12-2019

Technological Innovation and the GICS: A Discussion of Classification Needs in a Disrupted World

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Spring 2019

1. Introduction

When searching for potential securities, a long-standing starting point for many investors begins with a sector analysis. To complete this analysis, though, the respective sector must be defined. While this concept may seem overly simplistic, the way in which sectors are defined has the ability have a lasting impact on a portfolios management and measurement. The definition of these classes has the ability to provide seemingly unrelated categorizations at times. General Electric serves as a prime example. For many years their line of appliances has made them a household name across the United States, but when searching for information about GE on research platforms like Bloomberg, you will find that GE is not considered an appliance manufacturer at all (Bloomberg). Instead, it is actually classified as an aerospace firm within the Industrials sector – a far cry from the washer and dryer maker that many know it to be. Because of this, aerospace and defense powerhouses United Technologies and Honeywell International, are considered their primary competitors, even though GE's aviation business only barely lead its other business groups in terms of revenue in 2018 (Bloomberg). Examples like these are not restricted to Industrials or firms with mixed revenue bases, for instance, web-based transaction sites like online auctioneer Ebay and small business center Etsy were considered part of the Information Technology sector up until 2018, when cloud service provider Amazon remained a part of the Consumer Discretionary sector. While examples like these may exist across several sectors, examples of irregularly classified companies have become more prevalent within the Information Technology sector in recent years. When considering examples like these, the GICS, one of the most popular industry classification systems used in the financial industry,

appears to offer an inconsistent means of sector classification which can be problematic for end users. However, upon an analysis of the changes made to the GICS classification system, specifically the updates enacted in September of 2018, it appears that the GICS is transitioning their underlying categorization groupings in order to better reflect the changing business environment and expectations for an Information Technology firm.

As businesses have begun to branch out into these innovative endeavors in addition to their original functions, many companies have come to take on characteristics previously only held by technology firms. For instance, mainstays of the auto industry like Ford and General Motors are setting the goal of putting self driving cars on the road by the end of 2021 (Colias). Alternatively, in the cases of several companies that have formerly been classified in the Information Technology sector like e-commerce firms that operated solely through websites, what once made them seem groundbreaking is now not only widely used, it is basically a requirement for doing business. These issues have become more and more noticeable since the GICS's implementation, and just because a company was at one time considered technologically advanced or uses innovative technology in their business should not mean that they are automatically classified as a technology firm. In light of these changes, it bears cause to evaluate whether or not classification hierarchies like the GICS are updating their system in a way that properly reflects the types of firms who should exist within the Information Technology sector. Through the use of Bloomberg research tools and a historic log of changes made to the categories within the GICS hierarchy, it is possible to evaluate these changes in order to determine if they appropriately reflect shifting expectations for an Information Technology firm.

2. The Need for Classification Systems

In the introduction to their comprehensive work on classification systems, Bowker and Leigh note that “To classify is human. Not all classifications take formal shape or are standardized in commercial and bureaucratic products. We all spend large parts of our days doing classification work, often tacitly, and we make up and use a range of ad hoc classifications to do so” (Bowker 2). Sector classification has earned an integral position in academia, government, and business. While classification systems are primarily employed in analysis purposes, they are also frequently used as a tool to identify peers, benchmark performance, build indices, and gauge economic activity (Phillips & Ormsby 1). The need to better understand information drives the requirement for these types of systems, since “categorization, formally and informally, is the process we use to contextualize information as well as to capture and distribute knowledge.” (Phillips & Ormsby 2). However, without some consistency across groups concerning the taxonomy of this information, the classes created carry little meaning. This exemplifies the need for the systematic creation and ordering of information.

There are several formal classification systems used by the financial industry that take into account everything from business activities, international trade regulations, materials used in production, services offered, and goods sold, but for the last 20 years the Global Industry Classification Standard, more commonly known as the GICS, has been the most widely used classification system in the industry (“Stock Taxonomy”). However, the world has changed drastically in that same amount of time, and the fundamental basis on which companies are succeeding has changed. As both expectations and definitions for industries change, it is also becoming necessary for the systems used to classify those industries to evolve as well.

In the case of business sectors, these orderings are known as industrial classification schemes. Due to the rapid increase in the availability and granularity of information, the need for an accurate system has only continued to grow, as "classification schemes and the resulting taxonomy are the systems that formalize this process" (Phillips & Ormsby 2). In the same way ordering things in specific ways allows the mind to take large amounts of information and process it in meaningful ways, industry classification systems investors "by creating abstract categories of business and industry that define what a company is, what it does; and alternatively, what it is not, and what it does not do" (Phillips & Ormbsy 2). In much of the same ways professionals rely on indices to "to assess long term regularities that help in understanding the behaviour of financial actors, the evolution of the economy, and to make international comparisons", they also rely on industry classification systems to understand the trends within those indices (Hautcoeur 1).

3. Investments and Sector Breakdowns

The impact that industry classification systems have on the financial world are not just limited to aiding in the understanding of the professionals who use them. The GICS was created by Morgan Stanley Capital International in conjunction with S&P Dow Jones Indices in order to offer what they believe to be "an efficient investment tool to capture the breadth, depth and evolution of industry sectors" ("GICS"). This tool is used by investment professionals in a variety of ways, from the creation of a portfolio to the determination of its success or failure.

Sector analysis, also commonly referred to as Industry analysis, is a method by which an interested party evaluates a "a specific branch of manufacturing, service, or trade" and it is often

used by investors who employ a top down approach to portfolio management ("Industry & Company Analysis"). A top down approach to investing begins with an evaluation of the overall economic environment, which then leads to an industry analysis, and concludes with a company analysis that may potentially lead to the purchase of an equity ("Industry & Company Analysis"). Essentially sector analysis allows an interested party to evaluate the overall health of a specific industry group in order to determine the viability of the sector. It also further allows for the comparison of firms within an industry class to its peers, which gives the prospective investor an opportunity to compare the performance of multiple firms that supposedly share similar attributes with the end goal of choosing the superior firm. If companies are improperly classified by sector, this can render the sector analysis and peer comparison portion of the research process inaccurate at best and completely purposeless at worst ("Tracking Performance".

The use of sectors by investors does not end with stock research and selection. It is common practice for many portfolios to be weighted based on the percentage makeup of a sector within an index. Coincidentally the S&P 500 is one of the most common indices used for this purpose, and its sectors are defined using the GICS. The weight of a sector within the S&P 500 is used as a baseline for the weighting of holdings within an individual portfolio. Oftentimes recommendations are made in regard to overweighting or underweighting a portfolio in contrast to the corresponding weighting in the S&P 500. If a portfolio is overweight in a sector, then its manager has chosen to take a greater position in the sector than its S&P 500 counterpart, and the opposite is true if a portfolio is underweighted for a sector. If a portfolio is unequally weighted, then it is indicative of the managers assessment of the sector's valuation and performance prospects, and it also displays the manager's expectations and comfort level for the sector

relative to the foreseen risks and associated sector information ("US Equity Sector Strategy"). If firms that differ greatly in terms of growth drivers and risk exposure exist within a sector, then it is possible that a manager may not be weighing their sectors in a way that reflects the true industry environment.

Of course, the use of the S&P 500 as measure for sector weightings is only appropriate when the S&P 500 is used as part of a portfolios benchmark. A benchmark is used to "compare a fund's returns to judge its performance" and it can be an "average performance of funds similar to your portfolio or a broad index of the investments your fund usually picks from", which makes the S&P 500 an appropriate benchmark for funds dealing in stocks of larger companies (Morningstar). Just as individual companies are punished by the market for failing to meet their earnings advising, investment managers are subject to penalization for failing to exceed, or at least match, their benchmarks. Failure to meet these benchmarks can be detrimental to a portfolio's longevity, and repetitive failure to perform will reflect poorly on a manager's abilities as an investor ("Tracking Performance").

Given the ways in which sectors are used to build and measure portfolios, the importance of classification systems becomes highly evident. If the definition of a sector is not accurate within a classification system that is used to benchmark a portfolio, then the composition of the benchmark could inaccurately reflect the performance of a sector, which, in turn, could make the performance of a portfolio appear better or worse depending on the makeup. Essentially this would mean that it has the ability to artificially increase or decrease the returns a manager needs to beat ("Tracking Performance"). In the case of company analysis when using the S&P 500, for example, if a sector continues to perform well in the S&P 500, but the corresponding portion of an individual's portfolio fails to perform, then it negatively reflects on the managers ability to

select stocks. As aforementioned, this may not only negatively impact their career, but it can also lead to a loss of investors' confidence in the portfolio which could lead to a withdrawal of funds .

4. The Fourth Industrial Revolution & Sector Classification

Given the nature of the role that the GICS plays in the financial market place, the need for it to accurately reflect changing sector landscapes becomes more evident. Classification systems, however, are meant to provide consistency, so a sector should only be altered if it has experienced a shift in the nature of the business that occurs within it (Vermorken 36). Such a shift has occurred in the Information Technology sector. It is no longer feasible for companies not to integrate these advances into the fundamental areas of their business. Many firms that operate in areas that have traditionally not been associated with the technology field have become leaders in innovation by dedicating their resources to adapting to the new world order. Several key advances have been brought to the forefront of this movement in recent years, and because of this, it is becoming widely believed that the world has entered into a fourth industrial revolution (Schwab).

The last fifty years has been host to an unprecedented evolution in the information technology environment. It has expanded so much so that it has moved beyond siloed areas through integration into almost every aspect of most of the world's daily lives. This is not the first time the world has experienced such a shift. When the first industrial revolution occurred, it transformed the capacity of human performance, and each successive revolution has provided the platform on which the next phase has been able to develop. Many believe that the developed world is in the midst of a fourth industrial revolution. In much of the same ways the first

industrial revolution transformed the mechanization of production through steam power, the second revolution enabled mass production through the use of electricity, and the third industrial revolution allowed for automation through advancements in information technology and electronics, the fourth industrial revolution is razing the landscape across service and production industries through the implementation of the Internet of Things, artificial intelligence, robotics, 3-D printing, quantum computing, biotechnology, materials science, and energy storage (Schwab). Some might argue that the advances taking place are an extenuation of the third industrial revolution, but according to Klaus Schwab, Executive Chairman of the World Economic Forum, "When compared with previous industrial revolutions, the Fourth is evolving at an exponential rather than a linear pace. Moreover, it is disrupting almost every industry in every country. And the breadth and depth of these changes herald the transformation of entire systems of production, management, and governance" (Schwab).

These changes are evidenced through the shift from businesses traditional core areas to the adoption and integration of new focusses into their product, service, and development lines. Firms like Alibaba, Ford Motor Company, JPMorgan Chase, and Goldman Sachs are all investigating various ways of employing digital ledger blockchain into their business structure (Castillo). Employing blockchain in their businesses would allow these firms to engage in direct transactions that would negate the need for third party intermediaries by allowing a transaction to be approved across a shared network and become added like a block in a chain to a ledger shared in that network (Hutt). Other businesses like Walmart and Johnson & Johnson are using artificial intelligence for everything from product selection and development to hiring (Marr). IBM Watson, one of the more well-known artificial intelligence systems is now able to employ its cognitive computing capabilities in healthcare practices in order to aide doctors, like those at

world renowned Memorial Sloan-Kettering Cancer Center, who are now "using Watson's ability to sort through massive amounts of data, from clinical knowledge, case histories, and genomic and molecular data, that will help oncologists diagnose and treat an individual's cancer" because "Watson actually understands both structured and unstructured data and works with a human counterpart to actually learn from both Big Data systems and simple doctors notes" (Lee 46). These are just a few of the many ways recognizable organizations are stepping outside the traditional bounds of their industries through the technological innovation that has been made accessible through the fourth industrial revolution.

Of course, it is not enough that companies like these and many others are employing these technologies in their firms simply because they are available. Since the 1980's several knoweledge based growth models have been evaluated in order to determine the effect that investing in knowledge has on the economic performance of firms (Park). In the original knoweledge based model, researchers found that not only did investment in human capital and general knoweledge through R&D translate into profit maximization for individual firms, but it also led to "parts of that knowledge being spilled over to a societal knowledge stock that influenced the production function of other firms and increase their productivity" (Park). Most recently this model has been updated to account for effects that competition and innovation have on new and established firms in order to evaluate "the effects of technology-based entry on the innovativeness, productivity, and the implications of firms' heterogeneity on creative destruction and growth" (Park). The 2012 study found that not only does increasing investment in various forms of research and development increase the profitability of the firm, it is reshapes the entire business environment as it "reformulates the traditional economic growth model such that knowledge, technology, entrepreneurship, and innovation are regarded as core elements that play

as forces in operating interdependently one another. Accordingly, self-sustainable economic growth is possible in the knowledge-based economy. The web economy is a specific manifestation of the primarily knowledge-based economy" (Park).

This suggests that while these technologies and their uses may continue to evolve and adapt to the needs of specific firms and industries, they are not passing fads. Rather, they exemplify the shifting nature of business models, which proves the need to ensure that companies now classified in the Information Technology sector are not just users of technology, but they are significant contributors to the industry in keeping with the current environment.

5. Characteristics of a Good Classification System

Given the fact that a need exists for classification systems, and the fact that human beings posses an innate need to group and classify things does not necessarily make it is easy to identify an appropriate system by which to do so. These abstract groupings allow for a common understanding across boundaries to be established in order to better understand the mechanisms they attempt to congregate, but before trying to identify a "good" way to classify information, it is important to understand what components make up a classification system. By definition a classification is "a spatial, temporal, or spatio-temporal segmentation of the world" that has "consistent, unique classificatory principles in operation'' and categories that are mutually exclusive (Bowker 10). In the case of industry classification systems, it is vital that "Successful classification schemes create discrete categories, sets of classes, by maximizing the differences between industry groups and similarities of components within industry groups." (Phillips & Ormsby 2).

The GICS accomplishes these requirements through the breakdown of their hierarchy system, as each of the four levels that exist within the GICS begin with a broad sector class, that can then be split up into industry groups, industries, and sub-industries. The sub-industries are the most detailed of the levels, and each sub-industry only ever exists within a single sector ("GICS"). This prevents any possibility of repetition within industry types, and it creates a segmentation of businesses that provides consistency through its broader sector class. These systems vary based on their purpose, developer, and user, and the three primary developers of these systems are academics, governmental organizations, and business professionals. Much of the information regarding the creation of these business industry classification systems is proprietary, as is the case with the GICS, but it is still possible for end users to independently assess the usability of these systems from an outsider position by analyzing the historic changes made and the context of the business environment in which those changes were made.

6. Innovation & the GICS

When the GICS was first implemented in 1999, it was comprised of 10 sectors that included Energy, Materials, Industrials, Consumer Discretionary, Consumer Staples, Health Care, Financials, Information Technology, Telecommunication Services, and Utilities, and in the last twenty years those sectors and the sub-levels that exist within them have been revised nine times. Despite those changes though, at times there still appears to be inconsistent classification occurring with technology firms.

MSCI assigns companies in the classification system using a bottom up approach, that employs quantitative and qualitative analysis of a company's principal business activity. This

means that a company is placed in a GICS sub-industry, and it then assumes the broad sector class that the sub-industry resides in. MSCI prides itself on designing the GICS to be able to "reflect dynamic interactions across world markets" and "interpret the complexity and pace of industry movements, a consistent and comprehensive global industry classification standard is critical" ("GICS"). In order to maintain these capabilities, it is impossible for the makeup of the hierarchy to remain stagnant. As the GICS methodology for the creation and subsequent alterations to their hierarchal system is proprietary, the evidence of their approach concerning the movement among industries is best seen through the updates they make to the GICS. These updates are available to the public, and an examination of the breakdown of these changes suggests the MSCI and S&P Dow Jones take into account market shifts when re-evaluating their system, which demonstrates a long term, evolutionary approach to the alterations made to their taxonomy system. In addition to these historic changes, it is also public knoweledge that the MSCI and S&P Dow Jones uses revenues to determine a firm's principal business activity, which, through the use of Bloomberg research tools, can explain many irregular firms placement within (or outside of) the Information Technology sector.

When the GICS was established in 1999, the Information Technology sector was made up of two industry groups, eight industries, and twelve sub-industries that allowed for a wide variety of activity to occur and still be classified as an IT firm. The sub-industries that existed at the time reveal in the most detail what the GICS believed technology firms to be appropriately classified as. At the time, they included Internet Software & Services, IT Consulting & Services, Application Software, Systems Software, Networking Equipment, Telecommunications Equipment, Computer Hardware, Computer Storage & Peripherals, Electronic Equipment & Instruments, Office Electronics, Semiconductor Equipment, and Semiconductors. Between 1999

and the fall of 2018, there were four sub-industries added that still remain in the sector, and three that were removed or consolidated into other sub-industries. Those sub-industries added include Data Processing & Outsourced Services, Electronic Components, Electronic Manufacturing Services, Technology Distributors and those removed include Office Electronics, Computer Storage & Peripherals, and Computer Hardware. In September of 2018, the GICS experienced its most recent set of revisions, which led to the dissolution of the Telecommunication sector and the creation of the Communication sector. Incidentally, it was the creation of the Communications sector, along with some additional updates, that have allowed the GICS's identification classes to better incorporate the types of firms that should comprise the Information Technology sector based on the technological integration that has come about in recent years.

The changes that occurred took significant steps to removing irrelevant firms from the sector, and effectively demonstrate a recognition of the effects technology has had on transforming business structures. In September of 2018 when the Telecommunications sector was dissolved and the Communications sector was formed, 10% of the S&P 500 Index Market Cap changed classifications (Bartolini). Of that 10%, 72 firms were transferred out of the Information Technology sector. Twelve were moved into the Communications sector, and an additional sixty were moved into the Consumer Discretionary sector. Eighteen others were reclassified within the IT sector to either Internet Services & Infrastructure or Application Software following the dissolution of the Internet Software and Services sub-industry ("GICS"). This change was the most impactful to the IT sector, both in terms of size and scope, and led to the removal of several firms from the technology sector. Examples of companies that were removed from the IT sector into other sectors include Alibaba, Ebay, Etsy, Stamps.com, Alphabet Inc, Facebook, Nintendo,

and Ubisoft ("GICS"). These are just a few notable examples that are particularly interesting, because of the common and professional perceptions held about their businesses, as well as the changes that were made in the GICS business sub-industry. Each of these companies were removed because a majority of their revenue's were derived from either e-commerce, consumer advertising, or entertainment. All three of these businesses were removed from the IT sector after their corresponding sub-industries were moved into the Consumer Discretionary and Communication sectors. Stamps.com, Etsy, and Ebay's movement out of the technology sector seem like obvious and necessary moves as an outliers among some of the others listed, but it also signals a shift in the analysis MSCI & S&P Dow Jones are using to designate companies as information technology firms. While it may seem like an obvious choice to expunge these Internet Software & Services firms, their removal and others like them imply that MSCI is making an effort to remove companies who merely exist online or use technology in their businesses, rather than companies contributing to an advancement in information technology. The removal of these three sub-industries into the Internet & Direct Marketing sub-industry of the Consumer Discretionary sector the effectively corrected the issue of classifying web based companies within the Information Technology sector ("GICS").

What is more interesting, though, is the GICS's new treatment of companies like Facebook and Alphabet Inc, companies who are widely regarded for the ways they contributed to technology through their own research and development. Alphabet Inc, would seem like an especially unexpected move from the Internet Software & Services sub-industry classification within the technology sector to the Interactive Media & Services sub-industry in the Communication Services sector, but a review of their revenue by business segments actually reveals that since 2011, nearly 100% of their revenue has been generated through Google

Advertising (Bloomberg). Similarly, Facebook, despite its development and implementation of facial recognition software and recent data mining scandals, generated 98.5% of its revenue from advertising in 2018 as well. Retail giants Amazon and Alibaba, who have focused a great deal of attention on their smart home assistants and cloud computing services in recent years, both still earn more than 50% of their revenues from e-commerce, with cloud computing making up only 11% of Amazon's revenue and 4.2% of Alibaba's (Bloomberg). While the hype built up around the new and exciting enterprises they engage in may lead people to think of them as tech scions, their primary businesses appear to more accurately correspond to their placements within the GICS based on their revenue data.

All of the changes are indicative of MSCI's recognition of the effects of the knowledge growth models and disruptive technology. The ways in which MSCI and S&P Dow Jones have shifted the Information Technology sector in recent years indicates their goal for the GICS is to realign the current classification system in such a way that the hierarchy encases the shifts in businesses created by the technological revolution.

7. Concluding Remarks

Classifying companies within sectors allows a picture to be painted that pulls larger trends into focus – to see market shifts, drivers, successes, and failures. Without them, an already murky environment becomes a hurricane of information flow without reference points. With the onslaught of data being provided to investors and analysts every day, it is vital that the classification systems they use accurately display the dynamic market place they seek to simplify. Through an evaluation of the recent revisions made to the GICS, it can be seen that

MSCI is attempting to keep the Information Technology sector relevant and accurate by moving the sub-industries that the inconsistent firms existed in from one sector to another as they have become associated with different sectors, rather than change the revenue requirement that is used to place companies into sectors. This has allowed a majority of sectors to remain largely intact.

The GICS is an essential tool used in the perpetuation of the allocation of funds in capital markets around the world, and as such a tool, it should be subject to objective observation and evaluation in order to determine the appropriateness of its use within this fundamental system. The fact that the GICS is evolving to reflect market expectations and demands in a methodical way demonstrates that it is still a viable system to use for sector classification.

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