen. Elizabeth Warren (D-MA) advocated higher taxes to "address runaway wealth concentration."[3]

Wealth is concentrated by some measures.[4] The top 1 percent of the wealthiest Americans own 32 percent of U.S. household wealth.[5] But that statistic does not tell us where the wealth came from, what it consists of, or how it is used.

Where does top wealth come from? In the U.S. economy, the wealthiest 1 percent of households mainly earn their wealth from work and entrepreneurship. About 70 percent of these wealthiest Americans are self-made, rather than inheriting fortunes.[6] Also, 74 percent of them own a business, compared to 13 percent of all households.[7]

What does top wealth consist of? Some people seem to think that big fortunes consist of personal consumption assets. In discussing her proposed wealth tax, Senator Warren's website says, "Consider two people: an heir with $500 million in yachts, jewelry, and fine art, and a teacher with no savings in the bank."[8] Media articles on wealthy individuals often focus on the value of their personal assets, such as homes.

However, most top wealth consists of business assets, not personal assets. Looking at the top 0.1 percent of the richest households, 36 percent of their combined wealth is equity in private businesses and 33 percent is equity in publicly traded businesses.[9] Another 23 percent is debt, pensions, and other assets, much of which ultimately consists of capital in businesses. Just 8 percent of this group's wealth are their houses. Thus, the great majority of top wealth consists of business assets, which support economic growth.

Looking just at billionaires, the consulting firm Wealth-X estimates that just 2 percent of their fortunes consist of homes, yachts, jewelry, cars, and other luxury assets.[10] Consider the richest man in America, Jeff Bezos. His homes are worth about $500 million or more, but that accounts for less than about 0.3 percent of his total wealth of about $180 billion.[11] The great majority of Bezos's wealth consists of his ownership share of Amazon, a company he founded in his garage in 1994.

People complain that wealth is "concentrated." But in terms of how it is used, wealth is dispersed across the economy in productive business assets. Bezos's wealth reflects capital in Amazon's vast operations, which employ more than a million people. Without capital to support them, those workers would not have their jobs and billions of Amazon packages would not be delivered.

> "Most top wealth consists of business assets, not personal assets."

Senator Warren said: "The top 0.1% of families—the richest 1 in 1,000—now have nearly the same amount of wealth as the bottom 90% of American families combined. Meanwhile, for everyone else, opportunity is slipping away."[12] But with his Amazon assets, Bezos is generating job opportunities for many people while serving millions of consumers.

Bezos's wealth is mainly public equity, but what about private equity, which is the largest part of top wealth? One of the largest private companies in America is the food conglomerate Cargill, based in Minnesota. The Cargill and MacMillan families own 90 percent of Cargill, which has annual revenues of about $115 billion.[13] These families have built Cargill over decades, creating opportunities for workers in the food, agriculture, and transportation industries.

Many politicians seem to think that wealth and workers—capital and labor—are enemies. But the capital assets on Cargill's balance sheet of about $60 billion enable the company to employ 155,000 people. Like Cargill, many large private companies in America have been built over generations as families have stewarded productive assets. Sometimes an entrepreneur builds a large private business only to have subsequent family generations mismanage the business and dissipate the wealth, but there is nothing admirable about that.

French economist Thomas Piketty has claimed that "past a certain threshold, all large fortunes, whether inherited or entrepreneurial in origin, grow at extremely high rates."[14] That is not true. Wealth in the form of business ownership does not grow unless it is nurtured by sound management, careful investment, and ongoing innovation.[15]

Wealth in the form of business ownership is always tentative and subject to change, as it represents an estimate of the present value of discounted future net earnings. Every private and public company in America could be undercut by competition or changing tastes at any time and then plunge in value. In July 2021, the stock market said that Uber was worth about $92 billion, but the company has been losing money and will be worth little if it cannot figure out how to earn consistent profits.

In market economies, old wealth is often in decline as new wealth is being created by entrepreneurs starting and growing businesses. All businesses begin small, and most remain small. However, a limited number of them will become fast-growing "gazelles" and ultimately grow into large corporations. The growth of gazelles is often kick-started by angel investment, venture capital, or a combination of the two financing sources. The focus of this study is angel investment, but both sources of equity finance play an important role in fueling growth in promising young companies.

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The following sections describe the basics of angel investment and discuss how angel-funded companies generate innovation and competition. Angels steer their wealth to unproven products and technologies, and some of their risky bets ultimately become large businesses and cornerstones of the American economy.

FUNDING NEW VENTURES

The American economy is hugely dynamic. Every year, about 8 percent of businesses shut down and millions of jobs are lost from the closures.[16] Fortunately, entrepreneurs are continually creating new businesses to replenish jobs and incomes. Indeed, startup businesses create most net new jobs in the economy.[17] Without those startups, and without some of the startups becoming gazelles and growing quickly, the U.S. economy would shrink in a permanent recession.

Startups are experiments. Entrepreneurs make bets about technologies and consumer demands, and they adjust their plans as they go. Yet, despite all the time, effort, and money put into launching startups, half of new companies go out of business within five years and about two-thirds within 10 years.[18] Nobody knows in advance which ideas and products will succeed, so we need a steady stream of entrepreneurs launching a variety of new ventures. Economist John Haltiwanger and colleagues noted, "In the first years following entry, many startups fail . . . but the surviving young businesses grow very fast. In this respect, the startups are a critical component of the experimentation process that contributes to restructuring and growth in the U.S. on an ongoing basis."[19]

Angel Investment and Venture Capital

New businesses need funds to launch and grow. Entrepreneurs often tap into their savings, borrow on their credit cards, borrow against their homes, or sell some of their belongings to raise cash, which is called bootstrapping. Steve Jobs sold his VW van to raise cash for the launch of Apple Computer in 1976. Len Bosack and Sandy Lerner mortgaged their home and ran up their credit cards to get network hardware company Cisco Systems off the ground in 1984.[20]

Most startups will remain small businesses that serve local or narrow markets. These firms may not need outside financing, perhaps aside from small loans from friends, family, or local banks. Alternatively, some startups grow into large companies over time by relying on reinvested profits, not outside financing.

However, a share of startup and young businesses need outside equity financing. They do not have sufficient cash flow to pay interest on loans, and they may not be eligible for loans because they have few hard assets for collateral and do not have a track record of stable revenues. Furthermore, the main assets of some startups are intellectual property, which is not easy for potential lenders to evaluate. In these circumstances, equity financing is needed. After initial bootstrapping, Apple and Cisco both received outside injections of equity.

For technology startups, equity funding makes sense. Harvard Business School professor Tom Nicholas notes, "Because research and development is highly intangible and tends to be specific to the firm in which it is being used, it

has limited liquidation value. As a general rule, the use of debt tends to decrease with asset intangibility."[21] Also, in technology industries there can be a large information gap between an entrepreneur and a potential funder. A funder will need a close association with the entrepreneur to close that gap, which is a role that angels and venture capitalists (VCs) specialize in, but that banks and stock exchanges do not. Angels and VCs use staged financing—parceling out funding over time—to reduce the information gap and keep entrepreneurs focused and accountable.

Angel investors provide hands-on equity finance. They provide entrepreneurs with funding, mentorship, and access to their business contacts. They often have industry expertise and can help young companies raise additional funding. In his book on angel investing, Jason Calacanis summarized the four inputs of angels as "money, time, network, expertise."[22]

There are 334,680 active angel investors in the United States, according to the Center for Venture Research.[23] A 2019 survey by the Angel Capital Association found that two-thirds of U.S. angels have been entrepreneurs themselves, and three-quarters are over age 50.[24] A typical angel puts about 10 percent of his or her wealth into angel investment.[25]

A well-regarded survey on entrepreneurship found that 5 percent of U.S. adults are informal friends and family investors to startups.[26] Thus, roughly 10 million Americans may be considered informal angels. But in this study I focus on the smaller group of wealthy and professional angel investors, the type included in the Center for Venture Research estimate.

U.S. angel investment was $25 billion in 2020.[27] Angels invested in 64,480 companies, with an average investment of $392,025.[28] That year, 36 percent of U.S. angel investment went to health care and biotechnology, 23 percent to software, and most of the rest to energy, financial services, and retail.

The goal of many angel investors is to support startups that will become gazelles and grow rapidly. Some famous angel-funded startups that grew into large corporations include Apple Computer, Amazon, Facebook, Google, Uber, Home Depot, Costco, and Starbucks.

In fast-moving industries, gazelles need outside funding to scale up operations and gain a market presence with a new product or innovation. Gazelles often receive, in sequence, personal funding, then angel funding, and then numerous rounds of venture capital funding. If a business succeeds, it may be acquired or go public in an initial public offering (IPO) down the road. An acquisition or IPO creates an "exit" for angel and VC investors, who often use the proceeds to invest in new startups.

One pool of wealth that flows into startups and growth companies comes from "family offices." These are business structures that manage the investments of wealthy families with generally more than $100 million of investable assets. There are more than 2,000 family offices in the United States, and about four-fifths of them invest in private equity.[29]

This study focuses on angels, but angel and VC investment are interconnected, particularly in technology industries.[30] An expert at VC data company PitchBook noted that angels are "a key piece of the VC ecosystem" and that "angels and VCs have a symbiotic relationship."[31] Angels generally fund earlier stages of company growth with smaller investments, while VCs fund later stages with larger investments. Angels use their personal wealth to invest directly in startups, whereas VCs are structured as limited partnerships and raise funds from wealthy individuals, family offices, corporations, pension funds, university endowments, and foundations. Over the past decade, VC investment has averaged $91 billion a year, but it spiked to $166 billion in 2020.[32]

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A difference between angel and VC investment is the geographic dispersion. Angels are in every town and city and usually invest in startups close to home so that they can advise and monitor entrepreneurs. Venture capitalists are more concentrated in innovation hubs, such as Silicon Valley. More than one-third of American VC investment goes to Silicon Valley, whereas only about 17 percent of angel investment goes to California as a whole.[33]

Both angel and VC investment are "patient capital," but angels are even more patient than VCs. Angels often do not see a return on their successful investments for 5 to 10 years, and all the while they are working with entrepreneurs to

achieve success.[34] Angel investments are long term, risky, and highly illiquid. It is only people with substantial wealth, time, and expertise who can fill this unique role in the economy.

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Consider current efforts to improve battery technologies, which is a central challenge to improving the performance of electric vehicles. Enovix, founded in 2007 and backed by angel T. J. Rodgers and VC companies, is just now going public and is expecting to make its first commercial battery sales next year.[35] Meanwhile, QuantumScape was founded in 2010 and backed by angel Bill Gates, Volkswagen, and VC companies. It is pursuing a revolutionary design for solid-state batteries, which would have faster charging and reduced fire risks than existing batteries. The *Wall Street Journal* notes, "QuantumScape's investors are playing a very long game. The business plan doesn't envisage meaningful revenues before 2026. There is also no guarantee that the company's solution will win out over those of Toyota and others."[36] That is patient capital.

Risks and Rewards

Angel investors face many risks. The startups they invest in may misjudge consumer demands, their products may be faulty, or competitors may beat them to market. Angels also face risks that entrepreneurs have poor management skills, leave their startups, or that they hide bad news or act unethically.[37] Angel and VC investors in the high-flying blood-testing company Theranos, for example, discovered too late that the company's founders appear to have pulled a huge fraud.

Angel investment is generally higher risk than VC investment because companies have shorter track records when angel investments are made. The guidance that angels provide to young companies helps "de-risk" them for later VC investment. Angels also face financing risk, which means the risk that an angel-funded company will not be able to attract the VC funding it may need in the future for it to continue growing.

Politicians and the public underappreciate the huge risks that entrepreneurs and angel investors face. Most people are aware only of the companies that became large and successful, not the huge graveyard of startups that failed.[38] Today's big retail and technology companies seem to fill obvious consumer needs, but companies are never a sure thing when they are launched.

Music-streaming giant Spotify was a long shot when it was launched in 2008. One expert noted: "Most investors didn't want to touch it. The music industry was risky, had razor-thin margins, and opened a world of headaches in negotiating with industry execs."[39] There were worries that Spotify would face copyright issues, which had killed Napster. Fortunately, a wealthy Hong Kong angel and a VC firm took a chance on the Swedish startup.[40]

When Google was a startup, numerous VCs turned down the chance to invest. Google "was by no means a sure-shot investment in 1999. The search algorithm space was already crowded" at the time.[41] Similarly, some VCs passed on the chance to invest in Airbnb.[42] In the 1970s, Atari founder Nolan Bushnell turned down the chance to be an angel investor in Apple Computer, even though Steve Jobs had been an employee of his.[43]

As for Atari, Bushnell says that when he discussed his startup plan in 1972, "people thought the idea of playing games on a television set was the stupidest idea they'd ever heard of."[44] But Atari made Bushnell wealthy, and he put that wealth to good use by becoming a serial entrepreneur, including launching the Chuck E. Cheese restaurant chain.

As a wealthy angel, Jason Calacanis writes that he turned down an offer to invest in Twitter as a startup because the app seemed "inane and pointless."[45] He says that as a pioneer of blogging, he did not initially see any benefit in Twitter's short messages. He says of the startups that angels invest in, "If these businesses didn't look completely crazy, then everyone would want to invest in them and there would be no need for angels."[46] Calacanis invested $25,000 in Uber early on. He discusses how he invited Uber leaders to present at an angel forum in San Francisco to raise further funding.[47] Most angels at the forum passed up the chance as they saw no future in Uber, which at the time operated in a small niche market.

He notes that early investment in YouTube was also a risky bet because the company "was burning money, had come after a dozen previous failures doing the same thing, and had massive legal risk."[48] As for Tesla, Calacanis writes, "Elon Musk was delusional to think he could upend the car industry by going electric."[49] But Tesla has driven itself to the front of the electric car industry, ahead of existing major car producers.

To reduce risks, angels perform extensive screening and due diligence on companies before they invest. Unlike the quick decisions portrayed by the angels on *Shark Tank*, these activities are very time-consuming.[50] Despite their best efforts, angels typically lose money on more than half of their investments. They can diversify by investing in numerous startups, but screening and due diligence is so time-consuming that it is difficult for angels to diversify sufficiently when they invest alone.

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With such high risks and large time demands, why do angels do it? Why don't they just put their wealth in a stock index fund? Angels often have a strong desire to mentor young entrepreneurs, and they see their role partly as a social mission. They want to earn high returns, but they also enjoy the excitement of new ventures and want to contribute to innovation.

We do not have great data, but it appears that angels overall earn positive returns. A 2007 analysis by Robert Wiltbank and Warren Boeker examined returns on 1,137 angel investments.[51] They found that 52 percent produced losses, while the best 7 percent produced 75 percent of the overall returns. A 2017 analysis by Wiltbank and Wade Brooks examined returns on 245 angel investments.[52] They found that 70 percent lost money, while 10 percent produced 85 percent of the overall returns. The overall average gross rate of return across investments was 22 percent.

In angel investment, a small share of the bets produce big wins, and those big wins need to cover the losses on the many failed investments. The same pattern is evident in the venture capital industry. The rule of thumb in VC is that about two-thirds of investments fail to produce a return, and that is about what the data show.[53] In recent years, average VC investment returns appear to have fallen from the high levels of the 1990s.[54]

Another result from the Wiltbank and Brooks study needs stressing. The average holding period for angel investments they studied was 4.5 years, but the exits on the biggest successes often took about 10 years. The rare big wins from angel investment often take a decade of effort to pay off.

Trends in Angel Investment

Angel investment has changed in recent decades. Because of the high risks, the more investments an angel makes, the more likely they will earn positive returns overall. For that reason, angel investment has become more networked and structured. About 400 regional angel groups have been formed across the United States to make joint investments, up from just 10 such groups in the 1990s.[55]

Angel groups allow investors to pool funds and diversify, to learn from each other, and to efficiently screen companies and perform due diligence. Also, angel groups with pooled resources are better able to provide follow-on investments in growing companies. The groups are a major development in improving the flow of risk capital to young companies.

Another development is the rise of online angel investment platforms. AngelList, SeedInvest, Gust, and other platforms help match startups with angels. AngelList is designed "to make the investment process more transparent for angel investors and entrepreneurs through an online platform. Since its 2010 launch, 1,040 startups have raised $445 million from angel investors."[56]

A relatively new source of funds for entrepreneurs is "crowdfunding," which is small-dollar investments made through internet platforms. Kickstarter launched in 2009 and has pumped $6 billion from 20 million people into more than 200,000 projects and companies.[57] Betsy Mikesell and Angie White had a new idea for bunk bed sheets. In 2014, they raised $108,000 on Kickstarter to launch their business, called Beddy's.[58] The business succeeded and now generates $7 million in annual sales. Philosophy professor David Barnett raised money on Kickstarter in 2012 to develop his

smartphone accessory PopSockets. He has sold more than 200 million units of the product, which people laughed at when he first proposed it.[59]

Other new funding options for startups include initial coin offerings and exotic blends of debt and equity.[60] And there are new institutions to aid startups, including incubators and accelerators. The former provide office space, administrative support, and advisory services to startups for periods of up to two years. The latter provide intensified support and usually make equity investments in startups, but offer support for shorter periods than incubators. Y Combinator in Silicon Valley housed Airbnb in 2009 and provided $20,000 in exchange for 6 percent of the company's equity.[61]

> "Henry Ford, Steve Jobs, and other business leaders built the American economy. However, angel investors played key supporting roles."

Angel investment has evolved within broader changes in U.S. capital markets. One shift has been a huge increase in private equity compared to public equity. The number of publicly traded firms in the United States has fallen by half since 1996.[62] Another shift has been that VC investments have become larger and happen later in startups' growth phase, which has left a void for angels to fill in early stage investing. In parallel, exits for VC-funded firms tend to be later and larger. Finally, while exits used to be mainly through IPOs, they are now mainly through mergers and acquisitions.[63]

While the term "angel investment" was coined in the 1970s, angel investment is nothing new.[64] Wealthy individuals have been backing risky startups since the beginning of the Industrial Revolution, as discussed in the next section. As market economies have grown over the centuries, wealth has been continuously shifted from older industries to newer ones. Angel investors have been at the center of the action, steadily recycling wealth into promising startup enterprises.

ANGELS FUNDING ENTREPRENEURS

Economic histories often focus on the achievements of inventors and entrepreneurs. Henry Ford, Steve Jobs, and other business leaders built the American economy. However, angel investors played key supporting roles. As Tom Nicholas notes in his history of risk capital, "Some of America's leading entrepreneurs and technologists owed their start to wealthy individuals providing finance for investment and expansion."[65]

Henry Ford cofounded Ford Motor Company in 1903 with angel investor Alexander Malcomson, who had earned his wealth as a Detroit coal merchant.[66] His investment in Ford was a gamble because most automobile companies at the time failed.[67] Indeed, Ford's first automobile startup failed, and he left his second startup. Fortunately, Ford Motor Company succeeded. Henry Ford introduced his Model T in 1908 and earned a fortune by continuously cutting the car's price and expanding sales to the benefit of millions of consumers.

George Eastman was a bank clerk in the 1880s, and in his spare time experimented with photography. He quit his job and launched a photography company in 1888 with a $6,000 angel investment from Henry Strong, who had gained wealth by making buggy whips.[68] The startup became Eastman Kodak, which revolutionized photography in the 20th century by simplifying the process and cutting prices.

King Gillette was a traveling salesman, inventor, and author of utopian socialist novels, but he ended up earning wealth as a capitalist by introducing the first safety razor in 1903. Gillette's razor used disposable blades mounted in a handle. Like many entrepreneurs, he faced naysayers: "Machinists and metallurgists told Gillette there was no way to manufacture the thin blades he had in mind, making it impossible to find financial backers."[69] But Gillette persevered and eventually found an angel in John Joyce, who was willing to fund research and the purchase of manufacturing equipment.[70]

Gillette made his hoped-for breakthrough, and his company led the industry for the next century. More recently, startup Dollar Shave Club disrupted Gillette and other big players in the industry with a low-price, direct-to-consumer model. Dollar Shave Club was launched in a Los Angeles incubator and funded by angels and VCs.[71]

Steve Jobs and Steve Wozniak launched Apple Computer in 1976 and grew the company with the help of angel Mike Markkula, who had earned wealth at Fairchild Semiconductor and Intel Corporation. He invested $91,000 in 1977 to help launch the Apple II, and he guided Apple's inexperienced

cofounders, later becoming CEO.[72] Markkula's investment was followed by $288,000 in VC funding in 1978.[73]

Jeff Bezos's dream of an online bookstore became a reality with the help of private investors. Bezos started Amazon in his garage in 1994 using his personal savings and funding from his parents. Then, in 1995, wealthy telecom executive Thomas Alberg and others kicked in angel funding.[74] There was uncertainty about the company's prospects: "Bezos was looking to raise $1 million for his fledgling startup. While others balked at the $6 million valuation, Alberg saw promise."[75] Looking back, Alberg remembers, "When it started, I don't think Jeff or any of us had any idea of what Amazon would grow to."[76]

"Micron Technology received crucial angel funding and has grown to become one of the world's largest semiconductor companies."

Micron Technology received crucial angel funding and has grown to become one of the world's largest semiconductor companies. In 1978, Ward Parkinson, Dennis Wilson, and Doug Pitman left Texas-based computer chipmaker Mostek to found Micron in Idaho, the home state of Parkinson and Pitman.[77] Ward's brother Joe also joined the firm. Micron initially aimed to design semiconductors for other producers, but it soon switched to manufacturing memory chips itself in Boise.

The founders convinced three Idaho business people—Tom Nicholson, Ron Yanke, and Allen Noble—to invest $300,000 in the startup.[78] Nicholson was a rancher, Yanke owned a machine shop, and Noble was a potato farmer who knew the Parkinsons. Joe Parkinson recalls that the three angel investors showed "enormous courage" and "put everything they had at risk."[79] Indeed, it would have seemed crazy investing in a new semiconductor firm in tiny Boise, isolated from the technology hubs in Texas and Silicon Valley, especially when the industry was facing rising competition from Japanese chipmakers.

Micron's angel investors had business dealings with billionaire Idaho potato farmer J. R. Simplot and convinced him to invest $1 million in the fledgling company the following year, followed by millions more in subsequent years.[80] With the angel funding, Micron broke ground on its first semiconductor plant in 1980 and eventually battled its way to top of the industry with continuous innovation.[81] Today, Micron has more than 30,000 employees, including more than 6,000 in Idaho.[82]

Angels continue to be important to technology startups, but they invest in many different industries. Some of *Shark Tank*'s successful investments have included $350,000 for Squatty Potty (a toilet accessory); $300,000 for Lovepop (a greeting card company); $125,000 for Simply Fit Board (a fitness device); $75,000 for Sleep Styler (a hair roller); $2 million for Ten Thirty One Productions (an entertainment company); $100,000 for Tipsy Elves (an apparel company); and $300,000 for Bubba's Q Boneless Ribs (a food company).[83]

Wealthy Merchants

Wealthy individuals have long played a central role in funding entrepreneurs. Historically, many entrepreneurs had needs for capital that were not met by financial institutions such as banks and stock exchanges. Instead, entrepreneurs sought funding from wealthy people who were willing to share the risks of launching a new venture. During the Industrial Revolution, wealthy merchants were often angel investors.

Harold Livesay and Glenn Porter studied how manufacturing entrepreneurs in the 19th century raised money to start businesses and fund their fixed and working capital.[84] Banks in the 19th century were conservative and startups often did not have collateral for loans. Stock exchanges at the time mainly raised money for large enterprises, such as railroads.[85]

Where did manufacturing entrepreneurs get funding? Usually it was from wealthy merchants, often merchants who wanted to support producers making the items they traded. Livesay and Porter discuss how businesses making iron, textiles, machinery, rail equipment, and other products were often cofounded by cash-poor entrepreneurs and cash-rich merchants. Wealthy merchants brought money to the table as well as marketing experience. Livesay and Porter found, "Only the preexistence of a prosperous, experienced, and efficient mercantile community permitted such a rapid development of mass production in America."[86] They found that merchants were the "agents of transfer" in the 19th century, meaning that they recycled wealth from older industries to the newer industries of the day.

The same pattern is evident in the 18th century.[87] At the time, landowners had wealth, but it was not liquid. Merchant wealth was liquid and thus available for lending and equity investments.[88] As the 18th century progressed, the domestic and international trading wealth of merchants was increasingly invested in new manufacturing industries. Manufacturing startups needed funds for both fixed capital and working capital, the latter meaning assets such as raw materials, inventories, and customer credit. Entrepreneurs needed substantial working capital because of the inefficient payment and transportation systems at that time.[89]

A place with a good claim as the birthplace of the Industrial Revolution is Coalbrookdale, Shropshire, England. During the 18th century, entrepreneurs in the area made major advances in iron production. In 1709, Abraham Darby I was the first to use coking coal in a blast furnace to produce pig iron, which reduced the cost of the metal and expanded its use in the machinery and infrastructure of the rising industrial economy. Previously, charcoal made from timber was used in ironmaking, but it was expensive and the process caused deforestation. Darby's innovation was "one of the most important technological breakthroughs of the Industrial Revolution."[90]

Darby, his son, and his grandson were innovative leaders in ironmaking for decades.[91] Their success was capped off in 1779 when Abraham Darby III built the "Iron Bridge," which became world famous at the time and still spans the River Severn in Coalbrookdale today. This pathbreaking infrastructure was financed by local entrepreneurs, who were paid back over time from bridge tolls.

Historians have called Coalbrookdale the Silicon Valley of its day.[92] Area entrepreneurs and merchants in the 1700s reinvested their profits into a range of advanced infrastructure, including an incline railway to raise and lower boats, the first iron-wheeled railways, the first iron-hulled boat, and early steam engines that were used for pumping water out of mines, powering furnaces, and recycling water for waterwheels.

The Darbys are remembered by historians today and Coalbrookdale is a United Nations World Heritage Site. But behind the scenes, a wealthy merchant family from Bristol was crucial to the Darbys' success. Two generations of the Goldney family were angel investors in the Darby businesses, funding capital investments in their ventures.[93] The Goldneys helped manage the Darbys' finances and market their products. The Goldneys stepped in to oversee the Darby enterprise during crises, helped with business strategies, and made sure that the Darby financial accounts were in order. Like modern-day angels, the Goldneys provided risk capital in a very hands-on way.

> "Where did manufacturing entrepreneurs get funding? Usually it was from wealthy merchants."

The Goldneys would be called "superangels" today for their prolific startup investing. Thomas Goldney II originally gained wealth from merchant activities, such as ship voyages. He plowed his merchant profits into Darby's iron startup beginning in 1708, and then reinvested his earnings over the years into a mining startup, a bank startup, a brass and copper startup, and ironmaking startups.[94] A history of the family reveals how risky all these ventures were, but the Goldneys seemed to have good management, logistical, and financial skills.[95] They earned steady profits and recycled them back into leading-edge ventures of the day.

In sum, wealthy angel investors have been playing an important role in the economy for a long time. They supply equity risk capital to entrepreneurs when loans are not available. They advise and mentor entrepreneurs, helping them expand their enterprises. And they act as "agents of transfer," meaning that they take the risks of moving resources from past ventures into promising new ventures that are often at the leading edges of technology.

Angels Are Diverse

Angel investors come in all types. Some are individuals who take a chance on opportunities they happen to come across, while others are superangels who expertly screen and analyze opportunities and invest in dozens of startups.

Ian McGlinn is the first type. He is the angel who helped Anita Roddick launch the retail chain Body Shop. Roddick opened Body Shop as a single location in Brighton, England, in 1976. The next year she wanted to open a second location, but was turned down for a loan by numerous banks.

McGlinn was a friend of a friend and a local business owner, and he took a chance and invested £4,000 (about $8,000 at the time) with Roddick for an equity stake.[96] That was the beginning of a great success, as Body Shop expanded to thousands of locations across the globe.

Scientist Peter Buck invested $1,000 with a young family friend, Fred DeLuca, to open a sandwich shop in Bridgeport, Connecticut, in 1965.[97] It was a good call. Subway grew to more than 40,000 franchised locations, and the partners became wealthy.

Beatle George Harrison was an angel investor. In 1978, he invested $2 million to fund Monty Python's *Life of Brian* after EMI Films pulled out of the movie project, wary of its controversial theme.[98] Harrison's gamble paid off, as the movie was a hit. Wealthy individuals are often willing to take gambles on risky ideas that big companies shy away from.

Some angels are not so fortunate. Using wealth earned from his writing, Mark Twain invested in a range of startups making such products as a typesetting machine, grape shears, protein powder, watches, steam generators, cloth, and many others.[99] Alas, Twain made many bad calls, and over a 15-year period he bankrupted himself from such investments.[100] In 1877, Twain turned down an inventor's offer to invest in his electrical device, saying he "didn't want anything more to do with wildcat speculation."[101] The inventor was Alexander Graham Bell, who wanted Twain to invest in his telephone.

Andrew Mellon was a more successful angel than Twain. He began his career in banking, and as he gained wealth in the late 19th century he made equity investments in dozens of startups and young companies, often in leading-edge industries of the day, including electricity, petroleum, steel, and aluminum.[102] Mellon used his equity stakes to help guide companies and fix management failures, similar to the hands-on approach of angels and VCs today.

Laurance Rockefeller inherited vast wealth as the grandson of the founder of Standard Oil. If he had wanted, Rockefeller could have held his wealth in safe assets and relaxed. Instead, he set up an office with an expert team to screen and invest in an array of technology startups in aviation, electronics, and other dynamic industries of his day.[103] Rockefeller invested in 59 startups between 1938 and 1969. He said, "We are undertaking pioneering projects that with proper backing will encourage sound scientific and economic progress in new fields—fields that hold the promise of tremendous future development."[104] Rockefeller lost money on 44 percent of his angel investments. Overall, he earned a return over the decades somewhat less than his funds would have earned in the stock market.

Today, America is blessed with many wealthy superangels. Ron Conway is perhaps the most prolific, having made investments in about 650 companies over 35 years.[105] After working at a semiconductor firm during the 1970s, he founded, and then sold, several successful companies by the early 1990s. With this wealth, Conway became a full-time angel because he "enjoyed mentoring entrepreneurs more than being the entrepreneur himself."[106] He has had many hits, including early investments in Google, Facebook, Twitter, and PayPal, but he admits that he has also had failures and missed opportunities.[107]

Numerous Hollywood celebrities and music stars have used their wealth to invest in startups. PitchBook reported, for example, on 11 well-known rap stars—including Jay-Z, Nicki Minaj, 50 Cent, and Diddy—who have made angel investments in music companies, lifestyle products, and technology ventures.[108] And there is actor Ashton Kutcher, who has become an angel and venture capitalist. He began steering his wealth toward startups more than a decade ago as an early investor in Skype, followed by investments in Uber and other technology companies.[109] With partner Guy Oseary, he now runs a venture capital firm.[110]

"Today, America is blessed with many wealthy superangels."

Finally, many wealthy individuals fund startups with social purposes they consider important. Bill Gates has invested equity in dozens of startups, and with his ex-wife has funded startups with grants from the Bill and Melinda Gates Foundation. The foundation provided a $100,000 grant to startup Apeel, founded by young engineer James Rogers, who invented a coating for fruits and vegetables that extends product life and reduces food spoilage.[111] Two other startups have also introduced innovations to tackle food spoilage: Hazel Technologies, founded by Northwestern University students, and Afresh, founded by Stanford University graduates.[112] It is often startups—not existing companies—that succeed in tackling problems that have been around a long time.

Moderna and BioNTech

In the United States, COVID-19 has been beaten back by vaccines developed by Moderna of Massachusetts and BioNTech of Germany. BioNTech teamed with American pharmaceutical giant Pfizer in manufacturing and distributing its vaccine. As of August 2021, about 360 million doses of the two vaccines had been delivered in the United States.

The development of the technologies that enabled the two firms to respond quickly to the crisis was a product of scientific advances and large private investments over many years. Governments funded some of the research underlying the vaccines, and during the pandemic it funded production and distribution, but wealthy angels and venture capitalists played the crucial roles in the growth of the two companies.

"Governments funded some of the research underlying the vaccines, but wealthy angels and venture capitalists played the crucial roles in the growth of the two companies."

In the 1990s, Katalin Karikó at the University of Pennsylvania explored the potential of messenger RNA (mRNA). But "her work, attempting to harness the power of mRNA to fight disease, was too far-fetched for government grants, corporate funding, and even support from her own colleagues."[113] Nonetheless, after years of work, Karikó and her colleague Drew Weissman made a breakthrough in the early 2000s for practical applications of mRNA technologies.

Derrick Rossi of Stanford University, and later Harvard Medical School, realized the potential of the research, and in 2010 added his own advances to mRNA technologies. He teamed with academic colleagues and VC firm Flagship Pioneering to found Moderna that year.[114] The cofounders included Rossi, Kenneth Chien of Harvard Medical School, and Robert Langer of the Massachusetts Institute of Technology. Moderna's founding and current chairman is Noubar Afeyan of Flagship.

Moderna's plan was to "cut out the middlemen in biotech [by] creating therapeutic proteins inside the body instead of in manufacturing plants. The key: harnessing messenger RNA, or mRNA."[115] The plan was "highly risky. Big pharma companies had tried similar work and abandoned it because it's exceedingly hard to get RNA into cells without triggering nasty side effects."[116]

A 2020 piece in the *Wall Street Journal* examined how "skepticism has dogged Moderna since its creation in 2010" regarding its gamble on mRNA technology.[117] As late as mid-2020, a New York finance executive who focuses on health care said, "The idea that Moderna's going to rush a vaccine to the market and get it right the first time, the probability is extraordinarily small."[118]

In contrast to Moderna, the giant pharmaceutical firm Merck dropped the ball on mRNA technology and a COVID-19 vaccine. The company had looked into mRNA but "preferred to focus on proven technologies," reported the *Wall Street Journal*.[119] In July 2020, Merck's chief executive "told an online audience hosted by Harvard University that those raising hopes for a widely available vaccine by the end of this year are doing 'a grave disservice to the public.'"[120] Similarly, the CEO of pharmaceutical giant Novartis said in 2020 regarding COVID-19 that "an effective vaccine may not be available until the end of 2021."[121] Even experts cannot foresee the future in their own fields, which is why we need diverse independent flows of risk capital pushing all the edges in leading-edge industries.

Numerous streams of private capital supported Moderna's research. Scientist Timothy Springer invested $5 million at Moderna's founding. He had gained wealth from founding a previous biotech company.[122] Another early funder was financier Patrick Degorce, who invested in equity and provided Moderna a grant for cancer research.[123] By 2012, Moderna had raised more than $40 million in angel and venture investment.[124] By the time Moderna went public in 2018, it had raised more than $2 billion from private investors, including angels, venture capitalists, and corporate partners.[125] As for government funding, Moderna received just two awards prior to 2020 from federal agencies, for up to $25 million and $125 million, respectively.[126]

Meanwhile in Germany, husband and wife biotech entrepreneurs Uğur Şahin and Özlem Türeci read about the early advances in mRNA technologies and, with Christoph Huber, founded BioNTech in 2008 to explore them. Katalin Karikó joined BioNTech in 2013.[127] Şahin and Türeci had

previously founded successful biotech company Ganymed Pharmaceuticals, which they sold in 2016.

At its founding, BioNTech received a €150 million (more than $180 million) angel investment from Thomas and Andreas Struengmann.[128] The German brothers had founded a pharmaceutical firm in 1986 and sold it in 2006 for $7 billion. They had started the company "with about two-dozen employees in an apartment building near Munich and grew it into the world's fourth-largest generic-drug company."[129] With their wealth, the Struengmanns have invested in a range of life sciences startups, including Ganymed and BioNTech.[130]

All in all, BioNTech raised $1.3 billion from private investors before going public with an IPO in 2019.[131] One funder was the Bill and Melinda Gates Foundation, which invested $55 million. Before 2020, the company appears to have received, at most, only a few tens of millions of dollars of government funding.[132]

"Even experts cannot foresee the future in their own fields, which is why we need diverse independent flows of risk capital pushing all the edges in leading-edge industries."

When COVID-19 hit, Moderna and BioNTech began immediately working on vaccines after the companies' CEOs read about the new virus in January 2020.[133] When Chinese health officials published the genetic code of COVID-19, it took Moderna just two days to design a vaccine. Within 42 days, Moderna had shipped vials of its vaccine to the National Institutes of Health. Both companies gained government approval for their vaccines by December 2020 and began distributing millions of doses. These are the world's first vaccines created by mRNA technologies. Vaccines typically take many years to develop and deploy, but these vaccines took less than a year.

The Moderna and BioNTech vaccines are triumphs of the biotechnology industry, which has grown up alongside the pharmaceutical industry in recent decades. Generally, biotech firms derive medicines—biologics—from living organisms, whereas pharmaceutical companies derive medicines from chemical compounds. However, biologics are becoming an increasing share of revenues for traditional pharma companies as well, and most top-selling drugs today are biologics. The pharmaceutical industry is dominated by large multinational corporations, whereas the biotech industry consists of thousands of smaller research-based firms, which are often started by scientist-entrepreneurs.

For more than four decades, the U.S. biotech industry has been powered by risk capital, which sustains research spending, as firms may go years without earning profits. Indeed, one historian argues, "Venture capital created biotechnology as an industry."[134] The industry was launched in 1976 with the founding of Genentech by biochemist Herbert Boyer, venture capitalist Robert Swanson, and venture capital firm Kleiner Perkins, which initially invested $100,000 in the startup.[135] Genentech's first landmark was producing synthetic human insulin in 1978, and its insulin drug Humulin was the first genetically engineered therapeutic on the market. Insulin had previously been produced by harvesting versions of the hormone from millions of animal pancreases.[136]

Tom Perkins of Kleiner Perkins played a crucial role in the founding of Genentech, which set the biotech industry model for decades.[137] Perkins was an engineer who had gained wealth from computer investments. Through his "relentless effort to make Genentech a success, Perkins himself created a new mold for the entrepreneurial venture capitalist."[138] He oversaw Genentech's landmark 1980 IPO, which one study on the biotech industry noted was a "spectacular success" that "gave credence to the view that scientific research, infused with start-up firm spunk, could be a critical component of economic growth."[139]

Venture capital investment in U.S. biotechnology companies soared from $3.6 billion in 2011 to $18.0 billion in 2020.[140] Over the past 18 months, many biotech firms have been developing vaccines, antivirals, and treatments for COVID-19.

Serial Entrepreneurs

Leading-edge industries attract serial entrepreneurs, who are individuals that launch multiple startups. When entrepreneurs generate wealth from successful startups, they often act as their own angels in launching new companies. The biotechnology industry has attracted many serial entrepreneurs, including Moderna's cofounder, Robert Lander,

and Moderna's chairman, Noubar Afeyan, who have each founded or cofounded about 40 companies.[141]

Serial entrepreneurs have been important to America's economy for two centuries. Wilbur and Orville Wright channeled profits from their bicycle business into aviation research. George Westinghouse invented a braking system for trains that "saved untold numbers of lives and injuries," and then used the profits from that invention to launch numerous ventures, including Westinghouse Electric, which pioneered alternating current power systems.[142]

Peter Cooper held a range of jobs in New York City as a young man in the 1810s, including hatmaker, brewer, and grocer. He saved his money and bought a glue factory in 1821. He introduced several innovations to the glue industry and made large profits, which he channeled into new ventures. He invested in iron works in Baltimore, New York, and New Jersey. Cooper created America's first steam locomotive, and he was cofounder of a telegraph company and an investor in the first transatlantic telegraph cable. New Yorkers remember Cooper for founding the Cooper Union in 1853, a free private college for the education of men and women.

Thomas Edison launched more than a dozen businesses and garnered more than 1,000 patents. He was a telegraph operator in his teens and tinkered with inventions in his spare time. In his early 20s, he invented improvements to Wall Street stock ticker machines, earning tens of thousands of dollars. One success was a quadruplex telegraph machine, which he sold to Western Union in 1874 for $10,000. He used his profits to establish his Menlo Park research laboratory in 1876. A history of the telegraph noted, "Although Edison today is principally remembered for inventing the phonograph and the light bulb, it was his telegraphic background and the enhancements he made to the stock ticker that gave him the financial freedom to pursue his career as an inventor."[143]

Alexander Graham Bell invented the telephone in 1876. His research was financially supported by angels Gardiner Hubbard and Thomas Sanders. Bell struck it rich with the telephone, and then plowed his wealth into new ventures, including boat manufacturing, aviation, and research into deafness. Bell and Edison were typical of successful inventors of the late 19th century: many of them invested their own wealth into technology and research-driven startups.[144]

Henry Flagler began work as a teenager in grain sales in Ohio in the 1850s, saving money to buy his own store.[145] He also founded a distillery that he sold for a profit, and he cofounded a salt-mining business, but that went bankrupt. He then reentered the grain industry and, while in that position, he befriended John D. Rockefeller. Flagler and Rockefeller saw an opportunity in the new oil refining industry of the 1860s, and they cofounded the company that became Standard Oil. The business boomed and the pair became extremely wealthy.

> "When entrepreneurs generate wealth from successful startups, they often act as their own angels in launching new companies."

While visiting Florida in the 1880s, Flagler envisioned the state's large tourism potential. Over the next three decades, he channeled his wealth into infrastructure along the east coast. He built a railroad that stretched from St. Augustine to Key West, and he built grand hotels in cities along the way. He built hospitals, schools, water and sewer supplies, churches, electricity grids, fire stations, city halls, and other facilities for the state's growing population. Flagler's rail project from Miami to Key West was a particularly massive and costly project, which he finished in 1912 at age 82. Flagler had wealth, but he also had the vision and drive to sustain high risks and make long-term investments that Floridians still enjoy today.

Richard Branson is perhaps the most prolific entrepreneur of recent decades. As a young man in the 1970s, he started a student magazine and a record store, and at age 22 he launched Virgin Records. Branson took big risks on nontraditional artists and had hits with Mike Oldfield, Tangerine Dream, and the Sex Pistols. In the decades since, Branson has launched ventures in air travel, passenger rail, mobile phones, hotels, space travel, and many other fields. He has had both hits and misses, but his willingness to think big, do things differently, and use his wealth to challenge incumbent businesses has been remarkable.

Jeff Bezos is the wealthiest person in America, with a fortune of about $180 billion, which consists mainly of his part ownership of Amazon. Bezos is a serial entrepreneur and angel investor. He invested $250,000 in Google as a startup in 1998, and he was an angel investor in Uber, Airbnb, and

Twitter. These days, Bezos invests in startups in biotechnology, software, media, vertical farming, fintech, and space travel.[146] He also gives to nonprofit ventures in education, health care, renewable energy, homeless assistance, and veterans.

The race between Branson, Bezos, and Elon Musk to develop private space flight and space tourism illustrates the unique role of wealthy angels in supporting risky innovations. Branson put hundreds of millions of dollars into Virgin Galactic before the company went public in 2019.[147] The company also attracted a $100 million angel investment from former Facebook executive Chamath Palihapitiya. Bezos pumps a $1 billion a year of his wealth into his space company Blue Origin.[148] Musk launched SpaceX in 2002 and, in the first few years, pumped in about $100 million of his own money.[149] The company has gone on to raise more than $6 billion in private capital.[150]

"The race between Richard Branson, Jeff Bezos, and Elon Musk to develop private space flight and space tourism illustrates the unique role of wealthy angels in supporting risky innovations."

On July 11, 2021, Branson traveled aboard his VSS *Unity* to the edge of space from his New Mexico space facility. He was followed about a week later by Jeff Bezos, who traveled to the edge of space in his *New Shepard* spacecraft. Meanwhile, Musk's SpaceX currently handles most of NASA launches—at a cost one-third less than NASA's alternative launch provider.[151] SpaceX's 2020 launch of its *Dragon* spacecraft was the first U.S. human spaceflight since the final space shuttle flight in 2011. Each of these three companies is pursuing different technologies to reduce the costs of space travel, which is a different approach than the former monopoly spaceflight provider NASA followed for decades.

Wealth Waterfalls

In private equity, a "waterfall analysis" shows the payouts each shareholder receives in an exit after an acquisition or IPO. Those events get cash flowing to angel investors, VCs, entrepreneurs, and company employees who hold shares. The Silicon Valley Bank talks about a "waterfall effect" when exits generate floods of cash that fuel new rounds of startups.[152] The chair of the Angel Capital Association said that, with successful exits, angels "routinely put much of it back into funding more startups," and with their new cash "the management teams of successful companies very often become active angel investors themselves."[153]

Numerous factors led to the rise of Silicon Valley as the preeminent technology hub. The climate is nice, the region attracts entrepreneurial immigrants, the culture is conducive to collaboration, and Stanford University is a leader in academic-industry ties.[154] The mobility of skilled workers has also been important. A history of Silicon Valley noted that many entrepreneurs "struck gold because they wanted to build something their current employers weren't interested in."[155] Steve Wozniak developed the Apple I in his spare time while working at Hewlett-Packard (HP). He repeatedly offered the computer to HP and they rejected it, so Wozniak left to cofound Apple Computer.[156] Around the same time, engineer Chuck Peddle had an idea for a cheaper microprocessor than that sold by his employer, Motorola.[157] Motorola rejected his idea, so Peddle left to launch his computer chip elsewhere.[158] That chip was in the Apple I, Apple II, and other early personal computers, and its low price helped launch the personal computer revolution.

Silicon Valley's wealth waterfall has been massive. Since the 1950s, each wave of innovation has created millionaires and billionaires who have plowed their wealth back into the next round of startups. Successful entrepreneurs in technology industries often become angels and VCs, and those investors tend to invest close to home. Once Silicon Valley's wealth waterfall was underway, it gained huge momentum.

A famous example begins with Shockley Semiconductor. In 1957, eight engineers who were unhappy with Shockley management left to form their own semiconductor company. The engineers looked for startup funding from major corporations, but none were interested.[159] Eventually they found an angel, Sherman Fairchild, the wealthy head of Fairchild Camera and Instrument, and together they launched Fairchild Semiconductor. The company was successful, but eventually its top engineers began leaving to set up their own companies. Gordon Moore and Robert Noyce left to found Intel

Corporation in 1968 with their wealth from Fairchild and funds from venture capitalist Arthur Rock.[160] Intel was a big success, and Moore and Noyce used some of their growing wealth to invest in Silicon Valley startups. One history found that "over the course of just 20 years, a mere eight of Shockley's former employees gave forth 65 new enterprises, which then went on to do the same. The process is still going."[161]

Silicon Valley was built on many such startup-wealth-startup cycles. PayPal was founded by Peter Theil and five partners in 1998. The company went public in 2001 and was acquired in 2002, which made company investors and some employees rich. With his wealth, Theil became a Silicon Valley superangel, and he was an early investor in Facebook, Airbnb, LinkedIn, Spotify, and Yelp. Theil has also founded numerous companies and nonprofit ventures. Other PayPal employees, including Elon Musk, went on to found dozens of companies, a network called the "PayPal mafia."

"Angels, usually in conjunction with venture capitalists, fund high-growth startups that expand into large companies and inject competition and innovation into markets."

Historically, other regions had their heyday as innovation hubs and had similar wealth-driven growth cycles. Naomi Lamoreaux, Margaret Levenstein, and Ken Sokoloff studied the business networks in Cleveland during 1870–1920. Cleveland "played a leading role in the development of a remarkable number of second-industrial-revolution industries, including electric light and power, steel, petroleum, chemicals, and automobiles."[162] As with Silicon Valley, entrepreneurs in Cleveland made breakthroughs, gained wealth, and then reinvested locally in promising new ventures. Business growth snowballed through the city.

Lamoreaux and colleagues focused on Brush Electric, which was founded in 1880 by inventor Charles Brush and backed by wealthy local businesspeople. The company boomed from the success of its arc lighting systems. That success generated spin-off companies in electrical equipment, electric smelting, streetcars, electric automobiles, and other products. Lamoreaux and colleagues describe how Cleveland entrepreneurs relied on angels for financing, not banks or other institutions:

> One of the most striking features of the foregoing company histories is the limited role played by formal financial institutions, not only in the formation of the original Brush Electric Company, but also in the many startups and spinoffs that came out of this hub. The entrepreneurs who organized and promoted these new ventures secured investment capital largely by relying on personal connections.
>
> . . . [Investment in Cleveland's new enterprises] came primarily through local informal channels. Family and friends played a prominent role, as did upstream or downstream enterprises who had special reasons to encourage the development of complementary businesses. Other significant amounts came from business people in the local community who were eager to follow the example of those who had gotten rich from investing in cutting-edge technologies.[163]

A similar pattern emerged in other leading-edge industries of that era, including aviation and automobiles. There were hundreds of automobile startups in the first decade of the 20th century. In Detroit, the main source of financing for automobile startups was "local businessmen who had personal knowledge of the lead inventor or entrepreneur. It was not really until the 1920s that these enterprises turned to banks or public offerings of securities for additional infusions of capital."[164]

Steven Klepper studied the origins of Detroit's automobile industry. Many startups were spinoffs from prior firms. He found: "Experienced auto men not only founded the spin-offs but were also instrumental in their finance. Much like modern venture capitalists, they arranged financing for employee start-ups, and helped direct them."[165] What Klepper calls venture capitalists were actually angels and groups of angels.

He continues:

> The founders of the leading spin-offs were prominent men who had amassed some wealth, but generally not enough to finance their firms alone. Consequently, they had to seek finance elsewhere, mostly from wealthy

individuals, as few firms were able to attract finance from banks or investment bankers such as J.P. Morgan. . . . [I]ncumbent firms served as the breeding grounds for both employees who left to found their own firms and the men who helped finance these firms."[166]

Whether Cleveland or Detroit 120 years ago, or Silicon Valley today, technology hubs do not just include networks of entrepreneurs and engineers. They also include wealthy and experienced angel investors who are eager to take on the risks of helping new ventures get off the ground.

ANGELS AND INNOVATION

The largest factor producing rising living standards over the long term is technological progress and innovation, not simply the accumulation of capital.[167] To the extent that angel investors and venture capitalists help to launch and build companies that become major innovators, they have a large effect on long-term growth. This section discusses the role of angels in fueling innovative growth companies.

Angels and Growth Companies

At about $25 billion a year, angel investment seems relatively small, but it has an oversized effect on the U.S. economy. That is because angels, usually in conjunction with venture capitalists, fund high-growth startups that expand into large companies and inject competition and innovation into markets. Angels fund about 65,000 startups a year in the United States, which is about six times more than the number of companies funded by venture capitalists.[168]

Angel investment makes a difference to companies. In a statistical analysis of investments by 13 angel groups, Josh Lerner and colleagues found that "angel investors have a positive impact on the growth, performance, and survival of firms as well as their follow-on fundraising."[169] As noted, angels provide not just capital, but also guidance to entrepreneurs.

Angel investment nurtures potentially high-growth firms before the funding baton is passed to VCs. An expert at PitchBook noted, "Angel investors are a bedrock of the VC industry" and "angels are an integral component of the growth of VC ecosystems."[170] We do not know the exact share of VC-funded companies that have also received angel funding, but it appears to be roughly half or more. I researched the U.S. companies on a list of the "best VC bets of all time" and found that 65 percent had received angel funding.[171] I also researched the U.S. companies on a list of technology firms that did IPOs in 2020 and found that 52 percent had received angel funding.[172] Finally, I examined a list of U.S. technology companies with valuations of more than $1 billion from a 2018 study, and found that 54 percent were angel-funded.[173]

"We do not know the exact share of venture capitalist–funded companies that have also received angel funding, but it appears to be roughly half or more."

Several studies have examined the effect of VC-funded companies on the economy, which are suggestive of the impact of angel-funded companies because of the angel-VC overlap. Will Gornall and Ilya Strebulaev looked at 1,339 U.S. public companies that were founded between 1974 and 2014, and found that VC-backed firms accounted for 42 percent of the total number and 63 percent of the market capitalization.[174] The share of public companies that have been VC-backed has increased over time, and currently about two-thirds of IPOs are for VC-funded companies.[175]

Companies funded by venture capital are research-intensive. Among the 1,339 companies studied by Gornall and Strebulaev, VC-funded companies accounted for 85 percent of all research spending. Similarly, Jeremy Greenwood and colleagues found that VC-funded companies have higher research-to-sales ratios than other companies.[176] VC and angel funding allowed Moderna and BioNTech to sustain high research spending for years before earning any profits. BioNTech had losses 12 years in a row before it struck gold with its COVID-19 vaccine.[177]

Companies funded by venture capital are patent-intensive. In an analysis of 20 industries over a three-decade period, Samuel Kortum and Josh Lerner found that "increases in venture capital activity in an industry are associated with significantly higher patenting rates."[178] Similarly, the study by Greenwood and colleagues found that VC-funded

companies account for about one-third of all U.S. patents, and that share has been rising rapidly. That led the authors to conclude, "While the share of VC funding in total investment is still relatively small . . . its punch far exceeds its weight."[179] Paul Gompers and Josh Lerner called their book on the VC industry *The Money of Invention*.[180]

These studies show that VC-funded businesses are innovative. We also know that business innovation creates "positive spillover benefits that traverse across the globe," as Gornall and Strebulaev describe it.[181] How large are such spillovers? William Nordhaus explored that question by modeling U.S. business profits and productivity over a five-decade period. He concluded that "only a miniscule fraction of the social returns from technological advances over the 1948–2001 period was captured by producers, indicating that most of the benefits of technological change are passed on to consumers rather than captured by producers."[182] He found that businesses received only about 2 percent of the benefits from their innovations, with the rest accruing to consumers.

Two historical innovations illustrate Nordhaus's estimates. Western Union paid Thomas Edison $10,000 for his invention of the telegraph quadruplex. The device quadrupled telegraph wire capacity and saved Western Union $500,000 in construction costs for new telegraph lines.[183] Thus, Edison's profit was just 2 percent of the cost savings created by his invention.

Similarly, inventor Michael Pupin sold AT&T a patent in 1900 for "loading coils," which greatly improved long-distance telephone transmission. The technology was estimated to reduce AT&T costs by $100 million over 25 years, yet Pupin received just $255,000 for his patent.[184] One technology historian called the advancement "the single most important invention" in the telephone's first 40 years, yet the inventor received just a small share of the benefits.[185]

Recent advances in smartphones, biotechnology, and other industries will likely have similarly large spillovers. Consider Moderna and BioNTech again. Their mRNA progress will spur long-term benefits to medicine far beyond COVID-19.[186] Already, numerous companies are aiming to create mRNA vaccines for influenza, which are expected to be cheaper and more effective than current flu vaccines.[187] Also, BioNTech announced that it will build on its mRNA advances to develop more-effective shots against malaria and tuberculosis.[188] Those two diseases together kill more than a million people every year.

Disruptive Innovation

In his research, former Harvard Business School professor Clayton Christensen highlighted the importance of disruptive innovations, which are new products or technologies that often start in niche markets but end up displacing existing businesses and industries.[189] Disruptive innovations are major advances, and they are usually pioneered by new companies.[190] In his 2019 book on entrepreneurs and economic growth, Arthur Diamond concluded, "Major breakthrough innovations almost always arise from individual entrepreneurs or small startup firms rather than from the research and development labs of large incumbent firms."[191]

Established companies tend to focus on growing their current markets and can miss shifts in tastes and technologies that startups stumble upon and exploit. In their book on the importance of VC-funded startups, Gompers and Lerner note that "most large, mature corporations tend to look at their existing lines of business when choosing projects to fund. Technologies outside the firm's core market, or projects that raise internal political tensions, often get shelved."[192]

"Established companies tend to focus on growing their current markets and can miss shifts in tastes and technologies that startups stumble upon and exploit."

IBM dominated the mainframe computer market in the 1960s and 1970s but was slow to recognize the shift to minicomputers, which were pioneered by Digital Equipment Corporation (DEC) and other new firms. Then both mainframe and minicomputer firms initially missed the shift to personal computers pioneered by Apple and other startups in the late 1970s. Then Apple and IBM initially missed the shift to portable computers pioneered by Compaq in the 1980s. DEC, Apple, and Compaq were funded variously by angels and venture capitalists.

In his research, Christensen found similar patterns of disruption by new companies in many industries, including disk drives, steel mills, retailers, motorcycles, ships, transistor radios, and construction equipment. This pattern goes back

more than a century. Lamoreaux, Levenstein, and Sokoloff found, "New firms . . . provided much of the technological leadership in second-industrial revolution industries," meaning the new industries of the late 19th century.[193]

Consider the telephone. At the time of Bell's invention in 1876, Western Union dominated the telegraph market and was in the best position to invent the telephone. But Western Union did not invent the telephone, nor did it realize its potential. Western Union's president described the new device as a "toy" and rejected Bell's initial offer to sell him the patent rights.[194] That was not an uncommon view. A journalist wrote in 1883 that the issuance of Bell's patent initially "attracted little or no attention in the telegraphic world. The inventor was practically unknown in electrical circles, and his invention was looked upon, if indeed any notice at all was taken of it, as utterly valueless."[195] It is a good thing that Bell and his angel investors did not listen the naysayers and forged ahead.

"Technology has reduced the costs of startups in recent decades, helping them compete with big corporations."

The pattern of disruptive innovations continues today. Ridesharing was pioneered by startup Uber, not existing taxi companies. Uber was founded in 2009 by Garrett Camp and Travis Kalanik. Camp put $220,000 into Uber, which he had earned from building StumbleUpon, a social networking site.[196] Other angels and VCs kicked in $1.6 million to Uber at an early stage.[197] Uber has about 100 million users today.

Homesharing was pioneered by startup Airbnb, not existing hotel companies. Airbnb was launched in 2008 by a group of young friends, Brian Cheskey, Joe Gebbia, and Nate Blecharczyk, and funded by credit cards and their profits from a business selling novelty cereal boxes.[198] The company received an equity investment and guidance from Silicon Valley accelerator Y Combinator. Airbnb struggled at first, but through trial and error it eventually took off and has about 150 million users today.

The leading electric vehicle (EV) company in America is Tesla, not any of the major car producers. Tesla was founded in 2003 by Martin Eberhard and Marc Tarpenning, who had gained wealth from creating an early ebook reader. The key angel investor was Elon Musk, who put in $6.5 million in 2004 and became Tesla's chairman. Musk had gained wealth from a software company he cofounded in 1995 and sold in 1999. He took those profits and cofounded an online financial company that turned into PayPal, which was sold to eBay in 2002.

Tesla currently has more than half of U.S. electric vehicle sales, which is remarkable given the huge research budgets of the major car producers. Angels and VCs have funded numerous other electric vehicle startups, including Canoo, Fisker, Faraday Future, Lordstown Motors, Lucid Motors, and Rivian Automotive. Some of these companies may fail or not live up to promises, but it is impressive that investors have been willing to fund them given the tough competition from Tesla and the major producers.

Along the lines of Tesla, Uber, and Airbnb, CNBC publishes a list of top "disruptive" startups that are launching "attacks on the status quo in many industries," including financial services, health care, logistics, energy, and consumer products.[199] Will these attacks succeed? Startups have some advantages over big corporations.[200] They often begin in niche markets that large firms ignore because they do not seem to offer substantial profits. Yet niches can turn into whole new industries, as we saw with personal computers, which started as a hobbyist activity.

Startups are more flexible than large firms in exploring new markets and technologies by trial and error. They act first and then change course as they receive feedback. By contrast, large companies tend to have "soft budget constraints" and bureaucratic incentives that make it harder to change course on failing projects.[201] Startups also tend to have fewer rules and less built-in risk aversion than big firms.

Finally, startups have numbers on their side. Many new firms pursuing different paths are more likely to stumble upon breakthroughs than a few big firms or government agencies. This is one reason why the funding that startups receive from a vast diversity of 335,000 angels provides strength to the U.S. economy.

Technology has reduced the costs of startups in recent decades, helping them compete with big corporations. The personal computer revolution of the 1980s and internet revolution of the 1990s gave small businesses the information advantages of big businesses. The costs of operating businesses and

performing research have fallen further because of cloud computing, internet marketing, open-source software, computer simulation, three-dimensional printing, and other developments.[202] The "introduction of cloud computing services by Amazon is seen by many practitioners as a defining moment that dramatically lowered initial costs of internet and web-based startups."[203] As for marketing, the Dollar Shave Club disrupted the shaving industry with the help of a successful viral video that cost just $4,500 to make.[204]

"America has been a leader in many technology industries for decades, and high levels of risk capital flowing to entrepreneurs have played a crucial role in the nation's success."

Even the costs of nuclear fusion research have plunged, which has prompted two dozen startups to explore this energy source. While governments used to spend billions of dollars on fusion research, today "advances in computing, precision machinery and synthetic materials have allowed scientists to design reactors a fraction of the size and cost of those just a few years ago. Lower price tags have put fusion within reach of private investors, allowing ventures to sprout."[205] The funding for nuclear fusion startups is coming from venture capitalists and angel investors, including Bill Gates and Jeff Bezos.

The rise of smartphones, data mining, and other advances have led to swarms of fintech startups trying to undermine big banks and financial services companies:

- Chime and other "neobanks" provide basic account services with low fees and smartphone access. Chime was founded in 2012 with $3.75 million of angel funding and has 10 million customers.[206]
- Fair was founded in 2021 by Khalid Parekh with $20 million of angel funding to provide banking services to underserved immigrant communities.[207]
- Square is a digital payments company that has simplified retail point-of-sale processing and expanded into other business financial tools. The company was cofounded by Twitter cofounder Jack Dorsey and has received large angel and VC investment.
- Dave is a money management app with a loan facility that cuts bank overdraft fees for users. CNBC noted that Dave "is designed to eliminate many of the features customers can't stand about legacy banks."[208] Billionaire Mark Cuban invested $3 million in the company and sits on the board.
- Fundbox and other startups are reducing small business costs for borrowing, payments, and cash management, which has been a "boon to hair salons, bakeries and other small businesses that don't qualify for bank credit."[209] A Harvard Business School study noted, "as banks of all sizes have moved away from small firms and small dollar loans, new entrepreneurs have entered the field and used innovative approaches to fill the gap."[210]
- Robinhood was the first company to provide commission-free stock trades. It wants to "provide everyone with access to the financial markets, not just the wealthy."[211] The company received $3 million of early funding from venture capitalists and angel investors, including Tim Draper and Howard Lindzon.[212]
- SoFi is trying "to crack open one of Wall Street's oldest clubs: those getting distribution of IPOs at the offering price, before shares begin trading."[213] The company proclaims "everyone should have access to the uncapped upside potential of IPOs. Not just institutional investors."[214] SoFi was funded by angel Ron Suber, who has invested in more than a dozen fintech startups.
- Affirm "seeks to cut credit card companies out of the online shopping process by offering a way for consumers to secure immediate, short-term loans for purchases."[215] Affirm was cofounded in 2012 by PayPal cofounder Max Levchin, who raised $45 million in a first round of venture funding.[216]
- Hippo and other startups are invading the insurance industry. Hippo was founded in 2016 and received funding from a family office, angels, and VCs.[217] The company aims to improve home insurance with better data analysis and satellite photos.[218]

Some of these startups may not succeed, but consumers are benefiting from all the new competition. Fintech companies aim to cut fees and tap underserved markets,

and they "are clearly disruptors from a Clay Christensen point of view," noted the Harvard Business School study.[219] Christensen found that established companies often overlook downmarket consumers, which creates space for lower-cost startups to enter markets.[220]

History is replete with entrepreneurs who struck it rich by finding better ways to serve the poor. In their history of Western economies, Nathan Rosenberg and L. E. Birdzell Jr. found that "the West's system of economic growth offered its largest financial rewards to innovators who improved the life-style not of the wealthy few, but of the less-wealthy many."[221] Henry Ford innovated to slash the price of his Model T from $825 in 1908 to just $290 by 1927.[222] Ford was a great entrepreneur, but he needed a wealthy angel investor to help him launch his company.

ANGEL INVESTMENT AND PUBLIC POLICY

The U.S. economy is admired for its dynamism and innovation. America has been a leader in many technology industries for decades, and high levels of risk capital flowing to entrepreneurs have played a crucial role in the nation's success. Angel and venture capital investment is much larger in the United States than in other high-income countries.[223]

This section discusses regulatory and tax policies that affect flows of funding to startup businesses. Rigged industries have entry barriers that undermine the ability of entrepreneurs to raise money and challenge incumbents. Financial regulations affect the breadth of capital available for investing in startups. And tax policies affect investor incentives to take on the large risks and burdens of funding startups.

Opening Rigged Industries

Sen. Elizabeth Warren (D-MA) complained that "monopolists dominate our economy" and that the wealthy want to "keep the system rigged for themselves while opportunity slips away for everyone else."[224] Indeed, some industries have been "rigged" by government regulations that protect incumbent businesses from competition at the expense of consumers.[225] But America has always had entrepreneurs and wealthy angels eager to challenge entrenched companies and the regulations that protect them.

The classic case is MCI Communications' battle to undo AT&T's telephone monopoly from the 1960s to the 1980s.[226] AT&T provided mediocre customer service, was slow to adopt new technologies, and strongly defended its turf against market entrants.[227] MCI founder John Goeken teamed with millionaire Bill McGowan in 1968, and with McGowan's leadership and investment in the company, they challenged AT&T.

The federal government required AT&T to provide universal service, which was used as justification for keeping long-distance rates artificially high in order to subsidize local phone service. This structure created an opportunity for MCI to enter the long-distance market and undercut AT&T's prices. At the same time, AT&T restricted other companies from access to its local exchanges and barred anyone from attaching non-AT&T equipment to its system.

"America has always had entrepreneurs and wealthy angels eager to challenge entrenched companies and the regulations that protect them."

The AT&T monopoly began to crack with the 1968 Carterphone decision by the Federal Communications Commission (FCC), which allowed outside equipment to be attached to the phone system. That was followed by a long legal battle between MCI and AT&T, beginning with MCI's application for a license to use a microwave system for business-to-business long-distance services, which the FCC granted in 1969. Economist Robert Crandall noted how McGowan continued to push the FCC and AT&T during the early 1970s: "He knew that the FCC had kept AT&T's long-distance rates obscenely high in order to subsidize its local residential rates, and he wanted a piece of the much larger general long-distance market. In the 1970s, he simply began to offer this service without the FCC's permission."[228]

With momentum for reform, MCI was able to start raising millions of dollars from private investors, followed by proceeds from a 1972 IPO.[229] The company launched an antitrust suit against AT&T in 1974 and lobbied to gain full access to local exchanges. The federal government launched a parallel

antitrust suit against AT&T, which ended in a settlement in 1982 that broke up the AT&T system and opened the door to full long-distance competition.[230] With the legal uncertainty out of the way, MCI was able to raise $1 billion from high-yield bonds to make huge network investments. MCI cut consumer prices, pursued new technologies, and remade the telecommunications industry. Also worth noting is that the next revolution in telecommunications—cell phones—was also delayed by barriers to entry.[231]

Around the same time MCI was battling to enter long-distance markets, FedEx was dealing with regulations blocking its attempt to expand into the package delivery industry with overnight service. A young Fred Smith launched FedEx in 1971 based on an idea he wrote about during college. To finance the purchase of planes and trucks, Smith and his family invested about $8 million, and after a struggle he lined up venture investments and bank loans of about $50 million by 1973.[232] At the time, an oligopoly of delivery firms, protected by regulations, provided generally poor service. Smith faced restrictions imposed by the Civil Aeronautics Board (CAB) and the U.S. Postal Service. He reminisced to the *New York Times*, "People thought we were bananas" to take on all the market and legal challenges.[233]

FedEx had a bumpy ride the first few years, losing money and being turned down by the CAB to buy the larger jets it needed. Then, in 1977, Congress deregulated the air cargo industry, and FedEx was able to buy larger jets.[234] As the company's prospects brightened, it was able to raise cash for expansion from public equity markets. In 1979, the U.S. Postal Service—under political pressure—liberalized its monopoly over letters, which allowed FedEx to expand into "extremely urgent" overnight letters.

Air cargo deregulation in 1977 was followed by passenger airline deregulation in 1978. Previously, the CAB had limited airline entry, controlled routes, and micromanaged fares. The regulations produced bloated airline costs and high prices. Entrepreneurs might have tried to raise money and challenge the major airlines, but the uncertainty of CAB approvals would have undermined investor interest. Prior to deregulation, no new carriers had entered the national airline market for decades.[235] At its founding in 1967, low-cost carrier Southwest Airlines had to battle litigation from incumbent airlines for three years before gaining the regulatory approval to operate flights within Texas.[236]

Airline deregulation changed all that. One of the first airlines to enter was People Express, founded by airline industry veteran Donald Burr.[237] Burr sold his car, house, two condos, and drained his savings to put $350,000 into launching People Express in 1980.[238] Former business colleagues Gerald Gitner and Melrose Dawsey joined him and personally invested $175,000 and $20,000, respectively. Citibank Venture Capital invested $600,000, and then People Express raised $25 million in an IPO. The airline boomed in the early 1980s, driving down prices and changing the industry, but it later got into financial trouble and was acquired in 1987.

Investment banker Bill Hambrecht helped finance People Express and other upstart airlines in the 1980s. He shared Burr's view about challenging the "plutocrat" airlines and helping "small rivals to provide the public—especially those who, in the post-deregulation era, live in underserved markets—with better and cheaper service."[239] Perhaps the most successful low-price startup has been JetBlue, which was founded in 1999 by David Neeleman with $130 million in funding from venture capitalists and angel investor George Soros.[240] With startups injecting competition into the airline industry, real median fares fell almost 40 percent between 1980 and 2005.[241]

"In recent years, angel-funded startups have challenged incumbent firms and anti-competitive regulations in many industries."

Two new airlines launched in 2021: Breeze Airways and Avelo Airlines. Neeleman launched Breeze with $17 million of his own money and $83 million from angels and venture capitalists.[242] The two airlines will offer low-cost direct flights to underserved markets. One aviation specialist said, "Avelo and Breeze will be two new disruptors, promising friendly service, low fares, and flights on many routes that have limited or no current nonstop service."[243]

In recent years, angel-funded startups have challenged incumbent firms and anti-competitive regulations in many industries. Uber has fought regulations protecting taxicab oligopolies in city after city in its effort to reduce ride prices and

improve convenience. Airbnb has battled hotels that lobby to thwart the expansion of home rentals.[244] Tesla has battled state restrictions that limit new vehicle sales to independent dealerships and restrict direct-to-consumer sales.[245] Tesla uses various workarounds for these outdated laws.

When governments deregulate, capital flows to entrepreneurs. A 2020 study by Liya Palagashvili and Paola Suarez looked at 19,585 tech-driven startups in the United States and Canada across numerous industries. Their results "suggest that more regulated industries may exhibit lower rates of entry and that more regulated industries are associated with a greater likelihood of a startup closing."[246] They interpret their findings as showing that it may be easier for firms in industries with lighter regulation to attract risk capital.

"Angel investment occurs within a complex regulatory environment."

Deregulation has increased competition in numerous industries, but more reforms are needed. In aviation, the reforms of the 1970s opened entry to new airlines, but dominant airlines have continued to use their clout to restrict competitors from access to airport facilities.[247] In the beer industry, federal and state deregulation during the 1970s and 1980s allowed thousands of craft brewers to challenge the oligopoly of big producers, but today state distribution systems continue to favor big breweries over small ones.[248] Craft brewers in North Carolina call the beer regulatory system "rigged," which is the word that Senator Warren likes to use.[249]

In health care, federal and state policymakers relaxed barriers to telehealth during the pandemic, which prompted VC flows to telehealth startups to jump 70 percent in 2020 over 2019.[250] For example, telehealth firm Hinge Health was launched in 2016 with a $500,000 investment from the cofounder, and with the recent policy reforms the company was able to raise $300 million in venture capital.[251] However, numerous types of regulation continue to undermine entrepreneurship in health care, such as certificate-of-need rules in 34 states that restrict entry and investment.[252]

Regulatory barriers to market entry are a very broad topic. The narrower focus here is to suggest that investment will flow to startups eager to challenge incumbents when entry barriers are reduced. As such, policymakers worried about the market power of big corporations should reduce regulations and allow well-funded entrepreneurs to undermine that power.

Regulating Angel Investment

Angel investment occurs within a complex regulatory environment. The federal government imposes rules on private investment in startups, and it imposes regulatory burdens on public companies that can make it more difficult for angels to exit investments. Some investment rules have been liberalized in recent years, but further reforms are needed.

Equity investments in startups have long been limited to accredited investors. Under Securities and Exchange Commission (SEC) Rule 506 of Regulation D, these investors are generally individuals with annual incomes of more than $200,000, or at least $1 million in wealth aside from the value of their primary residences, although other individuals may also qualify. Private companies may receive funding from accredited investors with no dollar limit and without providing detailed disclosures. The idea is that accredited investors do not need government coddling.

However, the rules have reduced the ability of non-accredited (non-wealthy) Americans to invest in private businesses, including startups. That limits the capital available for startups and is unfair to the extent that private markets offer higher returns than public markets.[253] Arguing for repealing the accredited investor rules, angel Charles Sidman noted that "removing arbitrary and wealth-based legal barriers to economic opportunity is profoundly democratic."[254] In other words, repealing the rules would level the playing field for investors.

Former SEC chair Jay Clayton expressed a similar concern: "Because it is generally difficult and expensive for Main Street investors to invest in private companies, they will not have the opportunity to participate in the growth phase of these companies to the extent they choose not to enter our public markets or do so only later in their life cycle."[255]

Previously, most of the increase in value in technology companies occurred in public markets because IPOs were earlier in company growth cycles, but today larger appreciation often occurs prior to IPOs. With that in mind, a U.S. Treasury report noted, "To the extent that companies decide not to go public due to anticipated regulatory

burdens, regulatory policy may be unintentionally exacerbating wealth inequality in the United States by restricting certain investment opportunities to high income and high net worth investors."[256]

Another issue is that the accredited-investor rules do not ensure that only knowledgeable people pursue risky private investments. The rules mean that a wealthy doctor who knows nothing about mining can invest in a mining startup, but a nonwealthy mining engineer cannot.[257] Former SEC official Andrew Vollmer argued, "SEC's definitions necessarily engage in drawing fine lines between different types of investors and inevitably end up with arbitrary and irrational distinctions."[258] Vollmer concludes that the accredited-investor rules should be scrapped, as does the Cato Institute's Jennifer Schulp.[259]

The Jumpstart Our Business Startups (JOBS) Act of 2012 liberalized the rules for startup investing in several ways.[260] The act repealed a prohibition on startups using general solicitation to raise unlimited capital from accredited investors under Regulation D, Rule 506(c). And the act liberalized the Regulation A exemption to allow mini public offerings of up to $50 million, although it limited the ability of nonaccredited investors to participate in them.

The JOBS Act also legalized equity crowdfunding. Internet crowdfunding sites, such as Kickstarter, had allowed people to donate to activities such as arts projects or to prepay for upcoming products, but they did not allow equity investments. The JOBS Act changed that, allowing nonaccredited investors to invest through online portals, although within limits related to a person's income and wealth. Startups can now raise up to $5 million annually through such portals.

These reforms have broadened funding options for startups. Crowdfunding can "serve as a training ground" for investors who later become major angels.[261] Also, crowdfunding can help to de-risk startups to prepare them for later angel and VC funding. Crowdfunding can make financing available for a more diverse range of entrepreneurs.[262] In 2020, about $17 billion was raised in North America from crowdfunding of all types, although only a fraction of that was equity crowdfunding.[263]

Crowdfunding does not replace traditional angel investment. As discussed, wealthy angels provide not just funding, but also mentoring and networking support for entrepreneurs. Also, crowdfunding has downsides, such as opening a startup to negative publicity from small investors if things do not go as planned. Nonetheless, crowdfunding is a useful addition to funding options for entrepreneurs.

Angel investment is affected by the costs of going public in an IPO because that is one way that angels (and VCs) can exit their investments. One study across 14 European countries compared levels of investment to the ease of going public and found that "the opening of stock markets targeted at entrepreneurial companies positively affects the shares of early stage and high-tech venture capital investments."[264]

"Crowdfunding can 'serve as a training ground' for investors who later become major angels."

Unfortunately, the regulatory costs of going public have increased in the United States, which has been one factor in the declining number of public companies. The number of public companies fell from 7,322 in 1996 to 3,643 in 2019.[265] There was an average of 205 IPOs a year in the 1980s and 409 a year in the 1990s, but then just 126 a year over the past 21 years, although the number jumped in 2020 and 2021.[266] Growing companies are staying private longer before going public, with the result that the typical age of companies at their IPO increased from 4 years in 1996 to 11 years today.[267]

The Sarbanes–Oxley legislation of 2002 increased regulatory costs for public companies and may have dissuaded firms from going public.[268] The legislation appears to have raised costs for smaller companies relatively more than for larger companies.[269] Congress partly mitigated the damage with provisions in the JOBS Act to lighten compliance burdens for "emerging growth companies." These companies, which have annual revenues of less than $1.1 billion, are subject to fewer disclosures and reporting requirements for the first five years after an IPO.[270] Today, 90 percent of companies that go public are in this emerging growth category.[271]

Some market developments have made the process of going public easier in recent years.[272] One is direct listings or direct public offerings (DPOs), which reduce the lawyer and banker fees of going public and reduce the time burden imposed on company leaders from the IPO process. Spotify's

DPO in 2018 put this strategy on the map. The purpose of DPOs is not so much to raise money but to provide an exit for investors, including entrepreneurs, angels, and VCs.

Another development is the Special Purpose Acquisition Company (SPAC), which is a company that goes public as a shell and then finds private companies to acquire. It reduces regulatory costs because a SPAC IPO involves little in the way of business disclosures, and the acquisition of private companies may not be subject to the same disclosure rules. Virgin Galactic went public in 2019 through a SPAC. Special Purpose Acquisition Companies have been around for years, but their popularity has recently soared, with the number jumping from 59 in 2019, to 248 in 2020, and to more than 300 half way through 2021.[273] However, the SPAC wave may have recently crested and begun to fall.

The main exit for angels, entrepreneurs, and VCs is an acquisition by an established company. There are many more acquisitions than IPOs these days. For VC-funded companies, the share of all exits has shifted from about 80 percent by IPO in the 1980s to only 10 percent today, while the share by acquisition has increased from about 20 percent in the 1980s to 90 percent today.[274]

A disadvantage of acquisitions is that they may contribute to the dominance of large companies in the marketplace. Large technology companies, including Apple, Microsoft, Google, Facebook, and Amazon, each make numerous acquisitions each year.[275] Members of both parties in Congress worry about the power being exercised by large corporations. But federal rules that raise the costs of going public may be partly to blame by inducing startups to favor being acquired over listing as independent public companies.

Some policymakers favor antitrust enforcement to restrict or break up large companies, but antitrust interventions have a poor track record.[276] Instead, policymakers should reduce the regulatory costs of public companies and further liberalize the rules for investment in private companies to encourage entrepreneurial activity and flows of risk capital to startups.[277]

Taxing Angel Investment

Over the past century, Congress has nearly always kept effective tax rates on individual long-term capital gains below the rates on ordinary income. There are numerous reasons for this special treatment of capital gains. The first is inflation: if an investor buys a stock for $100 and sells it years later for $120, some portion of the $20 gain represents inflation and not a real return. A reduced capital gains tax rate is a rough way to correct this problem.

A second reason is that capital gains are highly responsive to taxation because capital is mobile and because gains are taxed on a realization basis. Higher capital gains tax rates would shrink the tax base substantially and possibly reduce tax revenues. The revenue-maximizing capital gains tax rate is 28 percent or less, meaning that the government would lose revenues by raising the rate higher than that.[278]

A third reason is the double taxation of corporate equity under the income tax. Equity is taxed at the business level by the corporate income tax and taxed again at the individual level by taxes on capital gains and dividends. By contrast, interest income is only taxed at the individual level. The result is that our tax code is biased against equity and in favor of debt, which may induce corporations to overleverage and, in turn, reduce their stability during downturns.

A fourth reason for keeping capital gains taxes low is the importance of gains as a spur to investment in startups and growth companies, particularly technology companies. A capital gain is the financial reward for the efforts, risks, and patience that entrepreneurs and angels put into potentially high-growth startups that end up succeeding.

"A fourth reason for keeping capital gains taxes low is the importance of gains as a spur to investment in startups and growth companies, particularly technology companies."

The top federal tax rate on long-term capital gains is 23.8 percent, which includes the basic rate of 20 percent plus a 3.8 percent net investment income tax. Including state taxes, the average U.S. capital gains tax rate is about 28 percent. That is higher than the 19 percent average rate among nations in the Organisation for Economic Co-operation and Development (OECD).[279]

The Biden administration is proposing to raise the capital gains tax rate from 23.8 to 43.4 percent for households with incomes above $1 million.[280] With state capital gains taxes, the average top federal-state rate would be 48 percent, or more than double the average OECD rate.[281] The Biden effort runs counter to a decades-long bipartisan consensus that keeping a low capital gains tax rate is important to innovation and economic growth.

The modern era of startup investing began in the late 1970s, spurred by two key policy changes. One was the 1979 relaxing of the "prudent man" rule allowing pension funds to allocate a larger share of their portfolios to riskier assets. The passing of the 1974 Employee Retirement Income Security Act had initially resulted in a conservative interpretation of the rule, which generally precluded pension fund investment in venture capital. With the 1979 reform, pension funds began allocating more cash to venture capital.

The other change was the slashing of the federal long-term capital gains tax rate. The Revenue Act of 1978 cut the top effective capital gains tax rate from 49 percent to 28 percent, and then the Economic Recovery Tax Act of 1981 cut the rate to 20 percent.[282] These reforms reversed the capital gains tax increases of the late 1960s, which were partly blamed for the low ebb of venture investment during the 1970s.[283]

Venture capital investment boomed after these reforms, quadrupling between 1980 and 1983 and continuing to grow after that.[284] The volume of angel investment during that period is unknown, but the capital gains tax cut would have increased angel investment incentives in parallel with VC incentives. That era saw flows of angel and VC investment into technology companies that reshaped the U.S. economy, such as Apple Computer, Compaq, Adobe, and Genentech.

Former Democratic senator Lloyd Bentsen of Texas was a key supporter of both the capital gains tax cut and the prudent-man reforms of the 1970s.[285] With taxes and regulations squelching the flow of startup capital at the time, Bentsen argued that without reforms, "we may never know how many potential Xeroxes or Polaroids have failed to get started."[286] At a June 1978 Senate hearing on the proposed tax cut, Bentsen said:

> This country has prospered because we have had a free enterprise system that has encouraged the entrepreneur, the small businessman, to take a risk with the understanding that he was going to be able to keep some of it if he won. We have not succeeded as a nation by playing it safe. Today, the risks of starting a new business are as high as ever, but the rewards are even less with our tax system.[287]

The 1978 capital gains tax cut had bipartisan backing in Congress, and it gained support from leading economists, such as Martin Feldstein, as well as leaders in Silicon Valley, such as Robert Noyce.[288] The cut was known as the Steiger Amendment, after Republican congressman William Steiger. The *Washington Post* editorialized in 1978: "The wild popularity of the Steiger amendment among the Democrats in Congress is a remarkable phenomenon. The Steiger amendment, you will recall, cuts capital-gains taxes for a small number of citizens, most of whom roost comfortably on the top rung of the income ladder."[289]

"With high capital gains taxes, potential entrepreneurs are less inclined to start businesses."

The capital gains tax rate was raised in 1986, but that prompted calls to cut it again, which happened in a bipartisan package in 1997. Leading up to the 1997 cut, Federal Reserve chair Alan Greenspan testified: "I think while all taxes impede economic growth to one extent or another, the capital gains tax, in my judgment, is at the far end of the scale. And so, I argued that the appropriate capital gains tax rate was zero."[290] The 1997 law signed by President Bill Clinton reduced the rate from 28 percent to 20 percent. Unfortunately, that sort of bipartisan consensus in favor of low capital gains taxes has broken down in recent years.

There are at least three effects of capital gains taxes on startups and growth companies.[291] First is a supply-side effect. With high capital gains taxes, investors are less willing to fund risky but potentially high-growth companies, instead favoring investments paying dividends or interest, such as tax-exempt municipal bonds.[292] Funds for VC investment come from numerous sources, each of which faces a different tax situation, including individuals, family

offices, corporations, pension funds, university endowments, and foundations. By contrast, angel investment comes from wealthy individuals, who are generally fully taxable at high marginal rates.

Second is a demand-side effect. With high capital gains taxes, potential entrepreneurs are less inclined to start businesses. An important financial return for the hard work, risk taking, and patience needed to launch a startup is the possibility of a capital gain five or more years down the road. Potential entrepreneurs compare wage employment with the possible payoff from a startup and the related capital gains tax burden.

"The capital gains tax is a 'success tax' because 'the government taxes the upside returns to investment but does not share symmetrically in projects that fail.'"

A third effect of capital gains taxes relates to the need of startup companies—particularly in technology industries—to attract highly skilled workers. Technology startups are usually cash-poor and often do not earn net returns for years after launch, yet they need to attract talented workers to compete with established corporate giants. One solution is to offer workers stock options, which pay off if a company succeeds and its valuation rises.[293] Three-quarters of VC-backed companies in the United States use stock options for their employees.[294] Such companies also use restricted stock awards and restricted stock units as equity-based compensation.

The taxation of stock options is complex, but the basic tax-planning goal for employees is to subject their gains to capital gains tax rates rather than ordinary income tax rates and the alternative minimum tax.[295] If the government were to raise capital gains taxes, it would reduce the ability of growth companies to attract top talent. The National Venture Capital Association called a proposed tax hike on stock options "an existential fight for the entrepreneurial business model."[296]

The capital gains tax is a "success tax" because "the government taxes the upside returns to investment but does not share symmetrically in projects that fail."[297] Capital gains are taxable, but net capital losses can generally only be deducted up to $3,000 annually against ordinary income. Numerous empirical studies have found that this success tax affects investment flows:

- A 2010 study by William Gentry measured the effects of state-level capital gains taxes on VC investment from 1969 to 2007. He found that "higher capital gains tax rates are associated with less venture capital funding flowing into a state."[298] Gentry interprets the findings as a demand-side effect: entrepreneurs are discouraged from starting high-growth businesses in states that have high capital gains taxes.
- A 2013 study by Alexander Popov and Peter Roosenboom looked at VC investment across 21 European countries from 1998 to 2008. They found that "venture capital investment has a stronger effect on new business creation in countries with lower taxes on capital gains."[299]
- A 2015 OECD study on financing young innovative companies summarized the academic literature, stating that "Capital gains tax is an important factor that shapes the seed and early stage equity market as tax will influence the investment and exit decisions by angel investors and venture capitalists."[300]
- A 2017 study by Magnus Henrekson and Tino Sanandaji examined the relationship between VC funding and the tax treatment of stock options across 38 countries.[301] Controlling for various factors, they found that countries with lower capital gains taxation of stock options have higher VC investment than other countries.
- A 2018 study by Alexander Edwards and Maximilian Todtenhaupt examined U.S. VC funding for 13,431 companies from 2005 to 2016.[302] Their analysis used the fact that a 2010 law exempted VC investments in some industries, but not others, from capital gains taxes. Using this difference, they estimated that the tax exemption increased funding in eligible startup firms per funding round by 12 percent.
- A 2019 study by Carolin Bock and Martin Watzinger examined 61,558 VC funding rounds across 32 countries from 2000 to 2012. They found that "higher capital gains tax rates are associated with fewer start-ups financed and a lower probability of receiving

follow-up funding."[303] The authors surmised that "an increase in the tax rate leads to fewer companies obtaining sufficient financial means to expand their idea as planned and hence, presumably, to less innovation within the economy."[304]

- A 2019 study by Jeremy Greenwood, Pengfei Han, and Juan Sanchez presents a model of VC investment, capital gains taxes, and the economy.[305] Their results suggest that if a country raises its capital gains tax rate from 15 percent to 50 percent, it would trim about 0.2 percentage points from annual economic growth by undermining VC investment.

Studies on the investment effects of capital gains taxes focus on venture capital rather than angel investment because we have much better data on VC. But the negative effects of higher taxes would be at least as strong on angel investment as on VC.

Angels have numerous options for exiting their investments, each having different federal tax implications. Angels can sell their shares for cash and realize a capital gain that is immediately taxable. That may occur after an IPO or when a company is purchased by another company in a stock-for-cash deal, called a "cash acquisition."

Another way for angels to exit is a stock-for-stock buyout. In this case, angels receive shares of the acquiring company and can defer payment of capital gains taxes until selling the shares down the road.[306] This is a "tax-free acquisition," or "reorganization."[307]

Yet another alternative is an "asset acquisition," or "merger." In this case, a company buys the assets of a target firm, then the target firm (if a C corporation) pays tax on the sale of the assets and the company is dissolved. Angel investors then pay capital gains taxes on their stock in the target company. There are numerous variations on this alternative, and each has different tax implications for the target company's assets going forward.

In addition to these tax considerations, the federal tax code includes breaks enacted to encourage investment in startup businesses. Tax code Section 1202 allows individuals up to a 100 percent exclusion of $10 million of capital gains on qualified small business stock (QSBS).[308] The stock must be held for five years in a domestic C corporation that has less than $50 million in assets at the time the stock was issued and immediately thereafter. If you sell your QSBS investment before five years, Section 1045 allows a tax-free rollover into another qualified startup. Investors, entrepreneurs, and employees are eligible for these benefits. However, Congress excluded numerous industries from the benefits, including hospitality, mining, architecture, law, engineering, and financial services.

Tax code Section 1244 is also important for angels. Since most investments in startups fail, the tax treatment of investment losses is important. Usually, taxpayers are only allowed to deduct net capital losses up to $3,000 against ordinary income annually, but Section 1244 allows for up to $50,000 annually in losses on qualified small business stock to be applied against ordinary income. The Section 1244 benefits are restricted to the same qualified businesses as Section 1202.

Optimally, investments in all types of businesses would be treated the same by the tax code. But the fact that Congress has carved out Sections 1202, 1045, and 1244 indicates that policymakers appreciate that low capital gains taxes are important for startup financing. To simplify the code and avoid distortions, Congress should adopt a uniformly low capital gains tax rate for all types of investment. A handful of high-income nations have adopted not just low tax rates on long-term gains, but the Alan Greenspan approach of a zero rate.[309]

"To simplify the code and avoid distortions, Congress should adopt a uniformly low capital gains tax rate for all types of investment."

Unfortunately, that is not the direction the Biden administration and many Democrats in Congress want to go. Instead, they want to equalize the top capital gains tax rate with the top ordinary income tax rate. And some Democrats, including Senate Finance Committee chair Ron Wyden (D-OR), want to impose accrual or mark-to-market taxation on capital gains for higher-earning taxpayers.[310] That would mean taxing changes in asset values every year whether or not assets are sold—or put another way, ending deferral for capital gains.[311] Such treatment would raise effective tax rates, increase tax code complexity, and

generate liquidity problems because changes in wealth on paper do not mean that individuals have cash available to pay taxes. Accrual taxation would be particularly misguided for assets such as startups and growth companies that have fluctuating valuations. No other nation in the OECD uses an accrual approach for taxing capital gains because of its impracticality and anti-growth effects.[312]

If Congress were to raise capital gains taxes, it is not clear whether it would keep special breaks such as Section 1202 for startup investing. If the general capital gains tax rate was jacked up and breaks were retained, there would be huge pressure to cram a wide range of economic activities through the breaks. Also, the higher the general capital gains tax rate were raised, the more lobbying pressure there would be to add new breaks for favored industries and types of investments.

"Wealth plays a central role because it drives the rapid creation and expansion of new businesses. Each round of startups that succeed generates returns for investors and entrepreneurs, who plow their new wealth into the next round of startups."

On the other hand, if Congress raised the general capital gains tax rate, that might embolden members to take further tax-hike steps, such as eliminating Section 1202 or deferral. Many tax economists advising liberal policymakers view the ideal tax system as having a Haig-Simons base, meaning full accrual or mark-to-market taxation—that is, taxing everybody's paper wealth gains every year.[313] This left-of-center approach of high capital gains tax rates, taxation of paper gains, and imposing high taxes on startup investing would severely damage America's technology and innovation industries.

It is troubling that federal policymakers are considering tax changes that would undermine entrepreneurial finance. Today's large and successful companies that drive the economy, such as Apple, did not just happen. In the beginning, there was often a wealthy angel who took a huge financial risk on an unproven entrepreneur. Tax policies should not create a barrier to such socially beneficial activity. Policymakers should strive for simple, uniform, and low taxation of capital gains.

CONCLUSION

This study examined the important role played by wealthy individuals in providing funding and guidance to startup businesses. With their independent pools of capital, angel investors support a large variety of promising startups that explore new goods, services, and technologies that existing businesses overlook. Many of the greatest successes in U.S. business history got off the ground with the help of wealthy angel investors.

Angel-funded startups generate competition. Many startups today are disrupting markets and challenging dominant companies in medicine, financial services, energy, automobiles, space travel, and other industries. The best check on corporate power is exposing industries to vigorous competition from well-funded startups.

The role of policymakers should be to foster an open and competitive environment allowing capital to flow to growth-oriented startups. Policymakers should continue liberalizing rules for investing in private companies, and they should reduce the costs of going public so that growing companies do not face barriers in pursuing initial public offerings.

Policymakers should repeal regulations that favor incumbent businesses over startups. Past reforms to industries such as telecommunications, package delivery, beer, and aviation illustrate how capital-fueled entrepreneurs will challenge dominant companies when regulatory barriers are reduced. But more federal and state reforms are needed in many industries to allow startups to compete on a level playing field with established businesses.

Policymakers should keep capital gains taxes low. Capital gains are the financial reward for the efforts, patience, and high risks of funding growth-oriented businesses. The Biden administration proposal to raise the top capital gains tax rate is misguided, especially since the U.S. rate is already higher than the OECD average. Proposals to tax gains on a mark-to-market or accrual basis would further raise effective tax rates and be a radical approach that is not followed by other nations.

All policymakers agree that America should be a global leader in technology. But they should recognize that technology hubs such as Silicon Valley are more than just groups of scientists and entrepreneurs. Wealth plays a central role because it drives the rapid creation and expansion of new businesses. Each round of startups that succeed generates returns for investors and entrepreneurs, who plow their new wealth into the next round of startups.

Higher capital gains taxes would starve cash from this virtuous growth cycle and undermine productive incentives. Without beneficial capital gains tax treatment, technology entrepreneurs would rather take salary jobs, investors would move their funds to safer assets, and employees lured to startups by stock options would instead favor big corporations.

In sum, policymakers should adopt tax and regulatory policies that are supportive of America's dynamic startup culture, which has spawned so many great companies and advances over the decades.

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