18/04/18


Yale SCHOOL OF MANAGEMENT

# Gilead Sciences, Inc. Valuation

## Recommendation: **BUY**

- Using APV we calculated an EV of **$137.38 billion** compared with a market cap **$98.68 billion**.
- We used a 3-stage process to come up with our valuation:
  - Current drug portfolio - **$106.71 bn**
  - Pipeline - **$18.34 bn**
  - R&D Dept - **$12.33 bn**
- Combining the above, we believe the company is undervalued by **39%**.

## Gilead [GILD]

| As of 18/04/2018 | |
|---|---|
| Latest Price | 75.42 |
| 52week High | 89.54 |
| 52week Low | 63.759 |
| P/E | 9.44 |
| EPS (Trailing 12M) | 7.92 |
| Dividend Yield | 3.05% |
| Market Cap | 98.68 Billion |
| Enterprise Value | 104.77 Billion |

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# Table of Contents

## Gilead Overview

Gilead Sciences Inc. is one of the world's largest biopharmaceutical companies that discovers, develops and commercialises innovative medicines in areas of unmet medical needs (Gilead.com, 2018). Gilead's primary areas of focus include:

- HIV/AIDS
- Liver Diseases
- Cancer
- Inflammatory & Respiratory Diseases
- Cardiovascular Conditions

Gilead currently has 22 marketed products and with a strong R&D pipeline, this number will continue to rise. Gilead had over 165 active clinical studies at the end of 2016 and currently has over 30 products in their dense pipeline.

Although 65% of Gilead's revenue comes from the US, they have operations worldwide in over 30 countries, including a significant European presence where 20% of their revenues come from. As well as the US and Europe, Gilead's products are also on shelves in Asia, South America, Australia and New Zealand. Their products are primarily distributed by wholesalers that include McKesson, AmerisourceBergen and Cardinal Health, among others.

Gilead further diversifies by actively seeking acquisitions. Gilead recently completed their biggest acquisition in October 2017, purchasing Kite Pharma for approximately $11.9 billion. Gilead has left the door open for future acquisitions which is something that we will discuss in this report and include in our valuation.

## Gilead's Growth Drivers

Growth in a biotechnology company revolves around patents. In a sense, it is extremely simplistic as you are accounting for your current portfolio of patents and that of future potential patents. If you have a patent on a useful drug, you may virtually take control of that specific market in which the drug is operating until patent expiry. The patent guarantees you will not face any direct competition as nobody will be able to produce the exact same drug as you until the expiration, allowing you to make large sales over this period. However, upon expiration of a patent, a company will face a lot of competition from cheaper generic drugs and ultimately stand not to make the gains they had previously been making; a phenomenon called the *patent cliff*.

The second main growth driver is the product pipeline. Aside from producing drugs that have already been approved, Gilead also directs vast resources into the creation of new drugs through R&D expenditure. Gilead disclose drugs they currently have in the pipeline and what phase each of them are in, giving us an indication of their approval proximity by the FDA which we will discuss further in our valuation of drugs awaiting FDA approval and drugs at other phases of development.

### Patent Cliff

The patent cliff occurs when a current company patent expires, allowing other companies to make generic forms of the previously patented drug. Since the 1990s this has become a major issue as the speed at which generics can take control of the market with their cheaper versions of the same drug has accelerated greatly (Aitken et al., 2013). According to Glazier, Fezza and Reynolds (2016), upon the loss of exclusivity, brand unit sales (on average) will dip by 16% within the space of one year. After a patent expires, generics swoop in and acquire (on average) between 80%-90% of total drug sales (Marketrealist.com, 2016)

(Renoe, 2017). Although literature and past studies do not give a specific timeframe over which this loss of market share occurs, from our own independent research it seems as though it takes approximately 5 years. For the purposes of the report, we assume that it takes 5 years after the loss of a patent before 80-90% of those drugs sales are depleted. The reason we such a dramatic lose in sales is because on average the cost of the generic drug will be 80-85% lower than the cost of the patented drug (Renoe, 2017). In 2017, generics account for 83% of the entire drug volume in the US. This is illustrated in *figure 1* which displays the decline in volume of branded drug sales as well as the increasing number of generics. We anticipate this margin increasing slightly more to 85% for generic drugs and we foresee the margin stabilizing at this point .

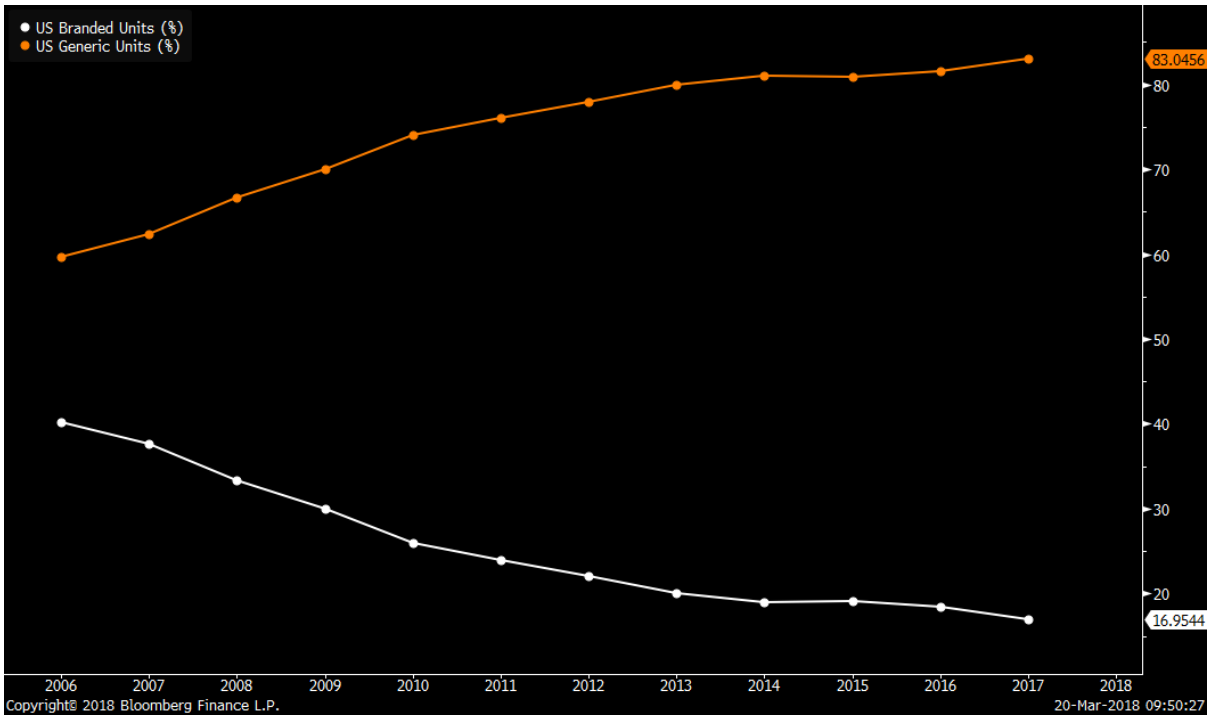


*Figure 1 – US-branded units vs US Generic units – Source - Bloomberg*

# Current Portfolio of Drugs

## Method for Valuation

For the purposes of valuing Gilead's current portfolio of drugs, we refer to the above information to value the drugs after patent expiration. We employ a 16% loss for year 1 and then we are predicting an 85% loss (an average of the loss of 80-90% expected by consensus) in sales by the end of 5 years which is line with the aforementioned margin of generics we predicted above using *figure 1*. It must be noted that this is an average and some drugs may fair better and some worse and could potentially vary the forecast. We can calculate the figure one year after the patent ends and five years after using these figures, and we linearly interpolated the figures in between these two figures to get the middle period (years 2, 3 and 4 after the patent expires). We will then keep a constant figure after year 5 as foresee Gilead keeping some small market share with each drug.

So for example if the patent expires in 2018, we forecast as follows;

$$2018\ sales = \ 2017\ sales + (2017\ sales * -16\%)$$

$$2022\ sales = 2017\ sales + (2017\ sales * -85\%)$$

Then, we simply interpolate 2019, 2020 and 2021 using the forecasted 2018 and 2022 figures (note: this was the pattern for most of the drug forecasting however some drugs followed a slightly different individualised forecast if we felt this pattern would not apply, so please read *'Reveneus – Each individual Drug'* to get a more in depth breakdown of each drug individually). We also accounted for the fact that sometimes patents expired at differed times in the US and EU and so we account for this by following the same formula but just accounted for each patent expiration by weighting them as US=76% and EU=24%. The theory behind using 76% and 24% was that 65% of Gilead's revenues came from the US and 20% from Europe, with remaining 15% coming from other. Getting rid of the 15% other because there is no patent to cover this portion (only US and EU patents) gave us our 76%

and 24% figures. These weights were only needed when the patents expired in different years.

## Valuation of Current Portfolio of Drugs

With the aid of the above information, we calculated the revenues of each individual drug. Each individual drug underwent different life cycles depending on its circumstances. For more information and clarity on how each individual drug revenue was calculated, please refer to the Appendix (particularly pages 29-38 where an in depth detail of how each drug was calculated.). *Figure 2* is an illustrated version of the forecast revenues for the current portfolio of drugs ONLY.

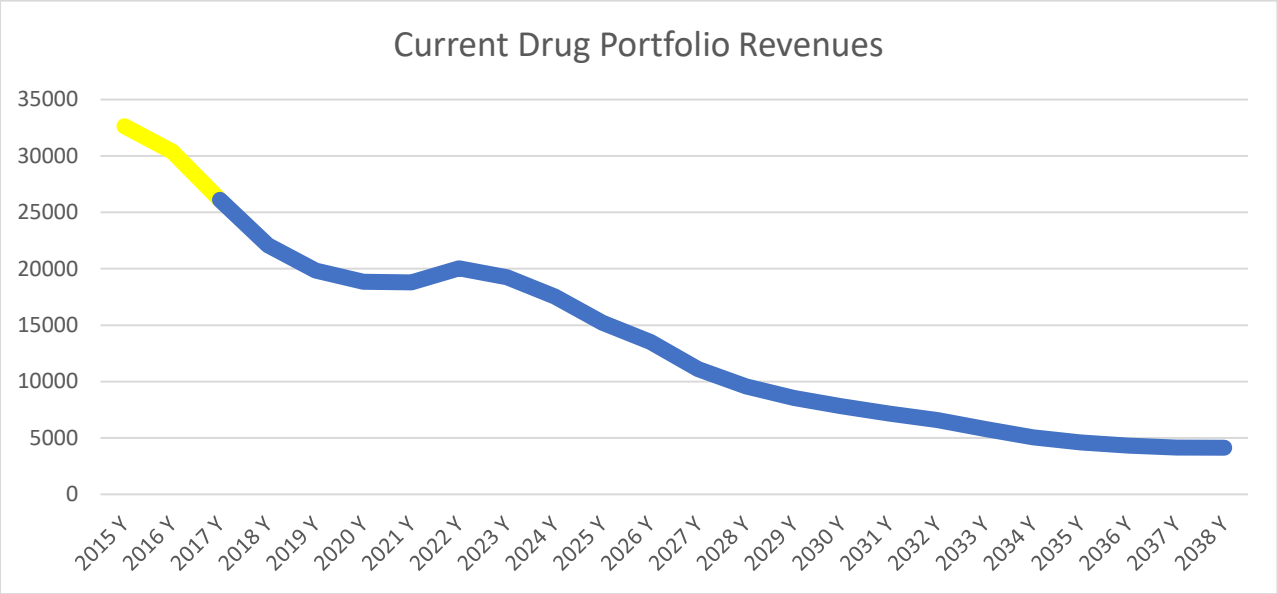


*Figure 2 - Revenues for the Current Drug Portfolio*

## Cost of Goods Sold

After calculating these revenues, we made a few other assumptions to complete our DCF. Since biotech companies tend not to have much fluctuation in their margins, we were able to keep most margins constant (Basu et al., 2008). We noticed that COGS (cost of goods

sold) consistently grew at the same rate as revenue. The correlation between revenue and COGS was 0.95 over the last 7 years and we saw no reason for this to change so we used the changing revenue figure to predict COGS.

### Selling General & Administrative Expenses

As Basu et al., (2008) outlined, SG&A tend to remain as a constant percentage of revenue and there has been a 0.96 correlation between the two variables over the past 7 years. We envisage no change in this pattern in the near future and so forecast SG&A in line with sales

### Depreciation & Amortization

We found a high R-squared (0.54) when we regressed the year-on-year change of depreciation & amortisation against the year-on-year change in sales (regression results illustrated in appendix). Using the coefficient from this regression (~0.03) which was significant at a 95% confidence interval (P-value = 0.0038), we were able to forecast our depreciation & amortisation using the following formula:

$$D\&A\ Last\ year + ((Present\ sales - Prior\ year\ sales) * 0.0300147392873134)$$

Given the lack of available information in this area, as well as information from the Basu et al., (2008) paper stating that it is a common property of a biotech firm to have margins consistent with revenues, we believe using this method will give us the most accurate forecast for depreciation & amortisation.

## Capital Expenditures

We found a high R-squared (0.52) when we regressed the year on year change of CapEx against the year on year change in sales (regression results illustrated in appendix). Using the coefficient from this regression (~0.027) which was significant at a 95% confidence interval (P-value = 0.0045), we were able to forecast our depreciation & amortisation using the following formula:

$$CapEx\ Last\ year + ((Present\ sales - Prior\ year\ sales) * 0.0270210167817669)$$

Given the lack of available information in this area, as well as information from the Basu et al., (2008) paper stating that it is a common property of a biotech firm to have margins consistent with revenues, we believe using this method will give us the most accurate forecast for CapEx.

## Working Capital

To forecast increase in net working capital, we examined the historical ratio of both current assets to sales and current liabilities to sales. We noticed that these ratios remained relatively stable so we got the average ratio for both current assets to sales and current liabilities to sales over the last 8 years and used that ratio to predict future current assets and current liabilities. Subtracting the forecasted current assets and current liabilities figures allowed us to get the change in net working capital figures going forward.

## Terminal Growth Rate

We predicted a terminal value halfway between predicted US GDP and predicated inflation which led us to our 2.47% figure. We extracted predicted inflation using statista.com (2018) and predicted US GDP using OECD data on knoema.com (2018). Due of the fact that the last of our patents expires in 2034, the last year of negative growth will be

2038. We expect that Gilead will keep a small percentage of each the market but have lost 85% of sales to generics as well as other competitors (as aforementioned in our earlier assumptions). If it was purely to stabilise, we would be utilising a terminal growth matching that of predicted inflation. However, given Gilead's past dominance we expect it may grow that market share very marginally and hence we predict a terminal growth rate which is slightly greater than predicted inflation.

## Enterprise Value using APV

Our assumptions used for the risk-free rate, market premium, beta and tax are all outlined in the appendix. We employed APV (adjusted present value) to discount our cash flows and that assumptions made to allows APV's usage are also outlined in the appendix. Based on the same, we derived an EV for the current drug portfolio of **$106.706 bn** as illustrated in *table 1*.

| | |
|---|---|
| EBIAT 2018 | 10,868 |
| Terminal Growth Rate | 2.47% |
| Cost of Equity | 8.18% |
| PV of FCF | 88,093 |
| PV of TV | 8,082 |
| **Enterprise Value** | **96,175** |
| | |
| **Total Debt** | **33,542** |
| | |
| Risk Free Rate | 1.90% |
| Interest on Debt | 637 |
| Tax Rate | 22.0% |
| Tax Shield | 140 |
| PV of Tax Shield | 7,379 |
| Plus: Cash & CE | 36,694 |
| Less: Total Debt | - 33,542 |
| | |
| **Equity Value of Current Drug Portfolio** | **106,706** |

*Table 1 - EV of Current Drug Portfolio using APV*

## Product Pipeline

We have structured our pipeline valuation into two segments that we will outline in turn:

- Drugs that are currently at phase III of development
- Drugs that are at each of phases I and II

Revenues for each of the above are forecasted into the future and discounted back to the present using a cost of equity of 8.18%. We then applied an estimated future EBIT margin of 46.43% (an average of the expected EBIT margin over the next five years) before introducing the previously outlined tax rate of 22% giving what we believe to be a fair estimate of the present value of future cash flows.

The following probabilities of reaching the market have been applied to the number of drugs at each respective stage of development:

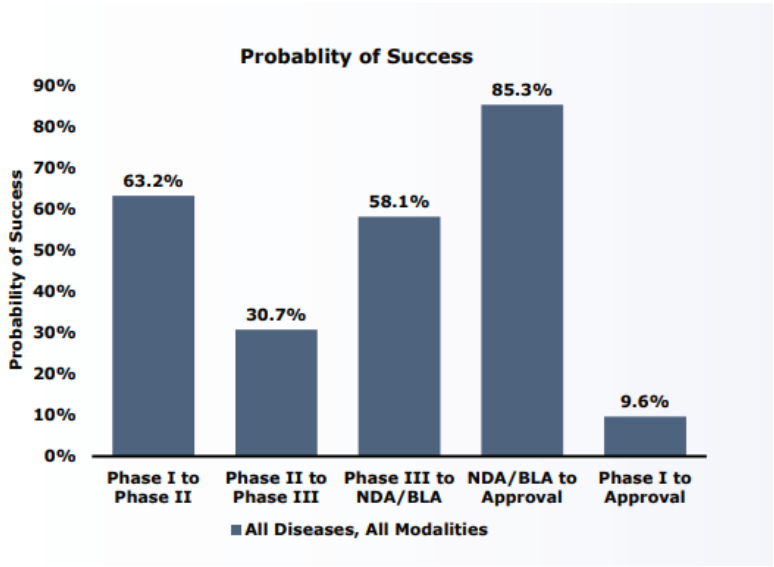


*Figure 3 – Probability of Success per Phase – source: Biotechnology Innovation Organisation, 2015*

## 1. Phase III of Development

Gilead has three 'new' drugs at phase III of development at the time of writing (Filgotnib is in phase III across three indications as will be outlined. Idelalisib is the chemical name for Zydelig, which is already in the company's current portfolio and is under evaluation for an additional indication. Descovy is also already on the market and being evaluated for a further indication). The average time spent between phase III, regulatory approval and reaching the market is 46.7 months (TUFTS, 2014) and the probability of progressing beyond the final stage of development is 49.6% (Biotechnology Innovation Organisation, 2015), both of which have been incorporated into our cash flow projections for each of the following drugs (see appendix):

**Selonsertib** – Selonsertib is an investigational small molecule inhibitor of ASK1 (a protein that promotes inflammation), apoptosis (cell death) and fibrosis in settings of oxidative stress. Oxidative stress can be increased in many pathological conditions including liver diseases such as NASH (nonalcoholic steatohepatitis) (Nash Biotechs, 2018). Gilead acquired Selonsertib from Nimbus Therapeutics for $1.2 billion in 2016 and is currently on fast-track status with the SEC with an estimated time to market of 29 months. Gilead is evaluating Selonsertib in combination with two other NASH medicines in its pipeline - FXR agonist GS-9674 and ACC inhibitor GS-0976.

It is forecasted that NASH could become the leading driver of liver transplants by 2020 and the eventual market for disease is estimated to be between $20bn and $35bn and there are no approved treatments on the market for the same (Berkrot, 2017) (Adams, 2017).

There are circa 16 million Americans diagnosed with NASH, with 1-3 million of those with NASH that has progressed to cirrhosis (late stage of scarring (fibrosis) of the liver caused by many forms of liver diseases and conditions, such as hepatitis and chronic alcoholism) (Jarvis, 2016).

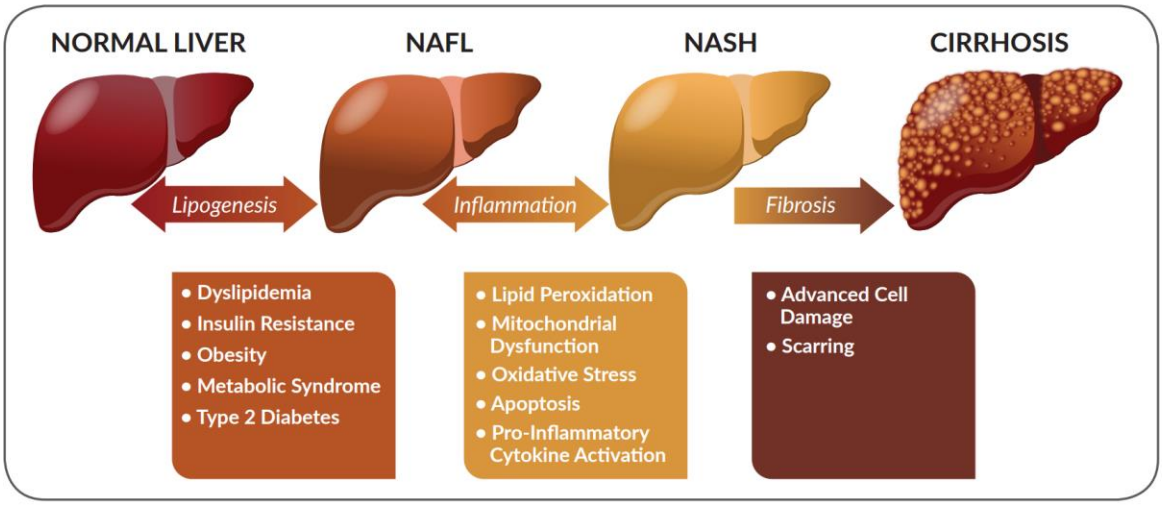


*Figure 4 – Source; https://www.caymanchem.com/news/research-tools-for-fatty-liver-diseases*

We focused on those patients with cirrhosis as they are more likely to seek treatment, resulting in a patient population of 2 million. As Gilead is a frontrunner to have Selonsertib reach the market before/alongside their competitors, we feel it is conservative and reasonable to assume they will treat 10% of cirrhosis sufferers, which is 200,000 patients. Our model uses an annual price of treatment of $14,300 in line with the estimated annual cost of PCSK9 inhibitors treatment (Arrieta, Hong, Khera et al, 2017). Intercept Pharmaceuticals' obeticholic acid (OCA - a PCSK9 inhibitor) is currently at phase III in evaluation for the treatment of NASH patients and there is no cost information for ASK1 treatment so we believe this price an appropriate benchmark. Using the above, we have calculated peak revenues of $2.86bn (i.e. seven years after the product's introduction to the market in 2020. We applied this approach for each of the individually-valued drugs and we will not be stating the same from hereon in order to avoid repetition (Mendonca & Treacy, 2016)), which seems reasonable in light of the $25-40bn potential market value and assuming a 10% market share. Finally, we employed a CAGR of 46.1% which is the expected expansion rate of the NASH market between 2017 and 2025 (Business Wire, 2018) to discount from expected peak sales in 2026 to derive sales for the preceding years.

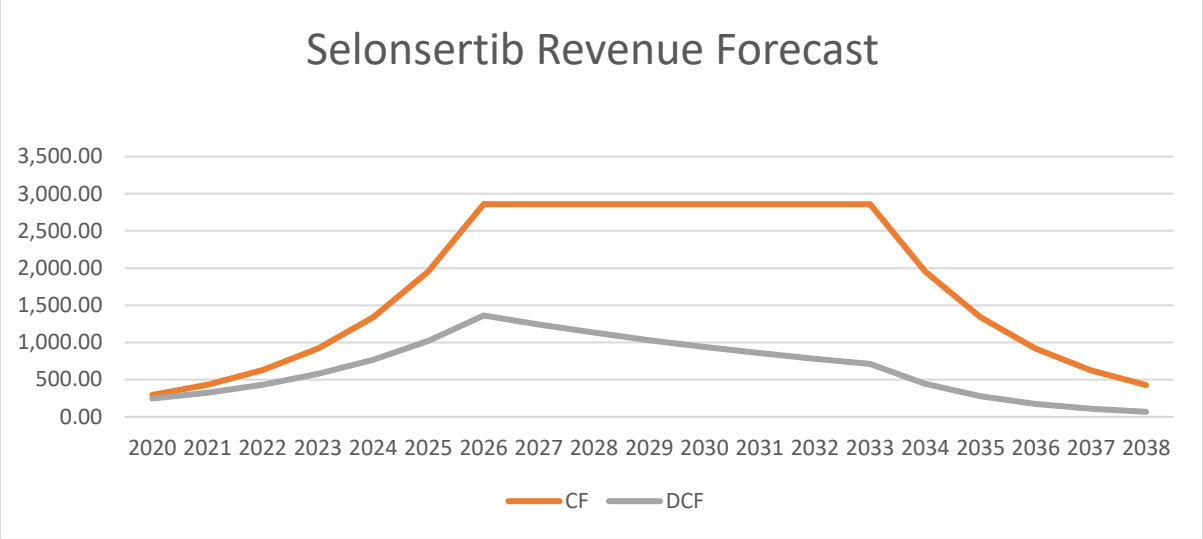


*Figure 5 – Selonsertib Revenue forecast*

**Filgotinib** – Filgotinib is a Janus kinase (JAK) inhibitor that functions by inhibiting the activity of the JAK1 enzyme. The drug was developed by Galapagos NV who hold a global collaboration agreement with Gilead to develop and commercialise the drug for the treatment of inflammatory indications. The drug is currently being investigated for its potential use in the treatment of rheumatoid arthritis, Crohn's disease and ulcerative colitis. The drug is widely regarded as a potential blockbuster and has illustrating a best-in-class safety profile to date within the JAK1 class, currently registering both low rates of infection and cardiovascular events relative to tofacitinib, upadacitinib, baricitinib and the IL and anti-TNF classes (Leone, 2017). This offers a relative unique selling point versus competition which we believe will allow the drug to prosper in time.

We have estimated that Filgotinib will achieve peak sales of $2bn in 2027. This is based on a historical analysis of similar drugs and using a 12.97% CAGR in line with that of AbbVie's Humira CAGR (Statista, 2018), a market leader in rheumatoid arthritis medication. We assume sales will remain at a constant level from thereon until the patent expires in 2030 on all 3 indications where generic competition, among other factors, are expected to cause a

reduction in revenue with sales eventually bottoming out at 15% of peak revenues (reasoning outlined previously) that we are predicting to occur perpetually.

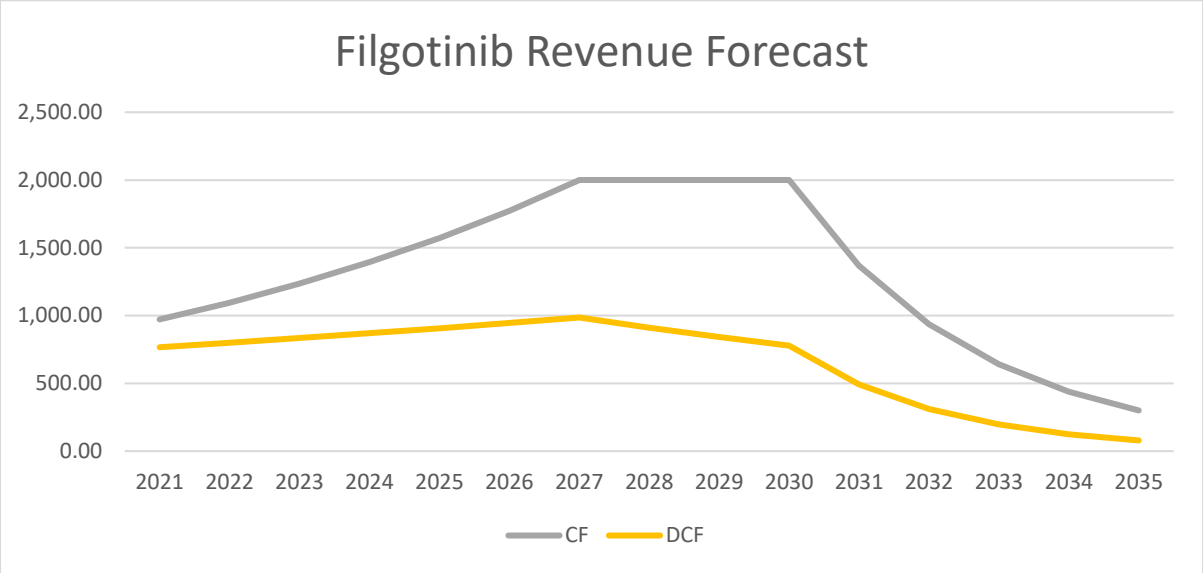


*Figure 6 – Filgotinib Revenue forecast*

**Andecaliximab** – The drug is an MMP9 mAb inhibitor and is being evaluated for the treatment of gastric cancer or gastroesophageal junction adenocarcinoma.

We modelled the drug's revenue based on that of Herceptin (trastuzumab) which is primarily used in the treatment of breast cancer but has also been applied in recent years in gastric cancer treatments. Stomach cancer occurs 56.77% as much as breast cancer and we adjusted our estimated revenues for the drug by the same factor (World Cancer Research Fund, 2012). We expect revenue to grow at a CAGR of 32.46% until peak sales of $919.73m are achieved in 2026 and maintained until 2031 at which point the patent on the drug expires where revenues are expected to decrease to 15% of peak sales over 5 years.

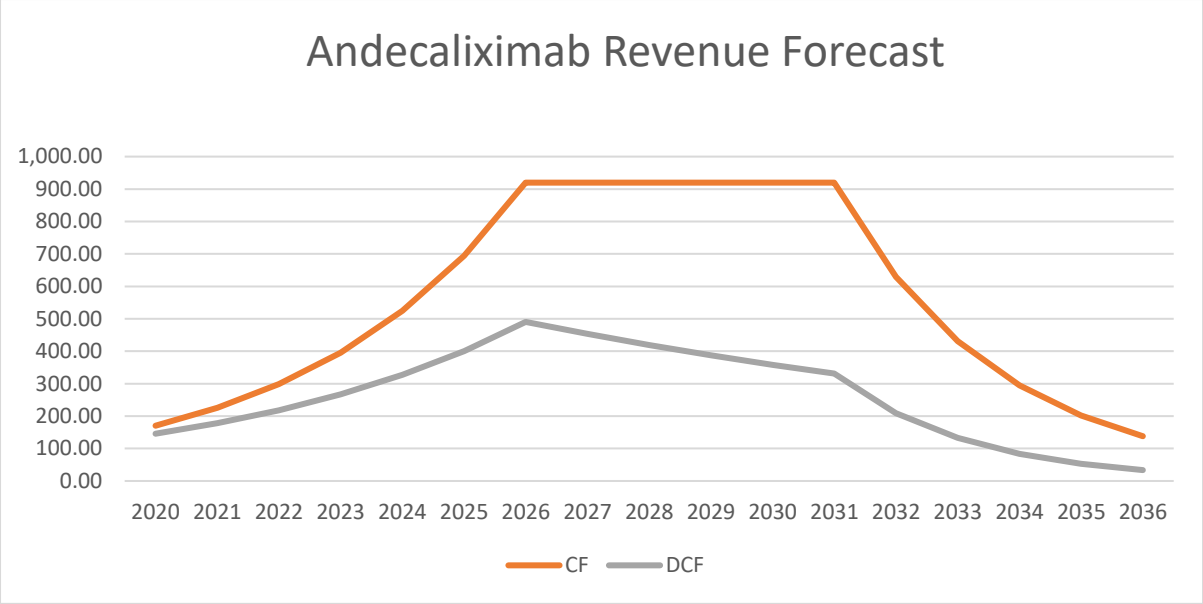


*Figure 7 – Andecaliximab Revenue forecast*

**Summary of PV of Forecasted Revenues for Phase III Products**

| PV of Forecasted Revenue for Phase III Products | Provisional | Due to Partner | Final $m |
|---|---|---|---|
| Selonsertib | 14,277.81 | 0% | 14,277.81 |
| Filgotinib (JAK1 inhibitor) | 11,734.26 | 25% | 8,800.69 |
| Andecaliximab | 5,356.64 | 0% | 5,356.64 |
| **Predicted PV of Revenues** | | | 28,435.14 |
| | | | |
| Probability of reaching market | | | 49.56% |
| **Effective PV of Phase III Revenues** | | | 14,092.45 |

Note - Discounting already applied within spreadsheets for each of the above-mentioned drugs

*Table 2 – Forecast Revenues for phase 3 products*

## 2. Phases I & II Valuation

Gilead currently has 17 different drugs (some drugs cover more than one indication) in phases I and II of development. Due to the difficulty of breaking out potential cash flows for each drug due to the lack of availability of specific revenue information, we derived an average revenue per drug figure of $1,414.42m per annum based on the amount of drugs that were contained in the company's current portfolio in a given year.

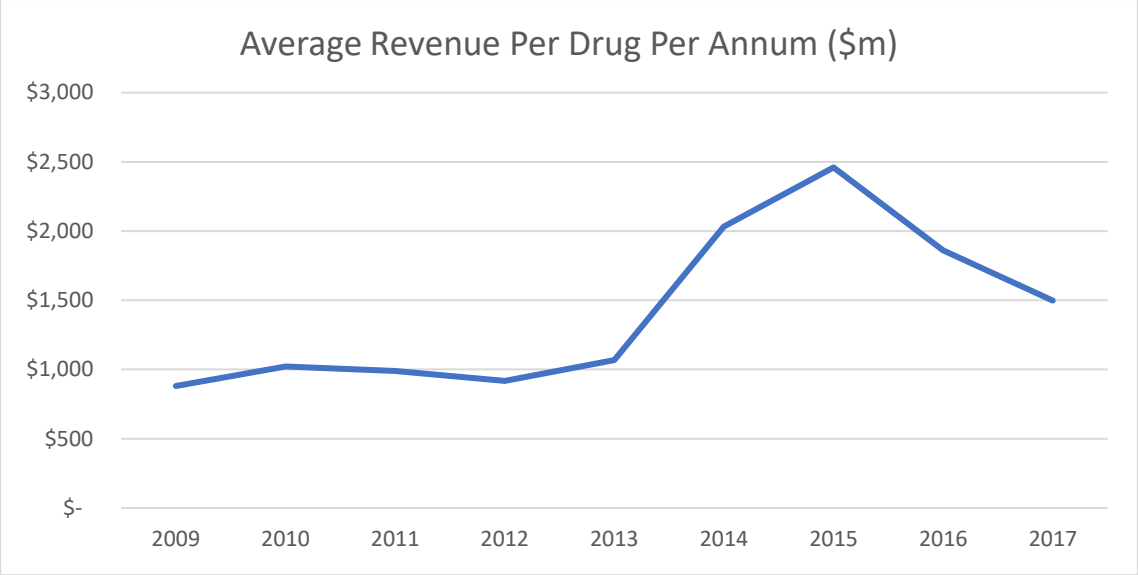


*Figure 8 – Average Revenue Per Drug Per annum*

| Description | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|---|
| Harvoni | - | - | - | - | - | 2,127 | 13,864 | 9,081 | 4,370 |
| Epclusa | - | - | - | - | - | - | - | 1,752 | 3,510 |
| Sovaldi | - | - | - | - | 139 | 10,283 | 5,276 | 4,001 | 964 |
| Vosevi | - | - | - | - | - | - | - | - | 293 |
| Genvoya | - | - | - | - | - | - | 45 | 1,484 | 3,674 |
| Truvada | 2,489 | 2,649 | 2,865 | 3,181 | 3,136 | 3,340 | 3,459 | 3,566 | 3,134 |
| Atripla | 2,382 | 2,926 | 3,224 | 2,574 | 3,648 | 3,470 | 3,134 | 2,605 | 1,806 |
| Descovy | - | - | - | - | - | - | - | 298 | 1,218 |
| Odefsey | - | - | - | - | - | - | - | 329 | 1,106 |
| Stribild | - | - | - | 58 | 539 | 1,197 | 1,825 | 1,914 | 1,053 |
| Viread | 667 | 732 | 737 | 849 | 959 | 1,058 | 1,108 | 1,186 | 1,046 |
| Complera/Eviplera | - | - | 38 | 342 | 810 | 1,228 | 1,427 | 1,457 | 966 |
| Other | 16 | 67 | 109 | 127 | 141 | 167 | 69 | 72 | 196 |
| Letairis | 184 | 240 | 293 | 410 | 520 | 595 | 700 | 819 | 887 |
| Ranexa | 131 | 239 | 320 | 373 | 449 | 510 | 588 | 677 | 717 |
| AmBisome | 298 | 305 | 330 | 346 | 352 | 388 | 350 | 356 | 366 |
| Zydelig | - | - | - | - | - | 23 | 132 | 168 | 149 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Total Drugs Per Year | 7 | 7 | 8 | 9 | 10 | 12 | 13 | 16 | 17 |
| Total Revenue Per Year | $ 6,167 | $ 7,158 | $ 7,916 | $ 8,260 | $ 10,693 | $ 24,386 | $ 31,977 | $ 29,765 | $ 25,455 |
| Average Rev Per Drug Per Year | $ 881 | $ 1,023 | $ 990 | $ 918 | $ 1,069 | $ 2,032 | $ 2,460 | $ 1,860 | $ 1,497 |
| Average Rev Per Drug '09 - '17 | $ 1,414 | | | | | | | | |

*Table 3- Average Revenue Per Drug Calculation Table*

From there, we calculated terminal revenues using a growing perpetuity formula incorporating cost of equity @ 8.18% and a terminal growth rate of 2.47%. The resultant revenues were subsequently adjusted for the probability of the drugs reaching the market from each respective phase and discounted appropriately based on the average time taken before the drug would be available for sale. Finally, as outlined in the phase III section, we applied operating costs and taxation to derive a final estimate of the present value of the products in phase I & II of development.

| Phase II | $m | |
|---|---|---|
| Average Revenue per Drug | 1,414.42 | |
| Drugs in Phase II | 10 | |
| Total Average Revenue | 14,144.22 | |
| **Predicted Terminal Revenues** | 247,709.68 | |
| **Predicted PV of Terminal Revenues** | 182,412.39 | * |
| Probability of reaching market | 15.20% | |
| **Effective PV of Phase II Revenues** | 27,726.68 | |

*Discounted 77/12 years @ 1+WACC as average time spent in phase II is 30.3 plus 30.7 spent at phase III and a further 16 for FDA approval according to tufts.edu.

*Table 4 – PV of potential Phase 2 Revenues*

| Phase I | $m | |
|---|---|---|
| Average Revenue per Drug | 1,414.42 | |
| Drugs in Phase I | 7 | |
| Total Average Revenue | 9,900.96 | |
| **Predicted Terminal Revenues** | 173,396.78 | |
| **Predicted PV of Terminal Revenues** | 91,957.84 | ** |
| Probability of reaching market | 9.60% | |
| **Effective PV of Phase I Revenues** | 8,827.95 | |

**Discounted 96.8/12 years @ 1+WACC as average time spent in phase I is 16.8 months, phase II is 30.3 plus 30.7 spent at phase III and a further 16 for FDA approval according to tufts.edu.

*Table 5 – PV of potential Phase 1 Revenues*

Combining the effective present value of revenues from both drugs at phase III and those at each of phases I & II, we derived an estimate for the PV of Gilead's product pipeline of **$18.34bn**, as shown below:

| | | $m |
|---|---|---|
| **Effective PV of Phase III Revenues** | | 14,092.45 |
| **Effective PV of Phase II Revenues** | | 27,726.68 |
| **Effective PV of Phase I Revenues** | | 8,827.95 |
| **Estimated Effective PV of All Pipeline Revenues** | | **50,647.09** |
| Estimated Future EBIT Margin | 46.43% | 23,515.44 |
| Tax @ 22% | | (5,173.40) |
| **Estimated PV of Product Pipeline** | | **18,342.05** |

*Table 6 – Estimated PV of product pipeline*

## 3. R&D Department Value

Investment in R&D is essential to allow the company to develop new patents from which it can derive future cash flows beyond those in its currently portfolio and pipeline.

We determined how many drugs have been FDA-approved since 2007 and subsequently divided this figure by the total R&D expenditure between 2007-17, giving us a λ (lambda) of 0.0003890, as shown in the following table:

| Drug | Year | R&D Expense ($m) |
|---|---|---|
| Vosevi | 2017 | $ 3,734 |
| Descovy | 2016 | $ 5,098 |
| | 2015 | $ 3,014 |
| Harvoni | 2014 | $ 2,854 |
| Zydelig | | |
| | 2013 | $ 2,120 |
| Stribild | 2012 | $ 1,760 |
| Complera | 2011 | $ 1,229 |
| Cayston | 2010 | $ 1,073 |
| | 2009 | $ 940 |
| Viread | 2008 | $ 722 |
| Letairis | 2007 | $ 591 |
| Sum R&D | | $ 23,135 |
| Total Drugs | | 9 |
| Lambda (Drugs/SumR&D) 0.00038902444470 | | |

*Table 7 – Lambda calculation*

λ represents the amount of drugs approved per dollar invested in R&D. We then multiplied this figure by forecasted R&D expenditure for the next 10 years, which was forecasted as follows;

To forecast R&D in this section we used our knowledge of the industry to forecast a declining R&D forecast. This is not much of a surprise considering the greater emphasis on M&A. *Figure 9* gives a visual illustration of our point. We can see that R&D departments in both Gilead and the Biotech industry as a whole had been gradually expanding up until 2016. This is when greater emphasis was put into M&A and hence R&D departments have begun to shrink, a trend which we foresee continuing. Gilead's R&D expense shrunk by almost 25% last year as management claim they pumped less money into R&D as a result of impacts of

ongoing milestone payments. We do not see such a rapid decline continuing next year however we believe a similar decline will take place over the duration of our forecast. We suspect roughly another 25% will be lost in R&D expenses as management continues to move towards M&A. We believe this decline is fair as we do foresee a strong shift towards M&A but we still envisage Gilead retaining a relatively strong pipeline which they are renowned for and this will still require a relatively large expense yet a sustainably cut back figure compared with the 2016 number. For our forecast we are anticipating that in 20 years' time (2038), the R&D expense will be half of the 2016 figure (just over 25% less than the 2017 figure). Using this assumption we were able to get the 2038 figure for the R&D expense and simply interpolate the 2018-2037 figures using a CAGR (17-38) of -1.8%.

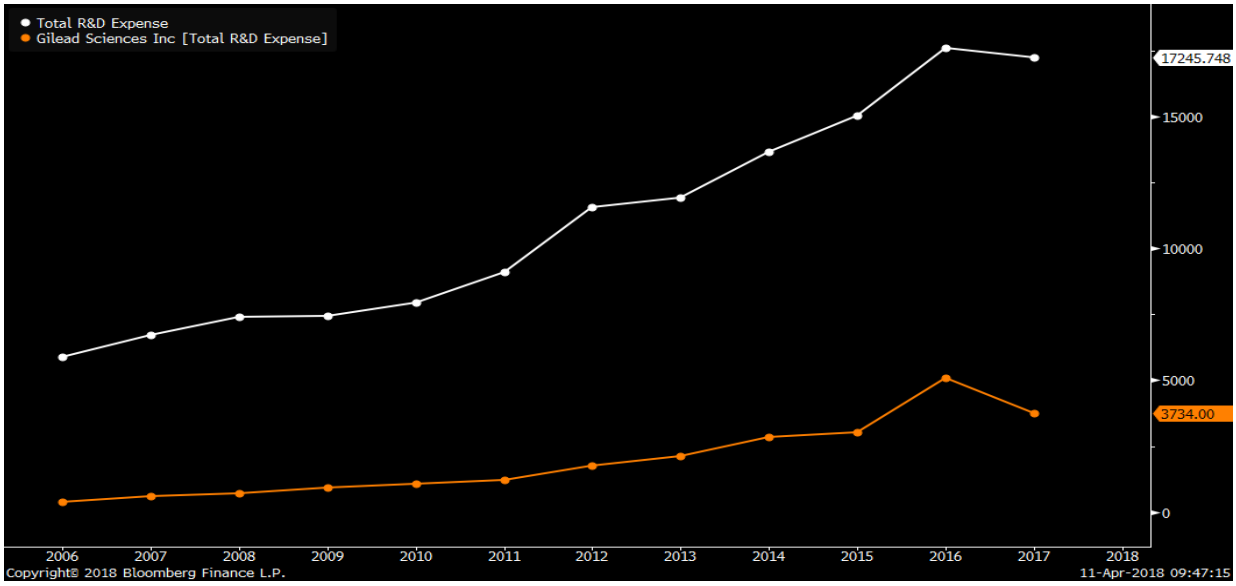


*Figure 9 - R&D Expenses - source:Bloomberg*

Furthermore, we employed a Poisson probability density function to determine the likelihood of having 0-8 drugs FDA-approved in a given year based on R&D expenditure (probabilities for each year summed to 1 at P(8)) and were calculated by applying the formula in *figure 10.* We employed the Poisson PDF as the probability of an FDA approval is completely independent of past approvals and the Poisson PDF assumes the occurrence of one event does not affect the probability that a second event will occur, i.e. approval of more drugs.

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

*Figure 10*

| λ | 0.00038902 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Poisson Probabilities | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 |
| Est R&D Expense | $ 3,666.73 | $ 3,600.67 | $ 3,535.80 | $ 3,472.10 | $ 3,409.55 | $ 3,348.12 | $ 3,287.81 | $ 3,228.57 | $ 3,170.41 | $ 3,113.29 |
| λ*R&D | 1.43 | 1.40 | 1.38 | 1.35 | 1.33 | 1.30 | 1.28 | 1.26 | 1.23 | 1.21 |
| P(0) | 24.02% | 24.64% | 25.27% | 25.91% | 26.54% | 27.19% | 27.83% | 28.48% | 29.13% | 29.79% |
| P(1) | 34.26% | 34.52% | 34.76% | 34.99% | 35.21% | 35.41% | 35.60% | 35.77% | 35.93% | 36.07% |
| P(2) | 24.43% | 24.17% | 23.91% | 23.63% | 23.35% | 23.06% | 22.76% | 22.46% | 22.16% | 21.85% |
| P(3) | 11.62% | 11.29% | 10.96% | 10.64% | 10.32% | 10.01% | 9.71% | 9.40% | 9.11% | 8.82% |
| P(4) | 4.14% | 3.95% | 3.77% | 3.59% | 3.42% | 3.26% | 3.10% | 2.95% | 2.81% | 2.67% |
| P(5) | 1.18% | 1.11% | 1.04% | 0.97% | 0.91% | 0.85% | 0.79% | 0.74% | 0.69% | 0.65% |
| P(6) | 0.28% | 0.26% | 0.24% | 0.22% | 0.20% | 0.18% | 0.17% | 0.16% | 0.14% | 0.13% |
| P(7) | 0.06% | 0.05% | 0.05% | 0.04% | 0.04% | 0.03% | 0.03% | 0.03% | 0.03% | 0.02% |
| P(8) | 0.01% | 0.01% | 0.01% | 0.01% | 0.01% | 0.01% | 0.00% | 0.00% | 0.00% | 0.00% |

*Table 8 – Poisson Probabilities*

Next, we calculated the 'present' value at t0 of the following patents upon FDA approval for the following drugs in Gilead's current portfolio using both realised and projected figures (see appendix for breakdown. t0 is relative to each drug and the year of approval):

- Vosevi
- Descovy
- Harvoni
- Zydelig
- Complera/Eviplera
- Ranexa
- Stribild

| Summary | |
|---|---|
| Patent Value at t0 | |
| Vosevi | $ 652 |
| Descovy | $ 15,642 |
| Harvoni | $ 21,627 |
| Zydelig | $ 982 |
| Complera/Eviplera | $ 4,354 |
| Ranexa | $ 2,710 |
| Stribild | $ 7,915 |
| | |
| **Median** | **$ 4,354** |
| **Mean** | **$ 7,697** |

*Table 9 - Patent value at t0*

From the above, we extracted the median PV (both Harvoni and Descovy are blockbuster drugs that would cause an unrealistic input to our R&D valuation model and the median is more indicative of a true potential patent value. We carried out the same analysis using the average value that is included in table 22 the appendix for reference.) to which we multiplied λ*R&D figures for each of the year 2018-2027. We then subtracted R&D expenditure at each year and then applied tax at 22% before discounting the resultant cash flows using our calculated cost of equity, giving us an estimated PV of the R&D department of **$12.329 bn.**

| Median PV of Patents at t0 | $ 4,353.91 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| λ - 0.000389024 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 |
| λ*R&D | 1.43 | 1.40 | 1.38 | 1.35 | 1.33 | 1.30 | 1.28 | 1.26 | 1.23 | 1.21 |
| Value of Patent | $ 6,211 | $ 6,099 | $ 5,989 | $ 5,881 | $ 5,775 | $ 5,671 | $ 5,569 | $ 5,468 | $ 5,370 | $ 5,273 |
| Less R&D Expense | $ (3,667) | $ (3,601) | $ (3,536) | $ (3,472) | $ (3,410) | $ (3,348) | $ (3,288) | $ (3,229) | $ (3,170) | $ (3,113) |
| | $ 2,544 | $ 2,498 | $ 2,453 | $ 2,409 | $ 2,365 | $ 2,323 | $ 2,281 | $ 2,240 | $ 2,200 | $ 2,160 |
| Tax @ 22% | $ (560) | $ (550) | $ (540) | $ (530) | $ (520) | $ (511) | $ (502) | $ (493) | $ (484) | $ (475) |
| Net Income | $ 1,984 | $ 1,948 | $ 1,913 | $ 1,879 | $ 1,845 | $ 1,812 | $ 1,779 | $ 1,747 | $ 1,716 | $ 1,685 |
| Discount Factor | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| PV @ 8.18% | $ 1,834 | $ 1,665 | $ 1,511 | $ 1,372 | $ 1,245 | $ 1,130 | $ 1,026 | $ 931 | $ 845 | $ 767 |
| | | | | | | | | | | |
| Estimated PV of R&D Dept | $ 12,329 | | | | | | | | | |

*Table 10 – Estimated PV of R&D Department*

## Total Valuation & Conclusion

Combining the EV based on Gilead's current drug portfolio, estimated present value of their drug pipeline and the value of their R&D department, we calculate the PV of Gilead to be **$137.38 billion**. This implies based on our calculations that Gilead is undervalued to the tune of **$38.70 billion** or **39%** and, as such, we recommend a **BUY** on the stock.

We believe that the undervaluation is fair given the following reasons;

1) The company have dominated and will, in our eyes, continue to dominate the HIV/AID's markets with their new drugs like Genvoya, Descovy, Odefsey and Biktarvy taking large market shares.
2) Gilead's pipeline is stronger and deeper than many of its competitors. They have many potential blockbusters in the pipeline and are becoming more diversified than ever before which will see them enabled to capture large market shares in new markets.
3) Gilead harbours a strong R&D department that we believe is certain to continue to produce value-added products to the company's drug portfolio in the future.

## Other Analyst Recommendations

We sought other analysts' recommendations on the stock in order to give the reader a more complete overview of what the general consensus is on Gilead. It is extremely important to note that this had no bearing or influence on our valuation - it is supplementary for the reader. Information on Bloomberg shows that out of analysts covering Gilead, 41.4% recommend a hold, 58.6% state buy and none recommend a sell. This is illustrated in *figure 11*.

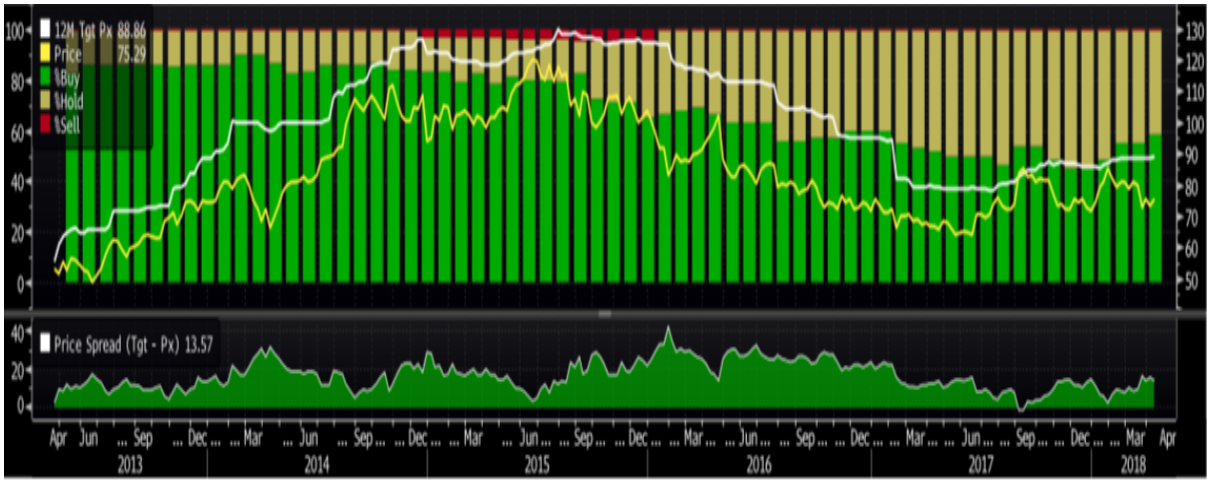


*Figure 11 - Analyst Predictions - source:Bloomberg*

# Appendix – Key Assumptions

## Adjusted Present Value (APV)

In valuing the biotech industry, we used the Adjusted Present Value (APV) rather than the weighted average cost of capital (WACC). The logic behind this was the fact the industry did not have a constant debt to equity ratio. We noticed that total debt had remained relatively constant in recent times. This is indicative of the Biotech industry as a whole. This is illustrated in *figure 12* sourced from Bloomberg which shows debt levels of both Gilead and the entire Biotech industry. You can see that, over the last number of quarters, debt levels have been somewhat stable and foresee this stability continuing. For these two reasons, we believed using APV was a better method and hence assumed a constant amount of outstanding debt in the industry.

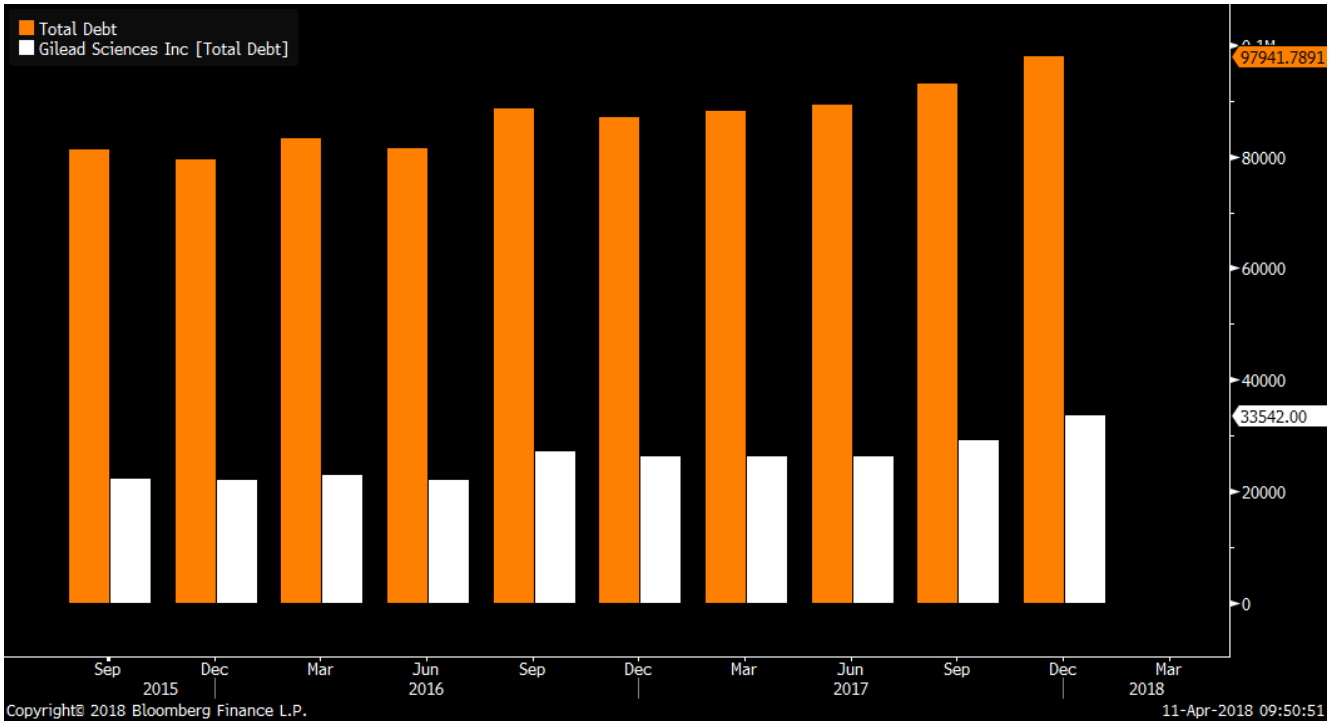


*Figure 12 - Total Debt - source:Bloomberg*

In using APV several formulae are needed. First is that of the Cost of Equity:

$$Cost\ of\ Equity = Rf + \beta(Rm - Rf)$$

From the above, we calculated a cost of equity of 8.18%. Using this cost of equity we acquired to the 'present value' (will be referred to as 'PV') of the free cash flows and PV of the terminal value as shown in the formula below;

$$\sum \frac{Free\ Cash\ Flows}{(1 + Cost\ of\ Equity)^t} + \frac{Terminal\ Value}{(1 + Cost\ of\ Equity)^n}$$

This gave us the PV (all equity) figure of $96175 million. The next step was to calculate t 8 PV of the debt tax shield. This involved calculating the tax shield by:

$$Interest\ on\ debt\ \times\ Tax\ Rate)$$

We then derived the present by simply dividing the tax shield by the risk-free rate. This gave us a figure of $7,379 million. That meant we had all the factors to calculate our APV which is calculated by:

$$APV = PV(All\ equity\ cash\ flows) + PV(Debt\ tax\ shield)$$

## Risk-Free Rate (Rf)

Seeing as Gilead has its headquarters based in the United States we decided to use a 10-year US treasury to get our Rf. The current (as of 18/4/18) 10 year US treasury is 2.9%. Subtracting a historical risk premium (Risk of the US treasury defaulting) of 1% gave us a Rf of 1.9%.

## Market Risk Premium

JP Morgan produced a report on 'The Quest for Market Risk Premium' (2008) in which they used nearly 100 years of data. They calculate an arithmetic historical risk premium of 6.9% which we will use for the purpose of this report (Zenner et al., 2008).

## Beta

We calculated a 60-month rolling beta figure by regressing Gilead's total excess returns against the Fama-French market premium (Rm-Rf) and the result is illustrated in *figure 13*. The Beta has been trending upwards for the past number of years, with the Beta being as high as 1.25 at the start of 2018. We felt that using this figure would give us a beta which would be too high and not indicative of what we felt the future beta would be. We also do foresee the beta going back to the lows it was at between 2013-2015 and we wanted to take into account the fact that Beta has been trending upwards over this entire time period. For this reason we decided the most accurate forecast for our Beta would be to take the average of all values which lie above the Median line, essentially an average of the last two years. This gave us Levered Beta of 1.1514. Because we are using APV, we had to use the Asset (or unlevered) Beta. Using our estimation of the levered beta we were able to calculate an unlevered beta of 0.9102.

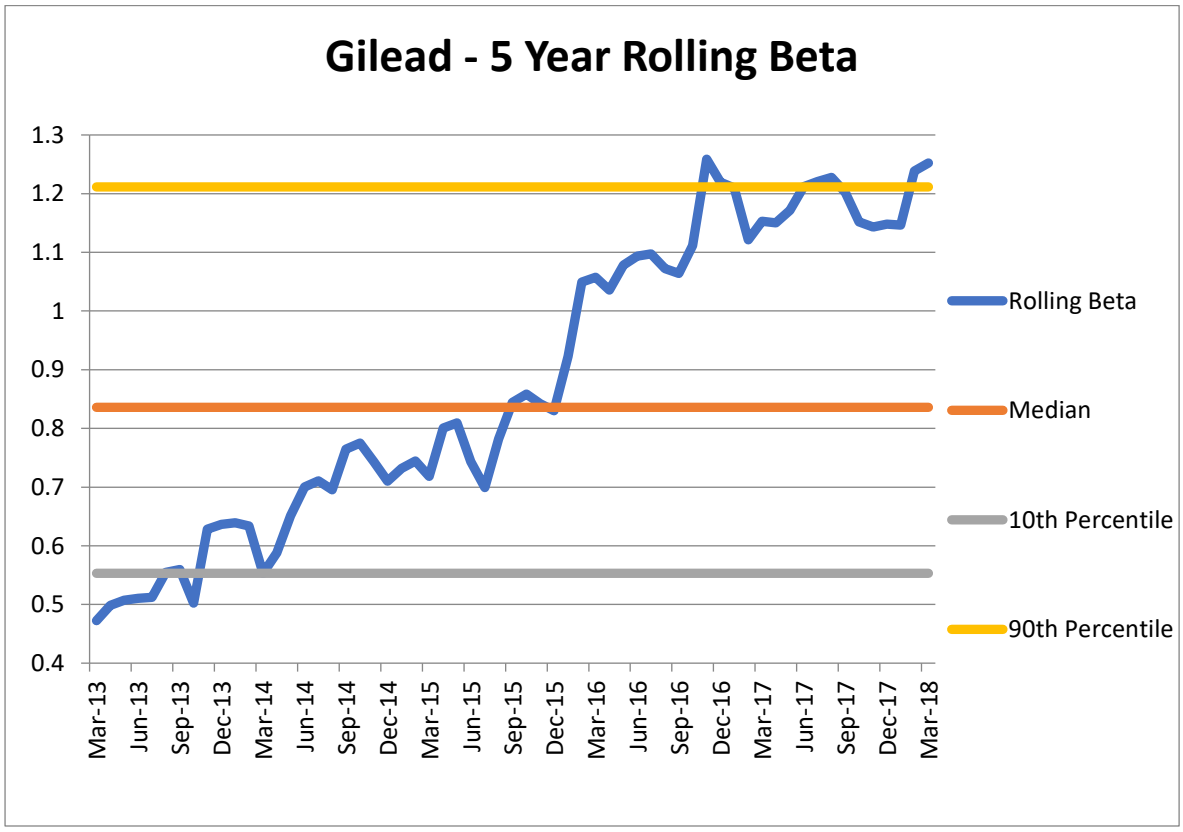


*Figure 13 – 60 month Rolling Beta*

## Tax

The US congress along with support from president Donald Trump, have decided to dramatically decrease corporate tax rates in the United States from 35% to as low as 21% (taxsummaries.pwc.com, 2017). This new corporate tax figure came into action on the 31/12/2017 and so will have an impact on our forecasted figures. Upon listening to the recent earnings calls of companies in our industry, the consensus is that the new tax cuts will have a positive impact. Gilead specifically stated that the new tax rate will increase their financial flexibility while not fundamentally changing their capital allocation priorities (Seeking Alpha, 2018). Gilead also claimed that they expect their effective tax to be stable between 21-23% for the foreseeable future. We decided to choose the middle ground of this predication and so we forecasted the tax rate at 22%.

## Revenues - Each Individual Drug[1]

**HCV Products** – Gilead saw their revenues for *Hepatitis C virus* (HCV) products slashed by half between 2015 and 2017. This HCV market is one that Gilead have dominated for a long time but now face stiff competition. According to Sagonowsky (2018), AbbVie CEO Richard Gonzalez has said that they have captured 32% of the market. Their new drug Mavyret took the market by storm in 2017 on approval and our expectations are that will dominate the market in coming years and greatly affect Gilead's HCV product revenue. Mavyret costs the consumer $13,200 per month and its treatment only takes two months whereas Gilead's Harvoni and Sovaldi cost $31,500 and $28,000 per month respectively and treatment takes 3 months. These significantly lower costs mean that we expect Mavyret to take almost complete control of the market. Pagliarulo (2018) expects that total HCV sales for Gilead will drop to between just $3.5 billion and $4 billion in 2018 and Beasley (2018) reiterate this by claiming the amount of US patients Gilead are supplying HCV products will fall from 231,000 to 160,000 due to do this increased competition.

Accenture.com (2012) claim that it takes between 5 to 7 years before a drug will reach peak sales. We believe that since Mavyret has seen such a proliferation in revenues that it will only take 5 years before AbbVie's drug Mavyret to reach peak sales. When the much cheaper Mavyret does reach peak sales this will a major impact on all of Gilead's HCV drugs, an impact which we believe will be similar to falling off the patent cliff. For this reason we believe that Gilead's four HCV drugs will all fall by 85% between 2017 and 2021 as they lose their market share to Mavyret which is a cheaper alternative to Gilead's four HCV drugs. This means using a CAGR of -37.77% to interpolate years 2018-2020. This may

[1] All Information regarding, the function of the drugs, patent expiration dates & competitors has come from Gilead's latest 10K report AND all information regarding side effects/ pros and cons of drugs, from iodine.com

seem like a drastic decrease however it is actually not as low as many other analysts predict (as previously mentioned) and we believe it is a fairer and more logical approach to forecasting their declining sales for their HCV drugs. We use this forecast to get to year 2021 and from then on we will discuss each of these drugs individually.

**Harvoni -** This drug is one of Gilead's most successful drugs ever bringing in revenues of nearly $14 billion in 2015 alone. It is used in the treatment of HCV genotypes 1, 4, 5 and 6 co-infections by combining two drugs, ledipasvir and sofosbuvir. It proved to be almost a foolproof cure for HCV and has a roughly 95% success rate from its 12 week cycle (Gatlin, 2018). The drugs sales have fell by almost 70% since 2015 due to a combination of a declining number of patients with HCV and increased competition, notably from Mavyret as previously mentioned. We forecast the drugs revenue till 2021 outlined above. From here on we expect the drug to keep this small market share until its patent expiration in 2030. We expect it to lose further ground when this happens as competition from generics and alternative drugs move into control of the market, hence following our patent cliff assumptions outlined earlier.

**Sovaldi –** This drug is renowned as Gilead's flagship HCV drug. It has reined in $44 billion during its current lifespan. Sovaldi has a similar function to Harvoni but, as opposed to Harvoni, Sovaldi is not a combination drug made up of just sofosbuvir and is used in combination with other drugs like Harvoni. Just like Harvoni, sales for Sovaldi have decreased by over 80% since 2015. We foresee the exact same thing happening to Sovaldi as has with Harvoni. Sovaldi US patent expires in 2029 and EU patent in 2028 and so we account for that as explained earlier.

**Epclusa –** When released in 2015 there was extremely high expectations for this drug because it was the first single tablet regimen approved to treat patients with HCV genotype 2 and 3. This was seen by it made $1.7 billion in year 1 and $3.5 billion in year 2. However, we now believe that it will reach its potential due to being undercut in price by its rival alterative drugs Mavyret (by AbbVie) and Zepatier (by Merck & Co. Inc) approved in 2017. Gilead admit that its revenues will decline with this competition. They also admit that they will lose a substantial market share due to the pricing pressure of these rival drugs. For that reason foresee the same thing happening with Epclusa as we have forecasted with Harvoni and Sovaldi. Sovaldi's US patent and EU patent expire in 2032.

**Vosevi –** Released in 2017, Vosevi is a pan-genotypic drug. Just like the three drugs mentioned above, Vosesi is used to treat chronic HCV and it is approved to use in the treatment of experienced patients. It will fall foul to the fact that its direct rival Mavyret was approved later in 2017 and is cheaper as well as the fact it has a shorter cycle. The forecast for Vosevi is the same as the three other HCV drugs mentioned above which all are vulnerable to cheaper alternatives produced by AbbVie and Merck & Co. Vosevi's US patent expires in 2034 and EU patent in 2033 and so we account for that as explained earlier.

**HIV/AIDS –** Thanks to Gilead, patients with HIV are living longer lives than ever before. Gilead's goal is to create several combination HIV drugs so that HIV patients can be on a single pill regime and have options on which single pill regime works best for them, rather than having to take several different pills a day. Gilead say that the HIV landscape had become more competitive and complex as treatment trends continue to evolve. Although Gilead face competition both branded and generic drugs, they have more control over this market and currently they are the dominating force in this market with a 79% US HIV market

share of single tablet regimens in 2017 (Goonewardene & Long, 2018). We are expecting competition to impact their revenues negatively. However we still foresee Gilead being the dominant force in this market. We breakdown each of Gilead's HIV drugs individually because as they all require slightly different assumptions due to the complexity in this field.

**Genvoya –** This drug has taken the market by storm since being approved and is up 184% year-on-year. Genvoya is a single tablet regimen for the treatment of HIV which is what Gilead have been seeking as stated earlier. Genvoya quickly gained a 41% market share and we expect this market share to increase further toward our estimate of 50%. We forecast that they will move towards this 50% share by 2022, essentially saying that it will take 7 years to reach peak sales which is an assumption we made earlier backed up by Accenture.com (2012), that it can take 7 years for a drug to reach peak sales. Using this assumption we could forecast the 2022 by dividing the 2017 sales by 41 and multiplying that figure by 50, to give them this push towards a 50% market share. We can simply interpolate years 2018-2021 using a CAGR of just over 4%. We checked our predictions against other analysts' predictions (these other analysts did not influence how we went about our calculation. We simply checked in order to compare forecasts.) and, in particular, a report by JP Morgan. In this report they predict a more explosive return, meaning that they forecast higher figures for 2018-2020 and similar figure to us thereafter however we feel that our prediction is more justifiable. We believe given the that fact that British giants GlaxoSmithKline have recently released a rival products, Triumeq and Tivicay, will slow the progress of Genvoya. We foresee Triumeq and Tivicay having a substantial market share in Europe lessening the impact Genvoya are expected to have in Europe. However, we still expect Genvoya to dominate in the US market and hence why we have a slower, steadier growth rate. After Genvoya reaches peak sales in 2022 we foresee it maintaining its market

share and having stable revenues until it falls peril to the patent cliff. Genvoya will lose its EU patent in 2027 and US patent in 2029 and we expect it to follow our standard patent cliff guidelines.

**Truvada –** This is drug is part of a combination therapy to treat HIV infection in adults. The drug reached its peak sales in 2016 but its European patent expired in 2017 and we witnessed the beginning of the fall off the patent cliff losing 12% of sales in 2017 which we expect this trend to continue. Their US patent expires in 2021 so we account for that as explained earlier. Luckily for Gilead the market share they will lose on Truvada should be regained by their new substitute drug, Descovy which has seen sales explode since coming onto the market in 2016. We will explain more on Descovy taking this market share below.

**Descovy –** This drug came onto the market in 2016 and quickly broke the $1 billion sales mark by 2017. Descovy is a combination drug used for the treatment of HIV-1 infection. As mentioned earlier, it is a substitute for Truvada and is apparently safer for your kidneys and bones compared with Truvada. Since Truvada has these greater downsides and sees its patent expiring, we expect to see a push towards more patients using Descovy and hence expect it to garner the market share which is being lost by Truvada. The retail price for Descovy and Truvada are also the same so we were able to forecast Descovy using past Truvada sales. Truvada sales peaked in 2016 at $3.566 Billion. CDC - Centers for Disease Control and Prevention (2017) stated that HIV diagnoses declined 5% between 2011 and 2015 and we foresee a similar decline happening over the next few years. For that reason we forecasted Descovy's peak sales being 95% of Truvada's peak sales by 2022 (7 years after it was approved). We think this is the most reasonable estimate as the drugs are substitutable and have the same retail price. Descovy will lose its EU patent in 2021 and US patent in 2022

and we expect it to follow our standard patent cliff guidelines as we expect either that it will lose sales to drugs Gilead has in the pipeline, Gilead's rivals and/or generics.

**Atripla –** This drug was intended as a stand-alone therapy for HIV but is often used as part of a combination therapy. Atripla is an almost identical position to the aforementioned Truvada. Its European patent expires in 2017 and US patent in 2021, just like Truvada. Its sales fell by 30% in 2017 as it began its fall off the patent cliff and we predict it follow our normal patent cliff guidelines. Fortunately for Gilead, we foresee its market share being eaten by their one of their newer substitute drugs, Odefsey. Since coming to market, Odefsey has seen its sales increase in 2017 increase by just under $0.8, which is almost exactly the same figure as Atripla sales fell by.

**Odefsey –** This is a combination drug used for the treatment of HIV-1 infection. As previously mentioned it is a substitute for Atripla as well as a substitute for Complera/Eviplera which we will discuss later. Similar to Descovy, Odefsey includes a new drug component which causes less harmful effects to kidneys and bones and has a lot less potential side effects than Atripla, so we suspect a shift towards Odefsey, especially seeing as Atripla is falling off the patent cliff and seemingly conceded its market share to Odefsey. The retail price for Odefsey and Atripla are only marginally different (Odefsey is roughly 1% cheaper) so we were able to forecast Odefsey using past Atripla sales. Atripla sales peaked in 2014 at $3.648 Billion. CDC - Centers for Disease Control and Prevention (2017) stated that HIV diagnoses declined 5% between 2011 and 2015 and we foresee a similar decline happening over the next few years. For that reason we forecasted Odefsey's peak sales being 95% of Atripla's peak sales by 2022 (7 years after it was approved). We think this is the most reasonable estimate as the drugs are substitutable and the same retail price. Odefsey will lose

its EU patent in 2021 and US patent in 2022 and we expect it to follow our standard patent cliff guidelines as we expect either that it will lose sales to drugs Gilead has in the pipeline, Gilead's rivals and/or generics.

**Stribild –** This drug is similar to Genvoya in that it is a single tablet regimen for the treatment of HIV but it has a slightly different chemical makeup which it is perceived gives Genvoya a large advantage. Genvoya includes a new drug component which causes less harmful effects to kidneys and bones and has a lot less potential side effects than Stribild. Sales for Stribild has declined by a rapid CAGR of -24% between 2015-2017. We expect Stribild to fall in direct correlation to Genvoya, meaning that Stribild are set to lose market share as Genvoya gains market share. This means using a CAGR of -5.28% yearly for Stribild until 2022 then the figures will remain stable until it falls villain to the patent cliff, following our normal patent cliff assumptions. Stribild US patent expires in 2029 and EU patent in 2027 and so we account for that as explained earlier.

**Viread –** This drug is used lower the amount of hepatitis B virus (HBV) present in a person but will not cure HBV. This drug was easy to value as its patent expires in 2018 in both the US and Europe. Teva Pharmaceutical have recently launched their generic version of the drug. We expect Viread to follow our normal patent cliff assumptions as the likes of Teva consume Viread's market share.

**Complera/Eviplera –** Marketed as Complera in the US and Eviplera in Europe, this drug is a single tablet regimen for the treatment of HIV. Complera/Eviplera has become out-dated and Gilead have several drugs which a patient could switch to such as Odefsey, Genvoya and Descovy. Complera/Eviplera is known to have potential serious life-threatening

side effects so we anticipate switches towards the other drugs mentioned which is built into the increasing revenues of those other drugs. Complera/Eviplera US patent expires in 2025 and EU patent in 2022 but we anticipate a worse scenario than the usual patent cliff assumptions. We use a CAGR between 2015-2017 of -17.72% to forecast future sales. We think this is fair as the patent cliff is not so much the issue with this drug. The issue is more likely to be a movement away from Complera/Eviplera and towards Gilead's other drugs and so we forecast sales falling by a significant amount.

**Biktarvy –** This drug is another combination drug to treat HIV. This market was brought to market in February 2018 and is anticipated to be a mega blockbuster. In Gilead's latest earning call CEO John Milligan claimed that this drug was as good as it gets in treating HIV and labelled the drug as the company's "Mount Everest". Various reports say it could generate anywhere in the $5 - $10 billion range in the next 5 years. As opposed to many of the other drugs we have looked at which involve switching between other Gilead-owned drugs, expectations are that Biktarvy will usurp market share from rival companies such as GlaxoSmithKline. We assume this drug will capture half of the market share that GlaxoSmithKline rival drugs, Tivicay and Triumeq, currently hold. Studies have proved that you can switch from GlaxoSmithKline's drugs to Biktarvy without fear of side effects and both seem comparably effective (Ryan, 2018). However Biktarvy has experienced 50% less drug related adverse events (side effects) so we expect a lot of patients to make the switch to Biktarvy (seekingalpha.com, 2018). We think Biktarvy taking 50% of the market share in 7 years' time is fair because we basically expect that any of the patients experiencing side effects will switch, as well as new consumers to make Biktarvy their first choice. In 2017 Tivicay and Triumeq reined in $3.865 billion in revenues so using that figure we estimate Biktarvy's revenues in 7 years-time, 2024, as half of that, $1.9325 billion. We simply divide

this figure by 5 to get 2018 sales an interpolate 2019-2023. This means we are expecting the drug to bring in $7.7 billion worth of revenues in the next 7 years which seems to be line with other analyst predictions. We believe Biktarvy will maintain these sales until in falls off the patent cliff in 2033, following our normal guidelines.

**Other Products –** These products include Letairis, Ranexa, AmBisome, Zydelig as well as 6 others. These other products are well diversified treating patients in areas such as Cardiovascular, Haematology/Oncology, Inflammation/Respiratory as well as other areas. These drugs accounted for less than 10% of sales revenue. These products are well diversified and we expect them to continue to perform. We predict that revenues in 2017 will be indicative of how these other products perform over the next few years and hence keep a stable figure. We averaged the years in which all the patents would expire for both the US and Europe and both came to 2024. Therefore we predict 2017 revenues to remain stable until 2024, after which they follow our normal patent cliff assumptions.

**Other Revenues –** These other revenues consist of royalty revenues. These revenues have been fairly constant over the years. We decided to simply use an average of the last three years to predict 2018 and use the same figure for the duration of the forecast period due to the lack of information. We believe this is the most accurate forecast we can produce given the information we are privy too.

# Appendix – Spreadsheets

SUMMARY OUTPUT

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.718436502 |
| R Square | 0.516151007 |
| Adjusted R Squar | 0.435509508 |
| Standard Error | 162.0775417 |
| Observations | 8 |

ANOVA

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 1 | 168137.2228 | 168137.2228 | 6.400563163 | 0.044683712 |
| Residual | 6 | 157614.7772 | 26269.12953 | | |
| Total | 7 | 325752 | | | |

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* | *Lower 95.0%* | *Upper 95.0%* |
|---|---|---|---|---|---|---|---|---|
| Change in CapEx | -19.49916706 | 62.71846835 | -0.310899924 | 0.766394392 | -172.9657305 | 133.9673964 | -172.9657305 | 133.9673964 |
| Change in Sales | 0.027021017 | 0.010680525 | 2.529933431 | 0.044683712 | 0.000886714 | 0.05315532 | 0.000886714 | 0.05315532 |

*Table 11 - Regression of Change in CapEx on Change in Sales*

SUMMARY OUTPUT

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.73447816 |
| R Square | 0.539458168 |
| Adjusted R Squar | 0.462701196 |
| Standard Error | 171.8085821 |
| Observations | 8 |

ANOVA

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 1 | 207457.7417 | 207457.7417 | 7.028132469 | 0.037974661 |
| Residual | 6 | 177109.1333 | 29518.18888 | | |
| Total | 7 | 384566.875 | | | |

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* | *Lower 95.0%* | *Upper 95.0%* |
|---|---|---|---|---|---|---|---|---|
| Change in D&A | 62.47981732 | 66.48404833 | 0.939771553 | 0.383610333 | -100.2007885 | 225.1604231 | -100.2007885 | 225.1604231 |
| Change in Sales | 0.030014739 | 0.011321777 | 2.651062517 | 0.037974661 | 0.002311348 | 0.05771813 | 0.002311348 | 0.05771813 |

*Table 12 - Regression of Change in D&A on Change in Sales*

| Drug name (Patent Expiry year) | 2015 Y | 2016 Y | 2017 Y | CAGR (15-17) | 2018 E | 2019 E | 2020 E | 2021 E |
|---|---|---|---|---|---|---|---|---|
| **Total Sales Revenue (Millions of $)** | **32639** | **30390** | **26107** | *-10.56%* | **22073** | **19833** | **18848** | **18788** |
| *% Change in Total Sales Revenue* | - | *-6.89%* | *-14.09%* | | *-15.45%* | *-10.15%* | *-4.96%* | *-0.32%* |
| **Total Product Sales Revenue** | **32151** | **29953** | **25662** | *-10.66%* | **21616** | **19376** | **18392** | **18331** |
| HCV products | | | | | | | | |
| Harvoni (2030) | 13864 | 9081 | 4370 | *-43.86%* | 2720 | 1692 | 1053 | 656 |
| Epclusa (2032) | 0 | 1752 | 3510 | - | 2184 | 1359 | 846 | 527 |
| Sovaldi (2029/2028) | 5276 | 4001 | 964 | *-57.25%* | 600 | 373 | 232 | 145 |
| Vosevi (2034/2033) | 0 | 0 | 293 | - | 182 | 113 | 71 | 44 |
| HIV and HBV products | | | | | | | | |
| Genvoya (2029/2027) | 45 | 1484 | 3674 | *803.57%* | 3823 | 3978 | 4139 | 4306 |
| Truvada (2021/2017) | 3459 | 3566 | 3134 | *-4.81%* | 2513 | 2014 | 1615 | 1295 |
| Atripla (2021/2017) | 3134 | 2605 | 1806 | *-24.09%* | 1448 | 1161 | 931 | 746 |
| Descovy (2022/2021) | 0 | 298 | 1218 | - | 1495 | 1834 | 2250 | 2761 |
| Odefsey (2025/2022) | 0 | 329 | 1106 | - | 1390 | 1746 | 2195 | 2758 |
| Stribild (2029/2027) | 1825 | 1914 | 1053 | *-24.04%* | 997 | 945 | 895 | 848 |
| Viread (2018) | 1108 | 1186 | 1046 | *-2.84%* | 672 | 431 | 277 | 178 |
| Complera/Eviplera (2025/2022) | 1427 | 1457 | 966 | *-17.72%* | 795 | 654 | 538 | 443 |
| Biktarvy (2033) | - | - | - | - | 276 | 552 | 828 | 1105 |
| Other Products | | | | | | | | |
| Other Products (2024) | 2013 | 2280 | 2522 | *11.93%* | 2522 | 2522 | 2522 | 2522 |
| Other Revenues | | | | | | | | |
| Royalty Revenue | 488 | 437 | 445 | *-4.51%* | 457 | 457 | 457 | 457 |

*Table 13 – Predict Revenues; Current Drug Portfolio*

| Drug name (Patent Expiry year) | 2022 E | 2023 E | 2024 E | 2025 E | 2026 E | 2027 E | 2028 E | 2029 E |
|---|---|---|---|---|---|---|---|---|
| **Total Sales Revenue (Millions of $)** | **20045** | **19257** | **17541** | **15214** | **13500** | **11102** | **9554** | **8531** |
| *% Change in Total Sales Revenue* | *6.69%* | *-3.93%* | *-8.91%* | *-13.26%* | *-11.26%* | *-17.76%* | *-13.95%* | *-10.70%* |
| **Total Product Sales Revenue** | **19588** | **18800** | **17084** | **14757** | **13044** | **10646** | **9097** | **8075** |
| HCV products | | | | | | | | |
| Harvoni (2030) | 656 | 656 | 656 | 656 | 656 | 656 | 656 | 656 |
| Epclusa (2032) | 527 | 527 | 527 | 527 | 527 | 527 | 527 | 527 |
| Sovaldi (2029/2028) | 145 | 145 | 145 | 145 | 145 | 145 | 139 | 110 |
| Vosevi (2034/2033) | 44 | 44 | 44 | 44 | 44 | 44 | 44 | 44 |
| HIV and HBV products | | | | | | | | |
| Genvoya (2029/2027) | 4480 | 4480 | 4480 | 4480 | 4480 | 3417 | 2606 | 1987 |
| Truvada (2021/2017) | 1038 | 832 | 667 | 535 | 535 | 535 | 535 | 535 |
| Atripla (2021/2017) | 598 | 480 | 384 | 250 | 250 | 250 | 250 | 250 |
| Descovy (2022/2021) | 3388 | 2846 | 1850 | 1203 | 782 | 508 | 508 | 508 |
| Odefsey (2025/2022) | 3466 | 3333 | 3053 | 2425 | 1650 | 1123 | 764 | 520 |
| Stribild (2029/2027) | 803 | 803 | 803 | 803 | 803 | 612 | 467 | 356 |
| Viread (2018) | 178 | 178 | 178 | 178 | 178 | 178 | 178 | 178 |
| Complera/Eviplera (2025/2022) | 364 | 300 | 247 | 203 | 167 | 137 | 113 | 93 |
| Biktarvy (2033) | 1381 | 1657 | 1933 | 1933 | 1933 | 1933 | 1933 | 1933 |
| Other Products | | | | | | | | |
| Other Products (2024) | 2522 | 2522 | 2118 | 1377 | 895 | 582 | 378 | 378 |
| Other Revenues | | | | | | | | |
| Royalty Revenue | 457 | 457 | 457 | 457 | 457 | 457 | 457 | 457 |

*Table 14 – Predict Revenues; Current Drug Portfolio*

| Drug name (Patent Expiry year) | 2030 E | 2031 E | 2032 E | 2033 E | 2034 E | 2035 E | 2036 E | 2037 E | 2038 E |
|---|---|---|---|---|---|---|---|---|---|
| **Total Sales Revenue (Millions of $)** | **7815** | **7159** | **6599** | **5787** | **5049** | **4597** | **4301** | **4136** | **4130** |
| *% Change in Total Sales Revenue* | *-8.40%* | *-8.39%* | *-7.83%* | *-12.30%* | *-12.75%* | *-8.97%* | *-6.43%* | *-3.84%* | *-0.15%* |
| **Total Product Sales Revenue** | **7358** | **6703** | **6142** | **5331** | **4593** | **4140** | **3844** | **3679** | **3673** |
| HCV products | | | | | | | | | |
| Harvoni (2030) | 551 | 358 | 233 | 151 | 98 | 98 | 98 | 98 | 98 |
| Epclusa (2032) | 527 | 527 | 442 | 287 | 187 | 121 | 79 | 79 | 79 |
| Sovaldi (2029/2028) | 72 | 47 | 30 | 22 | 22 | 22 | 22 | 22 | 22 |
| Vosevi (2034/2033) | 44 | 44 | 44 | 42 | 34 | 22 | 14 | 9 | 7 |
| HIV and HBV products | | | | | | | | | |
| Genvoya (2029/2027) | 1515 | 1156 | 881 | 672 | 672 | 672 | 672 | 672 | 672 |
| Truvada (2021/2017) | 535 | 535 | 535 | 535 | 535 | 535 | 535 | 535 | 535 |
| Atripla (2021/2017) | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 |
| Descovy (2022/2021) | 508 | 508 | 508 | 508 | 508 | 508 | 508 | 508 | 508 |
| Odefsey (2025/2022) | 520 | 520 | 520 | 520 | 520 | 520 | 520 | 520 | 520 |
| Stribild (2029/2027) | 272 | 207 | 158 | 120 | 120 | 120 | 120 | 120 | 120 |
| Viread (2018) | 178 | 178 | 178 | 178 | 178 | 178 | 178 | 178 | 178 |
| Complera/Eviplera (2025/2022) | 76 | 63 | 52 | 43 | 35 | 29 | 24 | 20 | 16 |
| Biktarvy (2033) | 1933 | 1933 | 1933 | 1624 | 1056 | 686 | 446 | 290 | 290 |
| Other Products | | | | | | | | | |
| Other Products (2024) | 378 | 378 | 378 | 378 | 378 | 378 | 378 | 378 | 378 |
| Other Revenues | | | | | | | | | |
| Royalty Revenue | 457 | 457 | 457 | 457 | 457 | 457 | 457 | 457 | 457 |

*Table 15 – Predict Revenues; Current Drug Portfolio*

| | 2013 Y | 2014 Y | 2015 Y | 2016 Y | 2017 Y | 2018 Y | 2019 Y | 2020 Y | 2021 Y |
|---|---|---|---|---|---|---|---|---|---|
| **Sales** | 11202 | 24890 | 32639 | 30390 | 26107 | 22073 | 19833 | 18848 | 18788 |
| *% growth* | | 122.19% | 31.13% | -6.89% | -14.09% | -15.45% | -10.15% | -4.96% | -0.32% |
| COGS | 2,859 | 3,788 | 4,012 | 4,272 | 4,371 | 3,696 | 3,321 | 3,156 | 3,146 |
| **Gross Profit** | **8,343** | **21,102** | **28,627** | **26,118** | **21,736** | **18,377** | **16,512** | **15,693** | **15,642** |
| *% margin* | 74.48% | 84.78% | 87.71% | 85.94% | 83.26% | 83.26% | 83.26% | 83.26% | 83.26% |
| SG&A | 1,694 | 2,982 | 3,422 | 3,384 | 3,878 | 3,279 | 2,946 | 2,800 | 2,791 |
| Other Expenses | - | - | 70 | - | - 486 | - | - | - | - |
| **EBITDA** | **6,649** | **18,120** | **25,135** | **22,734** | **18,344** | **15,098** | **13,566** | **12,893** | **12,852** |
| *% margin* | 59.36% | 72.80% | 77.01% | 74.81% | 70.26% | 68.40% | 68.40% | 68.40% | 68.40% |
| Depreciation & Amortization | 345 | 1,050 | 1,098 | 1,158 | 1,286 | 1,165 | 1,098 | 1,068 | 1,066 |
| **EBIT** | **6,304** | **17,070** | **24,037** | **21,576** | **17,058** | **13,933** | **12,469** | **11,825** | **11,785** |
| *% margin* | 56.28% | 68.58% | 73.65% | 71.00% | 65.34% | 63.13% | 62.87% | 62.74% | 62.73% |
| Taxes | 1,151 | 2,797 | 3,553 | 3,609 | 8,885 | 3,065 | 2,743 | 2,601 | 2,593 |
| **EBIAT** | **5,153** | **14,273** | **20,484** | **17,967** | **8,173** | **10,868** | **9,725** | **9,223** | **9,192** |
| Plus: Depreciation & Amortization | 345 | 1,050 | 1,098 | 1,158 | 1,286 | 1,165 | 1,098 | 1,068 | 1,066 |
| Less: CAPEX | 190 | 557 | 747 | 748 | 590 | 481 | 420 | 394 | 392 |
| Less: Change in Net Working Cap | - 1,328 | 11,363 | 2,919 | - 4,503 | 9,819 | - 8,645 | - 1,171 | - 515 | - 32 |
| **Unlevered Free Cash Flow** | **5,308** | **14,766** | **20,835** | **18,377** | **8,869** | **20,197** | **11,574** | **10,412** | **9,898** |
| Cost of Equity | | | | | | 8.18% | 8.18% | 8.18% | 8.18% |
| Discount Period | | | | | | **1.00** | **2.00** | **3.00** | **4.00** |
| Discount Factor | | | | | | 0.924381 | 0.854480 | 0.789865 | 0.730136 |
| **Present Value of Free Cash Flow** | | | | | | **18,670** | **9,890** | **8,224** | **7,227** |

*Table 16 - DCF; Current Drug Portfolio*

| | 2022 Y | 2023 Y | 2024 Y | 2025 Y | 2026 Y | 2027 Y | 2028 Y | 2029 Y |
|---|---|---|---|---|---|---|---|---|
| **Sales** | 20045 | 19257 | 17541 | 15214 | 13500 | 11102 | 9554 | 8531 |
| *% growth* | 6.69% | -3.93% | -8.91% | -13.26% | -11.26% | -17.76% | -13.95% | -10.70% |
| COGS | 3,356 | 3,224 | 2,937 | 2,547 | 2,260 | 1,859 | 1,600 | 1,428 |
| **Gross Profit** | **16,689** | **16,033** | **14,604** | **12,667** | **11,240** | **9,244** | **7,954** | **7,103** |
| *% margin* | 83.26% | 83.26% | 83.26% | 83.26% | 83.26% | 83.26% | 83.26% | 83.26% |
| SG&A | 2,978 | 2,860 | 2,606 | 2,260 | 2,005 | 1,649 | 1,419 | 1,267 |
| Other Expenses | - | - | - | - | - | - | - | - |
| **EBITDA** | **13,711** | **13,172** | **11,998** | **10,407** | **9,235** | **7,594** | **6,535** | **5,836** |
| *% margin* | 68.40% | 68.40% | 68.40% | 68.40% | 68.40% | 68.40% | 68.40% | 68.40% |
| Depreciation & Amortization | 1,104 | 1,080 | 1,029 | 959 | 908 | 836 | 789 | 758 |
| **EBIT** | **12,607** | **12,092** | **10,970** | **9,448** | **8,327** | **6,759** | **5,746** | **5,077** |
| *% margin* | 62.90% | 62.79% | 62.54% | 62.10% | 61.68% | 60.88% | 60.14% | 59.51% |
| Taxes | 2,774 | 2,660 | 2,413 | 2,079 | 1,832 | 1,487 | 1,264 | 1,117 |
| **EBIAT** | **9,834** | **9,432** | **8,556** | **7,369** | **6,495** | **5,272** | **4,482** | **3,960** |
| Plus: Depreciation & Amortization | 1,104 | 1,080 | 1,029 | 959 | 908 | 836 | 789 | 758 |
| Less: CAPEX | 426 | 405 | 359 | 296 | 249 | 185 | 143 | 115 |
| Less: Change in Net Working Cap | 657 | - 412 | - 898 | - 1,217 | - 896 | - 1,254 | - 810 | - 535 |
| **Unlevered Free Cash Flow** | **9,854** | **10,519** | **10,124** | **9,250** | **8,050** | **7,177** | **5,938** | **5,138** |
| Cost of Equity | 8.18% | 8.18% | 8.18% | 8.18% | 8.18% | 8.18% | 8.18% | 8.18% |
| Discount Period | **5.00** | **6.00** | **7.00** | **8.00** | **9.00** | **10.00** | **11.00** | **12.00** |
| Discount Factor | 0.674924 | 0.623887 | 0.576709 | 0.533099 | 0.492786 | 0.455522 | 0.421076 | 0.389234 |
| **Present Value of Free Cash Flow** | **6,651** | **6,563** | **5,839** | **4,931** | **3,967** | **3,269** | **2,500** | **2,000** |

*Table 17 - DCF; Current Drug Portfolio*

| | 2030 Y | 2031 Y | 2032 Y | 2033 Y | 2034 Y | 2035 Y | 2036 Y | 2037 Y | 2038 Y |
|---|---|---|---|---|---|---|---|---|---|
| **Sales** | 7815 | 7159 | 6599 | 5787 | 5049 | 4597 | 4301 | 4136 | 4130 |
| *% growth* | -8.40% | -8.39% | -7.83% | -12.30% | -12.75% | -8.97% | -6.43% | -3.84% | -0.15% |
| COGS | 1,308 | 1,199 | 1,105 | 969 | 845 | 770 | 720 | 692 | 691 |
| **Gross Profit** | **6,507** | **5,961** | **5,494** | **4,818** | **4,204** | **3,827** | **3,581** | **3,443** | **3,438** |
| *% margin* | 83.26% | 83.26% | 83.26% | 83.26% | 83.26% | 83.26% | 83.26% | 83.26% | 83.26% |
| SG&A | 1,161 | 1,063 | 980 | 860 | 750 | 683 | 639 | 614 | 613 |
| Other Expenses | - | - | - | - | - | - | - | - | - |
| **EBITDA** | **5,346** | **4,897** | **4,514** | **3,959** | **3,454** | **3,144** | **2,942** | **2,829** | **2,825** |
| *% margin* | 68.40% | 68.40% | 68.40% | 68.40% | 68.40% | 68.40% | 68.40% | 68.40% | 68.40% |
| Depreciation & Amortization | 737 | 717 | 700 | 676 | 654 | 640 | 632 | 627 | 626 |
| **EBIT** | **4,609** | **4,180** | **3,813** | **3,283** | **2,800** | **2,504** | **2,311** | **2,203** | **2,199** |
| *% margin* | 58.97% | 58.38% | 57.79% | 56.72% | 55.45% | 54.47% | 53.72% | 53.25% | 53.24% |
| Taxes | 1,014 | 920 | 839 | 722 | 616 | 551 | 508 | 485 | 484 |
| **EBIAT** | **3,595** | **3,260** | **2,974** | **2,560** | **2,184** | **1,953** | **1,802** | **1,718** | **1,715** |
| Plus: Depreciation & Amortization | 737 | 717 | 700 | 676 | 654 | 640 | 632 | 627 | 626 |
| Less: CAPEX | 96 | 78 | 63 | 41 | 21 | 9 | 1 - | 4 - | 4 |
| Less: Change in Net Working Cap | - 375 | - 343 | - 293 | - 424 | - 386 | - 237 | - 154 | - 86 | - 3 |
| **Unlevered Free Cash Flow** | **4,611** | **4,243** | **3,905** | **3,620** | **3,203** | **2,821** | **2,587** | **2,435** | **2,348** |
| Cost of Equity | 8.18% | 8.18% | 8.18% | 8.18% | 8.18% | 8.18% | 8.18% | 8.18% | 8.18% |
| Discount Period | **13.00** | **14.00** | **15.00** | **16.00** | **17.00** | **18.00** | **19.00** | **20.00** | **21.00** |
| Discount Factor | 0.359801 | 0.332593 | 0.307443 | 0.284194 | 0.262704 | 0.242838 | 0.224475 | 0.207500 | 0.191809 |
| **Present Value of Free Cash Flow** | **1,659** | **1,411** | **1,201** | **1,029** | **841** | **685** | **581** | **505** | **450** |

*Table 18 - DCF; Current Drug Portfolio*

| | 2009 A | 2010 A | 2011 A | 2012 A | 2013 A | 2014 A | 2015 A | 2016 A | 2017 A |
|---|---|---|---|---|---|---|---|---|---|
| **Disc Factor** | | | | | | | | | **1** |
| **Yosevi** | | | | | | | | | 293 |
| **Adjusted Pretax Income Margin** | | | | | | | | | 0.666 |
| **Adjusted Pretax Income** | | | | | | | | | 195.138 |
| **PV** | | | | | | | | | 180 |
| **Disc Factor** | | | | | | | | **1** | **2** |
| **Descovy** | | | | | | | | 298 | 1,218 |
| **Adjusted Pretax Income Margin** | | | | | | | | 1 | 1 |
| **Adjusted Pretax Income** | | | | | | | | 198 | 811 |
| **PV** | | | | | | | | 183 | 693 |
| **Disc Factor** | | | | | | **1** | **2** | **3** | **4** |
| **Harvoni** | | | | | | 2127 | 13864 | 9081 | 4370 |
| **Adjusted Pretax Income Margin** | | | | | | 0.666 | 0.666 | 0.666 | 0.666 |
| **Adjusted Pretax Income** | | | | | | 1416.582 | 9233.424 | 6047.946 | 2910.42 |
| **PV** | | | | | | 1,309 | 7,890 | 4,777 | 2,125 |
| **Disc Factor** | | | | | | **1** | **2** | **3** | **4** |
| **Zydelig** | | | | | | 23 | 132 | 168 | 149 |
| **Adjusted Pretax Income Margin** | | | | | | 0.666 | 0.666 | 0.666 | 0.666 |
| **Adjusted Pretax Income** | | | | | | 15 | 88 | 112 | 99 |
| **PV** | | | | | | 14 | 75 | 88 | 72 |
| **Disc Factor** | | | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| **Complera/Eviplera** | | | 38 | 342 | 810 | 1,228 | 1,427 | 1,457 | 966 |
| **Adjusted Pretax Income Margin** | | | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 |
| **Adjusted Pretax Income** | | | 25 | 228 | 539 | 818 | 950 | 970 | 643 |
| **PV** | | | 23 | 195 | 426 | 597 | 641 | 605 | 371 |
| **Disc Factor** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| **Ranexa** | 131 | 239 | 320 | 373 | 449 | 510 | 588 | 677 | 717 |
| **Adjusted Pretax Income Margin** | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 |
| **Adjusted Pretax Income** | 87 | 159 | 213 | 248 | 299 | 340 | 392 | 451 | 478 |
| **PV** | 81 | 136 | 168 | 181 | 202 | 212 | 226 | 240 | 235 |
| **Disc Factor** | | | | | **1** | **2** | **3** | **4** | **5** |
| **Stribild** | | | | | 539 | 1,197 | 1,825 | 1,914 | 1,053 |
| **Adjusted Pretax Income Margin** | | | | | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 |
| **Adjusted Pretax Income** | | | | | 359 | 797 | 1,215 | 1,275 | 701 |
| **PV** | | | | | 332 | 681 | 960 | 931 | 473 |

*Table 19 - PV of Patents for Product Pipeline (i)*

| | 2018 E | 2019 E | 2020 E | 2021 E | 2022 E | 2023 E | 2024 E | 2025 E | 2026 E | 2027 E | 2028 E | 2029 E | 2030 E | 2031 E | 2032 E | 2033 E | 2034 E | 2035 E | 2036 E | 2037 E | 2038 E | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Disc Factor** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** | **21** | **22** | **TV** | **PV Total** |
| **Yosevi** | 182 | 113 | 71 | 44 | 44 | 44 | 44 | 44 | 44 | 44 | 44 | 44 | 44 | 44 | 44 | 42 | 34 | 22 | 14 | 9 | 7 | | |
| **Adjusted Pretax Income Margin** | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | | |
| **Adjusted Pretax Income** | 121 | 76 | 47 | 29 | 29 | 29 | 29 | 29 | 29 | 29 | 29 | 29 | 29 | 29 | 29 | 28 | 22 | 15 | 9 | 6 | 4 | | |
| **PV** | 104 | 60 | 34 | 20 | 18 | 17 | 16 | 14 | 13 | 12 | 11 | 11 | 10 | 9 | 8 | 7 | 5 | 3 | 2 | 1 | 1 | 95 | **652** |

| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | TV | PV Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Descovy** | 1,495 | 1,834 | 2,250 | 2,761 | 3,388 | 2,846 | 1,850 | 1,203 | 782 | 508 | | |
| **Adjusted Pretax Income Margin** | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | | |
| **Adjusted Pretax Income** | 995 | 1,221 | 1,499 | 1,839 | 2,256 | 1,895 | 1,232 | 801 | 521 | 338 | | |
| **PV** | 786 | 892 | 1,011 | 1,147 | 1,301 | 1,010 | 607 | 365 | 219 | 132 | 7,294 | **15,642** |

| | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | TV | PV Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Harvoni** | 2,720 | 1,692 | 1,053 | 656 | 656 | 656 | 656 | 656 | 656 | 656 | 656 | 656 | 551 | 358 | 233 | 151 | 98 | | |
| **Adjusted Pretax Income Margin** | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | | |
| **Adjusted Pretax Income** | 1,811 | 1,127 | 701 | 437 | 437 | 437 | 437 | 437 | 437 | 437 | 437 | 437 | 367 | 238 | 155 | 101 | 65 | | |
| **PV** | 1,222 | 703 | 405 | 233 | 215 | 199 | 184 | 170 | 157 | 145 | 134 | 124 | 96 | 58 | 35 | 21 | 13 | 1,411 | **21,627** |

| | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 16 | 17 | 18 | TV | PV Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Zydelig** | 167 | 187 | 209 | 209 | 209 | 209 | 209 | 209 | 142 | 96 | 65 | 43 | 29 | | |
| **Adjusted Pretax Income Margin** | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | | |
| **Adjusted Pretax Income** | 111 | 124 | 139 | 139 | 139 | 139 | 139 | 139 | 95 | 64 | 43 | 29 | 19 | | |
| **PV** | 75 | 78 | 80 | 74 | 69 | 63 | 59 | 54 | 34 | 21 | 12 | 8 | 5 | 100 | **982** |

| | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | TV | PV Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Complera/Eviplera** | 966 | 654 | 538 | 443 | 364 | 300 | 247 | 203 | 167 | 137 | 113 | 93 | | |
| **Adjusted Pretax Income Margin** | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | | |
| **Adjusted Pretax Income** | 643 | 436 | 358 | 295 | 243 | 200 | 164 | 135 | 111 | 91 | 75 | 62 | | |
| **PV** | 343 | 215 | 163 | 124 | 94 | 72 | 55 | 42 | 32 | 24 | 18 | 14 | 300 | **4,354** |

| | 10 | 11 | 12 | 13 | 14 | 15 | TV | PV Total |
|---|---|---|---|---|---|---|---|---|
| **Ranexa** | 717 | 491 | 336 | 230 | 157 | 108 | | |
| **Adjusted Pretax Income Margin** | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | | |
| **Adjusted Pretax Income** | 478 | 327 | 224 | 153 | 105 | 72 | | |
| **PV** | 218 | 138 | 87 | 55 | 35 | 22 | 475 | **2,710** |

| | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | TV | PV Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Stribild** | 997 | 945 | 895 | 848 | 803 | 803 | 803 | 803 | 803 | 612 | 467 | 356 | 272 | 207 | 158 | 120 | 120 | |
| **Adjusted Pretax Income Margin** | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | 0.666 | | |
| **Adjusted Pretax Income** | 664 | 629 | 596 | 565 | 535 | 535 | 535 | 535 | 535 | 408 | 311 | 237 | 181 | 138 | 105 | 80 | | |
| **PV** | 414 | 363 | 318 | 278 | 244 | 225 | 208 | 192 | 178 | 125 | 88 | 62 | 44 | 31 | 22 | 15 | 1,729 | **7,915** |

*Table 20 - PV of Patents for Product Pipeline (ii)*

| Average PV of Patents at T0 | $ 7,697.35 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| λ - 0.000389024 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 |
| λ*R&D | 1.43 | 1.40 | 1.38 | 1.35 | 1.33 | 1.30 | 1.28 | 1.26 | 1.23 | 1.21 |
| Value of Patent | $ 10,980 | $ 10,782 | $ 10,588 | $ 10,397 | $ 10,210 | $ 10,026 | $ 9,845 | $ 9,668 | $ 9,494 | $ 9,323 |
| Less R&D Expense | $ (3,667) | $ (3,601) | $ (3,536) | $ (3,472) | $ (3,410) | $ (3,348) | $ (3,288) | $ (3,229) | $ (3,170) | $ (3,113) |
| | $ 7,313 | $ 7,181 | $ 7,052 | $ 6,925 | $ 6,800 | $ 6,678 | $ 6,557 | $ 6,439 | $ 6,323 | $ 6,209 |
| Tax @ 22% | $ (1,609) | $ (1,580) | $ (1,551) | $ (1,523) | $ (1,496) | $ (1,469) | $ (1,443) | $ (1,417) | $ (1,391) | $ (1,366) |
| Net Income | $ 5,704 | $ 5,601 | $ 5,501 | $ 5,401 | $ 5,304 | $ 5,209 | $ 5,115 | $ 5,023 | $ 4,932 | $ 4,843 |
| Discount Factor | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| PV @ 8.18% | $ 5,273 | $ 4,786 | $ 4,345 | $ 3,944 | $ 3,580 | $ 3,250 | $ 2,950 | $ 2,678 | $ 2,431 | $ 2,206 |
| Estimated PV of R&D Dept | $ 35,442 | | | | | | | | | |

*Table 21 –PV of Patents at T0 using Average*

# Bibliography

Adams, B., 2017. *Fierce Biotech.* [Online]
Available at: https://www.fiercebiotech.com/biotech/high-dose-gilead-nimbus-nash-med-hits-liver-fat
[Accessed 16 4 2018].

Amgen, 2018. *Amgen.* [Online]
Available at: http://www.amgen.com/en-au/media/news-releases/2018/03/amgen-and-allergan-receive-positive-chmp-opinion-for-abp-980-biosimilar-herceptin-for-the-treatment-of-three-types-of-cancer/
[Accessed 23 3 2018].

Armstrong, M., 2017. *EP Vantage.* [Online]
Available at:
http://www.epvantage.com/Universal/View.aspx?type=Story&id=719937&isEPVantage=yes
[Accessed 21 3 2018].

Arrieta, Hong, Khera et al, 2017. *Updated Cost-effectiveness Assessments of PCSK9 Inhibitors From the Perspectives of the Health System and Private Payers,* s.l.: s.n.

Berkrot, B., 2017. *Reuters.* [Online]
Available at: https://www.reuters.com/article/us-health-liver-nash-insight/nash-the-next-untapped-pharma-market-gives-investors-many-options-idUSKBN17Q0D5
[Accessed 16 4 2018].

Biotechnology Innovation Organisation, 2015. *Biotechnology Innovation Organisation.* [Online]
Available at:
https://www.bio.org/sites/default/files/Clinical%20Development%20Success%20Rates%202006-2015%20-%20BIO,%20Biomedtracker,%20Amplion%202016.pdf
[Accessed 31 3 2018].

BTIG, 2017. *Consensus Estimates Underestimate the Next Gen JAKs,* s.l.: s.n.

Business Wire, 2018. *Business Wire.* [Online]
Available at: https://www.businesswire.com/news/home/20180212005608/en/Global-Non-Alcoholic-Steatohepatitis-NASH-Market-2017-2025--
[Accessed 16 4 2018].

Cayman Chem, n.d. [Online]
Available at: https://www.caymanchem.com/news/research-tools-for-fatty-liver-diseases

David W. Thomas, J. B. J. A., 2015. *Biotechnology Innovation Organisation.* [Online]
Available at:
https://www.bio.org/sites/default/files/Clinical%20Development%20Success%20Rates%202006-2015%20-%20BIO,%20Biomedtracker,%20Amplion%202016.pdf
[Accessed 1 4 2018].

Idrus, A. A., 2018. *Fierce Biotech.* [Online]
Available at: https://www.fiercebiotech.com/biotech/amgen-novartis-migraine-drug-aimovig-hits-endpoints-phase-3b
[Accessed 25 March 2018].

Jarvis, L. M., 2016. *C&EN.* [Online]
Available at: https://cen.acs.org/articles/94/i39/silent-liver-disease-epidemic.html
[Accessed April 4 2018].

Leone, D., 2017. *Key Insights from ACR for Filgotinib - Safety Profile,* s.l.: s.n.

Mendonca & Treacy, 2016. *Three Part Valuation Points to a Correctly Priced Stock,* s.l.: s.n.

Nash Biotechs, 2018. *Nash Biotechs.* [Online]
Available at: http://www.nashbiotechs.com/drugs_en/SELONSERTIB.php
[Accessed 16 4 2018].

Patrick, M., 2017. *Market Realist.* [Online]
Available at: https://marketrealist.com/2017/01/romosozumab-expected-strengthen-amgens-bone-health-franchise-2017
[Accessed 19 3 2018].

PR Newswire, 2018. *PR Newswire.* [Online]
Available at: https://www.prnewswire.com/news-releases/european-medicines-agency-accepts-filing-for-evenity-romosozumab-300578460.html
[Accessed 18 3 2018].

Statista, 2018. *Statista.* [Online]
Available at: https://www.statista.com/statistics/318206/revenue-of-humira/
[Accessed 16 4 2018].

The Center for Biosimilars, 2017. *Centre for Biosimilars.* [Online]
Available at: http://www.centerforbiosimilars.com/news/her2positive-breast-cancer-market-to-reach-989-billion-by-2025
[Accessed 31 3 2018].

TUFTS, 2014. *Tufts Center for the Study of Drug Development.* [Online]
Available at: http://csdd.tufts.edu/files/uploads/Tufts_CSDD_briefing_on_RD_cost_study_-_Nov_18,_2014..pdf
[Accessed 30 3 2018].

Wise Guy Research Consultants PVT. Ltd., 2018. *Med Gadget.* [Online]
Available at: https://www.medgadget.com/2018/03/global-migraine-pipeline-drugs-market-to-expand-at-a-cagr-of-14-48-during-by-2022.html
[Accessed 25 3 2018].

World Cancer Research Fund, 2012. *World Cancer Research Fund.* [Online]
Available at: https://www.wcrf.org/int/cancer-facts-figures/worldwide-data
[Accessed 16 4 2018].

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