California Review Management

CORPORATE SOCIAL RESPONSIBILITY

The Rapid Rise and Fall of Biotech Stocks Adversely Impacts the Society

by Vijay Govindarajan, Hassan Ilyas, Felipe B. G. Silva, Anup Srivastava, and Luminita Enache

Image Credit | Nick Chong

It affects the fortunes of the biotechnology sector as a whole and populations in need of healthcare solutions.

INSIGHT | FRONTIER 15 Mar 2022

Recently, President Biden **announced** an ambitious goal to reduce cancer death rate by at least 50 percent and to improve the experience of living with and surviving cancer. Why has the society not made faster progress on cancer front? Why do discoveries in biotechnology sector occur in fits and spurts? We claim that this slow and sporadic progress has a lot to do with the vagaries of capital markets. Let's begin with a success story. There is little doubt that BioNTech (Pfizer), Moderna, and AstraZeneca vaccines had a profound impact on the developed world's recovery from the Covid-19 pandemic. Without them, countless more lives **and trillions of dollars of economic value** would have been further lost. The stock prices of these companies reached dramatic peaks after the world learned about their success. However, as of this week, they have already shed 50% of their peak market values, while we are still in the midst of the pandemic. This rapid rise and fall of these biotechnology stocks is not just about the Covid-vaccine stocks but also about the fortunes of the biotechnology sector as a whole. We describe this roller-coaster phenomenon in this post and claim that this phenomenon is not healthy for the society, particularly given the aging population and increasing need for new healthcare solutions.

Contrary to popular beliefs, most of the new drugs or vaccines are not discovered by big pharmaceutical companies like Pfizer or Merck. The development chain of a new life-science product can be divided into several phases: synthesis (discovery of a molecule or formulation), initial research (preclinical tests in lab and trials on animals), and development (human trials). The initial steps are typically taken by individual scientists, biotechnology start-ups, and research labs of universities. Those early-stage discoveries, their patents, or the discovering companies themselves, are then bought by the big pharmaceutical companies. The later steps in the development chain require numerous approvals from the Food and Drug Administration (FDA), which is numerous long and costly processes, that can only be done by big pharma. The next steps after FDA approval can also be undertaken only by big pharma: creation of brands through massive advertising campaigns, putting and scaling up manufacturing capabilities, and distribution of drugs using extensive vendor network. Small companies can try, but the likelihood of success is low given their lack of experience and capabilities in these areas. For example, Novavax is yet to be launched in the US**, despite a claim that is it a better vaccine than the currently available ones.**

Consider **two of Pfizer's largest drugs** from before Covid period: Pregabalin (Lyrica) and Palbociclib (Ibrance). They were discovered by Northwestern University and Onyx Pharmaceuticals, respectively. Similarly, Johnson & Johnson's blockbuster product, infliximab (Remicade), was synthesized at New York University in collaboration with a small biotechnology company Centocor. More recently, BioNTech's synthesized the Covid Vaccine. It then entered into a collaboration agreement with Pfizer to "**leverage Pfizer's broad expertise in vaccine research and development, regulatory capabilities, and global manufacturing and distribution network**." Biohaven, a small biotech company, relied on Pfizer for the **commercialization of its migraine drug Rimegepant**.

It must be clear from the above discussion that small biotech firms or research labs play the foundational role in innovation of drugs and vaccines. That innovation must benefit the society, evident from the progress in healthcare, physical well being, and increasing longevity of human beings over the last century. Yet, synthesis and discovery are not straightforward activities. Behind each successful product lie millions of research hours and thousands of synthesized products that never see the light of the day. Out of thousands of synthesized molecules, only few reach what is called Phase 1 success, and just 10% of those receive **FDA approval**. Even after FDA approval, only a few products are launched in the market, because a launching firm must reassess market potential before spending additional billions of dollars in creating manufacturing, branding, and distribution network. So, only a few start-ups, even among those that successfully synthesized products, are finally rewarded by big pharma. Why would a small company, or a group of scientists and doctors, devote their precious time, give up their careers, and spend their meager resources to develop something that has less than a lottery like chance to succeed? The answer is lottery like payoffs.

Let's consider a few examples. From market value of just $5 billion at the end of 2018, Moderna reached a **valuation** of $181 billion dollars in Sept 2021. BioNTech, which got listed in October 2019, reached a peak value of **$108 billion** in Aug 2021. This phenomenon is not just about Covid vaccines. Axsome Therapeutics, which traded for just $2 per share by the end of 2018, **reached $108 dollars** by the end of 2019. More important, big pharma pays large premiums to acquire listed companies and unlisted

start-ups. For example, in 2017, Gilead acquired a small biotech **Kite Pharma**, for $11.9 billion, and in 2020, Bayer acquired Asklepios, a gene-therapy startup, for a total cost of $4 billion. Acquisition by Big Pharma is typically the endgame for most biotech start-ups.

But the efforts and cost spent on drug development, after adjusting for inflation, keep doubling every nine years. This phenomenon is described in **Eroom's law**. (For curious people, Eroom is opposite of Moore's law, which describes the decreasing costs of discovering new products in electronics.) Given the rising costs, only rising lottery payoffs can keep up the incentives for small biotechnology start-ups to bet it all on their ventures. Indeed, announcement of each new multibillion dollar acquisition lifts both valuations and innovation efforts across the industry.

However, the purpose of this post is not to describe that small, biotechnology firms have lottery like payoffs, but to emphasize that any drop in lottery type payoffs could have an opposite impact on the society. The valuations of biotechnology companies have recently declined rather rapidly. Moderna's valuation is down to $64 billion and BioNTech's valuation is down to $38 billion, both more than 50% off their recent peaks. And it is not just about a few, isolated stocks. Diversified funds, that invest in hundreds of biotechnology stocks, are also off their recent peaks. For example, **XBI**, an S&P Exchange Traded Fund investing in biotechnology companies, is down 50% of its peak in less than twelve months. Neither the tech-heavy **Nasdaq** nor the **S&P 500 index** have declined by that much over the past one year, on the contrary, both have increased.

Why should one worry about sudden decline in valuations of biotechnology firms, or the vagaries in their fortunes? Well, they have a real impact on the society because an elaborate system of multi-stage and risky financing drives new drug discovery. Let's consider this chain of thought. Now big pharma would pay a lower price for successful innovation, and a successful biotech firm now has a lower chance of doing the initial public offering or being acquired at an astounding price. Lowering of lottery like payoffs, in conjunction with the rising costs of discoveries, means that venture capitalists would pull out investments from risky biotech projects and doctors and researchers will spend less hours in synthesizing new drugs. Importantly, some promising research would not progress further, and their discoveries would be prematurely lost. Thus, the roller coaster in the fortunes of biotechnology sector now means lower chance of developing new drugs

and vaccines, as well as loss of promising research effort. This is not just like putting off another steel plant, which can increase the steel prices, and increase the costs of automobiles. Not discovering a drug or a vaccine means prolonged illness, pain, or even more deaths. It may sound macabre, but fluctuating stock market fortunes of biotech firms would impact the health and wellbeing of citizens, something that personally touches us all, even if we don't invest in stock markets.

In sum, the rapid rise and fall of biotechnology sector adversely impact society. How to solve this problem? One proposed solution by **MIT's Andrew Lo**, is to pool the risks of multiple cancer projects and fund it using a superfund. We strongly endorse this idea. However, it is unclear how a superfund can better allocate seed capital to individual small projects than can capital markets or venture funds which are known for their speed and efficiency. Another idea is that such important research should not be left to private ventures but should instead be done by government sponsored and not-for-profit research institutions. Indeed, health-sector research is the **largest avenue** for government R&D funding, sponsored through National Institute of Health. Recall that **government research funding** was instrumental in development of Covid vaccines. Furthermore, the benefits from **public R&D spill over** to many more public and private projects that do benefit from private R&D. This point is enforced by President Biden's recent announcement on cancer research.

The key takeaway from this post is that there is a need for a new model to fund grassroot research in biotechnology sector. On one hand, the current model, based on venture funding, unleashes entrepreneurial energies and efforts, and attracts the best talent to biotechnology sector. On the other hand, the vagaries of biotechnology stocks in capital markets lead to fits and starts in biotechnology discoveries and cause frequent loss of promising research. Society must find a happy balance between the two forces and find a new way to address this problem, a problem that cannot be simply left to free markets.

Vijay Govindarajan Follow

Vijay Govindarajan is the Coxe Distinguished Professor at Dartmouth's Tuck School of Business and Faculty Partner at the Silicon Valley incubator Mach 49. He is the author of The Three Box Solution. Govindarajan is one of the world's leading experts on strategy and innovation and a two-time winner of the prestigious McKinsey Award for the best article published in the Harvard Business Review.

Hassan Ilyas Follow

Hassan Ilyas is a doctoral student in Finance at Johnson Graduate School of Management at Cornell University. His primary research interests are in exploring how financial markets and investors influence managerial decisions. Additionally, he explores how big data and machine learning can be used in finance by academics and practitioners. Prior to joining Cornell University, he worked as a data scientist at Goldman Sachs.

Felipe B. G. Silva Follow

Felipe B. G Silva is an assistant professor at the Trulaske College of Business of the University of Missouri. His research revolves around financial economics and macroeconomics and is featured in venues such as Bloomberg and Washington Post. His private sector experience includes the aerospace and financial services industries.

Anup Srivastava Follow

Anup Srivastava holds the Canada Research Chair at Haskayne School of Business, University of Calgary. He is one of the foremost experts on valuation and financial reporting of digital companies.

Luminita Enache Follow

Luminita Enache is an Associate Professor at Haskayne School of Business and Future Fund Fellow at the University of Calgary. She investigates the role intangibles plays in shaping the new economy firms, corporate governance, and more recently on the health economics. She specializes financial disclosures of biotechnology firms.