

Exploring the Technology, Media & Telecommunications Sector

WHITEPAPER

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This paper examines the technology, media and telecommunications (TMT) sector, particularly whether it offers diversification benefits and greater alpha opportunities than other equity sectors. We examine whether the TMT sectors offer statistically significant levels of dispersion greater than that of both the broader market, and of other sectors. Sectors with higher breadth may be better suited for active managers to extract alpha.¹

We find that investors in search of alpha may find greater opportunities within TMT than most other sectors. There is a high level of dispersion and a low level of correlation across the sector, giving investment managers a more robust opportunity set for generating alpha than exists in most other sectors. Active equity returns may be enhanced by finding skillful investment managers who invest in the TMT sector.

TMT Background

TMT has seen significant growth due to its impact on the economy and major disruption in the space. We believe that these factors may lead to increased breadth and a more attractive opportunity set for active investment managers. We highlight the backdrop for this growth and drivers of increased dispersion in this section.

The technology, media and telecommunications investment universe is a grouping of two individual Global Industry Classification Standard (GICS) sectors that share several key drivers, including the use of research and development as it relates to new technologies. The GICS methodology used by MSCI and S&P consists of 11 sectors, 24 industry groups, 69 industries, and 158 sub-sectors.² Within this standard, TMT is the combination of Information Technology and Communication Services. Investment managers often group TMT companies together in an investment universe for several reasons, some of which are rooted in history, while others pertain to the disruptive landscape of these industries.

Beginning around 1995, the advancement of technology combined with the acceleration of globalization, due in part to the internet, led many researchers to deem this the start of a “New Economy.” In general, industries associated with technology, media and telecommunications have continued to trend higher as a percentage of overall GDP as can be seen in Figure 1.

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¹ We define “alpha” as the difference between an active manager’s risk-adjusted return and their respective benchmark. Mathematically, alpha is defined as $R_p - [R_f + \beta^*(R_m - R_f)]$, where R_p = Portfolio Return, R_f = Risk-free rate, β = Beta, and R_m = market return.

² Source: MSCI, January 2020.

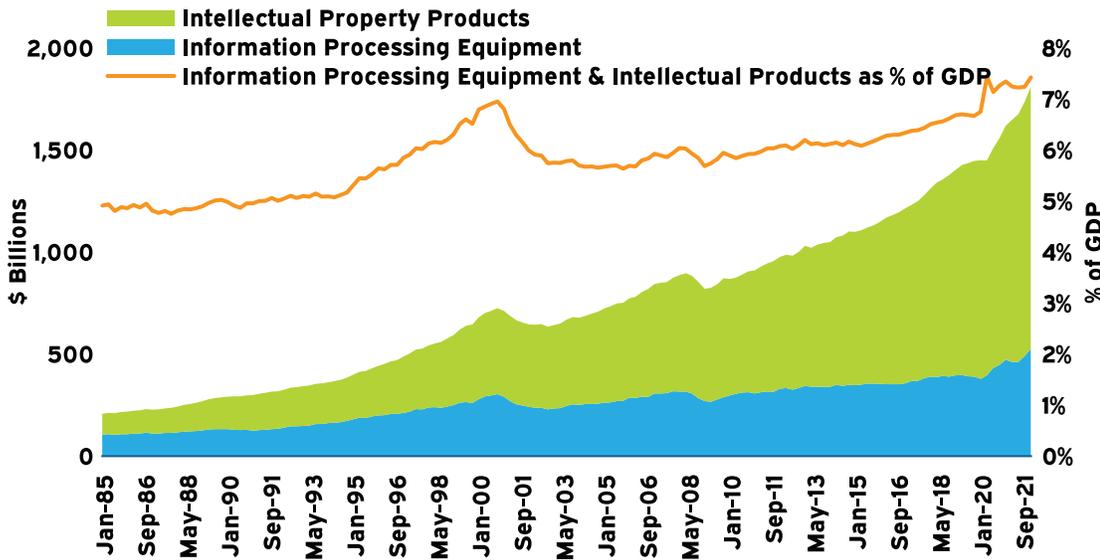


FIGURE 1
Intellectual Property Products and Information Processing Equipment as a % of US GDP

Source: FRED. Information Processing Equipment includes “Computers and peripheral equipment”. Intellectual Property Products includes “software”, “research and development”, and “entertainment, literary and artistic originals”. Data as of January 2022.

The TMT universe expanded because of the shift from an “old,” production-oriented economy toward a “new,” innovation-based economy. Technological innovation has served as the engine for the New Economy, which is defined by its reliance on the production and usage of innovative and/or new technologies³. Investments in innovation, rather than production capabilities, became key drivers of economic growth, most notably from computers, communication equipment, and software investments.

³ Source: Savrul, Kilic, “E-Commerce As An Alternative Strategy in Recovery From the Recession,” 2011: pg. 250-251.

The TMT sector is, perhaps, more subject to the effects of supply chain challenges than many other sectors. Likewise, they derive a significant portion of their revenue from outside the US. FactSet estimates that a quarter of the Communication Services and Information Technology stocks in the Russell 3000 find 25% or more of their total revenue coming from Asia.⁴

⁴ Source: FactSet. Data as of September 30, 2022.

Industry Changes

TMT’s significance to the US economy is reflected in the equity markets as well. The growth of IT and Communication Services as a percentage of the S&P 500 Index reflected in Figure 2 indicates the growth in capital invested in technology-focused sectors has outpaced other sectors over time.

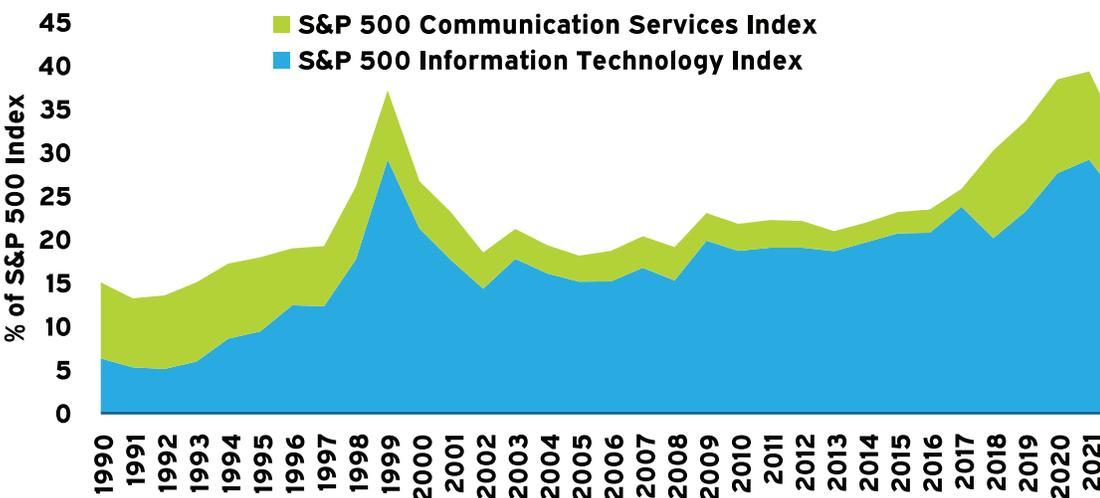


FIGURE 2
Growth in Capital Invested in Tech-Focused Sectors as a % of US Stocks

Sources: World Bank, FactSet. Data as of June 2022.

The GICS classifications are subject to change as industries evolve, and the most material reclassification for the TMT sector occurred in September 2018⁵. Upon this reclassification, the “Telecommunications Services” Sector was expanded and renamed “Communications Services”. This led to the addition of media companies that had previously been categorized as Consumer Discretionary in Communication Services. Examples include Comcast (NASDAQ: CMCSA), Netflix (NASDAQ: NFLX), and Disney (NYSE: DIS). Our dataset reflects this change⁶.

Disruption

Disruption can be thought of in two key components: disruptive technology and disruptive innovation.⁷ Disruptive technologies often (but not always) lead to disruptive innovation and the displacement of industry incumbents as a result.

Disruption can occur due to a variety of drivers such as:⁸

- **Cost** | New technologies and processes make the development of new products so cheap that incumbents become unprofitable.
- **Quality** | New technologies improve the quality of a product in such a fashion that old products are not viewed as competitive substitutes.
- **Customers** | Changes in customer preferences can make old products, services, or technologies less attractive to the consumer.
- **Regulation** | New laws can make old methods of business no longer available. Regulatory impacts are often driven by environmental and social concern.⁹
- **Resources** | When resources are exhausted or impacted by trade restrictions, those resources are no longer readily available.¹⁰

More than most companies in other sectors, TMT firms are subject to these disruptive forces and the revolutionary impact they have on how societies access, utilize, and monetize information. The rapid pace of disruption in the TMT space arguably creates a greater dispersion of opportunities for investors. Disruptive companies displacing the “incumbents” of an industry may lead to an attractive investment opportunity set. This disruption naturally produces winners and losers in these industries. The dispersion that this pace of change creates is what we examine via the data and analysis later in this paper.

Examples | Disruptors in the TMT space can be identified in many TMT industries. The concept of Moore’s Law¹¹ in the semiconductor industry highlights the impact of improved quality and lower cost of microchips used in tech devices. This innovation has led to cheaper, more powerful and accessible consumer technology than in years past. For example, a device that once took up an entire room can now fit in the palm of one’s hand.

In the Media industry, advertising has displayed signs of disruption as the adoption of digital advertising has allowed for more personalized and cost-efficient marketing methods. Within Telecommunication Services, the push toward lower latency (i.e., fewer/shorter delays) and higher accessibility has driven the development of 3G, 4G and 5G cellular networks. Each network generation has provided disruptive opportunities ranging from the development of mobile applications to on-the-go gaming and live streaming.

⁵ Source: MSCI.

⁶ See Appendix A for GICS classification used. Note that companies such as Netflix and Disney are multinational corporations with diverse revenue bases.

⁷ Source: Millar, Carla C.J.M., Martin Lockett and Ted Ladd (2018), “Disruption: technology, innovation and society” In: “Disruptive Technology and Innovation in Society”, a Special Issue of Technological Forecasting and Social Change an international journal 129: pg. 254-260

⁸ Ibid.

⁹ The Holding Foreign Companies Accountable Act of 2020 put U.S.-listed Chinese companies at risk of being delisted from American exchanges.

¹⁰ In July 2022, Congress passed the CHIPS Act of 2022. This act provided grants and research investment to the semiconductor industry in a goal to be on the forefront of supply chain vulnerabilities.

¹¹ Moore’s Law states that the number of transistors on a microchip doubles every two years and the cost of a computer is cut in half every two years.

TMT by major stock index

Figure 3 outlines the number of stocks Information Technology (IT) and Communication Services (CS) comprise within various leading indices, globally. As we have outlined, TMT is most often defined as the opportunity set inclusive of both sectors, as measured by the “Number of Total TMT Stocks” column in Figure 3. The “TMT Rank by GICS Sector (out of 10)” column provides a measure of breadth, or how many stocks investment managers have to pick from for their strategy. For example, as of May 2022, TMT comprised 507 out of the 3,024 stocks in the Russell 3000 index, ranking as the second most behind Health Care. Lower numbers indicate higher levels of breadth in that market.

Index	Location	# of IT Stocks	# of CS Stocks	# of Total TMT (IT+CS) Stocks	# of Stocks in Index	% of Total # of stocks	TMT Rank by GICS Sector (out of 10)
Russell 3000	US	389	118	507	3024	16.8%	2
Russell 2000	US	213	69	282	2002	14.1%	3
Russell 1000	US	176	49	225	1022	22.0%	1
MSCI ACWI	Global	362	176	538	2933	18.3%	1
S&P 500	US	76	26	102	504	20.2%	1
MSCI Europe	Europe	23	31	54	429	12.6%	3
MSCI Japan	Japan	35	16	51	260	19.6%	2
MSCI China	China	110	26	136	739	18.4%	1

FIGURE 3
Communication Services and Information Technology Role in Global Markets

Source: FactSet. Data as of May 2022.

Investment opportunity set for TMT

Studies have shown that an investor’s opportunity set is a function of correlation and dispersion.^{12,13} Correlation is the first element that defines an investment opportunity set. If correlation within an opportunity set is high (low), there is diminished (increased) ability for investors to distinguish themselves from their peers.

Dispersion is the second element defining a potential opportunity set. Dispersion seeks to quantify the size of the gap between the winners and losers within a market. If dispersion is low (high), the value of picking the winners is lessened (amplified), because the return difference between winners and losers is small (large).¹⁴

Therefore, the ideal opportunity set for skilled active managers would be one with low correlations and high dispersion. In other words, when a manager’s skill at picking stocks is positive, lower correlation and higher dispersion should, in theory, result in higher active returns.¹⁵

¹² Gorman, Sapra, Weigand, “The Role of Cross-Sectional Dispersion in Active Portfolio Management,” Investment Management and Financial Innovations, Volume 7, Issue 3, 2010: pg. 58.

¹³ Gregory Connor & Sheng Li, 2009. “Market Dispersion and the Profitability of Hedge Funds,” Economics, Finance and Accounting Department Working Paper Series n2000109. pdf, Department of Economics, Finance and Accounting, National University of Ireland - Maynooth.

¹⁴ Meketa Investment Group, “Health Care: An Evaluation of the Investment Opportunity Set”. July 2018

¹⁵ Gorman, Sapra, Weigand.

Grinold and Kahn posit that long-short market neutral strategies offer managers the ability to implement “their superior information most efficiently” and that these implementations offer the most benefit to investors who are best able to identify skillful managers.¹⁶ Ultimately, a market with breadth, dispersion and low correlation may provide the best hunting ground for investment managers. However, such a market structure provides no inherent positive benefit without a manager’s skill.

¹⁶ Grinold, Richard C. 1989. “The Fundamental Law of Active Management.” *The Journal of Portfolio Management*, vol. 15, no. 3 (Spring): pg. 48.

This theoretical framework has been put into quantitative form via the fundamental law of active management.¹⁷ This “law” is designed to assess the value of active management and is divided into two components: opportunity set (breadth) and investor skill (information coefficient). Formally, the law states that the information ratio (“IR”), a measure of risk-adjusted relative return, is approximated by the formula $IR = (\text{information coefficient}) \times \sqrt{\text{breadth}}$, assuming no portfolio constraints. Conceptually, the law asks: does the manager operate within an area of the market that provides an abundance of potential outperformance, and does the manager have the skill to extract outperformance beyond other participants? In theory, when both components are satisfied, they are positively related to alpha.

¹⁷ Source: Grinold, Richard. “The Fundamental Law of Active Management.” *The Journal of Portfolio Management*. 1989, 15 (3) 30-37.

Correlation

Figure 4 highlights the average 24-month pairwise correlation¹⁸ of stocks in each GICS sector as well as the broad Russell 3000 and the combined TMT universe (Information Technology and Communication Services). The thicker black dashed line is the TMT average rolling pairwise correlation. The TMT universe has tended to hover toward the lower end of the various sectors, a helpful feature for skillful managers to generate alpha.

¹⁸ Pairwise correlations measure the strength and direction of linear relationships between two variables. It is calculated as

$$r_{xy} = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{(\sum (x_i - \bar{x})^2)(\sum (y_i - \bar{y})^2)}}$$

where r = correlation coefficient, x_i = value of x-variable in a sample, \bar{x} = mean of the values of the x-variable, y_i = values of the y-variable in a sample, and \bar{y} = mean of the values of the y-variable

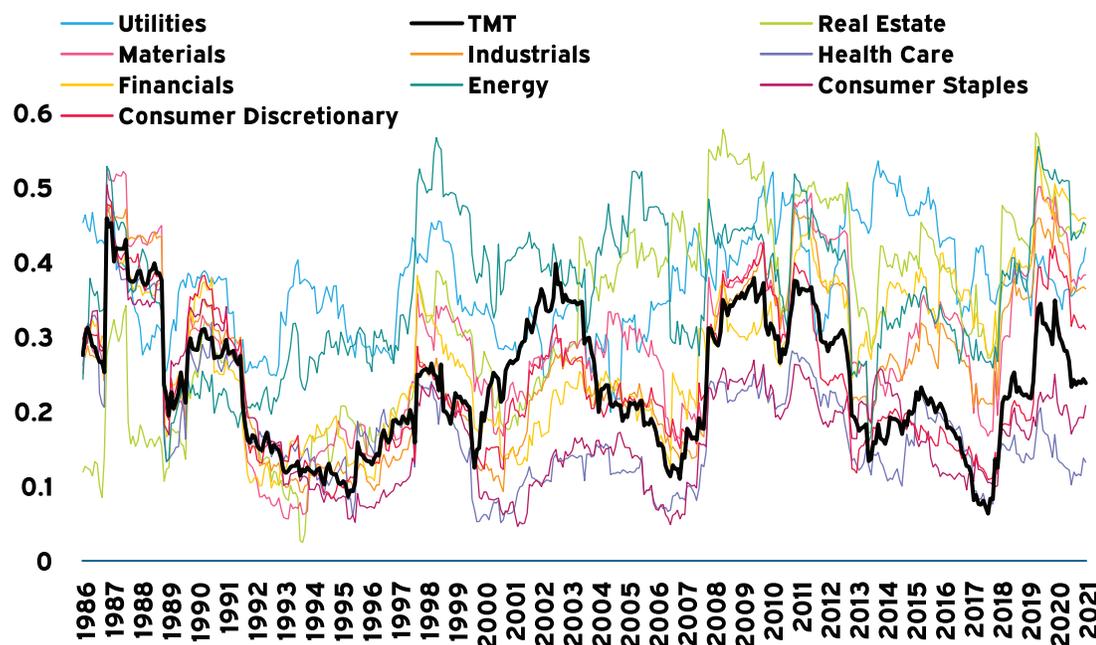


FIGURE 4
Average Monthly Correlation (1984 – 2021)

Source: FactSet. Data as of December 2021.

Another way to look at correlation is through confidence intervals¹⁹. Confidence intervals allow us to take a data set and compute a range with a certain level of confidence (generally 95%) that a data point will fall within a lower and upper bound, which at a 95% confidence level is two standard deviations on either side of the mean value of the data set.

¹⁹ Mean correlation was calculated using average pairwise correlation over a 24-month lookback. The mean was calculated through a Fisher transformation of the average pairwise correlation dataset to z-scores, averaging those z-scores and inverting a Fisher transformation back to a mean correlation.

Confidence Interval (95%)	Utilities	TMT	Real Estate	Materials	Industrials	Health Care	Financials	Energy	Staples	Disc.
Lower Bound	0.23	0.07	0.07	0.08	0.06	0.02	0.08	0.18	0.01	0.06
Mean Correlation	0.37	0.24	0.33	0.29	0.26	0.18	0.28	0.36	0.18	0.24
Upper Bound	0.51	0.41	0.58	0.50	0.47	0.33	0.48	0.55	0.35	0.42

FIGURE 5
Average Pairwise Correlation Confidence Interval (95% Confidence Level)

Source: Data is based on a 24-month rolling lookback period. FactSet. Data as of December 2021.

The mean correlation for TMT ranks third lowest, behind Health Care and Consumer Staples. TMT also has the third lowest upper bound, providing evidence that there have not been sustained periods of high correlation relative to other sectors.

Dispersion

We examined the monthly returns of all stocks in the Russell 3000 index for the period 1985 through 2021 and calculated the monthly stock price dispersion²⁰ for each sector and the entire index. Figure 6 highlights the “batting average,” or percentage of rolling periods where the TMT universe has had higher dispersion than the broad market and other individual sectors. In this analysis, we are looking for TMT to have at least a 50% mark. For example, TMT had higher dispersion than the broad US stock market (Russell 3000) in 82.9% of 3-year rolling periods from 1985-2021. Outside of the healthcare sector, TMT has had higher dispersion (>50%) across different rolling periods than every sector as well as the Russell 3000.²¹

²⁰ Monthly dispersion is calculated as the monthly variance of stock price returns.

²¹ The results of our tests for statistical significance at the 95% confidence level can be found in the Appendix.

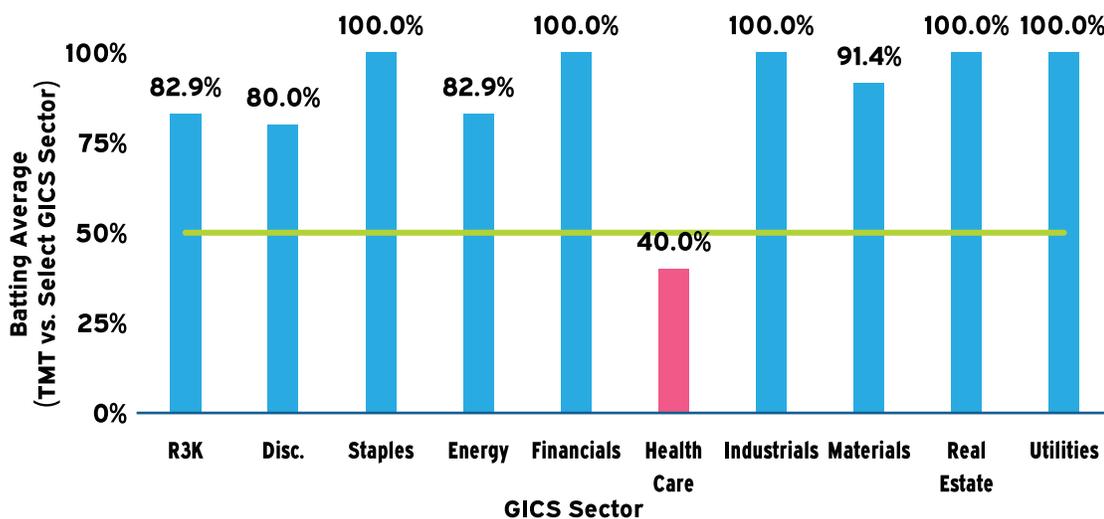


FIGURE 6
Batting Average of Rolling Period Dispersion (TMT vs. Select GICS Sector) (1985 – 2021)

Source: FactSet. Data as of December 2021.

Figure 6 also helps make the case that this dispersion has been persistent. As we broaden out the rolling period, we see the similar batting averages across sectors in relation to TMT. We believe this is a better representation of history because it reduces endpoint bias and some of the overall effect of single years where there was elevated equity volatility.

Persistence

Figure 6’s rolling period analysis also helps us get at the idea of persistence. However, just because TMT has historically presented an attractive opportunity set, does not guarantee that to be the case in the future. Said another way, is past dispersion/correlation a good predictor of future dispersion/correlation (i.e., will they persist)?

There is an argument to be made that capital market flows work to counteract these drivers and erode the alpha opportunity they create. Mainly, if TMT displays an attractive alpha opportunity relative to the broad market, investors should theoretically increasingly allocate to this area until the additional alpha is competed away or diminished. As capital flows out of other sectors and into TMT, other sectors may become under-followed and less efficient, presenting a better alpha opportunity relative to TMT, thus balancing out in the long run. However, if the drivers of dispersion discussed in the “Background” section are truly secular and not cyclical, then their effects should be apparent and persist through time.

Persistence of sector dispersion²²

Our previously displayed analysis of batting average helps us gain some perspective on the persistence of dispersion. Another way we can look at persistence is by viewing the rank of a sector’s dispersion at different intervals. Figure 7 looks at the rank of six GICS sectors and their relative ranks over subsequent three-year windows starting in December 1988 and ending in December 2021. A rank of one indicates the most disperse, while eleven indicates the least disperse. Signs of persistence would include fairly consistent ranks in each of these three-year windows.

²² Graph does not include several sectors that have showed persistent low levels of dispersion, to interpret the data more easily.

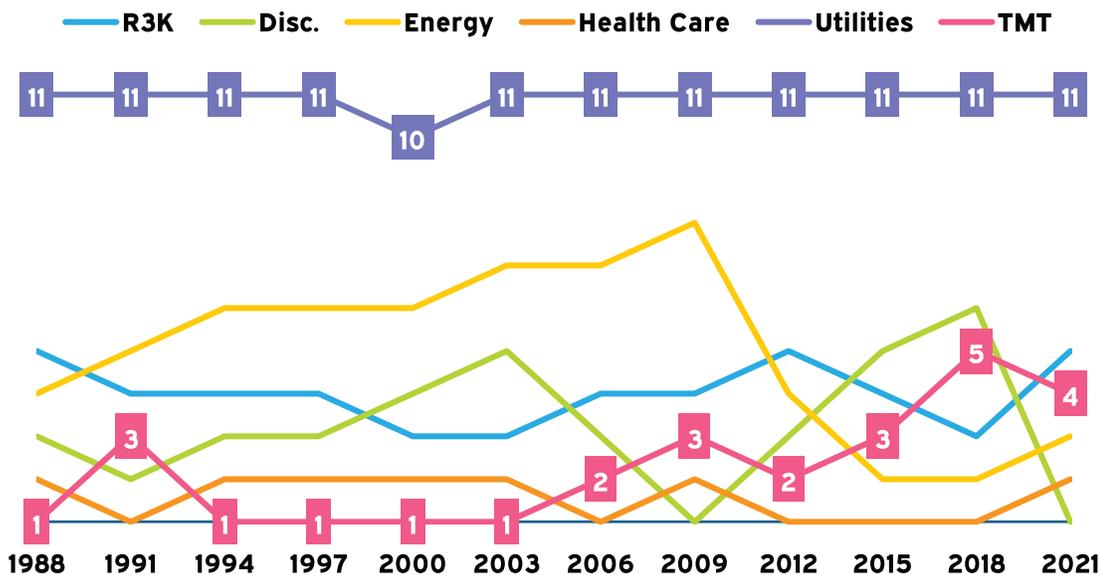


FIGURE 7
Dispersion Ranking of Various GICS Sectors

Source: FactSet. Data as of December 2021.

The utilities sector has displayed persistently low dispersion relative to other sectors over time. Health care, on the other hand, has had persistently high dispersion. TMT has held consistently high levels of dispersion relative to other sectors for most of the time period, though this has dropped in the past six years.

We suspect that the drop in dispersion ranking in recent years is due in part to several events that have created outlier data points in our near 40-year data set. For example, in April 2020, the price of a Crude Oil WTI entered negative territory for the first time in history²³. April 2020 variance in the energy sector reached 0.36, which was over 18 standard deviations above the sector’s historical mean variance.

²³ Source: IHS Markit.

Another outlier event occurred in the Consumer Discretionary sector in January 2021. The GameStop short squeeze initiated by a Reddit-based contingent of retail investors saw the price of GameStop stock - as well as a large number of other Consumer Discretionary stocks - rise significantly. Variance for the sector during this month was 0.96, significantly higher than the the next highest point in the sector’s history of 0.39. A value of 0.96 equates to 20 standard deviations above the historical mean variance for Consumer Discretionary.

Both of these data points are outliers and we do not believe they are representative of forward expectations of variance for either sector. If we remove these data points, and adjust the effect that these sectors had on the Russell 3000 in those months, we arrive at Figure 8, where TMT is the second most disperse sector in this most recent three-year period.

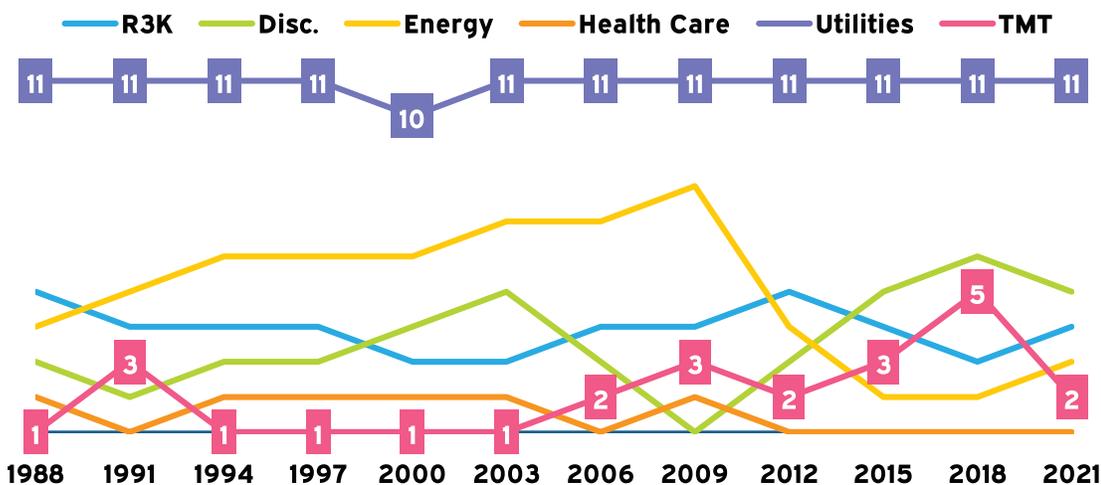


FIGURE 8
Dispersion Ranking of Various GICS Sectors, Adjusted for Recent Outliers

Source: FactSet. Data as of December 2021.

We do recognize that in the period from 2016-2018, TMT ranked fifth. Periodic displacements in rank may be expected, and this was the first time TMT ranked anything lower than third.²⁴ Nothing in the data from this three-year period suggests that there was a structural change in dispersion for TMT. Rather, other sectors simply experienced slightly higher dispersion. Should we see a sustained and structural relative decrease in dispersion in the coming periods, our analysis would have to be re-underwritten and the marketplace re-evaluated.

²⁴ It is worth noting that the difference in variance between #3 (Russell 3000) and #5 (TMT) was just 0.3%.

Persistence of correlation

In addition to looking at the persistence of dispersion, we also wanted to look at the persistence of correlation. Using the same (24-month rolling) pairwise correlation data from earlier, Figure 9 shows the rank of the TMT, health care and consumer staples sectors. The rank for all three sectors has been consistently low, except for the TMT sector during the popping of the dot-com bubble in the early 2000's.

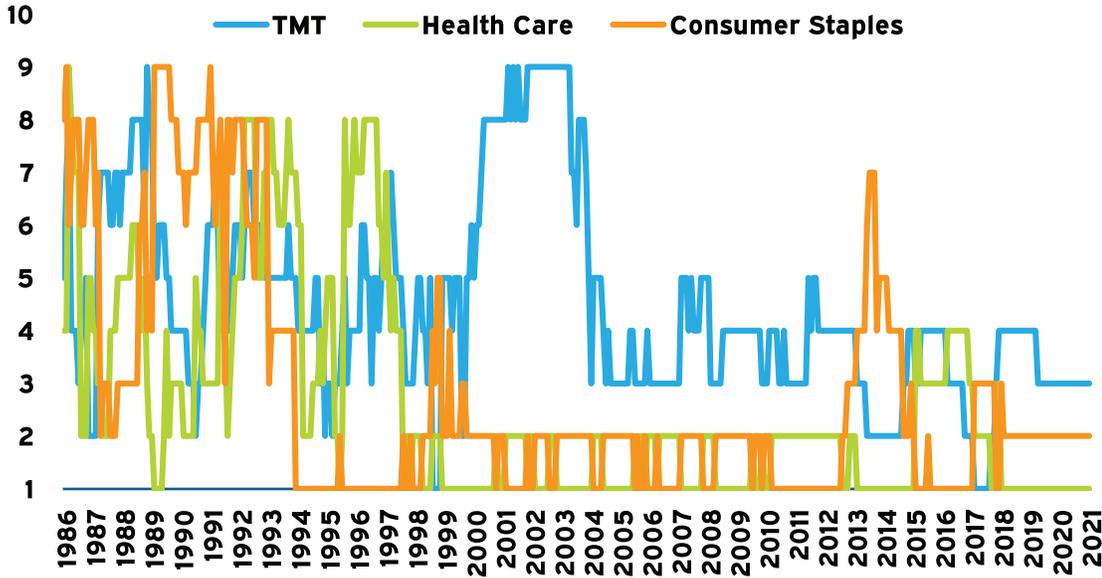


FIGURE 9
Rank of Correlation by Sector: 24-Month Rolling Periods

Source: FactSet. Data as of December 2021.

Implementation

TMT may be implemented in portfolios in a variety of ways. An investor may add a TMT investment manager as an active equity allocation inside of its global or domestic equity portfolio. That investor could also look to include a long-short equity manager in its equity or alternatives portfolio. This type of TMT manager will buy and also short stocks in the TMT space, potentially benefiting from the dispersion noted earlier. They may go long leaders in technology, media or telecommunications, while shorting those companies that the manager views as less primed for success. Implementation is dependent on that investor's risk and return appetite and should be carefully explored while working to find the appropriate allocation.

Conclusion

The TMT universe offers a unique investment opportunity set for active management. There is a high level of dispersion and a low level of correlation across the sector, giving investment managers a more robust opportunity set for generating alpha than exists in most other sectors.

The fundamental law of active management suggests that the presence of breadth (i.e., a robust opportunity set) does not alone imply the presence of alpha. Rather, manager skill is required to generate alpha. The high level of dispersion implies the presence of big winners and big losers, and hence the potential for significant outperformance (and underperformance). In a way, dispersion acts as a lever that amplifies the skill, or lack thereof, of investment managers.

We expect the low level of stock correlation and high level of stock dispersion in TMT to persist. Both are qualities that have existed in the sector historically, driven by the wide range of subsectors and disruptive developments. We plan to monitor the dispersion of all sectors and re-evaluate our assumptions and conclusions if the data changes over time.

Just like “old economy” to “new economy” has evolved over time, we may see a new iteration of this universe in the future. Disruption can be a cause of dislocation and some of the sub-industries in the two sectors may lend themselves better to disruption than others.

Based on our analysis, we expect to see the wide dispersion of stock performance combined with lower correlations among stocks to lead to wide dispersion of investment manager returns. The results should be higher alpha for those managers with skill than are likely to be achieved in other sectors. Given this expectation, we conclude that the combination of Information Technology and Communication Services sectors, or TMT, presents an attractive opportunity set for active management.²⁵

²⁵ Our paper also concludes that Meketa's 2018 analysis of the Health Care sector continues to be valid, as dispersion remains highest in that sector.

Appendix A

The below classification is as of February 2022, with the most recent guiding principles and methodology for GICS revised in January 2020.

Sector	Industry Group	Industry and Sub-Industry
Information Technology	Software & Services	IT Services → IT Consulting & Other Services → Data Processing & Outsourced Services → Internet Services & Infrastructure
		Software → Applications Software → Systems Software
	Technology Hardware & Equipment	Communications Equipment → Communications Equipment
		Technology Hardware, Storage & Peripherals → Technology Hardware, Storage & Peripherals
		Electronic Equipment, Instruments & Components → Electronic Equipment & Instruments → Electronic Components → Electronic Manufacturing Services → Technology Distributors
	Semiconductors & Semiconductor Equipment	Semiconductors & Semiconductor Equipment → Semiconductor Equipment → Semiconductors
	Communication Services	Telecommunication Services
Wireless Telecommunication Services → Wireless Telecommunication Services		
Media & Entertainment		Media → Advertising → Broadcasting → Cable & Satellite → Publishing
		Entertainment → Movies & Entertainment → Interactive Home Entertainment
		Interactive Media & Services → Interactive Media & Services

FIGURE 10
GICS Classification

Source: MSCI, February 2022, January 2020.

Appendix B

The analysis showed that the average dispersion for the TMT universe was higher than that of the broad Russell 3000 Index, as well as every other GICS sector outside of Health Care. To test if that difference was statistically significant, we first conducted F-Tests (variance test) to inform which t-Test (mean test) we should use. The null hypothesis for the F-Test is that the two data sets have equal variance. Any p-value lower than 0.05 would lead us to reject the null hypothesis and our t-Test would assume unequal variances. P-values higher than 0.05 would lead us to fail to reject the null hypothesis and perform a t-Test assuming equal variance.

The results of our t-test highlight that the difference in dispersion was statistically significant for all sectors except for consumer discretionary and health care. These tests were all run at a 95% significance level.

@ = .05	R3K	Disc.	Staples	Energy	Financials	Health Care	Industrials	Materials	Real Estate	Utilities
p-value	0.00	0.07	0.00	0.11	0.00	0.50	0.00	0.00	0.00	0.00
Conclusion	Reject Null	Fail to Reject Null	Reject Null	Fail to Reject Null	Reject Null	Fail to Reject Null	Reject Null	Reject Null	Reject Null	Reject Null

FIGURE 10
Tests for Statistical Significance – Dispersion (F-Test Two-Sample for Variances)

Source: Data for analysis from FactSet.

@ = .05	R3K	Disc.	Staples	Energy	Financials	Health Care	Industrials	Materials	Real Estate	Utilities
p-value	0.02	0.23	0.00	0.01	0.00	0.15	0.00	0.00	0.00	0.00
Conclusion	Reject Null	Fail to Reject Null	Reject Null	Reject Null	Reject Null	Fail to Reject Null	Reject Null	Reject Null	Reject Null	Reject Null

FIGURE 11
Tests for Statistical Significance – Dispersion (T-Test: Two-Sample Assuming (Un)equal Variances)

Source: Data for analysis from FactSet.

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