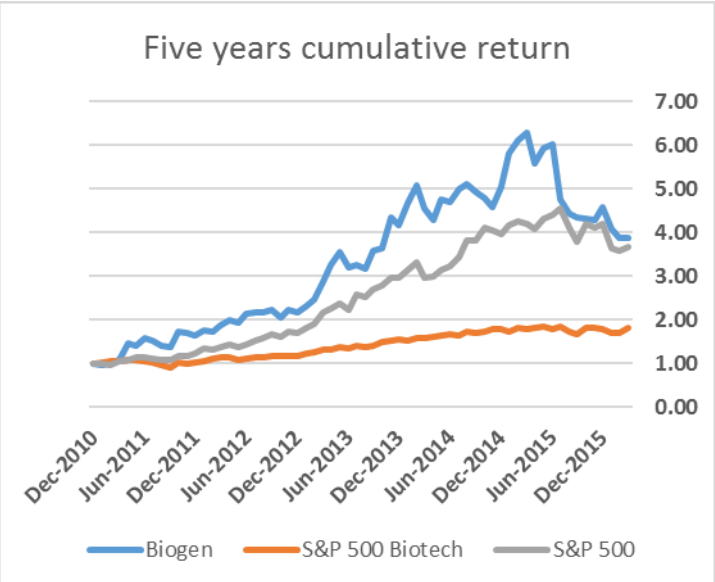
THREE PART VALUATION POINTS TO A CORRECTLY PRICED STOCK

Investment rating: Hold

Stock Upside Potential: 3.65%

Saturday 14th May 2016

- Our three part valuation by segment results in a total net present value of $59.831bn which compares with a market valuation of $57.4.bn indicating that current EV has upside potential of 4.7%.
- We forecasted a net present value of the remaining cash flows from the current portfolio as $39.47bn
- We valued the pipeline using a real option valuation for each drug in the late stage which resulted in a net present value of $14.61bn.
- We calculated the value of the R&D department by calculating the excess value created as the ratio of ROIC to an estimate of the company's required IRR for R&D and discounted back using the same IRR. This resulted in a valuation of $5.745bn
- BIIB is heavily exposed to speculation of a US price rebate following the US elections.



Yale SCHOOL OF MANAGEMENT

BIOGEN INC [BIIB]

Company Initiation Report

UCD DUBLIN UCD Michael Smurfit Graduate Business School

CAPITALIZATION AS OF 13/05/2016 USD MN

Last Price	262.03
52wk High (6/23/2015)	420.99
52wk Low (2/12/2016)	242.07
P/E (Trailing 12m)	15.66
Dividend Yield	--
Price to Book Ratio	5.56
Price to Sales Ratio	5.42
EV / Trail 12M EBITDA	9.72
Shares Outstanding	219.1
Market Cap	57,398.1
Enterprise Value	57,164.7

THREE PART ANALYSIS

Est. Enterprise Value	$59, 831
Est. Equity Value	$59,491
Implied Share Price	$271.59

Stock Upside Potential 3.65%

Target Price $271.59

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IMPORTANT DISCLOSURE

Before reading, please see the disclaimer at the end of this report for important information.

TABLE OF CONTENTS

RECENT PERFORMANCE

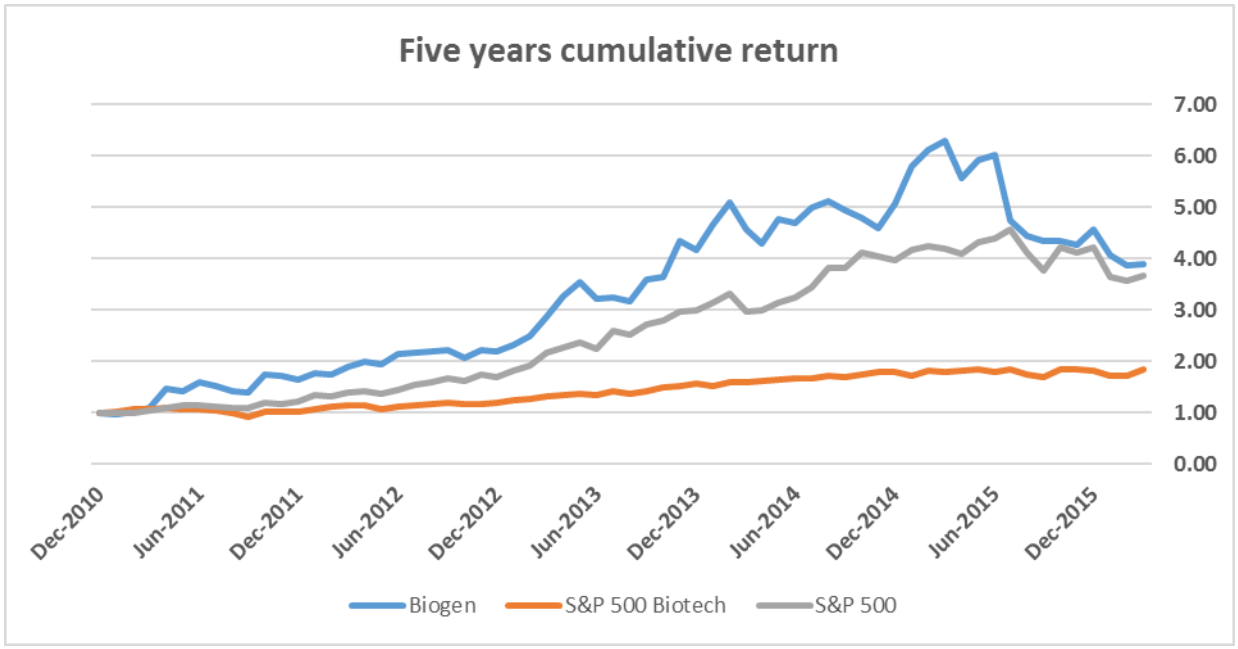


Figure 1: Historic share price performance. Source: Bloomberg.

INVESTMENT THESIS

The biotechnology sector has suffered a lot from the possibility of a price rebate in the US following the elections. Biogen is even more sensitive to this risk than most bio firms as not only does BIIB derive nearly 80% of its revenue from the US but it is heavily weighted (73%) towards a market (Multiple Sclerosis) for which drugs have increased at a rate well above inflation. In 20 years the average price in this market rose from $9,500 per year to $60,000 in 2013 which indicates a CAGR 9.65%. Recently a US Congressman sent out a letter to a biotech firm outlining his disgust at the practise of increasing the prices of drugs without providing any significant improvement in efficacy. This exposure has made the stock very volatile, and made addressing the issue of price rebates critical to the valuation of this firm. In 2011 the US prices were 54% more expensive than in Europe. We estimate that these levels will fall closer in line with international levels.

COMPANY OVERVIEW

Biogen is a biotechnology company focused on developing therapies for neurodegenerative, hematologic and autoimmune disorders. With 9 commercial products, Biogen has an extensive portfolio of multiple sclerosis therapies and new treatments for hemophilia patients. Of note, Biogen's expanding pipeline for Alzheimer's disease has garnered recent interest among the investment community and media following release of positive Phase 1b data for aducanumab, an Abeta monoclonal antibody in development for prodromal and mild Alzheimer's disease. As you can see from the table below, the company derives nearly 80% of its revenues from the US, this justifies our use of US prescription data as a proxy for global demand.

Revenue by Geography	FY 2010 31/12/2010	FY 2011 31/12/2011	FY 2012 31/12/2012	FY 2013 31/12/2013	FY 2014 31/12/2014	FY 2015 31/12/2015
Revenue	**4,716.4**	**5,048.6**	**5,516.5**	**6,932.2**	**9,703.3**	**10,763.8**
United States	2,786.7	3,020.6	3,380.3	4,861.8	6,896.4	7,957.6
Europe	1,218.6	1,221.5	1,258.4	1,197.9	1,423.2	1,530.7
Germany	362.9	378.1	410.3	418.9	813.6	669.7
Rest of World	253.2	309.0	333.5	314.1	398.8	399.2
Asia	95.0	119.4	134.0	139.5	171.3	206.6

Table 1: Revenue per Geography. Source Bloomberg

VALUATION – SUM OF THREE PARTS

To value this firm, we stripped the company into three parts:

1) The Current Portfolio of Drugs
2) The Pipeline
3) The R&D Department

We based this valuation on a method of valuing a biotechnology company proposed by Aswath Damodaran (http://people.stern.nyu.edu/adamodar/).

Value of Firm = Value of Current Portfolio of Drugs (using DCF value) + Value of The Pipeline (using option pricing) + (Value of New patents that will be obtained in the future – Cost of obtaining these patents, using a Poisson probability density function)

The first part, the current portfolio of drugs is valued using the usual discounted cash flow excluding the investments in R&D. Cash flows from each drug are forecasted until five years after expiry – we assume that generic competition will consume 100% market share at this point. The second part, the pipeline, is forecasted using a real option valuation; this allows us to take into account the probabilities of passing each stage of the FDA clinical trials and also the option to abandon the project at any stage of the clinical trials as well as the cost of each trial (phase III trials being the most expensive). Finally we calculate the value of the R&D department. Investment in R&D allows the company to acquire new patents with which it can generate future cash flows beyond what is currently in the pipeline.

VALUATION OF THE CURRENT PORTFOLIO

The current portfolio of drugs is valued using the usual discounted cash flow excluding the investments in R&D. Cash flows from each drug are forecasted until five years after expiry – we assume that generic competition will consume 100% market share at this point. We were also able to incorporate a US price rebate in 2017; this is the expected timing of a US price rebate if it is to happen.

REVENUE FORECASTS

To forecast the revenue of each drug we looked at the prices and quantities individually in order to allow us to introduce a US price rebate.

2017 US REBATE AND PRICE PROJECTIONS

First we took the percentage of Republicans and Democrats who currently support US Drug pricing Reform, 74% and 93% respectively. We assume that there is an equal probability of each party winning the election. We applied these probabilities to determine the likelihood of US Drug Price reform. We estimated that if the rebate were to go ahead this would have the effect of bringing US drug prices in line with international standards – a decline in prices by 33%. This implies an expected rebate of 27.5%. The effect of this is a once off drop in drug prices, with drug prices increasing in line with inflation thereafter, assumed to be 1%. This impacts only the proportion of revenue from the United States, currently 74% for our company.

UNITS SOLD

We looked at US prescription data per drug from Bloomberg to forecast the quantities sold going forward.

We forecasted the units sold based on a numbers of factors:

1) Patent Expiries
2) Historical US prescription trends
3) Drugs tend to reach peak sales 7 years from launch.

In the absence of prescription data from any other countries we used the historical US prescription trends in units as a proxy for global demand. We obtained the patent expiries of the from the company's 2015 10-K this is outlined in the table below.

BIIB US Patents

Product	Territory	Expected Expiration
TECFIDERA	U.S.	2018
	E.U.	2024
PLEGRIDY	U.S.	2026
	E.U.	2024
TYSABRI	U.S.	2016
	E.U.	2016
FAMPYRA	E.U.	2021
ELOCTATE	U.S.	2026
ELOCTA*	E.U.	2025
ALPROLIX	U.S.	2026

Table 2. Patent Expiration Source: Company Report

We analysed the impact of generic competition as follows:

- Within the first year of generic competition the drug will lose 16% (Grabowski, 2013) of the previous year's sales.
- We assumed that after 5 years of the patent expiration, the drug lose market share exponentially until approximately 10% of peak sales, given that generic competition on average consumes 90% of the market within 5 years (source: New York Times).

Historically the FDA only allowed clinical trials for generic drugs after the patent expires. Since the Hatch-Waxman Act generic competition has been encouraged and clinical trials have been permitted before the patent expires which ensures that the generic competitor can hit the market as soon as the patent expires. (MOSSINGHOFF)

PORTFOLIO

There are various MS treatment options available today that have been shown to reduce the frequency of relapses. There are many ways that these treatment options can be taken.

Avonex – A form of protein known as a Beta Interferon that the body produces naturally. Method of delivery is via injection. Avonex has been declining in revenue since 2011, last year Avonex corresponded to 24% of the company's revenue. Units sold have been decreasing for the past 4 years at a CAGR of 29%, Management has reacted to this by decreasing the average price per prescription by 17% CAGR to defend market share. Given that it lost patent in 2014 we forecasted that it's revenues would fall to 10% of peak sales 5 years after losing the patent, the cash flows in between this period were interpolated.

Tysabri – An intravenous medication reserved for patients with rapidly evolving MS. Method is by injection once every 4 weeks. Tysabri reached its peak revenues of $2.3bn in 2012 before declining to $1.8bn in 2015, this represented 17.5% of the total revenues in 2015. A unit sold has decreased by 6% CAGR from 2012 to 2015. Management reacted to the decline over this period by increasing price by 11% CAGR. Given that it will lose its patent this year, we expect revenues to decline to 10% of peak by 2021 consistent with our logic on generic competition.

Tecfidera – An oral capsule taken twice daily that is used to treat people with relapsing forms of MS, Tecfidera generated USD 3.638bi, 33.8% of the Company's total Revenue in 2015. Tecfidera started to be commercialized in 2013, eventhought Biogen already had patent of the compounds to produce the drug since 2003. The astronomic growth (3 fold) is jeopardized by the revocation of patent in Europe that happened in march this year and the end of exclusive right in USA, 2018. Both units sold and average price per prescription in USA have increased during this period at a CAGR of 41.65% and 11.4% respectively. We expect that the drug will reach is sales peak in 2017 and will rapidly decline due to the presence of generic competitors.

Plegride – is Biogen's newest potential blockbuster. Sales represented 3.1% of 2015 revenue. The number of units sold increased 445% MoM in one year, while prices also increased 328% over the same period. We expect the growth to continue but at a slower rate, 78% in 2016, calculated as the ratio of the growth in units sold in one year by the ratio of the price increase in the same period, multiplied by the one year geometric decrease in the ratio over the last two years. We expect Plegride to reach peak Revenue in 2021. The drug loses patent in 2026 with revenues declining to 10% of the peak by 2030.

Rituxan – Is a drug developed in partnership with Genentech, a member of the Roche Group. Its indicated to treat different stages of non-Hodgkin's lymphoma, Rheumatoid arthritis to name a few. The drug lost patent in Europe at the end of 2013 and is expected to lose patent in USA in 2018. Using our logic of generic competition, we expect sales to decline to 10% of its peak revenue in 2022.

Other Drugs

The 5 drugs analyzed above combine to form 91.3% of total 2015 revenues. The remainder of the portfolio was calculated using analysis consensus until 2023, after which we extrapolated until the expiry of the patent and subsequent decline in units sold due to the usual generic competition logic.

We estimate that the current portfolio will generate $115,537bn until 2030 in gross revenue and have a Discounted Cash Flow of $39,475bn.

MARGIN ANALYSIS

COSTS OF GOODS SOLD

The company does not provide specific commitments to COGS expenditure so we took an exponentially weighted moving average of the past 3 years.

R&D INVESTMENT

We completely exclude costs associated with investment in the R&D department as we value this department separately.

SG&A EXPENSES

The company does not provide specific commitments to COGS expenditure so we took an exponentially weighted moving average of the past 3 years.

ADMINISTRATIVE EXPENSES

The company does not provide specific commitments to COGS expenditure so we took an exponentially weighted moving average of the past 3 years.

VALUATION OF THIS SEGMENT

We estimate that the current portfolio will generate a net present value of $40.5bn

VALUATION OF THE PIPELINE

The second part, the pipeline, is forecasted using a real option valuation, this allows us to take into account the probabilities of passing each stage of the FDA clinical trials, the option to abandon the project at any stage of the clinical trials as well as the cost of each trial (phase III trials being the most expensive).

We based most of our figures, such as the probability of passing each stage and the costs of clinical trials for each stage from a report commissioned by the US Department of Health and Human Services in 2014 'Examination of Clinical Trial Costs and Barriers for Drug Development'. (US Department of Health and Human Services, 2014) The average time spent at each stage was sourced from TUFTS Center for the Study of Drug DEvelompment, 2014. We assume an average distribution of cash flows over the life of a drug (ie. showing how long it takes to hit peak sales after launch as well as the decline in sales following the loss of patent), this was obtained in line with the same approach outlined in the valuation of the current portfolio – drugs reach peak sales 7 years after launch and decline to 10% of peak revenues 5 years post patent expiration. Our model takes into account the number of quarters that the drug has already spent in its current phase (phase III) – as a check this matched the expected launch date provided in the newsflow (Appendix D) in the case of Nusinersen. The probability of passing stage III for each biopharmaceutical drug is 55% and the probability of failing is 45% with duration of 30.7 months according to this report, FDA review, the probability of passing here is 83% with the cost of applying estimated at $25 million and duration of 16 months. Finally, the costs associated with Phase IV are $2m, these costs are only incurred in the event of development for commercial purposes and so are included in the present value at the end of the clinical trials.

At the time of this report, Biogen had two potential blockbusters in the late stage pipeline, namely Nusinersen and Aducanumab.

NUSINERSEN

Nusinersen is a drug Biogen is developing to treat Spinal Muscular Atrophy. It has orphan drug status and fast track designation both in the US and EU. Our model estimates that the drug will remaining in phase 3 trial for around another month and will cost another $6.84 million. In case of success, management has the option to move to the next stage, the FDA review and incur further costs associated with that or abandon the project. The probability of passing the FDA review is 83% with the cost of applying estimated at $25 million and duration of 16 months. The expected present value of a successful outcome in the launch date is $7,082bn using our analysis. We employ the company's weighted average cost of capital to discount at each node. The value of the project was calculated to be $7.082bn before the FDA review and is estimated to have a net present value today of $3.864bn.

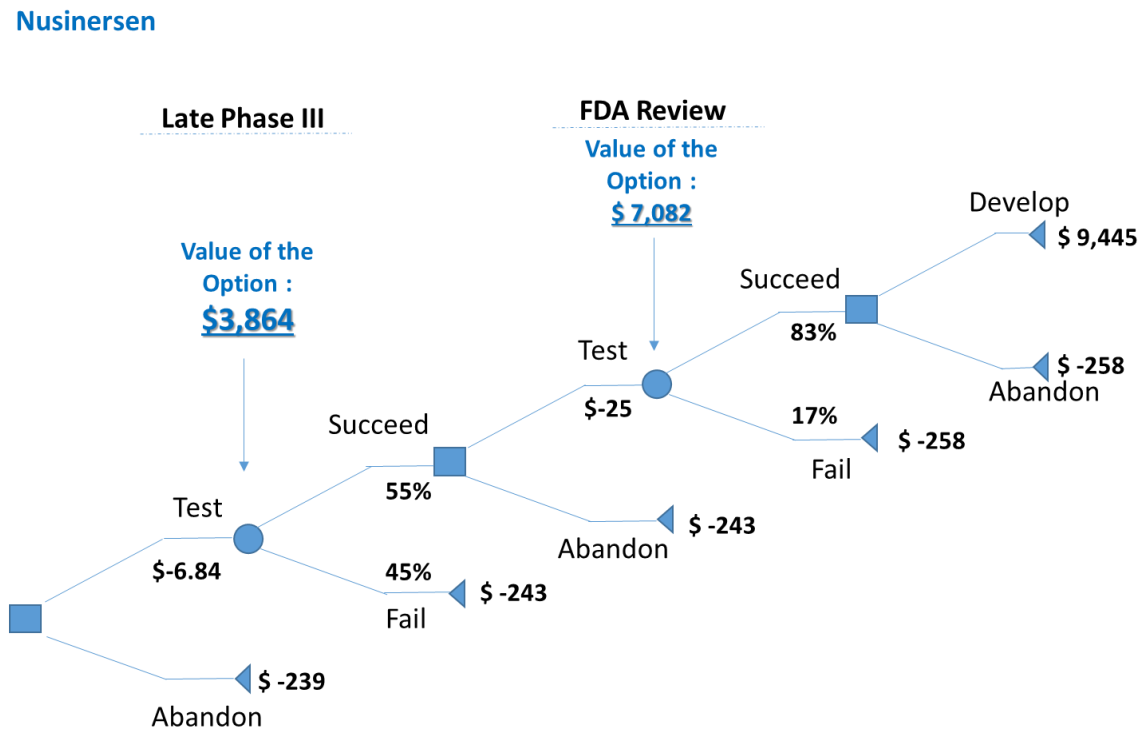


Figure 2: Real option tree valuation: Nursinersen. Source Author's Calculation

ADUCANUMAB

This drug showed in clinical trials that it could reduce declines in memory and thinking processes in the early stages of Alzheimer's disease. This is the only drug which has demonstrated the ability to reduce the amyloid plaque which causes Alzheimer's. According to most recent surveys, this drug could reach peak sales of $10bn. We adopt a more conservative approach, given that even drugs with more than one rare disease indication rarely obtain this performance. In our analysis, we use the analysts' consensus estimate of the drugs revenue until 2023 and forecast the followings CF until the drug reach its peak sales using the growth rate of 2022/2023. From there on we use our model of constant revenue until patent loss and consequently declining in revenue, given generic competition. We expect Aducanumab to reach its peak sales of about $6.381bn in 2026. We derive a present value of $31.138bn in 2020 – the time of launch. We estimate that this drug has 26 months left in phase III trial. Using the probabilities and cost of capital outlined in the introduction to this section we derive a total net present value of $10.747bn today.

Aducanumab

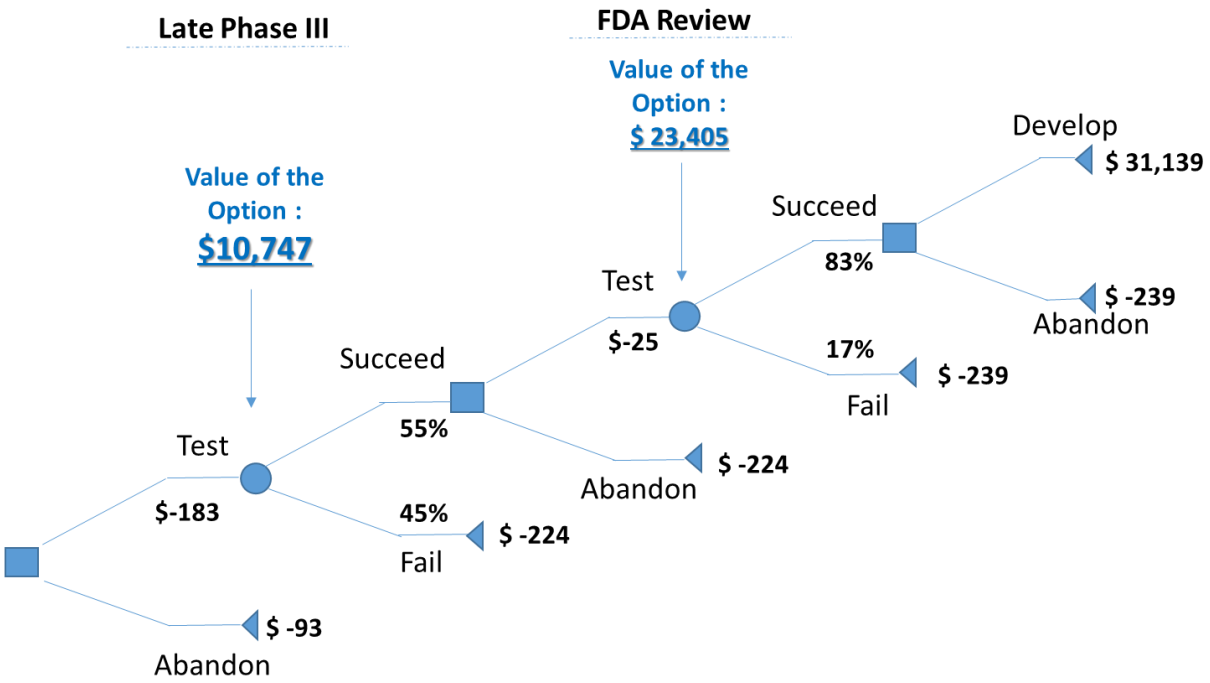


Figure 3: Real option tree: Aducanumab. Source: Author's Calculation.

VALUE OF THIS SEGMENT

We estimated the pipeline to have a present value of $14.6bn.

VALUATION OF THE R&D DEPARTMENT

Finally we calculate the value of the R&D department. Investments in R&D allows the company to acquire new patents with which it can generate future cash flows beyond what is currently in the pipeline. First we observed whether expenditure on R&D is dependent on revenue by graphing R&D as a percentage of revenue over the past 10 years alongside the CAGR of R&D expenditure and found the R&D as a percentage of revenue to be more core stable, although it has declined in recent years, this is illustrated in figure _. We concluded that R&D expenditure was independent of revenue and so used WACC to discount the values of Patents (to be done later). We then forecasted the R&D expenditure over the next 10 years using a EWMA (λ=0.94) of the CAGR of R&D Expenditure (lambda = 0.94), these results are illustrated on figure 4.

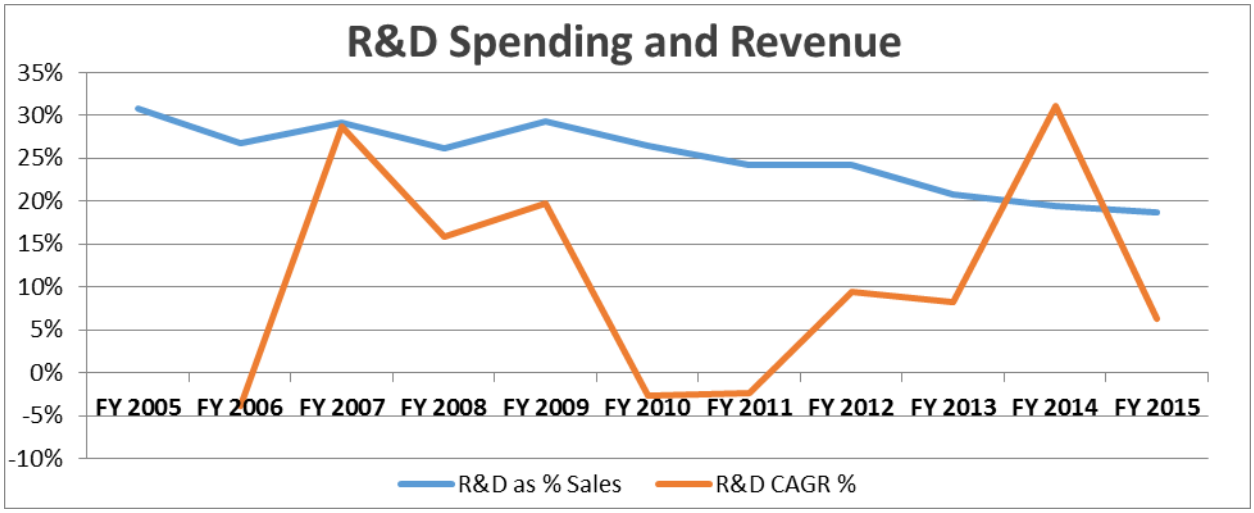


Figure 4: Graphical representation of R&D as a percentage of sales as well as the CAGR of R&D over the same period to determine the independence of R&D spending with revenue.

Figure 5: Forecasted R&D expenditure over the next 10 years. Source: historical from Bloomberg, forecasted expenditure via authors' analysis.

The FDA has approved the following NMEs (New Molecular Entities, which includes both New Drug Applications (NDAs) and New Biological License Applications (BLAs)) since the company's inception, including those approved by Biogen's acquisitions:

2014 Plegridy; 2013 Tecfidera; 2004 Tysabri; (FDA, 2016) 1997 Rituxan; 1996 Avonex; 1986 Intron. (Biogen, 2016).

To calculate the probabilities of having one or more NMEs approved by the FDA at any given year we employed the Poisson probability density function, with parameter lambda (λ). We used the Poisson pdf to take into account the fact that the probability of an FDA approval is completely independent of past approvals.

$$P(X = x) = \frac{\lambda^x e^{-\lambda}}{x!}$$

Figure 6: The Poisson probability distribution function (pdf).

Lambda was calculated as the number of NMEs approved by the FDA over the past 10 years divided by the total R&D expenditure over that 10 year period, this resulted in a value of 0.0002. We calculated lambda as a function of R&D expenditure as opposed to time to incorporate the fact that the rate at which NMEs are

approved by the FDA increases with increases in the amount spend in R&D. This rate is then multiplied by the amount spent on R&D in each year to determine the probabilities, these results are depicted on table 2.

λ	0.0002									
Poisson Probabilities	Est 2016	Est 2017	Est 2018	Est 2019	Est 2020	Est 2021	Est 2022	Est 2023	Est 2024	Est 2025
R & D Exp.	2,169.59	2,336.78	2,516.97	2,711.04	2,920.08	3,145.23	3,387.75	3,648.97	3,930.32	4,233.38
λ	0.33	0.36	0.38	0.41	0.44	0.48	0.52	0.55	0.60	0.64
P(0)	71.898%	70.093%	68.199%	66.215%	64.144%	61.984%	59.740%	57.414%	55.009%	52.532%
P(1)	23.721%	24.907%	26.103%	27.298%	28.483%	29.646%	30.776%	31.858%	32.877%	33.818%
P(2)	3.913%	4.425%	4.995%	5.627%	6.324%	7.090%	7.927%	8.839%	9.825%	10.885%
P(3)	0.430%	0.524%	0.637%	0.773%	0.936%	1.130%	1.361%	1.635%	1.957%	2.336%
P(4)	0.035%	0.047%	0.061%	0.080%	0.104%	0.135%	0.175%	0.227%	0.292%	0.376%
P(5)	0.002%	0.003%	0.005%	0.007%	0.009%	0.013%	0.018%	0.025%	0.035%	0.048%
P(6)	0.000%	0.000%	0.000%	0.000%	0.001%	0.001%	0.002%	0.002%	0.003%	0.005%

Table 3: The Poisson probabilities calculated for the probability of {x = 0, 1, 2, ..., 6} FDA approvals for the next 10 years.

The next step was to value the patent of an FDA approved NME, to do this we calculated the patent value of Biogen's three most recent Approved NME's (2004 Tysabri; 2013 Tecfidera; 2014 Plegridy) on the date they were approved (denoted Y0), using a combination of historical values, projected values which we had calculated (to 5 years beyond expiry) in our previous section 'The current portfolio' and using the company's WACC. We then took an EWMA (lambda = 0.94) of the SG&A as a % of revenue along with Other operating expenses and COGS to determine pre-tax and R&D costs cash flows for the patented drugs. We took a mean of these 3 values for the expected value of a FDA approved NME patent. These results are depicted on figure 7 and table 3. Further detail on how we calculated the value of the patents can be found in Appendix.

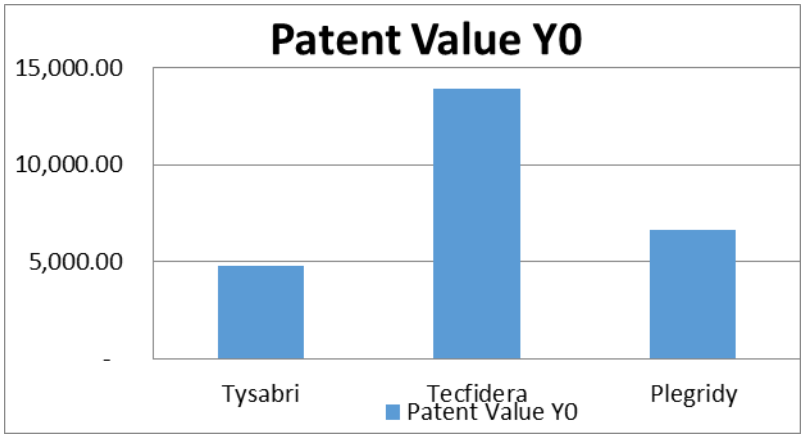


Figure 7: Patent value in Y0. Source Authors Calculations

Patent	Tysabri	Tecfidera	Plegridy
Patent Value Y0	4,755.17	13,958.60	6,620.05
Mean	8,444.61		
Standard Deviation	4,865.44		

Table 4: Authors calculation of the value of Biogen's 3 most recent FDA approved NMEs and their value on the date they were approved (Y0).

We then multiplied the expected PV of a FDA approved NME by the Poisson probabilities at each year and discounted back using the company's WACC. The next step was to subtract the R&D expenditure at each year and then to apply the tax rate to the profits (We assume tax levels remain flat at 2015 levels).

	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Revenue		2,422.5	2,683.0	3,171.6	4,097.5	4,377.3	4,716.4	5,048.6	5,516.5	6,932.2	9,703.3
R & D Exp.		747.7	718.4	925.2	1,072.1	1,283.1	1,248.6	1,219.6	1,334.9	1,444.1	1,893.4
R&D as % Sales		30.86%	26.78%	29.17%	26.16%	29.31%	26.47%	24.16%	24.20%	20.83%	19.51%
R&D CAGR %			-3.92%	28.78%	15.88%	19.68%	-2.69%	-2.32%	9.46%	8.18%	31.12%
NME	1	0	0	0	0	0	0	0	0	1	1
Name	Tysabri									Tecfidera	Plegridy
Value of Patent at t0	4,755.17									13,958.60	6,620.05
Excess Value (Patent - R&D Exp)											
Taxes	24%	24%	24%	24%	24%	24%	24%	24%	24%	24%	24%
Discounted Cash Flows of R&D	WACC	7.63%									
Sum DCF (10 year)	5,745.27										

	FY 2015	Est 2016	Est 2017	Est 2018	Est 2019	Est 2020	Est 2021	Est 2022	Est 2023	Est 2024	Est 2025
Revenue	10,763.8										
R & D Exp.	2,012.8	2,169.59	2,336.78	2,516.97	2,711.04	2,920.08	3,145.23	3,387.75	3,648.97	3,930.32	4,233.38
R&D as % Sales	18.70%										
R&D CAGR %	6.31%	7.79%	7.71%	7.71%	7.71%	7.71%	7.71%	7.71%	7.71%	7.71%	7.71%
NME	0	0.3299231	0.355346	0.382746	0.412258	0.444044	0.478281	0.515156	0.554873	0.59765	0.64372
Name											
Value of Patent at t0		2,786.07	3,000.76	3,232.14	3,481.35	3,749.78	4,038.89	4,350.29	4,685.69	5,046.92	5,435.96
Excess Value (Patent - R&D Exp)		616.48	663.98	715.18	770.31	829.70	893.66	962.54	1,036.72	1,116.59	1,202.59
Taxes	24%	24.40%	24.40%	24.40%	24.40%	24.40%	24.40%	24.40%	24.40%	24.40%	24.40%
Discounted Cash Flows of R&D		572.75	573.13	573.54	573.94	574.34	574.74	575.14	575.52	575.90	576.26
Sum DCF (10 year)											

Table 4: Discounted excess values created by the R&D Department. Source: Authors Calculation and Bloomberg

The sum of these cash flows comes to $5.7bn, this is our valuation of the R&D department, assuming 10 years of excess value created, and thereafter we assume any expenditure on R&D results in returns equal to the company's WACC and therefore do not produce any excess value.

VALUE OF THIS SEGMENT

This resulted in Present value of $5.7bn for the R&D department.

VALUATION ASSUMPTIONS OF THE CURRENT PORTFOLIO

MARKET BENCHMARK

We used the S&P 500 Index as our market benchmark. We examined a 11-year period from April 2005 to March 2016.

WACC

We calculated the WACC as follows:

$$WACC = \frac{E}{V} * Re + \frac{D}{V} * Rd * (1 - Tc)$$

This resulted in a WACC of 7.6% (Please see Appendix A.4. for the full disclosure of WACC Calculations)

COST OF EQUITY (RE)

We calculated the cost of equity as the average of the last annualized 60 months returns as follows:

$$Rf + \beta(Rm - Rf)$$

This resulted in a cost of equity of 8.4%

RISK FREE RATE (RF)

We estimated the risk free rate (Rf) based on the historical returns of the US 1-Month T-Bill twelve months' compound return given its low credit risk and also to avoid. The period used to estimate the annual Risk-Free Rate was the past 5 years using rolling windows of 1 year and then taking an arithmetic average.

This resulted in Risk Free rate of 1.16%.

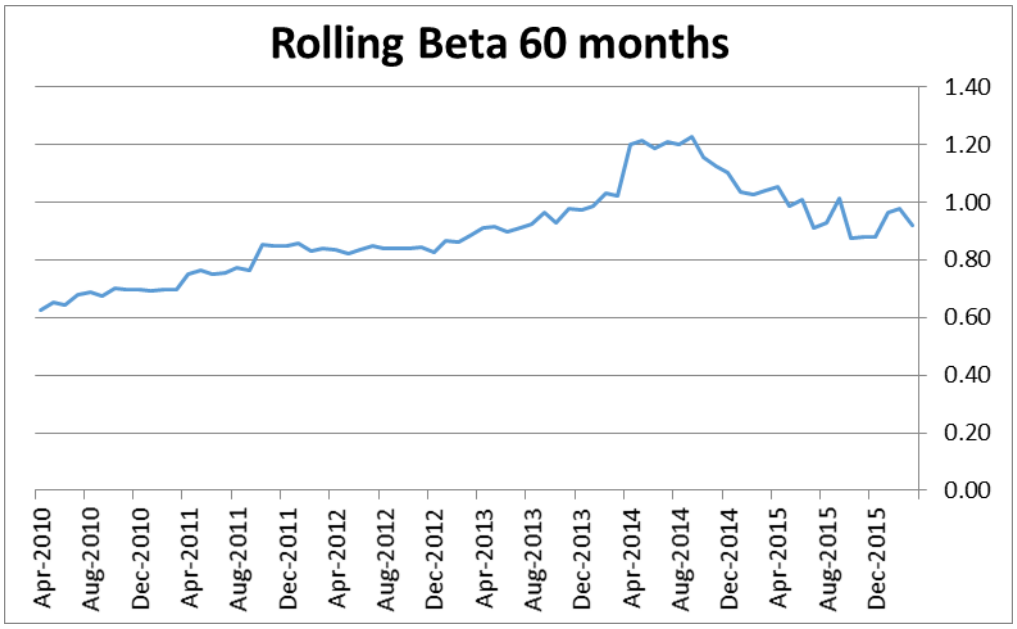
MARKET RISK PREMIUM

We calculated the market risk premium as the average of a rolling window of 12 monthly compound returns from the period between April 2006 to March 2016, which resulted in a risk premium of 7.89%.

BETA

To estimate the Beta we regressed BIOGEN total excess returns against the S&P 500 total excess returns over a 60 months' period from April 2010 to March 2016.

This produced the following results:



The end result is a levered beta: $\beta = 0.92$

COST OF DEBT (RD)

We calculated the cost of debt as follows:[1]

$$\frac{Total\ interest\ paid\ in\ 2015}{Average\ of\ Total\ Debt\ in\ 2015\ and\ 2014}$$

This resulted in a value of 1.5%

CORPORATE TAX RATE

We calculated our corporate tax rate as:

$$\frac{Total\ tax\ paid\ in\ 2015}{profit\ before\ tax\ 2015}$$

This resulted in a value of 24.4%

[1] 2015 Annual Accounts

DEBT RATIO & EQUITY RATIO

The company's debt ratio is 10.6%, calculated as Total Debt/Total Capitalization. The equity ratio is 89.4% calculated as 1 - debt ratio.

VALUATION ASSUMPTIONS OF THE PIPELINE

We discount the late stage pipeline using the company WACC as calculated for the Current Portfolio.

VALUATION ASSUMPTIONS OF THE R&D DEPARTMENT

We discount the R&D Department using the company WACC as calculated for the Current Portfolio.

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IMPORTANT DISCLOSURE

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APPENDIX A FINANCIAL ANALYSIS

A.1. CURRENT PORTFOLIO REVENUE ACTUALS

Biogen Inc (BIIB US) - By Measure

In Millions of USD except Per Share 12 Months Ending	FY 2008 12/31/2008		FY 2009 12/31/2009		FY 2010 12/31/2010		FY 2011 12/31/2011		FY 2012 12/31/2012		FY 2013 12/31/2013		FY 2014 12/31/2014		FY 2015 12/31/2015	
Revenue	**4,097.5**	**100.0%**	**4,377.3**	**100.0%**	**4,716.4**	**100.0%**	**5,048.6**	**100.0%**	**5,516.5**	**100.0%**	**6,932.2**	**100.0%**	**9,703.3**	**100.0%**	**10,763.8**	**100.0%**
Product Sales	2,839.7	69.3%	3,152.9	72.0%	3,470.1	73.6%	3,836.1	76.0%	4,166.1	75.5%	5,542.3	80.0%	8,203.4	84.5%	9,188.5	85.4%
Tecfidera	—		—		—		—		—		876.1	12.6%	2,909.2	30.0%	3,638.4	33.8%
Avonex	2,202.6	53.8%	2,322.9	53.1%	2,518.4	53.4%	2,686.6	53.2%	2,913.1	52.8%	3,005.5	43.4%	3,013.1	31.1%	2,630.2	24.4%
Tysabri	588.6	14.4%	776.0	17.7%	900.2	19.1%	1,079.5	21.4%	1,135.9	20.6%	1,526.5	22.0%	1,959.5	20.2%	1,886.1	17.5%
Plegridy	—		—		—		—		—		—		44.5	0.5%	338.5	3.1%
Eloctate	—		—		—		—		—		—		58.4	0.6%	319.7	3.0%
Alprolix	—		—		—		—		—		—		76.0	0.8%	234.5	2.2%
Fampyra	—		—		—		13.5	0.3%	57.4	1.0%	74.0	1.1%	80.2	0.8%	89.7	0.8%
Fumaderm	43.4	1.1%	49.6	1.1%	51.2	1.1%	54.7	1.1%	59.7	1.1%	60.2	0.9%	62.5	0.6%	51.4	0.5%
Amevive	0.3	0.0%	—		—		—		—		—		—		—	
Zevalin	4.8	0.1%	4.4	0.1%	0.3	0.0%	—		—		—		—		—	
Other	—		—		—		1.8	0.0%	—		—		—		—	
Unconsolidated Joint Business (Rituxan)	1,128.2	27.5%	1,094.9	25.0%	1,077.2	22.8%	996.6	19.7%	1,137.9	20.6%	1,126.0	16.2%	1,195.4	12.3%	1,339.2	12.4%
Co-Promotion Profits of Rituxan in the U.S	733.5	17.9%	773.6	17.7%	848.0	18.0%	872.7	17.3%	1,031.7	18.7%	1,085.2	15.7%	1,117.1	11.5%	1,269.8	11.8%
Royalty Revenue on Sales of Rituxan Outside the U.S	335.0	8.2%	255.7	5.8%	170.9	3.6%	117.8	2.3%	104.6	1.9%	38.7	0.6%	78.3	0.8%	69.4	0.6%
Reimbursement of Selling and Development Expenses	59.7	1.5%	65.6	1.5%	58.3	1.2%	6.1	0.1%	1.6	0.0%	2.1	0.0%	—		—	
Other Revenues	129.6	3.2%	129.5	3.0%	169.1	3.6%	215.9	4.3%	212.5	3.9%	263.9	3.8%	304.5	3.1%	236.1	2.2%
Corporate Partner (Zevalin and Amevive)	13.4	0.3%	5.1	0.1%	31.7	0.7%	57.4	1.1%	43.8	0.8%	78.2	1.1%	127.8	1.3%	188.6	1.8%
Royalties	116.2	2.8%	124.4	2.8%	137.4	2.9%	158.5	3.1%	168.7	3.1%	185.7	2.7%	176.7	1.8%	47.5	0.4%
Daclizumab																

Source: Bloomberg

A.2. CURRENT PORTFOLIO REVENUE ESTIMATES & DISCOUNTED CASH FLOW

Biogen Inc (BIIB US) - By Measure

In Millions of USD except Per Share 12 Months Ending	FY 2016 Est 12/31/2016		FY 2017 Est 12/31/2017		FY 2018 Est 31/12/2018		FY 2019 Est 31/12/2019		FY 2020 Est 31/12/2020		FY 2021 Est 31/12/2021		FY 2022 Est 31/12/2022		FY 2023 Est 31/12/2023	
Revenue	**10,918.6**	**100.0%**	**11,473.5**	**100.0%**	**12,342.8**	**100.0%**	**12,164.4**	**100.0%**	**11,100.5**	**100.0%**	**9,380.4**	**100.0%**	**8,183.2**	**100.0%**	**7,690.7**	**100.0%**
Product Sales	9,346.2	85.6%	9,844.2	90.2%	10,818.2	99.1%	11,023.3	101.0%	10,170.7	93.2%	8,672.9	79.4%	7,611.7	69.7%	7,131.3	65.3%
Tecfidera	4,123.5	37.8%	4,490.1	41.1%	4,756.1	43.6%	3,995.2	36.6%	2,520.8	23.1%	1,590.5	14.6%	1,003.5	9.2%	475.6	4.4%
Avonex	1,769.2	16.2%	1,162.7	10.6%	1,055.6	9.7%	958.4	8.8%	870.1	8.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Tysabri	1,839.1	16.8%	1,544.8	14.1%	974.7	8.9%	615.0	5.6%	388.0	3.6%	183.9	1.7%	0.0	0.0%	0.0	0.0%
Plegridy	601.8	5.5%	1,033.0	9.5%	1,402.4	12.8%	1,866.0	17.1%	2,436.4	22.3%	3,125.4	28.6%	3,094.1	28.3%	3,063.2	28.1%
Eloctate	548.8	5.0%	1,080.0	9.9%	2,000.0	18.3%	2,900.0	26.6%	3,236.0	29.6%	3,074.2	28.2%	2,920.5	26.7%	2,920.5	26.7%
Alprolix	326.0	3.0%	389.4	3.6%	477.5	4.4%	525.9	4.8%	555.8	5.1%	573.0	5.2%	593.5	5.4%	672.0	6.2%
Fampyra	89.3	0.8%	95.2	0.9%	99.5	0.9%	108.0	1.0%	112.7	1.0%	89.1	0.8%	0.0	0.0%	0.0	0.0%
Fumaderm	48.5	0.4%	49.1	0.4%	52.4	0.5%	55.0	0.5%	50.9	0.5%	36.9	0.3%	0.0	0.0%	0.0	0.0%
Amevive	—		—		—											
Zevalin	—		—		—											
Other	—		—		—											
Unconsolidated Joint Business (Rituxan)	1,325.8	12.1%	1,312.5	12.0%	1,102.5	10.1%	723.2	6.6%	474.4	4.3%	311.2	2.9%	133.9	1.2%	91.9	0.8%
Co-Promotion Profits of Rituxan in the U.S																
Royalty Revenue on Sales of Rituxan Outside the U.S																
Reimbursement of Selling and Development Expenses																
Other Revenues	210.7	1.9%	193.7	1.7%	186.8	1.5%	182.7	1.5%	152.8	1.4%	0.3	0.0%	0.1	0.0%		0.0%
Corporate Partner (Zevalin and Amevive)	186.7	1.7%	184.8	1.6%	183.0	1.5%	181.2	1.5%	152.2	1.4%	0.0	0.0%	0.0	0.0%		0.0%
Royalties	24.0	0.2%	8.9	0.1%	3.8	0.0%	1.5	0.0%	0.6	0.0%	0.3	0.0%	0.1	0.0%		
Daclizumab	35.8	0.3%	123.0	1.1%	235.2	1.9%	235.2	1.9%	302.5	2.7%	396.0	4.2%	437.5	5.3%	467.5	6.1%

Source: Author's Analysis.

Biogen Inc (BIIB US) - By Measure

In Millions of USD except Per Share 12 Months Ending	FY 2024 Est 31/12/2024		FY 2025 Est 31/12/2025		FY 2026 Est 31/12/2026		FY 2027 Est 31/12/2027		FY 2028 Est 31/12/2028		FY 2029 Est 31/12/2029		FY 2030 Est 31/12/2030	
Revenue	**6,463.3**	**100.0%**	**6,380.9**	**100.0%**	**5,896.0**	**100.0%**	**4,905.6**	**100.0%**	**3,723.9**	**100.0%**	**2,653.5**	**100.0%**	**2,260.7**	**100.0%**
Product Sales	5,953.0	54.5%	5,922.7	54.2%	5,442.4	49.8%	4,524.5	41.4%	3,473.5	31.8%	2,488.8	22.8%	2,152.4	19.7%
Tecfidera	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Avonex	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Tysabri	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Plegridy	3,032.6	27.8%	3,002.2	27.5%	2,521.9	23.1%	1,604.0	14.7%	1,020.3	9.3%	648.9	5.9%	312.5	2.9%
Eloctate	2,920.5	26.7%	2,920.5	26.7%	2,920.5	26.7%	2,920.5	26.7%	2,453.2	22.5%	1,839.9	16.9%	1,839.9	16.9%
Alprolix	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Fampyra	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Fumaderm	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Amevive														
Zevalin														
Other														
Unconsolidated Joint Business (Rituxan)	47.4	0.4%												
Co-Promotion Profits of Rituxan in the U.S														
Royalty Revenue on Sales of Rituxan Outside the U.S														
Reimbursement of Selling and Development Expenses														
Other Revenues	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
Corporate Partner (Zevalin and Amevive)	18.9	0.3%												
Royalties														
Daclizumab	462.8	7.2%	458.2	7.2%	453.6	7.7%	381.0	7.8%	250.5	6.7%	164.6	6.2%	108.2	4.8%

Source: Author's Analysis.

Biogen

Discounted Cash Flow Analysis

($ in millions, fiscal year ending December 31)

Operating Scenario: Base

Operating Scenario	1										
Mid-Year Convention	Y	Historical Period			CAGR	Projection Period					CAGR
		2013	2014	2015	('13 - '15)	2016	2017	2018	2019	2020	2021
Sales		**$6,932.2**	**$9,703.3**	**$10,763.8**	*24.6%*	**$10,918.6**	**$11,473.5**	**$12,342.8**	**$12,164.4**	**$11,100.5**	**$9,380.4**
% growth		*25.7%*	*40.0%*	*10.9%*		-	*5.1%*	*7.6%*	*(1.4%)*	*(8.7%)*	*(15.5%)*
COGS		857.7	1,171.0	1,240.4		1,235.5	1,298.3	1,396.7	1,376.5	1,256.1	1,061.5
Gross Profit		**$6,074.5**	**$8,532.3**	**$9,523.4**	*25.2%*	**$9,683.0**	**$10,175.1**	**$10,946.1**	**$10,787.9**	**$9,844.3**	**$8,318.9**
% margin		*87.6%*	*87.9%*	*88.5%*		*88.7%*	*88.7%*	*88.7%*	*88.7%*	*88.7%*	*88.7%*
SG&A		1,772.0	2,176.7	2,237.0		2,269.2	2,384.5	2,565.1	2,528.1	2,307.0	1,949.5
EBITDA		**$4,302.5**	**$6,355.6**	**$7,286.4**	*30.1%*	**$7,413.9**	**$7,790.7**	**$8,380.9**	**$8,259.8**	**$7,537.4**	**$6,369.4**
% margin		*62.1%*	*65.5%*	*67.7%*		*67.9%*	*67.9%*	*67.9%*	*67.9%*	*67.9%*	*67.9%*
Depreciation & Amortization		300.5	430.7	338.5		388.1	407.8	438.7	432.4	394.6	333.4
EBIT		**$4,002.0**	**$5,924.9**	**$6,947.9**	*31.8%*	**$7,025.8**	**$7,382.8**	**$7,942.2**	**$7,827.5**	**$7,142.8**	**$6,036.0**
% margin		*57.7%*	*61.1%*	*64.5%*		*64.3%*	*64.3%*	*64.3%*	*64.3%*	*64.3%*	*64.3%*
Taxes		976.4	1,486.1	1,692.9		1,711.9	1,798.9	1,935.2	1,907.2	1,740.4	1,470.7
EBIAT		**$3,025.6**	**$4,438.8**	**$5,255.0**	*31.8%*	**$5,313.9**	**$5,583.9**	**$6,007.0**	**$5,920.2**	**$5,402.4**	**$4,565.3**
Plus: Depreciation & Amortization		300.5	430.7	338.5		388.1	407.8	438.7	432.4	394.6	333.4
Less: Capital Expenditures		246.3	287.8	643.0		(519.5)	(545.9)	(587.2)	(578.7)	(528.1)	(446.3)
Less: Increase in Net Working Capital						748.9	(171.5)	(268.6)	55.1	328.8	531.5
Unlevered Free Cash Flow						**$5,931.4**	**$5,274.5**	**$5,589.9**	**$5,829.0**	**$5,597.6**	**$4,983.9**
WACC		7.6%									
Discount Period						0.5	1.5	2.5	3.5	4.5	5.5
Discount Factor						0.96	0.90	0.83	0.77	0.72	0.67
Present Value of Free Cash Flow						**$5,717.2**	**$4,723.4**	**$4,650.8**	**$4,505.8**	**$4,020.0**	**3,325.41**

Discounted cash flows from the current portfolio, Source: Bloomberg (historical) and Author's analysis (projected).

Discounted Cash Flow Analysis

($ in millions, fiscal year ending December 31)

Operating Scenario	1
Mid-Year Convention	Y

	2023	2024	2025	2026	2027	2028	2029	2030	('08 - '13)
Sales	**$7,690.7**	**$6,463.3**	**$6,380.9**	**$5,896.0**	**$4,905.6**	**$3,723.9**	**$2,653.5**	**$2,260.7**	*0.6%*
% growth	*(6.0%)*	*(16.0%)*	*(1.3%)*	*(7.6%)*	*(16.8%)*	*(24.1%)*	*(28.7%)*	*(14.8%)*	
COGS	870.3	731.4	722.1	667.2	555.1	421.4	300.3	255.8	
Gross Profit	**$6,820.4**	**$5,731.9**	**$5,658.9**	**$5,228.8**	**$4,350.5**	**$3,302.5**	**$2,353.2**	**$2,004.8**	*0.7%*
% margin	*88.7%*	*88.7%*	*88.7%*	*88.7%*	*88.7%*	*88.7%*	*88.7%*	*88.7%*	
SG&A	1,598.3	1,343.2	1,326.1	1,225.3	1,019.5	773.9	551.5	469.8	
EBITDA	**$5,222.1**	**$4,388.7**	**$4,332.7**	**$4,003.5**	**$3,331.0**	**$2,528.6**	**$1,801.7**	**$1,535.0**	*0.7%*
% margin	*67.9%*	*67.9%*	*67.9%*	*67.9%*	*67.9%*	*67.9%*	*67.9%*	*67.9%*	
Depreciation & Amortization	273.4	229.7	226.8	209.6	174.4	132.4	94.3	80.4	
EBIT	**$4,948.7**	**$4,158.9**	**$4,105.9**	**$3,793.9**	**$3,156.6**	**$2,396.2**	**$1,707.4**	**$1,454.7**	*0.6%*
% margin	*64.3%*	*64.3%*	*64.3%*	*64.3%*	*64.3%*	*64.3%*	*64.3%*	*64.3%*	
Taxes	1,205.8	1,013.4	1,000.4	924.4	769.1	583.9	416.0	354.4	
EBIAT	**$3,742.9**	**$3,145.6**	**$3,105.5**	**$2,869.5**	**$2,387.5**	**$1,812.4**	**$1,291.4**	**$1,100.2**	*0.6%*
Plus: Depreciation & Amortization	273.4	229.7	226.8	209.6	174.4	132.4	94.3	80.4	
Less: Capital Expenditures	(365.9)	(307.5)	(303.6)	(280.5)	(233.4)	(177.2)	(126.2)	(107.6)	
Less: Increase in Net Working Capital	152.2	379.3	25.5	149.8	306.0	365.1	330.8	121.4	
Unlevered Free Cash Flow	**$3,802.6**	**$3,447.1**	**$3,054.2**	**$2,948.4**	**$2,634.5**	**$2,132.7**	**$1,590.2**	**$1,194.4**	
WACC									
Discount Period	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	
Discount Factor	0.58	0.54	0.50	0.46	0.43	0.40	0.37	0.34	
Present Value of Free Cash Flow	**2,190.05**	**1,844.50**	**1,518.35**	**1,361.79**	**1,130.50**	**850.26**	**589.03**	**411.03**	

Discounted cash flows from the current portfolio, Source: Bloomberg (historical) and Author's analysis (projected).

A.3. THE PIPELINE

NUSINERSEN

In-Process reseacrh and development **WACC** **7.63%**

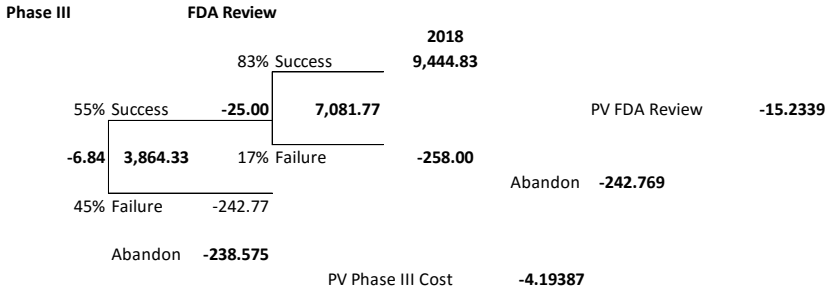
Nursinersen **Actual Phase**

Cost Inputs

Development Phase	Cost per Phase	Yeasr Remaninng	
Phase I	30		1.65
Phase II	45		2.53
Phase III	210	0.083333333	2.56
FDA Review	25	1.333333333	1.33
Phase IV	2		

According to duke edu brief report on recent trends, for drugs experiencing new generic competition, patent usually takes 12.6 years and revenue decline 16% in the first year.

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Exp. CF				417.00	772.90	1,237.00	983.75	1,164.11	1,366.00	1,503.00	1,487.97	1,473.09	1,458.36	1,443.78	1,262.52	796.60	502.62	317.13	144.38
Pv				387.42	667.15	992.02	732.97	805.83	878.52	898.07	826.03	759.77	698.82	642.76	522.20	306.12	179.45	105.19	44.49



Real Option Valuation of Nusinersen. Source: Author's analysis.

ADUCANUMAB

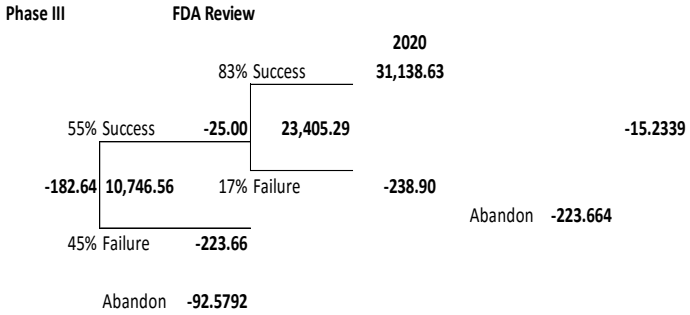
In-Process reseacrh and development

Aducanumab **Actual Phase**

Cost Inputs

Development Phase	Cost per Phase	Yeasr Remaninng	
Phase I	30		1.65
Phase II	45		2.53
Phase III	210	2.225	2.56
FDA Review	25	1.333333333	1.33
Phase IV	2		

Exp. CF	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Pv						287.14	892.00	1,998.00	2,671.00	3,570.69	4,773.43	6,381.30	6,317.49	6,254.31	6,191.77	6,129.85	5,149.07	3,248.85	2,049.88	1,293.39	612.99
						266.77	769.95	1,602.31	1,990.10	2,471.74	3,069.95	3,812.94	3,507.08	3,225.75	2,966.99	2,728.99	2,129.76	1,248.48	731.87	429.02	188.91



Real Option Valuation of Aducanumab. Source: Author's analysis.

A.4. CALCULATING THE PRESENT VALUE OF A FDA APPROVED NME PATENT AT Y0

Revenue	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Tysabri	3.1	4.6	35.8	229.9	588.6	776	900.2	1079.5	1135.9	1526.5	1959.5
Tecfidera										876.1	2909.2
Plegridy											44.5
Costs											
COGS as % sales	15%	15%	10%	11%	10%	9%	8%	9%	10%	12%	12%
SG&A as % sales	27%	27%	26%	24%	23%	21%	29%	22%	23%	24%	22%
Other Op. Expense as % sales	5%	5%	6%	6%	1%	0%	0%	0%	0%	0%	0%
Gross	53.03%	52.49%	57.95%	59.20%	66.38%	70.46%	62.85%	68.74%	67.27%	63.30%	65.50%
Cash Flows excl. R&D & Tax											
Tysabri	1.643918799	2.414549	20.74471	136.0976	390.695	546.7493	565.8177	742.0867	764.104	966.2213	1283.473
Tecfidera										554.5408	1905.526
Plegridy											29.14751

Revenue	FY 2015	Est 2016	Est 2017	Est 2018	Est 2019	Est 2020	Est 2021	Est 2022	Est 2023	Est 2024	Est 2025
Tysabri	1886.1	1839.08811	1544.834	974.7244	615.0095	388.0448	183.9088	0	0	0	0
Tecfidera	3638.4	4123.52	4490.055	4756.132	3995.151	2520.77	1590.498	1003.537	475.6132	0	0
Plegridy	338.5	862.1996972	1304.272	1453.576	1520.246	1548.302	1559.798	1564.459	1566.339	1567.097	1567.402
Costs											
COGS as % sales	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%
SG&A as % sales	21%	20.88%	20.88%	20.88%	20.88%	20.88%	20.88%	20.88%	20.88%	20.88%	20.88%
Other Op. Expense as % sales	0%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Gross	67.69%	67.56%	67.57%	67.57%	67.57%	67.57%	67.57%	67.57%	67.57%	67.57%	67.57%
Cash Flows excl. R&D & Tax											
Tysabri	1276.761	1242.509441	1043.823	658.6032	415.5507	262.1948	124.2638	0	0	0	0
Tecfidera	2462.949	2785.89835	3033.867	3213.631	2699.451	1703.238	1074.671	678.0714	321.3632	0	0
Plegridy	229.1414	582.5122017	881.2785	982.1541	1027.202	1046.159	1053.927	1057.076	1058.347	1058.859	1059.065

	Value of Patent before tax at Y0	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014
Tysabri	4,755.17	1.527321723	2.084185	16.63634	101.403	270.451	351.6327	338.0864	411.9609	394.0978	462.9971	571.3977
Tecfidera	13,958.60										515.2092	1644.808
Plegridy	6,620.05											27.08018
Discount using WACC	7.6%											

	FY 2015	Est 2016	Est 2017	Est 2018	Est 2019	Est 2020	Est 2021	Est 2022	Est 2023	Est 2024	Est 2025
Tysabri	528.0945	477.4763533	372.6739	218.4622	128.0639	75.0718	33.0558	0	0	0	0
Tecfidera	1975.176	2075.706447	2100.136	2066.793	1612.971	945.5331	554.2771	324.9205	143.0698	0	0
Plegridy	197.7898	467.1491122	656.6196	679.8772	660.6281	625.0992	585.0756	545.2024	507.1422	471.4004	438.0509
Discount using WACC											

Valuation of the patents is before tax and and R&D expenses are deducted, these costs are deducted in figure _ of the section entitled 'Valuation of the R&D Department'

Source: Historic drug revenues are taken from Bloomberg, estimated drug revenue are from our own analysis as calculated in the section entitled 'Valuation of the Current Portfolio'

A.5. WACC

WACC Calculation	
Target Capital Structure	
Debt-to-Total Capitalization	10.6%
Equity-to-Total Capitalization	89.4%
Cost of Debt	
Cost of Debt	1.5%
Tax Rate	24.4%
After-tax Cost of Debt	**1.1%**
Cost of Equity	
Risk-free Rate[1]	1.16%
Market Risk Premium[2]	7.89%
Levered Beta	0.92
Size Premium[3]	- %
Cost of Equity	**8.4%**
WACC	**7.6%**

Source: Author's analysis.

WACC	FY 2011 31/12/2011	FY 2012 31/12/2012	FY 2013 31/12/2013	FY 2014 31/12/2014	FY 2015 31/12/2015
Equity					
Cost of Equity	9.1%	10.1%	10.5%	9.9%	9.3%
Weight of Equity	96.2%	96.8%	99.1%	99.3%	91.1%
+ Debt					
Cost of Debt	1.9%	1.2%	3.0%	2.2%	2.3%
Weight of Debt	3.8%	3.2%	0.9%	0.7%	8.9%
+ Preferred Equity					
Cost of Pref Equity	--	--	--	--	--
Weight of Pref Equity	0.0%	0.0%	0.0%	0.0%	0.0%
WACC	**8.8%**	**9.8%**	**10.4%**	**9.9%**	**8.6%**

Source: Bloomberg

APPENDIX B RESEARCH & DEVELOPMENT

R&D PRODUCTIVITY RANKING

Rank		Company	Economic Returns to R&D Spending*	Patents / $1M R&D spend*	Average Relative Quality of Innovation*	Average Rank (by share of innovation) in Target Research Areas	Internal Bias Index
1		Bristol-Myers Squibb	1.50%	0.22	1.2	1.9	23
2		Celgene	32.30%	0.23	1.5	8.4	98
3		Vertex	-125.40%	0.81	2.4	4.2	53
4		Gilead	20.80%	0.16	1.1	6.4	185
5		Allergan	8.00%	0.46	1.4	8.1	96
5		Roche	7.70%	0.09	0.9	2	24
7		Amgen	9.40%	0.09	1.1	5.3	58
8		Johnson & Johnson	8.20%	0.07	1	4.8	34
9		Novo Nordisk	17.50%	0.11	1.7	10.8	439
9		AbbVie	11.10%	0.12	1	9.4	54
9		Pfizer	-3.20%	0.11	0.9	2.5	24
12		AstraZeneca	3.90%	0.1	1	7.1	43
12		Biogen Idec	9.10%	0.13	1.1	13.1	155
12		Shire	18.60%	0.11	1.4	15.4	338
15		Sanofi	1.50%	0.09	0.9	4.2	28
16		Merck	3.00%	0.08	0.9	5.4	35
17		GlaxoSmithKline	1.00%	0.09	1	6	36
18		Novartis	8.40%	0.05	0.7	5.3	37
19		Regeneron	8.30%	0.16	0.7	13.7	638
20		Bayer	-2.10%	0.07	0.9	10.3	82
21		Eli Lilly	4.50%	0.05	0.8	11.7	131
22		Alexion	12.80%	0.03	0.4	21.4	8,012
		*Sources: Bloomberg; AcclaimIP; SSR Health Hidden Pipeline Analysis and assumptions. *Rolling 5-year average.*					
		MARKET AVERAGE	**2.59%**	**0.16**	**1.09**	**8.06**	**482.86**

IMPORTANT DISCLOSURE

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