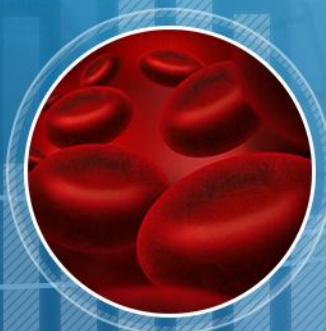


Pharma Corporations - 15
Tech Corporations - 15

Pharma AI Stock Index Teaser



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Goal and Applications of the Analytical Report

This report aims to assess financial dynamics of pharma and tech corporations applying AI for drug discovery and advanced healthcare in order to enable investors, corporations and other industry participants to develop effective short and long-term strategies.

Applying AI for Drug Discovery and cooperation with pharma AI companies may indicate the prospects for competitive advantage on the market. Understanding financial dynamics of such corporations is crucial for the analysis and assessment of threats and opportunities of AI for Drug Discovery industry.

Particularly, analytical report estimates activities of top 15 pharma and top 15 tech corporations comparing their market capitalization and conducting an in-depth analysis of pharma and tech stock indices in order to determine correlation between them and their relation to other well-known and relevant indices. This report also allows making an informed choice from the best stocks to buy in pharma and tech sectors. Also, the report is supplemented with a qualitative analysis and comparison of the aforementioned corporations.

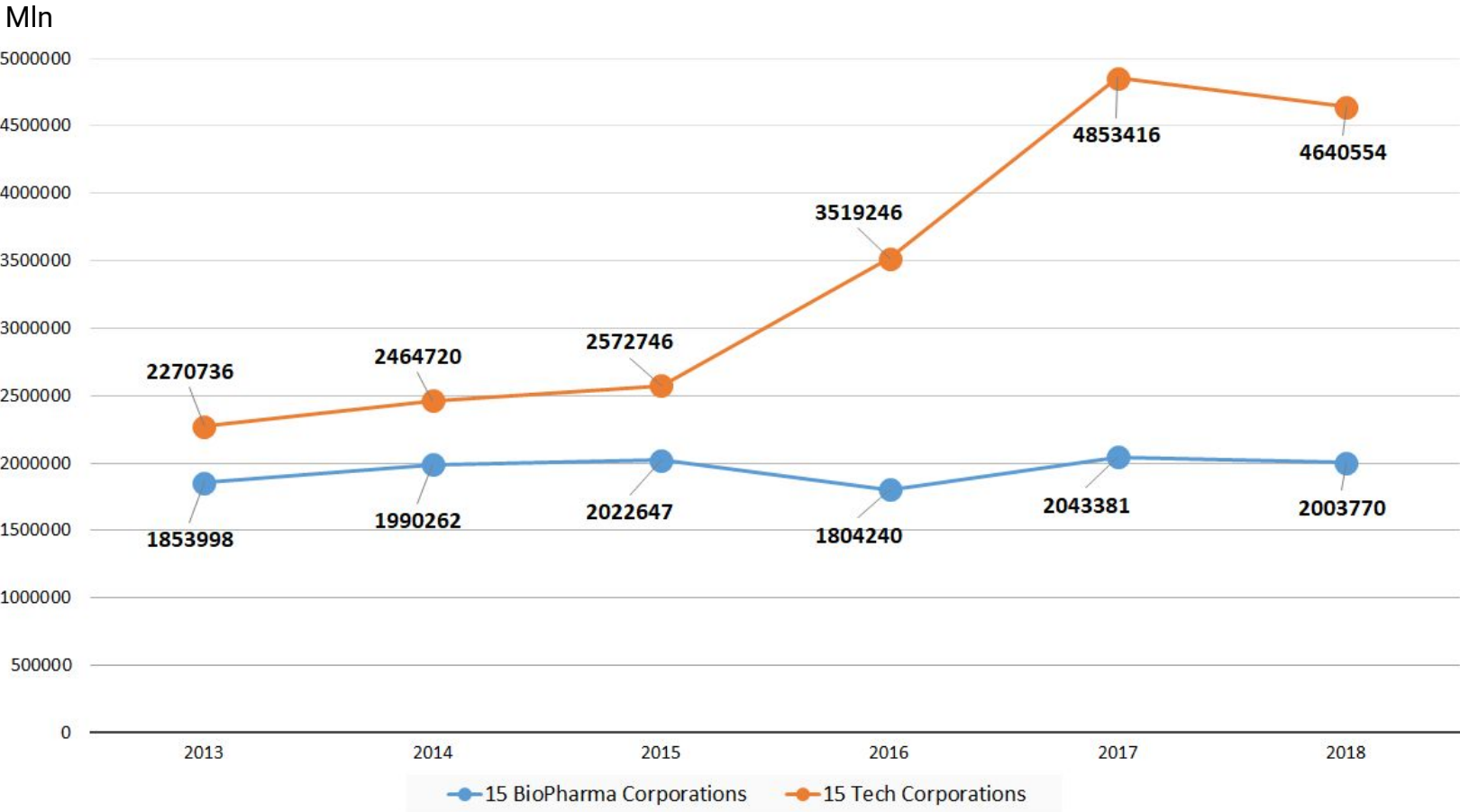
The findings of the report can be used for:

- Developing the optimal portfolio for investing in AI for Drug Discovery industry
- Predicting future financial dynamics in the industry
- Gaining understanding of current pharma and tech markets tendencies and crucial risks
- Risk assessment and formation of future market development scenarios
- Determining what has to be done in order to benefit from these tendencies

It is planned to release the updated versions of the report each quarter providing a more comprehensive understanding of financial dynamics of top pharma and tech AI corporations, as well as current market tendencies relevant to all institutions in the industry.

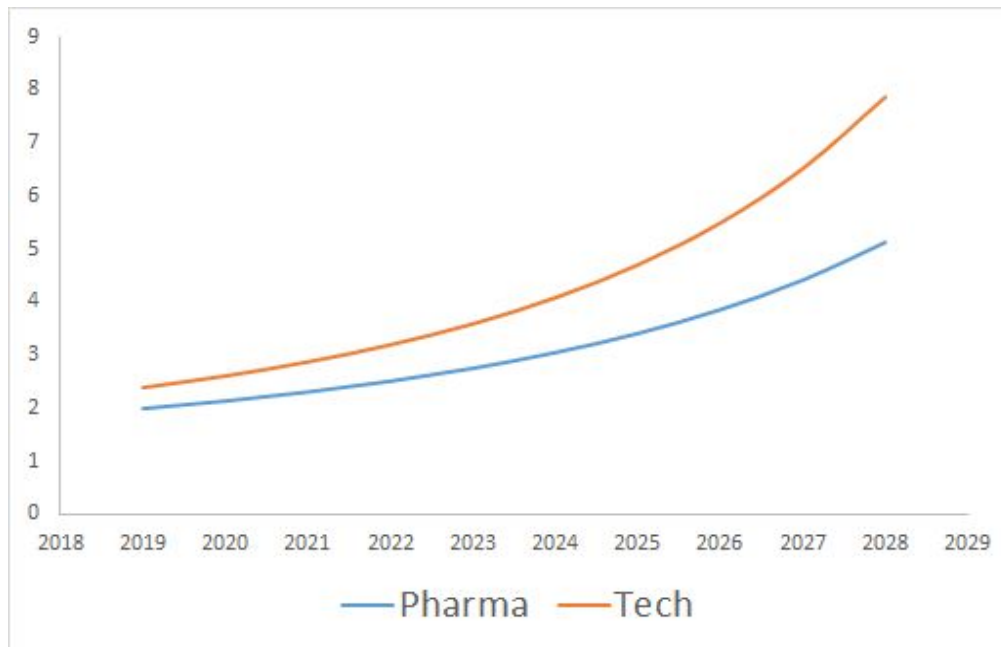
The parties who gain early access to this report will have deep expertise on how their strategic agendas can be optimized and stabilized in order to benefit from the impact of financial dynamics of the aforementioned corporations and how to utilize the opportunities related to these financial trends. Pharma and tech corporations themselves will be able to observe their place on financial landscape regarding the sector of AI for Drug Discovery.

Combined Capitalization of 15 Tech Corporations vs 15 BioPharma Corporations



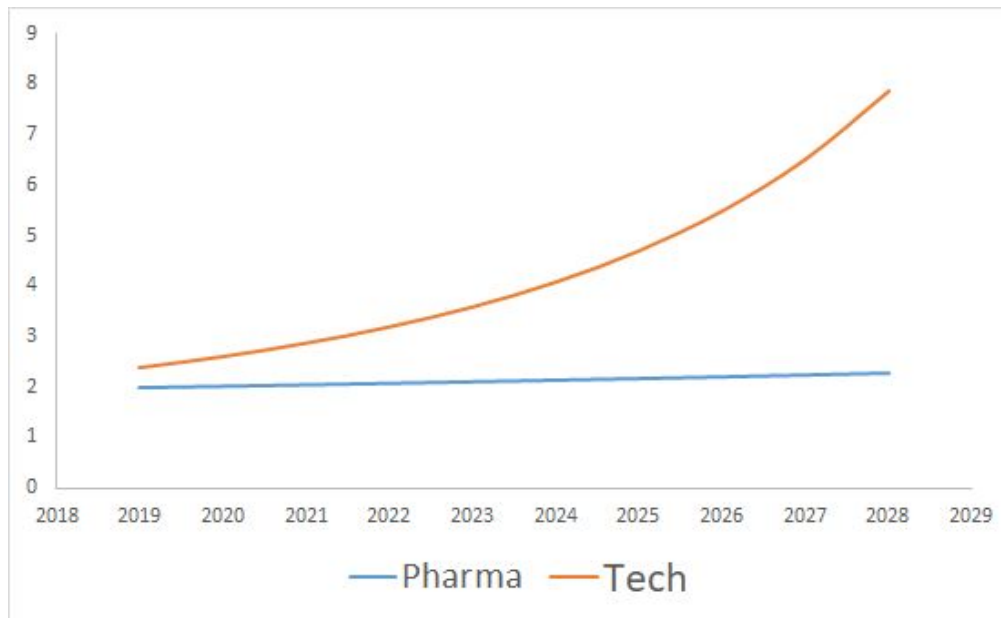
The combined capitalization of the 15 BioPharma corporations profiled in this report has remained at the same level for the past 5 years. The capitalization of 15 IT & Tech corporations profiled in this report is growing significantly. This shows evidence that recent growth of the BioPharma industry slowed down, while the IT & Tech industry was expanding. This is why it is so notable that the number of IT corporations has already matched the number of BioPharma corporations active in this subsector.

2 Possible Scenarios



Positive Scenario

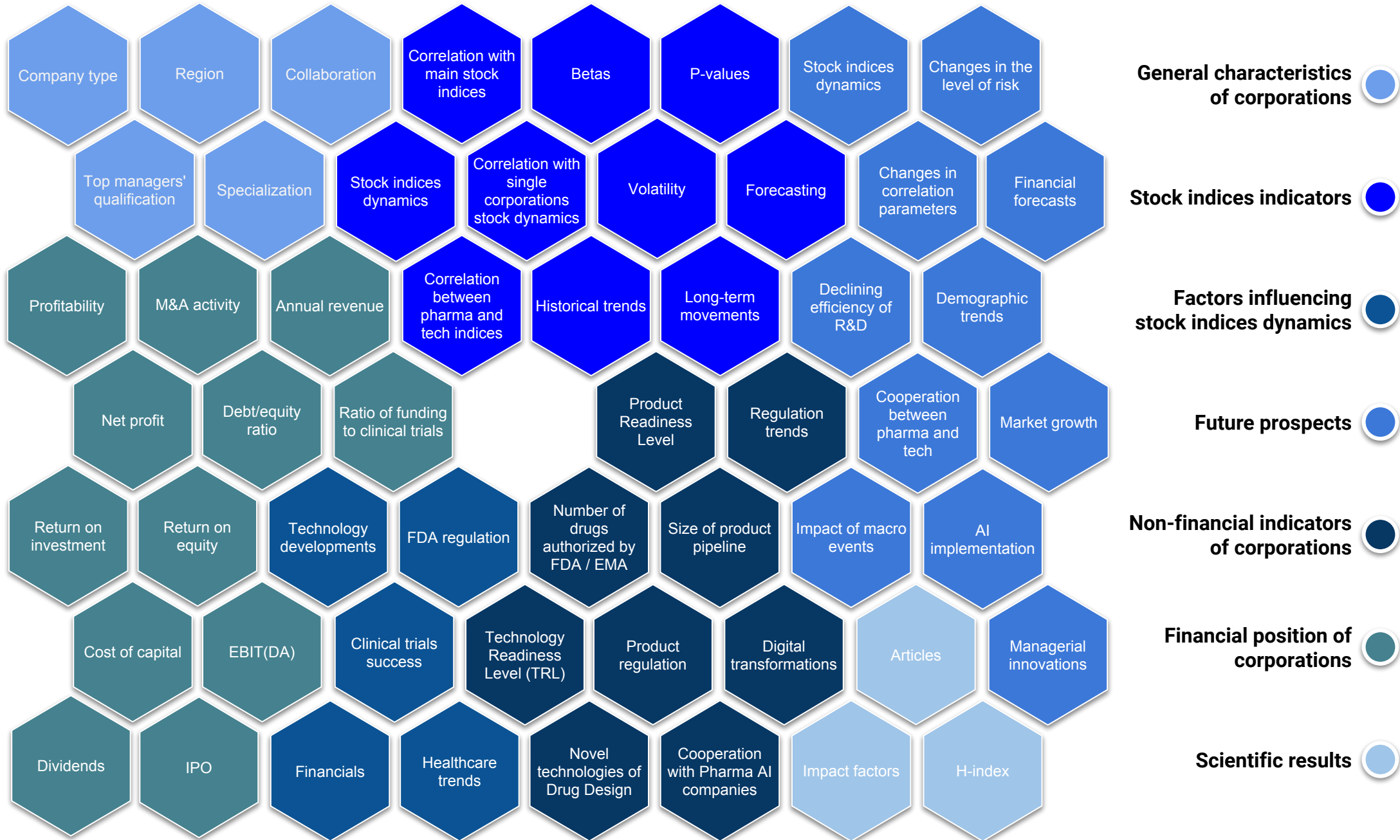
Pharma corporations will manage to overcome the current stagnation, which would lead to the exponential growth similar to that of tech corporations. There will be positive feedback between the dynamics of both industries, which will mean acceleration of growth. Correlation between pharma and tech indices will be relatively high. Pharma corporations will be able to utilize the development of AI for Drug Discovery.



Pessimistic Scenario

Stagnation of pharma corporations will go on. The gap between pharma and tech indices will increase, whereas correlation between them will be relatively low. Some linear or quasilinear growth of pharma index can be expected, but it will not lead to exponential growth. At the same time, tech corporations will continue their advancement.

Corporations and Market Analysis Framework



Pharma AI Stock Index

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15 Pharma Corporations Applying AI for Drug Discovery and 15 Tech Corporations Applying Advanced AI Techniques in Healthcare

Pharma Corporations

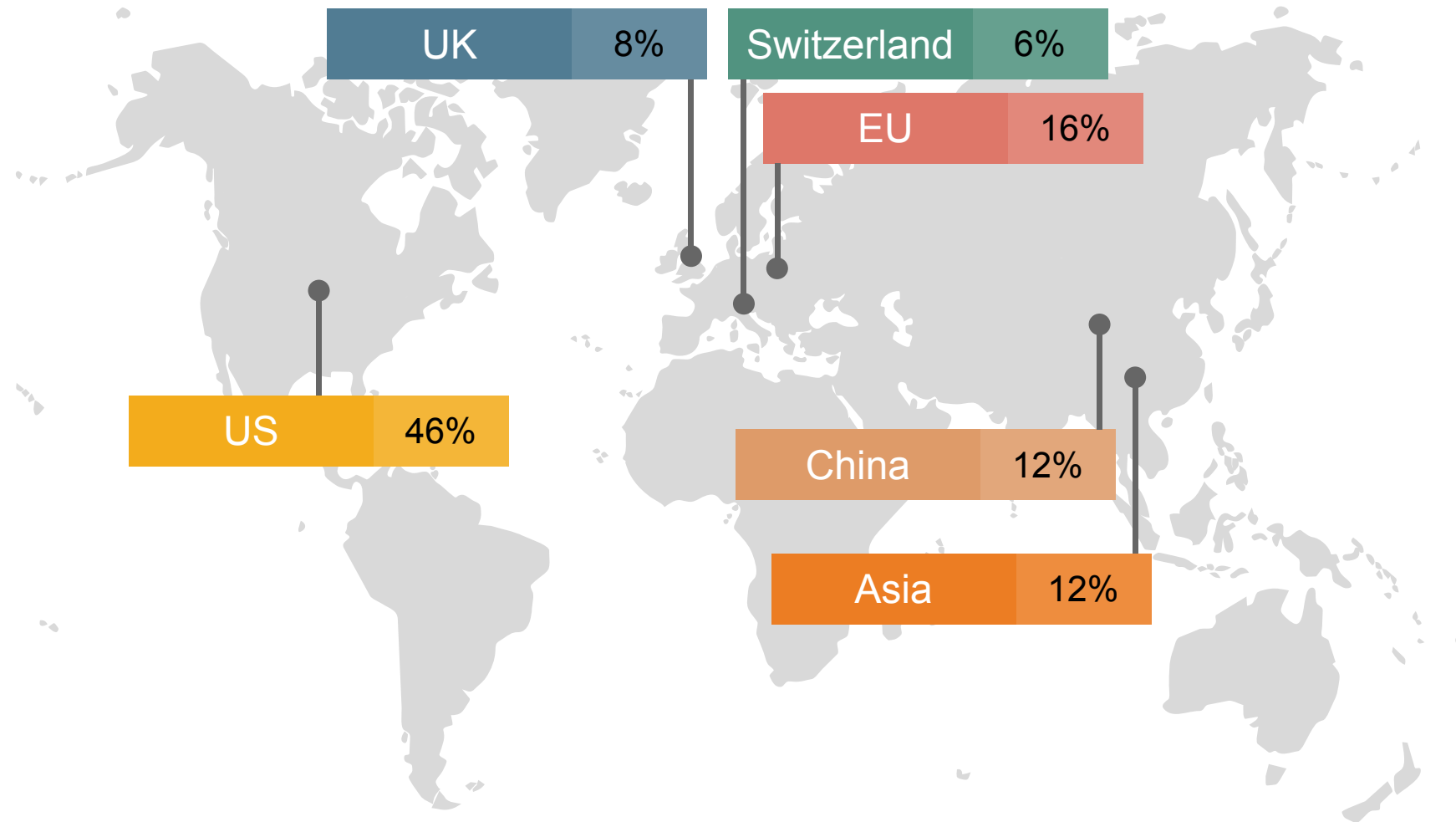
Tech Corporations

1. Amgen	1. Alibaba
2. Astellas Pharma	2. Amazon
3. Astrazeneca	3. Apple
4. Bayer	4. Baidu
5. Boehringer Ingelheim	5. Canon
6. Bristol-Myers Squibb	6. Google
7. Evotec	7. Hitachi
8. GSK	8. Huawei
9. Eli Lilly	9. IBM
10. Johnson & Johnson	10. Intel
11. Merck	11. Microsoft
12. Novartis	12. Nvidia
13. Pfizer	13. Samsung Electronics
14 Roche	14. Siemens
15. Sanofi	15. Tencent

AI for Drug Discovery Partnerships, Investments, Acquisitions

AI Companies			Pharma Corporations	Tech Corporations	AI Companies	
 Insilico Medicine 英科智能	 Exscientia DRIVEN BY KNOWLEDGE	 CloudPharmaceuticals	 gsk	 Tencent 腾讯	 XtalPi	 Atomwise Better medicines faster.
 CYCLICA	 Atomwise Better medicines faster.	 Numerate	 MERCK	 Alibaba Group	 XtalPi	
	 Biovista to seek - to know - to act	 XtalPi	 Pfizer	 amazon	 XtalPi	
 Exscientia DRIVEN BY KNOWLEDGE	 SCHRODINGER	 RECURSION pharmaceuticals	 SANOFI	 Baidu 百度	 Atomwise Better medicines faster.	
	 Biovista to seek - to know - to act	 Insilico Medicine 英科智能	 NOVARTIS	 IBM	 IBM Watson	
	 Numerate	 NuMedii	 Boehringer Ingelheim	 Google	 XtalPi	
 AiCure	 Atomwise Better medicines faster.	 CYCLICA	 BAYER	 NVIDIA	 Insilico Medicine 英科智能	
		 BenevolentAI	 Johnson & Johnson	 Apple	 SCHRODINGER	
	 AiCure	 GNS HEALTHCARE	 Roche	 Canon		
		 Insilico Medicine 英科智能	 药明康德 WuXi AppTec	 HUAWEI		
		 BERG	 AstraZeneca	 intel		
			 astellas	 HITACHI		
			 Bristol-Myers Squibb	 SAMSUNG		
			 AMGEN	 SIEMENS		
			 illumina			

30 Corporations Applying Advanced AI in Healthcare and Drug Discovery



The industry is experiencing an increasing level of regional diversification. Whereas historically the US has dominated the AI for Drug Discovery race in terms of a number of AI companies, volume of investments and number of industry specialized conferences, in 2019 we are observing an increased level of activity from the UK, Switzerland and China.

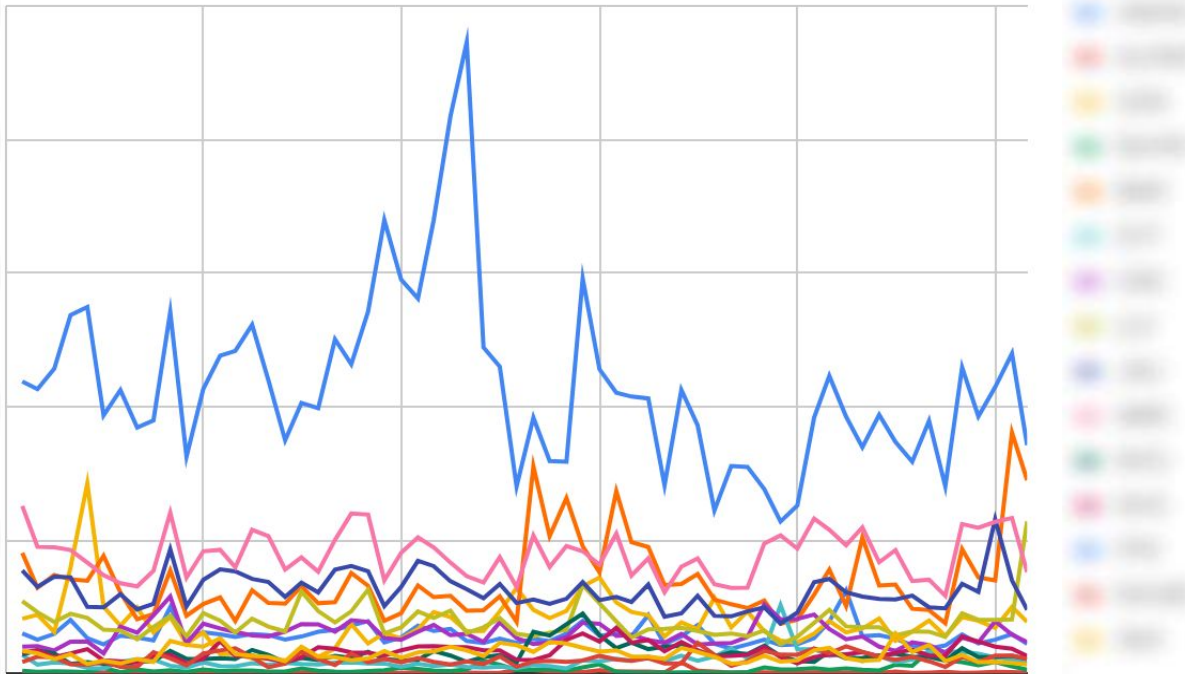


Key Points of Analytical Report

- The combined capitalization of the 15 BioPharma corporations profiled in this report has remained at the same level during the last 5 years.
- For the past 5 years, the capitalization of 15 IT & Tech corporations profiled in this report is steadily growing.
- As for the close price dynamics, most of the companies' stocks that we accounted for still do show significant increases. This is connected with existing industry burdens such as government pricing pressure, poor clinical trial results, increased litigation, competition, FDA scrutiny in the US, domestic price controls, and the gradual shift locally to generic drugs.
- At the same time, three of the profiled companies, Amgen, Eli Lilly, and Johnson & Johnson, leaders with blockbuster drugs in pipeline, stand out due to strong cash flow and faster growth comparing to traditional pharma.
- Keeping other things fixed, when tech stock increases by 1%, pharma AI stock index increases by 0,5% on average. The results turned out to be statistically significant at all significance level, so we can conclude that Pharma AI stock is less volatile and 48% less likely to respond towards movement in the technical market.
- Pharma Index is highly correlated with NASDAQ Biotechnology Index (25%) and NASDAQ itself (28%). This can be explained by the fact that all these three indices are often affected by similar factors of the external environment.
- The optimal portfolio in Pharma Industry is composed of the stocks of Astellas Pharma, Bayer, Eli Lilly, Evotec, Johnson&Johnson and Merck.
- 6 critical risks facing the pharmaceutical industry include increased competition from generic drugs, legal liability for opioid addiction, global quality control, patent cliffs, product liability and not keeping up with technology.

Pharma Corporations Market Cap Dynamics

Market capitalization of 15 pharma corporations dynamics

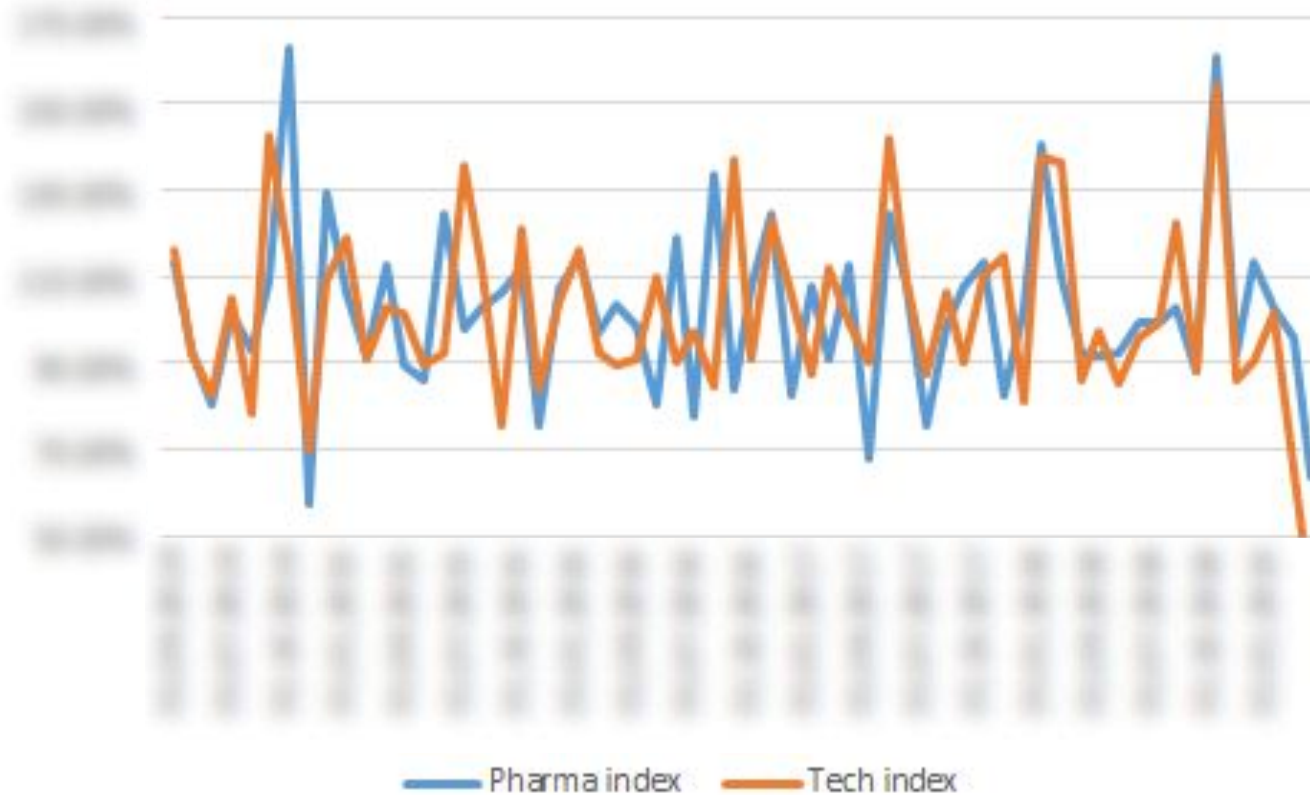


Pharmaceutical sector has an accelerated growth pace, but it is still slower than the other two large healthcare segments, medical equipment and healthcare services. Pharma corporations worldwide are expected to grow by 160% between 2017 and 2030. Pharmaceutical market growth is boosted by the following factors:

- Population aging and sedentary lifestyles leading to increased chronic disease prevalence
- Industrialized data services in R&D enabling the use of clinical trial data in trial simulations
- High urban pollution levels increasing the incidence of conditions like asthma

Dynamics of the Pharma AI Stock Index and Tech Index

The dynamics of capitalization growth of 15 pharma companies' stocks and 15 tech companies' stocks.

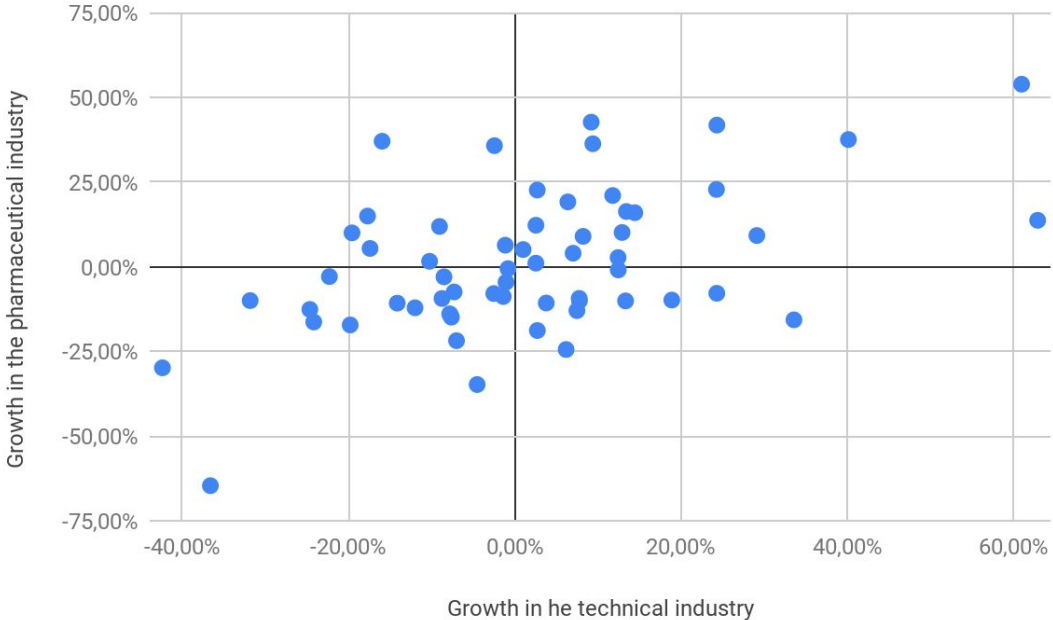


As we can see, there is no general trend or consistent path that both indices follow. Rises and falls are explained by different tech inventions and breakthroughs or, vice versa, various unfortunate events. However, there were several significant increases and declines. First one happened at the end of Summer 2014 and was caused by a series of major technological breakthroughs in pharma, such as neuromorphic chips, brain mapping, genome editing, etc. Nevertheless, this rapid increase was followed by the catastrophic decline in October 2014. This shock was provoked by several events, like US treasury freeze, worries about US airstrikes in Syria, Hong-Kong protests and Ebola virus spread.



Both indices are vulnerable to random social and scientific events and can hardly be predicted

Relationship between Pharma AI Stock Index and Tech Index



In order to check the connection of Pharma and Tech Indices, we ran a regression and found out that 25,9% of growth in the Pharma industry which applying AI for drug discovery can be explained by growth in the Tech industry. Moreover, keeping other things fixed, when tech stock increases by 1%, pharma AI stock index increases by 0,5% on average. The results turned out to be statistically significant at all significance level, so we can conclude that Pharma AI stock is less volatile and 48% less likely to respond towards movement in the technical market.

REGRESSION STATISTICS	
Intercept	0,0000
Technical Index	0,0050
R-squared	0,2590
F-statistic	1,2345
P-value	0,0001

	COEFFICIENTS	STANDARD ERROR	T STAT	P-VALUE
Intercept	0,0000	0,0000	0,0000	0,0000
Technical Index	0,0050	0,0001	50,0000	0,0000

Correlation between Indices

Correlations of the main indices

	Pharma index	Tech index	Combined index
Pharma index	1.00	0.15	0.15
Tech index	0.15	1.00	0.15
Combined index	0.15	0.15	1.00
S&P Pharmaceuticals Select Industry Index	0.95	0.10	0.10
Dow Jones U.S, Select Pharmaceuticals Index	0.95	0.10	0.10
S&P/TSX Venture Pharmaceuticals, Biotechnology & Life Sciences (Industry Group) Index (CAD)	0.95	0.10	0.10
NASDAQ Biotechnology Index	0.10	0.95	0.10
Dow Jones	0.10	0.10	0.95
S&P 500	0.10	0.10	0.95
Nasdaq	0.10	0.95	0.10
NYSE	0.10	0.10	0.95
Russel 2000	0.10	0.10	0.95

According to our calculations, the Pharma AI stock index is highly correlated with tech index. At the same time, the tech index is uncorrelated with NASDAQ Biotechnology Index and Dow Jones U.S. Select Pharmaceuticals Index, which includes the major part of traditional Pharma companies. This proves that investment analysis of Pharma corporations, which are applying AI drug discovery, should be conducted separately from the traditional pharma market.

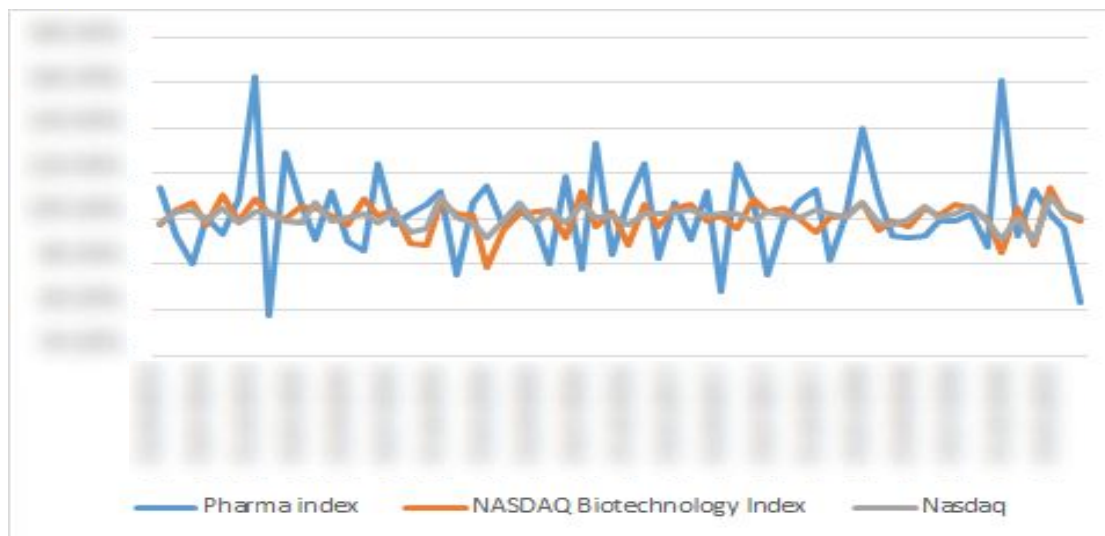
Besides, the correlation between the technical index and the combined index is higher than between Pharma AI stock index and the combined one. Thus, the influence of fluctuations in the tech stock is bigger than the one in the Pharma stock.

Relationship between Traditional Indices which are Highly Correlated with Pharma Index

Correlation of Pharma AI Index with the other main indices

INDEX	BETA COEFFICIENT	CORRELATION	P-VALUE
S&P/TSX Venture Pharmaceuticals, Biotechnology & Life Sciences			
NASDAQ Biotechnology Index			
S&P 500			
Nasdaq			

Pharma, NASDAQ and NASDAQ Biotechnology indices dynamics



We have analysed the correlation between Pharma Index and the other ones selected for this research. The main findings include:

- 1) Pharma Index is highly correlated with NASDAQ Biotechnology Index (25%) and NASDAQ itself (28%). This can be explained by the fact that all these three indices are often affected by similar factors of the external environment.
- 2) 25% of growth in Pharma AI industry is connected with the growth of NASDAQ Biotechnology Index. Also, it turned out that Pharma AI stock market is less volatile compared to those of Biotechnology.
- 3) The volatility in S&P 500 creates high risks for the stability of Pharma AI industry. The increase on 1% of S&P 500 leads to a decrease in growth in the pharma AI industry by 1,24% percentage point.

Relationship between Traditional Indices which are Highly Correlated with Pharma Index

Both pharmaceutical and technical industries seem perspective for buying stocks. What's better: make a stock portfolio of only pharma stocks or both pharma and tech?

PHARMA

Buying pharmaceutical companies stocks is considered to be challenging as high failure rate is about the pharmaceutical industry. A long procedure of R&D including preclinical and clinical testing is the main reason. Choosing stocks to buy investors must pay attention to companies' pipelines and amount of successful drugs registered as well as a number of drug candidates in clinical studies and phases they entered. Nevertheless, based on standard deviation analysis of technical index, technical companies stocks sometimes have even higher volatility due to different unpredictable factors. Pharmaceutical companies stock prices are more stable, so investing in them is less risky, than investing in both pharmaceutical and technical companies.

The main reason why investors are willing to buy pharmaceutical companies stocks is the rate of return which can be extremely high in case of successful trials, proven effectiveness and safety of a drug candidate

BOTH PHARMA AND TECH

To make a successful investment in the pharmaceutical industry, it's important to take into account all the peculiarities of the industry that can be not obvious at all. The technical industry is somewhat different in this aspect. Technical companies stock prices grow constantly and new products R&D doesn't take as much long as in the pharmaceutical industry. Therefore, buying technical companies stocks investors can somehow reduce risks associated with product testing and registration. Technical products usually don't need to be tested for effectiveness and of course, there are no clinical trials, which makes the technical industry more favourable for less ambitious investors whose aim is not to get the highest rate of return but not to lose all money invested.

The pharmaceutical stock market is less volatile and has significantly higher rates of return in case of successful R&D. Therefore, pharmaceutical companies stocks are considered to be more profitable.

Pharma AI Index Composition

According to data, Evotec is characterised as a company with the highest level of average return that means it has an excellent perspective as Evotec has performed very well during the last years with increasing revenue and net income. However, the number of absolute risk demonstrates that it might be negative deviation from an expected outcome, Beta systematic risk indicates that the portfolio moves in the opposite direction of the market and the efficiency of the securities will decrease with the increase of market efficiency, so Evotec's major challenge is to maintain the current high growth rate in the long run.

Eli Lilly, Merck and Roche show good financial results and are characterised by a Beta between 0 and 1, which signifies that company's portfolio moves in the same direction as the market, with less volatility and the risk level is lower than the average market (Eli Lilly and Roche). Merck's data indicates that the risk is higher than the average market and the portfolio will move in the same direction as the market, with a higher magnitude, and is very sensitive to systematic risk. Sanofi and GSK are known for the lowest level of risk. Bayer is defined for bad financial results, so depressed stock price may not go away any time soon.

Pharma AI Companies Statistics

Firm	Average return	Standard deviation	Beta (systematic risk)
EVT			
LLY			
MRK			
RHHBY			
JNJ			
NVS			
PFE			
AZN			
ALPMY			
AMGN			
SNY			
NVO			
BMY			
GSK			
BAYRY			

Tech Corporations Index Composition

The data of 15 tech companies' stocks demonstrates that Microsoft has a strong financial results, which is determined by steady earnings growth and the risk level that is lower than the average market. Google, Amazon, Apple and Alibaba are characterised as companies with high average return and Beta between 0 and 1 signifies that portfolios move in the same direction as the market. Canon and Siemens are known for the lowest level of risk. Baidu is defined for the lowest financial results due to data and the regulation in the company's search segment has slowed growth, nevertheless Baidu's valuation is currently attractive.

	Average return	Standard deviation	Beta (systematic risk)
MSFT			
GOOGL			
AMZN			
AAPL			
BABA			
INTC			
IBM			
TCENY			
SSUN			
SIEGY			
CAJ			
HTHIY			
NVDA			
BIDU			

10 Underappreciated Risks Facing Pharmaceutical Companies

RISK	IMPACT	PROBABILITY	ORIENTATION
	High	High	External
	High	High	External
	Moderate	High	External
	Moderate	Moderate	External
	Moderate	Low	Internal
	Moderate	Low	External
	Low	Low	Internal
	Low	Low	Internal
	Low	Low	External
	Low	Very Low	External

Sources

fitchsolutions.com



- **Summary**
- **Deliverables of the Report**
- **Proposal for Cooperation**

Pharma and Tech corporations demonstrate an increasing interest in AI. Applying AI for Drug Discovery and cooperation with pharma AI companies can be a sign that a corporation has prospects for competitive advantage. Understanding financial dynamics of such corporations is crucial for the analysis and assessment of threats and opportunities of AI for Drug Discovery industry.

The key questions regarding financial dynamics of pharma and tech corporations applying AI include:

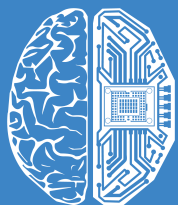
- **What is the specifics of the stock indices aggregated based on these corporations?**
- **What is the relation of these indices to the most important, well-known and relevant stock indices and what are the reasons for that?**
- **How can different institutions benefit from the knowledge of dynamics of these indices?**

This is a 60+ page report delivering practical answers to these specific questions in order to optimize the short and long-term strategies of investors, biopharma corporations and other institutions related to the industry, with a new updated edition being released each month, incrementally increasing the precision, practicality and actionability of its financial analysis. Each new edition will provide a more sophisticated, comprehensive and precise understanding of the reasons and consequences of financial dynamics of the aforementioned corporations, as well as what businesses such as pharma and tech corporations and private biotech companies need to do in order to benefit, rather than stagnate, from these tendencies. The report also suggests important insights for investors dealing in the related market. It is also planned to establish real-time information on the indices dynamics as well as on the statistical indicators of their relation to traditional and industrial-specific stock indices.

It will deliver:

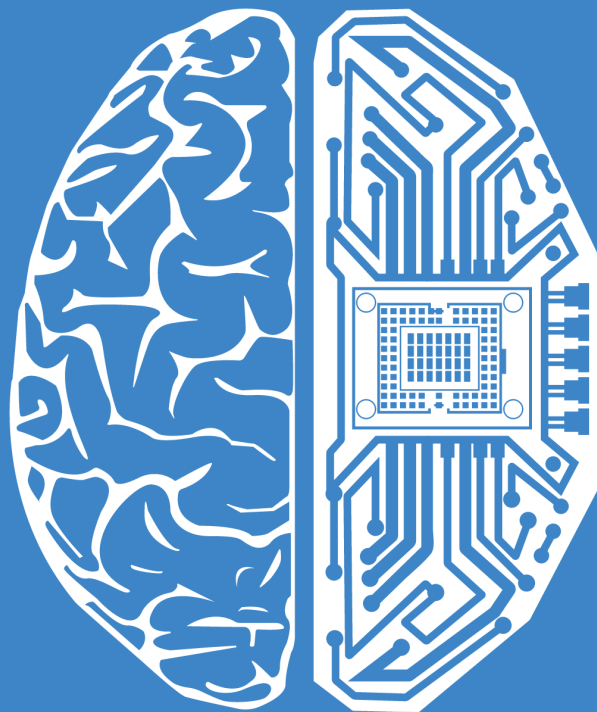
- Thorough analysis of stock dynamics of pharma and tech AI corporations considering their relation to AI for Drug Discovery industry
- 3-5-year estimation of possible future scenarios of indices development
- Instruction for assembling the best possible tools and solutions to deal with the industry trends
- Analysis of key market players in the AI for Drug Discovery and Biomarker Development landscape

The parties who gain early access to this report will have deep expertise on how their strategic agendas can be optimized and stabilized in order to benefit from the impact of financial dynamics of the aforementioned corporations and how to utilize the opportunities related to these financial trends. Pharma and tech corporations themselves will be able to observe their place on financial landscape regarding the sector of AI for Drug Discovery.



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