



Krause Fund Research

Fall 2022

Vertex Pharmaceuticals (NASDAQ: VRTX) Healthcare - Biotechnology

Analysts

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Investment Thesis

We recommend a BUY rating for Vertex Pharmaceutical as it is a reliable, consistent growth company with a potential upside of (6%). New treatments are expected from Vertex within the next 1-4 years.

Drivers:

- **Vertex is the Global Leader in CF Treatments.** Over the last four years, Vertex remains as the primary player in both the US and global markets for Cystic Fibrosis treatments. Versions of Vertex's treatments are sold in over 20 countries worldwide, including Canada and many European countries.
- **New Treatments.** Vertex has promising prospects for treatments to be made available within the next 1-4 years. Vertex has invested a lot of money into developing treatments for other debilitating diseases, such as sickle cell disease, beta thalassemia, and APOL1-mediated kidney disease.

Risks:

- **Growth subject to clinical trial results.** Year after year, the success rate of an autoimmune treatment tends to be between 12%-50%. As seen for Vertex over the course of 2021 when a kidney disease treatment failed clinical trials, the market does not take clinical trial failures lightly.
- **R&D is negatively affected in times of economic turmoil.** In the biotechnology industry, an increase to the cost of capital resulting from increasing inflation and Fed Funds Rates, reduces the drive for innovation in the industry, and in turn leads companies to divest from R&D, which would hinder future growth.

YTD Performance vs. S&P500



November 17, 2022

Stock Rating

Buy

Target: \$300-340

DCF/EP: \$340
DDM: \$247

Price Data

Current Price: \$305.44
52 Week Range: \$179.96-318.38

Key Statistics

Market Cap: 79,987M
Shares Outstanding: 254.5M
Price-to-Earnings Ratio: 23.11
Cost of Capital: 6.40%

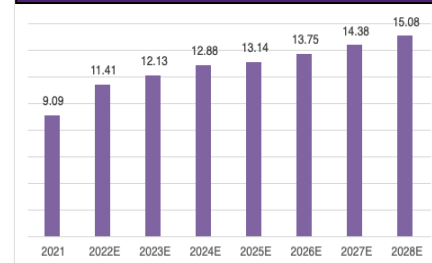
Financial Metrics

2021 Revenue: 7,574.4M
2022 Estimated Revenue: 9214.2M
2021 EPS: \$9.09
2022 Estimated EPS: \$11.41

Company Profile

Vertex Pharmaceuticals is a global biotechnology company based in Boston, Massachusetts. Vertex invests in scientific innovation to create and distribute treatments for life-threatening diseases. Vertex is currently the global leader for Cystic Fibrosis treatments and has ongoing research for treatments including but not limited to sickle cell disease, beta thalassemia, and APOL1-mediated kidney disease.

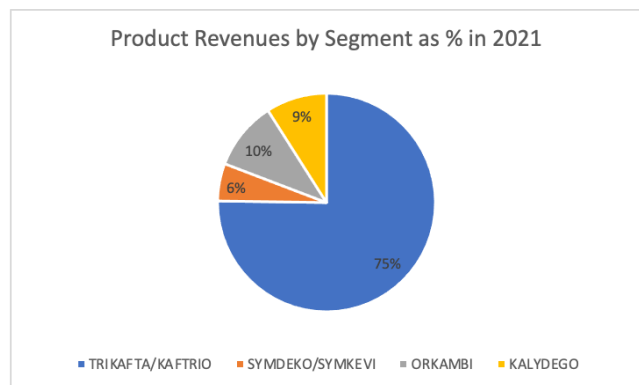
EPS Estimates



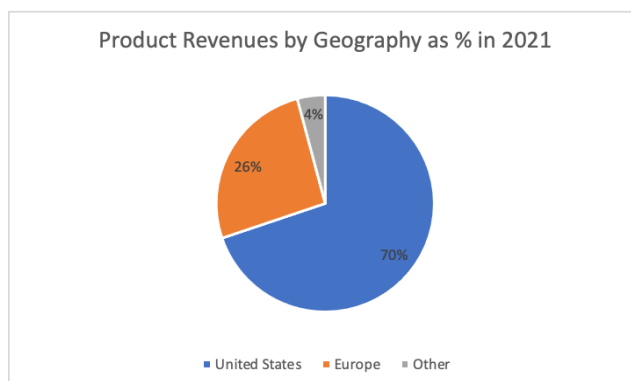
Company Analysis

Company Overview:

Vertex pharmaceuticals operates a global biotechnology company dedicated to discovering, developing, and producing transformative medicines for people suffering from serious diseases¹¹. The company primarily focuses on Cystic Fibrosis or CF treatment by having four approved treatments with TRIKAFTA as the leading treatment approved in 32 countries including the United States¹². CF is a genetic life-threatening disease caused by a defective gene which is most common in Caucasians. Four CF medicines have revenue generated mostly in the United States and Europe. Vertex's 97% CF market share globally in 2021 proved Vertex's dominance in the CF market¹³. Approximately 90% of the CF patients can be treated using Vertex's CF treatments and Vertex is currently working on generating effective drugs for the remaining 10% CF patients¹¹. Vertex also focuses on developing clinical trials on other research and development pipelines, such as Sickle Cell Diseases, APOL1-Mediated Kidney Disease, Type 1 Diabetes, Pain, Alpha-1 Antitrypsin (AAT), and Duchenne muscular dystrophy (DMD). Vertex current phase 3 trials CTX001 is a collaboration with CRISPR Therapeutics, focusing on developing a functional treatment for severe sickle cell diseases and beta thalassemia with regulatory submissions anticipated in 2022¹¹.



Source: VRTX 10-K²⁰²¹



Source: VRTX 10-K²⁰²¹

Product Segments:

Vertex's four CF treatments are: TRIKAFTA/KAFTRIO, SYMDEKO/SYMKEVI, ORKAMBI, KALYDECO

TRIKAFTA/KAFTRIO:

TRIKAFTA is a CF treatment that was approved in 2019 with a goal of treating patients aged 6 years or older who have at least one F508del mutation. TRIKAFTA's characteristic of being a combination of three other medications accounts for its success in sales. TRIKAFTA generated 75% of the product revenues in 2021, the highest revenue share. We project the company has a 40% TRIKAFTA growth in 2022, a 10% growth in 2023 due to TRIKAFTA's consistent performance over the years in the U.S. and an upcoming presentation with results for phase 3 TRIKAFTA in children aged 2 to 5 years old at the end of 2022 as disclosed in the recently third quarter report¹⁵. We also project TRIKAFTA will reach a steady growth of 5% from 2024 to 2028 since the company is in phase 3 for a new combination drug and the study result is predicted to be presented in 2024.

SYMDEKO/SYMKEVI:

SYMDEKO is a CF treatment that was approved in 2018 for patients aged 6 years or older who are homozygous for F508del mutation or with at least one mutation that is responsive to tezacaftor/ivacaftor. SYMDEKO generated 6% of product revenues in 2021. Since SYMDEKO began to experience negative growth in 2020 because of the implementation of TRIKAFTA in 2019, we

anticipate that this trend will continue from 2022 to 2028. We project a -55% and -30% growth in 2022 and 2023. The SYMDEKO will eventually have a -10% growth in 2028 until it gets completely replaced by TRIKAFTA.

ORKAMBI:

The 2015 FDA approval of ORKAMBI is intended to treat CF patients with homozygous F508del mutations who are 2 years of age or older. ORKAMBI accounted for 10% of product revenues in 2021 with a revenue of 771.6 million, which was down by -15% in 2020. We project a negative growth for ORKAMBI from 2022 to 2028 to match with the consistent historical negative growth performance. We expect ORKAMBI to have a -35% and -25% growth in 2022 and 2023 and a steady state of -15% growth starting from 2024 under the impact of TRIKAFTA being the revenue driven treatment. Another reason for the negative growth is the less effectiveness compared to TRIKAFTA since TRIKAFTA is a combination of three drugs, but ORKAMBI is only a combination of two drugs.

KALYDECO:

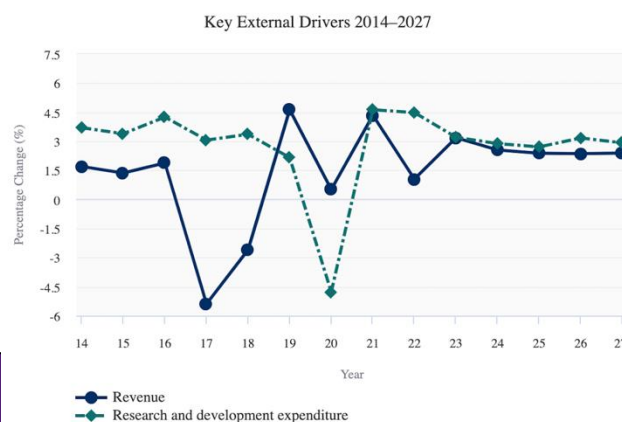
KALYDECO is a CF treatment that was approved in 2012 for patients aged 4 months or older who have a mutation that is responsive to ivacaftor. With 684.2 million, KALYDECO produced 10% of the product revenues in 2021, a decrease of -14% from 2020. Given that KALYDECO has historically experienced negative growth beginning in 2019, we anticipate it to continue during the projected period. We expect KALYDECO to have a -20% and -15% growth in 2022 and 2023 since the United States patent will expire in 2027 and the Europe patent will expire in 2025.

Industry Analysis

Biotechnology is the industry of altering and harnessing living organisms to manufacture a commercial product. Over half of the market share in the biotechnology industry is held by companies within the United States. There are three main subdivisions of the biotechnology industry. These are industrial, agricultural, and medical biotechnology. Industrial biotechnology

involves itself in generating energy or chemicals by harnessing enzymes and other microorganisms. Agricultural biotechnology concerns itself with altering organisms such as plants to enhance their ability to produce. The medical biotechnology sector involves using living cells and their materials to research and produce pharmaceutical products that treat and prevent diseases. We will be primarily focusing on companies within the biotechnology and pharmaceutical sectors, as these companies most closely resemble the business and revenue model of Vertex¹.

The two main trends of biomedical companies are their high investment in R&D to conduct clinical trials and study potential treatments and their competitiveness in patents to protect their intellectual properties. Being able to extract value from R&D expenditure helps to increase the profit margin of a company. The profit that an effective drug can bring to the company can be enormous with the stable number of patients in the market once it has been approved by the FDA following clinical trials. The graph shows a new trend of slowing down in R&D expenditure over revenue after the significant decrease due to Covid-19 in 2020. Recent high interest rates force biomedical companies to invest in safe short-term investments rather than risky long-term ones, slowing down R&D expenditure¹⁴.



Source: IBISWorld

Competition:

Vertex faces competition from other biopharmaceutical companies over R&D expenditure, patents, and profitability. Vertex, a large market cap company, has a specialty market in Cystic Fibrosis, with additional treatments in

the pipeline indicating its attractiveness. Companies with similar business models and operating structures are AbbVie, Biogen, Regeneron Pharmaceuticals, and Gilead Sciences.

AbbVie (ABBV)

AbbVie is a leading biopharmaceutical company headquartered in North Chicago, Illinois, with a 269 billion market cap. AbbVie has a diverse product line focusing on immunology, Oncology, Aesthetics, Neuroscience and Eye care. Humira is an immunology product and accounted for approximately 37% of its net revenue in 2021. AbbVie markets Creon, a pancreatic enzyme therapy for patients with Cystic Fibrosis¹⁶. The Cystic Fibrosis treatments offered by AbbVie and Vertex are the most promising options both currently and, in the future, because they are the most effective options available²¹. We also included AbbVie in our relative valuation model for the similarity in operation.

Biogen (BIIB)

Biogen is a biopharmaceutical company headquartered in Cambridge, Massachusetts, discovering, developing, and delivering therapies for neurological and neurodegenerative diseases¹⁷. Most Biogen's product revenues come from several treatments for multiple sclerosis (MS), including Tecfidera and Tysabri. As of 2021, Biogen has 9 treatments in the phase 3 trials.

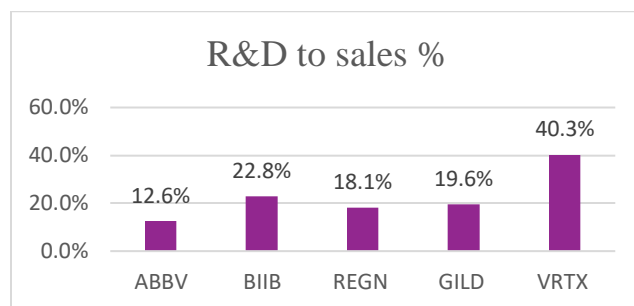
Regeneron Pharmaceuticals (REGN)

Regeneron Pharmaceuticals is a biotechnology company headquartered in Tarrytown, New York, engaging in the discovering, inventing, and developing medicines for serious diseases with a product line focusing on diseases that are secreted by cells or located on the cell surface¹⁸. EYLEA, an eye injection treating an eye disease to help patients maintain vision, and REGEN-COV, a Covid-19 treatment, together accounted for 95% of the net product revenues in 2021. Regeneron pharmaceuticals have 15 programs in phase 3 trials in 2021.

Gilead Sciences (GILD)

Gilead Sciences is a biopharmaceutical company headquartered in Foster City, California, focusing on

therapeutic areas such as viral diseases, inflammatory diseases, and oncology¹⁹. HIV treatment accounted for 66% of the product revenues in 2021. Gilead Sciences has 4 products in phase 3 trials in 2021.



Source: Companies 10-K²⁰²¹

Financial Metrixs (in millions)

	Net Margin (%)	ROE (%)	Sales (FYE)
ABBV	20.4%	80.5%	\$56,197
BIIB	15.0%	14.4%	\$10,982
REGN	50.2%	54.2%	\$16,072
GILD	22.7%	31.7%	\$27,305
VRTX	30.8%	24.9%	\$7,573

Source: Companies 10-K²⁰²¹

As shown above, Vertex is the top company in the operating metric, deriving 40.3% of sales from R&D expenditures in comparison to competitors in 2021. This effectiveness demonstrates Vertex's success in investing in R&D to continue creating treatments for the remaining 10% of CF patients and diversifying its pipeline to focus on other serious diseases that need effective treatments. In the financial metrics, even though Vertex ranks the second with a 30.8% of net margin, it still demonstrates Vertex's success in generating net income from sales on its major CF treatments. Regeneron Pharmaceuticals has a 50.2% net margin in 2021 due to its new focus on the Covid-19 treatment that boosted the sales¹⁸. Overall, these two factors show Vertex's strong ability in maintaining a growing business compared to other competitors in the biotechnology sector.

Porter's Five Forces

Competition in the industry: High

The biotechnology sector is highly competitive. Once a drug's patent has expired, competing companies will create similar treatments and market them to consumers to profit. That explains why biotechnology companies take such great care to

protect their intellectual property using patents. Biotechnology companies are constantly working to develop replacement therapies due to the intense competition for patents, so that these therapies can go through clinical trials, ensuring that the business will continue to turn a profit even after the patent on their key product expires. Although Vertex currently dominates the CF market, it is continually working to develop new CF treatments, such as VX-121/tezacaftor/VX-561, to ensure Vertex's dominant position in the CF market going forward.

Threats of new entrants: Low

New entrants will need a lot of time and money to start a biotechnology company since the biotechnology sector is capital intensive and requires strong leadership and connections. New entrants are usually small and specialized companies that cooperate with mature companies to create and develop treatments. For instance, Vertex partners with CRISPR Therapeutics, a small biotechnology company, to develop CTX001, a gene editing therapy that can treat sickle cell disease¹¹.

Power of suppliers: Moderate

Suppliers in the biotechnology companies might have a difficult time driving up the cost. There are components like manufacturing raw material, distributing centers, retail pharmacies/hospitals, and patients inside biotechnology sector's supply chains²⁰. There are numerous ways to locate suppliers, and because they are accessible, it might be risky for them to raise prices. Another risk is that more private insurance and government regulation might drive the price down. However, given how closely biotechnology companies collaborate with their suppliers, the cost of replacing them might be high. As a result, suppliers may find it challenging to raise prices, though it is not impossible.

Power of customers: Low

Biotechnology companies' customers have little influence over pricing due to the rareness of the treatments. Since biopharmaceutical companies target diseases that do not have a mature treatment market, customers do not have other choices but to choose the only available option that is offered. Due to patent protection, it is unlikely that competitors will develop similar treatments during the lifetime of patent. Vertex's dominance of the CF market and rising

profits show that customers have little control over their options.

Threat of substitute product: Low

The threat of substitutes is low and this correlates with customers' power. Since the key product characteristic for biopharmaceutical companies are the rareness of treatments and patent protections, competitors are highly restrained to product substitutes, especially for producing substitutes for company key products to weaken a company's power.

Economic Analysis

Capital Market Outlook

5 Year Returns



Source: Barchart.com

Over the past five years, Vertex has outperformed the S&P 500 and S&P Healthcare. Five years was the historical period used to capture returns before, during, and after the pandemic.

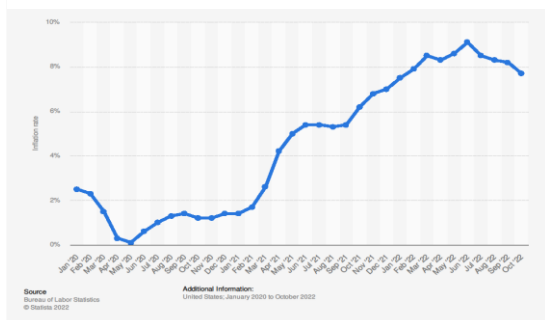
We believe that due to the recent downturn in the capital markets, and the feeling of an impending recession, that now is a good time to invest in the healthcare sector. Healthcare companies have historically had very low correlation to the rest of the market in times of recession, due to their relatively inelastic demand. Another aid to this trend is the institution of medical insurance. This ensures that as buying power would erode a customer's ability to pay, demand is unaffected and revenues are more secure as the buyer is not making direct payments to the seller, but instead the seller is paid by an insurance company, who is in turn required to provide coverage for

customers with diseases with covered treatments. For instance, Vertex's TRIKAFTA is covered by Medicare and Medicaid in the United States, and the alternative KAFTRIO is covered in many other countries other their organization of insurance.

Inflation and Interest Rates

Inflation has become a pressing issue upon the American economy since roughly the second quarter of 2021. Inflation has been steadily increasing from an annualized 1.5% CPI increase in the early months of 2021, to above 8% in Q3 of 2022³.

Annualized Inflation Rates Jan. 2020 – Oct. 2022



Source: Statista

Interest Rates

Due to the rapidly increasing inflation rates over the last two years, the Fed has been increasing interest rates at a clip not typically seen except in the case of a recession. Economists in the October poll expected another increase to the Federal Funds Rate of 50 basis points. This increase would take the rate to between 4.25% and 4.5% in December 2022. This would be the highest that interest rates have been since the financial crisis in 2007 and 2008. The ability to raise capital to perform crucial research and development is hindered when the cost of borrowing is drastically raised⁸.

Overall Economic Health

Economist consensus estimates for GDP include a grim outlook on overall production for the end of 2022 and 2023 in the United States. Estimates conclude that real GDP over 2022 will be around

0.8%. Estimates for 2023 center around 0% for real GDP growth. After the forecasted recession period, growth returns to a low yet stable level, with most estimates for real GDP growth coming in around 2% to 4%.

Healthcare Spending

The Centers for Medicare and Medicaid Services has released estimates for public healthcare expenditures in the United States. Although growth in spending has slowed since pandemic era levels of just below 10%, estimates for year-over-year growth are 5.1%, and are expected to reach \$6.8 trillion by 2030. Healthcare's share of GDP is also expected to remain at current levels, at 19.6%. Consistent healthcare spending ensures that biotechnology and pharmaceutical companies will have lower risk in generating revenue and demand, as insurance companies often cover the main treatments offered by these types of companies⁷.

Valuation Discussion

Throughout our valuation and analysis of Vertex Pharmaceuticals, we have made several assumptions. We based many of these assumptions on historical trends, as well as current movements and a forward-looking sentiment towards the market. We have included a Discounted Cash Flow analysis (using both free cash flow and economic profit), a Dividend Discount Model, and a relative P/E valuation model as our valuation models.

Revenue and Costs

As described above in the company analysis, Vertex procures four main product groups that bring in 99% of their revenue. Our projections were based on the treatment's current trajectory, as well as it's ability to penetrate a new market. For instance, KAFTRIO is still experiencing a great deal of revenue growth in European markets. As patents expire and new patents are acquired, we expect to see this general trend of great growth among a product's revenue, followed by a period of a few years where the treatment is phased out of the market in favor of a new treatment.

The following costs were determined by using historical average percentages of previous year sales. Pandemic years were included or excluded based on discretion. The furthest historical year that averages were extracted from was 2016.

Weighted Average Cost of Capital (WACC) – 6.38%

Cost of Equity In order to calculate the cost of equity, we had to make a few assumptions. First, we used a 10-year treasury bond for the risk-free rate, which after recent rate hikes sits at 3.88%. We used a 52-week average beta to reach an equity beta of .55 for Vertex. We then assumed Professor Damodaran's forward looking implied Equity Risk Premium of 4.59%.

Cost of Debt

We assumed the cost of debt to be the rate offered on Vertex's revolving credit facility, which is fixed to the risk-free rate, with a slight premium. Vertex is practically unlevered, so the cost of debt for the revolver is minimal at 4.36%.

Market Value of Common Equity

We used the basic total shares outstanding reported by Vertex as of their 10K in 2021. This gave us 254.48 million shares outstanding. We then used Vertex's closing price on 11/15/2022 of \$310.83 to calculate to determine our Market Value of Common Equity to be \$79,100.02 million.

Market Value of Debt

Vertex is extremely unlevered relative to many other companies in their sector. Their only obligations currently are their long-term operating and finance leases in 2021, at \$887.2 million.

DCF/EP Models

Key assumptions made for our DCF and EP models include a 2.5% CV growth rate for NOPLAT, a 60.65% CV ROIC, and our 6.38% WACC. We decided to use 2.5% as our continued value growth rate as that is the average yearly growth rate of GDP. CV ROIC was calculated as our 2028 projected NOPLAT

divided by our 2027 projected invested capital. We then calculated Free Cash Flow to the Firm by subtracting the change in invested capital from NOPLAT. For Economic Profit, beginning invested capital is simply multiplied by ROIC minus the WACC to arrive at that year's economic profit. After discounting these cash flows to the present value, we arrive at the value of our operating assets. After adjusting for non-operating line items, we arrive at the value of equity. For these models, our value of equity was \$82,011.5 million. Finally, to arrive at the intrinsic share value, we divide our value of equity by shares outstanding, and for our DCF and EP models, we concluded with an implied price of \$340 per share, 11% over the current share price.

Dividend Discount Model

Key assumptions for our Dividend Discount Model include a CV growth of EPS of 3%, a CV ROE of 12.83%, and a cost of equity of 6.4%. We expect EPS to grow slightly faster than NOPLAT as Vertex has recently engaged in small amounts of stock buybacks, and their payout ratio is 0.

Vertex has no history of paying dividends, and according to their 10-K has no plans of beginning dividend payments for common stock. Due to this our DDM is very simplistic. The only contributing factor to our intrinsic share value is the CV estimation derived from the EPS. Given no dividends, and a front-loaded growth estimation with the success of TRIKAFTA/KAFTRIO, and otherwise declining revenue segments, our DDM returned a very low intrinsic value per share, at \$247, 24% below the current share price.

Relative Valuation

We decided to use seven different companies in our relative P/E multiple analysis. These companies included AbbVie, Amgen, Biogen, Gilead Sciences, Regeneron Pharmaceuticals, Johnson & Johnson, and Merck. We chose these companies due to their proximity to Vertex in either the pharmaceutical or biotechnology industries. We concluded that the industry has average P/E ratios of 14.68 and 15.02 for 2022 and 2023 respectively. Comparing this to the P/E multiples seen over the years and projected for

Vertex, whose P/E multiple was 27.2 in 2022 and is expected to be 25.6 in 2023, which is a lot higher than the industry average or any peers. Due to this, when we figured Vertex's implied value from the average multiples of its peers, we reached an intrinsic stock value of \$167 and \$182 for 2022 and 2023 respectively.

Due to Vertex's drastically different capital structure and multiples, we conclude that relative valuation is not an adequate measure of value for Vertex.

Sensitivity Analysis

Risk-Free Rate vs. CV growth of NOPLAT

CV growth of NOPLAT	Risk Free Rate							
	340.24	3.60%	3.70%	3.80%	3.88%	4.00%	4.10%	4.20%
	1.90%	326.15	319.10	312.37	307.20	299.78	293.89	288.24
	2.10%	337.73	330.08	322.78	317.19	309.17	302.82	296.74
	2.30%	350.54	342.18	334.23	328.15	319.46	312.58	306.02
	2.50%	364.77	355.58	346.88	340.24	330.77	323.30	316.18
	2.70%	380.66	370.52	360.94	353.64	343.27	335.11	327.35
	2.90%	398.55	387.27	376.65	368.59	357.16	348.20	339.70
	3.10%	418.81	406.17	394.32	385.35	372.68	362.78	353.43

The first test we wanted to run in our sensitivity analysis was a variable of growth and a variable that would erode that growth. We figured that in the present economy, a measure that may resemble the changing Fed Funds Rate may be a good way to measure the erosion of value if one of our assumptions were to be off. What we found is that a 0.6% spread of the risk-free rate leads to over a \$38 price difference when growth is held constant.

WACC vs. CV growth rate of NOPLAT

CV growth of NOP	WACC							
	340.24	5.80%	6.00%	6.20%	6.38%	6.60%	6.80%	7.00%
	1.90%	351.82	335.05	319.85	307.32	293.32	281.68	270.96
	2.10%	365.69	347.38	330.86	317.32	302.23	289.75	278.28
	2.50%	398.47	376.27	356.46	340.39	322.66	308.12	294.87
	2.70%	418.03	393.33	371.46	353.81	334.45	318.65	304.33
	2.90%	440.29	412.60	388.27	368.77	347.51	330.26	314.70
	3.10%	465.84	434.53	407.26	385.56	362.06	343.13	326.14

The risk-free rate is a major assumption that is made when calculating the WACC, but after running the CV growth of NOPLAT vs the risk-free rate, we wanted to know what the effect would be if the WACC was more drastically affected. Also, both the assumption of WACC and of CV growth of NOPLAT may be subject to

some inaccuracy. To account for this, we ran these variables against each other to find out what the effect would be on the target price. With the WACC constant, an increase of 0.2% to the CV growth estimate increases the target price more than \$13 to \$353.81. Intrinsic price is also extremely sensitive to changes in the WACC, where a 0.3% increase to the WACC leads to a \$14 drop in estimated value to \$293.32.

R&D Expenses vs. SG&A Expenses

SG&A as a % of Sales	R&D Expenses as a % of Sales							
	340.24	26.00%	26.50%	27.00%	27.30%	27.50%	28.00%	28.50%
	12.50%	442.77	438.47	434.09	434.51	433.79	433.48	433.18
	13.00%	438.47	434.16	433.79	434.20	433.48	433.18	432.88
	13.11%	437.52	433.22	432.84	430.26	438.54	434.23	429.93
	13.50%	434.16	429.86	439.48	436.90	435.18	430.88	426.57
	14.00%	429.86	425.55	435.18	432.60	430.88	426.57	422.27
	14.50%	425.55	421.25	430.88	428.29	426.57	422.27	417.96

We wanted an operational metric for our sensitivity analysis. The two largest costs in the biotechnology industry are research and development and sales, general, and administrative expenses. To illustrate what would happen to the intrinsic value if a company were able to maintain the same levels of output while marginally changing their top expense categories. What we found is that a change of 1.2% to R&D expenses when SG&A and Revenue are held constant results in a \$10.33 range of prices. While only a 2% change in SG&A when R&D and revenue are held constant results in a \$17 range in prices.

Cost of Equity vs. CV Marginal Tax Rate

Marginal Tax Rate	Cost of Equity							
	340.24	5.80%	6.00%	6.20%	6.40%	6.60%	6.80%	7.00%
	16.00%	338.35	338.91	339.47	340.03	340.59	341.15	341.71
	18.00%	338.42	338.98	339.54	340.10	340.66	341.22	341.78
	20.00%	338.50	339.05	339.61	340.17	340.73	341.29	341.85
	22.00%	338.57	339.13	339.68	340.24	340.80	341.36	341.92
	24.00%	338.64	339.20	339.76	340.32	340.87	341.43	341.99
	26.00%	338.71	339.27	339.83	340.39	340.95	341.50	342.06
	28.00%	338.78	339.34	339.90	340.46	341.02	341.58	342.14

We measured that changes in cost of equity and marginal tax rate do not bring rigorous change to the stock price. The price range between the highest stock price and lowest stock price with a change of 1.3% in cost of equity and a change of 12% in marginal tax rate is \$3.79.

Normal Cash Estimate vs. Marginal Tax Rate

Marginal Tax Rate	Normal Cash Estimate							
	340.24	25.0%	30.0%	35.0%	40.0%	45.0%	50.0%	55.0%
	16.00%	350.06	346.72	343.38	340.04	336.70	333.36	330.02
	18.00%	350.14	346.80	343.45	340.11	336.77	333.43	330.09
	20.00%	350.21	346.87	343.53	340.19	336.84	333.50	330.16
	22.00%	350.28	346.94	343.60	340.26	336.91	333.57	330.23
	24.00%	350.35	347.01	343.67	340.33	336.99	333.64	330.30
	26.00%	350.43	347.08	343.74	340.40	337.06	333.71	330.37
	28.00%	350.50	347.16	343.81	340.47	337.13	333.78	330.44

We also aimed to measure a balance sheet assumption with a tax rate to capture the effects from both operating and non-operating factors. We found that 15% change in normal cash estimate with the marginal tax rate stays constant will bring a \$10 change in the stock price.

Important Disclaimer

This report was created by students enrolled in the Applied Equity Valuation class at the University of Iowa. The report was originally created to offer an internal investment recommendation for the University of Iowa Krause Fund and its advisory board. The report also provides potential employers and other interested parties an example of the students' skills, knowledge, and abilities. Members of the Krause Fund are not registered investment advisors, brokers or officially licensed financial professionals. The investment advice contained in this report does not represent an offer or solicitation to buy or sell any of the securities mentioned. Unless otherwise noted, facts and figures included in this report are from publicly available sources. This report is not a complete compilation of data, and its accuracy is not guaranteed. From time to time, the University of Iowa, its faculty, staff, students, or the Krause Fund may hold a financial interest in the companies mentioned in this report.

Sources

- (1) *Biotechnology Market Size & Growth Trends report, 2030*. Biotechnology Market Size & Growth Trends Report, 2030. (n.d.). Retrieved November 17, 2022, from <https://www.grandviewresearch.com/industry-analysis/biotechnology-market>
- (2) *Vertex Pharmaceuticals: Home*. Vertex. (n.d.). Retrieved November 17, 2022, from <https://www.vrtx.com/>
- (3) *Current US inflation rates: 2000-2022: US inflation calculator*. US Inflation Calculator |. (2022, November 17). Retrieved November 17, 2022, from <https://www.usinflationcalculator.com/inflation/current-inflation-rates/>
- (4) *Economic Forecast for the US Economy*. Validation request. (n.d.). Retrieved November 17, 2022, from <https://www.conference-board.org/research/us-forecast>
- (5) Kavita, J. (n.d.). *Cystic fibrosis (CF) therapeutics market size, share and growth by 2025*. Allied Market Research. Retrieved November 17, 2022, from <https://www.alliedmarketresearch.com/cystic-fibrosis-therapeutics-market>
- (6) Mikulic, M. (2022, November 8). *Value share of biotech sector by country worldwide 2021*. Statista. Retrieved November 17, 2022, from <https://www.statista.com/statistics/1246614/top-countries-share-of-global-biotech-value/#:~:text=As%20of%202021%2C%20the%20United,as%20of%202021%2C%20by%20country>
- (7) *Press release CMS Office of the actuary releases 2021-2030 projections of National Health Expenditures*. CMS. (n.d.). Retrieved November 17, 2022, from <https://www.cms.gov/newsroom/press-releases/cms-office-actuary-releases-2021-2030-projections-national-health-expenditures>
- (8) *United States Fed funds RATE2022 data - 1971-2021 historical - 2023 forecast*. United States Fed Funds Rate - 2022 Data - 1971-2021 Historical - 2023 Forecast. (n.d.). Retrieved November 17, 2022, from <https://tradingeconomics.com/united-states/interest-rate>
- (9) *United States GDP annual growth RATE2022 data - 2023 forecast*. United States GDP Annual Growth Rate - 2022 Data - 2023 Forecast. (n.d.). Retrieved November 17, 2022, from <https://tradingeconomics.com/united-states/gdp-growth-annual#:~:text=GDP%20Annual%20Growth%20Rate%20in,the%20second%20quarter%20of%202020>
- (10) Wong, C. H. (n.d.). *Estimation of clinical trial success rates and related parameters*. Academic.oup.com. Retrieved November 17, 2022, from <https://academic.oup.com/biostatistics/article/20/2/273/4817524?login=true>
- (11) Vertex Pharmaceuticals 2021 10K
- (12) “Frequently Asked Questions.” *CF GET LOUD*, <https://www.cfgetloud.ca/faq#:~:text=Trikafta%20has%20received%20regulatory%20approval,%2C%20Norway%2C%20Iceland%20and%20Liechtenstein>.
- (13) Investments, Khaveen. “Vertex Pharmaceuticals: Cystic Fibrosis Leader (Nasdaq:VRTX).” *Seeking Alpha*, Seeking Alpha, 24 Aug. 2021, <https://seekingalpha.com/article/4451461-vertex-pharmaceuticals-cystic-fibrosis-leader>.
- (14) “The University of Iowa Libraries.” *Off Campus Access - The University of Iowa Libraries*, <https://my-ibisworld-com.proxy.lib.uiowa.edu/us/en/industry/n001/industry-at-a-glance>.
- (15) “Vertex Reports Third Quarter 2022 Financial Results.” *Vertex Pharmaceuticals*, 27 Oct. 2022, <https://investors.vrtx.com/news-releases/news-release-details/vertex->

reports-third-quarter-2022-financial-
results.

- (16) AbbVie 2021 10K
- (17) Biogen 2021 10K
- (18) Regeneron Pharmaceuticals 2021
10K
- (19) Gilead Sciences 2021 10K
- (20) “Fisher Scientific.” *Lab
Equipment and Lab Supplies*,
<https://www.fishersci.com/us/en/education-products/featured-categories/biotechnology-resources-education/importance-of-biotechnology/biotechnology-science-of-the-future.html>.
- (21) GlobalData UK Ltd. “Vertex and
AbbVie Are the Only Current and Future
Players in the Cystic Fibrosis Market,
Says GlobalData.” *GlobalData*,
GlobalData UK Ltd., 1 Sept. 2021,
<https://www.globaldata.com/vertex-abbvie-current-future-players-cystic-fibrosis-market-says-globaldata/>.

Vertex Pharmaceuticals
Revenue Decomposition

<i>Fiscal Years Ending Dec. 31</i>	2019	2020	2021	2022E	2023E	2024E	2025E	2026E	2027E	2028E
Segments:										
TRIKAFTA/KAFTRIO	420.1	3863.8	5697.2	7976.1	8773.7	9212.4	9673.0	10156.6	10664.5	11197.7
% Growth		820.0%	47.0%	40.0%	10.0%	5.0%	5.0%	5.0%	5.0%	5.0%
U.S. Patent Expiration Date (2037)										
European Patent Expiration Date (2037)										
SYMDEKO/SYMKEVI	1417.7	628.6	420.4	189.2	132.4	112.6	95.7	86.1	77.5	69.7
% Growth	84.5%	-55.7%	-33.1%	-55.0%	-30.0%	-15.0%	-15.0%	-10.0%	-10.0%	-10.0%
Patent expiration date (2027)										
European Patent Expiration Date (2028)										
ORKAMBI	1331.9	907.5	771.6	501.5	376.2	319.7	271.8	231.0	196.4	166.9
% Growth	5.5%	-31.9%	-15.0%	-35.0%	-25.0%	-15.0%	-15.0%	-15.0%	-15.0%	-15.0%
Patent Expiration Date (2030)										
European Patent Expiration Date (2026)										
KALYDEGO	991	802.9	684.2	547.4	465.3	409.4	368.5	339.0	311.9	286.9
% Growth	-1.6%	-19.0%	-14.8%	-20.0%	-15.0%	-12.0%	-10.0%	-8.0%	-8.0%	-8.0%
Patent Expiration Date (2027)										
European Patent Expiration Date (2025)										
Product revenues, net	4160.7	6202.8	7573.4	9214.2	9747.5	10054.1	10408.9	10812.8	11250.2	11721.3
% Growth	36.9%	49.1%	22.1%	21.7%	5.8%	3.1%	3.5%	3.9%	4.0%	4.2%
Other revenues	2.1	2.9	1	200	220	242	261	280	294	300
% Growth	-77.2%	38.1%	-65.5%	15.0%	10.0%	10.0%	8.0%	7.0%	5.0%	2.0%
Total revenues	4162.8	6205.7	7574.4	9414.2	9967.5	10296.1	10670.3	11092.4	11543.8	12020.8
% Growth	36.6%	49.1%	22.1%	24.3%	5.9%	3.3%	3.6%	4.0%	4.1%	4.1%
Markets:										
United States	3,060.30	4,826.40	5,287.3	5763.2	6339.5	7100.2	7739.2	8281.0	8695.0	9129.8
% Growth	29.9%	57.7%	9.5%	9.0%	10.0%	12.0%	9.0%	7.0%	5.0%	5.0%
ex-U.S.	1,100.40	1,376.40	2,286.1	3543.5	5315.2	7707.0	10789.8	14566.3	19373.1	25185.1
% Growth	61.3%	25.1%	66.1%	55.0%	50.0%	45.0%	40.0%	35.0%	33.0%	30.0%
Product revenues, net	4,161.00	6,203.38	7,573.4	9306.6	11654.7	14807.2	18529.0	22847.2	28068.1	34314.8
% Growth	37.0%	49.1%	22.1%	22.9%	25.2%	27.0%	25.1%	23.3%	22.9%	22.3%

Income Statement

[illegible]

Vertex Pharmaceuticals
Balance Sheet

<i>Fiscal Years Ending Dec. 31</i>	2019	2020	2021	2022E	2023E	2024E	2025E	2026E	2027E	2028E
Assets										
Current assets:										
Cash & cash equivalents	3109.3	5988.2	6795.0	9991.9	12732.9	15095.7	17930.2	20755.9	23572.7	26474.8
Marketable securities	699.0	670.7	729.9	770.0	812.4	857.1	904.2	954.0	1006.4	1061.8
Accounts receivable, net	633.5	885.4	1136.8	1396.2	1478.3	1527.0	1582.5	1645.1	1712.1	1782.8
Inventories	167.5	280.8	353.1	414.5	438.9	453.4	469.8	488.4	508.3	529.3
Prepaid expenses & other current assets	213.5	308.4	545.8	543.0	574.9	593.9	615.5	639.8	665.8	693.4
Total current assets	4822.8	8133.4	9560.6	13115.7	16037.5	18527.1	21502.3	24483.3	27465.4	30542.0
Total property & equipment, gross	1437.6	1749.1	1990.1	2147.7	2310.1	2477.3	2649.6	2827.0	3009.7	3197.9
Less: accumulated depreciation	692.5	790.6	896.0	1013.3	1135.0	1261.0	1391.4	1526.4	1665.9	1810.0
Property & equipment, net	745.1	958.5	1094.1	1134.4	1175.1	1216.3	1258.1	1300.6	1343.9	1388.0
CapEx (AVG from the past five years on CF)			153.0	157.6	162.4	167.2	172.2	177.4	182.7	188.2
Intangible assets	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0
Goodwill	1002.2	1002.2	1002.2	1002.2	1002.2	1002.2	1002.2	1002.2	1002.2	1002.2
Deferred tax assets	1190.8	882.8	934.5	625.6	317.6	369.3	60.5	0.0	0.0	0.0
Operating lease assets		325.6	330.3	342.5	354.8	367.2	379.8	392.6	405.7	419.0
Other assets	157.6	49.4	110.8	185.2	196.1	202.6	209.9	218.3	227.1	236.5
Total assets	8318.5	11751.8	13432.5	16805.6	19483.3	22084.7	24812.8	27797.0	30844.3	33987.7
Liabilities and Shareholders' Equity										
Current liabilities:										
Accounts payable	87.6	155.1	195.0	225.3	238.5	246.4	255.3	265.4	276.2	287.7
Accrued expenses	1116.9	1405.0	1678.6	2247.9	2380.0	2458.4	2547.8	2648.6	2756.4	2870.3
Other current liabilities	130.3	317.4	268.4	369.9	391.7	404.6	419.3	435.9	453.6	472.4
Total current liabilities	1334.8	1877.5	2142.0	2843.1	3010.2	3109.4	3222.4	3349.9	3486.2	3630.3
Long-term finance lease liabilities	538.6	539.0	509.8	662.2	631.4	643.4	692.0	700.8	724.7	753.2
% of net PPE										
Long-term operating lease liabilities		350.5	377.4	403.0	411.4	429.0	442.1	457.9	472.7	488.4
% of operating lease assets										
Long-term contingent consideration	176.5	189.6	186.5	184.2	177.5	85.7	85.7	85.7	85.7	85.7
Other long-term liabilities	183.3	108.4	116.8	120.3	123.9	127.6	131.5	135.4	139.5	143.6
Total liabilities	2233.2	3065.0	3332.5	4212.8	4354.5	4395.2	4573.7	4729.6	4908.8	5101.3
Shareholder Equity:										
Common stock	7940.2	7896.6	6883.3	6977.8	7072.4	7166.9	7261.4	7356.0	7395.7	7395.7
Accumulated other comprehensive income (loss)	-2.0	-68.5	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9
Stay constant										
Retained earnings (accumulated deficit)	-1853.0	858.7	3200.8	5599.1	8040.5	10506.7	12961.8	15695.4	18523.9	21474.9
Assume R/E will increase (share of stock)										
Total shareholders' equity	6085.2	8686.8	10100.0	12592.9	15128.8	17689.5	20239.1	23067.3	25935.5	28886.5
Total liabilities and shareholders' equity	8318.5	11751.8	13432.5	16805.6	19483.3	22084.7	24812.8	27797.0	30844.3	33987.7

Vertex Pharmaceuticals
Historical Cash Flow Statement

Fiscal Years Ending Dec. 31	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Cash flows from operating activities:										
Net income	-51.1	-687.6	-742.7	-588.2	-84.0	91.6	2087.1	1176.8	2711.6	2342.1
Adjusted to reconcile net income to net cash provided by operating activities										
Stock-based compensation expense	114.3	127.3	177.5	231.0	237.7	290.7	325.0	360.5	429.5	441.4
Depreciation & amortization expense	38.2	48.4	63.3	62.3	61.4	61.4	72.4	106.9	109.5	125.6
Write-downs of inventories to net realizable value	133.2	10.4	-	-	-	15.3	20.4	-	-	-
Deferred income taxes	36.7	-285.1	0.3	3.3	17.0	-120.5	-1512.3	167.4	277.3	-154.6
Losses (gains) on equity securities	-	-	-	-	-	-	-2.6	-197.6	-311.9	-17.1
Increase (decrease) in fair value of contingent consideration	-	-	-	-	-	-	-	4.5	13.1	-3.1
Other non-cash items, net	-0.2	6.7	-	9.5	6.1	-2.8	12.1	16.9	78.8	14.4
Other operating activities	10.7	733.3	-0.5	2.5		493.9	30.1			
Changes in operating assets and liabilities:										
Accounts receivable, net	39.9	53.4	7.4	-104.8	-33.0	-71.8	-108.2	-225.6	-223.4	-274.7
Inventories	-29.9	7.1	-16.5	-23.1	-16.5	-45.0	-32.0	-64.0	-132.0	-92.8
Prepaid expenses & other assets	-12.3	-12.1	-15.8	-9.3	-8.7	-111.1	16.7	35.4	-297.6	-91.8
Accounts payable	14.9	-49.2	25.0	-1.7	-11.7	8.8	36.6	-22.8	51.3	31.9
Accrued expenses & other liabilities	29.2	43.7	-3.3	102.7	88.6	246.2	195.6	210.9	547.3	322.2
Other operating assets and liabilities	-55.6	-48.0	-8.0	-49.7	-20.8	-11.9	129.3			
Net cash flows from operating activities	267.8	-51.6	-513.2	-365.4	236.1	844.9	1270.3	1569.3	3253.5	2643.5
Cash flows from investing activities:										
Payments to acquire businesses, net of cash acquired	-	-	-	-	-	-	-	-1154.2	-	-
Maturities of available-for-sale debt securities	1367.9	2348.3	1557.9	1067.4	757.6	369.2	431.6	475.9	372.3	499.3
Sale of equity securities	-	-	-	-	-	-	-	94.9	437.6	-
Purchases of available-for-sale debt securities	-1705.8	-2412.4	-1424.2	-633.0	-616.6	-532.6	-431.9	-537.2	-431.4	-528.2
Purchases of property & equipment	-71.1	-51.4	-51.2	-45.3	-56.6	-99.4	-95.5	-75.5	-259.8	-235.0
Other investing activities	-16.8	61.4	-8.6	-120.2	20.1	-174.9	-106.3	-39.3	-19.3	-77.0
Net cash flows from investing activities	-425.8	-54.1	74.0	268.9	104.5	-437.7	-202.2	-1235.3	99.4	-340.9
Cash flows from financing activities:										
Issuances of common stock under benefit plans	191.7	265.9	274.6	185.6	68.2	344.8	289.3	343.2	264.9	102.0
Repurchases of common stock	-	-	-	-	-	-	-350.0	-192.0	-539.1	-1425.4
Payments in connection with common stock withheld for employee tax obligati	-	-	-	-	-	-	-	-	-200.3	-135.9
Payments on finance leases	-	-	-	-	-	-	-	-39.2	-42.3	-47.0
Proceeds from finance leases	-	-	-	-	-	-	-	-	13.3	22.6
Other financing activities	-19.5	-85.0	222.8	3.3	65.0	-276.4	-10.5	14.7	-1.8	5.7
Net cash flows from financing activities	172.2	180.9	497.4	188.9	133.3	68.4	-71.2	126.8	-505.3	-1478.0
Effect of changes in exchange rates on cash	-0.1	4.7	-2.2	-2.8	-4.7	5.8	-6.2	1.6	20.6	-13.4
Net increase in cash, cash equivalents & restricted cash	14.1	79.9	56.0	89.5	469.2	481.5	990.7	462.4	2868.2	811.2
Cash, cash equivalents & restricted cash - beginning of period	475.3	489.4	569.3	625.3	714.8	1183.9	1667.5	2658.3	3120.7	5988.9
Cash, cash equivalents & restricted cash - end of period	489.4	569.3	625.3	714.8	1183.9	1665.4	2658.3	3120.7	5988.8	6800.1

Vertex Pharmaceuticals
Forecasted Cash Flow Statement

Fiscal Years Ending Dec. 31	2022E	2023E	2024E	2025E	2026E	2027E	2028E
Cash flows from operating activities:							
Net income	2898	3068	3239	3286	3416	3557	3705
Non-cash adjustments:							
Depreciation & amortization expense	117	122	126	130	135	139	144
Deferred income taxes	309	308	-52	309	60	0	0
Operating lease assets	-12	-12	-12	-13	-13	-13	-13
Add Working Capital Accounts							
Changes of assets:							
Assets receivables	-259	-82	-49	-55	-63	-67	-71
Inventories	-61	-24	-14	-16	-19	-20	-21
Prepaid expenses & other current assets	3	-32	-19	-22	-24	-26	-28
Changes of liabilities:							
Accounts payable	30	13	8	9	10	11	11
Accrued expenses	569	132	78	89	101	108	114
Changes in working capital	281	7	4	5	5	6	6
Net cash flows from operating activities	3594	3492	3305	3718	3604	3689	3842
Cash flows from investing activities:							
Increase in short-term investment	-40	-42	-45	-47	-50	-52	-55
Changes in gross PPE	-158	-162	-167	-172	-177	-183	-188
Changes in intangibles	0	0	0	0	0	0	0
Changes in goodwill	0	0	0	0	0	0	0
Increase in other assets	-74	-11	-6	-7	-8	-9	-9
Net cash flows from investing activities	-272	-216	-218	-227	-235	-244	-253
Cash flows from financing activities:							
Current portion of long-term debt	102	22	13	15	17	18	19
Payment of long-term debt (leases and contingent consideration)	176	-29	-62	62	25	39	44
Payment of other long-term debt	4	4	4	4	4	4	4
Proceeds from issuance of common stock (ESOP)	95	95	95	95	95	40	0
Repurchases of common stock	-500	-627	-773	-831	-683	-728	-754
Net cash flows from financing activities	-125	-536	-724	-656	-543	-628	-687
Net change in cash	3197	2741	2363	2834	2826	2817	2902
Cash, beginning of year	6795	9992	12733	15096	17930	20756	23573
Cash, end of year	9992	12733	15096	17930	20756	23573	26475

Vertex Pharmaceuticals
Common Size Income Statement

Fiscal Years Ending Dec. 31	2019	2020	2021	2022E	2023E	2024E	2025E	2026E	2027E	2028E
Revenues										
Product revenues, net	99.95%	99.95%	99.99%	97.88%	97.79%	97.65%	97.55%	97.48%	97.46%	97.51%
Other revenues	0.05%	0.05%	0.01%	2.12%	2.21%	2.35%	2.45%	2.52%	2.54%	2.49%
Total revenues	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Costs and expenses										
Cost of sales	10.59%	10.10%	10.28%	9.08%	9.10%	9.10%	9.10%	9.11%	9.11%	9.12%
Research & development expenses	42.15%	29.48%	40.28%	37.30%	37.30%	37.30%	37.30%	37.30%	37.30%	37.30%
Selling, general & administrative expenses	15.82%	12.42%	11.09%	13.11%	13.11%	13.11%	13.11%	13.11%	13.11%	13.11%
Depreciation & Amortization	2.57%	1.76%	1.66%	1.25%	1.22%	1.22%	1.22%	1.22%	1.21%	1.20%
Total costs & expenses	71.23%	53.97%	63.27%	60.74%	60.74%	60.74%	60.74%	60.74%	60.74%	60.74%
Income from operations	28.77%	46.03%	36.73%	39.29%	39.33%	40.16%	39.26%	39.26%	39.26%	39.26%
Interest income	1.53%	0.36%	0.06%	0.43%	0.42%	0.43%	0.44%	0.45%	0.45%	0.46%
Interest expense	-1.41%	-0.94%	-0.81%	-0.50%	-0.55%	-0.52%	-0.47%	-0.48%	-0.47%	-0.47%
Other income, net	4.62%	4.78%	0.06%	0.46%	0.54%	0.55%	0.59%	0.63%	0.75%	0.80%
Income before provision for income taxes	33.51%	50.22%	36.05%	39.22%	39.21%	40.07%	39.23%	39.23%	39.25%	39.26%
Provision for income taxes	5.24%	6.53%	5.13%	8.43%	8.43%	8.62%	8.44%	8.44%	8.44%	8.44%
Net income	28.27%	43.70%	30.92%	30.79%	30.78%	31.46%	30.80%	30.80%	30.81%	30.82%

Vertex Pharmaceuticals
Common Size Balance Sheet

Fiscal Years Ending Dec. 31	2019	2020	2021	2022E	2023E	2024E	2025E	2026E	2027E	2028E
% of total assets CS										
Assets										
Current assets:										
Cash & cash equivalents	37.38%	50.96%	50.59%	59.46%	65.35%	68.35%	72.26%	74.67%	76.42%	77.90%
Marketable securities	8.40%	5.71%	5.43%	4.58%	4.17%	3.88%	3.64%	3.43%	3.26%	3.12%
Accounts receivable, net	7.62%	7.53%	8.46%	8.31%	7.59%	6.91%	6.38%	5.92%	5.55%	5.25%
Inventories	2.01%	2.39%	2.63%	2.47%	2.25%	2.05%	1.89%	1.76%	1.65%	1.56%
Prepaid expenses & other current	2.57%	2.62%	4.06%	3.23%	2.95%	2.69%	2.48%	2.30%	2.16%	2.04%
Total current assets	57.98%	69.21%	71.18%	78.04%	82.31%	83.89%	86.66%	88.08%	89.05%	89.86%
Property & equipment, net	8.96%	8.16%	8.15%	6.75%	6.03%	5.51%	5.07%	4.68%	4.36%	4.08%
Intangible assets	4.81%	3.40%	2.98%	2.38%	2.05%	1.81%	1.61%	1.44%	1.30%	1.18%
Goodwill	12.05%	8.53%	7.46%	5.96%	5.14%	4.54%	4.04%	3.61%	3.25%	2.95%
Deferred tax assets	14.32%	7.51%	6.96%	3.72%	1.63%	1.67%	0.24%	0.00%	0.00%	0.00%
Operating lease assets	0.00%	2.77%	2.46%	2.04%	1.82%	1.66%	1.53%	1.41%	1.32%	1.23%
Other assets	1.89%	0.42%	0.82%	1.10%	1.01%	0.92%	0.85%	0.79%	0.74%	0.70%
Total assets	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Liabilities and Shareholders' Equity										
Current liabilities:										
Accounts payable	1.05%	1.32%	1.45%	1.34%	1.22%	1.12%	1.03%	0.95%	0.90%	0.85%
Accrued expenses	13.43%	11.96%	12.50%	13.38%	12.22%	11.13%	10.27%	9.53%	8.94%	8.44%
Other current liabilities	1.57%	2.70%	2.00%	2.20%	2.01%	1.83%	1.69%	1.57%	1.47%	1.39%
Total current liabilities	16.05%	15.98%	15.95%	16.92%	15.45%	14.08%	12.99%	12.05%	11.30%	10.68%
Long-term finance lease liabilities	6.47%	4.59%	3.80%	3.94%	3.24%	2.91%	2.79%	2.52%	2.35%	2.22%
Long-term operating lease liabilities	0.00%	2.98%	2.81%	2.40%	2.11%	1.94%	1.78%	1.65%	1.53%	1.44%
Long-term contingent consideration	2.12%	1.61%	1.39%	1.10%	0.91%	0.39%	0.35%	0.31%	0.28%	0.25%
Other long-term liabilities	2.20%	0.92%	0.87%	0.72%	0.64%	0.58%	0.53%	0.49%	0.45%	0.42%
Total liabilities	26.85%	26.08%	24.81%	25.07%	22.35%	19.90%	18.43%	17.01%	15.91%	15.01%
Common stock	95.45%	67.19%	51.24%	41.52%	36.30%	32.45%	29.26%	26.46%	23.98%	21.76%
Accumulated other comprehensive income	-0.02%	-0.58%	0.12%	0.09%	0.08%	0.07%	0.06%	0.06%	0.05%	0.05%
Retained earnings (accumulated deficit)	-22.28%	7.31%	23.83%	33.32%	41.27%	47.57%	52.24%	56.46%	60.06%	63.18%
Total shareholders' equity	73.15%	73.92%	75.19%	74.93%	77.65%	80.10%	81.57%	82.99%	84.09%	84.99%
Total liabilities and shareholders' equity	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
% of revenue CS										
Assets										
Current assets:										
Cash & cash equivalents	74.69%	96.50%	89.71%	106.14%	127.74%	146.62%	168.04%	187.12%	204.20%	220.24%
Marketable securities	16.79%	10.81%	9.64%	8.18%	8.15%	8.32%	8.47%	8.60%	8.72%	8.83%
Accounts receivable, net	15.22%	14.27%	15.01%	14.83%	14.83%	14.83%	14.83%	14.83%	14.83%	14.83%
Inventories	4.02%	4.52%	4.66%	4.40%	4.40%	4.40%	4.40%	4.40%	4.40%	4.40%
Prepaid expenses & other current	5.13%	4.97%	7.21%	5.77%	5.77%	5.77%	5.77%	5.77%	5.77%	5.77%
Total current assets	115.85%	131.06%	126.22%	139.32%	160.90%	179.94%	201.52%	220.72%	237.92%	254.08%
Property & equipment, net	17.90%	15.45%	14.44%	12.05%	11.79%	11.81%	11.79%	11.73%	11.64%	11.55%
Intangible assets	9.61%	6.45%	5.28%	4.25%	4.01%	3.88%	3.75%	3.61%	3.47%	3.33%
Goodwill	24.07%	16.15%	13.23%	10.65%	10.05%	9.73%	9.39%	9.04%	8.68%	8.34%
Deferred tax assets	28.61%	14.23%	12.34%	6.65%	3.19%	3.59%	0.57%	0.00%	0.00%	0.00%
Operating lease assets	0.00%	5.25%	4.36%	3.64%	3.56%	3.57%	3.56%	3.54%	3.51%	3.49%
Other assets	3.79%	0.80%	1.46%	1.97%	1.97%	1.97%	1.97%	1.97%	1.97%	1.97%
Total assets	199.83%	189.37%	177.34%	178.51%	195.47%	214.50%	232.54%	250.59%	267.19%	282.74%
Liabilities and Shareholders' Equity										
Current liabilities:										
Accounts payable	2.10%	2.50%	2.57%	2.39%	2.39%	2.39%	2.39%	2.39%	2.39%	2.39%
Accrued expenses	26.83%	22.64%	22.16%	23.88%	23.88%	23.88%	23.88%	23.88%	23.88%	23.88%
Other current liabilities	3.13%	5.12%	3.54%	3.93%	3.93%	3.93%	3.93%	3.93%	3.93%	3.93%
Total current liabilities	32.07%	30.26%	28.28%	30.20%	30.20%	30.20%	30.20%	30.20%	30.20%	30.20%
Long-term finance lease liabilities	12.94%	8.69%	6.73%	7.03%	6.33%	6.25%	6.49%	6.32%	6.28%	6.27%
Long-term operating lease liabilities	0.00%	5.65%	4.98%	4.28%	4.13%	4.17%	4.14%	4.13%	4.09%	4.06%
Long-term contingent consideration	4.24%	3.06%	2.46%	1.96%	1.78%	0.83%	0.80%	0.77%	0.74%	0.71%
Other long-term liabilities	4.40%	1.75%	1.54%	1.28%	1.24%	1.24%	1.23%	1.22%	1.21%	1.20%
Total liabilities	53.65%	49.39%	44.00%	44.75%	43.69%	42.69%	42.86%	42.64%	42.52%	42.44%
Common stock	190.74%	127.25%	90.88%	74.12%	70.95%	69.61%	68.05%	66.32%	64.07%	61.52%
Accumulated other comprehensive income	-0.05%	-1.10%	0.21%	0.17%	0.16%	0.15%	0.15%	0.14%	0.14%	0.13%
Retained earnings (accumulated deficit)	-44.51%	13.84%	42.26%	59.48%	80.67%	102.05%	121.48%	141.50%	160.47%	178.65%
Total shareholders' equity	146.18%	139.98%	133.34%	133.77%	151.78%	171.81%	189.68%	207.96%	224.67%	240.30%
Total liabilities and shareholders' equity	199.83%	189.37%	177.34%	178.51%	195.47%	214.50%	232.54%	250.59%	267.19%	282.74%

Vertex Pharmaceuticals
Value Driver Estimation

Fiscal Years Ending Dec. 31	2019	2020	2021	2022E	2023E	2024E	2025E	2026E	2027E	2028E
NOPLAT ESTIMATION:										
Total Revenues	4163	6206	7574	9414	9968	10296	10670	11092	11544	12021
Less COGS	441	627	779	854	907	937	971	1010	1052	1097
Less SG&A	658	770	840	1234	1307	1350	1399	1454	1513	1576
Less R&D Expense	1755	1830	3051	3512	3718	3841	3980	4138	4306	4484
Less Depreciation & Amortization Expense	107	110	126	117	122	126	130	135	139	144
Plus Implied Interest on Operating lease	0	14	14	15	15	16	17	17	18	18
EBITA	1202	2884	2793	3711	3929	4059	4206	4373	4550	4738
Marginal Tax Rate	22.0%	21.8%	21.5%	21.5%	21.5%	21.5%	21.5%	21.5%	21.5%	21.5%
LESS TOTAL Adjusted Taxes										
Income tax provision	218	405	388	794	840	887	900	936	974	1015
Plus shield on oper. lease interest	0	3	3	3	3	3	4	4	4	4
Plus shield on interest expense	13	13	13	10	12	11	11	11	12	12
Less shield on interest income	-14	-5	-1	-9	-9	-10	-10	-11	-11	-12
Less shield on other income	41	64	-1	-9	-12	-12	-14	-15	-19	-21
Plus shield on fair value of contingent consideration	1	3	-1	0	-1	-20				
Total Adjusted Tax	259	483	402	789	833	861	891	925	960	998
PLUS Change in Deferred Taxes										
Deferred Tax Liabilities	0	0	0	0	0	0	0	0	0	0
Deferred Tax Assets	1191	883	935	626	318	369	60	0	0	0
Change in Deferred Taxes	308.86	308.04	-51.72	308.86	308.04	-51.72	308.86	60.47	0.00	0.00
NOPLAT:	1252	2709	2340	3232	3404	3146	3624	3508	3591	3740
Invested Capital (IC):										
Operating Assets										
Plus Normal cash	1665	2482	3030	3766	3987	4118	4268	4437	4618	4808
Plus Accounts Receivable	634	885	1137	1396	1478	1527	1583	1645	1712	1783
Plus Inventory	168	281	353	415	439	453	470	488	508	529
Plus Prepaid expenses & other current assets	214	308	546	543	575	594	615	640	666	693
Total	2680	3957	5065	6119	6479	6693	6936	7210	7504	7814
Operating Liabilities										
Less Accounts Payable	88	155	195	225	239	246	255	265	276	288
Less Accrued Expenses	1117	1405	1679	2248	2380	2458	2548	2649	2756	2870
Less Other Current Liabilities	130	317	268	370	392	405	419	436	454	472
Total	1335	1878	2142	2843	3010	3109	3222	3350	3486	3630
Operating Working Capital	1345	2079	2923	3276	3469	3583	3714	3860	4018	4184
Plus Net PPE	745	959	1094	1134	1175	1216	1258	1301	1344	1388
Plus Intangible Assets	400	400	400	400	400	400	400	400	400	400
Plus PV of operating leases	0	326	330	342	355	367	380	393	406	419
Invested Capital (IC):	2490	3763	4748	5153	5399	5567	5751	5954	6167	6391
Free Cash Flow (FCF):										
NOPLAT	1252	2709	2340	3232	3404	3146	3624	3508	3591	3740
Change in IC	904	1273	985	405	246	168	185	202	213	223
FCF	347	1436	1355	2826	3158	2978	3440	3306	3377	3517
Return on Invested Capital (ROIC):										
NOPLAT	1252	2709	2340	3232	3404	3146	3624	3508	3591	3740
Beginning IC	1586	2490	3763	4748	5153	5399	5567	5751	5954	6167
ROIC	78.93%	108.80%	62.17%	68.06%	66.06%	58.28%	65.11%	60.99%	60.31%	60.65%
Economic Profit (EP):										
Beginning IC	1586	2490	3763	4748	5153	5399	5567	5751	5954	6167
x (ROIC - WACC)	72.55%	102.42%	55.79%	61.68%	59.67%	51.90%	58.72%	54.61%	53.93%	54.27%
EP	1150	2550	2100	2929	3075	2802	3269	3141	3211	3347

Vertex Pharmaceuticals

Weighted Average Cost of Capital (WACC) Estimation

Cost of Equity:

Risk-Free Rate	3.88%
Beta	0.55
Equity Risk Premium	4.59%
Cost of Equity	6.40%

ASSUMPTIONS:

10 yr treasury bond YTM November 15, 2022
average of monthly estimates over 5 years
Damodaran implied ERP as of November 1, 2022

Cost of Debt:

Risk-Free Rate	3.88%
Implied Default Premium	1.67%
Pre-Tax Cost of Debt	5.55%
Marginal Tax Rate	21.5%
After-Tax Cost of Debt	4.36%

10 yr treasury bond rate

Assumption: Rate off of long-term lease with revolving credit facility

Market Value of Common Equity:

Total Shares Outstanding	254.48
Current Stock Price	\$310.83
MV of Equity	79,100.02

MV Weights

98.89%

Market Value of Debt:

Short-Term Debt	
Current Portion of LTD	
Long-Term Debt	887.2
PV of Operating Leases	
MV of Total Debt	887.20

1.11%

Market Value of the Firm

79,987.22

100.00%

Estimated WACC

6.38%

Discounted Cash Flow (DCF) and Economic Profit (EP) Valuation Models

CV Growth of NOPLAT	2.50%
CV Year ROIC	60.65%
WACC	6.38%
Cost of Equity	6.40%

DCF Model:

EP Model:

Economic Profit (EP)	2928.6	3075.1	2801.9	3269.1	3140.9	3210.7	3346.6
Continuing Value (CV = 2027)	86212.99						
PV of EP	2752.9	2717.2	2327.3	2552.4	2305.2	2215.1	2170.4
	1407.5						
Total PV of EP	74349.9						
Invested Capital (last FYE)	4747.9						
Value of Operating Assets:	79097.8						
Non-Operating Adjustments							
PLUS excess cash	3765.2						
PLUS marketable securities	729.9						
Debt	887.2						
Other							
LESS ESOP	507.7						
LESS contingent consideration	186.5						
Value of Equity	82011.5						
Shares Outstanding	254.5						
Intrinsic Value of Last FYE	\$ 322.27						
Implied Price as of Today	\$ 340.24						

Vertex Pharmaceuticals

Dividend Discount Model (DDM) or Fundamental P/E Valuation Model

<i>Fiscal Years Ending Dec. 31</i>	2022E	2023E	2024E	2025E	2026E	2027E	2028E
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EPS	\$ 11.41	\$ 12.13	\$ 12.88	\$ 13.14	\$ 13.74	\$ 14.37	\$ 15.07
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Key Assumptions

CV growth of EPS	3.00%
CV Year ROE	12.83%
Cost of Equity	6.40%

Future Cash Flows

P/E Multiple (CV Year)	22.50
EPS (CV Year)	\$ 15.07
Future Stock Price	\$ 339.01
Dividends Per Share	
Discounted Cash Flows	\$ 233.59

Intrinsic Value as of Last FYE	\$ 233.59
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Implied Price as of Today	\$ 246.61
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Vertex Pharmaceuticals
Relative Valuation Models

Ticker	Company	Price	EPS	EPS	P/E 22	P/E 23
			2022E	2023E		
ABBV	AbbVie	\$147.61	\$13.86	\$11.84	10.65	12.47
AMGN	Amgen	\$273.81	\$17.49	\$18.64	15.66	14.69
BIIB	Biogen	\$284.29	\$16.98	\$15.64	16.74	18.18
GILD	Gilead Sciences	\$83.00	\$7.06	\$6.77	11.70	12.30
REGN	Regeneron Pharmaceuticals	\$739.80	\$43.08	\$41.72	17.1	17.5
JNJ	Johnson & Johnson	\$173.97	\$10.04	\$10.37	17.3	16.7
MRK	Merck	\$102.09	\$7.37	\$7.53	13.6	13.3
			Average		14.68	15.02
VRTX	Vertex Pharmaceuticals	\$310.83	\$11.41	\$12.13	27.2	25.6

Implied Relative Value:

P/E (EPS22)	\$	167.48
P/E (EPS23)	\$	182.19

Vertex Pharmaceuticals
Key Management Ratios

Fiscal Years Ending Dec. 31	2019	2020	2021	2022E	2023E	2024E	2025E	2026E	2027E	2028E
Liquidity Ratios:										
Current Ratio (current assets/current liabilities)	3.61	4.33	4.46	4.61	5.33	5.96	6.67	7.31	7.88	8.41
Day Sales Outstanding (average accounts receivable/revenue per day)	\$ 55.55	\$ 52.07	\$ 54.78	\$ 54.13	\$ 54.13	\$ 54.13	\$ 54.13	\$ 54.13	\$ 54.13	\$ 54.13
Quick Ratio ((current assets-inventory)/current liabilities)	3.49	4.18	4.30	4.47	5.18	5.81	6.53	7.16	7.73	8.27
Asset-Management Ratios:										
Fixed Asset Turnover (net revenue/average fixed assets)	5.59	6.47	6.92	8.30	8.48	8.47	8.48	8.53	8.59	8.66
Inventory Turnover (net sales/average inventory at selling price)	28.53	27.69	23.90	24.53	23.36	23.08	23.12	23.15	23.16	23.17
Receivables Turnover (sales/accounts receivable)	5.96	9.25	10.38	12.23	12.27	12.01	11.80	11.63	11.47	11.32
Financial Leverage Ratios:										
Debt to Assets Ratio (total debt/total assets)	0.1	0.10	0.09	0.08	0.07	0.06	0.05	0.05	0.05	0.04
Debt to Equity Ratio (total debt/total equity)	0.1	0.14	0.12	0.11	0.09	0.07	0.07	0.06	0.05	0.05
Debt to Capital Ratio (total debt/(total debt+total equity))	0.13	0.12	0.11	0.10	0.08	0.07	0.06	0.06	0.05	0.05
Profitability Ratios:										
Return on Equity (NI/Beg TSE)	19.34%	31.22%	23.19%	23.02%	20.28%	18.31%	16.24%	14.81%	13.71%	12.83%
Return on Assets (net income/total assets)	14.15%	23.07%	17.44%	17.25%	15.75%	14.67%	13.24%	12.29%	11.53%	10.90%
Operating Margin (operating income/revenue)	28.77%	46.03%	36.73%	39.29%	39.33%	40.16%	39.26%	39.26%	39.26%	39.26%

Vertex Pharmaceuticals

Effects of ESOP Exercise and Share Repurchases on Common Stock Account and Number of Shares Outstanding

Number of Options Outstanding (shares):	3,611
Average Time to Maturity (years):	5.42
Expected Annual Number of Options Exercised:	667

Current Average Strike Price:	\$ 141.76
Cost of Equity:	6.40%
Current Stock Price:	\$310.83

Fiscal Years Ending Dec. 31	2022E	2023E	2024E	2025E	2026E	2027E	2028E
Increase in Shares Outstanding:	667	667	667	667	667	280	
Average Strike Price:	\$ 141.76	\$ 141.76	\$ 141.76	\$ 141.76	\$ 141.76	\$ 141.76	
Increase in Common Stock Account:	95	95	95	95	95	40	-
Share Repurchases (\$)	-500	-627	-773	-831	-683	-728	-754
Expected Price of Repurchased Shares:	\$310.83	\$ 330.74	\$ 351.92	\$ 374.46	\$ 398.44	\$ 423.96	\$ 451.11
Number of Shares Repurchased:	(1.61)	(1.89)	(2.20)	(2.22)	(1.71)	(1.72)	(1.67)
Shares Outstanding (beginning of the year)	254.48	253.54	252.31	250.78	249.23	248.18	246.74
Plus: Shares Issued Through ESOP	0.67	0.67	0.67	0.67	0.67	0.28	0.00
Less: Shares Repurchased in Treasury	-1.61	-1.89	-2.20	-2.22	-1.71	-1.72	-1.67
Shares Outstanding (end of the year)	253.54	252.31	250.78	249.23	248.18	246.74	245.07