Article

Disruptive Innovations, Fundamental Strength and Stock Winners: Implications for Stock Index Revisions

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Abstract

Globally, disruptions driven by technological advancements are visible in the form of unicorns and declining lifespan of the index constituents. Sectors such as information technology, financial services, energy, consumer goods and automobile are found to be more prone to disruptive innovation. Assessing the financial strength of the incumbents is crucial to assess their strength to endure disruption. We construct a fundamental strength index (FSI) using 11 financial performance measures covering 7 key attributes, namely profitability, efficiency, solvency, liquidity, net investments, pursuance of innovation and entry barriers, over the 5-year period 2014–2019. FSI helps in categorizing stocks of National Stock Exchange (NSE) 200 universe as 'A' being the fundamentally strongest and 'C' being the weakest. Potential crossovers can take place between 'C' category stock in Nifty 50 (Next 50) and 'A' category stock belonging to the Next 50 (Nifty Midcap 100). The results show that the disruptor's portfolio (Next 50 stocks) outperforms the incumbent's portfolio (Nifty 50 constituents) with a return of 1.61 per cent vs 0.47 per cent. A similar observation holds true for the Next 50 and Nifty Midcap 100, with the disruptor's portfolio surpassing the incumbent's portfolio (return of 2.59% vs 0.44%). The study has significant implications for the policymakers, investors, companies and academicians.

Key Words

Disruptive Innovation, Financial Strength, Index Revisions, Unicorns, Portfolio Returns

Introduction

Disruptive innovation, a term coined by Harvard Business School in 1995, describes a process where a new firm with relatively fewer resources is successful in challenging the well-known large incumbent firms. Launch of Apple's iPhone marked the beginning of serious innovative disruption (Christensen et al., 2015). Also, the global financial crisis emanating from the USA in 2008 caused severe financial disruption in the world, resulting in an unprecedented rise in unemployment (Hatzius et al., 2010). Since then, the scale and speed of the change are tremendous. The change in the economic landscape is reflected in the changing composition of the stock market index, as can be observed in the declining tenure of stocks in the S&P 500, a US capital market index, with 33 years in 1964 to 24 years in 2016 and is predicted to be only 12 years by 2027 (Anthony et al., 2017). However, the changing face of the S&P 500 would not only be a result of incumbent companies' poor performance but also the emergence of unicorns, start-up companies foraying into newer areas of disruption. However, these forces of disruption are stronger in some sectors and industries.

Taking a future perspective, the 'unicorn' and 'decacorn'[1] phenomena of highly valued disruptive start-ups along with the increasing mergers and acquisitions, private equity and venture capital activity indicate stepping-up of turbulence in the future. The unicorn was a term coined for private companies with a valuation more than USD 1 billion assuming that their occurrence is a rarity. Until September 2019, there are more than 398 unicorns globally (CB Insights, 2019). These large companies already fulfil the minimum criteria required for inclusion in the index, S&P 500, and would rank higher than the incumbent, post their listing.

In a broader context, the frequent index rejigs and shrinking lifespans of the companies are the result of the composite changes in the market forces—technology shifts and economic shocks, highlighting the importance

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of understanding and navigating the disruptive innovation as early cautionary signals. Investors need to pay attention to these trends, intensifying turmoil in the economy, and devote time and money for harnessing returns.

Prior work provides evidence that the index revisions significantly impact the stock performance. Studies (Baran & King, 2012; Becker-Blease & Paul, 2006, 2010; Biktimirov & Li, 2014; Chan et al., 2013; Chen et al., 2004; Dhillon & Johnson, 1991; Edmister et al., 1996; Elliott et al., 2006; Fernandes & Mergulhão, 2016; Gregoriou, 2011; Gregoriou & Nguyen, 2010; Hegde & Mc Dermott, 2003; Hrazdil, 2009; Kamal, 2014; Kot et al., 2015; Mazouz et al., 2014; Miller & Ward, 2015; Sadeghi, 2011) have analysed the effect of index reorganization on the liquidity, cost of equity capital and abnormal rate of return in the international context. Afego (2017) presents a detailed review of studies related to changes in index compositions.

All this put together provides a strong argument for the academic community and investors to pay attention to the stock index movement, inclusions and exclusions of the stocks. Additionally, Rahman and Rajib (2014) suggest that the index revisions are perceived to indicate the financial health of the stocks, and investors believe that winner (loser) stocks are included (eliminated) based on their financial strength. On similar lines, efficient market hypothesis postulates that the market capitalization is a true reflection of the intrinsic value of the stock which depends on the financial performance as reported in the form of revenue, income, expenses and turnover ratios.

Moreover, there is a large body of work illustrating the role of fundamental analysis in identifying winner stocks (Abarbanell & Bushee, 1997; Lev & Thiagarajan, 1993; Ou & Penman, 1989). Piotroski (2000) develops an F-score based on financial statement analysis using measures of performance (ROA and accrual) in conjunction with measures of leverage, liquidity and efficiency. Beneish et al. (2001) utilize market-based indicators to discern extreme performers and then apply fundamental signals to discriminate between the winners and losers among these firms. Their findings highlight the importance of fundamentals while developing an investment strategy. Mohanram (2005) creates a G-Score index to identify winners and losers among the value stocks. The study, in addition to the measures analysed in F-score, includes expenditure on research and development, capital assets and advertising to account for growth aspects. The results highlight the role of fundamentals in generating excess returns on the portfolios. Lopes and Galdi (2008) employed accounting-based financial data to identify winner stocks for the Brazilian markets. Richardson et al. (2010) document the research on fundamental analysis and accounting anomalies. Mohr (2012) applies an F-score in the context of European stock markets. Shen and Tzeng (2015) suggest that financial ratios help in stock selection using soft computing. Alberg and Lipton (2017) create an investment strategy using deep neural networks to forecast future fundamentals and demonstrate its advantage over the naïve strategy. Mohanram et al. (2018) construct a B-Score index to specifically screen US bank stocks.

However, these studies largely focus on the developed markets. Harvey (1995) warrants a separate study for emerging markets as the level of market efficiency differs considerably. Indian stock market is a unique case in point as it has the highest number of listed companies (5,065 in number according to The World Bank; The Global Economy, 2018), but it portrays high transaction costs, low liquidity and weak market microstructure in contrast to the developed economies. Indian stock market experiences substantial interest from foreign institutional investors (FIIs), with USD 11.41 billion flowing in the first six months of 2019, the highest in five years.[2]

A few studies (Joshipura & Janakiramanan, 2015; Kumar, 2007; Parthasarathy, 2010; Rahman & Rajib, 2014; Selvam et al., 2012; Vijaya & Vedpuriswar, 2003) focusing on the Indian market have analysed the effect of changes in index constituents on stock return and liquidity. Some studies (Aggarwal & Gupta, 2009, 2016; Gopikumar et al., 2019; Sharma & Sharma, 2009; Singh & Kaur, 2015) have attempted to apply the profitable strategies based on the F-score and G-score in the Indian context. Recently, Accenture, in its report for India, published 'Disruptability Index', which assesses the exposure to current and future disruptions compiling information on financial performance, operational efficiency, degree of innovation and market share.

Given this backdrop, we draw implications and extend the prior work taking a futuristic view on index revisions. The proposed framework not only acknowledges the challenge posed by the unicorns but also aims to gauge the incumbent's financial strength to survive the disruptive innovation. The article argues for the consideration of disruptive innovation and fundamental factors in explaining the possible inclusions and exclusions in the index. To achieve this objective, we first synthesize disruptions in the listed and unlisted space by observing the S&P 500 and the emergence of unicorns. We further interpret the global disruptions in the Indian context to be able to visualize the true impact of these disruptions on the structure of the Indian stock market index, taking NSE 200 as a case. To account for the financial resilience of the companies, we create a fundamental strength index (FSI) and test its efficacy in identifying the winner and loser stocks. To decipher the changing composition of the index, we perform an ABC analysis to identify the possible crossovers in the NSE 200 universe between the Nifty 50, Next 50 and the Nifty Midcap 100 stocks of NSE 200, and the emerging Indian unicorns.

The article makes a noteworthy contribution by synthesizing different aspects of the index revisions, disruptive innovations and fundamental factors. Our research has important implications for the policymakers, practitioners and academicians by focusing on this fairly underemphasized yet important dimension of index revisions. The

lessons learnt by observing the upheavals in the international context and combining them with the financial strength of the firm to cope up with these disruptions, gauged by FSI, help in ascertaining the likelihood of inclusion (exclusion) in (from) the stock index. The findings may assist investors in better investment decisions.

The following section of this article offers the synthesis of disruptions in the listed universe (stock market index) and the unlisted universe (unicorns) globally with special reference to India. The third section presents the data and methodology used for developing FSI. The penultimate section covers the results of the ABC analysis, identifying crossovers between the incumbent and challenger stocks. Summary and conclusion are provided in the last section.

Disruptive Innovation: Global and Indian Experience

This section synthesizes the global disruptions and emergence of unicorns, with special reference to India. First, we observe the change in the weight of sectors in the S&P 500 Index, followed by the profiling of unicorns across the world. After identifying the major sectors experiencing disruptions globally, we decipher them in the Indian context, taking into account the sociocultural factors influencing the pace of adaptations and associated risks and challenges.

The data set for this section is assembled using the Bloomberg database (for S&P 500 Index stocks over the period of 2007–2018), information from websites such as CB Insights, Tech in Asia, Crunchbase supplemented by the press releases and published reports (data for unicorns, pertaining to company names, country of origin and its valuations) and NSE website for Indian indices data.

We take S&P 500 for observing the impact of the disruptions on the incumbent firms, that is, in the listed universe, as it is commonly considered to represent the global activity (Nandy & Chattopadhyay, 2019). S&P 500 comprises of well-diversified global companies across sectors with relative weights in terms of market capitalization reflecting their importance from an economic perspective. The sector classification in S&P 500 is defined in line with the Global Industry Classification Standard (GICS) which details 11 sectors[3] across 24 industry groups and provides their definitions. The sectoral and industry mapping helps in ascertaining the sectors which are vulnerable to major disruptions.

Over the years, the composition of the index has changed to reflect the underlying economic importance. Trends that are the driving force behind the index reconstitution range from the massive disruption in retail, increased digitalization and rise of the software-enabled online platforms to the emergence of clean energy challenging the fossil fuel-based energy and increased globalization. Some sectors have higher exposure to turbulence than the others.

Disruptions encompassing technological advances, cloud computing and artificial intelligence (AI) indicate further turmoil enabling quick scaling up of operations, global reach and no geographical limitations in expansion. This can be observed from Table 1, which depicts substantial churning in the composition of the index. Information technology (IT) sector has experienced an increase in its weight and contributes the maximum to the index in 2018. Sectors such as real estate, consumer discretionary and communication services have also shown a significant rise in the S&P 500 Index. Extreme volatility is visible in the retail sector, for instance, Amazon disrupting brick and mortar retail companies. Large incumbents are falling out of the index, owing to declining valuations. Energy sector has witnessed a sharp decline in its weight in the index, as cleantech is gaining prominence and oil prices are descending. Specifically, the incumbents are falling out of the index, but the challengers/private companies are yet to make it in the index. Both these dimensions working together have resulted in the falling weight of the sector. Increased investment in renewable sources has for the first time exceeded the traditional energy resources, that is, fossil fuels (Ren21, 2019, p. 24). The S&P Global Clean Energy Index[4] confirms this trend with one-year total return of 35.39 per cent in contrast to –7.74 per cent by the S&P Global 1200 Energy Index,[5] as on 31 October 2019.

The emergence of Facebook, Apple, Amazon, Netflix and Google (FAANG) in recent times highlight one of the significant shifts as they constitute major weight in the index, unlike the previous giants, General Electric (GE), Pfizer, ExxonMobil, etc.

The index reorganization points to an increasing private equity activity. Several companies are exiting the index on

Table 1. Sector Weights in the S&P 500 Index (2007 and 2018)

Sector	2007 (%)	2018 (%)	Percentage Change
Real estate	1.13	2.45	**117.56**
Consumer discretionary	5.59	9.88	**76.77**
Communication services	7.68	13.25	**72.36**
Information technology	13.94	19.15	**37.41**
Health care	11.01	13.93	**26.52**
Financials	14.56	13.23	**–9.16**
Utilities	3.12	2.74	**–12.38**
Industrials	10.60	9.23	**–12.98**
Consumer staples	9.83	7.36	**–25.10**
Materials	3.10	2.24	**–27.73**
Energy	11.92	5.67	**–52.41**

Source: The authors.

Note: Table 1 shows the changing weights of the sectors overtime since 2007 (beginning of disruptive innovation) reflecting the change in their underlying economic importance. IT carries maximum weight in the index, and energy sector has witnessed the sharp decline in its weight as on 2018. Percentages may not total to 100 due to rounding off. Significance of bold values is to represent the magnitude of percentage change.

account of going private, for instance, Staples in 2017. A number of privately owned companies are seeking listing on the US index, for instance, Alibaba.

Taking cognizance of this fact, we parallelly identify and profile the 398 unicorns all across the globe, out of which (about 50%) 196 unicorns are from the USA, followed by China with 101 unicorns. India ranks third globally with 18 unicorns.

Decacorns (see Table 2) pose a significant challenge to the listed companies at the bottom of the rung as their existing valuation is already above the minimum market capitalization requirement of S&P 500 which is USD 8.2 billion, and they can displace the incumbent when listed.[6] The USA leads with the maximum number of decacorns (12), trailed by China (5) and with 1 each in Singapore, India, Indonesia and Brazil. The maximum number of decacorns (3) have appeared in categories such as fintech, hardware and supply logistics sectors followed closely by automotive and transport sectors with 2 decacorns.

Comparative analysis across years was also performed to gauge which sectors are increasingly becoming prone to disruption. We watch the number of unicorns incorporated across years from 2010 to 2019, as depicted in Table 3 and conclude that fintech, e-commerce, internet software and service, AI and logistics are the top five business activities where unicorns have appeared in the past decade. This observation of unicorns and decacorns indicates that the sectors which are experiencing a higher degree of disruption are financial services, consumer discretionary (goods and services), automobile sector and IT.

Further, we look at the aggregate valuation of unicorns' category wise in Table 4. AI ranks number 1 with fintech being the second, followed by automotive and transportation, e-commerce and direct-to-consumer, supply chain, logistics and delivery. In the Other category, rank 3, SpaceX (US$18.5 billion), Epic Games (US$15 billion) and WeWork (US$47 billion) contribute maximum.

The analysis provided in Table 4 offers important insights into the main trends of disruption, which have implications and effect on every industry and market. Nonetheless, based on the reflection of the listed (S&P 500 Index) and unlisted (unicorns and decacorns) universe of companies, five major sectors are identified which are more prone to disruptive innovation than the others. They are as follows:

1. IT
2. Financial services
3. Consumer discretionary goods and services
4. Automotive and transport
5. Energy

Table 2. Profile of Global Decacorns

S. no.	Company	Valuation(US$ Billion)	Category	Country	Date
1	ByteDance	75	Artificial intelligence	China	07 April 2017
2	Didi Chuxing	56	Automotive and transportation	China	31 December 2014
3	JUUL Labs	50	Consumer and retail	USA	20 December 2017
4	WeWork	47	Other	USA	03 February 2014
5	Airbnb	29.3	Travel	USA	26 July 2011
6	Stripe	22.5	Fintech	USA	23 January 2014
7	SpaceX	18.5	Other	USA	01 December 2012
8	Epic Games	15	Other	USA	26 October 2018
9	Grab	14.3	Automotive and transportation	Singapore	04 December 2014
10	DoorDash	12.6	Supply chain, logistics and delivery	USA	01 March 2018
11	Palantir Technologies	12.18	Data management and analytics	USA	05 May 2011
12	Bitmain Technologies	12	Hardware	China	06 July 2018
13	Samumed	12	Health	USA	06 August 2018
14	Wish	11.2	E-commerce and direct-to-consumer	USA	18 May 2015
15	Global Switch	11.08	Hardware	USA	22 December 2016
16	DJI Innovations	10	Hardware	China	06 May 2015
17	One97 Communications	10	Fintech	India	12 May 2015
18	Gojek	10	Supply chain, logistics and delivery	Indonesia	04 August 2016
19	Infor	10	Supply chain, logistics and delivery	USA	16 November 2016
20	Nubank	10	Fintech	Brazil	01 March 2018
21	Beike Zhaofang	10	Internet software and service	China	18 July 2019

Source: The authors (compilation from CB Insights as on September 2019).

Note: Table 2 illustrates the profile of the global decacorns, which are privately owned companies with a valuation of more than USD 10 billion. The table details the category and country of origin of 21 decacorns, sorted on the basis of the valuations. Date represents the time when the company joined the unicorn club.

Table 3. Rise of Unicorns over the Years (2010–2019)

Categories	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Grand Total
Grand Total	1	3	4	3	27	49	29	67	123	92	398
Fintech	–	1	–	–	2	6	–	10	14	14	47
E-commerce and direct-to-consumer	1	–	1	–	5	9	9	6	7	8	46
Internet software and service	–	–	–	2	–	7	3	7	20	7	46
Artificial intelligence	–	–	–	–	1	3	2	7	17	14	44
Supply chain, logistics and delivery	–	–	–	–	2	1	3	3	12	8	29
Other	–	–	1	–	1	3	3	8	5	7	28
Auto and transportation	–	–	–	–	3	1	1	–	11	8	24
Mobile and telecommunications	–	–	–	–	5	5	1	4	3	2	20
Consumer and retail	–	–	1	–	–	–	2	4	7	4	18
Health	–	–	–	–	3	2	–	4	6	2	17
Data management and analytics	–	1	–	1	1	1	–	2	4	6	16
Hardware	–	–	–	–	2	2	3	2	5	–	14
EdTech	–	–	–	–	–	2	1	5	2	2	12
Travel	–	1	–	–	–	1	–	2	4	4	12
Cybersecurity	–	–	1	–	2	1	–	1	1	5	11
Health	–	–	–	–	–	4	1	2	4	–	11
E-commerce/ marketplace	–	–	–	–	–	1	–	–	–	1	2
Business intelligence and analytics	–	–	–	–	–	–	–	–	1	–	1

Source: The authors (compilation from CB Insights as on September 2019).
Note: Table 3 exhibits the growth pattern of unicorns over the last decade time period across sectors. Globally, 398 unicorns exist, majority in fintech, e-commerce, internet software and AI. Since 2014, tremendous growth can be observed.

Table 4. Tracking Innovations by Business Activity

Sector	Aggregate Valuation (US$ Billion)
Artificial intelligence	163.64
Fintech	146.79
Other	126.26
Automotive and transportation	122.72
E-commerce and direct-to-consumer	121.96
Supply chain, logistics and delivery	86.97
Internet software and service	81.74
Consumer and retail	78.8
Hardware	61.97
Travel	49.2
Data management and analytics	37.38
Mobile and telecommunications	35.57
Health	21.5
EdTech	20.92
Cybersecurity	17.95
E-commerce/marketplace	2.07
Business intelligence and analytics	1

Source: The authors (compilation from CB Insights as on September 2019).
Note: Table 4 presents the aggregate valuation of unicorns as per activity-wise classification to identify the innovation propelling disruption significantly.

Further, in the subsequent paragraphs, we analyse specific factors in the Indian context which would influence the adaptability and thus the success of the new disruptive innovation.

Table 5 presents the specific demand- and supply-side factors for India, highlighting the trends that are expected to play out strongly, owing to the sociocultural response.

India, a large economy with the highest GDP growth rate of 7 per cent (The World Bank, 2018), a huge population base of approximately 1.3 billion with half of them being below the age of 25 presents a unique opportunity in favour of the unicorns. Increasing disposable incomes, growing middle-class segment (World Economic Forum, 2019), increasing broadband penetration (number of internet users from 483 million in 2018 is likely to be 666.4 million in 2023; Statista, n.d.), growing base of wireline subscribers (increasing by 44% over the next four years and supportive government policies further strengthens the prospects for disruptive innovation.

The growth drivers and challenges for the disruptions are to be understood in the context of various factors: earlier economic reforms and current market trends, as well as the impact of technological change and changing attitudes on the part of the government, large companies and society overall. Digital technologies have appeared as a crucial determining factor of economic growth and global dynamics with innovation having a spill over effect on the trajectory of social well-being, financial inclusion and climate change.

India holds ranks third globally in terms of the number of unicorns, and their numbers are on the rise. Their presence has propelled economic growth and employment. In 2018, start-ups accounted for 2.64 per cent of the total jobs created in India. They are projected to create between 200,000 and 250,000 jobs in 2019 (Inc42, 2018). With innovative, scalable and impactful solutions, they contribute towards socio-economic development and transformation. Better quality digital infrastructure has lowered the entry barriers in almost every sector. This has led to an

Table 5. Demand- and Supply-side Factors Driving Disruptive Innovation in India

Demand-based Factors		Supply-side Factors	
Economic need	a) Cheaper and quicker (age of contractual jobs + recession) b) Inefficiencies of entry barriers/ regulation made incumbents non-consumer friendly and non-transparent c) High disposable income available to youth d) Capital access easier e) Easy to start a company (tech + government + finance + skill)	Technology and timing sweet spot	a) Broadband penetration b) Smartphone cheap c) Cloud-based architecture helps SaaS, PaaS, IaaS to succeed (AWS, etc.) d) Free GPS e) Open source boom (R, Python, Red Hat, GitHub) f) AI, ML growth g) The rise in computing power of smaller devices h) Connected world (IoT) i) Virtualization
Sociological need	a) Urban distant society: Need for socializing b) Friend focus vs blood relatives focus c) Female empowerment (less cooking, dating apps) d) Focus on looks/fashion/healthy lifestyle, etc. e) Taboos disappearing		
Behavioural need	a) Privacy b) Millennial impatience c) Willingness to share d) 'Viral syndrome'	Knowledge-based economy	a) Higher IT skills in the general populace b) Coding c) A more educated populace so digital content production + consumption is on the rise
Ecological need	a) Environmental consciousness b) Pollution hazards—diseases rising c) Policy push	Globalization	a) Knowledge b) Capital c) Technology d) Workforce e) Consumer patterns changing through imitation
Political need	a) Start-ups = Job creation b) Fiscal push for overcoming the digital divide c) Tax policy supporting start-ups d) Pressure to reform		

Source: The authors.

increased contribution to the GDP by the unlisted entities, most of them being small and medium enterprises (SME), start-ups (technologically enabled, consumer-oriented firms) and companies in the unorganized sector.

Though the stock index is continually reorganized to echo the changes in the real economy, there is a fall in India's aggregate stock market capitalization (listed domestic companies) as a percentage of gross domestic product from 87.85 per cent to 76.5 per cent (The World Bank, 2019), pointing to the departure of the index as a true reflection of the economic activity.

Gradually, emerging sectors and stocks are added to the Nifty replacing the incumbent stocks. Increased contribution of financial services, from 20 per cent to 39 per cent, in the index since its inception indicates its prominent role in improving economic growth and development. Similarly, IT, one of the key drivers of the present economy, has approximately 13 per cent weight in the index, but had a negligible presence in the index earlier. The weight of various sectors in the Indian stock market index, specifically NSE 200, NSE 100 and Nifty 50, as on October 2019 is shown in Table 6. The topmost five sectors are financial services, consumer goods, energy, IT and automobile sector. These observations reaffirm that some sectors are more important than others.

Further, we identify the sectors in which the disruption is taking place in the Indian context. Eighteen Indian unicorns have emerged across different sectors and industries. In Table 7, it can be seen that One97 Communications (parent company of Paytm) is the only Indian decacorn. The maximum number of Indian unicorns are engaged in

Table 6. Sector Weight in the NSE Indices: A Comparison

Sectors	Nifty 50	NSE 100	NSE 200
Financial services	39.47	38.05	36.74
Consumer goods	12.38	14.06	14.24
Energy	15.31	14.15	13.71
IT	13.01	11.38	10.93
Automobile	6.11	6.05	6.37
Pharma	2.15	3.43	3.86
Construction	3.72	3.42	3.48
Metals	2.93	2.8	2.7
Cement and cement products	1.5	2.23	2.27
Telecom	1.78	1.59	1.46
Services	0.64	1.08	1.18
Industrial manufacturing	Nil	0.26	0.89
Fertilizers and pesticides	0.67	0.58	0.75
Chemicals	Nil	0.38	0.51
Textiles	Nil	0.26	0.36
Media and entertainment	0.33	0.28	0.34
Healthcare services	Nil	Nil	0.22

Source: The authors (as on 31 October 2019).

Note: Table 6 exhibits the sector weights in three NSE indices—Nifty 50, NSE 100 and NSE 200 representing 66.8 per cent, 76.8 per cent and 86.7 per cent, respectively, of the free float market capitalization of the stocks listed on NSE as on 29 March 2019. The weights of the top five sectors are in similar range across the narrow and broad market index. However, healthcare services, having the least weight (0.22) in NSE 200 finds no place in NSE 100 and Nifty 50. Similarly, sectors such as industrial manufacturing, chemicals and textiles are absent from Nifty 50. There are the top 5 sectors consistently across the three indices in terms of the sector weight. Pharma sector and thereon the sector might have a different weight in the three indices shown in the table. This revelation along with the analysis of global disruptions form the basis for studying the demand and supply dynamics of only these sectors in detail.

Table 7. Profile of Indian Unicorns

S. no.	Unicorn Company	Date	Valuation (US$ Billion)	Category
1	One97 Communications (Paytm)	12 May 2015	10.00	Fintech
2	Snapdeal	21 May 2014	7.00	Supply chain, logistics and delivery
3	Samsara Networks (Ola)	27 October 2014	6.20	Automotive and transportation
4	BYJU'S	25 July 2017	5.75	EdTech
5	Oyo Rooms	25 September 2018	4.30	Travel
6	Swiggy	21 June 2018	3.30	Supply chain, logistics and delivery
7	Udaan	3 September 2018	2.30	Supply chain, logistics and delivery
8	Zomato	10 April 2015	2.18	Internet software and service
9	ReNew Power	14 February 2017	2.00	Energy
10	BillDesk	16 November 2018	1.80	Fintech
11	Delhivery	27 February 2019	1.50	Supply chain, logistics and delivery
12	Hike	16 August 2016	1.40	Mobile and telecommunications
13	ShopClues	12 January 2016	1.10	E-commerce and direct-to-consumer
14	BigBasket	06 May 2019	1.00	Supply chain, logistics and delivery
15	Rivigo	11 July 2019	1.00	Supply chain, logistics and delivery
16	PolicyBazaar	25 June 2018	1.00	Fintech
17	Ola Electric Mobility	02 July 2019	1.00	Auto and transportation
18	InMobi	02 December 2014	1.00	Mobile and telecommunications

Source: The authors (compilation from CB Insights as on September 2019).

Note: Table 7 illustrates the profile of Indian unicorns, providing information regarding the date when the company joined the unicorn club and the category to which it belongs, sorted on the basis of valuation as on September 2019.

the business of supply chain, logistics and delivery (6), primarily in the form of online platforms followed by fintech (3), automotive and transport (2), energy (1) and among others (6) with IT as the backbone of all innovation.

In sum, five prominent sectors emerge to be analysed for the scope and extent of disruptive innovation.

1. IT
2. Financial services
3. Consumer goods
4. Energy
5. Automotive and transport

Information Technology

This sector underpins all the innovations across sectors. Key disruptions in the IT space which are challenging the Indian IT industry: commoditized AI/machine learning (ML), cloud computing, conversational AI, chatbots, blockchain, augmented analytics, hardware and software feature to support AI, ML, cybersecurity, 3D printing and rising manpower costs. As IT companies help their clients switch to cloud services platform, they gain from the migration business, but are losing the long-term infrastructure management business. Apart from global majors such as IBM, Accenture and Capgemini, Indian players such as TCS and Infosys are most favourably placed in the cloud services space. In the June 2018 quarter, the share of revenues coming from digital space was 60 per cent for Accenture, 45 per cent for Capgemini, 25 per cent for TCS and 28 per cent for Infosys. Indian IT companies' R&D is just 0.5 per cent of sales, much lower than 3 per cent spent by the global IT players.

Financial Services

Since the global financial crisis of 2008, the financial services sector has witnessed continuous evolution and the maximum number of unicorns globally. The emergence of fintech, block chained assets, algorithm-based lending, automated customer engagement, digital product and services distribution, and seamless payments are disrupting the financial services industry. Dhar and Bose (2016) discuss the role of blockchain technology to address the issue of non-performing loans in the Indian banking sector. Venture capitalists have invested about US$40 billion of funds globally in fintech in 2018, a jump of 120 per cent (*Reuters*, 2019). Between January 2013 and October 2018, 1994 fintech companies have been founded, depicting a healthy growth of the Indian fintech market (PwC-ASSOCHAM, 2019). India also tops the global list for consumer fintech adoption with approximately 87 per cent of its digitally active population using fintech products and services in comparison to 64 per cent worldwide (EY, 2019). This deep penetration offers fintech firms a great opportunity to also address the low penetration issues which plague the Indian Insurance sector (2.76% in life insurance and 0.93% in non-life insurance; The Insurance Regulatory and Development Authority of India [IRDAI], 2019). Lower ticket size, thin margins but high-frequency transactions will become the new norm in the financial services industry. Change in the regulatory policies and continuous interventions compound the challenges faced by the incumbents in the financial services sector.

Consumer Goods and Services

This sector encompasses a broad array of activities spanning the consumer durable and non-durable goods and services. Consumer's changing face, new patterns of personal consumption, innovative business models, structural industry shifts and technological advancements are causing intense disruption. E-commerce activities have witnessed a fillip in its growth trajectory with the timely and effective implementation of several government policies.[7] The advent of consumer-oriented technology have concurrently transformed the logistics, delivery and direct to consumer retail business. Services sector encompassing activities such as healthcare, hospitality, education and communications is getting reshaped with the onset of digitalization. Herrmann et al. (2018) and Chanchaichujit et al. (2019) present the changing dynamics of the healthcare industry, stating direct to consumer wellness products and mobile apps to offer exciting opportunities. The travel and tourism sector has faced disruption since the emergence of low-cost airlines. MakeMyTrip, the pioneer of the online ticket platform in India, is now joined by Trivago, Airbnb, Oyo rooms, etc. Changing travel expectations, emergence of social media marketing, rise of big data, AI, virtual reality and robotics act as a catalyst for the hospitality sector. Education sector has experienced proliferation of 3,500 start-ups, with 100 per cent of FDI allowed. This has made India the second largest e-learning market, after USA (IBEF, 2020). Dhamija et al. (2020) discuss in detail the emergence of EdTech in South Asia. The study highlights affordable access to internet as one of the major supporting factors, while weak digital infrastructure and student engagement to be the hindering factors for the development of this sector. According to a 2016 KPMG report, the Indian EdTech market is pegged to touch US$1.96 billion by 2021 with unicorn like BYJU's inspiring many other start-ups such as Khan Academy and Toppr.

Energy

Energy sector bears a significant influence on the economic growth trajectory. With the issues such as climate change and global warming taking centre stage, there is increased focus on renewable sources of energy (solar, wind among other alternatives). Prevalence of smart grids, increased focus on electric vehicles and government policy reforms (hydropower policy for 2018–2028; Renewable Energy Act, 2015) are changing the energy storage and energy

efficiency landscape. Despite these factors, the unicorns are virtually absent in this sector, owing to huge initial capital expenditure requirements and high entry barriers. ReNew Power is the only unicorn in the Indian energy sector focusing on cleantech. Nevertheless, with the lowering set-up costs for the alternative fuels, the sector is ripe for disruptive innovation in future.

Automotive and Transport

Growth in the automotive sector is driven by disruptive technologies and business models in autonomy, connectivity, electrification and vehicle sharing. By 2020, it is estimated that 1 in 10 cars will be used for shared mobility. Seamless transportation (on-demand cab services, bike taxis, carpooling, etc.) have facilitated the growth of Ola, an Indian unicorn. Introduction of electric vehicles and stricter emission norms (BS-VI) add to the challenges faced by the Indian automobile sector.

Construction of FSI: Data and Methodology

For this section, secondary data pertaining to NSE 200 stocks for the period of 2009–2017 is retrieved from Prowess,[8] a Centre for Monitoring Indian Economy (CMIE) database (as endorsed by Buckley et al., 2016; Chittoor & Aulakh, 2015; Choudhury & Khanna 2014; Krishnan & Kozhikode, 2015).

The year 2009 is the starting year for the creation of fundamental accounting measures as the disruptive innovations took centre stage after the launch of Apple iPhone in 2007 (Christensen et al., 2015), and the Indian economy showed signs of recovery from the second quarter of the 2009–2010 post the global financial crisis (Arora et al., 2010). This exercise results in the FSI value beginning 2014, which coincides with the time when India witnessed its first unicorn, Snapdeal.

We focus on NSE 200 as a representative of the Indian stock market as it reflects the performance of both large and mid-market capitalization companies. The universe of NSE 200 is further subdivided into Nifty 50, Next 50 and Nifty Midcap 100 index. NSE 200 denotes about 86.7 per cent of the free float market capitalization and 84.6 per cent of the traded value of the stocks listed on NSE as on 29 March 2019. All these indices are managed by NSE Indices Limited. The index constituents are chosen on a pre-specified criterion focusing on market capitalization, impact costs, sectoral representation, etc., and this list is revisited twice in a year. The stock is excluded from the index either on account of corporate restructuring actions or because of the declining market capitalization.

In the world of continuous disruptions, we adopt a fundamentals-based framework combining criteria used by Piotroski (2000), Mohanram (2005) and Accenture Disruptability Index to identify the potential winner and loser stocks. We construct an FSI, drawing on 7 elements/aspects (profitability, efficiency, solvency, liquidity, net investments, the pursuit of innovation and barriers to entry) captured by 11 different estimates to reflect the financial health of the stocks as shown in Table 8. For calculating stock return, the adjusted month-end stock prices are used.

Table 8. Measuring Financial Strength of Companies: Key Parameters and Measures

Parameter	Measure
Profitability	5-year EBITDA CAGR
Consistency in profits	5-year EBITDA consistency
Growth	5-year revenue CAGR
Transaction intensity	COGS/revenue
Labour intensity	GAS/sales
Asset intensity	Revenue/invested capital
Innovation	R&D/revenue
Solvency	Interest cover ratio
Liquidity	CFO/TL
Net investments (CAPEX)	Change in TA/TA
Barriers to entry	Market share

Source: The authors.

We bring together three measures—growth, consistency and performance of profitability aspect—and assume that a higher value would show greater financial strength. The growth and performance parameter are measured as 5-year revenue and 5-year earnings before interest depreciation and amortization (EBITDA) CAGR on a rolling basis, respectively. The consistency is determined by calculating the average standard deviation of 5-year EBITDA values on a rolling basis.

The second aspect, managements' ability to operate efficiently, is measured by the degree of the transaction, asset and labour intensity. These parameters are influenced by the industry and operations; therefore, we standardize it using the industry average. Cost of goods sold (COGS) to revenue, revenue to total invested capital and selling, general and administration cost ratio (SG&A) capture the degree of the transaction, asset and labour intensity respectively.

To incorporate the solvency aspect, we use the interest coverage ratio. To account for solvency in the short term, that is, liquidity, we estimate the cash flow from operation as a proportion of total assets. Better solvency and liquidity are showed by higher ratios.

To ascertain the level of susceptibility to future disruption, we look at the rate of net investment in total assets (ratio of change in total assets scaled by total assets), level of expenditure on research and development (ratio of R&D expenses to the total revenue of the firm) and the market share held by the company in a sector (ratio of the firm revenue to the total revenue of the sector). All these measures put together demonstrate the future growth prospects of the company.

We estimate these parameters annually, after the elimination of outliers. As a next step, a min-max range is

calculated across the total time period for each variable separately to capture the drift in the relative position over time. We dissect our NSE 200 universe in deciles, using class size as (Max-Min)/10. Further, we assign scores for every company on each of the aforementioned parameters, with 10 exhibiting best performance (top 10% stocks) and 1 for the poorest performance (bottom 10%). Except for the efficiency measures (transaction, labour and asset intensity) and consistency in profits, where the least value indicates the best performance, all other measures bears a positive relationship with the fundamental financial performance. An aggregate score ranging from 110 to 11 is achievable for each stock based on its performance. Based on the average FSI score for the period of 2014–2017, NSE 200 universe is divided into three groups. A company having the highest FSI score is categorized as 'A', being the fundamentally strongest, and the company with the lowest FSI score is categorized as 'C', being the fundamentally weakest.

Analysis of Incumbents vs Challengers

In this section, we examine the crossovers between the stocks making up Nifty 50, Next 50 index along with the Nifty Midcap 100 stocks present in the NSE 200 index. These crossovers are identified based on the relative strength and vulnerability measured by FSI, as described in

Table 9. Analysis of Incumbents and Challengers

	Next 50 and Nifty 50		Nifty Midcap 100 and Next 50	
S. No.	Challenger Portfolio	Incumbent Portfolio	Challenger Portfolio	Incumbent Portfolio
1	Pidilite Industries Ltd	Maruti Suzuki India Ltd	Century Textiles & Industries Ltd	United Spirits Ltd
2	Avenue Supermarts Ltd	Tata Motors Ltd	Tata Chemicals Ltd	NHPC Ltd
3	Petronet LNG Ltd	Power Grid Corporation of India Ltd	NBCC (India) Ltd	Bandhan Bank Ltd
4	HDFC Standard Life Insurance Co. Ltd	NTPC Ltd	Dilip Buildcon Ltd	SBI Life Insurance Co. Ltd
5	Aditya Birla Capital Ltd	Oil & Natural Gas Corporation Ltd	Rajesh Exports Ltd	General Insurance Corporation of India
6	Sun TV Network Ltd	GAIL (India) Ltd	Avanti Feeds Ltd	Bharat Heavy Electricals Ltd
7	Container Corporation of India Ltd	Kotak Mahindra Bank Ltd	United Breweries Ltd	Steel Authority Of India Ltd
8	Interglobe Aviation Ltd.	HCL Technologies Ltd	Aditya Birla Fashion & Retail Ltd	Hindustan Zinc Ltd
9		HDFC Bank Ltd	Future Retail Ltd	NMDC Ltd
10		Hindalco Industries Ltd	Castrol India Ltd	Piramal Enterprises Ltd
11		Tata Steel Ltd	Apollo Hospitals Enterprise Ltd	
12		Coal India Ltd	Info Edge (India) Ltd	
13		Sun Pharmaceutical Industries Ltd	V-Guard Industries Ltd	
14		Bharti Infratel Ltd	Hexaware Technologies Ltd	
15			Sun Pharma Advanced Research Co. Ltd	
16			Syngene International Ltd	
17			Ajanta Pharma Ltd	
18			Alkem Laboratories Ltd	
19			Quess Corp Ltd	
Mean monthly excess return (In excess of risk-free return)	**1.61%**	**0.47%**	**2.59%**	**0.44%**
Volatility	**5.13%**	**4.17%**	**5.61%**	**6.32%**
Sharpe ratio (Risk adjusted return)	**0.313**	**0.112**	**0.461**	**0.069**

Source: Authors calculations.

Note: Table 9 presents the results of the ABC analysis. Crossovers would take place between an incumbent 'C' category stock in Nifty 50 and a potential challenger 'A' category stock of Next 50 and likewise between Nifty Midcap 100 and Next 50 index. After identifying these crossovers, equally weighted portfolios are created of the vulnerable incumbent and potential challengers across the NSE 200 universe. The performance of the portfolios with challenger and incumbent stocks is illustrated by the mean monthly excess return, volatility in terms of standard deviation and Sharpe ratio to account for risk adjusted return.

Table 10. List of Vulnerable Companies in the Nifty Midcap 100 Index

S no.	Company Name	Industry
1	Graphite India Ltd	Industrial manufacturing
2	Sterlite Technologies Ltd	Telecom
3	Edelweiss Financial Services Ltd	Financial services
4	National Aluminium Co. Ltd	Metals
5	Berger Paints India Ltd	Consumer goods
6	IDBI Bank Ltd	Financial services
7	Bharat Financial Inclusion Ltd	Financial services
8	Reliance Capital Ltd	Financial services
9	Mangalore Refinery & Petrochemicals Ltd	Energy
10	H E G Ltd	Industrial manufacturing
11	Godrej Industries Ltd	Consumer goods
12	Punjab National Bank	Financial services
13	Bank of India	Financial services
14	Central Bank of India	Financial services
15	Jubilant Life Sciences Ltd	Pharma
16	Manappuram Finance Ltd	Financial services
17	Mahindra & Mahindra Financial Services Ltd	Financial services
18	G M R Infrastructure Ltd	Construction
19	Tata Global Beverages Ltd	Consumer goods
20	Adani Power Ltd	Energy
21	Jindal Steel & Power Ltd	Metals
22	Tata Power Co. Ltd	Energy

Source: The authors.
Note: Table 10 shows the list of vulnerable stocks (category C) of the Nifty Midcap 100 index which will face challenge by the Indian unicorns.

the previous section. We postulate that for a Nifty 50 constituent, the challenge will be presented by the constituent stocks of Next 50. Similarly, for the Next 50, the Nifty Midcap 100 stocks in NSE 200 would be the challengers. Unicorns in India would act as challengers to these Nifty Midcap 100 stocks.

In the ABC analysis, we identified stocks that are in category C and belonged to Nifty 50 as a vulnerable incumbent which will be challenged by 'A' category stock belonging to Next 50. Similarly, a potential challenger to a vulnerable incumbent of Next 50 would be 'A' category stock from the basket of a Nifty Midcap 100 stocks. After identifying these crossovers, equally weighted portfolios are created of the vulnerable incumbent and potential challengers across the NSE 200 universe.

The results show that considering Nifty 50 and Next 50, disruptors portfolio, having 8 challenger stocks, yielded a monthly return of 1.61 per cent and the disrupted portfolio, with 14 incumbent stocks, yielded a return of 0.47 per cent. The challenger's portfolio return is more volatile (5.13%), reflecting increased risk in the higher expected return of the investors. A higher Sharpe (1964) ratio[9] reaffirm that the disruptors portfolio provides a higher risk adjusted return with 0.313 vs 0.112 of the incumbent portfolio. A similar exercise with Nifty Midcap 100 and next 50 constituents indicates that the challengers' portfolio (19 companies) provide a higher monthly return over the 5-year period 2014–2019 (2.59% vs 0.44%) and lower risk in terms of standard deviation (5.61% vs 6.32%), outperforming the incumbent's portfolio (comprising 10 companies). A higher Sharpe ratio (0.461) confirms higher risk adjusted return achieved by the disruptor's portfolio against 0.069 of the incumbent portfolios. Table 9 shows return and volatility for the portfolios based on the incumbent and challengers stocks.

This exercise suggests the winners and loser's portfolio in the long run, as the incumbents may continue to thrive even after the disruption takes root. Stock returns on disruptive innovation may not be predictable by conventional financial models. We consider the Indian unicorns (see Table 7) to pose a challenge to the Nifty Midcap 100 stocks which are vulnerable as per the FSI score (see Table 10). It is evident that financial services sector is most susceptible to disruption with nine vulnerable companies followed by energy and consumer goods sector with three companies each being vulnerable to disruptive innovation.

This understanding of disruptive innovation can be a powerful tool in the hands of the investors, for making investment decisions. Vulnerable incumbent companies may not reap the earlier benefits in the present disruptive circumstances. Identifying companies which pre-empt disruption and take advantage of it will be an important determinant to earn abnormal returns.

Summary, Conclusions and Implications

Dawn of the digital era is disrupting businesses at an unprecedented rate. Conventional businesses with relatively low entry barriers are highly vulnerable, primarily in

sectors such as financial services, energy, IT, automobile and consumer discretionary among others. These disruptions can be observed both with the declining lifespan of the stocks in the index and emergence of unicorns globally. Index revisions indicate that fundamentally strong companies can survive in this era of disruption, as it is imperative to proactively acknowledge and invest in disruptive innovation. Improved understanding of this phenomenon enhances the success potential, for the companies, investors and policymakers alike.

Against this background, this article explores the joint role of the disruptive innovation and fundamental factors in determining the future composition of the stock market index, illustrated by NSE 200. We build an FSI that comprises of measures encompassing profitability, efficiency, solvency, liquidity, net investments, pursuit of innovation and barriers to entry including 11 key financial ratios. Based on the average FSI score for the period of 2014–2017, NSE 200 universe is divided into three groups—'A' being the fundamentally strongest (highest FSI score) and 'C' being the fundamentally weakest (lowest FSI score). We conduct an ABC analysis to identify crossovers between the potential challengers, that is, category A stocks of Next 50 (Nifty Midcap 100) index, and vulnerable incumbent, that is, category C stocks of Nifty 50 (Next 50) index among the NSE 200 universe respectively. The vulnerable constituents of Nifty Midcap 100 index would face challenge from the Indian unicorns.

The results of the ABC analysis highlight that the disruptors portfolio outperform the incumbent portfolio looking at the crossovers between Next 50 and Nifty 50 (yielding a higher return of 1.61% with a Sharpe ratio of 0.313) and in the same way between Nifty Midcap 100 and Next 50 index (yielding a higher return of 2.59% with a Sharpe ratio of 0.461)

The findings underscore the importance of tracking disruptions in India and being cautious about the crossovers between the incumbents and challengers in the medium and long run. Keeping in this in mind, investors can benefit from the long position in the challengers and short position in the incumbents. Thus, affirming that the FSI can act as a useful tool for the policymakers, stock exchanges and investors for simplified screening of winner stocks in the era of disruptive innovation and help to address the issue of stock selection problem.

The findings of the study have significant implications. Corporations as well as governments may be vulnerable to disruptive economic changes, but right integration can be mutually beneficial for all stakeholders. On part of the governments, a systemic policy response is needed. Governments should help start-ups with initial tax breaks, smooth registration processes and also ensure a level playing field in various regulated sectors such as energy and banking. Incumbents should see unicorns not as challengers but as collaborators in their quest for revenue growth and cost efficiency. Investors/traders can factor in the effect of the disruptions on the incumbents and can generate alpha returns by selecting stocks using FSI. Paying attention to the financial strength of the incumbents, it is possible to predict the inclusions and exclusions in the index and gain profits. Securities exchanges would have to manage frequent readjustments in the index to keep pace with the rapid economic developments. For the academicians, the concepts of market efficiency are continuously evolving and thus need to be redefined in light of disruption.

The article is a pioneering study taking a futuristic view of index revisions, accounting for the role played by disruptive innovation and the fundamental financial factors. The study contributes to financial innovation and business valuation literature for an emerging market like India.

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Notes

1. Decacorn (new term) has been invented to refer to firms with a valuation more than USD 10 billion. Similarly, hectacorn for USD 100 billion.
2. https://www.livemint.com/market/stock-market-news/fii-inflows-in-first-six-months-of-2019-at-highest-in-five-years-1561749708898.html
3. Sectors as per GICS classification are consumer discretionary, consumer staples, energy, financials, healthcare, industrials, materials, real estate, technology, telecommunication services and utilities.
4. The S&P Global Clean Energy Index provides liquid and tradable exposure to 30 companies from around the world that are involved in clean energy-related businesses. The index comprises a diversified mix of clean energy production and clean energy equipment and technology companies.
5. The S&P Global 1200 Energy Index consists of all members of the S&P Global 1200 that are classified within the GICS® energy sector.
6. https://us.spindices.com/indices/equity/sp-500
7. Approval of 100 per cent foreign direct investment (FDI) in single brand retail and 51 per cent in multi-brand retail; implementation of Goods and Services Tax (GST) resulting in the reduction of tax rates; new Consumer Protection Act, 2019 replacing the old Consumer Protection Act, 1986.
8. CMIE Prowess database contains compiled information for more than 50,000 Indian firms, including all listed companies.
9. The Sharpe ratio is computed by dividing the excess portfolio return (over and above the risk-free rate) by the standard deviation of the portfolio's excess return.

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