BIOMARIN®

TC Consultants

UCD DUBLIN UCD Michael Smurfit Graduate Business School

BioMarin: Pipeline Filled With Gold

Recommendation: BUY

Overall: UNDERVALUED STOCK

In our assessment, BioMarin's value is 28.5% above the current stock price. BioMarin has not generated a profit in 10 years. This is forecasted to change, and the key drivers in this undervaluation are:

1. Cost structure reshuffle: BioMarin aims to cut operating costs as a percentage of sales. We predict R&D dropping from 47% (2018) to 25% (2023), SG&A failing from 40% (2018) to low 30%s. Conforming to the industry average for **profitable** orphan drug manufacturers. BioMarin has been **successful** in their cost reduction since statement **3 years** ago, decreasing the R&D to sales ratio from **72%** to **47%** 2018 year-end.
2. Strong Performing Portfolio of products: Currently BioMarin holds a portfolio of 6 drugs, generating a gross profit margin of 79% (2018), in touching distance of industry average for **profitable** orphan drug manufacturers (86%).
3. Sales Growth: Strong sales growth of greater than 15% over the last ten years, coupled with entering new territories (Brazil and Europe) for certain drugs, we estimate a YOY growth of roughly 10% till 2026 (excluding pipeline drugs).
4. Lucrative Pipeline: BioMarin has two blockbuster drugs coming onto the market in 2020 and 2024. These drugs add over $10 Billion to BioMarin's Valuation, based on our valuation of each drug. Even with the drugs bringing in 50% of our valuation figures, the company remains a buy.

Investment Risks

Government intervention:

- BioMarin raises the prices of their drugs in line with industry inflation. Price inflation has come under scrutiny from many politicians running for office in the 2020 Presidential elections.
- We have calculated at current probabilities of election results that the expected impact is a 0.2% fall in price inflation (5% down to 4.8%).
- This is not a significant threat at this moment in time. However, this will change over time as probabilities change.
- Since BioMarin is an Orphan drug manufacturer, this will limit the abilities of the new government from dictating prices, as they are protected under the Orphan Drug Act 1983.
- **Convertible Debt (Dilution Risks):** All of BioMarin's debt is convertible; this can have a negative impact on share prices in the future due to dilution when converted. Currently $800 Million. If all debt was converted, we would still have a target price of **90.24$,** which is **26% undervalued**.

Ticker: BMRN

NAICS: 325412

Market Cap Current: $12.6 B

Implied Equity Value:

$16.47 B

P/E: - 296.62

EPS: -0.24

Dividend Yield: 0%

Share Price: $71

Target Price: $91.50

Date: 28th October 2019

Recommendation: BUY

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Table of Contents

Business Description

BioMarin Pharmaceutical Inc. is a global biotechnology company that develops and commercializes innovative therapies for people with serious and life-threatening rare diseases and medical conditions. BioMarin develops 'orphan drugs', for rare diseases (FDA describes a rare disease as a disease which impacts less than 200,000 in the USA)[1]. BioMarin uses 'enzyme-replacement therapy' and 'gene therapy' to treat their patients[2]. BioMarin treats for metabolic disorders, often which impact individuals at a very young age. These can include growth disorders, neurological and intellectual disabilities. BioMarin currently has six drugs in its current portfolio;

Major Commercial Products	Indication	Expiration (USA Orphan Drug Exclusivity)	Expiration (European Union Orphan Drug Exclusivity)	Patient Population (New borns)	Cost of drug per year
Aldurazyme	MPS I (3)	Expired	Expired	1 in 100,000 to 500,000 newborns	$ 200,000
Brineura	CLN2 (4)	2024	2027	0.5 in 100,000 newborns	$ 500,000
Kuvan	PKU (5)	Expired	2020 (5)	1 in 10,000 to 15,000 newborns	$ 57,000
Naglazyme	MPS VI (6)	Expired	Expired	1 in 250,000 to 600,000 newborns.	$ 350,000
Palynziq	PKU (7)	2025	TBD (7)	1 in 10,000 to 15,000 newborns	$ 267,000
Vimizim	MPS IVA (8)	2021	2024	1 in 250,000 to 600,000 newborns.	$ 380,000

Figure 1 "On the Market Products"– BioMarin 2018 10K

Major Product Candidates in development	Target indication	U.S. Orphan designation	EU Orphan designation	Stage	Population	Price (USD)
ValRox	Hemophilia A	Yes	Yes	Clinical Phase 3	One in 5,000 newborns	$2,000,000
Vosoritide	Achondroplasia	Yes	Yes	Clinical Phase 3	One in 15,000 to 35,000 newborns	$300,000

Figure 2 "In Pipeline Products" – BioMarin 2018 10K

Diseases BioMarin treats:

MPS (Mucopolysaccharidosis) - refers to a group of inherited conditions in which the body is unable to properly breakdown mucopolysaccharides (long chains of sugar molecules that are found throughout the body)[3].

PKU (Phenylketonuria) - is a rare inherited disorder that causes an amino acid called phenylalanine to build up in the body. PKU is caused by a defect in the gene that helps create the enzyme needed to break down phenylalanine[4].

CLN2 (Form of Batten's disease)-A disease which is an inherited disorder that primarily affects the nervous system[5].

Hemophilia A, also called factor VIII (FVIII) deficiency or classic haemophilia, is a genetic disorder caused by missing or defective factor VIII, a clotting protein[6].

Achondroplasia is a disorder of bone growth that prevents the changing of cartilage (particularly in the long bones of the arms and legs) to the bone. It is characterized by dwarfism[7].

[1] FDA – Orphan drug criteria
[2] Morgan Stanley 17th Annual Global Healthcare Conference
[3] https://rarediseases.info.nih.gov/diseases/7065/mucopolysaccharidosis
[4] https://www.mayoclinic.org/diseases-conditions/phenylketonuria/symptoms-causes/syc-20376302
[5] https://ghr.nlm.nih.gov/condition/cln2-disease
[6] https://www.hemophilia.org/Bleeding-Disorders/Types-of-Bleeding-Disorders/Hemophilia-A
[7] https://rarediseases.info.nih.gov/diseases/8173/achondroplasia

Business Strategy:

BioMarin has implemented a business strategy for years, which its primary focus has been to develop into a hugely profitable and self-sustaining enterprise. The company has sacrificed positive net profits and dividends (Have not made a profit since 2010) to increasingly focus on developing the business, through R&D (Average R&D/Sales = 54% compared to industry average of 22.8%) and Sales & General (Average 42%, compared to industry of 20%). The company now is currently has a unique combination of a strong, established base business (Growing at 15%, treatments are for life) and have a productive R&D engine (New product release this year – Palynziq, two potential blockbuster drugs ValRox and Vosoritide).

BioMarin strategy is centralized around its 'Four pillars of Driving Growth';

- Strong and Growing Base Business
- New product launches
- New potential blockbuster products markets
- Manufacturing capabilities to support growth

Strong and Growing business:

BioMarin has a diversified portfolio, to which none of their drugs brings more than 33% of their revenue. They are not reliant on one drug. As well every 18 months to 30 months, they have introduced new drugs onto the market. While many of their drugs patients expire, these drugs have 'new and improved' versions released, when the patient expires (example Palynziq for PKU, as Kuvan loses its patency). It's noteworthy many of their patients will remain on these drugs for their entire lifetime.

New Product Launch:

The new product launch is Palynziq, a drug used to treat for a severe form of PKU. Palynziq was recently approved in both the USA and Europe. As of the end of 2019, there is expected to be 551 commercial patients on Palynziq, with 158, currently enrolled and awaiting first treatment[8]. Palynziq falls into place as one of the key driving factors of BioMarin's growth plan to achieve a 2 billion revenue in 2020.

One of the significant factors is that although Kuvan's patent has expired, CEO J.J. Bienaimé recently discussed in the Q3 earnings call that there is substantial data of Kuvan patients transitioning to Palynziq. This will help counteract the loss of patients from Kuvan. Alongside, severe sufferers from PKU will be choosing Palynziq. These are patients who never used Kuvan, or the drug didn't offer benefits. This has created a unique situation where BioMarin has counter-acted the loss of users from Kuvan and gained new customers. It's also noteworthy that many patients will remain on Kuvan (Mild/Moderate patients of PKU)[9].

Potential Blockbuster drugs:

Vosoritide:

Vosoritide is an experimental drug for the treatment of achondroplasia, the most common cause of dwarfism, by encouraging cartilage and bone growth. Currently, there are no other treatments for Vosoritide, except limb-lengthening surgery[10]A recent 42-month study showed results of an increase in 5.7cm with the use of Vosoritide. In the recent earnings call, the results of the Phase 3 program were 'going very well', with results expected to be released end of 2020 or early 2021[11]

[8] Morgan Stanley 17th Annual Global Healthcare Conference.

[9] BioMarin Q3 earnings call 2019

[10] Morgan Stanley 17th Annual Global Healthcare Conference

[11] BioMarin earnings call Q3 2019

Update on this program will be provided on the 14th of November. At this current rate, Vosoritide is expected to enter the market within 12-18 months and add an extra revenue stream to BioMarin. Our estimations (Based on market conscientious, evaluation of clinical trials and earnings report), we believe a price of $300,000 per year. With roughly 25000 impacted in BioMarin territories, we believe is worth $928 million dollars to BioMarin.

ValRox:

ValRox is a gene therapy candidate, which is being proposed to help treat haemophilia A. This treatment will aim to spur production of factor VIII (FVIII), a blood-clotting protein that is missing or defective in patients. The ultimate point of treatment is to stop or decrease the bleeding events that characterise the disorder[12]. ValRox is a high potential treatment, which we estimate could provide costs of an estimated $2 million. With 30,000 people living with severe haemophilia A (Earnings call), and potentially 70000 patients (JP Morgan slides), to which can be treated with ValRox in the future, this remains an enormous cash-cow waiting for BioMarin.

ValRox is currently in phase 3 of testing, with BioMarin intends to apply for marketing approval for US and European markets in Q4 (JP Morgan slides). This coincides with the application for 'accelerated status' BioMarin is releasing on ValRox. ValRox remains the current leader in the field, to get to haemophilia A gene therapy with competition from Pfizer and Sangamo, also developing their own gene therapies (Which are in Phase 1). A recent study of 25 doctors who treat 3000 haemophilia A patients revealed that - 28% intend to prescribe ValRox to their patients with two years - 39% intend to prescribe ValRox within five years[13]. Haematology drugs have a phase III approval rate of 75%[14] - All haematology drugs (Couldn't get haematology orphan drugs). No question that this drug/company will be profitable (Cost structure is in place). Haematology drugs have the highest rate of POS rate in the drug industry.

Manufacturing capabilities to support growth

BioMarin has invested in its facilities and manufacturing capacities to ensure they grow as a company. In July 2017, BioMarin commissioned a commercial-scale gene therapy manufacturing facility, located in Novato, California, and began cGMP production of ValRox to support clinical development activities and anticipated commercial demand. This facility can support the manufacturing of product for approximately 2,000 patients per year (K-10). In September 2018, BioMarin announced a €40 million investment to expand their Irish facility, by developing a new drug filling facility[15].

Location	Square Feet	Use	Expiration Date
San Rafael facility, San Rafael, California	407,300	Corporate headquarters, laboratory and office	Owned property
Several facilities in Novato, California	275,600	Clinical and commercial manufacturing, laboratory and office	Owned property
Several leased facilities in Novato, California	226,200	Office and warehouse	2020-2023
Shanbally facility, Cork, Ireland	209,600	Manufacturing, laboratory and office	Owned property
Dublin, Ireland	43,500	Office	2030
Brisbane, California	38,300	Office	2029
London, England	22,600	Office	2025

Figure 3 Locations– BioMarin 2018 10K

[12] https://www.evaluate.com/vantage/articles/events/company-events/BioMarin-hopes-long-term-valrox-data-can-stem-bleeding
[13] https://www.biopharmadive.com/news/BioMarin-confirms-timeline-for-hemophilia-gene-therapy-putting-pressure-on/558279/
[14] https://www.bio.org/sites/default/files/Clinical%20Development%20Success%20Rates%202006-2015%20-%20BIO,%20Biomedtracker,%20Amplion%202016.pdf
[15] https://www.independent.ie/business/irish/BioMarin-expands-its-cork-facility-with-37m-investment-37276570.html

Management and Governance

BioMarin leadership consists of their CEO Jean-Jacques Bienaimé and nine other members, with a board of 11 members (Including Jean-Jacques Bienaimé). He joined the company in May 2005 as Chief Executive Officer and member of the board of directors, bringing with him over 25 years of experience in the biotechnology and pharmaceutical industries. Under his leadership, the market capitalization of BioMarin went from around $450 million in May 2005 to approximately $14 billion in summer 2019. Mr Bienaimé

Mr Bienaimé has held numerous senior roles as president at Glenencor and Sangstat (Both biotechnology companies). Mr Bienaimé holds an extremely successful track record at both companies. At Glenencor he increased revenues substantially to over $400 million, eventually, culminating in the sale of the company to Danisco in the spring of 2005 for an enterprise value of over $1.2 billion. At Sangstat, he guided the company to profitability prior to its acquisition by Genzyme Corporation[16].It's also noteworthy that Mr Bienaimé also holds a 91% approval rating on Glassdoor.com[17] (Average CEO approval is 69%[18].

Industry Review (Porters Five Forces):

The threat of new entrants - Low:

Since BioMarin is an orphan drug industry, it holds exclusivity rights to many of its drugs. No other company can provide alternatives to these drugs until the patient expires on these drugs. In the case of BioMarin, some of their commercial products have lost their IP rights, and as a result, generic drugs for these diseases can be created by other companies. To counteract this impact, BioMarin has generated some new drugs such as Palynziq (Some Naglazme users have been transferred to Vimizim). It's noteworthy that some of the market sizes are so small that even with the patient expired, many competitors won't create generics to compete with the current drugs (Example there is no other FDA approved drugs available to treat MPS).

Bargaining power of suppliers – Low:

Raw materials and supplies required to produce BioMarin products and product candidates are available in some instances from one supplier and in other instances from multiple suppliers. To this date, there have been no disruptions in the BioMarin's supply of materials. Since many of the materials are unique, BioMarin is dependent on the supplier, but conversely, since some of these materials are unique, the supplier is dependent on BioMarin. All BioMarin's products (With the exception of Firdapse and Kuvan) are produced in-house[19].

Bargaining power of buyers – Low/Medium:

The bargaining power for buyers is generally low/medium. Majority of drugs are purchased through government schemes and insurance companies[20]. Governments and insurance agency usually based on the value of the drug in relation to; Cost-effectiveness, treatment of an unmet need, burden of illness, the degree of rarity of the condition being treated[21].

Much of the media attention in relation to orphan drugs, is governments refusing to pay the high price. The best example is with Kuvan, where a patient involved in the trial treatment was refused access of the drug as the NHS (National Health board Service – United Kingdom) refused to pay the £70,000 payment ($90000) for Kuvan. These disputes are commonly resolved with lower prices or the buyers simply accept the price tag. Often governments and insurance boards will be happy to the high prices (Due to lack of alternatives).

[16] https://www.BioMarin.com/about/leadership-team/jean-jacques-bienaime/
[17] https://www.glassdoor.ie/Reviews/BioMarin-Pharmaceutical-work-life-balance-Reviews-EI_IE9303.0,23_KH24,41.htm?countryRedirect=true
[18] https://www.glassdoor.com/about-us/top-ceos-in-2019/
[19] 2019 BioMarin 10-k
[20] https://www.forbes.com/sites/matthewherper/2016/07/28/from-rare-to-great/#32a007c7ff36
[21] https://invivo.pharmaintelligence.informa.com/IV005214/Orphan-Drug-Pricing-And-Reimbursement-Challenges-To-Patient-Access

The threat of substitutes – Low:

Due to the market exclusivity of 'orphan drugs', there are no other alternatives available for patients. Many of the patient populations that BioMarin provides drugs for only contains 1000 patients. Due to the lack of patients in the market and drug exclusivity, there remains a high barrier to entry for competitors.

Industry rivalry – Low:

BioMarin has 'orphan drug' status on all its drugs, which enables them to control the market. As a result, until the IP rights run up on the drugs, no other company can provide any alternatives. Even in the case of Aldurazyme and Naglazyme, both remain the only FDA approved drugs on the market, with no alternatives available. [22] [23]

Investment Risks:

The main investment risk that we see with BioMarin is the dependence that this drug has placed on ValRox. Although there remains great potential with Vosoritide, reducing its R&D costs and becoming a profitable business, for this stock to become 'blockbuster', it will be dependent on securing ValRox as a treatment for haemophilia A. BioMarin currently is the front of the race for this treatment, however this still isn't a guarantee for success. We believe BioMarin is very confident in achieving 'accelerated status', applying for marketing approval at the end of Q4.

The company has been under a lot of controversies, especially in relation to their high prices. Alongside the scandal with the British health board, over the price of Kuvan, there have been controversies In June 2019, a Belgian court ordered BioMarin to continue supplying Vimizim to a young girl suffering from Morquio syndrome free of charge, after BioMarin stopped providing Vimizim, negotiations with the Belgian health authorities collapsed[24].

This company has been accumulating negative net profits since 2010 and never provided dividends. BioMarin has been involved in a 'growth-driving strategy' for years, with the primary objective of building an extremely profitable company. Shareholders and analysts are optimistic that BioMarin will start delivering positive net profits. BioMarin has predicted that positive profits for 2021, yet still shareholders will still have to wait for dividends.

Currently, this isn't a company which would be attractive to risk-averse investors. This is primarily down to the lack of profits generated (which are simply being reinvested back into R&D to support growth for the future). Alongside the lack of profits, the probability of success of ValRox, which will be a major factor in the increase of stock growth, holds the market to withhold or be 'wary' of BioMarin.

There certainly is a risk factor in developing orphan drugs, but the probabilities are in BioMarin's favour. 75% of all haematology drugs pass Phase III testing. The results for Vosotride were overwhelmingly successful. The introduction of ValRox will impact the diversified portfolio in 2020, taking 75% of all revenue, down to 50% by 2026 (Sales graph – Appendix 1). [(14)]

[22] **https://rarediseases.info.nih.gov/diseases/10335/mucopolysaccharidosis-type-i**
[23] **https://rarediseases.info.nih.gov/diseases/7095/mucopolysaccharidosis-type-vi**
[24] https://www.tijd.be/ondernemen/farma-biotech/BioMarin-moet-verder-levensreddend-middel-leveren-aan-patiente/10140276.html

Financial Analysis

Key Performance Indicators (KPI's)

Metric	Company	31/12/2009	31/12/2010	31/12/2011	31/12/2012	31/12/2013	31/12/2014	31/12/2015	31/12/2016	31/12/2017	31/12/2018
EBITDA Margin (1)	Biomarin	12%	8%	0%	-13%	-20%	-6%	-7%	-63%	6%	-2%
	Industry (1)	43%	41%	40%	40%	40%	48%	50%	49%	51%	46%
SPREAD		-32%	-34%	-40%	-53%	-60%	-54%	-57%	-113%	-45%	-48%
Gross Margin (2)	Biomarin	80%	81%	81%	82%	83%	84%	83%	81%	82%	79%
	Industry (1)	87%	86%	85%	85%	85%	86%	88%	88%	87%	86%
SPREAD		-7%	-5%	-4%	-4%	-2%	-3%	-5%	-7%	-6%	-7%
Operating Margin (3)	Biomarin	5%	0%	-8%	-22%	-28%	-12%	-12%	-72%	-1%	-8%
	Industry (1)	37%	35%	34%	35%	34%	41%	44%	43%	44%	40%
SPREAD		-32%	-35%	-42%	-57%	-62%	-54%	-57%	-115%	-45%	-48%
R&D to Sales (4)	Biomarin	36%	40%	49%	61%	66%	63%	72%	60%	48%	47%
	Industry (1)	23%	23%	23%	23%	24%	21%	22%	23%	23%	24%
SPREAD		14%	17%	26%	38%	42%	41%	50%	37%	25%	24%
COGS to Sales (5)	Biomarin	21%	19%	19%	18%	18%	17%	17%	19%	19%	21%
	Industry (1)	13%	14%	15%	15%	15%	14%	12%	12%	13%	14%
SPREAD		7%	5%	4%	4%	3%	3%	5%	7%	6%	7%
SG&A to Sales (6)	Biomarin	39%	41%	40%	40%	44%	41%	45%	43%	44%	41%
	Industry (1)	21%	21%	21%	21%	21%	19%	17%	17%	17%	18%
SPREAD		18%	20%	19%	18%	22%	22%	28%	26%	27%	23%
Cash Ratio (7)	Biomarin	3.85	3.27	2.07	2.63	4.28	4.01	1.33	1.80	1.71	2.07
	Industry (2)	5.69	4.87	5.84	5.66	6.24	8.00	9.19	6.51	7.08	8.40
Total Debt/Capital (8)	Biomarin	61%	34%	31%	26%	33%	30%	22%	20%	29%	22%
	Industry (2)	19%	20%	38%	48%	22%	23%	16%	22%	18%	22%

Figure 4 Key Performance Indicators – Bloomberg (Appendix 2)

- Over the period of analysis in figure 4, BioMarin's **EBITDA margin (1)** has been far below the industry average, with a peak underperformance of -113% in 2016. This is due to BioMarin not turning a profit and in turn, not paying taxes. In some case's benefiting from deferred income taxes. This is due to the fact that BioMarin has made losses historically and can carry them forward into future fiscal years to reduce their tax liability. **We believe** EBITDA Margin is a great indicator of BioMarin's future, as can be seen in the table (4) **BioMarin spends on average 2X the percentage of sales on R&D than the industry average.** In years that R&D has been at its lowest the spread between EBITDA margin of BioMarin and the industry has been at its lowest.

- **Gross Margin:** Without taking into account subjective spending, BioMarin remains on par with the industry leaders in regards to generating gross profit from their portfolio of products. With a spread under 10%, BioMarin remains close to the gross profit levels of the big players in the industry (such as **Amgen**).
- **Operating Margin**: This is the focal point of both our quantitative and qualitative analysis. BioMarin has been a loss-making firm due to its expenses department. Mainly **research and development** (4), BioMarin chooses to spend excess amounts of sales on developing a stronger portfolio into the future, and this is evident with a spread of up to 50% over the period of analysis in figure 4. This is accompanied by large **Selling general and Administration margins**, as with the development of new drugs BioMarin has to market and advance these new products into unoccupied territories (Brazil and Europe for Vimizin recently). This drives up sales and marketing costs, as a percentage of sales.
- **The Cash Ratio (7) and Total Debt/Capital (8**) figures are promising. Showing BioMarin to have sufficient cash reserves (liquid assets) to meet current liabilities comfortably. BioMarin is also conforming towards an industry average debt ratio, meaning BioMarin is becoming less levered, meaning future revenues will be more valuable to shareholders as fewer profits will be taken due to repayment of interest on debt and amortization of the principle. As **of Q3 2019,** BioMarin has **$432 Million** in cash and cash equivalents.

Overall: BioMarin is unprofitable currently and historical due to research and development (4) and Selling general, and administration (6) costs being above the industry average. Both (5) and (6) have been driven by portfolio development and market expansion in the last decade. Thus provides a platform for BioMarin to be extremely profitable in the future.

Financial Statement Forecasting

In order to execute our valuation of BioMarin, we forecasted the key driver of the company (Sales) and the cost structure of the company.

To evaluate the firm accurately, we separated the sales of approved patent patented products and the forecasted sales of pipeline drugs. We forecasted sales of marketed products to create the pro forma statements then added the NPV of Pipeline drugs to the company value.

"On Market Drug" Sales

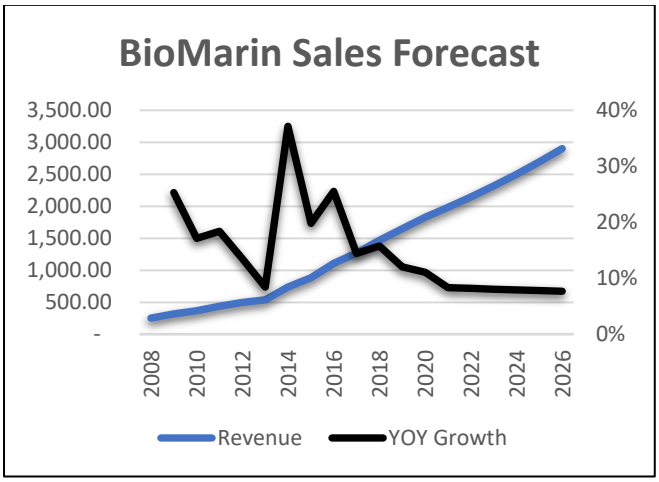

Figure 5 "On Market Products" Sales Forecast – Author

Accompanying table for this graph in appendix 1

We forecasted the revenue from the sale of each on the market drug based off several factors shown below:

Marketed Drug Revenue forecast	
Drug	Forecasting metrics
Vimizim	Baby Births Per Year(1) Inflation adjusted for presidential election(2)
Kuvan	Baby Births Per Year(3) Inflation adjusted for presidential election(2)
Naglazyme	Baby Births Per Year(3) Inflation adjusted for presidential election(2)
Aldurazyme	Baby Births Per Year(3) Inflation adjusted for presidential election(2)
Brineura	Baby Births Per Year(3) Inflation adjusted for presidential election(2)
Firdapse	Population Growth(4) Inflation adjusted for presidential election(2)

Figure 6 Forecasting Metrics – Author

Accompany explanation to figure 6:

(1) Drugs with this metric for forecasting are drugs related to **infants**. We forecasted the **baby birth figure** for the territory BioMarin sells into; then by applying the diagnosis rate, we could approximate a growth rate for the revenue of each drug. We added initial penetration and baby growth figures for Brazil for drugs with this reference to account for their breakthrough into the **Brazilian market**.

(2) We used **probabilities** for the expected outcome of the **2020 US presidential election**. As depending on who controls the congress/senate/presidential office affects the **pricing structure** of BioMarin. Therefore we forecasted prices of drugs to rise at the rate of standard biopharma inflation rate adjusted for the presidential election. Paddy Power is a leader in poll analytics in Ireland, with a quant team to rival any top analytical firm.

US 2020 Election Effect on Prices			
Indursty Price Inflation	5%		
	Democrat	Republican	Independent
Bookmaker odds	4/6	Evens	60/1
Implied Probabilty	54%	45%	1%
Affect	-2%	2%	0%
Price Inflation	4.8%		

Figure 7 2020 Election Impact on Sales – Paddy Power (Poll Analysts)

(3) Drugs with this metric for forecasting are drugs related to infants. We forecasted the baby birth figure for the territory BioMarin sells into; then by applying the diagnosis rate, we could approximate a growth rate for each drug.

(4) Drugs with this metric for forecasting are drugs related to the full population. We forecasted the population figure for the territory BioMarin sells into, then by applying the diagnosis rate, we could approximate a growth rate for each drug.

All forecasts to do with population and birth rates were forecasted using an exponentially smoothing model based on world bank data from 1960 to present.

Pipeline:

Just like any other pharmaceutical company, the ability to produce revenue streams through new products is the generator of wealth. For BioMarin, we have two **extremely promising drugs** coming to market **in 2020 (Valrox) and 2024 (Vosoritide)**. We valued these drugs using a DFC model. Below the assumptions and valuations are outlined:

Varlox assumptions	
Market Information	
Territory population with diseas	70,000
Growth rate due to births	1 in 5000 live births
Price tag (Millions)	$2.0
Penetration rate	4%
Patent Length	10 Years
Valuation specifics	
WACC for project	10%
FCF/Sales	30%
Value of the Drug (Billions USD$	**$6.89**

Figure 8 Valrox Valuation Assumptions– Bloomberg

Vosoritide assumptions	
Market Information	
Territory population with diseas	20,000
Growth rate due to births	1 in 25000 live births
Price tag (Thousands)	$300
Penetration rate	15-25% varys over life of project
Patent Length	10 Years
Valuation specifics	
WACC for project	10%
FCF/Sales	30%
Value of the Drug (Billions USD$	**$0.98**

Figure 9 Vosoritide Valuation Assumptions– Bloomberg

Details of the assumptions and calculations of the Pipeline wealth for BioMarin is outlined in the valuation section of the report.

Cost Structure:

We analysed earnings calls, cost structure planning and general economic theory to forecast the cost structure of BioMarin for the period 2020 to 2026 shown below in figure 10. BioMarin stated on their Q3 earnings, they target figures and are on track to achieve the following cost structure for the 2019 year-ended results:

- SG&A – 41%
- R&D – 40%
- COGS – 20%

Costs Structure Forecast (as percentage of revenue)							
	2020	2021	2022	2023	2024	2025	2026
SG&A (1)	40%	38%	37%	36%	35%	34%	33%
R&D (2)	35%	31%	27%	25%	25%	25%	25%
COGS (3)	20%	20%	19%	19%	18%	18%	17%

Figure 10 Cost Structure Forecast – Author

1) ***Selling General and Administration costs (SGA):***
   Historically have been 42% on average of revenue over the period of analysis (2009 – 2018). This expense is considerably higher than the industry average of 20% over the same period. The majority of this expense is made up of marketing and sales teams expenses focused on breaking into new markets, as discussed previously (Brazil and Ireland). We expect this ratio to fall into the future due to successful market penetration and increased brand recognition in territories of operation.
2) **Research and Development (R&D):**
   BioMarin historically has operated very high Research and development margins (R&D as % of sales), peaking at **72%** in 2015. As mentioned previously in investor statements and most recently in 2019 Q3 earnings call, The CEO stated they are on track to reduce their R&D costs down to **25%** (industry average 23%). They have proven to come thru on this target, and we forecast they will reach **25%** R&D to sales ratio by **2023**, based on levels of reduction over the last three years. R&D may not necessarily be driven down, just the percentage decreases compared to sales, comes into line industry.

3) **Cost of Goods Sold (COGS):**
   BioMarin maintains a higher than industry average COGS at **18%** historically over the period of analysis (2009 – 2018) but rose to **21%** in 2018. COGS are expected to fall to **20%** based on current standings (YTD reports) and the Q3 earnings last week. We expect COGS as a ratio of sales to fall by **2-5% (total)** over the next ten years over the following reasons:
   - Increased **efficiency** in the production line due to a new fully operational plant in Ireland for European sales.
   - Increased production quantities for all portfolio sales; the company expects to realise **economies** of scale from bulk purchasing power of materials
   - Due to **streamlined** drug administration processes, BioMarin expects decreases in drug to patient cost, profit per patient interaction is increased.

Valuation:

Model: *Pro forma*

Reasoning: A proforma model is a model which estimates future free cash flows for a company based on the relationships between key line items from an Income statement, balance sheet and cash flow statement with sales. Therefore, predicting sales figures, we can predict how a company's financials will look for periods into the future.

Then based on this prediction, we can value the company using a multiple-step discounted cash flow model. We decided against a Dividend discount model because Alexion has not paid dividends and does not plan on paying dividends in the near future. We decided against a Leveraged buyout model because we are recommending a buy or sell on a stock, rather than for the purposes of analysing if an investor should buy the whole company.

Using a proforma model also allows us to perform a Discounted Cash Flow model on the portfolio of **on the market drugs** and **in pipeline drugs** separately and combine the valuations to get full value for the company.

The reason we valued the company in two sections was to see, even if these drugs failed, would the company be profitable or a buy.

Procedure

1) Forecasted sales, as explained previously.
2) Developed relationships between key line items on the balance sheet and income statement with sales.
3) Using the relationship founded and presented in figure 13, forecast a set of year-end financial statements from **2019 to 2026.**
4) Using this set of forecasted Financial Statements, we calculated the forecasted free cash flows of the company for the years **2019 to 2026**
5) A discounted cash flow model was then used to value the company based on currently marketed drugs
6) Valuation of Pipeline drugs using a discounted cash flow model.
7) Summation of **on the market drug value** and **in pipeline drug value** to get an overall valuation for BioMarin.

WACC

WACC Calculation	
Shares outstanding (1)	180
Share Price (2)	71
Market Cap	12,814
Debt (3)	844
Tax Rate (4)	18%
Cost of debt (5)	4.4%
Expected Market Return (6)	7.7%
Risk Free Rate (7)	1.67%
Levered Beta (8)	1.35
Unlevered Beta (9)	1.10
WACC based on CAPM	
Cost of equity (10)	8.3%
WACC	8.0%

Figure 11 WACC Calculations – Author

To calculate the weighted average cost of capital for this firm, we used the following figures:

1) The current Q3 2019 number our outstanding shares on the market place.
2) Current share price as of 28th October 2019 on the NASDAQ stock exchange.
3) The current outstanding debt of BioMarin Q3 2019
4) A weighted average tax rate between all the territories BioMarin operates in.

Weighted Average Tax Rate (WATR)			
Revenue by geographic location	2018	% of Revenue	Tax Rate
United States	696,793	47%	21%
Europe (Ireland)	436,434	29%	12.50%
Latin America	185,046	12%	15%
Rest of world	172,939	12%	20%
Total Revenues	1,491,212	1	
WATR	18%		

Figure 12 WATR Calculations– Bloomberg

5) The interest rate paid on historical debt for BioMarin
6) The average yearly return of the S&P500 over the last five years
7) US 3 Month T-bill
8) The beta of BioMarin against the S&P500 market index as a proxy
9) Unlevered beta of BioMarin to strip debt from distorting the cost of equity capital
10) Cost of equity calculated using the CAPM method

Financial Statement Forecast and Relationship Figures

Description	2019 E	2020 E	2021 E	2022 E	2023 E	2024 E	2025 E	2026 E
Sales Growth YOY	12%	11%	8%	8%	8%	8%	8%	8%
Current Assets/Sales	61%	61%	61%	61%	61%	61%	61%	61%
Current Liabilities/Sales	36%	36%	36%	36%	36%	36%	36%	36%
Fixed Assets/Sales	95%	95%	95%	95%	95%	95%	95%	95%
Cost of Goods Sold/Sales	20%	20%	19%	19%	18%	18%	17%	17%
SGA/Sales	41%	40%	38%	37%	36%	35%	34%	33%
R&D/Sales	40%	35%	31%	27%	25%	25%	25%	25%
Depreciation Rate	4%	4%	4%	4%	4%	4%	4%	4%
Amortitization on debt	2%	2%	2%	2%	2%	2%	2%	2%
Other Liabilities average	14%	14%	14%	14%	14%	14%	14%	14%
Cash/Sales	90%	90%	90%	90%	90%	90%	90%	90%
Debt/Assets	23%	23%	23%	23%	23%	23%	23%	23%
Interest Rate on Debt	4%	4%	4%	4%	4%	4%	4%	4%
Interest Paid on Cash & Marketable Securities	2%	2%	2%	2%	2%	2%	2%	2%
Tax Rate	18%	18%	18%	18%	18%	18%	18%	18%
Dividend Growth	0%	0%	0%	0%	0%	0%	0%	0%
Amoritization on intangible assets	5%	5%	5%	5%	5%	5%	5%	5%

Year	2018	2019	2020	2021	2022	2023	2024	2025	2026
Income Statement									
Sales	1,470	1,647	1,829	1,982	2,144	2,316	2,500	2,694	2,901
Other Revenue	21	21	21	21	21	21	21	21	21
Cost of Goods Sold	315	329	358	379	401	424	446	470	493
Operating Expenses	**1,299**	**1,335**	**1,366**	**1,367**	**1,370**	**1,412**	**1,495**	**1,581**	**1,670**
Selling General Administration expenses	604	677	727	762	798	834	871	908	946
Research and Development expenses	696	659	640	606	573	579	625	674	725
Other operating expense	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Operating Income (Loss)	(123)	(17)	105	235	373	481	559	644	738
Interest Payments on debt	44	49	52	55	58	61	63	66	69
Interest earned on cash and marketable securities	23	27	30	33	36	38	41	45	48
Net Interest	21	22	22	22	22	23	22	21	21
Other Non operating expenses	**95**	**91**	**101**	**108**	**116**	**124**	**133**	**142**	**152**
Loss from Affiliates	1	-	-	-	-	-	-	-	-
Other Non-Op (Income) Loss	(2)		-	-	-	-	-	-	-
Depreciation and Amort	**96**	**91**	**101**	**108**	**116**	**124**	**133**	**142**	**152**
Profit before tax	(239)	(130)	(17)	105	235	334	404	481	565
Taxes	**65**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Current income tax	(3)	-	-	(19)	(41)	(59)	(71)	(85)	(100)
Deferred Tax income	68	-	-	19	41	59	71	85	100
Profit after tax	(174)	(130)	(17)	105	235	334	404	481	565
Dividends	-	-	-	-	-	-	-	-	-
Retained Earnings	**(174)**	**(130)**	**(17)**	**105**	**235**	**334**	**404**	**481**	**565**
Balance Sheet									
Cash and Marketable securities	1,084	1,482	1,646	1,783	1,929	2,084	2,249	2,424	2,610
Current Assets	972	1,001	1,111	1,204	1,302	1,407	1,518	1,636	1,762
Fixed Assets									
PPE at cost	1,421	1,565	1,737	1,882	2,036	2,200	2,374	2,559	2,755
Accumulated depreciation	(473)	(540)	(615)	(696)	(784)	(879)	(981)	(1,091)	(1,209)
Net PPE	**948**	**1,025**	**1,122**	**1,186**	**1,252**	**1,321**	**1,393**	**1,468**	**1,546**
Long-term recievables	**236**	**236**	**236**	**236**	**236**	**236**	**236**	**236**	**236**
Intangible and other	**1,187**	**1,187**	**1,187**	**1,168**	**1,127**	**1,068**	**996**	**911**	**811**
Total Assets	4,427	4,931	5,302	5,577	5,846	6,116	6,392	6,675	6,965
Current Liabilities	523	591	657	712	770	832	897	967	1,042
Pension Liabilities	-	-	-	-	-	-	-	-	-
Other Liabilities	106	239	265	287	311	336	362	391	421
Debt	830	1,112	1,195	1,257	1,318	1,379	1,441	1,505	1,570
Equity	2,968	2,989	3,185	3,322	3,447	3,569	3,691	3,812	3,933
Total Liabilities and Earnings	4,427	4,931	5,302	5,577	5,846	6,116	6,392	6,675	6,965

Figure 13 Relationship of line items with sales – Author& Figure 14 Forecasted Financial statements – Author

In the above figure 13 and figure 14, we show Relationship between financial line items and sales along and a forecasted set of financial statements for the "on the market portfolio of drugs" respectfully. All relationships are based on a combination of historical averages along with current trends of the industry and objectives of the firm.

Some important figures not previously covered in prior analysis:

- **Tax rate:** since BioMarin has only had two fiscal years where they paid tax since 2009 have no effective tax rate to use for future analysis. Therefore we calculated a weighted legal tax rate based on the territories BioMarin operates in, shown above in figure 13. We also assumed that BioMarin would use up their 461 Million deferred Tax asset as soon as possible. Meaning they don't pay tax on earnings in the initial years of profitability, shown in figure 14.
- **Dividends:** BioMarin does not pay dividends and has no plans or aspirations to pay one in the immediate future.
- **Pension Liabilities:** BioMarin offers a 401K scheme which is at the liability of employee not employer.
- **Debt/Asset Ratio**: Remain constant based on a 5-year historical analysis. This applies to all relationships that remain constant.

IMPORTANT REMINDER: *The figures in figure 13 and 14 are for the current portfolio of drugs '***ON THE MARKET***'.*

*The rise in SGA and other costs for the '***PIPELINE DRUGS***' are included in the ratio of revenue turned into Free Cash Flows in the valuation of ValRox and Vosoritide separately from the on the market drugs. Shown in Figure 15 and 16.*

Pipeline Valuation (Varlox) – *$6.89 Billion*

WACC	8.00%		Drug Value (USD)	9,187,982,011.44							
			Stage 3 Probability of								
Premium for risk of project	2%		success	75%							
Total WACC	10.00%		Expected probability	6,890,986,508.58							
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Market size (Per person)	70,000.00	67,367.50	64,838.77	62,409.62	60,076.16	57,834.55	55,681.12	53,612.26	51,624.51	49,714.67	47,879.37
Market growth (Per person)	167.50	165.9659612	164.4051131	162.9224093	161.435069	159.9542368	158.3796658	156.7428813	155.1363414	153.292662	151.334003
Market decrease (per person)	2,800.00	2,694.70	2,593.55	2,496.38	2,403.05	2,313.38	2,227.24	2,144.49	2,064.98	1,988.59	1,915.17
Price in USD	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
Patients treated (per person)	2,800	2,695	2,594	2,496	2,403	2,313	2,227	2,144	2,065	1,989	1,915
Penetration rate %	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Revenue USD	5,600,000,000	5,389,400,328	5,187,101,592	4,992,769,938	4,806,092,933	4,626,764,021	4,454,489,799	4,288,980,580	4,129,960,788	3,977,173,264	3,830,349,746
FCF/Sales Rate %	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
Free Cash Flow USD	1,680,000,000	1,616,820,099	1,556,130,478	1,497,830,981	1,441,827,880	1,388,029,206	1,336,346,940	1,286,694,174	1,238,988,236	1,193,151,979	1,149,104,924
Discount Factor years	**1.25**	**2.25**	**3.25**	**4.25**	**5.25**	**6.25**	**7.25**	**8.25**	**9.25**	**10.25**	**11.25**
Discounted FCF USD	**1,491,346,527.47**	**1,304,807,406.65**	**1,141,684,621.73**	**999,029,655.96**	**874,267,669.58**	**765,147,268.87**	**669,701,204.26**	**586,209,185.80**	**513,168,389.23**	**449,266,367.16**	**393,353,714.72**

Figure 15 Valrox Valuation – Author

Shown in the above figure 15 is the valuation of Varlox, a stage 3 testing drug to treat haemophilia A. The assumptions made in this model are as follows:

- ***Price:*** This drug is a "one and done" treatment, where patients receive an injection of the gene therapy then they will experience a decay of symptoms associated with haemophilia A. The CEO has been quoted to say the drug will not cost more than 5X current yearly haemophilia A treatment (400,000$). Thus we arrive at a price of $2 Million per patient.
- ***Market Size and Penetration:*** The market size for patients with HA in BioMarin's sales territory is currently 70,000. Market growth is based on 1 in 5000 live births being born with the disease. We believe that only limited patients will be able to access this drug throughout the lifespan of the patent due cost and willingness of BioMarin to treat and cure all of the markets. The penetration rate is a percentage of the market size for that year. This is not a growth rate.
- ***Valuation Length:*** We have chosen to value the product over a ten year life span due to patents laws for the industry.
- ***Free Cash Flows:*** Due to BioMarin implementing a strategy of expense reduction in R&D and other operating expenses, we have used the industry average for large biopharmaceutical companies, this average is the average percentage of sales turned into free cash flows. The industry average is 30%
- ***WACC:*** The discount rate for this project is adjusted versus the overall company discount rate to account for increased risk in clinical trial stage drugs. Since these drugs are in the final stages of testing and have been recently fast-tracked by government agencies, we can expect this drug to be successful and on the market in 2020. However, we still add 2% to account for extra risk over on the market drugs.
- ***Expected value***: we incorporated the probabilities of stage three **orphan** haemophilia drugs being successful (**75%)** to estimate an expected value of this drug.

Limitations: The drug will be on the market post valuation period, but due to uncertainty post-patent expiration (price and market penetration), we cannot forecast any further with accuracy. Therefore we can assume that the drug value is greater than **$6.89 Billion**.

Pipeline Valuation (Vosoritide) - *$0.98 Billion*

Wacc	8.00%		Drug Value (USD)	1,308,575,161.30							
			Stage 3 Probability of								
Premium for risk of project	2%		success	75%							
Total WACC	10.00%		Expected probability	981,431,370.98							
	2024	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**
Market size (Per person)	20,000.00	20,032.29	20,064.28	20,095.95	20,127.30	20,158.33	20,188.99	20,219.25	20,249.13	20,278.59	20,307.61
Market growth (Per person)	32.29	31.99084736	31.67593316	31.34857626	31.02726828	30.6585324	30.26680059	29.87650291	29.45512265	29.01850842	28.58477898
Price in USD	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
Patients treated (per person)	3,000	4,006	5,016	5,024	5,032	5,040	5,047	5,055	5,062	5,070	5,077
Penetration rate %	15%	20%	25%	25%	25%	25%	25%	25%	25%	25%	25%
	2024	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**
Revenue USD	900,000,000	1,201,937,221	1,504,820,840	1,507,196,535	1,509,547,678	1,511,874,723	1,514,174,113	1,516,444,123	1,518,684,861	1,520,893,995	1,523,070,383
FCF/Sales Rate %	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
Free Cash Flow USD	270,000,000	360,581,166	451,446,252	452,158,960	452,864,303	453,562,417	454,252,234	454,933,237	455,605,458	456,268,198	456,921,115
Discount Factor years	**5.25**	**6.25**	**7.25**	**8.25**	**9.25**	**10.25**	**11.25**	**12.25**	**13.25**	**14.25**	**15.25**
Discounted FCF USD	**163,717,371.60**	**198,769,372.65**	**226,239,226.91**	**206,000,572.12**	**187,568,887.48**	**170,783,221.99**	**155,496,508.55**	**141,575,031.14**	**128,897,159.10**	**117,351,881.11**	**106,838,187.59**

Figure 16 Vosoritide Valuation – Author

Shown in the above figure 16 is the valuation of Vosoritide, a stage 3 testing drug to treat Achondroplasia (dwarfism). The assumptions made in this model are as follows:

- ***Price:*** Based on market consensus, earnings reports and interviews/presentations from company directors, we expect to see this drug hit the market at 300,000 per patient per year.
- ***Market Size and Penetration:*** The current market size for BioMarin based on current territories of operations is 20,000. With a diagnosis rate of 1 in every 25,000 new-borns per year, we have forecasted the market size to grow, as shown above during the ten years of patent life. We are aware that this drug is only treatable for patients from birth until growth maturity (18-25 years of age). But due to the period of valuation, we did not have to take the drop off rates into account (patients finishing treatment). BioMarin forecasts a penetration rate of roughly 20% and increasing through the life of the drug, as shown above, this rate will be highly volatile once patents run out, estimation 2034. The penetration rate is a percentage of the market size for that year. This is not a growth rate.
- ***Valuation Length:*** We have chosen to value the product over a ten year life span due to patents laws for the industry.
- ***Free Cash Flows:*** Due to BioMarin implementing a strategy of expense reduction in R&D and other operating expenses, we have used the industry average for large biopharmaceutical companies, this average is the average percentage of sales turned into free cash flows. The industry average is 30%
- ***WACC:*** The discount rate for this project is adjusted versus the overall company discount rate to account for increased risk in clinical trial stage drugs. Since these drugs are in the final stages of testing and have been recently fast-tracked by government agencies, we can expect this drug to be successful and on the market in 2020. However, we still add 2% to account for extra risk over on the market drugs.
- ***Expected value***: This is a development-mental drug trail, with an average probability of success for orphan drugs in stage 3 of 58.1%. We increase this to 75% based on a strong showing in results to date.

Limitations: The drug will be on the market post valuation period, but due to uncertainty post-patent expiration (price and market penetration), we cannot forecast any further with accuracy. Therefore we can assume that the drug value is greater than **$0.98 Billion.**

Current Portfolio Valuation

WACC	8.00%							
Long-term FCF growth	4%							
Year	2019Q4	2020	2021	2022	2023	2024	2025	2026
Line Item								
Profit after tax	(32)	(17)	105	235	334	404	481	565
Add back depreciation and amort	23	101	108	116	124	133	142	152
Minus Net working capital								
Minus increase in operating CA	(7)	(110)	(93)	(98)	(105)	(111)	(118)	(126)
Add back increase in operating CL	17	65	55	58	62	66	70	74
Subtract CAPEX	(36)	(172)	(145)	(154)	(164)	(174)	(185)	(196)
Add back net interest after taxes	10	43	45	48	50	52	54	57
Free Cash Flow	(26)	(90)	75	205	301	370	444	526
Year	2019Q4	2020	2021	2022	2023	2024	2025	2026
FCF	(26)	(90)	75	205	301	370	444	526
Terminal Value								13,682
Total	(26)	(90)	75	205	301	370	444	14,208
Discounting	2019Q4	2020	2021	2022	2023	2024	2025	2026
Factor	0.25	1.25	2.25	3.25	4.25	5.25	6.25	7.25
Discounted value	(25)	(82)	63	159	217	247	275	301
Perpituity value								7,832
Total	(25)	(81)	66	163	221	252	281	8,140

Figure 17 Forecasted Free Cash Flows– Author

In the above figure, we outline the Free cash flow calculations for BioMarin based on their current portfolio of on the market drugs. We can see the **path to profitability** clearly in this figure. As we see positive free cash flows emerging in 2021 and continuing into future periods.

We discounted these future cash flows back to present value using the WACC, and the discount factors showed above. We also calculated a perpetuity value of terminal cash flows with a growth of **4%**, which is comprised of several factors (inflation, cost restructuring, sales growth).

Final Valuation Calculations		
	Non Converted	Converted
Enterprise Value	9,017	9,017
Add back initial Cash	423	423
Asset Value	9,440	9,440
Subtract year 0 debt	(843)	0
Implied equity value (CMD)	8,597	9,440
Add in Varlox Value	6,891	6,891
Add in Vosoritide DCF Value	981	981
Implied equity value (TD)	16,470	17,313
Number of shares outstanding	180	192
Share Value	$ 91.50	$ 90.24
Current market value	$ 71.19	$ 71.19
Share Premium	-28.53%	-26.76%

Total Company Valuation

Figure 18 BioMarin Valuation Calculations – Author

As can be seen in figure 18, we arrived at a valuation for BioMarin of **91.50$** per share. This is at a **28.5%** discount compared to the current market price.

We arrived at this valuation by the following steps:

1) Current portfolio Value: enterprise value is the sum BioMarin's discounted forecasted free cash flows from their portfolio of on the market drugs (CMD). We added initial cash and subtracted debt from this figure to get the implied equity value
2) Pipeline: We added the valuation of stage three pipelines drugs mention previously. To arrive at a total implied equity value which includes all drugs (TD).
3) We divided the Total Implied equity value by the number of shares outstanding to arrive at the per-share valuation of BioMarin.
4) We calculated a scenario where all convertible debt is converted (100% of total debt) to show the impact on share valuation.

Z score and Sensitivity Analysis:

As shown in the calculations in figure 19, The Altman Z score test shows that despite making a loss YoY since 2010, BioMarin remains a company with a state of financial soundness.

This is due to a strong Z score of 5.31, indicating BioMarin is far above the threshold of 2.99 for financial soundness.

A sensitivity analysis of WACC used in calculating the value of BioMarin's on the market drugs shows how changing the WACC, and Long term growth parameter changes the valuation of the model. Shown in figure 20

Potential Risks and Recommendation:

The risk for BioMarin:

1. **Unsuccessful revenue streams from the pipeline (Valrox and Vosoritide):**
    - We have accounted for this risk in valuation by increasing the WACC discounting the cash flows.
    - Even with Valrox and Vosoritide worth 50% of our valuation estimates, BioMarin is a clear buy at a valuation of 77$.
    - These drugs have been fast-tracked in final testing, and physicians worldwide have vouched to prescribe the drug once it hits the market. For Valrox, a study of 35 doctors (3000) patients, they vowed to have 35% of their patients prescribed (treated) within five years.
2. **Pricing growth capped by the government:**
    - As shown in fig 7, we used polling odds to value the effect of the 2020 election on the price inflation for BioMarin from 2020 to 2026. The effect at this moment in time is only a 0.20% decrease.
3. **Reduction in R&D expenditure as % Sales:**
    - R&D will fall as a percentage of sales, but as shown in figure 14, it is still forecasted to be above $600 Million per year. Their ability to produce blockbuster drugs will not be affected by this cost restructuring.
    - These figures are based on the "on the market drugs" not including the pipeline drugs.

We believe that the following three factors lead to BioMarin being **undervalued** versus the market by **28.5%** and a **strong buy**-in our eyes:

1. **Lucrative Pipeline:**
    - BioMarin has two blockbuster drugs coming onto the market in 2020 and 2024 with a combined Net Present Value of **$10.5 Billion**.
2. **Cost Restructuring**
    - After the successful penetration into Brazil and European markets for some of the products BioMarin offers, we expect to see SG&A costs to fall.
    - Top directors have stated in year-end reports, and earnings call that they aim to reduce R&D costs as a % of sales, down from a peak 72% to 25% (just above industry average).
3. **Market Expansion:**
    - BioMarin has successfully entered into two new markets (Brazil and Europe) on some of their portfolio drugs.

Why is the market so wrong?

1. By nature, investors are risk-averse and to invest in a company who has never made a profit, based on the potential drugs it can bring to market is hard.
2. Pharma industry has been performing poorly in the last year with the S&P500 Pharmaceuticals index down 11.76% over the last 12 month period.

Investors are fearful of the pharmaceutical industry at the moment.

Our investment philosophy: Be fearful when everyone is greedy and be greedy when everyone is fearful. **This stock is a definite buy.**

Altman Z-Score			
PARAMETERS			
Income statement			
Net sales			1,491
Operating income		-	124
Balance sheet			
Current assets			2,056
Total assets			4,427
Current liabilities			523
Total liabilities			1,459
Retained earnings		-	1,694
Public companies			
Market value of equity			12,814
Private companies			
Book value of equity			-
CALCUATIONS			Z
		Factor	Public Mfg
Working capital/Total assets	X1	0.35	1.2
Retained earning /Total assets	X2	-0.38	1.4
EBIT/Total assets	X3	-0.03	3.3
Market value of equity/Total liabilities	X4	8.78	0.6
Book value of equity/Total liabilities	X4A	0.00	
Net sales/Total assets	X5	0.34	1.0
		Z-Score	**5.39**
LEGEND			
Financially sound if greater than			2.99
Caution required if between			2.77 - 2.99
Likely to go bankrupt within 2 years if between			1.8 - 2.7
Likelihood of bankruptcy is high if below			1.88
Average for nonbankrupt companies			5.02
Average for bankrupt companies			-0.29

Figure 19 Altman Z Score Calculations – Author

		WACC				
	$ 91.50	8.00%	9.00%	10.00%	11.00%	12.00%
g	4.00%	91.49747	80.19097	72.70599	67.40008	63.47437
r	4.50%	97.95609	83.98009	75.14412	69.07012	64.67352
o	5.00%	106.56906	88.71649	78.06967	71.01831	66.04397
w	5.50%	118.63005	94.80614	81.64505	73.32045	67.62527
t	6.00%	136.72774	102.92568	86.11382	76.08263	69.47011
h	6.50%	166.90711	114.29304	91.85862	79.45808	71.65038

Figure 20 Valuation Sensitivity Analysis – Bloomberg

Important Disclosure:

This report has been written by MBA students at Yale's School of Management in partial fulfilment of their course requirements. The reports are a student, not professional; they are intended to serve solely as examples of student work at Yale's School of Management. They are not intended as investment advice. They are based on publicly available information and may not be a complete analysis of all relevant data.

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Appendix:

Appendix 1 Sales forecast table per drug;

Sales Forecast by Drug									
Drug on the market	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Vimizim	481.98	550.00	586.62	616.51	647.90	680.87	715.49	751.85	790.03
Kuvan	433.58	440.00	464.65	490.62	517.97	546.77	577.10	609.04	642.66
Naglazyme	345.85	365.00	383.56	403.05	423.52	445.01	467.57	491.26	516.14
Aldurazyme	135.10	140.55	153.24	166.75	181.14	196.46	212.76	230.09	248.51
Brineura	39.89	65.00	101.60	141.18	183.95	230.10	279.84	333.41	391.00
Firdapse	21.79	21.87	23.05	24.30	25.61	26.99	28.44	29.97	31.58
Palynziq	12.17	65.00	116.70	139.47	163.96	190.28	218.55	248.88	281.39
Total	1,470.36	1,647.42	1,829.43	1,981.89	2,144.04	2,316.47	2,499.75	2,694.50	2,901.31
YoY Growth		12.04%	11.05%	8.33%	8.18%	8.04%	7.91%	7.79%	7.68%

Sales Forecast by Drug (In pipeline)									
Pipeline	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Valrox	-	-	5,600.00	5,389.40	5,187.10	4,992.77	4,806.09	4,626.76	4,454.49
Vorsitide	-	-	-	-	-	-	900.00	1,201.94	1,504.82
Total	-	-	5,600.00	5,389.40	5,187.10	4,992.77	5,706.09	5,828.70	5,959.31

Sales % by Drug									
All drugs	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Vimizim	32.78%	33.39%	7.90%	8.36%	8.84%	9.32%	8.72%	8.82%	8.92%
Kuvan	29.49%	26.71%	6.25%	6.66%	7.07%	7.48%	7.03%	7.15%	7.25%
Naglazyme	23.52%	22.16%	5.16%	5.47%	5.78%	6.09%	5.70%	5.76%	5.83%
Aldurazyme	9.19%	8.53%	2.06%	2.26%	2.47%	2.69%	2.59%	2.70%	2.80%
Brineura	2.71%	3.95%	1.37%	1.92%	2.51%	3.15%	3.41%	3.91%	4.41%
Firdapse	1.48%	1.33%	0.31%	0.33%	0.35%	0.37%	0.35%	0.35%	0.36%
Palynziq	0.83%	3.95%	1.57%	1.89%	2.24%	2.60%	2.66%	2.92%	3.18%
Valrox	0.00%	0.00%	75.38%	73.11%	70.75%	68.31%	58.57%	54.28%	50.27%
Vorsitide	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	10.97%	14.10%	16.98%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Appendix 2: Industry comparison breakdown:

Industry (1)
Amgen Inc
Biogen Inc
Celgene Corp
Gilead Sciences Inc

Industry (2)			
ACADIA Pharmaceuticals Inc	Atara Biotherapeutics Inc	Exelixis Inc	Sangamo Therapeutics Inc
Acceleron Pharma Inc	Athenex Inc	Editas Medicine Inc	Sarepta Therapeutics Inc
Achillion Pharmaceuticals Inc	BioCryst Pharmaceuticals Inc	Fate Therapeutics Inc	Seattle Genetics Inc
Acorda Therapeutics Inc	Biogen Inc	FibroGen Inc	Spectrum Pharmaceuticals Inc
Adverum Biotechnologies Inc	BioMarin Pharmaceutical Inc	Flexion Therapeutics Inc	Stemline Therapeutics Inc
Agios Pharmaceuticals Inc	Bluebird Bio Inc	G1 Therapeutics Inc	Spark Therapeutics Inc
Aimmune Therapeutics Inc	Blueprint Medicines Corp	Genomic Health Inc	TG Therapeutics Inc
Akcea Therapeutics Inc	Biohaven Pharmaceutical Holding Co Ltd	Gilead Sciences Inc	Twist Bioscience Corp
Akebia Therapeutics Inc	Cara Therapeutics Inc	GlycoMimetics Inc	Ultragenyx Pharmaceutical Inc
Alder Biopharmaceuticals Inc	Celgene Corp	Global Blood Therapeutics Inc	United Therapeutics Corp
Alexion Pharmaceuticals Inc	ChemoCentryx Inc	Halozyme Therapeutics Inc	Vanda Pharmaceuticals Inc
Alkermes PLC	Clovis Oncology Inc	Heron Therapeutics Inc	Veracyte Inc
Alnylam Pharmaceuticals Inc	Coherus Biosciences Inc	Homology Medicines Inc	Vericel Corp
AMAG Pharmaceuticals Inc	Cytokinetics Inc	Immunomedics Inc	Vertex Pharmaceuticals Inc
Amgen Inc	CytomX Therapeutics Inc	Incyte Corp	Viking Therapeutics Inc
Amicus Therapeutics Inc	CareDx Inc	Insmed Inc	Voyager Therapeutics Inc
AnaptysBio Inc	Dicerna Pharmaceuticals Inc	Intercept Pharmaceuticals Inc	Xencor Inc
Anika Therapeutics Inc	Deciphera Pharmaceuticals Inc	Intrexon Corp	ZIOPHARM Oncology Inc
Arena Pharmaceuticals Inc	Denali Therapeutics Inc	Ionis Pharmaceuticals Inc	Repligen Corp
ArQule Inc	Eagle Pharmaceuticals Inc/DE	Iovance Biotherapeutics Inc	Retrophin Inc
Arrowhead Pharmaceuticals Inc	Emergent BioSolutions Inc	Ironwood Pharmaceuticals Inc	Rhythm Pharmaceuticals Inc
Audentes Therapeutics Inc	Enanta Pharmaceuticals Inc	Intellia Therapeutics Inc	Rigel Pharmaceuticals Inc
AbbVie Inc	Epizyme Inc	Invitae Corp	Rocket Pharmaceuticals Inc
Allogene Therapeutics Inc	Esperion Therapeutics Inc	Kura Oncology Inc	Ra Pharmaceuticals Inc
Apellis Pharmaceuticals Inc	Exact Sciences Corp	Ligand Pharmaceuticals Inc	Sage Therapeutics Inc