Digitizing the Old Economy

SPARKLINE CAPITAL

March 2023

Kai Wu

Founder & Chief Investment Officer

kai@sparklinecapital.com

Executive Summary

Old Economy stocks trade at low valuations due to the perception that they are being disrupted. In reality, tech hiring data show that many Old Economy firms are embracing digitization. Stocks of these Early Majority firms have outperformed. Big tech layoffs may accelerate technological diffusion, unlocking further upside for these overlooked stocks.
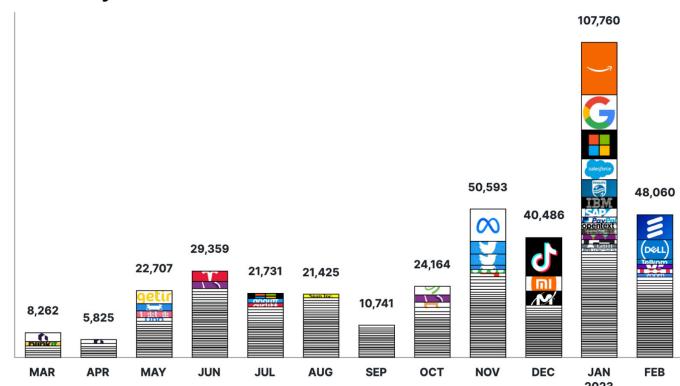
Redeploying Talent

Big Tech-xodus

After two decades of relentless expansion, Big Tech is in the midst of an unprecedented wave of layoffs. In the past year, over 390,000 employees have been laid off from 2,000 tech companies, including giants like Google, Meta, and Amazon.

Exhibit 1
Tech Layoffs 😢

Source: Trueup.io, Sparkline. As of 2/28/2023.

Notably, Elon Musk, upon acquiring Twitter, laid off over half of its staff, arguing that the firm can be run just as well with a leaner, more "hardcore" team. This has fed a narrative that tech workers are overpaid, coddled, and unnecessary.
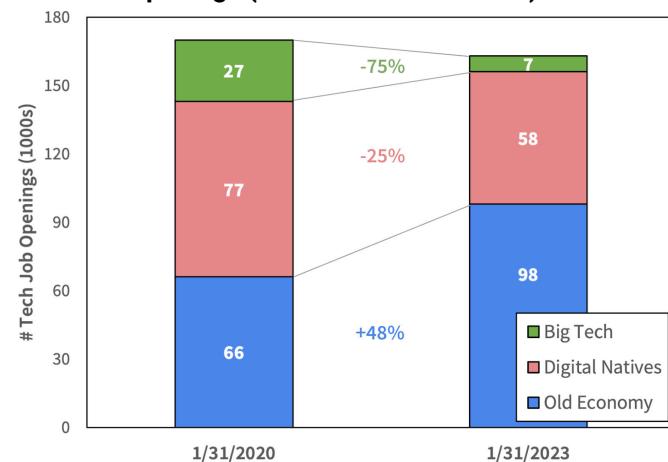
Insatiable Demand

While this may be true in some specific cases, the broader labor market data do not agree. Tech workers continue to be in high demand. The next exhibit tallies up the number of open tech jobs at large publicly traded U.S. companies.

We focus on the change since Jan 2020, since tech hiring was abnormal during the pandemic. While the total number of open tech jobs was about flat over this period, this masks a compositional shift. Big Tech openings collapsed -75% while those at other Digital Natives fell -25%. On the other hand, Old Economy firms actually ramped up tech hiring by +48%.

Exhibit 2
Tech Job Openings (Jan 2020 vs. Jan 2023)

Source: LinkUp, S&P, FTSE, Crunchbase, Sparkline. Universe is Russell 1000. Old Economy firms are those outside the GICS IT & Communication sectors without venture capital funding. Big Tech is GOOG, META, AMZN, AAPL and MSFT. Digital Natives are the balance.

While **Big Tech** retrenches after their pandemic hiring binge, other firms are still recruiting tech workers. Demand remains especially robust at **Old Economy** firms, which now account for 60% of open tech jobs (compared to 39% in Jan 2020).

The next exhibit lists the Old Economy companies with the most tech job openings. These employers, mostly from the defense, banking, and healthcare sectors, collectively seek to hire over 30,000 new tech employees.

Exhibit 3
Old Economy IT Worker Demand

Source: LinkUp, S&P, FTSE, Crunchbase, Sparkline. As of 1/31/2023.

1

Technology is now embedded in all facets of the economy, even the asset-heavy Old Economy. Whether manufacturing cars, analyzing credit data, or managing supply chains, tech human capital is a key factor of production.

Your Layoff Is My Opportunity

For decades, Big Tech has hoarded top tech talent, starving Old Economy firms of the technical skills required to meet their digitization goals. Now, as Big Tech relaxes its grip on the labor market, legacy firms see a golden opportunity.

Traditional employers have announced ambitious plans to expand tech hiring in the coming years. GM plans to hire 8,000 tech workers to meet its EV goals. After each already having grown their tech workforce by thousands, a diverse set of firms like Walmart, UnitedHealth, and JPMorgan are aggressively pursuing talent from prestigious tech firms.

Many legacy firms are even transforming their work cultures to attract talent. For example, as they push into autonomous tractors and precision agriculture, midwest manufacturers like Deere and Caterpillar are building tech campuses in major cities and offering the option of remote work.

Even the public sector is making a play for departing Silicon Valley talent. Seeking 1,000 new tech hires, the Department of Veterans Affairs is creating a special higher salary bracket and fast-tracked hiring process for tech employees.
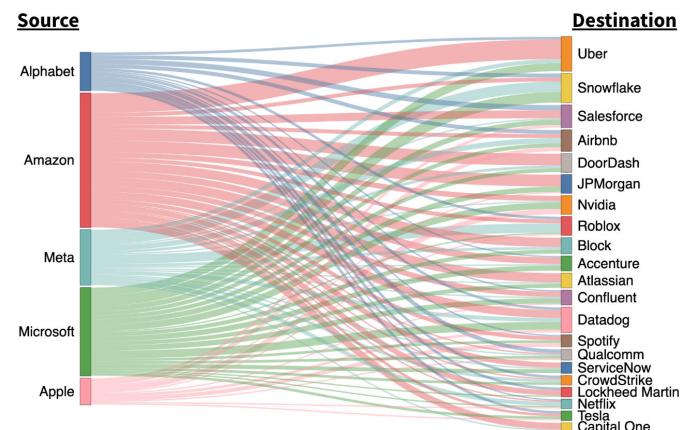
Old Economy employers offer more than just a safe harbor from uncertain labor markets. For many tech employees, applying their skill sets to solve problems in other domains is quite rewarding. These fields are much less saturated by software and thus more ripe for digital transformation.

We are still early in the layoff cycle and tech firm severance tends to be generous, but we do have some very preliminary data on the destinations of these workers. The next exhibit shows the top recipients of Big Tech developer outflows based on LinkedIn profile changes the past three months.

So far, the top beneficiaries of Big Tech developer outflows have been other Digital Natives, such as Uber, Snowflake, and Roblox. However, across our full universe of 1,000 publicly traded U.S. employers, a respectable 25% of Big Tech outflows have gone to Old Economy firms.

Exhibit 4
Big Tech Outflows (Nov 2022 - Jan 2023)

Source: LinkedIn, FTSE, Sparkline. Destination universe consists of Russell 1000 companies excluding Big Tech. Analysis includes tech workers only. From 10/31/2022 to 1/31/2023.

While Old Economy firms are heavily courting tech workers, job transition data has yet to vindicate their efforts. But it's still very early. Given the importance of tech talent today, investors should closely monitor how this migration unfolds.
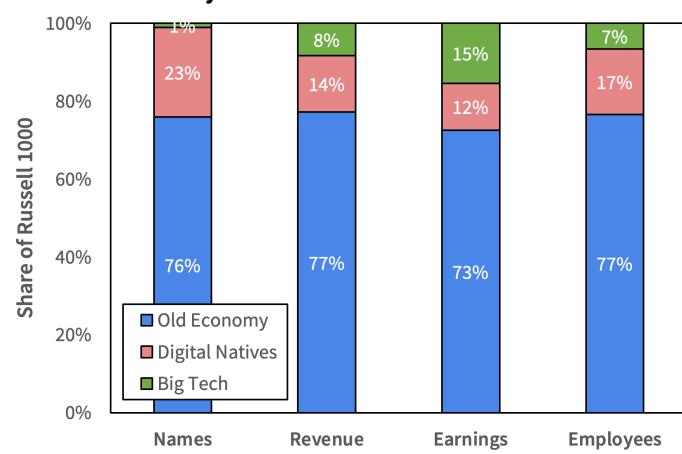
Technological Diffusion

Sleeping Giants

Media and investor attention tend to focus on flashy tech companies at the expense of boring Old Economy firms. However, despite their lower profile, Old Economy firms are the backbone of the U.S. economy.

Exhibit 5
The Old Economy Matters!

Source: SEC, S&P, FTSE, Crunchbase, Sparkline. As of 1/31/2023.

The previous exhibit allocates Russell 1000 fundamentals based on our taxonomy. The Old Economy constitutes an impressive 76% of names, 77% of revenue, 73% of earnings, and 77% of jobs. If we were to include private companies, its share of the economy would be even greater!

We believe the redistribution of tech talent away from the tech giants could end up being a boon for the U.S. economy. After all, the marginal time of a talented developer is likely better spent modernizing our industrial base than further optimizing the shades of blue on our iPhone apps.

For investors in Old Economy stocks, this talent rebalancing could lead to large returns. Old Economy stocks are trading at a deep -43% discount relative to Digital Natives and Big Tech, implying significant upside for overlooked legacy firms that successfully achieve their digitalization goals.

Exhibit 6
The Old Economy Discount 🏷️

	Price / Earnings	Price / Sales	Price / Book	EV / EBITDA	Average
Big Tech	25.2	4.6	9.2	14.6	13.4
Digital Natives	41.6	3.4	4.6	14.9	16.1
Old Economy	18.8	1.7	3.1	12.5	9.0
Avg. Discount	-44%	-56%	-55%	-15%	-43%

Source: SEC, S&P, FTSE, Crunchbase, Sparkline. Avg. Discount is the discount on each metric of the Old Economy relative to the average of Big Tech and Digital Natives. As of 1/31/2023.
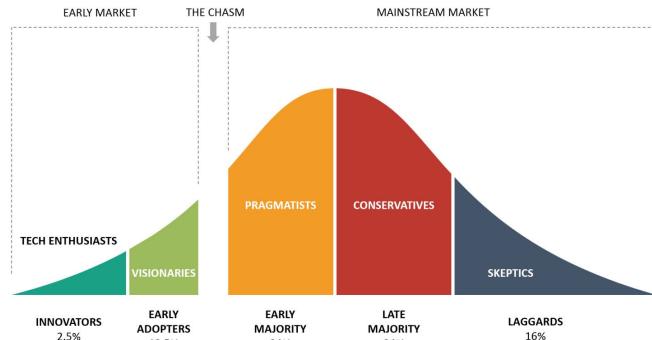
Of course, not all legacy firms will successfully modernize. The group is trading cheap for good reason. While some firms are truly embracing the digital age, others are doing so reluctantly or even actively resisting. While the former may be interesting investments, the latter are likely value traps.

Crossing the Chasm

We can refine our analysis using the model of technological diffusion made popular in the book Crossing the Chasm.

In this model, new technologies diffuse across the economy in five stages. Innovations are first embraced by Innovators, followed by Early Adopters. However, these groups comprise only a small part of the total addressable market. The full impact of new technologies is not realized until they have "crossed the chasm" to the Mainstream Market.

Exhibit 7
Technological Diffusion

Source: Geoffrey Moore.

Within the Mainstream Market, firms display varying levels of openness to novel inventions. The Early Majority are first to appreciate the practical value of new technologies. They are followed by the Late Majority. Finally, the Laggards, who view innovation with mistrust, are forced to adapt or die.

Most research on disruptive innovation focuses on the Early Market, as this is where exciting innovations are first seen. However, the Mainstream Market is actually the bigger, more lucrative prize. Even incremental innovations applied over a much larger installed base can have tremendous leverage.

While digital disruption is often viewed as a threat to legacy firms, we see it as a massive opportunity. The Old Economy is still in the early phases of digitization, with technologies such as AI, robotics, and smart manufacturing yet to achieve mass adoption. The Early Majority firms able to first apply these innovations will enjoy a significant advantage over their slower rivals.

Man Behind the Machine 🕵️

However, identifying the Early Majority is easier said than done. Corporate executives uniformly love to tout their commitment to digital transformation. This makes it hard to separate firms that are truly adopting technology from those that just like to talk about it.
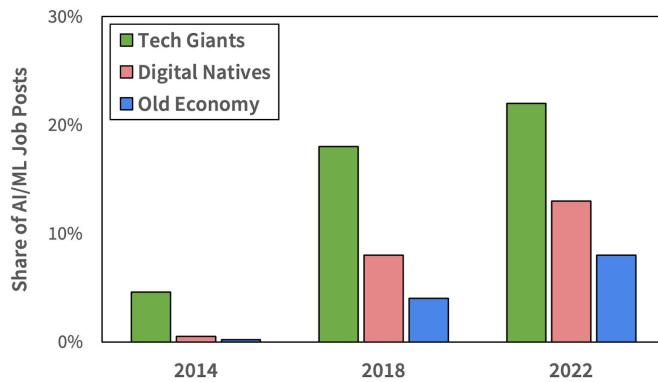
In A Human View of Disruption (Feb 2021), we proposed a way to cut through the propaganda. We use labor market data to identify firms hiring employees skilled in innovative technologies. We assume that employers would only pay the premium wages required to attract top technical employees if they are serious about investing in the technology.

In fact, Bloom et al (2021) showed that human capital does indeed track the diffusion of technology from Innovators to Laggards. At first, people skilled in new technologies almost exclusively work at Innovator firms. Over time, access to these skills broadens and these workers can be found at Early Adopters and eventually the Mainstream Market.

The next exhibit illustrates this with a live example. It shows how AI talent is diffusing through the economy based on the rising share of tech job postings that mention "artificial intelligence" or "machine learning."

Exhibit 8

The Expanding Reach of AI 🤖

Source: LinkUp, S&P, FTSE, Crunchbase, Sparkline. As of 1/31/2023.

The current wave of AI innovation (e.g., LLMs) started several years ago with pioneering research at Google, Facebook, and other tech giants. Realizing its potential, Early Adopters started hiring workers to bring AI into their markets. As talent becomes more plentiful and use cases more concrete, AI is now spreading rapidly to the Old Economy.

Technology is as much about people as software. Follow the talent and it will lead to the employers truly investing in the digital age.
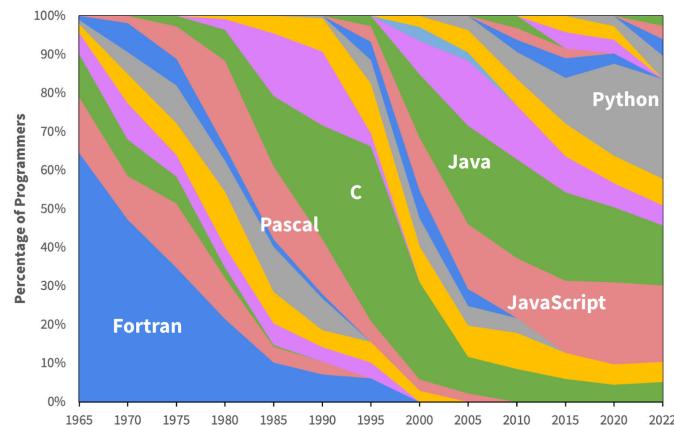
The Early Majority

Job Embeddings

In order to identify firms hiring innovative talent, we first need to define what tech skills are considered cutting-edge. The challenge is that technology's cutting edge is a moving target. For example, the next exhibit shows that while Fortran was dominant in the 1960s, it was surpassed by Pascal, C, Java, JavaScript and Python in later decades.

Exhibit 9

Top Programming Languages

Source: Data Is Beautiful, Sparkline. As of 12/31/2022.

One way to quantify the demand for various tech skills is to examine corporate job postings. In particular, job postings for technical roles usually list the specific technologies needed. In the job posting below, candidates must be proficient in Java, Python, and Snowflake and ideally also have experience with AWS products.

Exhibit 10

Job Posting Example

Source: Caterpillar, Sparkline.

We use data from LinkUp, a vendor specializing in extracting clean job posting data. LinkUp scrapes company websites directly, rather than relying on aggregators (e.g., Indeed), which helps ensure the data is as fresh as possible and avoids duplicates arising from reposted jobs.

While most research using labor market data focuses on job titles, this can be misleading. Generic job titles, such as "analyst" or "associate," provide limited context on the role. Employers also often have varying naming conventions for the same job, as with "AI/ML engineer" and "data scientist."

Thus, we instead utilize the full job description. Since these descriptions are unstructured text, we use natural language processing (NLP). In Investing in Innovation (Apr 2022), we used NLP to find trending technology clusters in over two centuries of patent data. We now adapt this methodology to extract technical skills from job descriptions.

Our NLP models generate word embeddings that capture the relationship between terms found in job postings. In the next exhibit, we provide five concepts and ask the model to find similar terms. As you see, the model was trained not only on single words but also phrases (bi- and trigrams).

Exhibit 11
Job Embedding Example

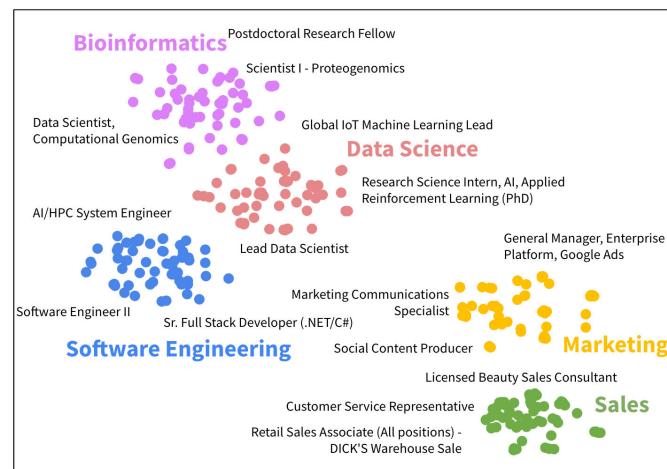| TensorFlow	Amazon Web Services	JavaScript	Computer-Aided Design	SQL
pytorch	aws	nodejs	creo	microsoft sql server
scikitlearn	docker	angularjs	solidworks	relational database
cuda	azure	html css	autocad	etl
spark	kuberentes	typescript	catia	postgres
xgboost	virtualization	jquery	matlab simulink	rdbms

Source: LinkUp, Sparkline. As of 1/31/2023.

Our embeddings successfully identify related technologies, grouping machine learning libraries, such as TensorFlow, PyTorch, and XGBoost. Similarly, they cluster front-end web development skills, such as JavaScript and Node.js, and relational database concepts like MS SQL, Postgres, and ETL.

Embeddings can also be used to cluster the job postings themselves based on the similarity of their contents. The next exhibit is a visualization of the job embedding space.

Our model arranges the job postings in intuitive ways. It separates clusters into "hard skills" in the upper left and "soft skills" in the lower right. Moreover, it correctly assigns both very specific jobs ("Retail Sales Associate (All positions) - DICK's Warehouse Sales") and generic jobs ("Postdoctoral Research Fellow") to the relevant clusters.
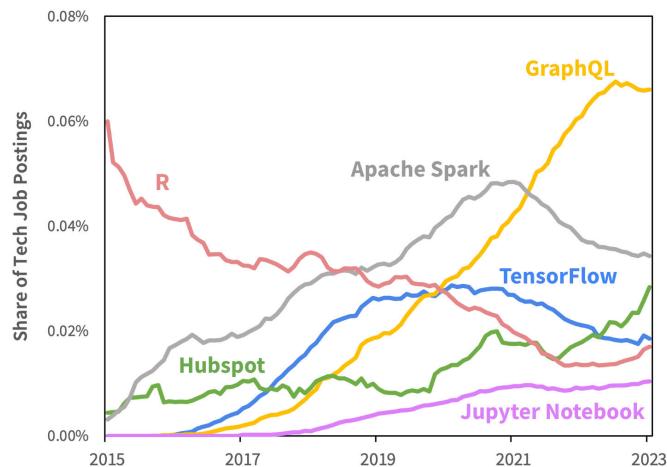
Exhibit 12
Labor Map

Source: LinkUp, Sparkline. As of 1/31/2023.

Cutting-Edge Skills 🥷

Now that we can parse job descriptions into their underlying skill bundles, we need a way to identify which skills are cutting-edge. One intuitive approach is to look for a rising share of employers demanding a given skill. The next exhibit shows the evolving demand for a handful of technologies.

Exhibit 13
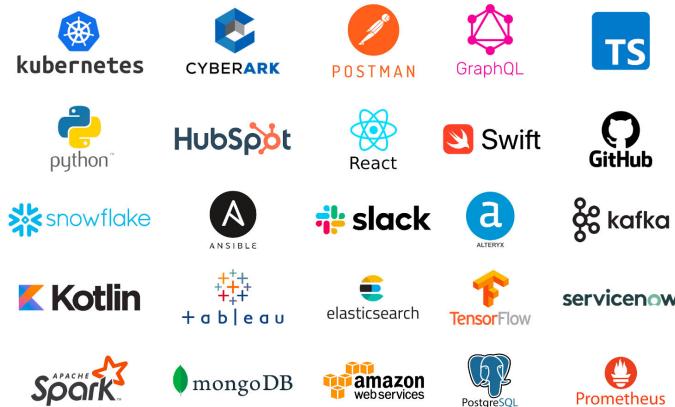**Evolving Technical Demand**

Source: LinkUp, Sparkline. As of 1/31/2023.

Over the period, R has declined as python and its related tools, such as Jupyter notebooks, gained popularity in the data science community. Machine learning tools, such as TensorFlow and Apache Spark, saw rapid early adoption but have leveled off in the past few years. On the other hand, GraphQL and HubSpot have continued to gain traction.

The next exhibit shows the fastest growing technology skills over the past five years. This list contains both open source and proprietary software with a wide variety of uses, such as databases, software deployment, and machine learning.
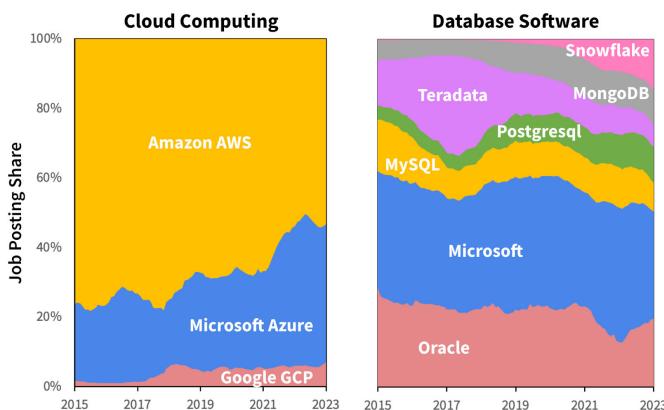
Exhibit 14
In-Demand Technologies (2018-2022)

Source: LinkUp, Sparkline. As of 1/31/2023.

As an aside, job posts can also be used to gauge the traction of enterprise tech vendors given the insight they provide into corporate tech stacks. The next exhibit infers market shares for cloud computing and database software.

Exhibit 15
Market Share Examples

Source: LinkUp, Sparkline. As of 1/31/2023.

Cloud computing is an oligopoly. AWS was the first-mover but has been ceding share to Azure and GCP. The database market is more fragmented. Since 2015, Oracle, Microsoft, Teradata, and MySQL lost share, while Postgres, MongoDB and Snowflake gained. Snowflake has been particularly impressive, gaining 15% share in just a few years.

The Early Majority

Now that we have a way to identify innovative tech skills, let's determine which Old Economy employers are most aggressively pursuing workers with these skills.

The next exhibit shows top companies based on the number of open innovative jobs. We define innovative jobs as those requiring at least one of the top 50 technical skills, which we determine each month based on two-year trailing data.
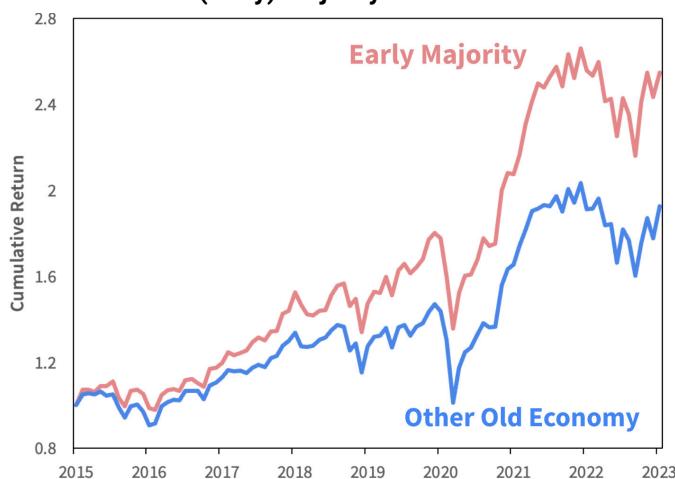
Exhibit 16
Innovative Legacy Employers

Source: LinkUp, S&P, FTSE, Crunchbase, Sparkline. As of 1/31/2023.

While there is some overlap with the list of companies based on overall tech job demand (Exhibit 2), we also find many new names, such as UnitedHealth, Walmart, Caterpillar and GM. As we saw earlier, these employers have recently been in the news for their efforts to recruit top tech talent.
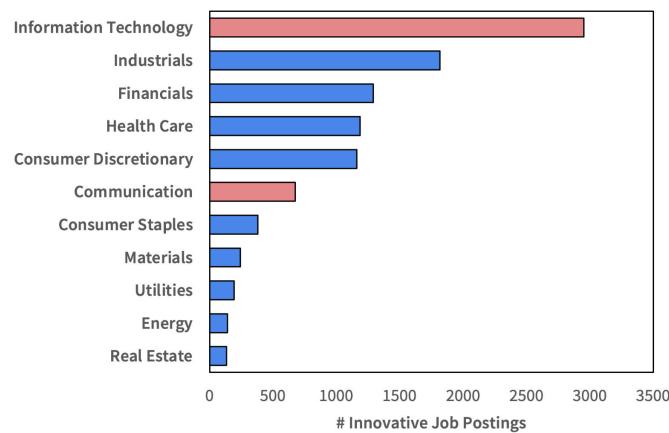
Each job post is associated with a timestamp based on when it was scraped. This gives us the ability to backtest the performance of a strategy using only the data available at each point in time. Our strategy buys the stocks of Old Economy firms with the most open innovative jobs each month. We compare the performance of this Early Majority portfolio to that of other Old Economy stocks.

Exhibit 17
I Want to Be the (Early) Majority

Source: S&P, FTSE, Crunchbase, LinkUp, Sparkline. Universe is Russell 1000 Old Economy stocks. Simulation does not include transaction or shorting costs or fees. See important backtest disclosure. As of 1/31/2023.

Since 2015, shares of Early Majority companies defined using our methodology have outperformed those of their Old Economy peers by a solid +3.5% per year.

Next, we count the total number of innovative job postings by industry. We show all 11 GICS sectors, denoting the Old Economy in blue and New Economy in red.

Exhibit 18
Innovative Job Demand by Sector

Source: S&P, FTSE, LinkUp, Sparkline. New Economy in red. As of 1/31/2023.
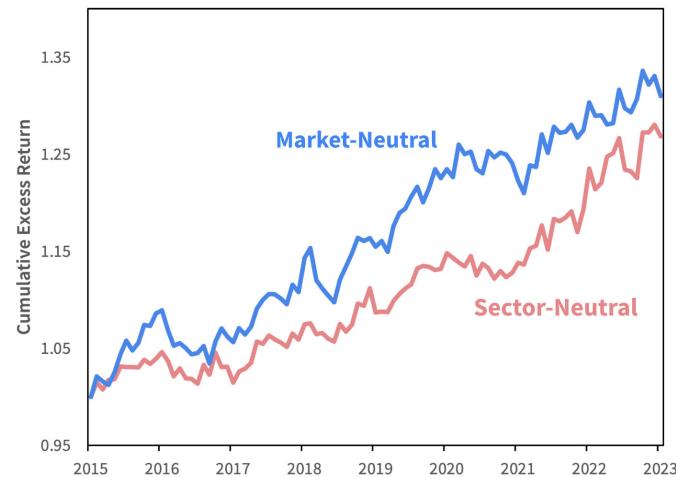
Within the Old Economy, industrial, financial, healthcare, and consumer discretionary firms are most actively pursuing innovative tech talent. In order to ensure that our strategy's returns are not driven solely by this sector bias, we build a second strategy that selects the top employers in each sector. Some representative holdings are below.

Exhibit 19
Innovative Recruiters by Sector

Source: S&P, FTSE, Crunchbase, LinkUp, Sparkline. As of 1/31/2023.

The next exhibit shows the returns of this sector-neutral version of the strategy. For each sector, the strategy buys the top and sells the bottom stocks based on innovative job posts. We also show the long-short returns of the original strategy for comparison (i.e., the "market-neutral" strategy).

Exhibit 20
Innovative Job Demand Strategy

Source: S&P, FTSE, Crunchbase, LinkUp, Sparkline. Universe is Russell 1000 Old Economy stocks. Simulation does not include transaction or shorting costs or fees. See important backtest disclosure. As of 1/31/2023.

The sector-neutral strategy is also profitable, confirming that the original strategy's outperformance is not simply due to its sector allocation (e.g., overweight industrials). Rather, we learn that cutting-edge talent helps employers outcompete both the general market as well as their direct rivals.
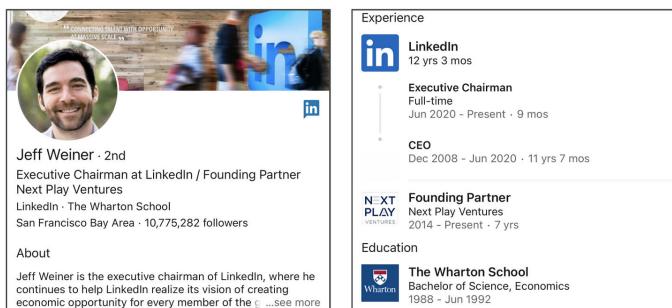
Google Brain Drain 🧠

Hoarding Talent

In [Searching for Superstars](#) (Apr 2021), we showed that Big Tech has been gobbling up top talent. Our analysis used LinkedIn profiles to build both a point-in-time snapshot of each firm's workforce and a graph of company-to-company talent flows (based on work experience history).

Exhibit 21
LinkedIn Example
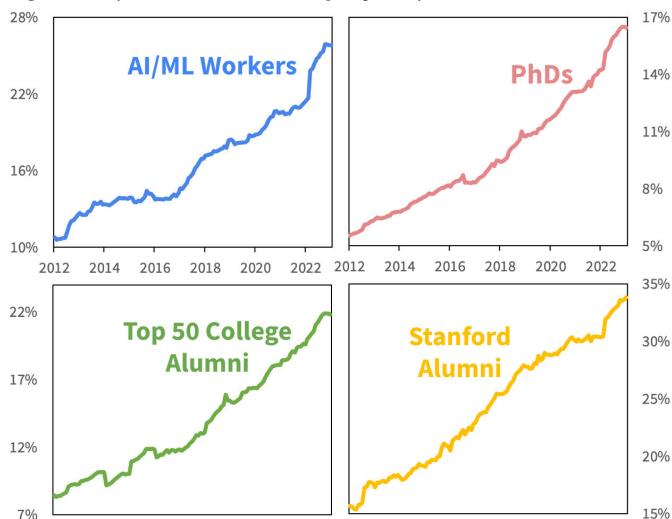
Source: LinkedIn.

The next exhibit shows Big Tech's share of LinkedIn profiles on four proxies for top talent. These shares are calculated relative to the universe of employers in the Russell 1000.

Exhibit 22
Big Tech (% of LinkedIn Employees)

Source: LinkedIn, FTSE, Reiter, U.S. News & World Report, Sparkline. Universe is Russell 1000. Top 50 redefined each year based on U.S. News & World Report rankings. Big Tech consists of GOOG, META, AMZN, AAPL and MSFT. AI/ML is artificial intelligence and machine learning. As of 1/31/2023.

Despite accounting for only 11% of LinkedIn profiles, Big Tech employs 26% of **AI/ML workers**, 16% of **PhDs**, 22% of **alumni from top-ranked colleges** and an astounding 34% of **Stanford graduates** working at large public companies!

Big Tech's utter dominance of technical human capital is unparalleled. It reflects substantial investment in recruiting top engineers through a combination of salaries, benefits, prestige, and talent density. Plus, who doesn't want to work in a futuristic office with free massages and matcha lattes?!
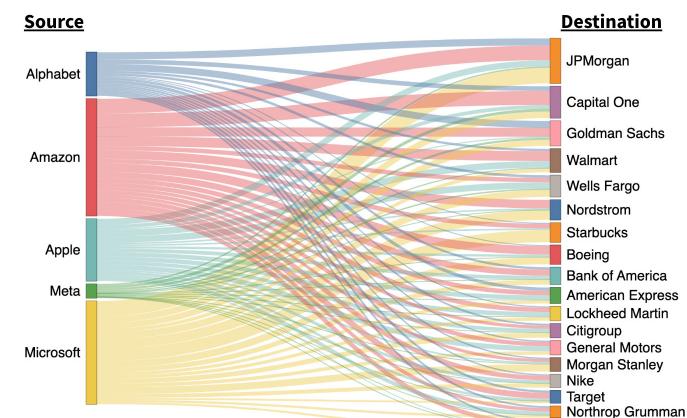
The War for Talent

While Big Tech has been the big winner in the War for Talent, not all Old Economy employers have been completely boxed out. Many legacy employers have even managed to hire software developers away from the tech giants.

The next exhibit shows the top flows of engineering talent from Big Tech to Old Economy firms over the past decade.

Exhibit 23
Out of the Plex

Source: LinkedIn, S&P, FTSE, Crunchbase, Sparkline. Tech workers only. From 1/31/2013 to 1/31/2023.

The top recipients of Big Tech departures have been banks, such as JPMorgan, Capital One, and Goldman; retailers, such as Walmart, Target, and Nordstrom; consumer brands, such as Starbucks and Nike; and industrial firms, such as Boeing and General Motors.

Next, we build an investment strategy that buys the stocks of the Old Economy employers hiring the most workers from Big Tech. Each month, we rebalance the portfolio based on data from the trailing three years (with a reporting lag). As before, we also construct a sector-neutral strategy that buys the top and sells the bottom stocks from each GICS Sector.

Exhibit 24
Big Tech Alumni Strategy

Source: S&P, FTSE, Crunchbase, LinkedIn, Sparkline. Universe is Russell 1000 Old Economy stocks. Simulation does not include transaction or shorting costs or fees. See important backtest disclosure. As of 1/31/2023.

Old Economy employers able to lift talent from the tech giants subsequently outperformed both other legacy firms and their industry rivals. This makes sense, as the ability to poach highly paid Big Tech engineers signals both a serious commitment to digital transformation and the ability to offer compelling career trajectories to these employees.

Superstar Talent 🏆

In [Searching for Superstars](...) (Apr 2021), we argued that the knowledge economy has increasingly driven the distribution of human talent toward a power law. This is especially true in tech due to the scalability of software. Success today depends less on the median than the top decile employee.

As we saw, one key to Big Tech's success has been its ability to amass a legion of superstar engineers. However, tech giants are not the only organizations minting cutting-edge technologists. In fact, most human capital formation actually occurs at educational institutions.

Academic credentials can be used as a proxy for superstar talent. Employees with PhDs generally have more expertise than those with Bachelor's degrees. Similarly, top-ranked universities tend to be more fertile hunting grounds for future superstars. While many brilliant individuals of course lack such credentials, research has shown that these metrics do have some predictive value.

The next exhibit shows Old Economy employers with a high share of STEM PhDs and top university alumni.
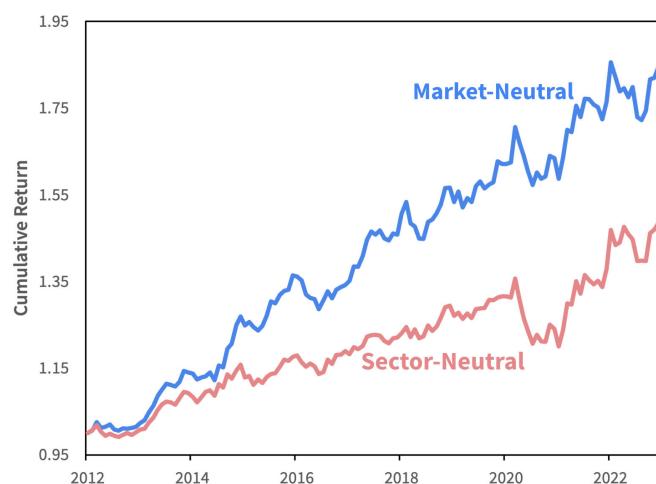
Exhibit 25
Superstar Magnets 🧲

Source: S&P, FTSE, Crunchbase, LinkedIn, Sparkline. As of 1/31/2023.

Many of these superstar magnets are prestigious Wall Street banks, which are known to have strong Ivy League recruiting pipelines. We also find a large number of pharmaceutical and industrial engineering firms with high concentrations of highly skilled PhD researchers.

The next backtest confirms that superstar talent is not only valuable in the tech sector. Old Economy firms employing superstars tend to subsequently outperform their peers by a considerable 5.2% per year (3.2% on a sector-neutral basis).

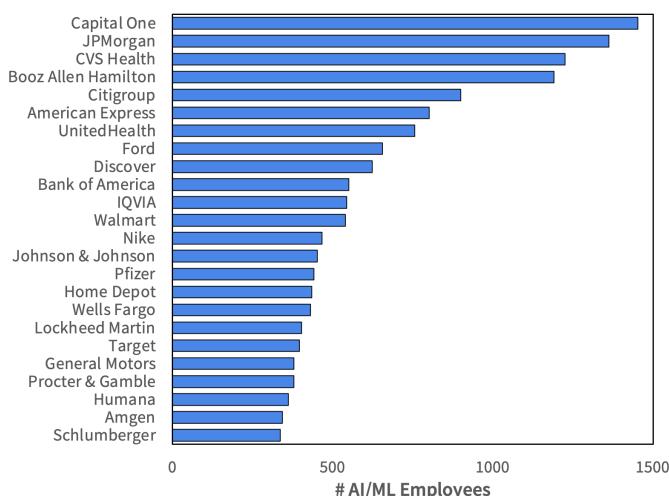**Exhibit 26**
Return on Genius 🎓

Source: S&P, FTSE, Crunchbase, LinkedIn, Sparkline. Universe is Russell 1000 Old Economy stocks. Simulation does not include transaction or shorting costs or fees. See important backtest disclosure. As of 1/31/2023.

Finally, we come full circle on AI, the hot technology of the day. Earlier, we showed that AI talent has been diffusing from Early Adopters to the Mass Market. We now drill down to the individual Old Economy firms with high AI talent.
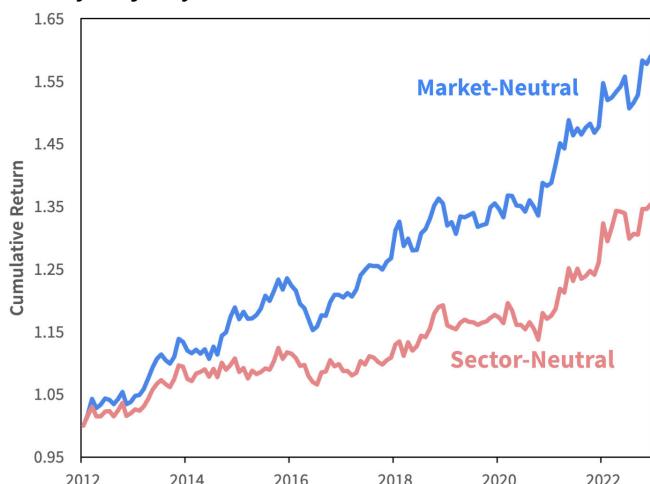
Exhibit 27
Old Dogs, New Tricks 🐕

Source: S&P, FTSE, Crunchbase, LinkedIn, Sparkline. As of 1/31/2023.

The top Old Economy employers of AI talent hail from the financial, healthcare, and consumer sectors. These firms collectively employ thousands of data scientists deploying AI across a wide range of tasks, such as loan underwriting, drug development, and autonomous vehicles.

Finally, we backtest a strategy that buys Old Economy stocks with high AI talent. As before, we rebalance monthly and build both market- and sector-neutral strategies.

Exhibit 28
AI Early Majority

Over the past decade, the Early Majority firms that embraced AI outperformed their competitors. Investors bullish on AI should take interest in such companies, as their hiring positions them to benefit from AI's continued progress.

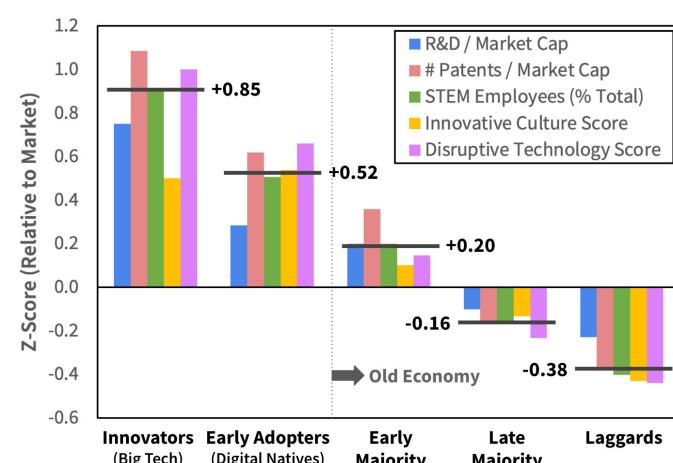# Investing in the Old Economy

Hidden Innovators 🕵️

The Old Economy is not monolithic. While many legacy firms do fit the stereotype of fading dinosaurs, others are making large investments in the digital age.

Using a composite of the various metrics developed in this paper, we segment the Old Economy into three groups: Early Majority, Late Majority and Laggards. We now have five total groups per Moore's technological diffusion model (Exhibit 7).

The next exhibit compares these groups on several metrics of innovation (normalized to be zero on average).

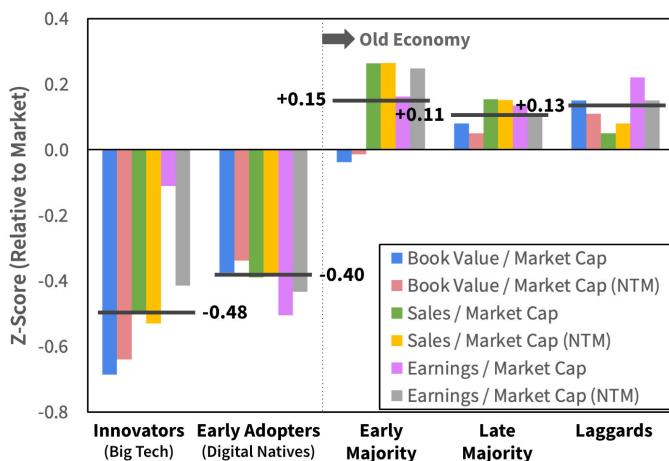**Exhibit 29**
Stages of Technological Diffusion

Source: SEC, S&P, FTSE, Crunchbase, LinkUp, LinkedIn, Glassdoor, USPTO, Sparkline. Russell 1000 universe. R&D and patents calculated over a trailing 12-month period. See culture and disruption score definitions in these papers (culture, disruption). As of 1/31/2023.

Our five groups display monotonically descending levels of innovation, with Innovators highest and Laggards lowest. As expected, the Early Majority is considerably more innovative than the rest of the Old Economy.

10

While innovation is good, investors must also consider the price paid to obtain this innovation. We only want to invest in companies for which the market is failing to appreciate some aspect of value. We'll start by calculating the standard valuation ratios (e.g., price/book, price/earnings).

Exhibit 30
Old Economy Discount

Source: SEC, S&P, FTSE, Crunchbase, LinkUp, LinkedIn, Sparkline. Russell 1000 universe. Calculations over trailing 12-month period, except those denoted NTM, which use next 12-month analyst forecasts. As of 1/31/2023.

Investors are willing to pay a significant premium for New Economy firms, which are on average 0.4 to 0.5 standard deviations expensive. Conversely, the market demands a modest discount to buy Old Economy firms.

Importantly, the market fails to price the three Old Economy subgroups differently. Early Majority, Late Majority and Laggards all trade at around +0.1 standard deviations cheap despite their widely varying levels of innovativeness.
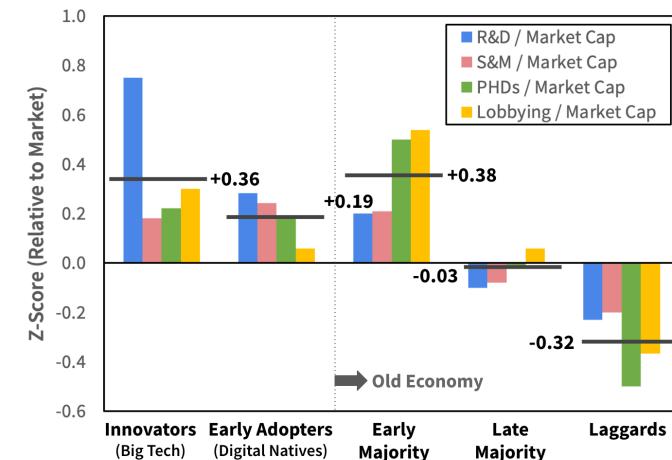
Intangible Value ✨

In [Intangible Value](#) (Jun 2021), we argued that traditional valuation ratios (e.g., price/book) are biased against New Economy stocks due to these firms' reliance on intangible assets that do not show up on balance sheets. It's possible that the Old Economy discount merely reflects this bias.

In order to correct this bias, we incorporate intangible assets into our definition of fundamental value. Our framework includes four intangible pillars: intellectual property, brand equity, human capital, and network effects. We use metrics ranging from **R&D expenditures** to **PhD employees** to build intangible value ratios for these pillars.

The next exhibit recasts the previous one using intangible value ratios. Rather than compare a company's price to, say, tangible book value, we compare it to intangible metrics, such as **Sales & Marketing** or **Lobbying** expenditures.
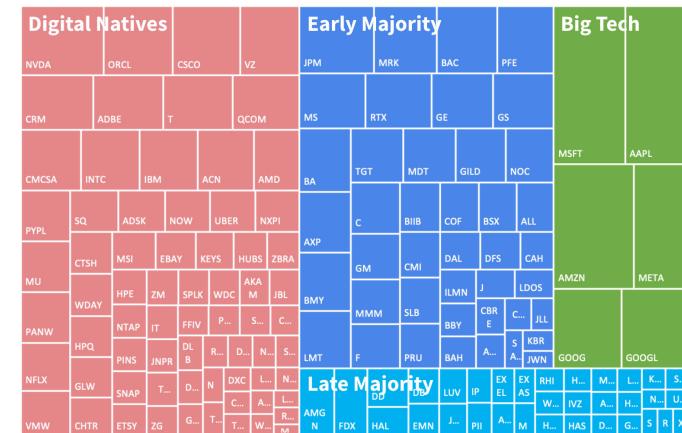
Exhibit 31
Intangible Value

Source: SEC, S&P, FTSE, Crunchbase, LinkUp, LinkedIn, Senate, Sparkline. Russell 1000 universe. R&D, S&M and PhDs calculated over a trailing 12 month period. S&M is sales and marketing expenditures. As of 1/31/2023.

After accounting for their greater intangible assets, the Early Majority is now cheaper than the rest of the Old Economy. This also fixes the bias against Big Tech and Digital Natives, swinging them from very expensive to somewhat cheap.

These valuations are reflected in the current holdings of our intangible value strategy, which buys the 150 most attractive Russell 1000 stocks on composite intangible value. The strategy's exposures are shown below.

Exhibit 32
Portfolio Allocation

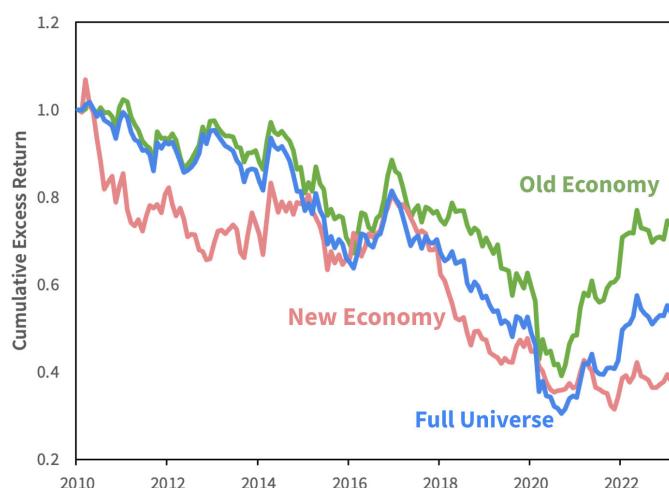Source: S&P, FTSE, Crunchbase, LinkedIn, LinkUp, Sparkline. As of 1/31/2023.

The portfolio holds 17% **Big Tech** and is evenly split between **Digital Natives** and **Old Economy** firms at 41% each. Within the **Old Economy**, it holds 32% in **Early Majority**, 9% in **Late Majority** and 0% in **Laggards**. Overall, we feel this split offers a nicely diversified portfolio of intangible value stocks.

Importantly, Intangible Value (Jun 2021) finds that stocks with high intangible value scores have outperformed those with lower scores over the past few decades (in backtest). Since we published this paper, we have often been asked whether the intangible value factors work for Old Economy as well as New Economy stocks.

In order to address this, let's start with the performance of the traditional value factor (i.e., Fama-French price/book), which does *not* incorporate intangible assets. The next exhibit shows its performance in the **Full Universe** as well as separately in the **Old Economy** and **New Economy**.

Exhibit 33
The Fall of TradVal
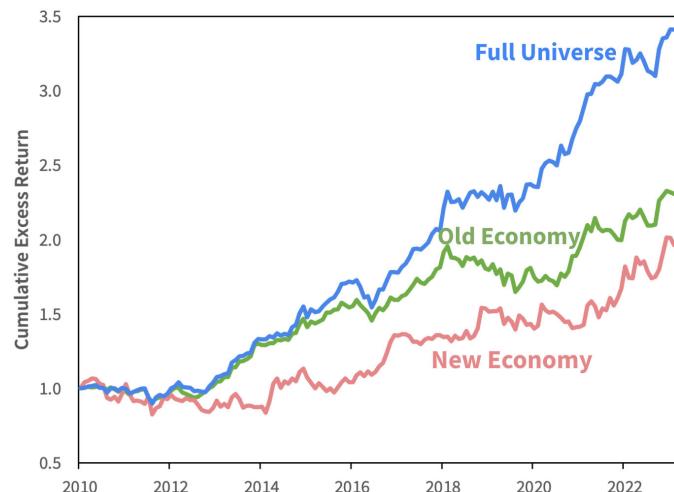
Source: SEC, S&P, FTSE, Crunchbase, Sparkline. Long-short portfolio of the top and bottom 15% of Russell 1000 stocks on book/market. Simulation does not include transaction or shorting costs or fees. See important backtest disclosure. As of 1/31/2023.

The past thirteen years have been tough for the traditional value factor. It was particularly abysmal at selecting stocks in the **New Economy**, for which tangible book value plays a steadily declining role. Its track record in the **Old Economy** has been less bad, although even here it has lost money.

Against this baseline, we next show the performance of the intangible value factor. The setup is identical, except that we use intangible value instead of price/book.

Exhibit 34
The Dawn of iVal

Source: S&P, FTSE, Crunchbase, Sparkline. Long-short portfolio of the top and bottom 15% of Russell 1000 stocks on intangible value. Simulation does not include transaction or shorting costs or fees. See important backtest disclosure. As of 1/31/2023.

Intangible value has been effective at selecting stocks from *within* both the **New Economy** and **Old Economy**. Its **Full Universe** performance is even better, due to the additional value from being able to allocate *between* the **New Economy** and **Old Economy**.

Interestingly, intangible value has actually worked better in the **Old Economy** than the **New Economy**. This may in part be due to its broader opportunity set, which contains over three times as many stocks. However, this could also be due to greater pricing inefficiencies in **Old Economy** stocks.

Market Polarization

As with many aspects of U.S. society, markets are becoming more and more polarized. The stock market is increasingly trading as two distinct markets (i.e., the New and Old Economies), each with their own distinct investor base.

While politics have Democrats and Republicans, markets have "Value Investors" and "Growth Investors." The rift between these factions seems to be widening, with Growth Investors caricatured as naively chasing speculative tech narratives and Value Investors clinging to dying businesses.

The Old Economy is now more or less the exclusive domain of Value Investors, as Growth Investors have left it for dead. Unfortunately, the conservative Value Investors that remain

are mostly unwilling to allocate capital on the basis of intangible investment, despite its rising importance.

We believe this segmentation creates a massive opportunity. Markets crudely view the world as binary (i.e., companies are either innovative or not). However, in reality, technology diffuses in stages, leading to a nuanced picture that is better described in shades of gray.

As shown, the Old Economy is not a monoculture but rather contains a diverse set of firms at varying stages of tech adoption. We believe the Early Majority has been unfairly cast aside by both the Growth and Value communities, leading to potentially interesting opportunities.

Conclusion

The Old Economy offers fertile ground for investors willing to take a non-traditional approach to investing in traditional industries.

Our approach uses labor market data to identify the subset of Old Economy firms investing in the digital age. We find that these Early Majority stocks have outperformed their legacy competitors over the past decade, as the market has failed to price in their investments in digital transformation.

Moreover, the current valuations of Early Majority stocks remain attractive on both traditional and intangible value metrics. Consequently, we believe that Old Economy stocks can constitute an important part of a diversified intangible value portfolio.

Finally, we believe the ongoing layoffs of technical talent from prestigious Big Tech firms present a big opportunity for the Old Economy. Early Majority firms have great upside, which the addition of this talent would help catalyze.

Kai Wu

Founder & CIO, Sparkline Capital LP

Kai Wu is the founder and Chief Investment Officer of Sparkline Capital, an investment management firm applying state-of-the-art machine learning and computing to uncover alpha in large, unstructured data sets.

Prior to Sparkline, Kai co-founded and co-managed Kaleidoscope Capital, a quantitative hedge fund in Boston. With one other partner, he grew Kaleidoscope to $350 million in assets from institutional investors. Kai jointly managed all aspects of the company, including technology, investments, operations, trading, investor relations, and recruiting.

Previously, Kai worked at GMO, where he was a member of Jeremy Grantham's $40 billion asset allocation team. He also worked closely with the firm's equity and macro investment teams in Boston, San Francisco, London, and Sydney.

Kai graduated from Harvard College Magna Cum Laude and Phi Beta Kappa.

Backtest Disclosure