Norwegian School of Economics

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Valuation of Novo Nordisk A/S

– A focused pharmaceutical company

By

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Master thesis, Financial Economics

NORWEGIAN SCHOOL OF ECONOMICS

Executive summary

In this paper I have conducted a comprehensive analysis of Novo Nordisk A/S. Based on reputable valuation methodologies like Free Cash Flows to Equity by the means of a scenario analysis and a comparable multiples approach my aim has been to determine if the share price of Novo Nordisk is undervalued, overvalued, or correctly valued. Overall, my findings indicates that the equity price of Novo Nordisk differs slightly from the current market price. According to the weighted equity estimate obtained from the scenario analysis and the relative valuation, a fair price of Novo Nordisk's stock is estimated at DKK 410 & DKK 417, respectively. This is approximately 13%-15% higher than the current market price of 363 as of 29.04.2016.

Thus, this thesis concludes that the share price of Novo Nordisk is likely to be undervalued.

Stock recommendation: Buy.

Preface

This thesis marks the end of the Master of Finance program at the Norwegian School of Economics (NHH). As I am approaching myself a career as an analyst / equity manager, I found a master thesis on valuation a natural theme to explore.

A valuation exercise covers a wide array of disciplines and requires broad expertise. Based on these characteristics, I was of the opinion that such a task would represent the best opportunity to prepare myself for the working life that awaits upon completion of my studies. As such, both knowledge and technical insight on valuation obtained throughout the master programme have supplemented me well.

Regarding the choice of sector & company to write about, I wanted to exploit the opportunity to specialise in the subject that fascinates me the most; the unique challenges related to equity valuation in the biotech/big pharma-industry. In order to obtain this in-depth knowledge & expertise, I thought it could be exciting to write about what ought to be a household name in the Nordic area but that somehow isn't, namely Novo Nordisk. Despite a market cap almost 3 times larger than Statoil ASA, Novo Nordisk have somehow gone under the radar for most people. Thus, given the outstanding historical performance of this Danish giant, I wanted to find out if the pricing of the company could be justified, and at the same time learn more about the underlying value drivers in the industry in general.

As such, I can easily testify to that the task of writing this thesis has been a challenging & time-consuming endeavour. Yet, it has been informative to be able to employ some the knowledge acquired throughout the studies.

I am of the opinion that the master thesis represents a worthy end to some great and eventful years at NHH. Finally, I want to thank my supervisor Endre Bjørndal that has guided me with some longed advice when I have needed it the most. I am convinced that his guidance & feedback has helped raised the bar significantly.

Bergen, May 2016

Brede S. Seim

Abbreviated Table of Contents

Table of Contents

1 Introduction

This master thesis addresses a valuation of Novo Nordisk A/S with the intention to derive at a value estimate of the equity in Novo Nordisk.

1.1 Research question & boundaries

"What is the value of Novo Nordisk and its corresponding share price?"

This thesis is limited by the fact that I, as an external analytic, only have access to public available information. As the outcome of any valuation is perishable, I have tried to utilize the most up-to-date information. However, with new information continuously arriving in the markets I have stopped my updating as of 29.04.2016 – the publication date of the first quarter in 2016.

I have assumed the intended user of this material is an international diversified equity manager.

1.2 Outline

In the first part of this thesis, I will present Novo Nordisk and its business. Following an in-depth look at the strategic framework surrounding the pharmaceutical industry, I will provide a thorough review of relevant valuation theory. The idea is to identify a suitable choice of valuation methods.

Going further, I will adjust, rearrange & normalise Novo Nordisk's reported financial statements in a comprehensive & congruent framework. Serving as the basis for a normalised, historical performance assessment, the focus relies on identifying financial ratios and profitability measures likely to be sustainable into the future.

Based on previously presented theory on valuation, I will calculate Novo Nordisk's cost of equity. Taking into account the strategic considerations in the pharmaceutical industry, as well as the outcome of the strategic financial statement analysis, I will use this to prepare a scenario analysis. By discounting the implied future cash flows, I can obtain a value estimate of the equity in Novo Nordisk. In the end, the valuation will be complemented by a comparable multiples approach as a consistency check.

2 Novo Nordisk A/S – "The pure play insulin bet"

Headquartered in Bagsværd, Denmark, Novo Nordisk is a focused, multinational, pharmaceutical company with leading positions in diabetes care and other chronic conditions such as haemophilia and growth hormones. Since the firm's inception in the early 1900's – adding only a recent entry into the (related) drug treatment market of obesity – Novo Nordisk has maintained full focus on research & development into the biological & medicinal branch of endocrinology (i.e. glands & hormones).

Whereas most of Novo Nordisk's have been emphasising a "jack of all trades"-strategy diversifying into a range of non-related segments, the silver lining of the company may very well rest within this narrowly defined area of research. Underlining the importance of this point, Novo Nordisk's stock has yielded a total **CAGR of 21.7% since 1987** (assuming continuously reinvested dividends).

Today, with production facilities in 7 countries, R&D facilities on 3 continents, affiliates or offices in 75 countries, approximately 41.000 employees, and a fully integrated & developed marketing department reaching over 180 countries, the scalability of Novo Nordisk's focused business profile yields among the best margins in the industry. Including a database of roughly 800 active patent families, this indicates significant barriers to entry.

Thus, coupled with an all-organic growth strategy and an effective dividend yield of ~4%, Novo Nordisk has long been considered one of the top choices in the world of biotech investing. Ending 2015 with a market capitalisation of DKK 862 billion (USD 154 billion) the company's shares can be traded on both the Nasdaq Copenhagen (ticker: NOVOB) and on the New York Stock Exchange (ticker: NVO).

2.1 Historical outperformance

According to a frequently cited study done by Ibbotson & Kaplan (2000), about 40% of the variation in returns among mutual funds is explained by policy differences in asset allocation. The remaining 60 % is explained by other factors, such as style within asset classes and security selection. Separating the winners from the losers, this means a positioning to the right industry – but also an analysis of the companies within the industry itself – can produce significant effects on overall portfolio development.

Figure 1 – Sector performance: Biotech the best performing sector 5 years in a row

2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015 YTD
Energy 29%	Telecom 32%	Energy 32%	Biotech 10%	IT 60%	Cons Disc 26%	Biotech 22%	Biotech 38%	Biotech 74%	Biotech 33%	Biotech 7%
Biotech 18%	Energy 22%	Materials 20%	Cons Stap -18%	Materials 45%	Industrials 24%	Utilities 15%	Financials 26%	Cons Disc 41%	Utilities 24%	Healthcare 6%
Utilities 13%	Cons Disc 17%	Utilities 16%	Healthcare -24%	Cons Disc 39%	Materials 20%	Cons Stap 11%	Cons Disc 22%	Healthcare 39%	Healthcare 23%	Cons Disc 4%
Healthcare 5%	Utilities 17%	IT 16%	Utilities -32%	S&P 500 23%	Energy 18%	Healthcare 10%	Healthcare 15%	Industrials 38%	IT 18%	Telecom 0%
Financials 4%	Financials 16%	Cons Stap 12%	Telecom -34%	Industrials 17%	S&P 500 13%	Cons Disc 4%	S&P 500 13%	Financials 33%	Financials 13%	Cons Stap 0%
S&P 500 3%	Materials 16%	Industrials 10%	Cons Disc -35%	Healthcare 17%	Telecom 12%	Energy 3%	IT 13%	S&P 500 30%	Cons Stap 13%	S&P 500 0%
Materials 2%	S&P 500 14%	Telecom 8%	Energy -36%	Financials 15%	Financials 11%	IT 1%	Telecom 12%	IT 26%	S&P 500 11%	Materials 0%
Cons Stap 1%	Cons Stap 12%	Healthcare 5%	S&P 500 -38%	Energy 11%	Cons Stap 11%	Telecom 1%	Industrials 12%	Materials 23%	Cons Disc 8%	IT 0%
IT 0%	Industrials 11%	S&P 500 4%	Industrials -42%	Cons Stap 11%	IT 9%	S&P 500 0%	Materials 12%	Cons Stap 23%	Industrials 8%	Industrials -2%
Industrials 0%	IT 8%	Biotech -3%	IT -44%	Utilities 7%	Biotech 2%	Industrials -3%	Cons Stap 8%	Energy 22%	Materials 5%	Financials -3%
Cons Disc -7%	Healthcare 6%	Cons Disc -14%	Materials -47%	Telecom 3%	Utilities 1%	Materials -12%	Energy 2%	Utilities 9%	Telecom -2%	Energy -4%
Telecom -9%	Biotech -3%	Financials -21%	Financials -57%	Biotech -7%	Healthcare 1%	Financials -18%	Utilities -3%	Telecom 6%	Energy -10%	Utilities -7%

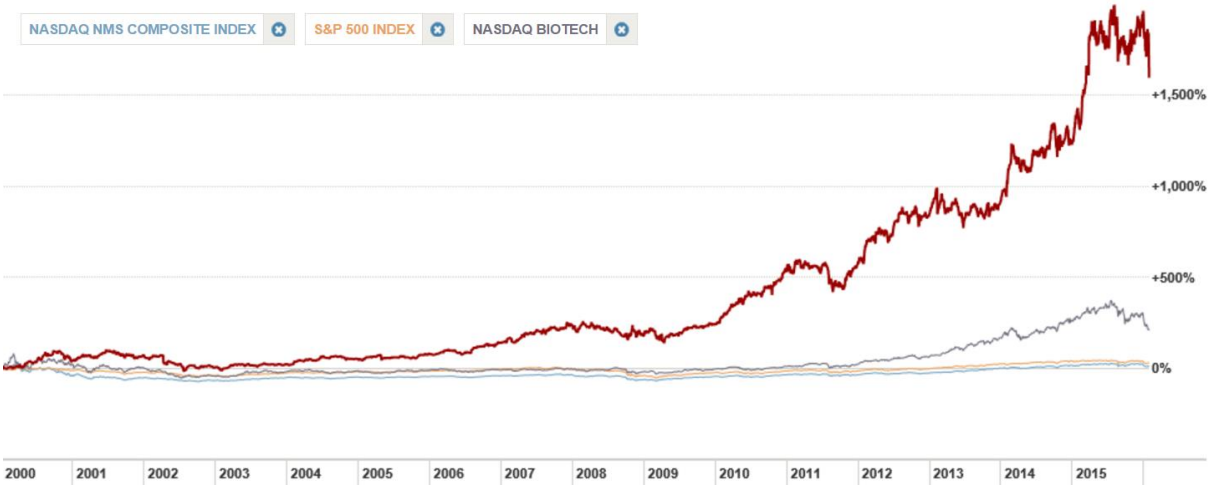
Source: Yahoo finance, Credit Suisse

As illustrated in the figure above, Biotech has been one of the hottest sectors since the millennium. Amongst other being the first in history to become the best performing sector in 4 consecutive years, the foundation for some spectacular firm-specific returns has been present (Yahoo Finance, 2015).

While the start of this latest bull-run was characterised by the biotech firms going from a "hope and dreams model" of pushing drugs for rare diseases at high prices, lately, the trend has been about being able to combine these great medical breakthroughs with growth and profitability. Coupled with low interest rates and a general multiple expansion, this has led to a relative stretched valuation evidenced by a year-on-year sector decline of -20% (i.e. which mainly happened after the update of the above figure).

As illustrated in the figures below, Novo Nordisk A/S is **one** of the companies that has taken the opportunity to excel. Delivering persistent sales growth & high margins has resulted in some serious alpha-returns to the investors. The question, of course, becomes to what degree this trend can continue.

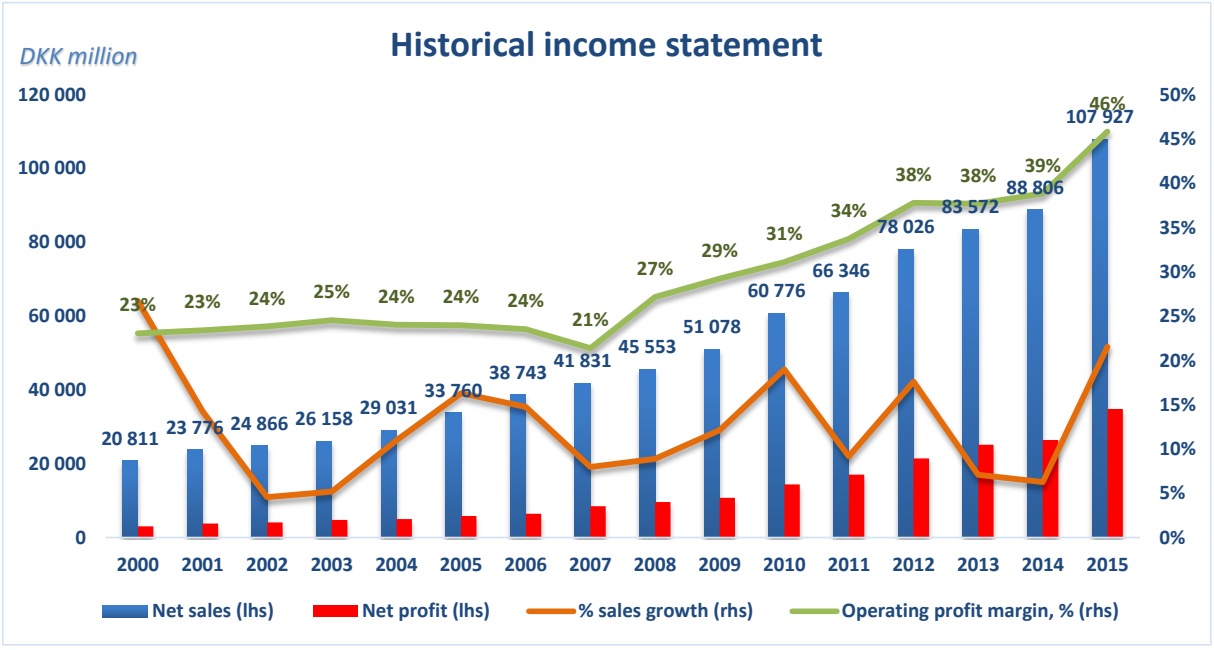
Figure 2 – Novo Nordisk's (NVO) share performance in red vs. major indices, 01/01/2000 – 04/02/2016



Source: Financial Times

Barely looking at the fundamentals in the figure below, there are no real signs of Novo Nordisk slowing down or even deviating the slightest from this long-term historical trend. Disaggregating the expectations "the Street" implicitly has assumed in today's valuation of the company, however, is a different question. More precisely, before looking at any strategic considerations I would suspect that Novo Nordisk has been caught in the political headwinds & negative sentiment surrounding the industry lately. All else equal, this might represent a buy opportunity.

Figure 3 – Development in fundamentals: Novo Nordisk's historical income statement



2.2 In-depth presentation

In the next sections, a more in-depth presentation of everything from Novo Nordisk's history to dividend policy will follow.

Note that a complete list of Novo Nordisk's products, R&D-pipeline and key patent expiration dates are enclosed in tables at the end of appendix 1.

2.2.1 History

Figure 4 - Nordisk's Insulin Leo in 1923 (lhs) and Novo's Insulin Novo & the Novo Syringe in 1925 (rhs)

Source: Novo Nordisk, History

The roots of Novo Nordisk can be traced back to Copenhagen, Denmark, in 1923 & 1925 with the founding of *Nordisk Insulinlaboratirum* and *Novo Terapeutisk Laboratirum*, respectively. The firms began manufacturing a revolutionary new medicine – insulin – that had been developed by two Canadian scientist a few years earlier, in 1920.

The companies developed into two of the best in their field of diabetes, and after many years of intense competition, they finally merged in 1989 – creating Novo Nordisk. Since then, the company has expanded with leading positions within diabetes care, haemophilia care, growth hormone therapy and hormone replacement therapy. Notable historic highlights are presented in the table below (Novo Nordisk, History Book):

Table 1 - Highlights in the history of Novo Nordisk

Year	Company	Product/event	Description
1936	Nordisk	protamine-protein	*A scientific breakthrough that significantly prolonged the effect of insulin, requiring fewer daily injections*
	Novo	Milestone	*Exporting insulin to 40 countries*
1953	Novo	Lente®	*A long-acting insulin-zinc suspension that for a time covered up to a third of the world's insulin consumption*
1973	Nordisk	Nanormon®	*A growth hormone for the treatment of growth hormone insufficiency.*
1974	**Novo**	**B-shares**	***Quoted on the Copenhagen Stock Exchange***
1981	Novo	Stock listing	*First Scandinavian company to be listed on the New York Stock Exchange*
1982	Novo	"Human insulin"	*Launching of the world's first insulin preparation identical to human insulin. Big event internationally.*
1985	Novo	NovoPen®	*A popular injection system with replaceable insulin cartridges*
1988	Nordisk	Norditropin®	*Genetically engineered human growth hormone*
1989	**Novo Nordisk**	**Merger**	***Becomes the world's leading producer of insulin.***
1996		NovoSeven®	*Treatment of haemophilia patients*
1999		NovoRapid®	*Company's first modern insulin.*
2009		Victoza®	*Glucagon-Like Peptide-1 (GLP-1) analogue for treatment of type 2 diabetes*

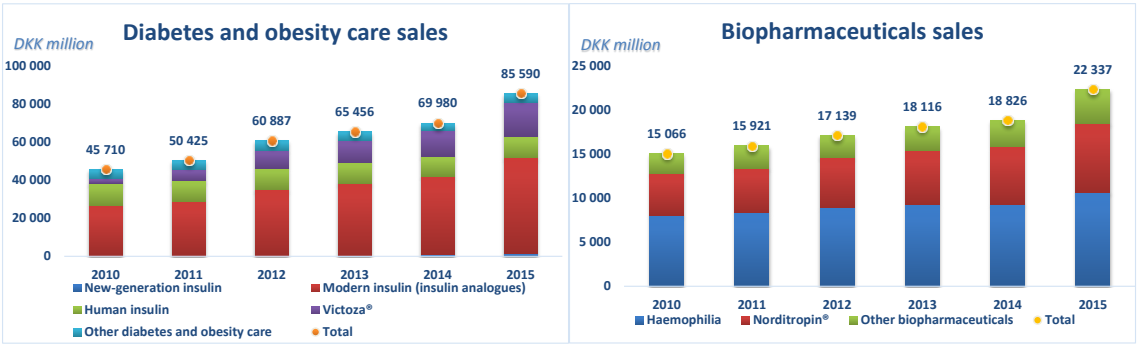
Source: Novo Nordisk, History

In the course of Novo Nordisk's 90-year-old history, they have also enjoyed considerable international success producing and selling penicillin and industrial enzymes (e.g. Novozymes A/S). Due to managements desire to concentrate on the Group's core business, however, the penicillin business was divested in 1994. Novozymes, on the other hand, was founded as a separate company in a demerger from Novo Nordisk in 2000 (Novo Nordisk, History Book).

2.2.2 Novo Nordisk's business segments: Overview & development

In this section, a walkthrough of Novo Nordisk business is presented. Starting off with a highlight of the recent development of the company's most important segments in terms of sales in the figure below, a more thorough discussion of each of Novo Nordisk's disaggregated segments will be presented (*see appendix 1 for scientific background*).

Figure 5 – Novo Nordisk's sales, divided by segment

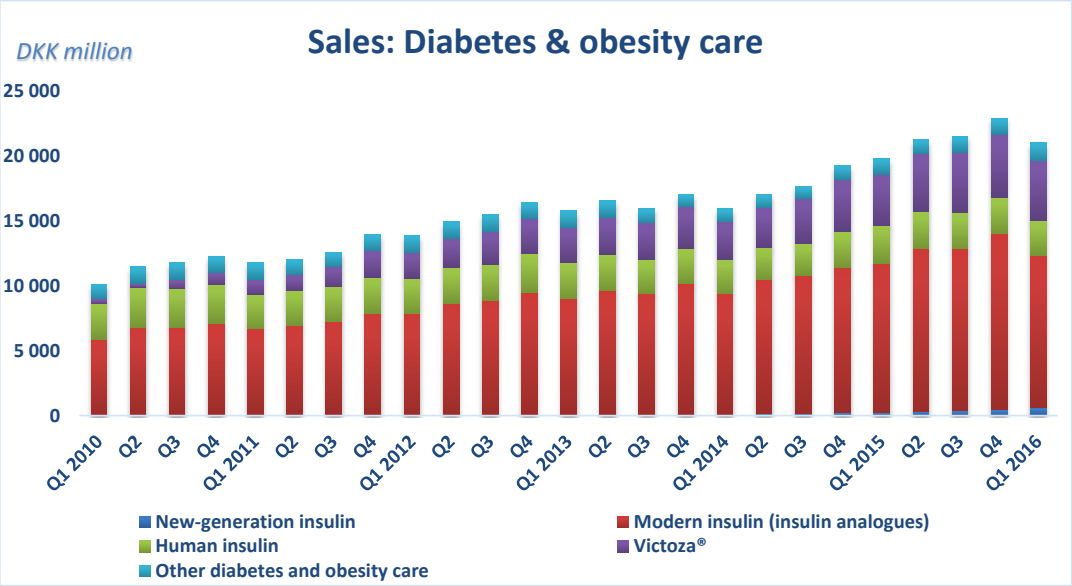


In the "diabetes & obesity care"-segment" the figure above illustrates the importance of modern insulins and the growing contribution from Victoza® (GLP-1). In the "biopharmaceuticals"-segment, it is the treatment of haemophilia (bleeding disorders) and Norditropin® (human growth hormone) that constitutes the largest business. With an overall weighting of approximately 80/20 the relative contribution from each segment, however, indicates that the diabetes business – in terms of sales – is far more important than the biopharmaceuticals segment.

2.2.2.1 Diabetes & obesity care

Detailing the same data presented in the figure above on the "diabetes & obesity care"-segment, on a quarterly basis, the trends become even more revealing in the figure below.

Figure 6 – Quarterly sales development in Novo Nordisk's "Diabetes- & Obesity"-segment



With this development in mind, a thorough discussion of each segment will follow:

- **Human insulin vs. Modern insulin (insulin analogues) vs. New generation insulin**

As the names may reveal, Novo Nordisk has chosen to classify its insulin segments according to "how old" the research of the products are based on.

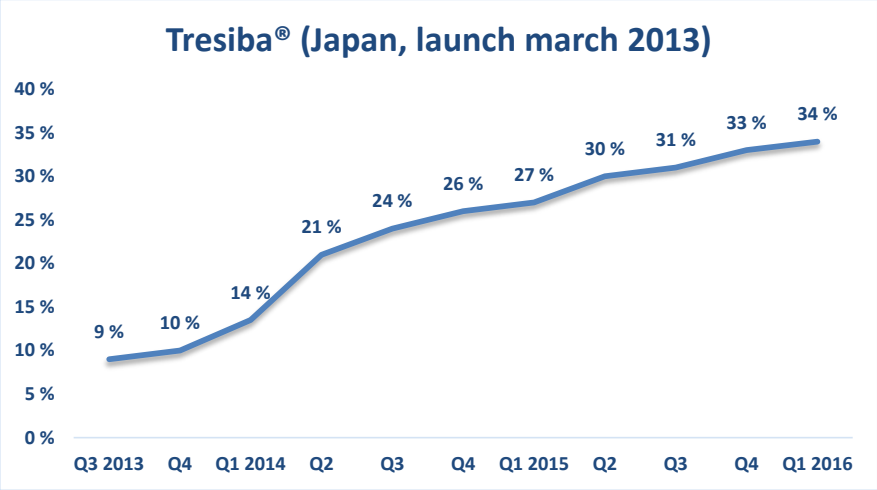
Progressing from the use of animal insulin, **human insulin** is the classification of synthetic insulins grown in laboratories to mimic the insulin in humans. These recombinant, biosynthetic insulins started entering pharmaceutical approval from late 1970's to late 1980's. E.g., regular human insulin has a peak effect in 2-4 hours, and duration of action of 6-8 hours (Diabetes.co.uk, 2016).

In the 1990's a newer form of human insulin called insulin analogues – "**modern insulin**" – were produced. These analogues are an altered form of insulin, different from any occurring in nature. Through genetic engineering of the underlying DNA, the amino acid sequence of insulin can be changed to alter its characteristics (absorption, distribution, metabolism and excretion). The two main types of analogues are fast acting (lispro, aspart, glulisine) and long acting (detemir, degludec, glargine). Amongst other, these insulins do not have the same degree of peak action and therefore act more consistently over their duration (Wikipedia, 2016).

Evolving from the technology on modern insulins, "**new-generation insulin**" – mainly insulin degludec – is an "ultra-long-acting" insulin analogue developed by Novo Nordisk under the brand name Tresiba®. Studies demonstrate that Tresiba® is the first basal insulin to offer people with diabetes the possibility of injecting their basal insulin at any time of the day with the option to adjust the time of injection (*the role of basal insulin, also known as background insulin, is to keep blood glucose levels at consistent levels during periods of fasting*). In terms of the degree of peak action half-life would have been 25 hours, with a duration of action of at least 42 hours.

Novo Nordisk launched its first new-generation product on the European market in Q1 2013, and now have Tresiba®, Ryzodeg® and Xultophy® in the portfolio (Drugs.com, 2016). With initial rollout still evolving to secure market access, in 2015, total sales of this portfolio reached DKK 1438 million. However, based on the initial response of the first launch of Tresiba® in Japan – illustrated in the figure below – the development should indicate encouraging potential regarding continued launch and market penetration.

Figure 7 – Quarterly development of the first launch of Tresiba® in Japan, measured as a share of the total new-generation market



GLP-1 / Victoza®

Figure 8 - The main effects of GLP-1

Source: Novo Nordisk, annual report 2015, p.27

As illustrated in the figure above, what makes GLP-1 (*see textbox*) so powerful is that it does several things at the same time, including lowering blood glucose levels and reducing appetite; GLP-1 is produced by the gut and the brain in response to eating. GLP-1 interacts with the pancreas to increase the amount of insulin in the body. It stimulates insulin secretion in the beta cells in the pancreas and reduces glucagon in the alpha cells. It does so in a glucose-dependent manner, which helps lower fasting and postprandial ("*after-meal*"-) blood glucose. At the same time, GLP-1 increases feelings of satiety and reduces feelings of hunger – leading to a reduction of food intake (Novo Nordisk, annual report 2015, p.27)

Glucagon-like peptide-1 (GLP-1)

Glucagon-like petide-1 (GLP-1) is defined as a "*neuropeptide (peptide is the scientific term for a small protein) and an incretin – a group of metabolic hormones that stimulate a decrease in blood glucose level.* (Wikipedia, 2016)

The hormone in its natural state, however, is not a suitable drug candidate. According to Lotte Knudsen in Novo Nordisk "GLP-1 has a half-life of less than two minutes in the blood and therefore can't be used as a medical therapy in its natural form, so we needed to use our protein engineering expertise to crease a modified version – an analogue – that will work for 24 hours. We have achieved this by attaching a natural fatty acid to the GLP-1 peptide that inhibits the elimination of GLP-1. The molecule was named **liraglutide**" (Annual report 2015, p.26).

Liraglutide – which is 97% similar to the naturally occurring human diabetes – was launched in 2009 under the brand name Victoza® as the first GLP-1 treatment on the market. Thus, GLP-1 analogues are a relatively new therapy for type 2 diabetes.

Currently, Novo Nordisk have another GLP-1 analogue – **semaglutide** – in clinical trials. With the result that semaglutide remains in the blood plasma longer than liraglutide, semaglutide can be taken once a week compared with the once-daily administration of liraglutide – also providing the opportunity to be taken as a tablet.

- **Other diabetes & obesity care**

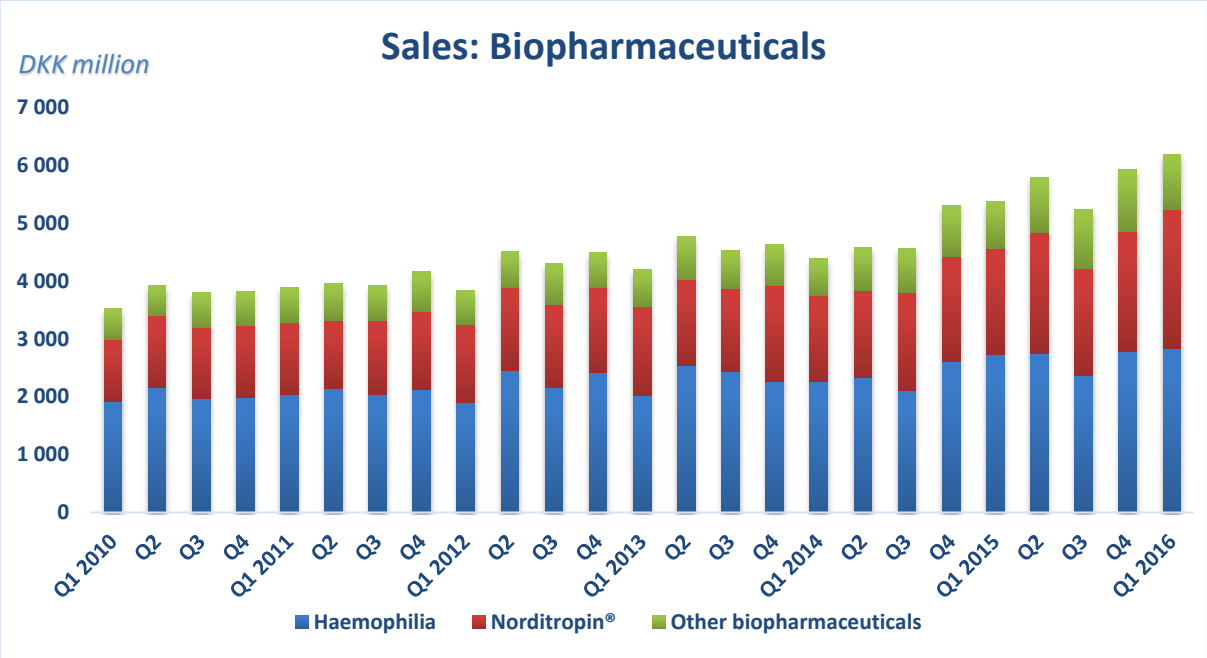
Sales of other diabetes and obesity care products consist predominantly of oral antidiabetic agents (OAD), needles and Saxenda®.

In 2015, Novo Nordisk launched Saxenda® (a higher-dose version of liraglutide (3mg)) in the US and in the first markets outside the US. This is Novo Nordisk's first product for chronic weigh management in what can be characterised as a currently undeveloped market.

2.2.2.2 Biopharmaceuticals

Detailing the data presented in the figure on "Biopharmaceutical sales" on a quarterly basis, the trends in sales development becomes even more revealing in the figure below.

Figure 9 – Quarterly sales development in Novo Nordisk's "Biopharmaceuticals"-segment



Thus, with this development in mind, a thorough discussion of each segment will follow:

- **Haemophilia**

People with haemophilia have either a partial or a complete lack of an essential blood-clotting factor. Though there is no cure for haemophilia, it can be controlled with regular infusions of the relevant deficient clotting factor, i.e. factor VIII in haemophilia A or factor IX in haemophilia B.

By the use of recombinant factor replacement (*genetic recombination – rDNA*), Novo Nordisk currently has treatments developed for factor VII-, factor VIII- (haemophilia A) & factor XIII deficiency, marketed as NovoSeven®, NovoEight® & NovoThirteen®, respectively.

NovoSeven® arrived at the market in 1985 and enabled the blood of "immune" patients (*patients developing inhibitor/antibodies against standard treatment*) to form stable clots.

Although the initial patient population was only a few thousands globally, the product became important for treatment of both on-demand bleeding episodes, management of people with inhibitors during surgery, acquired haemophilia, factor VII deficiency and Glanzmann's thrombasthenia (*a bleeding disorder due to blood abnormality*). In 2012, **NovoThirteen®** was initially launched in Europe targeting a rare and serious bleeding disorder affecting about 1300 people globally. In 2014, **NovoEight®** became the company's first treatment for the wider haemophilia – type A – community, with an estimated population of 350.000 (Novo Nordisk, annual report 2015, p.32).

- **Norditropin®**

Norditropin® [somatropin (rDNA origin) injection] – a genetically engineered (recombinant) human growth hormone – is a therapy for people suffering from growth hormone deficiency. Used to treat both children who are short in stature and/or who are not growing because of low or no growth hormone, as well as adults, the product was first launched in 1995.

The segment "Norditropin®" contains both the hormone injections itself, as well as a series of prefilled multidose delivery systems. Today, Norditropin® is the leading product in the global growth hormone market with a 32 % market share measured in volume (Norditropin, 2016).

- **Other biopharmaceuticals**

Sales of other products within biopharmaceuticals consist predominantly of hormone replacement therapy-related (HRT) products.

2.2.3 Novo Nordisk's pipeline overview

Potentially more important for the long-term sustainability of Novo Nordisk's operating margins and market shares than its current product portfolio, the company's R&D-pipeline should drop a few hints on what innovations should be expected to gradually reach the market. Thus, looking at the present pipeline, the potential for sustained future returns seems promising. Some of the highlights from 2015 include (Novo Nordisk, annual report 2015, p.2):

- Tresiba®, for type 1 and type 2 diabetes, was approved in the US in September and launched in January 2016.
- Xultophy®, for type 2 diabetes, was launched in the first Europe countries and filed for approval in the US.
- Saxenda®, Novo Nordisk's first product for chronic weight management, was launched in the US in April 2015 (as well as in the first market outside the US).
- NovoEight®, for haemophilia A, was launched in the US, while a long-acting factor IX, for haemophilia B, was filed for approval in Europe.
- A once-daily oral formulation of semaglutide was taken into phase 3 development.

In light of the near-term patent expiry dates for some of the company's (currently) best-selling products – and especially when considering the threat of generic competitors & biosimilars – Novo Nordisk will need to focus on extending patent terms and/or replacing the relevant products altogether. However, given its late stage pipeline potential, as well as some of its recent market introductions, Novo Nordisk should not be in the immediate danger of a potential "patent cliff". In other words, Novo Nordisk seems to employ a healthy balance of exploiting the sales potential in its current portfolio simultaneously as they focus on securing a competitive edge through its R&D-pipeline for the future.

(As previously mentioned, a complete list of the R&D-pipeline & key patent expiration dates are provided in tables at the end of appendix 1)

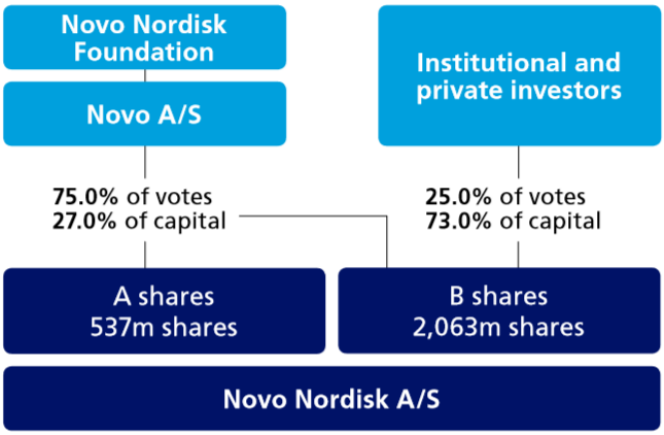
2.2.4 Shares and capital structure

Novo Nordisk's B shares are listed on Nasdaq Copenhagen (ticker: NOVOB) and on the New York Stock Exchange (ticker: NVO) as American Depository Receipts (ADRs). The total market value of Novo Nordisk's B shares, excluding treasury shares, was DKK 804 billion as of year-end 2015.

Novo Nordisk's total share capital of DKK 520 million is divided into an A share capital of nominally DKK 107.5 million, and a B share capital of nominally DKK 412.5 million. The company's A-shares are not listed and are held by Novo A/S – a Danish public limited liability company wholly owned by the Novo Nordisk Foundation. Besides the B-shares being publicly listed, the main difference between the A and B shares is that each A share carries 200

votes, while each B share only carries 20 votes (Novo Nordisk, annual report 2015, p.44). As of 31.12.2015, the free float of listed B shares was 89.5%. **In summary**, the figure below should provide a good illustration of the company's ownership structure:

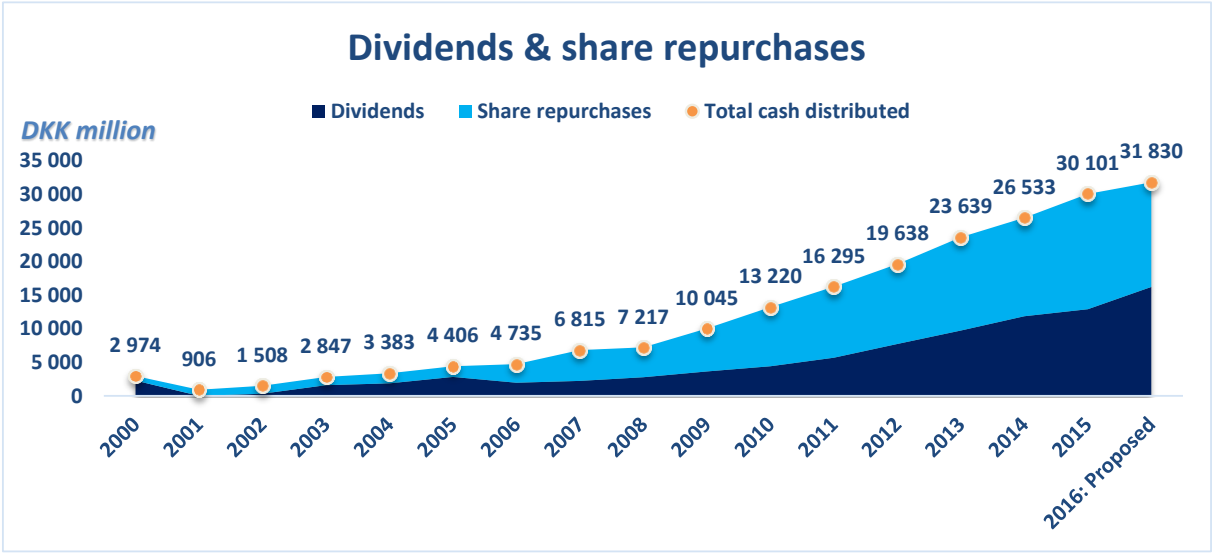
Figure 10 – Novo Nordisk's ownership structure



Source: Novo Nordisk, annual report 2015, p.45

Regarding Novo Nordisk's dividend policy, the company's guiding principle is that any excess capital after the funding of organic growth opportunities and potential acquisitions should be returned to investors. The company applies a pharmaceutical industry benchmark to ensure a competitive pay-out ratio, and is complemented by significant share repurchase programme. Historically this have resulted in the following cash distribution to shareholders (Novo Nordisk, annual report 2015, p.44-45):

Figure 11 – Historical cash returns to shareholders



As illustrated in the figure above, for 2016, the Board of Directors will propose a dividend of DKK 16.2 billion. The stock goes ex-dividend as of closing 21. March 2016. At the same time, the company has for the next 12 months decided to implement a new share repurchase programme in which the expected total repurchase value amounts to DKK 14 billon. Thus, in 2016, the combined pay-out equivalents a yield of ~4%.

3 Strategic considerations in the pharmaceutical industry

Figure 12 - The process of inventing & commercialising a new drug

Source: Jdrf.org

The aim of this introductory strategic analysis is to map the position of Novo Nordisk and its industry, both in relative and absolute terms. The presented sections will represent a rough list of prioritisation, where the most important arguments comes first.

In this context, I have a chosen an approach that I hope will yield a more productive angle. Both in terms of the reader not losing interest, but also for the author not to lose oversight over key "selling points", it's important to keep in mind that what matters in the end are the long-term trends, not the framework itself.

Through the identification of Novo Nordisk's core underlying value drivers, it is possible to gain an understanding of what drives profitably in the industry today, and what powers are at work shaping the future. This insight will be used to align and translate qualitative predictions into quantitative assumptions and suppositions for use in the valuation framework. In this regards, the three implicit questions I seek to answer are the following (Kaldestad & Møller, 2012, p.72):

- What drives profits and create outperformance?
- To what extent is it possible to sustain outperformance?
- What factors influence growth, and how should this play out into the future?

3.1 The changing landscape of pricing, reimbursement & formularies

The pharmaceuticals sector has always been of worldwide importance. In 2010, global spending on prescriptions drugs topped USD 800 billions. With the continued increase in sales primarily driven by the development of new, innovative and progressively effective medicines, it inevitably comes at the expense of having higher medicine prices and growing health-related expenditures (Baker & McKenzie, 2011).

On this background, many countries have in recent years endeavoured on the one hand to support their respective pharmaceutical industry by creating an environment which incentivises innovation, and on the other hand maintain a healthcare system that is within financial reach of their citizens (e.g., all EU member states have adopted laws that limit public expenditures on medicinal products). In addition, most governments are in the process of establishing detailed rules and practices regarding the pricing and reimbursement of such products.

The consensus on the most significant long-term trend in the pharmaceutical sector today, is the pressure on payers to cut drug prices, scale back reimbursement and/or encourage the use of generics. As such, the world's biggest drugmakers face a new reality when it comes to the pricing of their products, especially in the US. To fight back, pharma companies need to prove the value of their products.

Regulatory pricing

Without going into detail on how pharmaceutical companies actual come up with their prices, in most jurisdictions, **drug prices are regulated**. For example, in the UK the Pharmaceutical Price Regulation Scheme is intended to ensure that the National Health Service (NHS) is able to purchase drugs at "reasonable prices." In Canada, the Patented Medicine Prices Review Board examines drug pricing, compares the proposed Canadian price to that of seven other countries and determines if a price is "excessive" or not**. In these circumstances, drug manufacturers must submit a proposed price to the appropriate regulatory agency** (Wikipedia, 2016).

Reimbursement

Reimbursement is defined as an act of compensating someone for an expense (Merriam-Webster, 2016).

Once a regulatory agency has determined the clinical benefit and safety of a product and **pricing has been confirmed** (if necessary), a drug manufacturer will typically submit it for evaluation by a payer of some sort. Payers may be private insurance plans, governments, or health care organisations such as hospitals. This is also where the discipline of "Health Economics" often is applied (*see relevant section below*). **If a product is deemed cost-effective, and price and any risk-sharing agreement is negotiated, the drug is placed on a drug list or *formulary*** (Wikipedia, 2016).

3.1.1 The leading example of the U.S.

As indicated, drug makers in the US have long relied on their ability to charge whatever they have deemed appropriate. In the past, the high prices have been defended by industry advocates as a way to recoup the billions of dollar spent on experimental drugs that fail and to offset discounts offered overseas. However, as insurers increasingly use aggressive tactics to extract steep price discount – even for the newest medication – those days are long gone (Reuters, 2015).

Formulary management

At the core of most reimbursement regimes is the drug list, also known as the "formulary". Managing this list can involve many different approaches. Often, formularies may be used to drive choice to lower cost drugs by structuring a sliding scale of co-payments favouring cheaper products **or those for which there is a preferential agreement with the manufacturer.** This is the principle underlying the preferred drug lists used in many US state Medicaid programs. (Wikipedia, 2016)

Most financial analysts and other observers of the pharmaceutical industry agree on one thing: the industry is changing. In fact, the way most healthcare products and services are being delivered and paid for is undergoing rapid change. Having the world's largest economy and healthcare market, the US seems to be leading the way.

Accounting for roughly 44% of global pharmaceutical sales, the US healthcare system is complex, as it involves multiple payers and intermediaries with complex interactions. Roughly half of all Americans are insured by their employers (known as the managed care segment), one-third is insured through public programmes (such as Medicare and Medicaid) while around 9% of Americans are uninsured. The health plans use various methods to manage the use and cost of pharmaceuticals. Among the most widely used interventions are generic substitution, quantity limits, prior authorisation and tightly controlled Preferred Drug Lists (Novo Nordisk, annual report 2015, p.36).

As illustrated in the figure below, while healthcare in the US historically has been delivered by small, independent practices and hospitals, an increasing number of healthcare providers are now becoming part of fully integrated delivery networks. At the same time, the managed care segment is consolidating, leading to fewer, more powerful payers. As a result, rebate negotiations have become tougher for the pharmaceutical industry; contracts are generally

of shorter duration than before and often have price protection mechanisms built in. In practice, this means that list price increases automatically trigger an increased rebate level.

Figure 13 – Healthcare professional are consolidating into integrated delivery networks in the U.S.

Source: Novo Nordisk, annual report 2015, p.36

When launching a new drug and applying for reimbursement, an important consideration is the insurance status of target patients – notably whether they are covered at all as well as the scope of coverage and the limits placed on such coverage. Specifically, it is essential for a drug to be included on preferred drug lists (especially on the list of Medicare and Medicaid reimbursable drugs); a preferred status translates into lower patient cost, **which decreases the impact of the price variable** (Bratic, Blok & Gostola, 2014).

Thus, in an attempt to counter some of the increasing pressures on the interconnectedness of sales prices & profit margins, the solution for the pharmaceutical industry seems to partly rely on the increasing importance of "Health Economics" (*see textbox*) when applying for reimbursement (Cohen, Stolk & Niezen, 2007):

Health Economics

"Health economics" is defined as "*a branch of economics concerned with issues related to efficiency, effectiveness, value and behaviour in the product and consumption of health and healthcare*" (Wikipedia, 2016)

- Most authorities today are using what is called a "Health Economic calculation" as an important tool to consider the value of a product. This is in line with the trend of regulatory authorities in countries such as the U.K. beginning to impose "fourth hurdle" requirements that drugs most demonstrate cost effectiveness, not just safety, efficacy and quality. Hence, the implication for research-based companies is

the dual objective of new drugs both being able to demonstrate value as well as containing cost.

- To clear this fourth hurdle, companies need to show that their products are more effective than relevant competitors and that the increased cost of the same product is offset by saving elsewhere in the healthcare system. For example, in a home care done by a nurse they will include calculations of hourly costs, driving for saved or extra visit, costs of secondary treatment and of course the cost of the relevant product. Thus, the total cost of treatment, both direct & indirect, will be measured. The basis for the calculation will have to be supported by studies and other documentation, but if such a health economic calculation is in favour of the product, health authorities will be likely to adopt it.
- Subject to strict budget constraints, this would imply that as new innovations reaches the market, the funding of (older) pharmaceuticals that are less cost effective will be cancelled and/or result in the delisting of a drug altogether (for example due to an unjustifiable high price).

Thus, in an environment already characterised by intense pricing pressure, there is an increased risk that a company's revenues will be severely harmed if drugs fail to receive reimbursement approval. All else equal, this will really separate the winners from the losers in the biotech/pharma-sector.

3.1.1.1 A side note on the impact of the Affordable Care Act ("Obamacare")

As briefly elaborated in the textbox to the left, the Affordable Care Act of 2010 represent a wave of new regulations in the health care market. As the Act targets the health care insurers in particular, it is a common conception that increased competition in this clause will translate into higher competition & lower margins for the pharma companies as well. As it turns out however, this can only be expected to be partly true, and as it so

Key features of the Affordable Care Act

"On March 23, 2010, President Obama signed the Affordable Care Act. The law put in place comprehensive health insurance reforms that put consumers back in charge of their health care. A new wave of powerful evidence points to one clear conclusion: The Affordable Care Act is working to make health care more affordable, accessible and of a higher quality, for families, seniors, businesses, and taxpayers alike. ***This includes previously uninsured Americans****, and Americans who had insurance that didn't provide them adequate coverage and security."* (HHS.gov, 2016)

happens, the drug industry was actually a *key backer* of the whole thing.

Although the health reform calls for rebates from drug makers to pay for some of the additional benefits to the uninsured, the health law will also bring 32 million of ***additional*** uninsured Americans health benefits – i.e., implicitly expanding the total addressable market. In specific, according to a report from GlobalData, this will pave the way for a major rebound in sales with an estimated USD 115 billion in new business over a 10-year period (Forbes, 2013). Thus, despite the fact that the number of changes in the reform may translate into a few financial sacrifices to begin with, the prospects of an increased patient population could very well turn out to favour the pharma players in the long-term – all else equal, increasing overall industry sales & profits, but leaving the total effect on margins ambiguous.

3.1.2 China: Short-term cap removal vs. long-term pricing pressure

Until June 2015, China had maximum retail prices imposed on most of its drugs. Although there has been a clear trend towards loosening control, such price liberalisation should be seen in the context of a government push to allow market forces to play a greater role in the economy. In order to incentivise foreign and domestic firms to sell better drugs, the new system should hopefully reflect supply and demand in a more timely way (especially when the artificially low prices experienced before led drug makers to cut quality) (The Economist Group, 2016). Hence, the cap removal have reduced uncertainty for drug companies, which until now have been victim to sudden enforced changes in the prices of their drugs.

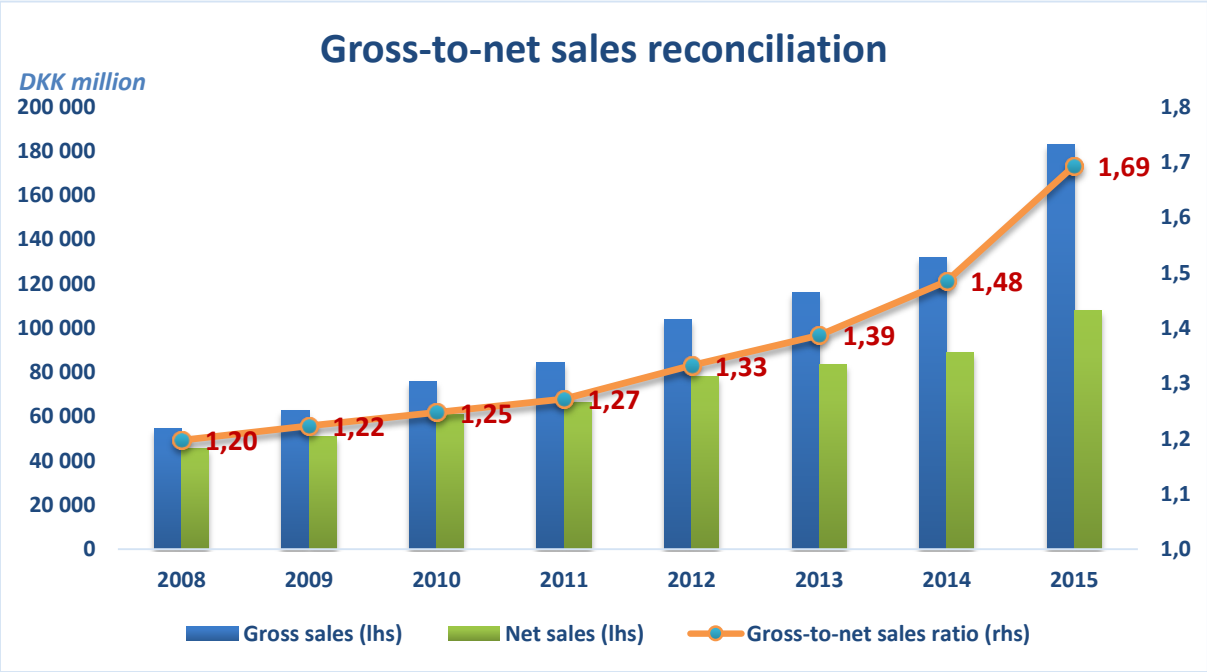
However, while the move may lead to short-term prices rises in some categories, overall pricing pressures are still expected to remain intense. Officials expect that state-run tendering and national medical insurance spending caps will serve to keep down prices. Amongst other, most drugs are sold at hospitals, where bidding systems serve to suppress prices. In the longer term, the move to free pricing should therefore lay the basis for a shift towards a more value-based healthcare. In order to improve cost-effectiveness, this will link drug sales and pricing more closely to patient outcomes (The Economist Group, 2016).

3.1.3 Pricing pressure as experienced by Novo Nordisk

As Novo Nordisk states in its 2015 annual report “sales discounts and rebates are predominantly issued in North America. In addition, political pressures to contain healthcare

cost have led several other countries to impose significant price reductions on pharmaceutical products. As such, governments in Europe have implemented concerted austerity measures, while government-mandated price cuts have been introduced in China, Japan and major countries in Region International Operations" (p.64). Highlighted in the figure below, this translates into Novo Nordisk increasingly giving higher sales rebates & discounts than before (measured as the difference between gross & net sales).

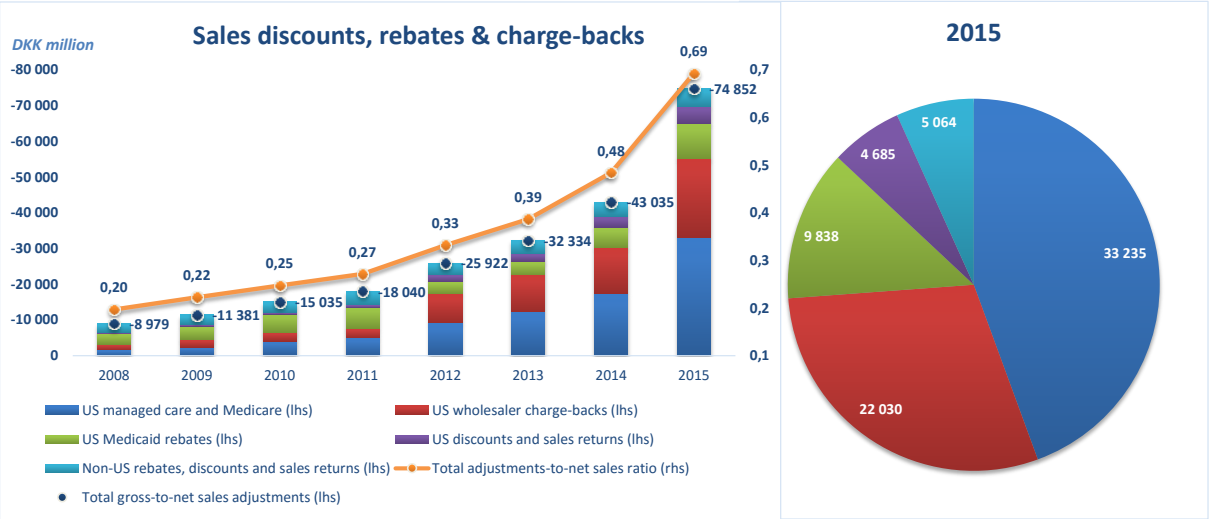
Figure 14 – Novo Nordisk's gross-to-net sales reconciliation, as a measure of price pressure



Digging even further into details, in the US, pharmacy benefit managers (PBMs) have seen a larger role in negotiating price concessions with drug manufacturers on behalf of private payers for both the commercial and government channels. Including recent industry consolidation among private payers and PBMs, this has resulted in greater focus on negotiating higher rebates from drug manufacturers.

To reduce overall drug costs, private payers are increasingly keen to adopt narrow formularies that exclude certain drugs, while securing higher rebates from the preferred brand (Novo Nordisk, annual report 2015, p.64). This trend appears relatively strong when disaggregating the data on the difference in gross & net sales in the figure below.

Figure 15 – Novo Nordisk's gross sales deductions in order of classification



Thus, also determining the list of drugs covered in the Health Plan's formulary, the PBMs role are likely to keep expanding payer pressure. For the future, all else equal, this might indicate that – instead of raising prices – the company is more reliant on the introduction of new drugs for further growth.

3.1.4 EU's increased focus on generics

In the field of pricing and reimbursement, in the EU, Member States are free to develop their own national and regional pharmaceutical policies (as long as they comply with the overall EU provisions) (Vogler, 2012). With limited budgets, especially after the global financial crisis having forced the introduction of short-term rigid cost-containment measures, European countries now view generics as a policy option that enables savings to be made. Hence, generics – if deemed reimbursable – are subject to the same policies as patented drugs.

Furthermore, several markets, including Germany and the Netherlands, have established reference pricing. In reference pricing, products are often clustered by therapeutic group. Consequently, if the reference price is based on the least expensive drug in the cluster, once generic entry occurs, all products in a reference group drop to that price, effectively truncating patent life for the newest drugs in a reference category. Ultimately, this will translate into lost revenues for an affected company (Bratic, Blok & Gostola, 2014).

In summary, the European pharmaceutical systems use several different types of pricing and reimbursement policies for medicines. With a revitalised focus on generics uptake then, all else equal, the prospect of maintaining high prices (& margins) should be lower in the future

than what has been the case in the past. After all, the negative outcome from the price negotiations regarding distribution of Novo Nordisk's Tresiba® in Germany, in 2015, should best be considered a formal warning of what might become the "new normal" in the future.

3.1.4.1 Empirical evidence

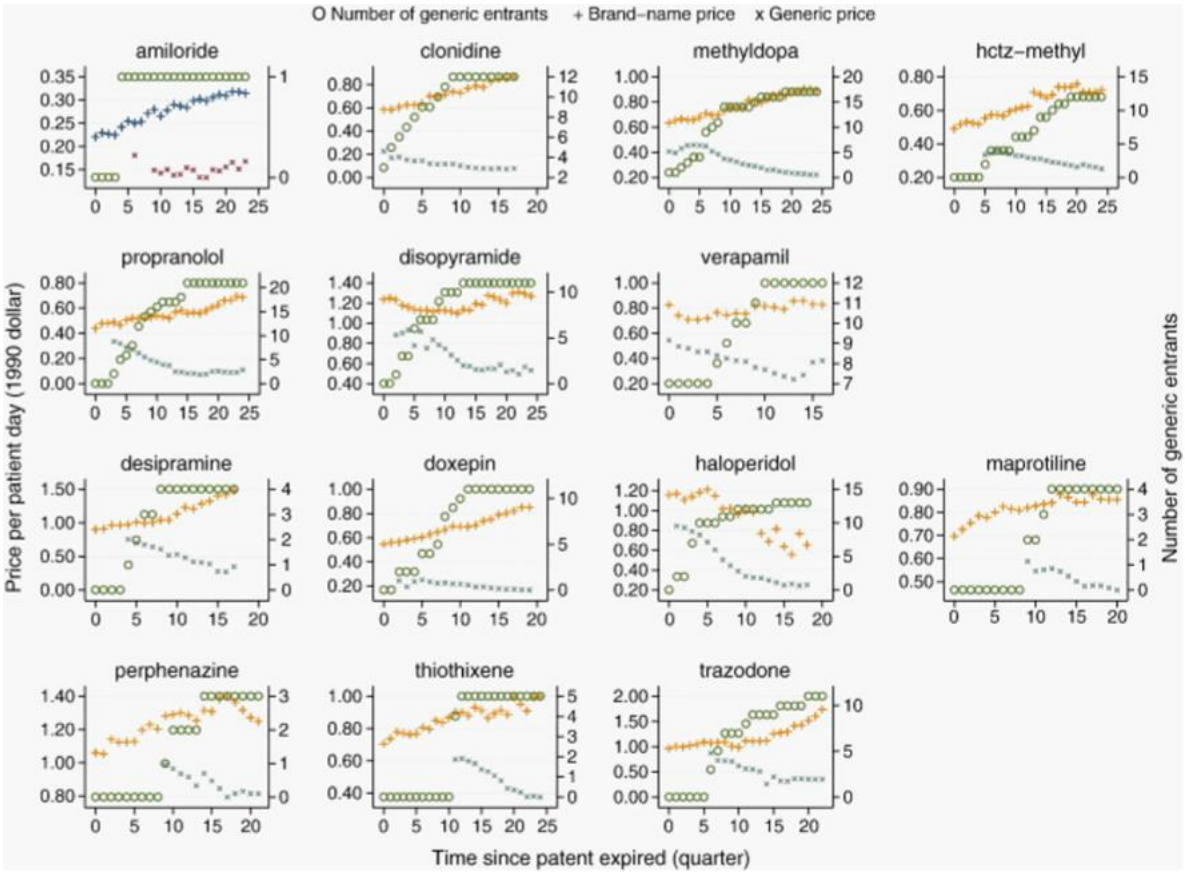
In theory, the focus on generics to lower prices should be completely natural. After all, in microeconomics, the competition within a class of commodities (in this case generics) should follow the standard case of Bertrand competition, meaning prices in equilibrium are set equal to marginal costs. The reality, however, is not that simple. Empirical results indicate that as a soon as a patent reaches expiration and competitors release their own product priced significantly below the incumbent, the incumbent reacts by actually *raising* its prices – not *lowering*. Although this might come as a surprise, the intuition behind proves simple enough, and it relates to segmentation of the market (Brekke, 2015):

- Consumers have different willingness to pay (WTP) when it comes to quality (e.g. due to differences in income, preferences etc.)
- Companies can profit by introducing new product versions with different (perceived) qualities to different prices
- As a result, the market is segmented to the degree that consumers with high (low) WTP buys the product with the high (low) quality. In this case, the larger the difference in price, the larger the difference in quality the consumer will place on the products.
- For newcomers, the implication is the possibility of a profitable entrance with products of lower quality without the additional risk of tough price competition. For incumbents, the implication is a continuation of profit margins at the expense of market shares.

An implicit assumption behind this logic is that brand values act as a measure of quality, and that there actually exist competing products ready to enter the market. In either case, the intuition should be interesting when seen in light of the recent political "fuss" around the industry's above-inflationary (and predatory) price increases.

The results are backed up by the empirical data illustrated in the figure below:

Figure 16 - The pricing of generics: Original product vs. copies

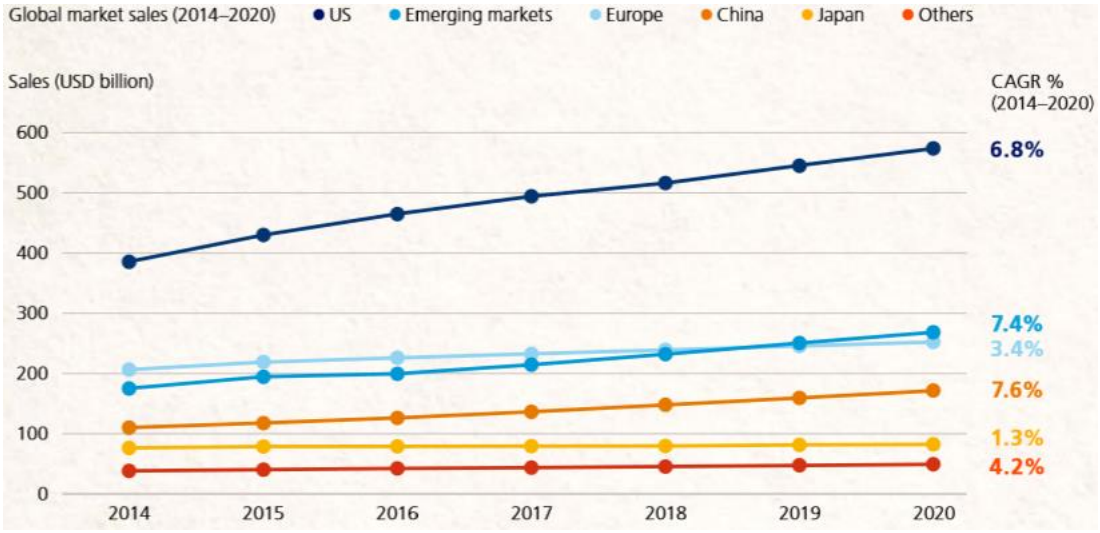


Source: Brekke, lectures, 2015

After patent expiration, when generic entry occurs, the incumbent raise its price while new entrants lower their prices. According to perceived quality – through brand recognition – this segments the market relative to price differences.

3.2 Market growth: Favourable demographics

Figure 17 – Forecasted growth for the global pharma market, bringing the total market to USD 1.4 trillion in 2020 (excluding rebates & discounts)



Source: Novo Nordisk, Annual report 2015

As the figure above indicates, IMS Health predicts that the global consolidated pharmaceutical market will grow 6% annually towards 2020 (Novo Nordisk, annual report 2015, p.37). Despite market access challenges and price pressure, investments in better healthcare seems to keep the sector on a steady path. The main drivers for this growth will come through ageing populations, unhealthy eating habits and too little exercise.

3.2.1 Diabetes market

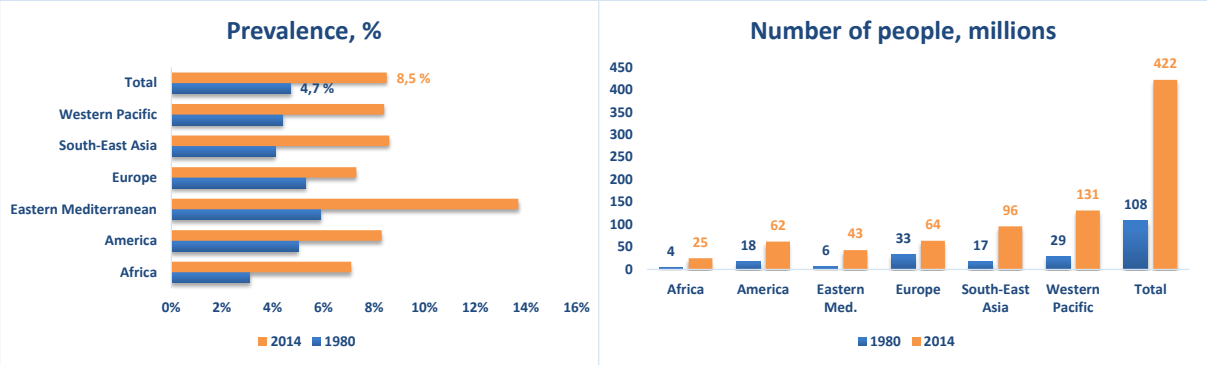
The diabetes pandemic represents a severe burden on people and society. As well as being a factor in 5 million deaths, in 2015, diabetes accounted for **USD 673 billion in global health expenditures** – that is, 11.6% of the total healthcare spend worldwide (IDF atlas, 2015). Excluded from this numbers are the impact of reduced employment and productivity.

One possible "solution" to this enormous drag on governments' health budgets can be found in the potential of improved adherence to diabetes medications. Both leading to better health outcomes and reduced costs (and obviously benefitting Novo Nordisk), studies supporting the cost-effectiveness of screening and optimising treatment have proven that, while short-term cost of treatment and management may increase, long-term costs for healthcare systems will substantially decrease. This is also in line with evidence showing that early detection and optimal control of diabetes lead to fewer and less serious complications,

as well as increased life expectancy. In specific, diabetes patients who do not consistently take their medicines as prescribed are 2.5 times more likely to be hospitalised than those who do (Medicines in Development, 2014). In addition, in the U.S. alone, a recent study in Health Affairs projected that improved adherence to diabetes medications could avert more than 1 million emergency room visits and 0.6 million hospitalisations annually, for total potential savings of **USD 8.3 billion** annually (Medicines in Development, 2014).

Currently, as illustrated in the figure below, an estimated 422 million adults were living with diabetes in 2014 (compared to 108 million in 1980), with prevalence close to doubling in the same period, rising from 4.7% to 8.5% of the adult population (WHO, global report, 2016).

Figure 18 - Estimated prevalence and number of people with diabetes (adults 18+ years)



Source: WHO, global report, 2016

According to the International Diabetes Federation – reflecting an increase in associated risk factors such as being overweight or obese – by 2040 it is predicted that more than 10% of the world's adult population, 642 million people worldwide, will have diabetes (IDF atlas, 2015).

Regarding the diabetes drug treatment market in specific, the **global market amounts to DKK 353**. Of this, Novo Nordisk products account for approximately 27%. Because of the increasing number of people with diabetes and the need for better treatments, combined with an annual market growth of around 10% in the last decade, all indications point to the growth continuing in roughly the same manner as before. Of the global treatment market, each segment's market share (as well as Novo Nordisk's share of each segment) is pictured in the table below. Note that overlap between segment definitions make Novo Nordisk's sum of market shares appear larger than what is actually the case (i.e., 31% if calculated directly vs. 27% if using reported number based on total market).

Table 2 – Segments market shares of total diabetes treatment market, measured in value

Diabetes segment	Market share	Novo Nordisk's share of segment
Insulin	56 %	47 %
OAD – oral anti-diabetic (oral diabetes products)	37 %	N/A (negligible presence)
GLP-1	7 %	67 %
Total	**100 %**	**27 %**

Source: Novo Nordisk, annual report 2015

In summary – underlining the potential for a further market expansion and potentially triggered by the increased focus on "Health Economics" – the main growth drivers in the diabetes treatment market are likely to be both increased prevalence & increased adherence to treatment. Likely to enhance this growth is an increased average cost per patient impact, partly countered by a general price reduction stemming from new cost control measures.

3.2.2 Biopharmaceuticals market

Overall, Novo Nordisk's biopharmaceutical segments – mainly the haemophilia (bleeding disorder) market & the growth deficiency market (*see appendix 1 for scientific background*) – seems likely to experience a relatively weaker growth than the diabetes market. However, the smaller patient populations increase the potential for high prices and solid margins. Some of Novo Nordisk's retail prices in the table below illustrate this point:

Table 3 – Examples of Novo Nordisk's product retail prices

Product	Price
NovoSeven®	USD 9.200 per vial
Tretten®	USD 35.000 a vial
Norditropin®	USD 1.500 a pen
Activella®	USD 2 a tablet
Vagifem®	USD 20 a tablet

According to a recent forecast by GlobalData on haemophilia – limiting the segment universe to only include recombinant therapies for haemophilia A and B – the market is set to experience limited growth, rising from USD 5.4 billion in 2014 to USD 6.3 billion in 2024, implying a CAGR of 1.5% (GlobalData, 2015). Including other, rarer factor deficiencies, the main drivers for growth should involve the following factors (Grand View Research, 2015):

- In the developed countries, increasing per capita usage rates in anticipation of bleeding episodes are expected to render the most growth.

- In the non-developed countries improved & increased healthcare spending, as well as expanding “medical tourism”, should widen the total reachable market. In light of new novel coagulating factors, this should help address the high unmet medical needs further.
- However, in both cases, the high cost of treatment will act as a major restraint for volume growth.
- Although the market remains competitive, only a few players dominate it. On the accounts of low observed therapy switching rates and the difficulty to achieve FDA-approval, barrier to entry remains high.

According to another research report from GlobalData, the global market for growth hormone deficiency treatment will rise in value from USD 1.26 billion in 2014 to approximately USD 1.88 billion in 2024, representing a CAGR of 4.1% (European Pharmaceutical Review, 2015).

Offering improved compliance and adherence outcomes, the anticipated less frequent dosing schedules of new drugs currently in development are likely to be attractive to patients. Hence, the patients who currently refuse to take their daily growth hormone injections are expected to opt for the long-acting drugs and eventually increase the overall drug treatment rate. All else equal, this implies a stronghold of position for incumbents.

3.3 Patents

Generally, new drugs are protected by patents that grants an inventor a period of market exclusivity. Patents are granted anywhere along the development lifeline of a drug and can encompass a wide range of claims. During this period, the pharmaceutical companies do not face generic competition and the potential for economic rewards becomes tremendous. Typically, patents expire **20 years** from the date of filing.

Following patent expiration, however, generic firms enter the market, prices drop dramatically, and innovators typically lose a large portion of the sales in the market. Thus, the innovator is dependent upon this period of exclusivity in order to earn a normal return on their investment in R&D (Grabowski et al., 2015, p.2).

Marketing exclusivity, unlike exclusivity based on protection from patents, is exclusive marketing rights granted by the FDA upon approval of a drug and can run concurrently with a patent or not. Exclusivity is designed to promote a balance between new drug innovation and generic drug competition, and is a statutory provision granted to an NDA applicant (*New Drug Application*) if statutory requirements are met (FDA, 2016). Examples of the length of various types of exclusivities are provided in the table below:

Table 4 – Length of different types of granted exclusivities, in the U.S.

Type of Exclusivity	Length of Exclusivity
Orphan drug	7 years
New Chemical Entity (NCE)	5 years
Biological products	12 years
"Other" exclusivity	3 years
Paediatric exclusivity	6 months added to existing patent/excl.
(Successful) Patent challenge	180 days (for generics)

Source: FDA, 2016

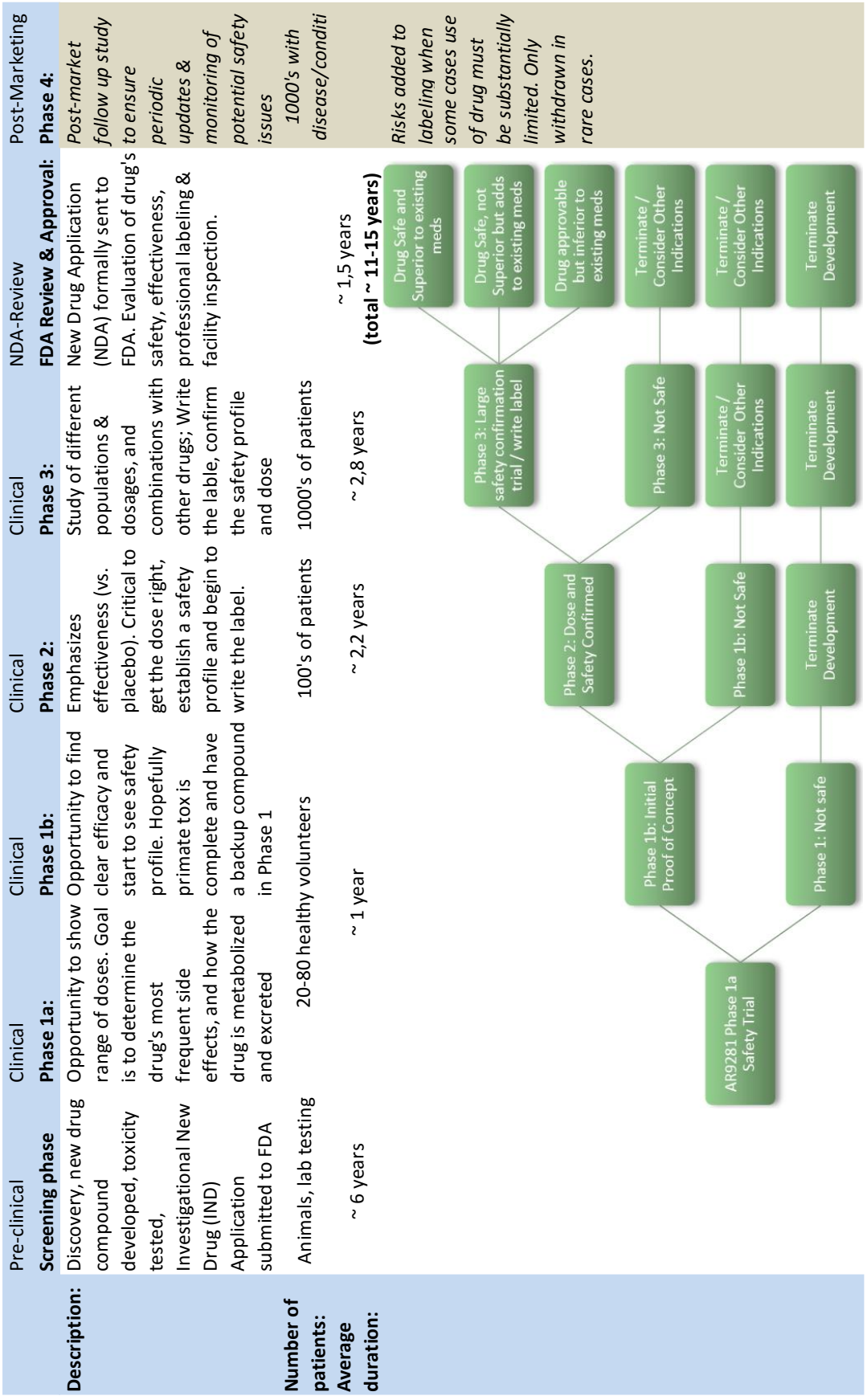
However, the process of actually obtaining a FDA-approval is highly demanding. This is explained in the next section on the FDA drug approval process.

3.3.1 FDA drug approval process

FDA (2016) defines a drug as "any product that is intended for use in the diagnosis, cure mitigation, treatment, or prevention of disease; and that is intended to affect the structure or any function of the body". The main characteristics and phases of the drug approval process in the US are illustrated in the figure below.

As indicated by the figure, the entire process from screening & researching to final FDA-approval, can take anywhere from 10-20 years. At the same time, the probability of a new compound going through each phase with success is surprisingly small.

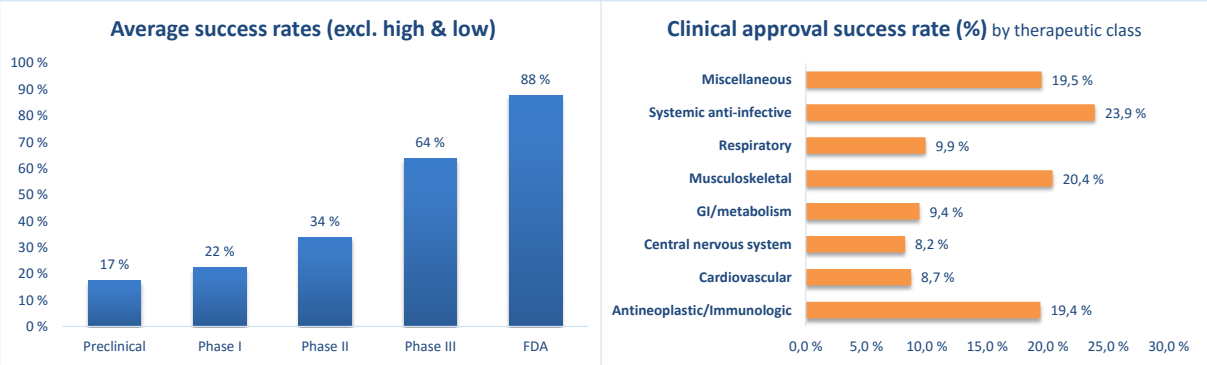
Figure 19 – Key developments in the FDA-approval process



Source: FDA, 2016 & Torreya Partners, 2013

Specifically, depending on the current phase of the drug, the average likelihood (*based on data from 14 studies*) of a product reaching final FDA-approval is as estimated in the figure below (Torreya Partners, 2013):

Figure 20 - Probability of final FDA approval for products entering a certain phase & by therapeutic class

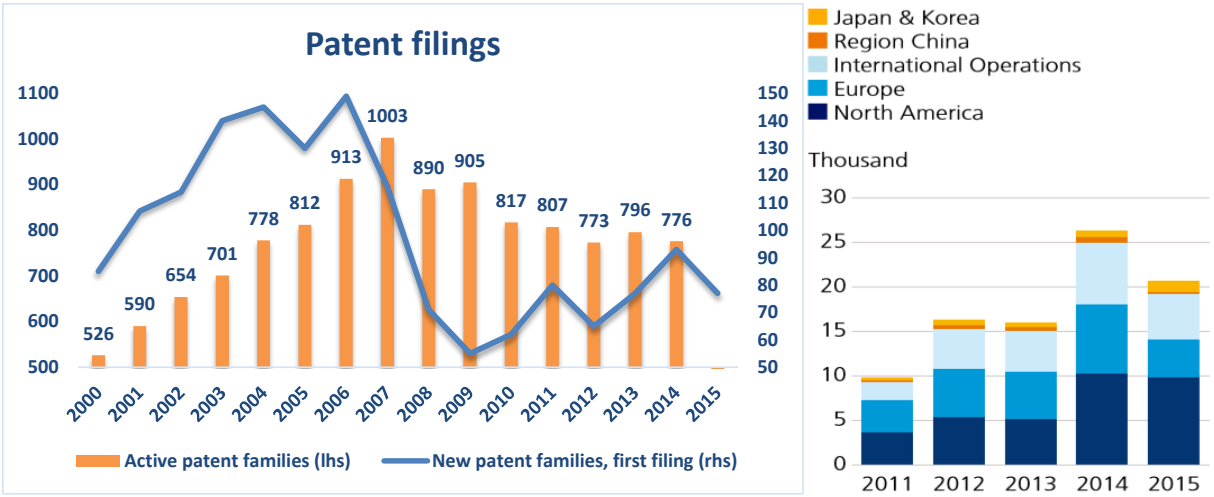


Source: Torreya Partners, 2013. (GI – gastrointestinal)

By therapeutic class, Novo Nordisk should place itself in the "GI/metabolism" (*more specific would be endocrinology*) class, with an overall successful industry approval rate well below average of 9.4%. According to this data, **that means only 1 in 10 new diabetes compounds will reach the market after 15 years of research**. Thus, it would be an understatement to claim that Novo Nordisk's currently large market shares (*provided in the SWOT-analysis*) should contribute to a continued robust performance in the future as well.

In fact, based on statistics alone and as illustrated in the figure below, Novo Nordisk should be able to present a wide array of products reaching final FDA-approval. In addition to having close to 800 active patent families at hand, the company has in recent years experienced a significant upturn in the level of late stage clinical trials (*as indicated by the aggregated patient years in clinical trials*).

Figure 21 – Novo Nordisk number of patents (lhs) & distribution of cumulative patient years in clinical trials (rhs)



Source: Novo Nordisk, annual reports 2000-2015

3.3.2 Patent strategies

It is widely recognised, however, that the pharmaceutical industry in general faces serious financial challenges. Large number of blockbuster drugs are losing patent protection and going generic. Moreover, many of the new products are biologics with much narrower target patient populations and comparatively higher prices relative to traditional pharmaceuticals. Facing this so-called "patent cliff" scenario, the industry has moved to accelerate drug development process and to adopt different strategies to extend the lifetime of the patent monopoly. This should provide the economic incentives necessary to utilise it for drug discovery and development (Gupta, Kumar, Roy & Gaud, 2010).

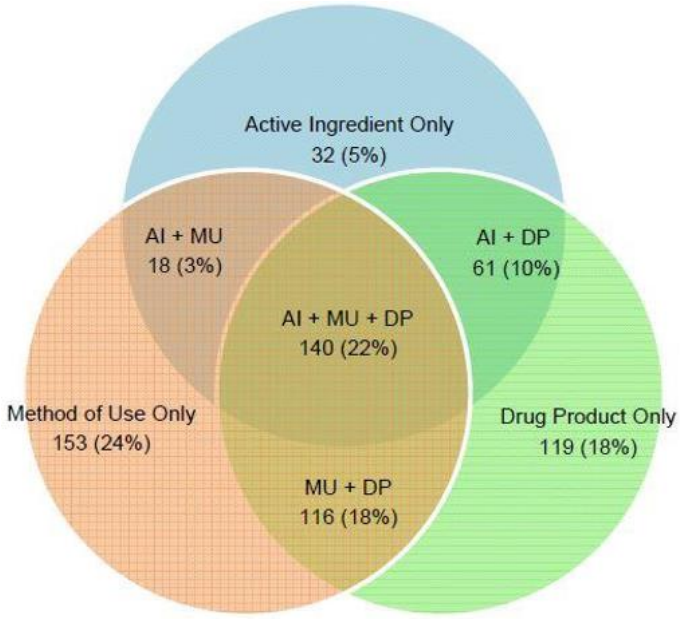
To maximise the commercial lifecycle of a drug, pharmaceutical companies can employ a number of strategies to extend patent protection on an important compound. An **"evergreening"** strategy is a strategy characterised by innovators pursuing multiple patents with different expiration times **on the same product**. In particular, separate patents can be obtained on a product's active ingredients, method(s) of use, and formulation(s). Some of these later listed patents can lead to longer potential exclusivity periods for the branded products, but may rest on narrower claims that are more vulnerable to patent challenges by generic firms. Reflecting accepted views on patent scope and strength a hierarchical ordering is presented below (Grabowski et al., 2015, p.3):

1. Active Ingredient (AI) patent – strongest in terms of the scope of patent claims.
2. Method-of-Use (MU) patent

3. Drug Product (DP) patent – weakest in terms of the scope of patent claim.

In the figure below, a sample of 213 NMEs (*see textbox*) approved between 1994 and 2006 are classified according to the patent at issue. The sample contained 639 Orange Book listed patents. The data imply that an NME, in the sample, has an average of 1.18 AI patents, 1.26 MU patents, and 0.56 drug product patents, totalling at 2.90 average patents per NME.

Figure 22 – Combination of Orange Book listed patents, 1994-2006 NMEs



Source: Grabowski et al., 2015.

NME vs. NCE

A **New Molecular Entity** (NME) is a drug that contains an active moiety/ingredient that has never been approved by the FDA or marketed in the US.

A **New Chemical Entity** (NCE) is a drug that contain no active moiety/ingredient that has been approved by the FDA. (Wikipedia, 2016).

Importantly, NCE status governs the granting of the 5-year exclusivity period, while NME status now governs the granting of a 12-year exclusivity period.

Orange Book

"The publication *Approved Drug Products with Therapeutic Equivalence Evaluations* (commonly known as **the Orange Book**) identifies drug products approved on the basis of safety and effectiveness by the FDA under the Federal, Food, Drug and Cosmetic Act" (FDA, 2016).

3.3.3 Litigation risk and its implication on effective patent life

One of the most controversial provisions of the 1984 Hatch-Waxman Act was the creation of incentives for generic firms to challenge brand-name patents before they expired. In particular, a generic firm can file an ANDA (Abbreviated New Drug Application – for generic drugs) four years after the brand product's approval date with the claim that its product does not infringe the reference products patent(s), or that these patent(s) are invalid (a so-

called **paragraph IV challenge**). The first generic manufacturer to file a paragraph IV challenge resulting in entry prior to patent expiration (from either a court victory or settlement) is granted a **180-day exclusivity period**.

The 180-day period of generic exclusivity is generally very profitable to a generic manufacturer because the firm can discount its price only moderately compared to the brand product and still gain most of the branded product's sales. As a result, it is argued that generic firms have an incentive to race to be the first ANDA filer with a patent challenge, and to challenge patents even when the probability of success is low (Grabowski et al., 2015).

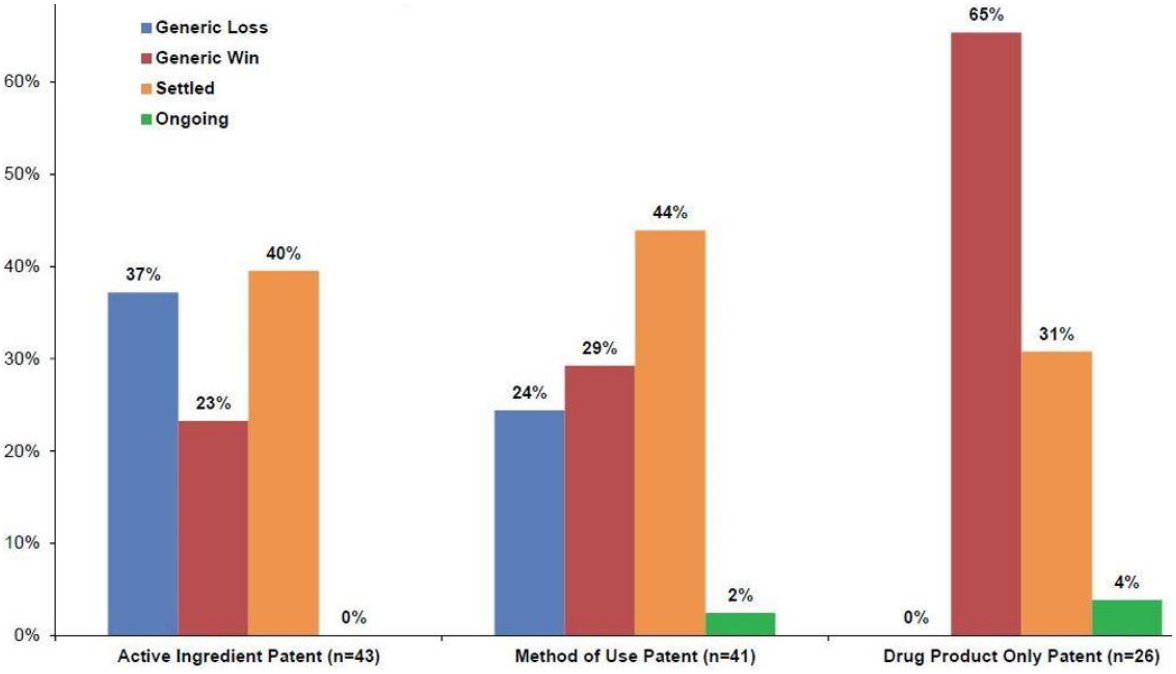
Accordingly, there has been a rise in the number of settlements for violations in the last two decades. Between 1991 and 2011, pharmaceutical companies settled more than 165 cases of civil and criminal actions by federal and state governments in the U.S. Total criminal penalties were estimated at **USD 19.8 billion** – in which 73% of the awards were paid between 2006 and 2010. Although the settlements and financial penalties stem from a variety of violation, over 50% of the major lawsuits were accounted for by drug safety issues (Bratic, Blok & Gostola, 2014). Therefore, possibly the greatest risk of all – namely that of public litigation – could have some serious detrimental effects when it comes to the reputation of a new drug.

On top of this, recent enforcements in the U.S. include the amendment of the Fraud and Enforcement and Recovery Act of 2009, making it easier for whistle-blowers to bring lawsuits, resulting in massive recoveries in subsequent years. Additionally, in 2010, the government passed the Dodd-Frank Act, in which the "SEC" gets to lure out potential whistle-blowers with a newly established USD 451 million fund, also protecting them against retaliation.

Based on this evidence, it does not come as a surprise that the bestselling drug products, ranked by peak sales, have a higher likelihood of experiencing a patent challenge over their lifetime. In terms of litigation outcomes by patent type, the branded firms have won the majority of court decision when it comes to active ingredient patents (represented by "generic loss" in the figure below). Despite this favourable outcome, the generic firms gain early entry in the majority of AI patent cases when settlements are taken into account. For method-of-use patents, the odds of success slightly favour generics, with 44 percent of the

patent challenges resulting in settlements. In the case of drug-product-only patents, generics prevail in virtually all the patent cases, winning 65 percent in court decisions, while 31 percent are resolved through settlements. These court outcomes should also be consistent with patent experts' opinions on the strength and scope of biopharmaceutical patents. At the same time, the proclivity of innovative firms to settle should be consistent with study findings on these firms having much more to lose from an adverse court decision. With generics winning a significant number of times, this also makes it a real possibility (Grabowski et al., 2015).

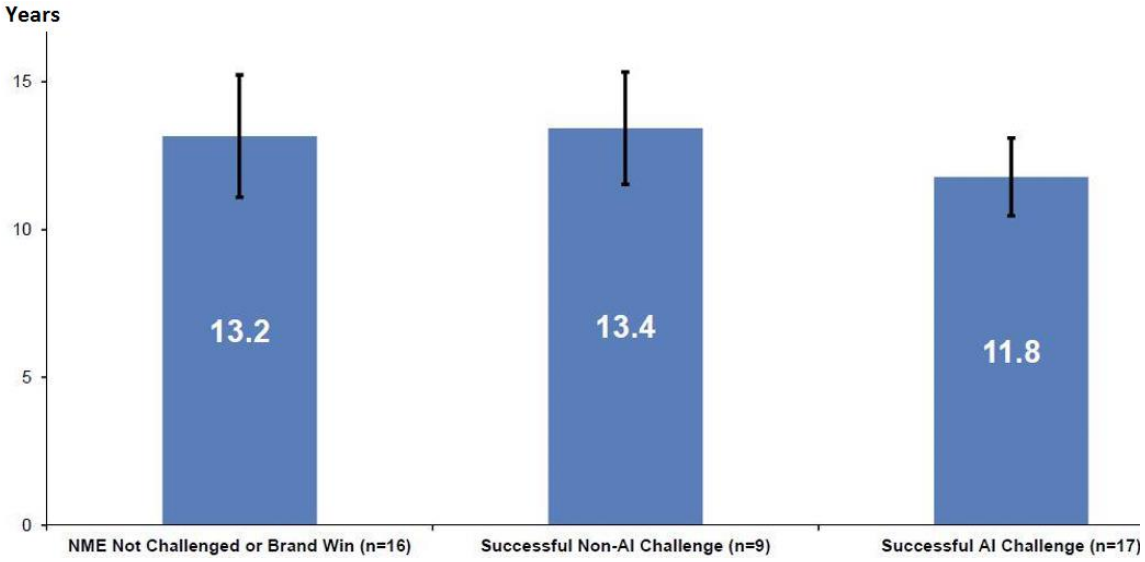
Figure 23 - Litigation outcomes by patent type, top quintile NMEs (in terms of sales) 1994-2006



Source: Grabowski et al., 2015.

A key finding from the Grabowski-study, the estimated average patent life for the brand firm was 13.2 years when winning (or not being challenged at all) on the AI-patent. Surprisingly (arguably due to the low sample), the average effective patent life were extended by 0.2 years in those cases the generic firm won the challenge on the other, non-active-ingredient, patent types. In line with expectations, on the other hand, a successful generic firm's challenge on branded firms' active ingredient resulted in a considerable reduction in effective patent life of 1.4 years (compared to brand win/no challenge). These findings are summarised in the figure below.

Figure 24 – Average patent life of top quintile NME products, 1994-2006



Source: Grabowski et al., 2015.

In the case of the largest selling products, these finding indicate that almost all NMEs are subject to challenges. Also, despite a considerable variability observed across NMEs, patent challenges are resulting in shorter average effective market exclusivity periods and implicit significantly shorter time to generic entry.

Thus, while the odds of winning court decisions on active ingredient patents may favour innovative firms, the risks in terms of lost future revenues and market valuation are sufficient to go for the settlement (Grabowski et al., 2015, p.26-28).

3.3.4 "Biosimilars" and the implication of The 2010 Biosimilar Price Competition and Innovation Act (BPCIA)

"Biosimilars" (*see textbox*) are officially approved versions of original innovator products, and can be manufactured when the original product's patent expires.

In 2010, the Biological Price Competition and Innovation Act (BPCIA) was passed, establishing an abbreviated approval pathway for biosimilars in the US (Bratic, Bloc & Gostola, 2014):

Biosimilars

A "biosimilar" (also known as a follow-on biologic or subsequent entry biologic) is defined as "*a biologic medical product which is almost an identical copy of an original product that is manufactured by a different company*" (Wikipedia, 2016).

- The BPCI Act aligns with the FDA on what is already known about a drug, thereby saving time and resources in regards to the approval process.
- Prior to this legislation, there was no regulatory pathway to approve biosimilar products and therefore, most biologics benefitted from never having to compete with generic products. With this Act, however, generic companies can now start marketing cheaper biosimilars.
- While the Congress extended the regulatory market exclusivity period for innovators to **12 years** (vs. 5 years for New Chemical Entities (NCEs)), the Congress did not, however, create an exclusivity period for the first filing biosimilar application challenging the patents of the reference product (as was the case with the paragraph IV challenge in the section above). As such, it is less likely that branded firms will experience the same intensity of patent challenges compared to the case above. Rather, biosimilars should only pose as a threat after the patent expiration date.

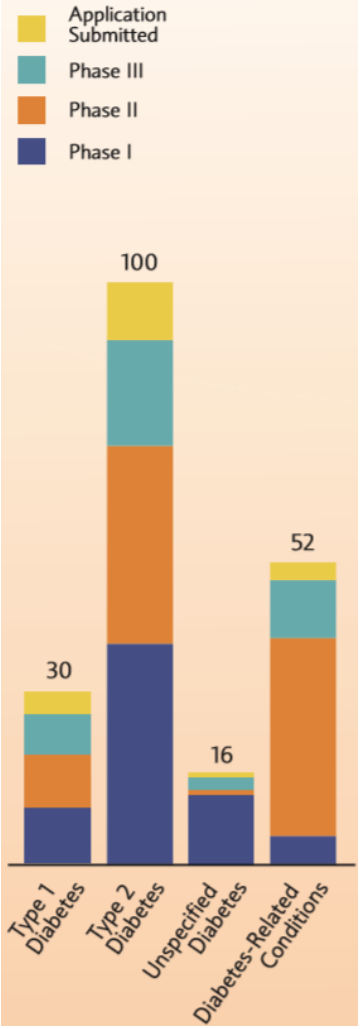
Even though the biosimilar market is rising, the price drop for biological drugs at risk of patent expiration is not as great as for other generic drugs; in fact, it has been estimated that the price for biosimilar products will be 65%-85% of their originators. Considering only the top 10 best-selling products, as of 2011, this would have put 36% of the USD 140 billion market for biological drugs at risk (Fernandez & Hurtado, 2012).

According to a report by Allied Market Research, the global biosimilar market is expected to grow from an estimated USD 1.3 billion in 2013, reaching USD 35 billion by 2020 (Pharmtech, 2015). Exactly how and to what extent these events will change the market dynamics is difficult to assess at the moment, but at some point it will almost certainly translate into increased competition.

3.3.5 Current patent database: U.S diabetes R&D-pipeline

In 2014, American biopharmaceutical research companies were developing 180 medicines to treat diabetes and related conditions (Medicines in Development, 2014). In addition, there were 200 active clinical trials. Including 14 trials initiated by Novo Nordisk, 140 had not yet started recruiting patients, while the remaining 60 were highly active. The distribution of trials were as represented in the figure to the right. Note that the majority of development projects were distributed in phase I & phase II.

Figure 25 – Diabetes pipeline in the US



Source: Medicines in Development, 2014

Amongst the 200 medicines in development in 2014, the innovations with the highest potential include (Medicines in Development, 2014):

- **Stimulating the formation of insulin producing cells** – A treatment for type 1 diabetes designed to stimulate and enhance the regeneration insulin-producing cells (islets); there are often too few insulin-producing islets to keep up with the demand for insulin.
- **Next-generation oral treatment** – A potential treatment for type 2 diabetes part of the DPP-4 inhibitor class, but chemically distinct from other approved medicines in this class (*see scientific background in section on SWOT-analysis*). In clinical trials, the medicine was able to inhibit more than 80 percent of its target enzyme for seven days, making it potentially a once-weekly treatment versus daily.
- **Once-Weekly Treatment (by Novo Nordisk)**—A treatment in the same class of drugs as some other approved medicines for type 2 diabetes, but with a longer therapeutic life that may make it suitable for once-weekly dosing. The medicine is a human glucagon-like peptide (GLP-1) analogue that lowers blood glucose and reduces body weight.

No immediate cure for diabetes seems likely to be found in the "near-term" future, however.

3.4 Cost of entry: Signs of a productivity crisis?

Assuming the regulatory pricing pressure in the pharmaceutical market is of a long-term nature, then – all else equal – this would require improving the productivity of R&D to maintain a reasonable level of return on investment. Looking at the statistics, however, this does not look outright credible:

- In December 2013, Deloitte and Thomson Reuters examined the total cost of newly introduced drugs from the twelve pharmaceutical companies with the largest R&D budgets. Their results indicated that it costs **USD 1.3 billion** to bring a newly discovered compound to market. At the same time, however, the average forecast for peak sales declined by 43 % compared to 2010, dropping from USD 816 million to USD 466 million (Forbes, 2014).
- The same study also indicated that the high nominal prices of new drugs, despite common belief, do *not* compensate for the smaller patient populations that they target. More specifically, they found that the internal rate of return (IRR) on R&D spending had dropped in half since 2010, from 10.5% to 4.8%, indicating that the pharmaceutical industry as a whole is failing to achieve its hurdle rate. In plain speaking, this implies that sales of new drugs are struggling to overcome either the challenge of loss of patents, weak pricing power for older drugs and/or reduced productivity in R&D – or a combination of all factors taken together.
- In another study, by the Tufts Center for the Study of Drug Development, they estimated that the cost to research and develop a new drug stood at USD 802 million in 2003 (equal to USD 1044 million in 2013). However, in a new update from 2014, they had at to revise their estimate upwards by almost two and a half times the inflation-adjusted 2003 estimate – to **USD 2558 million** (including the final costs of marketing, distribution networks and everything).

Being almost twice as large as the estimate from Deloitte and Thomson Reuters, it would be wise to take a closer look at one of the assumptions used by the Tufts Group;

- The Tufts group looked at costs from the first step of research, before discovery, meaning that the cost of abandoned projects were allocated to the successful ones. Implied from the study, at least 8 out of 10 projects were abandoned (with some

drugs still under development and probable to get abandoned). While this should be roughly in line with the statistics on clinical approval success rates gathered earlier in the thesis, the author noted that "clinical approval success rate have declined significantly" since their earlier study.

While especially the Tufts report is controversial, the total body of evidence still indicates a productivity crisis in pharmaceutical R&D. Combining the vast investments necessary with the generally low IRR of 4.8% (from the Deloitte and Thomson Reuter study), the threat of new entrants should in either scenario be close to negligible. Even if a new compound should be perceived as "extraordinary" promising, the road to final drug approval would be a decade into the future, and the total capital needed to fund operations this long would represent a serious risk on its own. Furthermore, without extensive sales networks to rely on – and with competitors see you coming from the granting of approval in each phase – a newcomer would in a best-case scenario have to rely on a partner to make an impact. As Novo Nordisk's strategy involves acquiring research portfolios to add competences, the "threat of entry" should present itself as an opportunity rather than a serious risk.

3.4.1 "Big pharma" vs. non-harmonised healthcare systems: The advantage of size, experience & pre-established distribution networks

Building on this last point, to recoup the largest possible return on investments most products would probably benefit from being launched around the globe over a relatively short period. However, with the markets consisting of relatively fragmented and uncoordinated healthcare services divided by national boundaries, the system seems rigged in favour of the big and pre-established players. To illustrate this point further, I will use the European market as an example.

Although it's true that the European Medicines Agency (EMA) grants market access in its 27 member states with one final drug approval application, in practice, medicines only reach the market when each member state decides that its national health system will reimburse for the drug. Since the EU has not harmonized the healthcare systems of its member states, differences across the reimbursement and pricing environment of Europe makes it challenging for a small newcomer to make a sudden impact on its own. Every reimbursement application follows special arrangement procedures, and, as a result, it takes

time just to get oversight and make the necessary preparations. For a small-cap biotech company with a limited patent portfolio approaching expiration dates, the alternatives are limited. Even with a product outperforming in clinical trials, on most occasions the best method to have their products extracting the most value from the markets would be out-licensing, partnership or merging into a (large-cap) pharmaceutical company. Thus, while Europe's cumulative market size offer great opportunities, the markets remains fragmented (even inside Germany one must adhere to several "states") and – all else equal – its potential is best exploited by the big players.

3.4.2 Possible solution: "21st Century Cures"

Examining the entire regulatory process governing the research enterprise and recognising that the federal drug and device approval apparatus is the relic of another era, the U.S. Congress have in recent years launched a bipartisan initiative for "21st Century Cures". With the objective of both modernising and personalising health care, encourage greater innovation, support research, and streamline the system, the 21st Century Cures Act (HR 6) was approved on July 10, 2015 (Energy and Commerce Committee, 2016).

More precisely, the aim of HR 6 is to "accelerate the discovery, development and delivery of life saving and life improving therapies". Amongst other, it will transform the "quest for faster cures by" (The 21st Century Cures Act, FACT SHEET, 2015):

- Measuring success and identifying diseases earlier through personalised medicine
  - HR 6 will advance personalised medicine – amongst other through the utilisation of drug development tools such as biomarkers (which can be used for earlier assessment of how a particular therapy is working and on whom) – making sure patients can be treated based on their unique characteristics at the appropriate time
- Modernising clinical trials

- Personalised medicine allows researchers to design more targeted clinical trials that can produce results faster and cheaper (faster patient recruitment, screening in advance, less bureaucracy, allowing new creative trial designs etc.)

- Removing regulatory uncertainty for the development of new medical apps (enabling the monitoring of real time patient data)
- Providing new incentives for the development of drugs for rare diseases

Although it may be too soon to tell if the Act will have any profound effects on the regulatory approval pathway in the US, it should at least mark a turning point in the amount of paperwork and total time spent in the lengthy processes of "bureaucracy" (e.g. a NDA typically consists of at least 100.000 pages). As such, it should serve to benefit all stakeholders involved.

Also, it is possibly in this light that Novo Nordisk's newly announced partnership with IBM Watson Health should be seen. According to Novo Nordisk "this partnership will explore possibilities for improved diabetes care via insights from real-time, real-world evidence of Novo Nordisk diabetes treatments and devices" (Annual report 2015, p.4).

3.5 Tax evasion and the role of transfer pricing

"The avoidance of taxes is the only intellectual pursuit that carries any rewards" – John Maynard Keynes.

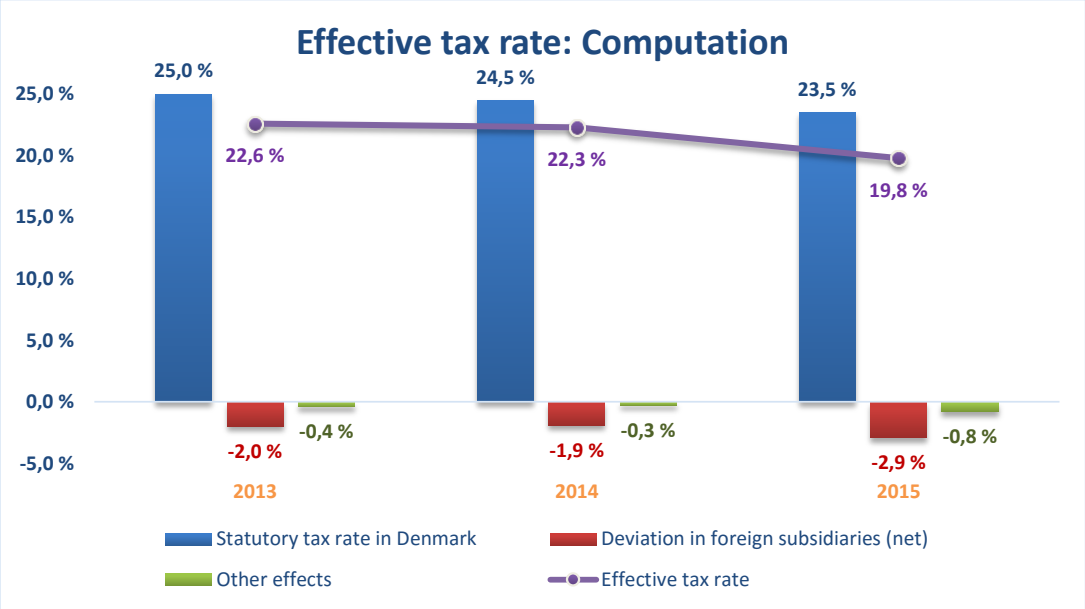
The amount charged when one firm (or division) sells goods or services to another firm (or division) is called **transfer pricing**. Through the active use of subsidiaries in multinational firms, transfer prices can be "manipulated" to shift income from high-tax countries to low tax countries (especially by the widespread use of tax havens). Assuming the shareholders only care about their (financial) return on investment, the objective of transfer pricing – that is, to minimise income and maximise deductible expenditures in high-tax jurisdictions (and vice versa in low-tax jurisdictions) – would also be equivalent to maximising profits. The problem, of course, is that such abusive transfer pricing is illegal, and what firms may think is legal tax planning might be considered tax evasion by tax authorities. This indicates a grey area where it is unclear what is legal (Schindler & Schjelderup, 2015).

In recent years, this has paved the way for growing political concern, especially in the OECD and the UN. However, focusing on the "arm's length principle" – the price that would have been set between independent trading partners in the market place – the international consensus on transfer pricing might be very difficult to find, especially when there are no obvious market parallels, e.g. as is the case with intellectual property. With studies showing that multinationals face lower effective tax rates than domestic firms, this has spurred the way for increased governments supervision and control. Thus, as new stricter international rules prevails, (abusive) transfer pricing is more likely to be condemned.

3.5.1 Novo Nordisk's tax approach

Generally, a firm is tax domiciled where the board has its primary function (oversight of control). For Novo Nordisk this is Denmark. As the figure below illustrates, however, the effective tax rate of Novo Nordisk has for a long time been lower than Denmark's statutory tax rate.

Figure 26 – Novo Nordisk's effective tax rate, 2013-2015



In fact, this is in line with the company's explicit finance policy of "pursuing a competitive tax level in a responsible way". This means that the firm will both pay taxes in the jurisdictions where actual business activity generates profits and, at the same time, achieve a tax level around the peer group average (Novo Nordisk, tax approach, 2016).

Evidence on that this latest statement may sound a bit contradictory, in 2013, Novo Nordisk was hit with transfer pricing adjustments of DKK 22 billion by the Danish tax authority (SKAT)

resulting in increased tax bill of DKK 5.5 billion. The dispute concerned the transfer of the company's entire biopharmaceutical division from Denmark to Switzerland and dated all the way back to 2002. Including the ruling of intellectual property rights (IPRs) & patents being transferred at too low of a price, the parent company also should have charged more for the services it provided, the verdict said (International Tax Review, 2013). Hence, as this example serves to illustrate, the concept of valuing intellectual property rights is a tricky dilemma.

As a potential solution for such "miscalculations" Novo Nordisk are actively negotiating multi-years agreements, known as **Advance Pricing Agreement (APA)** (*see textbox*), in key jurisdictions. Already implemented in countries like the US, Canada, Japan, China and India, this should, in theory, help contain the risk of future fines at a minimum.

Advance Pricing Agreement (APA)

An APA is an ahead-of-time agreement between a taxpayer and a taxing authority on an appropriate transfer pricing methodology for some set of intercompany transactions over a fixed period of time. (Novo Nordisk Tax approach, 2016)

3.6 Company-specific SWOT analysis

Expanding the strategic analysis with a company-specific SWOT-analysis, I hope to detect some key areas of focus for the valuation. A summary is provided in the table below and more carefully investigated in the rest of the section.

Table 5 – Novo Nordisk SWOT analysis, summary

Strengths	**Weaknesses**
- Superior portfolio enabling Novo Nordisk to sustain its leadership position in the global diabetes market - Strong position and high margins in the growth hormone market - Increased focus on the U.S. market	- Product recalls may affect the company's brand value and reputation
Opportunities	**Threats**
- Expanding leadership position in diabetes - Establishing presence in the obesity treatment market - Further cultivate the potential of GLP-1 analogues - Strategic initiatives to tap haemophilia market	- Pricing pressure and reimbursement restrictions by payers - Delays or failure of pipeline products could affect the productivity of the company - Increasing pressure from competitors and managed care companies could affect Novo Nordisk's profit margins

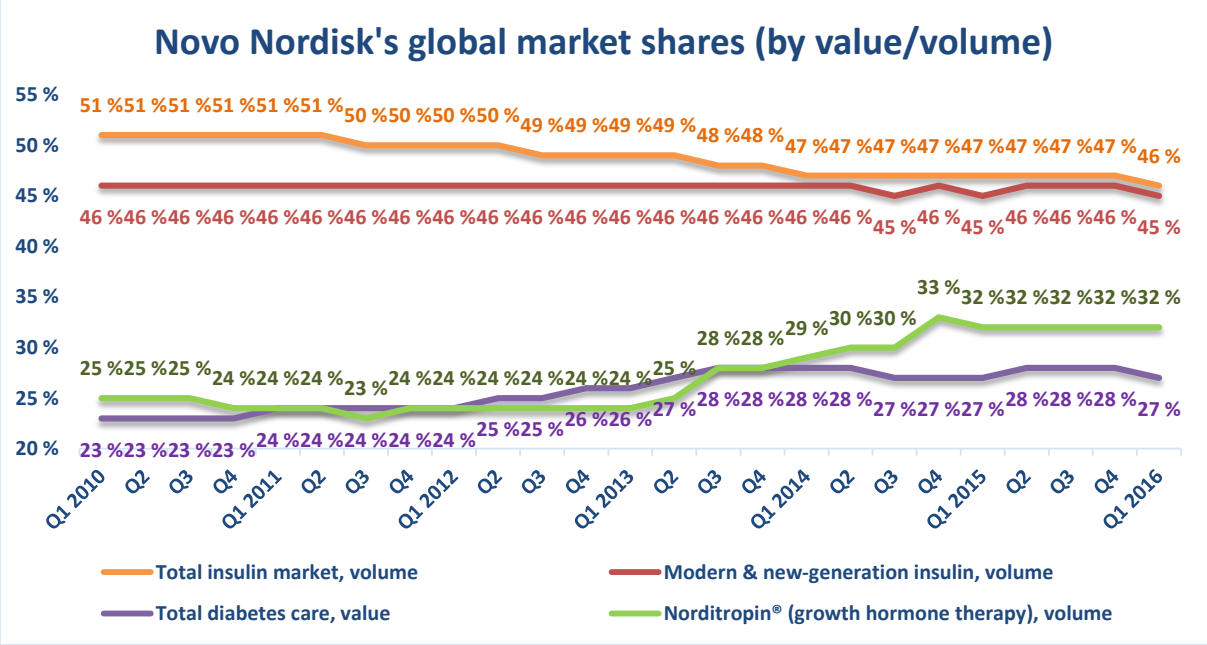
Note that topics previously commented in the thesis, e.g. pricing pressure & reimbursement restrictions, will only be provided in the summary. Also, for a complete walkthrough of the scientific background on these segments, please find a dedicated section in appendix 1.

3.6.1 Strengths

In 2007, Novo Nordisk decided to focus all its efforts in diabetes care on protein-based products, such as insulin and GLP-1. As a result, the company is now the dominant leader in both segments, with market shares of 47% and 67% respectively.

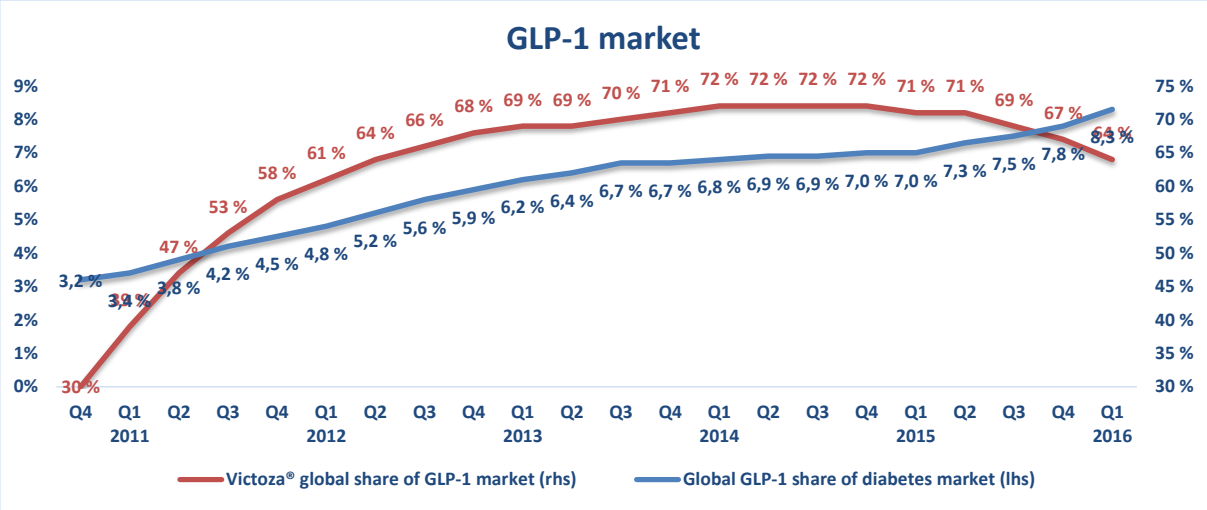
With a total value market share of the aggregated diabetes treatment market of 27%, Novo Nordisk has world leading position in delivering diabetes care. Including an advanced portfolio of modern insulins, the company has one of the broadest diabetes product portfolios in the industry. In addition, Novo Nordisk has a strong position within the niche of growth hormone therapy. The development of these market shares are highlighted in the figure below.

Figure 27 – Novo Nordisk's quarterly development in market shares, by segment



Illustrating the development in market shares of Novo Nordisk's currently most lucrative segment - modern insulins – and the second most grossing segment – GLP-1, the market shares in the figures above & below, respectively, have been on a steady path in two otherwise rapidly increasing markets.

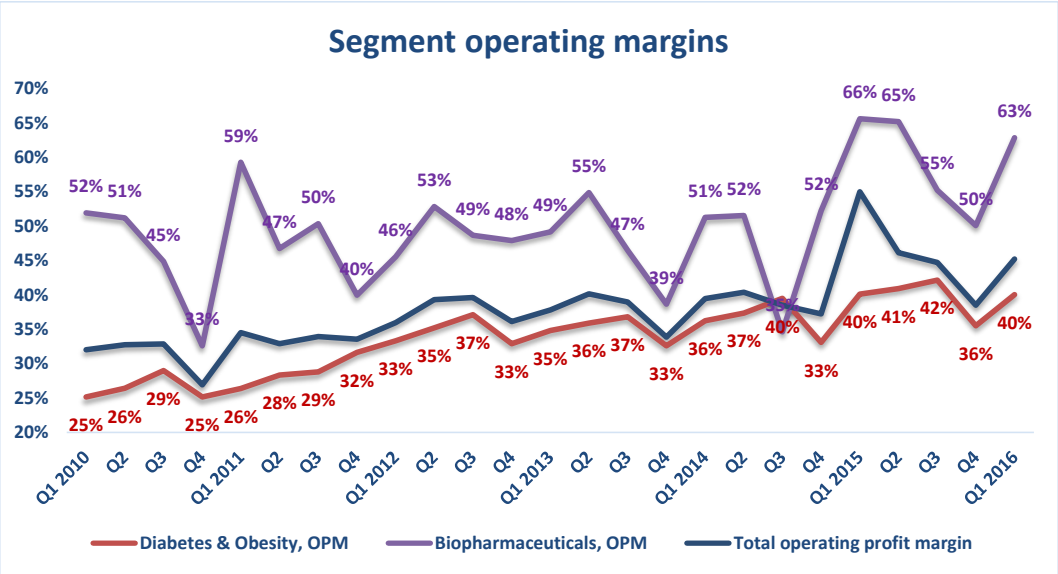
Figure 28 – Development of total GLP-1 market & Novo Nordisk's market share (through Victoza®)



As further detailed in the figure above – with over 1 million users worldwide and sales of DKK 18 billion, in 2015 – Victoza® has made Novo Nordisk the superior market leader in the GLP-1 segment for treatment of type 2 diabetes. With competitors approaching the markets with their own products, however, Novo Nordisk's market share has started to decline in the last year or so. Despite this relative setback the combination of a strongly expanding GLP-1-segment as well as Novo Nordisk being able to continue its growth rate of ~10% (y-on-y in local currencies) in the same period coinciding with the market share decline, the outlook of company-specific growth being sustained around today's level remains promising.

In the biopharmaceutical market, Novo Nordisk also has a leading position within haemophilia care, growth hormones and the hormone replacement therapy markets. The company is, amongst other, the leading provider of human growth hormone therapy, represented by a global volume market share of 33% (mainly through sale of Norditropin®, as illustrated in the first figure), in 2015. Although the relevant biopharmaceutical market is smaller than the total diabetes care market, the operating profit margins are substantially higher. This last point is illustrated in the figure below, with the aggregated biopharmaceutical segment's operating profit margin (OPM) averaging well above the equivalent of the diabetes & obesity care segment. In addition, with recent contractual wins coupled with a strong pipeline, Novo Nordisk's margins in the biopharmaceutical segment should be secured well into the future.

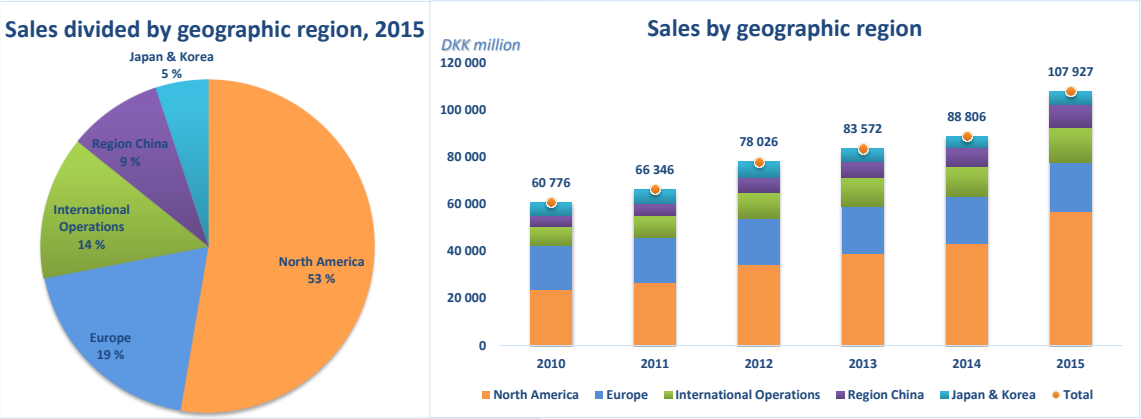
Figure 29 – Novo Nordisk's segments, operating profit margins



Headquartered in Denmark, Novo Nordisk has historically garnered the majority of its revenues from the European Union. However, as the European economy continues to face cost-containment pressures, governments have reacted by introducing pricing cuts on medicines and restricting access to them. This has negatively affected Novo Nordisk's sales in Europe.

Reflecting continuing market penetration by the modern insulin, the annualised growth rate for Novo Nordisk in the North-American market, in the last 5-year period, have been 19.2%. Consequently, with a share of total sales at 53%, the company's most important market is located in North America. As detailed in the figure below, also contributing positively is the development in International Operations & Region China, partly countered by the mentioned problems in Europe as well as Japan & Korea.

Figure 30 – Novo Nordisk's sales divided by geographic region



Driven by an aging demographic profile and increases in obesity, the prevalence of diabetes is expected to expand at its highest rate in the US. Thus, the key to promoting growth remains a continued focus on the US market.

In summary, Novo Nordisk's leading position in the global diabetes market should both provide the company with a relatively strong bargaining position as well as secure its position for further growth. A strong brand also helps the company to maintain high margins in the biopharmaceutical segments.

3.6.2 Weaknesses

Figure 31 – Novo Nordisk's number of product recalls and failed inspections, in the period 2007-2015

As depicted in the figure above, in 2015, Novo Nordisk had two instances of product recalls, both related to the incorrect labelling of products (Novo Nordisk, annual report 2015, p.101). When comparing with e.g. the period 2010-2013, this indicates a trend of less incidents than before – at least when measured in terms of the pure *number* of product recalls. As most of these incidents were minor offenses, it is probably more relevant to look at the *severity* of the recalls in any individual year, however.

Amongst other, in 2013, Novo Nordisk had a case of what can only be described as a major product recall. Amongst the six recalls that year, an internal quality control found that a small percentage (0.14%) of certain batches of the company's NovoMix 30® did not meet the specification for insulin strength. This could have led to the patient's blood sugar levels becoming higher or lower than expected. Consequently, 3 million products were recalled from the market that year. In terms of the number of affected patients, this translates into

4200 being directly exposed. Although the total cost of recall does not appear to be stated anywhere in the company's public records, it is not the material cost of recalling the products in itself that should matter. E.g., even if these costs should be as high as DKK 1 billion, it would still constitute a cost of less than 1% of sales (compared to 2015). Hence, what really matters is the far more detrimental effects and long-term consequences of a damaged reputation. Among both patients and insurers, the potential scenario of a larger patient population being affected could seriously hurt the Novo Nordisk brand.

Thus, it almost goes without saying what consequences a more serious and/or undetected recall might have on Novo Nordisk's brand name and reputation in the markets. Although it is not easy to perfectly control for and prevent events like this, it is important for an investor to be aware of such events of "tail risk". Hence, this highlights the importance of diversification when investing in the biotech/pharma-sector.

3.6.3 Opportunities

With its recent launches & continued rollout of its new generation of insulin products, such as Tresiba®, Xultophy® and Ryzodeg®, Novo Nordisk are likely to maintain or even expand its position within both the modern & new-generation insulin segments.

Excluded from this simple projection is the company's focus on the semaglutide molecule; since the launch of Victoza® in 2009, Novo Nordisk has continued to study the GLP-1 molecule and has subsequently created semaglutide – another GLP-1 analogue that has shown great potential in phase 2 and 3 clinical trials. Amongst other, the company's strong protein engineering capabilities has made it possible to take the semaglutide once a week compared to the once-daily administration of liraglutide (used in Victoza®). If this concept should reach final FDA-approval, Novo Nordisk should be able to leverage both its own position within GLP-1 as well as accelerate an expansion of the entire segment (*the background for this statement is further advocated & explained in the textbox below*).

Building on the same technology, other opportunities in the pipeline include:

- Significant projects include a new faster-acting formulation of insulin aspart and a once-daily tablet version of semaglutide.

- The development of semaglutide has for the first time provided Novo Nordisk with the opportunity to develop a GLP-1 analogue that can be taken as a tablet. With close to no representation in the Oral Antidiabetic (OAD)-market (currently worth DKK 130 billion), this would – if successful – represent a huge opportunity to revitalise the company's position. Already entered in phase 3 clinical trials the oral semaglutide would potentially provide the power of GLP-1 with the convenience of a tablet. Adding to this potential is its weight-losing properties.
- Novo Nordisk is also investigating the potential of GLP-1 analogues for the treatment of conditions other than diabetes and obesity. For instance, a phase 2 clinical programme using semaglutide in the treatment of non-alcoholic steatohepatitis (NASH) – a common liver disease with no currently approved treatments – will be initiated in 2016.

Scientific background: The potential of GLP-1 vs. DPP-4

In patients with type 2 diabetes, incretin-based therapies (*a group of metabolic hormones*) improve glycaemic control with low incidence of hypoglycaemia and without weight gain – both advantages over traditional treatments. While dipeptidyl peptidase-4 (DDP-4) inhibitors are administered orally and provide a physiological increase in glucagon-like peptide-1 (GLP-1) levels, GLP-1 receptor agonists (GLP-1RAs) are injectable and deliver pharmacological levels of GLP-1RA.

In short, head-to-head clinical trials has shown that GLP-1RAs provide superior glycaemic control, weight loss and overall treatment satisfaction vs. DPP-4 inhibitor. Assuming weight is not a concern, however, the only circumstance DPP-4 inhibitors *may sometimes* be preferred to GLP-1RA, is when oral administration is a desirable feature or when GLP-1RA cannot be tolerated (i.e. due to transient nausea) (Brunton, 2014).

In summary, this should further highlight the potential of Novo Nordisk's GLP-1 portfolio and pipeline, especially when considering next-generation GLP-1 of (oral) tablets.

In conjunction with obesity reaching pandemic proportions with up to 1.9 billion adults estimated as being overweight, and known to be a major risk factor in developing serious diseases such as type 2 diabetes, Novo Nordisk's recent entrance into the obesity treatment market can be considered a natural therapeutic area to extend operations (WHO, 2016). With the limited reimbursement opportunities so-far, however, the drug treatment market continues to remain small & undeveloped – currently amounting to an "optimistic" DKK 10 billion at most (as biased stated by Novo Nordisk themselves). Thus, the company would need a blockbuster to gain any serious traction (Novo Nordisk, annual report 2015, p.17):

- Building on the success with Victoza®, the company launched a higher-dose version of the same product (liraglutide) under the brand name Saxenda® for the treatment of obesity, in 2015. Selling for more than USD 1000 a carton, Novo Nordisk's ambition is to build a long-term presence in the obesity market, and Saxenda® is only seen as the first of several steps towards achieving this.
- A recent phase 3 study suggest the semaglutide-molecule may be significantly more effective for the treatment of obesity than what Saxenda® currently is.

In a search for strategic initiatives to tap further into the high-margin haemophilia market, Novo Nordisk launched NovoEight®, in 2014, to move into the main haemophilia A market. As Novo Nordisk ambition is to expand its leadership position within both haemophilia A and haemophilia B, the company recently filed for approval of long-acting factor IX for the treatment of haemophilia B, as well a long-acting clotting factor in phase 3 for segment A.

In summary, Novo Nordisk seems to be strongly positioned with its R&D-pipeline and on the offensive for generating incremental revenues in the years to come.

3.6.4 Threats

As well as the general tendency of increasing price pressure and reimbursement restrictions by payers – possibly the most important factor influencing Novo Nordisk's long-term aspects related to sales growth & profit margins – delays and/or failure of pipeline products could affect the productivity of Novo Nordisk in the longer term. As known, developing a new pharmaceutical product is an expensive undertaking that could easily take up to 15 years. Given the significant uncertainty regarding the timing and success of the regulatory approval process, potential failures might lead the company into a vulnerable position defending its market shares. With the gradual expiry of key elements in the company's patent portfolio, this might open them up to generic competition as well. Including the constant threat of a competitor launching a superior blockbuster could seriously lower the expectations embedded in Novo Nordisk's share price.

3.7 Conclusion

In light of the recent consolidations in the healthcare payer market increasing pricing pressure – as well as the implementation of austerity measures, stricter & more limited reimbursement opportunities and the general focus on generics uptake – going forward, the market forces should contribute to a shift in the pendulum favouring the healthcare payers.

For the pharmaceutical companies – probably resulting in decreased leverage in negotiations and limiting the potential for further price increases – all else equal, this should translate into future growth opportunities becoming more dependent on continuous deliveries from the R&D-pipeline. With the possible added threat of biosimilars, this should further differentiate the role of innovators and generic competitors. Hence, potentially eradicating any competitive advantage in the long term, any delays or failures related to the R&D-pipeline could quickly lead to a loss of market shares and/or reduced margins.

However, given Novo Nordisk strong position in the modern- & new-generation diabetes treatment market, combined with its promising pipeline, the company should be able to stand the test against a turning tide – at least for the short-term. Although still early to predict, in the longer term, having consolidated its position in the important GLP-1 segment, the company should have a first-mover advantage in an expanding market, also providing leverage across segments into e.g. the Oral Anti-diabetic (OAD)-market. Combined with the high prices & limited competition in the niches of the biopharmaceutical segments, this should help preserve margins not far from today's levels. Relative to the growth of the last decade, on the other hand, increased prevalence and adherence to medicines should be expected to be countered by higher discounts & rebate levels. Most likely leading to an overall slowdown in growth rates, this risk is further exacerbated by the gradual expiry of the current patent portfolio.

4 Theory on valuation

Generally, there are three broad categories of approaches to valuation that should be taken into account when valuing (biotech/pharma-) companies (Bratic, Blok & Gostola, 2014, p.52). Common to all, they are based on a combination of observed facts and subjective assumptions:

- ***Asset Approach*** – used to calculate a business's value as the fair market value of a company's assets less the fair market value of its liabilities;
- ***Income Approach*** – used to calculate a business's values based on the present value of expected future cash flows; and
- ***Market approach*** – used to calculate a business's values based on metrics from other traded pharmaceutical companies

For an overall assessment of the valuation universe Kaldestad & Møller (2012) have chosen to decompose these mentioned approaches further, applicable to all sectors & industries. Outlined below, it is important to keep in mind that the classification only represents a practical approach to valuation, meaning it would hardly pass as any measure of the scientific method. Thus, judgement and subjective assumptions may result in different parties reaching different outcomes.

Depending on the context, the methods all have their pros and cons. A short explanation of the different approaches will follow, before concluding on a final choice of method(s) in the end.

4.1 Earnings based approach

"Value equals the present value of future cash flows" (Kaldestad & Møller, 2012, p.29):

$$Value_0 = \sum_{t=1}^{t=n} \frac{Cash\ flows_t}{(1 + cost\ of\ capital)^t}$$

Earnings based approaches, also known as fundamental valuation, are based on the discounted value of a company's expected future cash flows (DCF). In the DCF-approach, one needs to make 1) a prognosis of future cash flows, 2) an estimate of the capital costs and 3) discount the cash flows back to the present by utilising the cost of capital.

Different variations in the choice of cash flows and cost of capital include:

- Free cash flow to Firm/Equity
- Dividend model
- EVA/Residual value
- Normalisation method

4.1.1 Free Cash Flow to Firm/Equity

In the free cash flow to the firm model (FCFF), the goal is to find the total cash flows that accrues to the company's owner and creditors. Neither a change in outstanding debt nor interest payments will affect the FCFF.

In the free cash flow to equity model (FCFE), on the other hand, the goal is to find the cash flows that accrues to the company's owners. Payments to or from the creditors will decrease or increase the FCFE, respectively.

Two common methods for calculating the respective methods are illustrated in the table below:

Table 6 – Free cash flow to Firm (lhs) & Equity (rhs)

Free Cash Flow to the Firm	**Free Cash Flow to Equity**
EBIT*(1-tax rate)	Net profit
+ Net depreciation & impairments	+ Net depreciation & impairment
- Capital expenditures	- Capital expenditures
+/- Change in working capital	+/- Change in working capital
	+/- Change in debt
= Free Cash Flow to the Firm	**= Free Cash Flow to Equity**

Source: Damodaran, 2012

The main difference between these models and the dividend model outlined below, is that the free cash flow models is based on what the company theoretically could have distributed to the owner and/or creditors, while the dividend model is based on the amount that is actually distributed (i.e. neglecting withheld cash).

4.1.2 Dividend discount model

The dividend discount model follows the same setup as free cash flow to equity, meaning it includes financial items & debt repayments; net cash flows equals the cash flow paid to the owners. The value of equity is by this definition the present value of all future dividends, discounted using the equity cost of capital (Kaldestad & Møller, 2012, p.37-38):

$$V_0^{EQ} = \sum_{t=1}^{\infty} \frac{D_t}{(1 + r^{EQ})^t}$$

Where:

$V_0^{EQ} = The\ present\ value\ of\ equity$

$D_t = Expected\ dividend\ in\ year\ t$

$r^{EQ} = the\ cost\ of\ equity$

$t = years$

Although the method is intuitive and easy to understand, it suffers from some serious drawbacks. With inconsistency of assumptions being a common problem, e.g. the modelling of cost of capital as a function of a changing gearing ratio, the model is most suitable for companies with stable cash flows, a predefined level of distribution and in situations where a relatively constant gearing ratio is to be expected.

Assuming the company has reached steady state, the dividend model is often supplemented with the **Gordon Growth formula** for an even simpler & timesaving exercise:

$$V_0^{EQ} = \frac{D_1}{r^{EQ} - g}$$

Where,

$$g = expected\ growth\ rate\ in\ dividends$$

4.1.3 EVA/Residual value

Economic Value Added (EVA), or residual value, is valuation model trying to take into account the opportunity cost of invested capital. According to the model, the value of a company consist of the invested capital +/- the present value of the out-/underperformance

the invested capital generates in its lifetime. One common variant of the model is the following (Kaldestad & Møller, 2012, p.43-45):

$$EV = IC + \sum_{t=1}^{t=n} \frac{Residual\ income\ (EVA)}{(1 + WACC)^t}, \qquad Residual\ income = E_t - r * IC$$

Where,

$EV = Enterprise\ value$

$IC = Invested\ Capital$

$E_t = Operating\ profit\ minus\ taxes\ (EBIT * (1 - tax\ rate))$

$r = Cost\ of\ employed\ capital\ (WACC)$

The idea is that capital should only be allocated to projects that generates a return above, or equal, to the cost of capital. If not, the investor would be better of placing his or hers money somewhere else. The out-/underperformance in a period is equal to operating profit minus taxes minus the opportunity cost of invested capital.

As a rule of thumb, if residual income in a period is <0 the company is destroying shareholder values, and if residual income is >0 the company is outperforming the general market. Hence, the advantage of the model relies on its focus on the real value drivers in a company. The drawback comes with the influence of different accounting principles on invested capital, especially when it comes to intangible assets. Thus, the method is most appropriate for companies located in capital-intensive industries.

4.1.4 Normalisation method

Sometimes, it can be a time-consuming endeavour to develop an explicit prognosis period, followed by a terminal value calculation to capture the value creation “into eternity”. The normalisation method is a less demanding exercise that still captures the principle of discounting future cash flow to the present.

A bit simplified, the normalisation method can be perceived as a “naïve” copy of the traditional DCF-method. With the only difference of omitting the explicit prognosis period, the normalisation method jumps right to the Gordon growth formula and the extrapolation of profits when calculating the terminal value. Thus, the method is based on a company’s

expected, normalised cash flows, which is then capitalised by applying the cost of capital (Kaldestad & Møller, 2012, p.179):

$$Value = \frac{Cash\ flow_1}{(WACC - growth)}$$

If the company in question has reached steady-state, and today's income statement is believed to be a fair representation of the long-term normalised level, then this approach might do the trick. The drawback lies in the sensitivity of a few variables being extrapolated into eternity – e.g., a small error can produce big leaps in value.

4.2 Market based approach (Comparative valuation)

In this approach, value is indirectly estimated based on what comparable companies, or assets, are traded for in the marketplace. The method involves 1) the collection of prices of comparable companies and 2) an adjustment for the company-specific differences relative to the companies it is compared to. The comparable companies traded in the marketplace then provides a benchmark to which an estimate of value can be attached (Kaldestad & Møller, 2012, p.151-167).

More specifically, comparative valuation is done by looking at the relative pricing of other comparable companies (known as peers). The valuation is usually conducted by dividing the market capitalisation of the company by a performance measure, or value driver, located in e.g. the income statement (sales, EBITDA, EBIT etc.), the balance sheet (book value of equity, employed capital, etc.) or some other means of performance, and then multiplying this ratio by a certain factor (/multiple):

$$Value = "Performance\ measure" * Multiplier$$

Due to experience with what might be representative multiples in the industry and/or for comparable companies – eventually combined with a discount/premium relative to the characteristics of the valued company in question – a benchmark for different kinds of multiples can be obtained. By studying the relationship between the company's own ratios with the multiples of "peers", a value estimate of one's own company is possible. Example of relevant multiples are listed in the table below:

Table 7 – Typical multiples used in a relative valuation

Relevant ratios	Formula
P/E	Price / Earnings
PEG	Price / (Earnings*Growth)
P/CF	Price / Cash flow
P/B	Price / Book value of equity
EV/EBITDA	Enterprise value/Earnings before interest, depreciation, taxes & amortisation
EV/EBIT	Enterprise value / Earnings before interest & taxes (after depreciation & amortisation)
EV/Sales	Enterprise value / Sales

The beauty of this approach lies in its simplicity, but assumes there actually exist truly comparable companies. Because no two companies are identical, this might be a challenge. Besides this point, the multiple-method serves its purpose both as an indirect valuation on its own, but also as benchmark relative to the value estimate obtained from, e.g., the DCF-valuation. Hence, as a consistence check, this method is superb.

4.3 Balance based approach

"Value equals the sales value of all assets minus debt" (Kaldestad & Møller, 2012, p.29).

This substance-based approach focuses on what value the market put on a company's (tangible) assets today. It is simple in use, but assumes it actually exists an active market for the relevant assets or that it is possible to get an appraisal. With focus centred around the company's tangibles and their independent values, and not on the processes & activities in the company itself, the chances are that the approach may (significantly) undervalue the business as a whole. The most common approaches include:

- Net asset value (NAV)
- Liquidation value

4.3.1 Net asset value (NAV)

In theory, the net asset value of a company will be equal to the lowest of the assets in "going concern" and liquidation. In this approach, a company is valued according to the market value of the company's assets minus net interest bearing debt and deferred taxes. The main difference from the DCF-approach is that the NAV-method does not recognise the value of use in own operations – the inputs in the valuation depends entirely on observable characteristics from prices of identical or similar assets traded in the marketplace. In the case of an asset having distinctive properties, which only the company itself has the ability to utilise, the sales value of the asset may be lower than the utility currently received.

The sales value will also exclude synergies from the use of a combination of assets, intangibles and structural capital. Thus, the method works best in the case of the assets having a well-established market and independent values from rest of operations, e.g., the shipping market:

Table 8 – Example of a net asset value (NAV) calculation

Sales value ship
- Deferred taxes
- Net interest bearing debt
= Net asset value (NAV)

4.3.2 Liquidation value

In a liquidation scenario, the transaction price of similar assets may not give the best estimate on the current sales price. With few potential buyers, combined with the need for immediate liquidation and opportunistic behaviour in the market, the danger of (heavily) discounted prices may be present – known as a fire sale. In times of a general credit crunch, this will increase the potential discount further.

In addition to the factors affecting NAV, there will be additional costs associated with the liquidation process itself. As a result, the liquidation value should be less than the net asset value:

Table 9 – Liquidation value

Sales value ship (discounted value)
- Deferred taxes
- Liquidation costs
- Net interest bearing debt
= Net asset value (NAV)

4.4 Cost based approach

"Value equals the cost of acquiring identical assets" (Kaldestad & Møller, 2012, p.29).

This approach is based on the assumption that a buyer is not willing to pay more for an asset than it will cost to replace or acquire an identical asset in the marketplace. Relevant valuation factors include age, depreciation and technical development. Although the method may appear easy to use, the relationship between the cost and real value may not always be obvious in the real world (e.g., the shipping market). As with the substance-based approach, the market for assets of an intangible nature may be more difficult to come by (especially at cost/par value).

4.5 Option based approach

Value equals fundamental value (DCF value) + value of flexibility (Kaldestad & Møller, 2012, p.29).

In certain situations, a traditional fundamental analysis will understate the real value of a company. This is due to a common ignorance of the value-potential in the right, but not the obligation, to make specific types of action. Examples of this kind of flexibility include the option to delay a project, the option to expand a project, the option to dispose of a project, and/or the option to shelve a project – namely the use of real options. Hence, real options analysis attributes value to good management, consider risks and the implications on project development that the DCF method essentially fails to incorporate. The drawback comes from the more complex and demanding calculations.

4.5.1 Real options

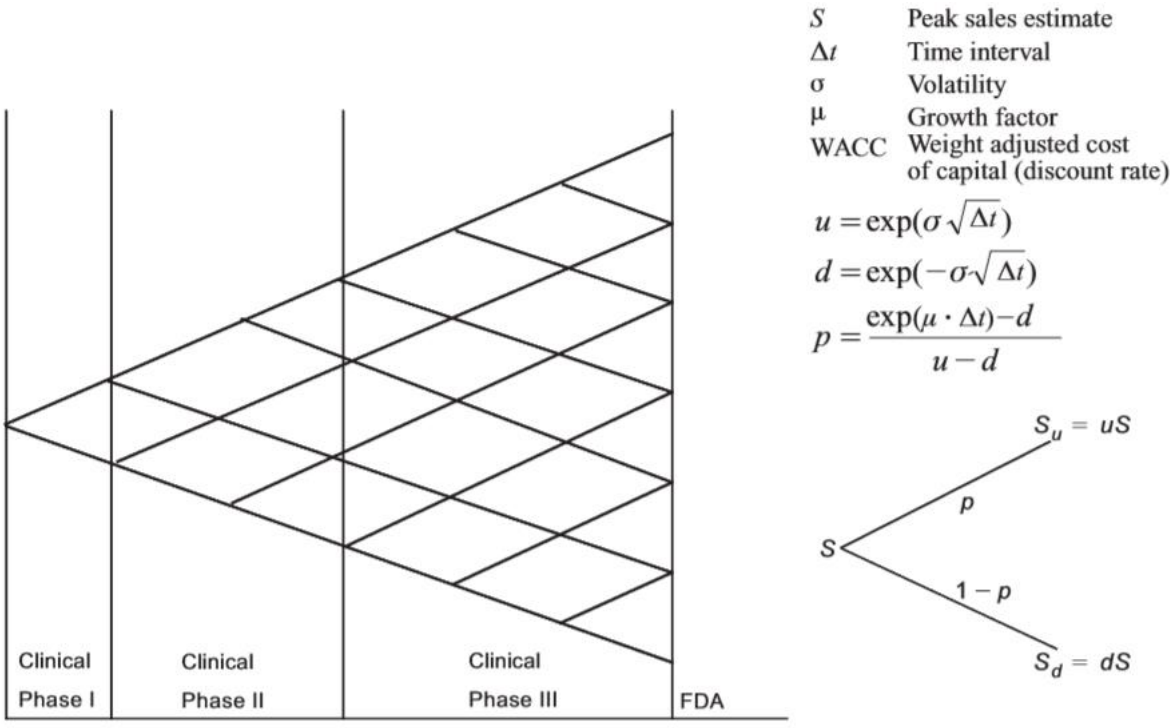
The value of a company including real options is the present value of future cash flows in a static scenario, with the additional value of flexibility:

$$V_0 = \overbrace{V_{"as\ is"}}^{Fundamental\ value} + \overbrace{present\ value\ of\ flexibility}^{Option\ value}$$

Regarding the biotech-industry and the value potential in R&D-pipelines & patents, real options valuation could really complement the DCF-method. Specifically, patents and/or a drug going through the steps in the FDA drug approval process could be modelled as an option. In this last circumstance, the expected costs of the different clinical phases would correspond to the purchase of an option in that step. Thus, the company will exercise the options only if the necessary investments (the costs of the subsequent phase or the launch costs) are less than the value the company gets in return. The launch costs are the option fee to launch the drug. In return, the company gets all sales revenues generated of the drug (Villiger & Bogdan, 2006, p.176-177).

In real options, the sales estimate fluctuates. The degree of this uncertainty is called volatility, and at the beginning of the project one can only guess how well the drug will sell. With every step in time, new information on the drug and the market allows this estimate to be adjusted. This corresponds to the different branches of the binomial lattice in the figure below. For each end node we know the peak sales. We can then discount back the cash flows resulting from each sales scenario, and subtract this value with the necessary investments to commercialise the drug. Negative values lead to abandonment of the drug. Consequently, the value at these nodes is set to zero. Using this method, we can deduce the values one node earlier, until we work the tree back to the root node, i.e. the scenario with today's peak sales estimate. The value for this node is exactly the real options value of the project.

Figure 32: Framework illustrating the binomial lattice of the development in sales estimate for a clinical project.



Source: Villiger & Bogdan, 2006, p.177

4.5.2 Financial options

In finance, financial options can be valued with a formula, normally the so-called Black-Scholes formula. The Black Scholes formula for a European call option on that stock that pays dividends at the continuous rate δ is (McDonald, 2014, p.363):

$$C_0 = Se^{-\delta T}N(d_1) - Ke^{-rT}N(d_2)$$

Where,

$$d_1 = \frac{\ln\left(\frac{S}{K}\right) + \left(r - \delta + \frac{1}{2}\sigma^2\right)T}{\sigma\sqrt{T}}$$

$$d_2 = d_1 - \sigma\sqrt{T}$$

(In which, S = current price of stock, K = strike price, σ = volatility, r = continuously compounded risk-free interest rate, T = time to expiration, δ = dividend yield).

Unfortunately, the Black-Scholes formula cannot be translated into a real option formula, for three main reasons (Villiger & Bogdan, 2006, p.178)

1. In finance, you can hedge away all risk by building a replicating portfolio, i.e. a combination of underlying bonds and shares. This practice is not feasible with R&D projects, because the underlying is not tradeable*.
2. R&D projects are staged and the project must achieve several milestones, equivalent of options on options – known as compound options. The Black-Scholes formula describes only a one-time option*.
3. The Black-Scholes formula cannot capture the uncertainty inherent to clinical trials*.

*It is true that it is possible to modify the Black-Scholes formula by relaxing the hypothesis of the replicating portfolio, that it can be extended to compound options, and that it is possible to implement the technical uncertainty as well. However, most programs do not offer the necessary mathematical functions for solving the resulting (huge) formula, and I believe the complexity of such a task to be outside the scope of my thesis.

4.5.3 Monte Carlo simulation

Monte Carlo simulation – a tool for considering all possible combination of events – is a method for determining the probability of certain outcomes and their related values (Bratic, Tilton & Balakrishnan, 1997, p.5).

With Monte Carlo simulation, one simulates the possible future values of a project; therefore, as a by-product one can generate the distribution of payoffs. It starts out with determining ranges of estimates for the various factors that affect value, including market size, capital expenditures, product pricing, manufacturing rights, economic environment, time to market, etc. With significant variables identified, a computer simulation is used to predict results based on simultaneous changes in the variables.

Although the output from method may appear very scientific, the assumptions still involves a great deal of subjectivity, and the results must be critically evaluated for reasonableness.

4.6 Choice of valuation methods

As discussed, the preferred method(s) for use in a valuation depend on a number of context-specific variables. With Novo Nordisk operating in a highly dynamic & technological environment characterised by investments in intangibles like R&D, marketing and distribution networks, the limitation of accounting conservatism can firstly exclude the use of the balance- & the cost based approach; the historical booked values would in this case severely understate the true market value of intangibles & structure capital.

Hence, I have chosen to employ a combination of an earnings based-, marked based- & option based approach. More precisely;

- I will split the valuation into an earnings-based approach valuing Free Cash Flows to Equity (FCFE).
- To give an estimate of the additional value of flexibility, the earnings based approach will be complemented by a separate valuation of the real option portfolio in appendix 3. This opportunity is modelled in a decision tree analysis as the possible approval of semaglutide related to a renewed entrance into the Oral Anti-diabetic (OAD)-segment.
- In the end, as a consistence check, the fundamental valuation is supplemented with a peer review (multiples valuation).

4.7 Cost of capital: Theory

The cost of capital represents the opportunity costs that investors face for investing their funds in one particular business instead of others with similar risk. The return must compensate for inflation, time value and risk (Kaldestad & Møller, 2012, p.105).

In a valuation, the cost of capital is mainly used as a discount rate. It's the price charged by investors for bearing the risk that the company's future cash flows may differ from what they anticipate when they make the investment, i.e., the minimum rent that investors expect to earn from investing in the company (Koller et al., 2010, p.35).

Summarised in the table below, there are three essential components needed to estimate the cost of capital. With none of these variables being directly observable, various models and a set of assumptions & approximations are needed for the estimation of each component. By estimating the expected return on alternative investments with similar risk using market prices, it is possible to extract an estimate of its own (Koller et al., 2010, p.235-237):

Table 10 - Standard framework for estimating the Weighted Average Cost of Capital (WACC)

Component	Methodology	Data requirements	Considerations
Cost of equity	Capital asset pricing model (CAPM)	• Risk-free rate • Market risk premium • Company beta	Use long-term government rate denominated in same currency as cash flows The market risk premium is often modelled to a point between 4.5% and 5.5% To estimate beta, lever the company's industry beta to company's target debt-to-equity ratio
After-tax cost of debt (*not further discussed*)	Expected return proxied by yield to maturity (YTM) on long-term debt	• Risk-free rate • Default spread • Marginal tax rate	Use a long-term government rate denominated in same currency as cash flows Default spread is determined by company's bond rating and amount of physical collateral In most situation, use a company's statutory tax rate
Capital Structure	Proportion of debt and equity to enterprise value		Measure debt and equity on a market basis. Use a forward-looking target capital structure

Source: Koller et al., 2010, p.237

Note that as Novo Nordisk pursues organic growth based on limited debt financing, combined with a historical low debt-to-equity ratio, the debt cost of capital should not be relevant in this valuation. Hence, the focus in the valuation will be centred on ***Free Cash Flows to Equity*** *(FCFE) and the resulting employment of* ***cost of equity*** *only.*

4.7.1 Capital Asset Pricing Model (CAPM)

One of the key insights of academic finance that has stood the test of time concerns the effect of diversification on the cost of capital. Assuming diversification reduces risk to investors and it is not costly to diversify, then investors will not demand a return for any risks they take that they can easily eliminate through diversification. They require compensation only for risks they cannot diversify.

In order to participate in the stock market the investor needs to be compensated for any additional risk taken beyond the "guaranteed" risk-free return available from government bonds, known as systematic risk. Systematic risk is essentially the volatility in aggregated stock prices we see on a daily basis (also known as market risk). Rather than just being affected by the fundamental attributes of the individual companies, stock market returns are driven by general market exposures, and are much more difficult to control or plan for, e.g., economic business cycles.

Unlike systematic risk, unsystematic risk is diversifiable. It pertains to company- (or industry-) specific risks – a product launch, new industry regulations, a corporate announcement, etc. As a result, this type of risk can be avoided by diversifying across stocks and sectors and investors will not demand a premium for it.

For decades, the standard model for measuring differences in costs of capital has been the **capital asset pricing model** (CAPM) [1]. The CAPM postulates that the expected rate of return on any security equals the risk-free rate plus the security's beta times the market risk premium (Koller et al., 2010, p.239):

$$E(R_i) = r_f + \beta_i * [E(R_m) - r_f]$$

[1] The Fama-French three-factor model and arbitrage pricing theory model (APT) are two well-known alternatives having gained popularity in recent years. For the purpose of this valuation, however, I believe the CAPM remains the most suitable model.

Where,

$E(R_i) = expected\ return\ of\ security\ i$

$r_f = risk\text{–}free\ rate$

$\beta_i = security\ i's\ sensitivity\ to\ the\ market$

$E(R_m) = expected\ return\ of\ the\ market$

Hence, in the CAPM the risk-free rate and market risk premium, defined as$[E(R_m) - r_f]$, are common to all companies, only beta varies.

4.7.2 Risk-free interest rate

The risk-free rate is a hypothetical return on a security, or a portfolio of securities, that does not contain any bankruptcy- or default risk. As such, the risk-free rate is the foundation of all risky investments representing the minimum required return (Kaldestad & Møller, 2012, p.108). In practice, the best approximation of such securities is (high-quality) government bonds. Disregarding any potential country-, liquidity- or maturity premium, these securities should have close to no covariance with the general market (represented by a CAPM beta of 0).

The most important issue regarding a risk-free interest rate is the choice of maturity profile. Ideally, each cash flow should be discounted using a government bond with the same maturity, meaning the 1-year Treasury bill should discount the cash flow received in year 1, etc. The complexity overcomes the usefulness of this approach, however. For the matter of this thesis, the cash flows will be discounted by their approximate maturity counter-part, meaning the first cash flows will be closely matched by their exact maturity, and later cash flow will be matched by a more normalised interest rate level.

The advantage of this approach is a balance between the variability of short-term interest rates against the relative consistent assumptions regarding inflation in both the numerator and the denominator in the longer term. The main drawback comes with the interest rates used not fully taking into account the perceived negative relationship between the equity risk premium and the risk-free rate. If the risk-free rate is located far away from a more normalised level, this translates into a potential CAPM miscalculation. Thus, some caution needs to be exerted, especially regarding the sensitivity in terminal value calculation.

Additional factors to take into considerations may include:

- *Credit/country risk premium*: Although not necessarily risk free, long-term government bonds in the United States and Western Europe have extremely low betas and are generally considered good proxies for the true risk-free rate.
- *Effective maturity (duration)*: Derived from the argument that cash flows should be discounted with the interest rate from a same maturity government bond, it's important to use zero-coupon bonds (ZCB). Because long-term government bonds often make interim interest payments, this causes their effective maturity to be shorter than their stated maturity (in addition, an implied reinvestment risk for the received coupon needs to be taken into consideration).
- *Liquidity premium:* Long-term bonds such as the 30-years Treasury bond might match the duration of the longer dated cash flows better, but their illiquidity means their prices and yields premiums may not reflect their theoretical value. Thus, the most common proxy in e.g. the U.S is 10-year government STRIPS.
- *Interest rate risk*: In the liquidity preference theory, investors want to be compensated for interest rate risk that is associated with long-term bond issues. Because of the longer maturity, there is a greater price volatility associated with these securities, meaning the yield premium will also increase with maturity.
- *Currency*: To model inflation in a consistent matter, the government bond yield should be denominated in the same currency as the company's cash flow to estimate the risk-free rate.
- *Supply/demand*: If there is a low amount of issued (zero-coupon) bonds of a certain maturity, then a mismatch with the relative higher demand can lead to unusual low interest rates, or vice versa. A practice solution to this problem is found in the SWAP-market. Serving as a proxy for the real risk-free interest rate, the SWAP-rate will only contain a modest credit risk premium for the overnight, usually government-insured, intra-bank lending rate (Kinserdal, 2014).

4.7.3 Beta

Beta represents a certain stock's incremental risk to a diversified investor, where risk is defined as the extent to which the stock correlates with the aggregate stock market:

$$\beta_E = \frac{Cov(r_i, r_m)}{\sigma^2(r_m)}$$

Where,

$Cov(r_i, r_m) = covariance\ between\ the\ stock\ and\ the\ market\ portfolio$

$\sigma^2(r_m) = variance\ of\ the\ market\ portfolio$

On average beta is equal to one, meaning that the average of the stock market must necessarily fluctuate with itself. To find the company-specific beta, on the other hand, there are a number of methods for estimation. Below, there are listed two approaches sufficient for the majority of cases (Kaldestad & Møller, 2012, p.117).

4.7.3.1 Method 1 – Observation of "comparables"/regression analysis

The traditional method for estimating a company's beta is to base the beta on comparable companies (or an industry). The problem is that even with two otherwise identical companies, the beta will be different when the gearing ratio changes. All else equal, a company's beta will increase with increased leverage, reflecting the increased sensitivity (/variance) of increased rental expenses on the net result. To adjust for differences in leverage the comparison across companies is carried out in three steps:

1. The (levered) equity beta, β_e, of all comparable companies is identified (for example through a news service, regression analysis, database, etc.).
2. The identified equity beta for all relevant companies is unlevered, finding the operating beta given 100% equity financing:

   $$\beta_U = \beta_E * \frac{E}{EV}$$

   Where,

   $E = equity\ value$

   $EV = enterprise\ value$
3. Given the average of the comparables (or industry's) unlevered beta, the company's levered beta is found by adding its own leverage. Thus, the company's equity beta equals the company's operating beta (commonly known as the unlevered beta) times a leverage factor:

   $$\beta_E = \beta_U * \frac{EV}{E}$$

At first glance, this approach may seem straightforward, but some discretion in the regression analysis needs to be advised. First, most of the bigger institutional investors are globally diversified. With this in mind, the regression should be run against a World Index. If not, choosing for example the Oslo stock exchange as the benchmark index would yield a disproportionate weight against oil-related industry. Second, the choice of estimation period is sensitive for the frequency & length of the time interval measured. E.g., there exists a subjective trade-off between the length of an estimation period potentially measuring the entire economic business cycle and, hence, sorting out short-term "noise", versus the sacrifice of relevance (which may be essential when there is a recent change in fundamentals).

4.7.3.2 Method 2 – Fundamental analysis

Given that the regression analysis sometimes yield irrational outcomes for individual companies, e.g., like a *negative* beta (implying that investors are happy to take on risk for *less* than a risk-free return), there exist doubt on causality or the real relationship between observed historical numbers, it's possible to subjectively adjust the beta obtained.

One common adjustment is the following, adjusting the equity beta towards the stock market average of one:

$$\beta_{adj.} = \frac{2}{3} * \beta_E + \frac{1}{3} * 1$$

The rationale for such a subjective adjustment comes from the simple assumption that a company will drift towards one as it matures, and/or the difference between high and low equity betas isn't really that high as the CAPM predicts. Although no scientific proof exist, there is little doubt that especially extreme values are likely to benefit from this adjustment.

For an overall assessment of whether or not the obtained equity beta seems reasonable or not, other subjective adjustments may stem from a look at the company's operational gearing (i.e., the ratio of fixed vs. variable costs) and predictability/cyclicality of product demand. The downside of this approach, relative to the "regression"-based approach, is a greater potential of manipulation and a bigger requirement for independent thinking. In both approaches, however, a rough rule-of-thumb estimate will probably serve its purpose as a consistence check.

4.7.4 Equity risk premium

As previously mentioned, systematic risk (or "market risk") is a type of risk that cannot be eliminated through diversification. Although investments in equities has proven rewarding over the long run, it has also been accompanied by significant variability of returns, the best example being the recent financial crisis. Given that investor dislike volatility – at least on the downside – they will only be prepared to invest in riskier assets as long as there is some compensation for risk. Thus, in theory, the equity risk premium should be a function of investor's risk aversion and volatility (Kinserdal, 2014):

$$Equity\ risk\ premium = Risk\ aversion * Volatility(/variance)$$

If this is true, a change in one of these elements would produce a change in investors implied cost of capital. An observation confirming this view is the fact that in "bull markets" investors are more eager to carry risk, meaning risk aversion is declining yielding lower risk premiums. In the opposite situation, in "bear markets", when risk aversion & volatility increases, the implied risk premium may increase substantially.

The implication for today's market indicates a relationship between low interest rates and equity risk premiums worth examining further: In the case of a risk-free interest rate being set low in an attempt to stimulate an economy characterised by a poor outlook, all else equal, the investors should demand a higher risk premium. At the same time, the low interest rates will depress the incentive to invest in other asset classes and increase the demand for "inflation protected" assets, i.e. stocks. All else equal, this will bid down the implied risk premium leaving the total net effect on risk premiums rather ambiguous. The matter is further complicated with the expected return on the market being unobservable.

In practice, the reward for equity risk is measured as the difference between the return on equities and the return from risk-free investments, such as Treasury bills (Dimson, Marsh & Staunton, 2011):

$$Equity\ risk\ premium = E(R_m) - r_f$$

With no single model for estimating the equity risk premium having gained universal acceptance, methods for estimation generally fall into three main categories (Koller et al., 2012, p.242):

1. Estimating the future risk premium by measuring and extrapolating historical returns
2. Using regression analysis to link current market variables, such as the aggregate dividend-to-price ratio, to project the expected market risk premium (*not further discussed in this thesis*).
3. Using DCF valuation, along with estimates of return on investment and growth, to reverse engineer the market's cost of capital.

4.7.4.1 Historical market risk premium.

Investors, being risk averse, demand a premium for holding stocks over risk-free bonds. If the level of risk aversion has not changed over the past 100 years, then historical excess returns should be a reasonable proxy for future premiums – an assumption that may or not be accurate.

In a frequently cited study by Dimson et al., most recently updated in 2011, a comprehensive database of annual asset class returns from the beginning of 1900 to the end of 2010 are analysed and used to estimate realized returns and equity premiums across a variety of national markets and regions. Accounting for known econometric issues such as survivorship bias, Dimson et al. find that the equity premium is positive and substantial in all markets. Presented as annualized geometric & arithmetic mean estimates (*see textbox)*, the equity premiums should be equal to investor's *ex ante* expectations plus the effect of "luck" – i.e., historical returns were probably higher than investors anticipated because of factors such as unforeseen exchange rate gains and unanticipated expansion in valuation multiples. In addition, past returns were enhanced following the Second World War by business conditions that improved in many dimension.

Averaging methodology: Arithmetic vs. Geometric mean

Annual returns can be calculated using either an arithmetic- or a geometric average. An arithmetic (simple) average sums each year's observed premium and divides by the number of observations (T):

$$Arithmetic\ Average = \frac{1}{T}\sum_{t=1}^{T}\frac{1+R_m(t)}{1+r_f(t)} - 1$$

A geometric average compounds each year's excess return and takes the root of the resulting product:

$$Geometric\ Average = \left(\prod_{t=1}^{T}\frac{1+R_m(t)}{1+r_f(t)}\right)^{\frac{1}{T}} - 1$$

Due to the negative autocorrelation of stock market returns, the geometric mean should provide the best estimate of **the future compounded rate of return**, while the arithmetic mean should be the best unbiased estimator for one period and/or when looking into the past (Koller, 2012, p.243-244).

Results to be inferred from the study are given in the table below:

Table 11 – Historical equity risk premiums (relative to T-bills)

Averaging methodology	Long-run equity premium, World Index
Arithmetic mean	4.5-5.0%
Geometric mean	3.0-3.5%

Source: Dimson et al., 2011.

4.7.4.2 Estimating the market risk premium with forward-looking models.

A stock's price equals the present value of its dividends. Assuming dividends are expected to grow at a constant rate, we can rearrange the growing perpetuity to solve for the market's expected return:

$$Price = \frac{Dividend}{k_e - g}, \qquad converts\ to\ k_e = \frac{Dividend}{Price} + g$$

In which,

$k_e = cost\ of\ equity$

$g = expected\ growth\ in\ dividends$

Implied from the model is a continuously changing expected return on equity. Stripping out expected inflation and subtracting with a long-term risk-free rate the method produces a remarkably constant (*ex-ante*) expected excess return.

Although this method is intuitive and simple to use, it ignores a few market realities. First, the dividend-to-price yield itself depends on the expected growth in dividends, and second, dividends are only one form of corporate payouts. Thus, the theoretical justification of the method may not be as strong as the one based on over 100 years of historical data.

4.7.5 Cost of equity

To value a company by discounting free cash flows to equity (FCFE), a weighted average cost of capital (WACC) is not necessary; to be more precise, the debt cost of capital is weighted with 0%, and it is only the cost of equity that contributes. Hence, the most important principle underlying successful implementation of the cost of capital is consistency between the components of the cost of capital and choice of valuation model.

5 Strategic financial statement analysis

This section shows how reported financial statements can be rearranged, adjusted and analysed to allow for a valuation-oriented analysis. Note that additional details, calculations and comments are provided in appendix 2.

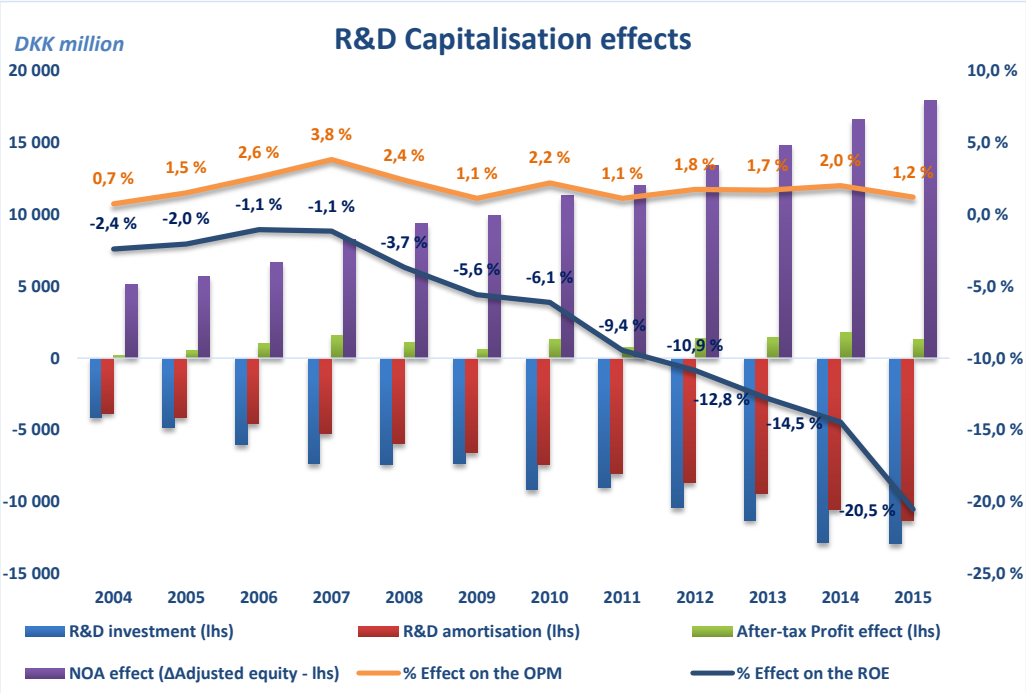
5.1 Summary of adjustment effects

The aim of this first part is to rearrange and align the income statement, balance sheet and cash flow statement (for simplicity the adjustments are included in the rearrangements right away). These statements will subsequently form the basis of a performance assessment, as well as the construction of pro forma financial statements in the valuation model.

With the intention to improve the understanding of a sustainable level of earnings and the resources that generate sustainable earnings, the section provides a quick introduction and summary of the consolidated adjustments to the income statement and balance sheet items. Specifically, I have made four accounting adjustments to the reported financial statements:

- **Capitalisation (*or balance sheet activation*) of previously expensed R&D-expenditures** (which in reality are investments). As an illustration of the resulting effects, a reproduced figure & explanation from appendix 2 are provided below:

Figure 33 - R&D capitalisation effects for Novo Nordisk, balance sheet method



Due to increasing historical R&D-investments, adjustments increase profits and operating assets. In reality, taxes are paid on such profits. Employing the effective tax rate in each individual year, these adjustments create deferred tax liabilities. With continuous growth in the R&D-investments, the effect continues throughout the period. This means that both net profit and net operating assets (NOA) are increasing. With the denominator (adjusted equity) increasing relatively more than the increase in the numerator (net profits), the result is an overall decrease in the return on equity (ROE). The operating profit margin, on the other hand, is positively affected. **The most important result, however, is the introduction of a R&D asset with a value of DKK 24.65 billion at the end of 2015.**

- **Normalisation of operating provisions**; provisions are operating expenses and they have direct effect on operating profits. Thus, any inappropriate/"non-normal" levels of net expenses can depress/inflate earnings in any individual year. The adjustment leads to a more representative level of operating provisions.
- **Capitalisation of leased assets**; due to Novo Nordisk having leasing arrangements that are structured in a way that leased resources are not booked as assets on the balance sheet (when in reality they should), the resulting adjustment is similar in effect as the immediately expensed R&D-investments.
- **Normalisation of potentially non-normal items** as e.g. "other operating income, net" and net financial items; these line items may fluctuate unpredictable in any individual year, and should be considered unsustainable earning elements. Thus, for consistent performance measurement these items should be normalised (i.e., removed or adjusted).

A complete summary of the relevant effects on income statement and balance sheet numbers are presented in the table below (*detailed assumptions & calculations are provided in appendix 2*), and will be included in all rearranged statements henceforth. Also, as illustrated in the R&D-example above, the adjustments are all conducted in a congruent accounting system. This means that each accounting change is theoretically aligned through the counteraction of an equivalent (opposite) change in some other line item. Hence, all adjustments accounted for in a consistent manner:

Table 12 – Summary of all adjustments to congruent financial statements

SUMMARY OF ALL ADJUSTMENTS TO CONGRUENT FINANCIAL STATEMENTS																
(*in DKK million*)	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
R&D Capitalisation																
ΔOperating expenses		*Build up phase*			-322	-716	-1 438	-2 067	-1 439	-752	-1 700	-957	-1 776	-1 832	-2 309	-1 640
ΔOperating profit, pre-tax					322	716	1 438	2 067	1 439	752	1 700	957	1 776	1 832	2 309	1 640
ΔNet profit (/NOPLAT)					217	510	1 012	1 605	1 094	579	1 339	746	1 369	1 418	1 793	1 315
ΔOperating assets	2 580	4 991	6 689	7 700	8 022	8 739	10 176	12 243	13 683	14 435	16 135	17 092	18 868	20 700	23 010	24 650
ΔOperating liabilities (defer	938	1 811	2 404	2 753	2 858	3 065	3 490	3 952	4 297	4 470	4 832	5 042	5 450	5 864	6 380	6 705
ΔAdjusted equity (& ΔNOA)	1 642	3 180	4 285	4 947	5 164	5 674	6 686	8 292	9 385	9 964	11 303	12 050	13 419	14 837	16 630	17 945
Operating provisions																
ΔOperating expenses		*Limited financial information*			-154	-584	-209	-1	182	-125	-1 414	-1 116	-269	-441	-2 676	-4 507
ΔOperating profit, pre-tax					154	584	209	1	-182	125	1 414	1 116	269	441	2 676	4 507
ΔNet profit (/NOPLAT)					103	416	147	0	-138	96	1 113	870	207	341	2 079	3 613
ΔOperating assets		*Limited financial information*			0	0	0	0	0	0	0	0	0	0	0	0
ΔOperating liabilities					-103	-416	-147	0	138	-96	-1 113	-870	-207	-341	-2 079	-3 613
ΔAdjusted equity (& ΔNOA)					103	416	147	0	-138	96	1 113	870	207	341	2 079	3 613
Leased assets																
ΔOperating expenses	-222	-214	-282	-266	-301	-342	-366	-403	-234	-222	-337	-383	-347	-372	-413	-406
ΔOperating profit, pre-tax	222	214	282	266	301	342	366	403	234	222	337	383	347	372	413	406
ΔNOPLAT	141	136	184	174	202	243	258	313	178	171	265	298	267	288	321	326
Δinterest expenses	222	214	282	266	301	342	366	403	234	222	337	383	347	372	413	406
ΔNet profit	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ΔOperating assets	2 725	3 212	4 316	4 797	5 419	6 156	6 598	7 252	4 693	5 893	8 940	10 147	11 298	12 049	13 454	13 300
ΔInterest bearing debt	2 725	3 212	4 316	4 797	5 419	6 156	6 598	7 252	4 693	5 893	8 940	10 147	11 298	12 049	13 454	13 300
Non-normal items																
ΔNet operating expenses	245	468	391	650	147	-95	-300	-296	-386	-413	-240	-485	-485	-551	-540	1 890
ΔOperating profit, pre-tax	-245	-468	-391	-650	-147	95	300	296	386	413	240	485	485	551	540	-1 890
ΔNet profit (/NOPLAT)	-156	-299	-254	-426	-99	68	211	230	293	318	189	378	374	426	420	-1 515
Summary, adjustments	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Δ(Net) Operating expenses	23	254	109	384	-630	-1 737	-2 312	-2 766	-1 877	-1 511	-3 691	-2 940	-2 877	-3 196	-5 939	-4 664
ΔOperating profit, pre-tax	-23	-254	-109	-384	630	1 737	2 312	2 766	1 877	1 511	3 691	2 940	2 877	3 196	5 939	4 664
ΔNOPLAT	-14	-162	-71	-252	423	1 237	1 628	2 149	1 426	1 164	2 907	2 293	2 217	2 473	4 612	3 739
Δimplicit Interest expenses	222	214	282	266	301	342	366	403	234	222	337	383	347	372	413	406
ΔNet profit	-156	-299	-254	-426	221	994	1 370	1 836	1 248	993	2 642	1 995	1 950	2 186	4 292	3 413
ΔOperating assets	5 305	8 203	11 005	12 497	13 441	14 894	16 774	19 496	18 375	20 327	25 075	27 239	30 166	32 750	36 464	37 950
ΔOperating liabilities	938	1 811	2 404	2 753	2 755	2 649	3 343	3 951	4 436	4 374	3 718	4 172	5 242	5 523	4 301	3 092
ΔInterest bearing debt	2 725	3 212	4 316	4 797	5 419	6 156	6 598	7 252	4 693	5 893	8 940	10 147	11 298	12 049	13 454	13 300
ΔAdjusted equity	1 642	3 180	4 285	4 947	5 267	6 090	6 833	8 292	9 247	10 060	12 417	12 920	13 626	15 178	18 709	21 558
ΔOperA, % of market equity	5,4 %	6,9 %	15,6 %	15,3 %	13,5 %	13,0 %	13,5 %	11,3 %	13,5 %	12,8 %	8,6 %	9,2 %	7,6 %	7,8 %	6,8 %	4,7 %
ΔOperL, % of market equity	1,0 %	1,5 %	3,4 %	3,4 %	2,8 %	2,3 %	2,7 %	2,3 %	3,3 %	2,8 %	1,3 %	1,4 %	1,3 %	1,3 %	0,8 %	0,4 %
ΔIBD, % of market equity	2,8 %	2,7 %	6,1 %	5,9 %	5,5 %	5,4 %	5,3 %	4,2 %	3,5 %	3,7 %	3,1 %	3,4 %	2,8 %	2,9 %	2,5 %	1,7 %
ΔAdjEq, % of market equity	1,7 %	2,7 %	6,1 %	6,1 %	5,3 %	5,3 %	5,5 %	4,8 %	6,8 %	6,3 %	4,3 %	4,4 %	3,4 %	3,6 %	3,5 %	2,7 %

Unlike the adjustments affecting the income statement, the adjustments to the balance sheet (as indicated in orange) are of a relatively negligible nature when benchmarked to the real market value of equity in any individual year. With the latter value fully embracing the forward-looking value of Novo Nordisk's resources, in essence, this translates into the historical balance sheet severely understating the true values. The implication for the performance measurement is that all booked balance-sheet numbers – at best – will either misrepresent relationships between ratios and/or distort the picture altogether. Thus, to enhance the understanding of Novo Nordisk's underlying value drivers the foundation for such future performance measures should preferably be identified through the income statement.

For a complete review of individual accounting items, the reader is referred to appendix 2 (under the heading "Congruent accounting adjustments"). In addition, rearrangements related to both the income-, balance sheet- & cash flow statement are provided.

5.2 Financial Ratio Analysis: Decomposing profitability measures

To truly understand company performance it is not enough to adjust financial statements, however. In this section, I introduce common financial ratios. A financial ratio is a combination of two measures and it forms the backbone of any accounting-based valuation analysis. Hence, the aim of the analysis is to conduct a systematic review of corporate accounting data (including adjustments) – all else equal - enabling a chance to say something about the company's financial position and development.

Given that accounting is a social construction and subjective in its nature, comparability is immensely important. Generally, there are three types of possible comparisons. For the sake of objectivity, however, I only find the two first mentioned methods relevant:

i. *inter-temporal comparisons*, such as time trends in company profitability,
ii. *cross-sectional comparisons*, such as between companies in the same industry or divisions in the same company, and
iii. *aspiration level comparisons*, such as actual performance relative to management's outspoken financial targets.

In the end, I hope the financial ratio analysis will reveal relevant trends that can form the basis for the valuation. However, it is important to stress the limitations of such an exercise – the analysis can never be better than the quality of the accounting records (which might be a huge problem for research-intensive companies like Novo Nordisk) and an error in the material can quickly lead to wrong conclusions.

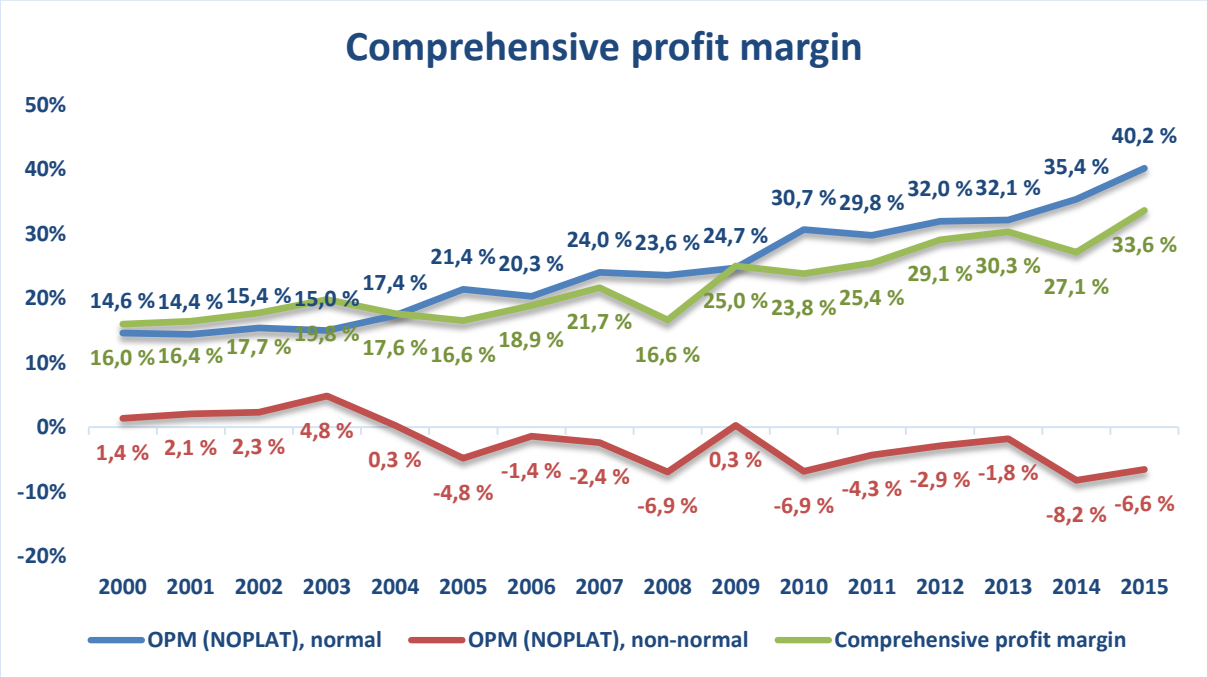
For the sake of convenience, the background material used in the construction of the financial ratios has been moved to the end of appendix 2.

5.2.1 Inter-temporal comparison

The aim of the inter-temporal comparison is to spot trends likely to continue (or break) into the future. Hardly arguable, the most important measure should be of Novo Nordisk's operating performance. Depicting a steady upwards sloping trend in the normalised NOPLAT-margin in the figure below, the company's has delivered close to consistent improvements on a year-on-year basis. With all adjustments happening in a comprehensive framework, however, the resulting non-normal NOPLAT-margin becomes negative when the net positive adjustments must be turned around into the equivalent net negative impact. As

discussed, this is due to the financial statements being congruent – every adjustment ought to be allocated somewhere. For the future, only the normalised NOPLAT will be relevant.

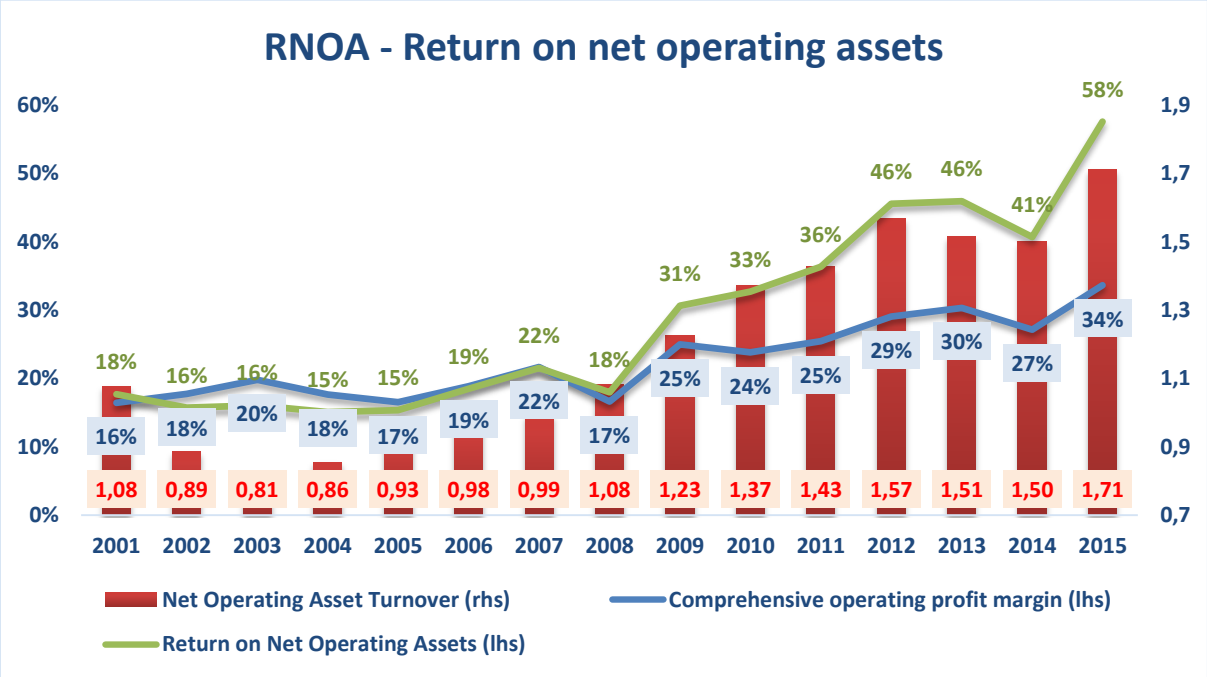
Figure 34 – Novo Nordisk's historical operating profit margins (OPM – operating profit margin)



With profitability ratios measuring a company's ability to generate profit, they are essential to understand in the process of valuing a company. Hence, it is common that profitability analysis have to take differences in resources in account. In so doing, profits are usually related to the capital used to generate profits, or to revenues – both of which are done in the figure below. As illustrated, the comprehensive profit margin can be disaggregated into a function of NOA Turnover (NOAT) and Return on NOA (RNOA):

$$Comprehensive\ profit\ margin = NOAT * RNOA$$

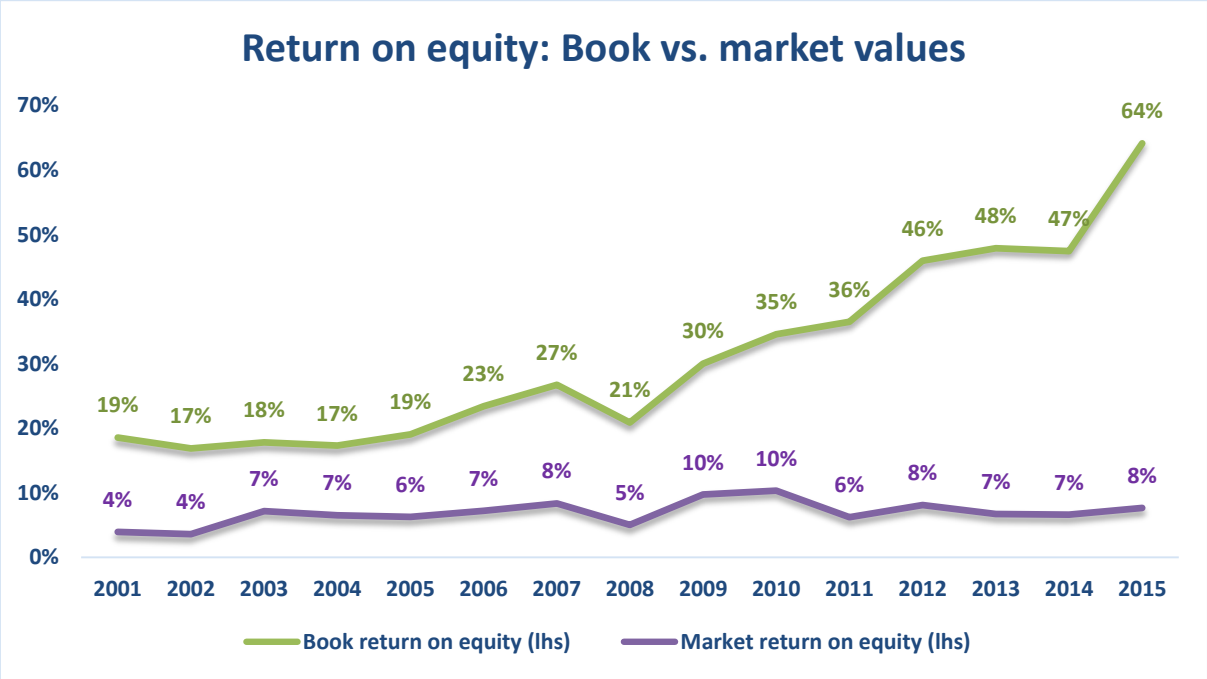
Figure 35 – Novo Nordisk's comprehensive operating profit margin as a function of historical return on net operating assets (RNOA) and NOA turnover (NOAT)



As briefly mentioned in the section above on adjustments, it is hard to disentangle any meaningful trends or information when using balance sheet numbers. This observation is especially apparent when comparing the sales-linked profit margins against the balance sheet-based ratios in the figure above; while the balance sheet-based ratios seem to fluctuate more randomly on a year-to-year basis, the sales-linked ratios margin are more trending & stable in comparison. This unpredictability related to the first-mentioned ratios is, of course, the consequence of a higher sensitivity attached to employing relatively small balance sheet numbers in denominator.

Thus, even when the ratios include all the previously made adjustments, it should be clear that accounting conservatism still represents a significant bias when it comes to the capital-based profitability ratios. This becomes especially apparent when comparing the book return against the market return of equity (*excl. dividends*) in the figure below. As seen, the market places an implicit significant higher value on "adjusted equity" than what is possible to obtain through external information in accounting statements.

Figure 36 - Return on equity, the effect of conservatism on book returns vs. market returns



As the above example serves to highlight, there is an inherent limitation in the reported balance sheet that cannot possibly be corrected for through external accounting information alone. In effect this indirect discrimination of biotech companies pursuing organic growth when develop intangible assets leaves the adjusted balance sheet – at best – highly biased.

However, by focusing on the sales-linked ratios the underlying trend should be hard to misinterpret – Novo Nordisk's historical performance has been solid, highly profitable and almost continuously upward sloping. Hence, the implication for the valuation is that any reliable extrapolations regarding predictions & forecasts into the prognosis period will have to be based on ratios benchmarked against sales. With this limitation in mind, any further assumptions will be highlighted and stressed in the valuation itself.

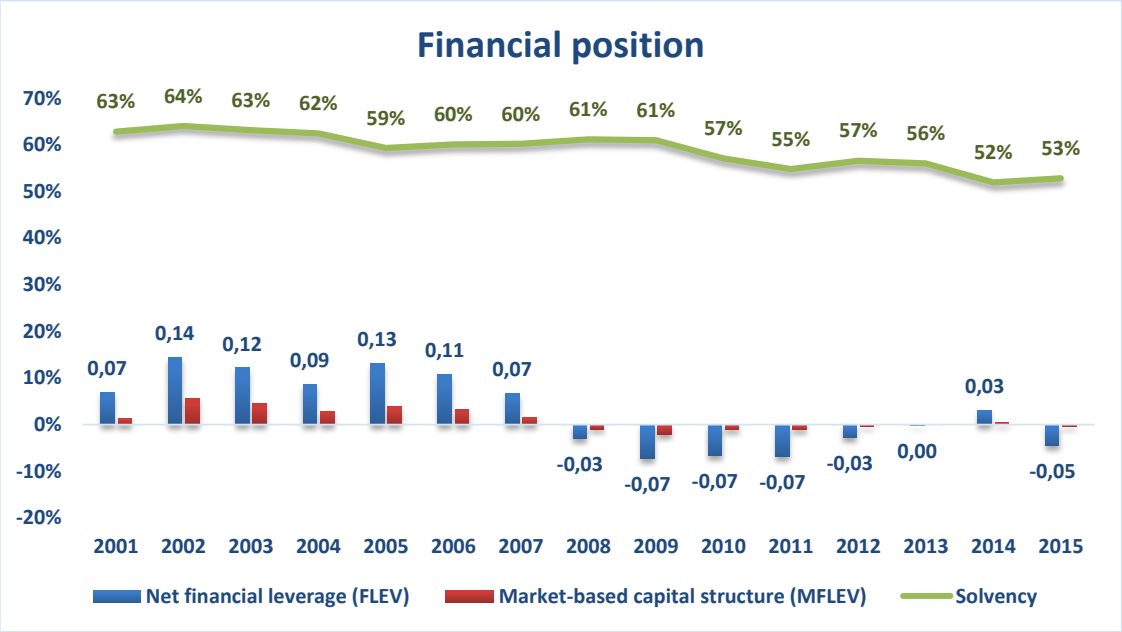
One closer look at Novo Nordisk's financial position deserves some further attention, however. As known, Novo Nordisk has not been known for employing a lot of debt in their operations. With net financial leverage (FLEV) defined as;

$$FLEV = \frac{IBD - FinA}{AdjEQ} = \frac{Net\ interest\ bearing\ debt\ (NIBD)}{AdjEQ} = gearing\ ratio,$$

The value-weighted average of net financial leverage (FLEV) and market-based capital structure (MFLEV – only replacing book value of equity by the market value) have been

reasonable stable ranging from around -0.1 to 0.15. A *negative* average in this first mentioned case implies that financial assets, on average, have been larger than interest bearing debt. This situation is illustrated in the figure below.

Figure 37 – Novo Nordisk's financial position, 2001-2015



Ignoring the negligible use of debt, the key takeaway should be that Novo Nordisk has had a high & stable solvency at above 50% (defined as Adjusted Equity / Total Assets). Thus, it may seem like it would be best to forget about the (historical) use of leverage altogether – it only seems to contribute by adding confusion.

5.2.2 Cross-sectional comparison

In an effort to put Novo Nordisk's economic achievements into context, I have compared its accounting numbers with the "industry average". Although a truly comparable firm would be one with cash flows, growth potential, and risk similar to Novo Nordisk, I have chosen to compare with the industry average(s) to quickly highlight a problem recurring through this whole analysis – namely that of accounting conservatism.

A common caveat with the accounting statements of the biotech/pharmaceutical-industry in general, is that it's hard (if not close to impossible) to make accurate comparisons between the financial statements of what would otherwise be close to two identical companies. As an external analyst, with limited information, the task of adjusting accounting statements across various regulations would simply be too challenging and time-consuming to justify the

point of this analysis in the first place – specifically, that of identifying the value drivers that matters the most for use in the prognosis period.

Being far away from any means of conclusive material – using reported accounting numbers and keeping in mind the fallacy of this method – the overall impression is that Novo Nordisk had a superior performance on all metrics when compared to both the biotech- and the pharmaceutical industry average, in 2015. The other fundamentals seems relatively normal as well. This is all described in the table below:

Figure 38 – Cross-sectional accounting comparisons

(in 2015)	**Novo Nordisk**	411 companies in sample **Drugs, Biotechnology**	157 companies in sample **Drugs, Pharmaceutical**	**Difference (NVO vs. Pharma)**
Performance-related				
Net profit margin, reported	32,3 %	17,7 %	17,5 %	14,8 %
Pre-tax operating margin, reported	45,8 %	30,7 %	23,9 %	21,9 %
After-tax operating margin, reported	36,7 %	30,3 %	22,9 %	13,8 %
Pre-tax Lease & R&D adjusted margin	50,1 %	35,2 %	24,9 %	25,2 %
After-tax Lease & R&D adjusted margi	40,2 %	34,6 %	24,0 %	16,2 %
ROE, reported	74,2 %	22,4 %	15,2 %	59,0 %
ROIC, reported	127,4 %	20,3 %	15,2 %	112,2 %
Working capital ratios				
Account receivables / Sales	14,3 %	17,8 %	17,8 %	-3,4 %
Inventory / Sales	11,8 %	9,6 %	13,5 %	-1,7 %
Account payables / Sales	4,6 %	11,2 %	7,1 %	-2,5 %
Non-cash WC / Sales	21,6 %	20,3 %	25,3 %	-3,7 %
Investments				
CapEx / Depreciation, reported	210,9 %	740,7 %	217,3 %	-6,4 %
Net CapEx/Sales, reported	2,5 %	32,7 %	20,2 %	-17,7 %
Net CapEx / EBIT(1-t), reported	6,9 %	147,5 %	112,5 %	-105,6 %
Sales / Capital, reported	2,25	0,59	0,63	1,62
Debt fundamentals				
Book debt to capital, reported	2,2 %	50,6 %	33,7 %	-31,5 %
Market debt to capital	0,1 %	12,0 %	11,2 %	-11,0 %
Market debt to capital (adjusted for leases)	1,8 %	12,5 %	11,5 %	-9,7 %

Source: Damodaran Online (2016)

Where,

$ROIC = Return\ on\ Invested\ Capital = EBIT(1-t)/(Debt + Equity - Cash)$,

using book values (a close to equivalent measure of ROCE – return on capital employed)

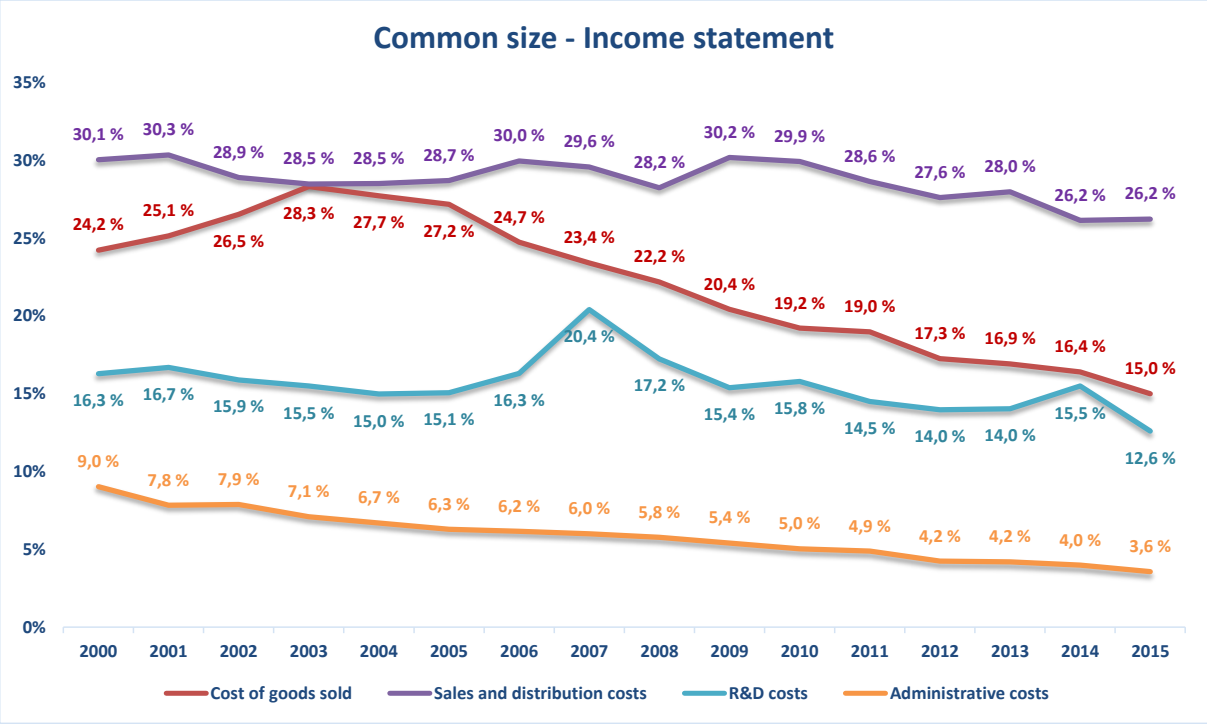
5.3 Common-size analysis: Spotting trends

A common-size financial statement is a company financial statement that displays all items as percentages of a common base figure, e.g. sales revenues or total assets. Creating common-size financial statements makes it easier to analyse a company over time and helps spotting trend that a raw financial statement may not uncover. This will be directly applicable when benchmarking key line items against sales in the prognosis period in the valuation.

For a complete presentation of all individual accounting items, exhaustive tables are presented in tables at the end of appendix 2. With the exception of the cash flow statement, all figures are based on reported statements.

5.3.1 Analysing the income statement

Figure 39 – Novo Nordisk's common size income statement, benchmarked against sales revenues



The common figure for the income statement is total revenues. Because the method focus on R&D and what it represents as a percent of total sales, it is appealing for research-intensive companies like Novo Nordisk. As can be observed in the figure above, sales & distribution costs and R&D costs have remained relatively stable in the period, while cost of goods sold (COGS) and administrative costs have declined – all else equal indicating reasonable economies of scale as the business has expanded.

5.3.2 Analysing the balance sheet

The common figure for the common-size balance sheet analysis is total asset (or total liabilities + equity):

Figure 40 – Largest assets in Novo Nordisk's common size balance sheet, benchmarked against total assets

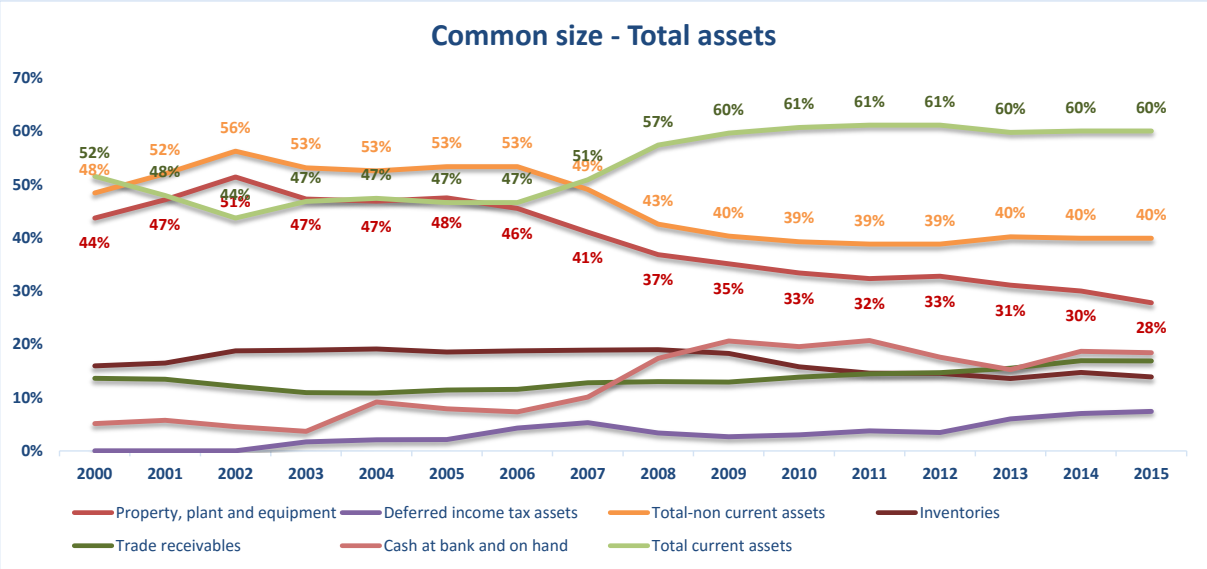
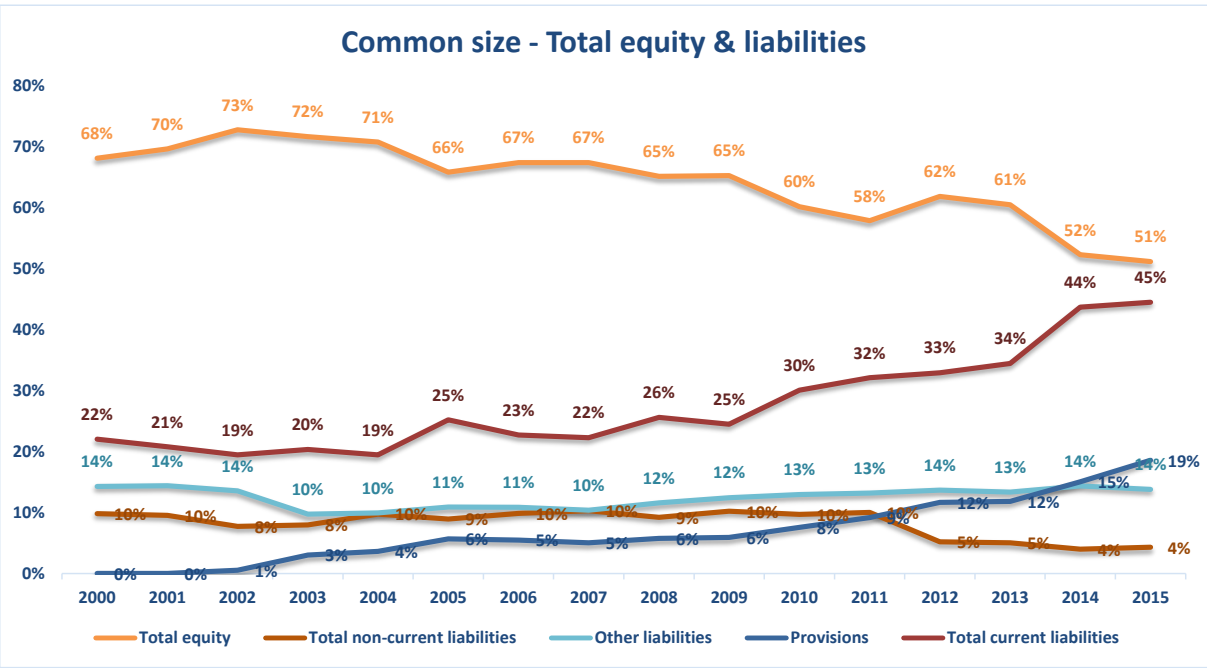


Figure 41 – Largest line items (of equity & liabilities) in Novo Nordisk's common size balance sheet, benchmarked against total equity & liabilities



In terms of total non-current assets in the top figure above, the declining trend in property, plant and equipment stands out the most. With Novo Nordisk's business being of an intangible nature this should not have any dramatic consequences, but the fact that the

decline coincides with a renewed strategic focus on investments in new production plants may indicate a somewhat artificial low level of investments in recent years. The relative lower investment level in the cross-sectional comparison and “net cash used in investing activities” in the common-size analysis of cash flows below further confirm this.

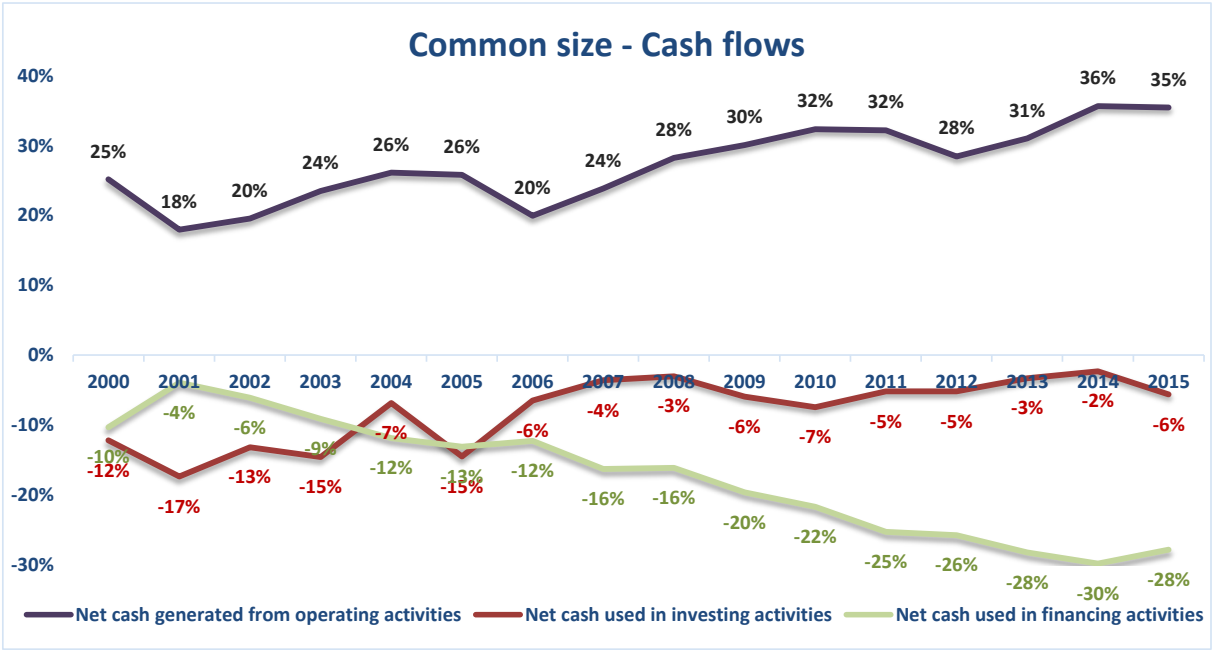
As illustrated in the top & bottom figures above, both total current assets & total current liabilities, respectively, have developed in a relatively synchronised upwards-trending manner. Furthermore, because provisions and cash already have deemed too high, they have been normalised accordingly.

Overall, in the figures above, the common size perspective reaffirms Novo Nordisk’s capital structure of employing close to no interest bearing debt. With considerable cash on hand, as well as unused credit facilities, the firm’s financial flexibility should be more than satisfactory.

5.3.3 Analysing the cash flow statement

Novo Nordisk’s rearranged, consolidated cash flows are presented in the figure below. As seen, the company generated an impressive level of operating cash flows averaging at over 30% of sales in the period. Share repurchase activity, in combination with dividends paid, left the shareholders well off with a direct return averaging at 21.2% of sales.

Figure 42 – Consolidated items in Novo Nordisk’s common size cash flow statement, benchmarked against sales



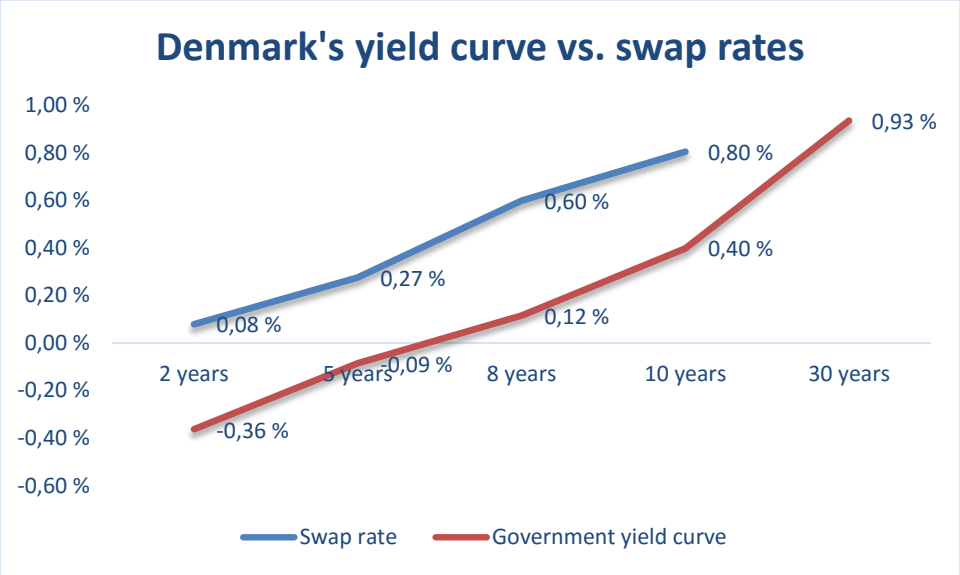
Similar to the income statement analysis, many items in the cash flow statement are more meaningful when benchmarked against sales. For example, when combined with the balance sheet analysis this yields extra insight into capital expenditures (Capex).

As illustrated, net Capex (*proxied by "net cash used in investing activities"* – see table at end of appendix 2 for accuracy) has been on a relatively declining trend in recent years. Although some of the difference can be attributed to economies of scale, it is interesting how a newly announced investment plan coincides with this trend. Thus, in the prognosis period, the real sustainable level of investments in PPE should probably average higher than the recent years' average of 4% to 5% of sales.

6 Valuation of Novo Nordisk

6.1 Cost of capital: calculation

Figure 43 - Denmark's government yield & swap curves, updated 12.04.2016



Sources: http://www.investing.com/rates-bonds/denmark-government-bonds & http://www.nasdaqomxnordic.com/bonds/denmark/swap

The most important criteria when deciding on the choice of risk-free rates is the consistency principle; the risk free rate used to come up with expected returns should be measured consistently with the cash flows that are measured (Damodaran, 2016). Thus, as the cash flows estimated are in DKK terms, the risk free rate will have to be the Denmark's government bond rate.

Given the particularly low yield curve in Denmark (as illustrated in the figure), if purchasing power parity is to be assumed then differences in interest rates reflect differences in expected inflation. Since both cash flows and the discount rate are affected by expected inflation, a low discount rating arising from the low risk free rate should exactly be offset by a decline in expected nominal growth rates for cash flows, and overall value will remain unchanged. Thus, I don't think it's appropriate to advocate for a normalisation to a higher long-term average right away; I believe that today's low rates – especially in the near-term – across developed markets is not a passing phase or a central bank anomaly, but a reflection of low inflation expectations (in some circumstances even *deflation*) and low real growth.

To secure some degree of matching between the duration of interest rates and the relevant cash flows, I have chosen to employ a combination of short and long interest rates when deciding on the risk-free interest rates. As the most near-term Danish government's rates are *negative* and no player in the Danish swap market seems to be willing to set a negative fixed rate interest rate in practice, I will substitute the short-term government rates with the relevant short-term swap rates (up to and including 10 years). Due the fact that some of the bonds may be illiquid and controlled, this substitution should be acceptable (in either case the overall value impact would be negligible). For the terminal value calculation, on the other hand, I will employ a more normalised and representative interest rate of 2%.

6.1.1 Beta

Table 13 – Comparable industries unlevered beta

Industry	Unlevered beta	Weighting
Biotechnology	1.12	33.33 %
Pharmaceuticals	0.90	66.66 %
Total	0.97	100 %

Source: Damodaran Online, 2016

To find the fundamental beta of Novo Nordisk's business I will use the unlevered beta of the firm's average industry beta(s) and adjust for company-specific factors, as outlined in the following formula:

$$Equity\ beta^2 = Unlevered\ beta * \left(1 + (1 - \text{tax rate})\left(\frac{\text{Debt}}{\text{Equity}}\right)\right)$$

Assuming Novo Nordisk can be characterised as part a biotechnology company (in-house research capabilities) and part a pharmaceutical company (vast sales & distribution networks), I will use a weighted average of these two industries unlevered betas to find Novo Nordisk's (levered) beta. Subjectively weighting the biotech industry's unlevered beta at 33.33% and the pharmaceuticals at 66.66% (assuming most value stems from present sales & products), this yield the following outcome for Novo Nordisk beta:

$$Equity\ beta = 0.9733 * \left(1 + (1 - 0.20)\left(\frac{14.373}{804.000}\right)\right) = 0{,}987$$

[2] Using market values as of 31.12.2015, and the effective tax rate for the prognosis period of 20%

As seen, due to a negligible use of interest-bearing debt, Novo Nordisk levered beta is close to its weighted industries unlevered betas. Also, in theory, the levered beta of close to 1 should be consistent with Novo Nordisk being a relative mature company.

Taking into account the additional consideration that a higher beta probably should be attached when having a focused, less diversified portfolio, then – all else equal – this should probably advocate for a subjective adjustment upwards. However, given the non-cyclical nature of Novo Nordisk's business – and the fact that beta is supposed to be a measure of exactly this cyclicality – then, all else equal, the firm's lower sensitivity to macroeconomic changes should translate into a lower beta. Taken together, I subjectively set the beta of the company equal to **1.1**. Hence, this higher adjustment should also capture the future sensitivity of regulatory changes regarding pricing pressure & reimbursement.

In addition, assuming Novo Nordisk debt policy will remain relatively constant, I see no need for a continuous updating through iteration. Thus, the beta of 1.1 should be valid for the entire prognosis period.

6.1.2 Equity risk premium

As Novo Nordisk is an international company, I strongly believe that a global equity risk premium will be the most suitable choice in this valuation. Assuming the targeted investor for this analysis is well diversified – and excluding any complications from e.g. a "home bias" (due to a dual listing in Copenhagen and NASDAQ) – any potential country-specific risks will preferably be handled in the cash flows for consistency measures. As neither the U.S. nor Denmark have any significant country-risk premiums, this should be of a negligible nature.

Having operations all over the world, I believe the global equity risk premium to best be approximated by the global historical risk premium obtained in the Dimson et al. study from 2011, examining "Equity Premiums around the World". By employing a horizon of 111 years, from the beginning of 1900 to the end of 2010, and measuring the reward for equity risk by comparing the arithmetic difference between the return on equities and the return from risk-free investment, such as Treasury bills, the authors finds a **"World" premium of 4.5%** (reflecting an average of 19 countries). This compares to a historical premium in the US of 5.3%. Also inferred from the results, survivorship bias had only a "very small" effect on the

estimate of the premium for the World index, and the equity premium remained positive and substantial in all markets (Dimson et al., 2011).

As the author notes, this global focus results in lower risk premiums than previously assumed. However, the authors defend their views well and on the contrary, it can be argued that long-run evidence invariably taken from the U.S. market typically has been treated as being universally applicable. In fact, few economies, if any, can rival the long-term growth of the United States, which should make it dangerous to generalise purely from this "isolated" case.

Thus, I choose to employ a global equity risk premium of 4.5% going forward.

6.1.3 Cost of equity

The cost of equity is defined as,

$$K_e = r_f(t) + \beta_e * [E(R_m) - r_f]$$

With β_e equal to 1.1, and the market risk premium $[E(R_m)-r_f]$ equal to 4.5%, the only time-dependent variable modelled, in this case, is the risk-free interest rate, $r_f(t)$. This means that the cost of equity will be approximated by its closest counterpart in terms of the duration on the relevant cash flows:

Table 14 – Novo Nordisk's cost of equity, calculation

Determinants	**Year 2**	**Year 5**	**Year 8**	**Year 10**	**Terminal value**
$R_f(t)$ (rounded numbers)	0.1%	0.3%	0.6%	0.8%	2.0%
β_e	1.1	1.1	1.1	1.1	1.1
$[E(R_m-r_f]$	4.5%	4.5%	4.5%	4.5%	4.5%
Total cost of equity	5.05%	5.25%	5.55%	5.75%	6.95%

While the short-term equity cost of capital may be perceived as unusually low, it is important to keep in mind that this has everything to do with the low inflation expectations. Combined with the advocated lower equity risk premium the overall result is a lower than "normal" (and historical) equity cost of capital.

Furthermore, with a monthly turnover in its share capital of roughly DKK 20 billion – the Novo Nordisk Foundation owning the 100% of the A capital, but having no intention to sell –

and the free float of (B-) shares totalling at 89.5%, there is no indication that a liquidity premium should be added to Novo Nordisk's cost of equity.

6.2 Prognosis period: base-case scenario

For growth companies with considerable higher growth than for the long-term average of the economy as a whole, the prognosis period will typically be longer than for mature companies with a lower growth rate. This is due to the FCFE-method presupposing constant growth in the terminal value calculation, and as a result, it is essential that the forecast period is long enough for the company to reach steady state. In this case, with Novo Nordisk's patents securing periods of market exclusivity and monopoly profits, I will model in a transient phase going from high to medium growth before the company, in the end, will slow down to below or around the aggregate economy's growth. This implies that the DCF-model consists of 3 phases, from high to medium to low (/economy-wide) growth.

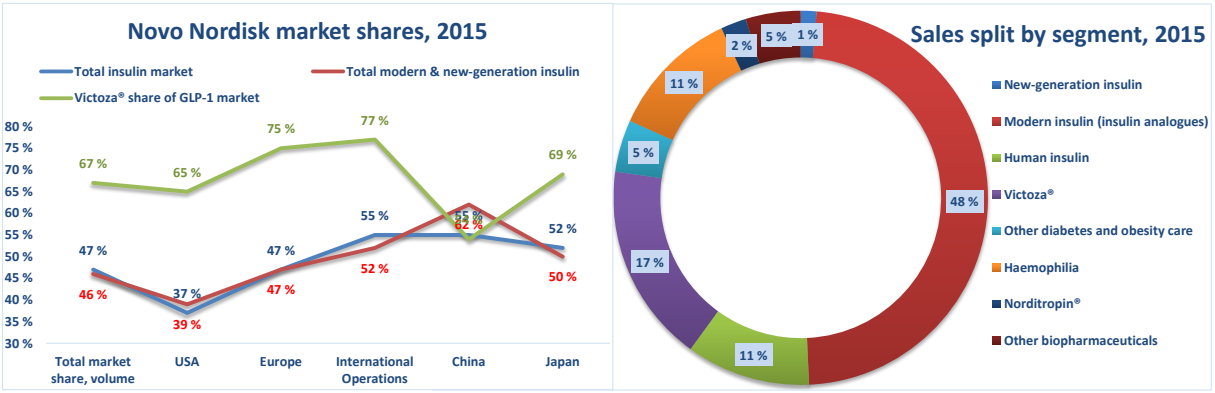
It is the results from the strategic- and financial statement analysis that will lay the groundwork when estimating the future cash flows. As accurate predictions regarding the future are difficult to make, the author's own discretion and ability to reason might in some cases come to use. Therefore, I find once again that it is my duty to highlight that a potential investor should use his/hers own judgement and critical thinking when reading through.

I have chosen to employ a prognosis period of 5 plus 5 years, with high and medium growth respectively. Although estimates from 5 years and beyond immediately become more uncertain and difficult to predict, the nature of Novo Nordisk's business indicates that some projections, albeit more conservative, are still possible to make. A prognosis period of more than 10 years, on the other hand, are considered more a game of chance than what is rationally justifiable. As such, the value of the cash flows after this point will be added to the terminal value.

As a preparation for the prognosis period, I have started with an investigation of what I consider the main value drivers for future growth in Novo Nordisk. The drivers are divided into matters of geographical representation and segments of particular importance. Importantly, the growth of the industry as a whole will be a key element in the modelling of

profitability, especially in the long term. Examples of some of these company-specific drivers are illustrated in the figure below.

Figure 44 – Growth drivers, Novo Nordisk



Note that it is a combination of the market leadership in both the old and new & up and coming segments weighted against the segments' importance in terms of sales that can be expected to be the most crucial drivers of sales growth. In addition, the relatively lower penetration of the U.S. market could indicate a further potential of increased marketing activities.

6.2.1 Sales

When estimating future growth rates in sales revenues, I have deliberately chosen not to model in assumptions regarding development of market shares. As the aggregate market in either case is growing and based on the principle that less details sometimes yields a more accurate prediction – especially given the vast amount of sub-segments & products in this case – I believe that an extrapolation of current growth rates on an aggregate basis could provide the most credible estimate for the future as well. Thus, without worrying about e.g. the effects of cannibalisation of newer products replacing an older portfolio, the aggregated drivers will avoid the confusion of focusing on too many details.

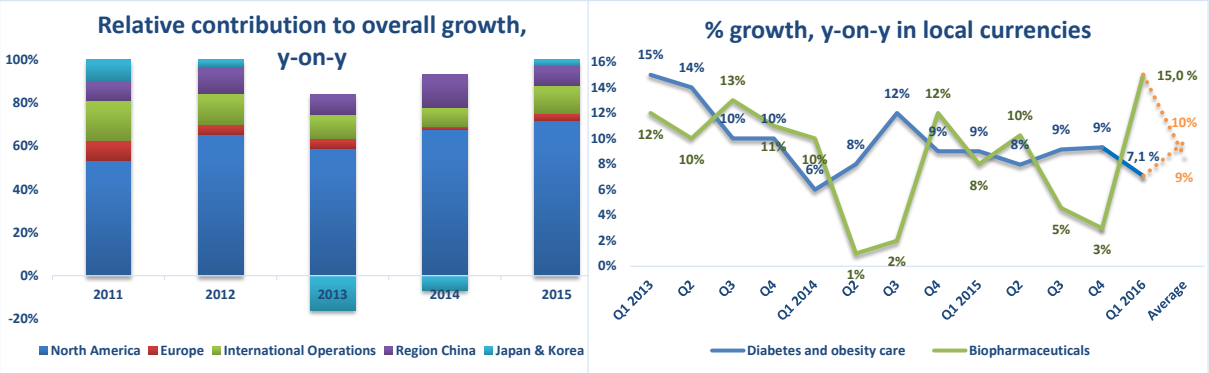
As "detailed" in the strategic analysis, however, what is important is that the overall market is trending upwards and value is created through the introduction of new products, more customers & increased adherence to treatment. All else equal, this benefit all players.

Figure 45 – Novo Nordisk's historical sales growth, as reported

As illustrated in the figure above, since the turn of the century Novo Nordisk has experienced a CAGR in sales revenues of 10.84%. Partly benefitting from exchange rate depreciation, the value-weighted average in the same period has been 12.85%.

Given the ~80/20 contribution from the diabetes and the biopharmaceutical segment, respectively, the latest growth figures seems to have stabilised around the same levels as historically. Albeit showing a tendency of weakly slowing down, with two next-generation diabetes products in the pipeline and supported by the growing importance of the North-American market, the company should be expected to continue to deliver the same level of growth, at least in the short-term. This is illustrated in the figure below.

Figure 46 – Geographic regions weighted contribution to overall growth (lhs) & y-on-y quarterly growth rates in local currencies, differentiated by segment (rhs)



Hence, the development of Novo Nordisk's "near-term" sales growth will mainly depend on the four following factors (*a more thorough review is offered in the SWOT analysis*):

1. Continued rollout of new-generation insulin products
2. Strengthening its position in the US
3. Expansion of the GLP-1 segment
4. Roll-out of its late stage haemophilia A & B treatments, as well as a long-acting growth hormone offering once-weekly injections

In the longer-term, Novo Nordisk's largest opportunity is likely to be centred around the research on semaglutide in the context of both GLP-1 and oral treatment, as well enhancing the company's edge within "obesity-related" diabetes;

- In its update from 17.12.2015, Novo Nordisk successfully completed its fourth (out of a total of six) phase 3a trial with semaglutide in people with type 2 diabetes (Novo Nordisk, 2015). Generally demonstrating "superior" efficacy in glycaemic control and weight loss, the programme has so far supported the supposition that semaglutide has the potential to become the most efficacious GLP-1 product for people with type 2 diabetes (headline results of the two remaining trials are expected in the first half of 2016).

To summarise, with both of Novo Nordisk's aggregated segments being characterised by hard-to-penetrate oligopolies, the company look set to ride the wave of a patient pool that keeps growing every year, especially within diabetes care; with no cure in sight, the demand is not even close to peak. Just as Novo Nordisk has conquered the North-American market – through aggressive marketing and user-friendly devices – competitors should have a hard time stealing back any market shares.

However, with competitors lagging behind in recent years, it would be naïve to think that Novo Nordisk's significant market shares (& resulting growth) can be preserved forever. Also, it is still uncertain how the threat of biosimilars and generics will play out. Thus, in the longer term, competition from established players should be assumed to disrupt growth. This yields the following (subjective) outcome of growth rates for the base-case prognosis period:

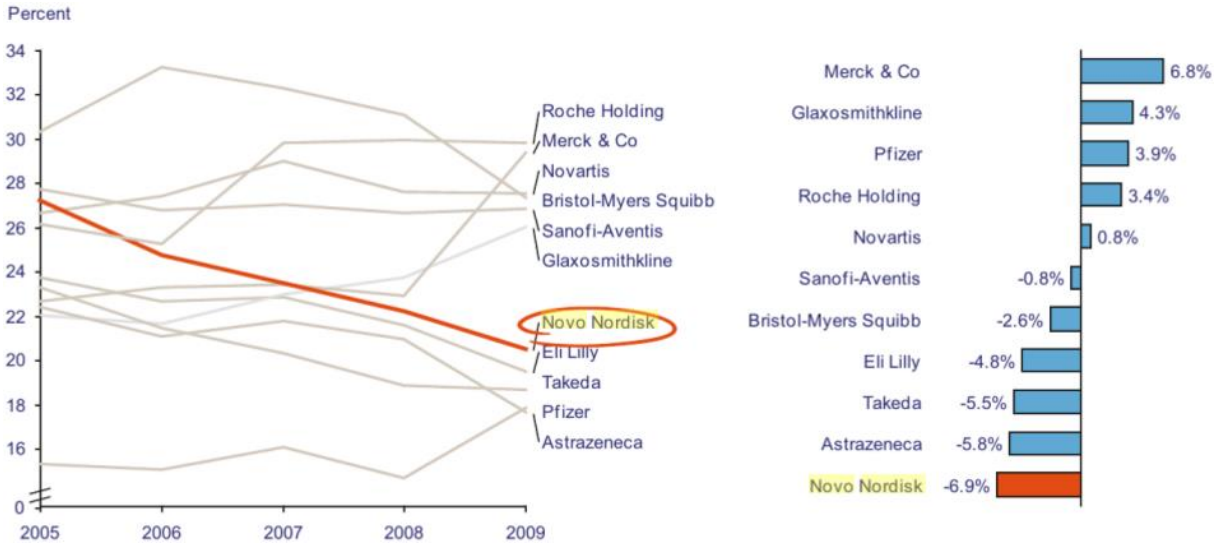
Table 15 – Total net sales, prognosis Novo Nordisk

		Period of high growth					*Period of medium growth*					*Low/average growth*
(*in DKK million*)	**2015**	**2016e**	**2017e**	**2018e**	**2019e**	**2020e**	**2021e**	**2022e**	**2023e**	**2024e**	**2025e**	**Terminal value**
Net sales	96 266	104 448	112 804	121 828	131 575	142 101	152 048	161 171	169 229	175 998	181 278	184 904
Growth (in local currencies)	8,4 %	8,5 %	8,0 %	8,0 %	8,0 %	8,0 %	7,0 %	6,0 %	5,0 %	4,0 %	3,0 %	2,0 %

Note that net sales & implied growth in 2015 excludes the impact from currency depreciation, and consequently has been adjusted downwards to reflect the true development in sales (when measured in local currencies).

6.2.2 Operating expenses

Figure 47 – Novo Nordisk cost of goods sold in comparison to its competitors: COGS as percent of net revenue trend (lhs) & CAGR of COGS as percent of net revenue in the same period (rhs)



Source: Friedli, T. Basu, P. Bellm, D. Werani, J. (2013). Leading Pharmaceutical Operational Excellence: Outstanding Practices and Cases. Springer-Verlag Berlin Heidelberg, p.134.

As revealed in the common size analysis and highlighted in the figure above, Novo Nordisk's cost of goods sold (COGS) has long been on a declining trend relative to sales. Originating from a strategic initiative in 2003, Novo Nordisk has defined broad measures & solutions to secure a strong focus to achieve its ambition of long-term operational excellence, and more importantly, provided the necessary framework to back it up. Amongst other incorporating one of the most efficient pharmaceutical production systems in the world (patented as cLEAN®), I think the results illustrated in the common-size analysis should speak for itself.

Deviating from the value-weighted average of 20.1% of sales, I subjectively assume that the COGS will stabilise in the lower end of the recent years range of 15.0%-19.2%, specifically at 16.5%. Besides the discussion above the reasons for this includes:

- First, this is in line with what Novo Nordisk states in its 2015 annual report (p.7) on the decline in that year's COGS; specifically that it reflected a "positive currency impact of 1.5 percentage points". Thus, adjusted for the currency impact the 2015's COGS would have constituted 16.5% of sales.
- Second, taking into account the increased focus on modern insulins and investments in modern manufacturing facilities securing good manufacturing efficacy (economies of scale), I think this lower level of COGS should be expected in the future as well.

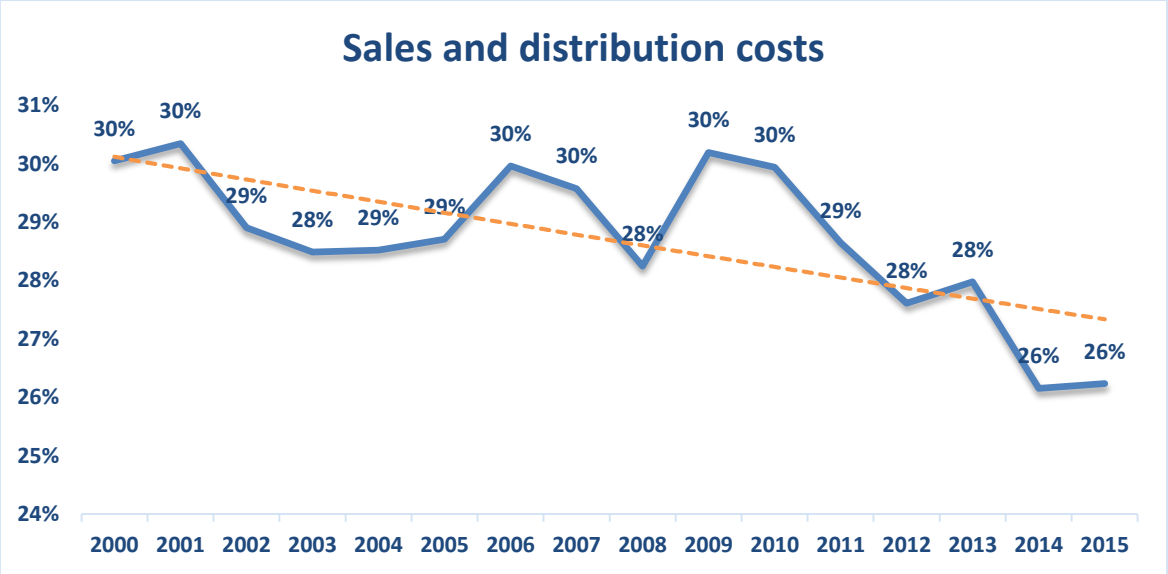
In total, this yields the following outcome for the prognosis period (when benchmarked against sales):

Table 16 – Cost of goods sold (COGS), prognosis Novo Nordisk

(*in DKK million*)	2015	2016e	2017e	2018e	2019e	2020e	2021e	2022e	2023e	2024e	2025e	Terminal value
COGS, %	15,0 %	16,5 %	16,5 %	16,5 %	16,5 %	16,5 %	16,5 %	16,5 %	16,5 %	16,5 %	16,5 %	16,5 %
COGS		17 234	18 613	20 102	21 710	23 447	25 088	26 593	27 923	29 040	29 911	30 509

6.2.2.1 Sales and distribution costs

Figure 48 – Historical development in S&D-costs relative to net sales, Novo Nordisk 2000-2015



Sales and distribution costs have historically averaged (value-weighted) at 28.3% of net sales. However, as the figure illustrates, the development relative to sales has trended downwards. Most likely indicating economies of scope, I think these latest figures should be more representative when modelling for the future:

- Factors indicating an even lower number (relative to sales) are an already established marketing force and solid market shares.

- Factors indicating a higher percentage, on the other hand, are general healthcare payer consolidations, pricing pressure & limited reimbursement opportunities – all else equal, implying more complex & demanding negotiations (e.g., centred around the company's innovative product portfolio).

In summary, I subjectively choose to let S&D-costs stabilise at 27% of net sales for the prognosis period. Being 1 percentage point higher than the benchmarked costs for the last two years, this should reflect economies of scope being countered by a significant number of product launches in a more complex regulatory environment.

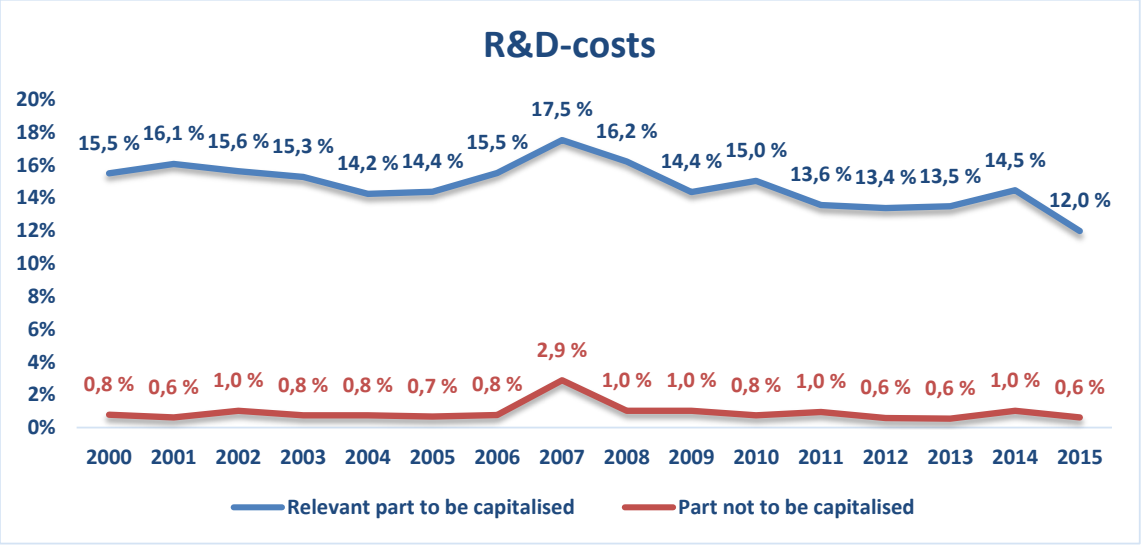
Table 17 – Sales and distribution costs, prognosis Novo Nordisk

(*in DKK million*)	2015	2016e	2017e	2018e	2019e	2020e	2021e	2022e	2023e	2024e	2025e	Terminal value
S&D, %	26,2 %	26,5 %	27,0 %	27,0 %	27,0 %	27,0 %	27,0 %	27,0 %	27,0 %	27,0 %	27,0 %	27,0 %
Sales & distribution costs		27 679	30 457	32 894	35 525	38 367	41 053	43 516	45 692	47 520	48 945	49 924

6.2.2.2 R&D costs/amortisation

When it comes Novo Nordisk's historical R&D-costs directly expensed in the income statement, it is important to differentiate between what – according to my estimates and assumptions – should have been capitalised and what should have been expensed (as it was). As the "R&D costs" in reality is a digest of 3 different line items, I identify all "internal and external R&D-costs" & "employee costs" as the relevant parts to be capitalised, and "depreciation, amortisation and impairment losses" as the relevant part to be directly expensed (as it should to avoid double counting).

Figure 49 – Novo Nordisk's historical expensed R&D-costs, benchmarked against net sales



As the figures above shows, both the "relevant part to be capitalised" and the "part not to be capitalised" have remained relatively stable throughout the period (especially when considering the varying amount of clinical trials in circulation in any individual year). Thus, I see no reason to deviate from the value-weighted averages of **14.3%** and **0.9%**, respectively. This yields the following direct expenses & amortisations for the prognosis period:

Table 18 – Relevant part of R&D to be directly expensed (depreciation, amortisation and impairment losses) as benchmarked against net sales, prognosis Novo Nordisk

Relevant part of R&D to be directly expensed (*in DKK million*)	**2015**	**2016e**	**2017e**	**2018e**	**2019e**	**2020e**	**2021e**	**2022e**	**2023e**	**2024e**	**2025e**	**Terminal value**
Depr., amort. and impairment losses, %	0,6 %	0,9 %	0,9 %	0,9 %	0,9 %	0,9 %	0,9 %	0,9 %	0,9 %	0,9 %	0,9 %	0,9 %
Depr., amort. and impairment losses		933	1 008	1 088	1 175	1 269	1 358	1 440	1 512	1 572	1 619	1 652

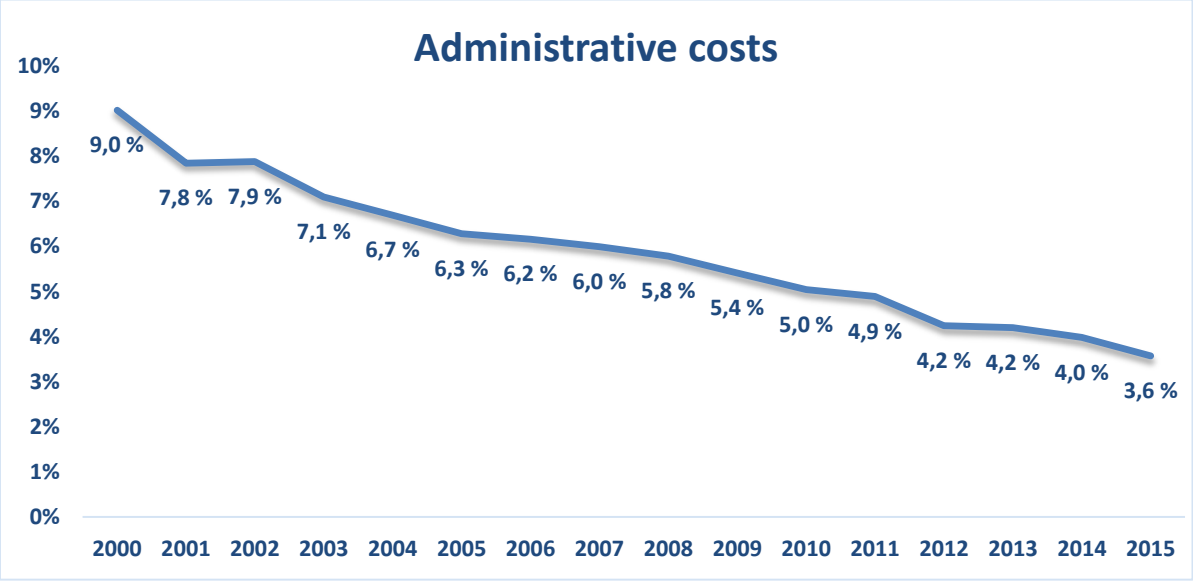
Table 19 – Amortisation from adjustments, prognosis Novo Nordisk

(*in DKK million*)	**2015**	**2016e**	**2017e**	**2018e**	**2019e**	**2020e**	**2021e**	**2022e**	**2023e**	**2024e**	**2025e**	**T+1**	**T+2**	**T+3**	**T+4**	**T+5**
Amortisations from adjustment	11 296	12 489	13 633	14 870	16 069	17 553	18 916	20 302	21 660	22 932	24 054	24 996	25 781	26 444	27 024	27 564
Implicit growth in expense (with lag)	7,2 %	10,6 %	9,2 %	9,1 %	8,1 %	9,2 %	7,8 %	7,3 %	6,7 %	5,9 %	4,9 %	3,9 %	3,1 %	2,6 %	2,2 %	**2,0 %**
Total amortisations, % of sales		12,0 %	12,1 %	12,2 %	12,2 %	12,4 %	12,4 %	12,6 %	12,8 %	13,0 %	13,3 %	13,5 %	13,7 %	13,7 %	13,8 %	13,8 %

Note that it takes 5 year from Novo Nordisk reaches its constant, terminal value sales growth rate of 2% (T+1), until the "lagging" amortisation schedule catches up (in T+5). With growth, this is due to the previous amortisations originating from a lower absolute level and, hence, is forced to play catch-up until the terminal value where new investments – adjusted for inflation – merely replace older amortisations. Also, because of growth, total amortisations in any individual year are always under 14.3% when benchmarked against sales.

6.2.2.3 Administrative costs

Figure 50 – Novo Nordisk's administrative costs, benchmarked against net sales



As illustrated in the figure above, "Administrative costs" is a typical line item where economies of scale comes to work. Given the gradual decrease in annual costs (when benchmarked against sales) as well as the eight latest quarters of administrative costs ranging from 3.3% to 4.3%, I will simply assume that the costs will stabilise at 3.5% of sales:

Table 20 – Administrative costs, prognosis Novo Nordisk

(*in DKK million*)	2015	2016e	2017e	2018e	2019e	2020e	2021e	2022e	2023e	2024e	2025e	Terminal value
Administrative costs, %	3,6 %	3,5 %	3,5 %	3,5 %	3,5 %	3,5 %	3,5 %	3,5 %	3,5 %	3,5 %	3,5 %	3,5 %
Administrative costs		3 656	3 948	4 264	4 605	4 974	5 322	5 641	5 923	6 160	6 345	6 472

6.2.2.4 Normal portion of other income/expenses

As outlined and detailed in appendix 2, the "normal portion of other income/expenses" consisted of a normalisation of historical asset & liability sales. The value-weighted average deemed as normal in that circumstance was 1.5%, and, all else equal, there no indication that this should change in the future:

Table 21 – Normal portion of other income/expenses, prognosis Novo Nordisk

(*in DKK million*)	2015	2016e	2017e	2018e	2019e	2020e	2021e	2022e	2023e	2024e	2025e	Terminal value
Normal portion of other income/expenses,	3,2 %	1,5 %	1,5 %	1,5 %	1,5 %	1,5 %	1,5 %	1,5 %	1,5 %	1,5 %	1,5 %	1,5 %
Normal portion of other income/expenses		1 541	1 664	1 797	1 941	2 097	2 243	2 378	2 497	2 597	2 675	2 728

6.2.2.5 "Other" operating expenses from adjustments: Operating provisions & leasing

Extrapolating the two remaining cost items from the accounting adjustments, it is necessary to record the gradual increase in the sales-linked level of operating provisions as an expense, and make a split between the operational & financial expense related to the leased assets. As these items already have been adjusted & normalised in the strategic financial statement analysis, I only need to extrapolate the same assumptions into the future.

Regarding the operating provisions, the overall normalised level has been identified and targeted at 8.8% of sales. Extrapolating this level into the future, the costs are measured as the yearly increase in absolute terms when benchmarked against sales:

Table 22 – Operating expense from increased provisions, prognosis Novo Nordisk

(*in DKK million*)	2015	2016e	2017e	2018e	2019e	2020e	2021e	2022e	2023e	2024e	2025e	Terminal value
Operating provisions, %	8,8 %	8,8 %	8,8 %	8,8 %	8,8 %	8,8 %	8,8 %	8,8 %	8,8 %	8,8 %	8,8 %	8,8 %
Operating expense	-4 507	-307	737	796	860	928	877	805	711	597	466	320

Using the same assumptions on leased assets as in 2015, e.g. an asset-backed interest rate of 3.1% and assuming total leasing commitments will grow in line with the overall sales growth, the following split between category of expenses is obtained:

Table 23 – Reallocation of leasing costs, prognosis Novo Nordisk

(*in DKK million*)	2015	2016e	2017e	2018e	2019e	2020e	2021e	2022e	2023e	2024e	2025e	Terminal value
ΔOperating expense	-406	-441	-476	-514	-555	-600	-642	-680	-714	-743	-765	-780
ΔFinancial expense	406	441	476	514	555	600	642	680	714	743	765	780

Note that the split between the operating & financial expense does not have any real effects on value, and thus in reality is superfluous.

6.2.3 Implied capital structure

As the means of a consistence check – even as the adjusted balance sheet of the past has been deemed relatively useless – it is still interesting to take a look at some of the implications for the implied development related to key balance sheet parameters of the future. Extrapolating all assumptions on R&D capitalisation, target operating provisions and congruent leasing adjustments into the prognosis period results in the following implied parameters:

Table 24 – Implied model parameters, prognosis Novo Nordisk

Model parameters	2015	2016e	2017e	2018e	2019e	2020e	2021e	2022e	2023e	2024e	2025e	T+1	T+2	T+3	T+4	T+5
NOA Turnover	1,60	1,73	1,81	1,86	1,91	1,95	1,98	1,99	1,99	1,99	1,98	1,98	1,99	2,00	2,01	N/A
Gearing ratio (using market values)	0,00	0,01	0,01	0,02	0,02	0,02	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03
ΔFCFE from reduction of FinA		7523	5000	5000	0	0	0	0	0	0	0	0	0	0	0	0

A few comments are necessary:

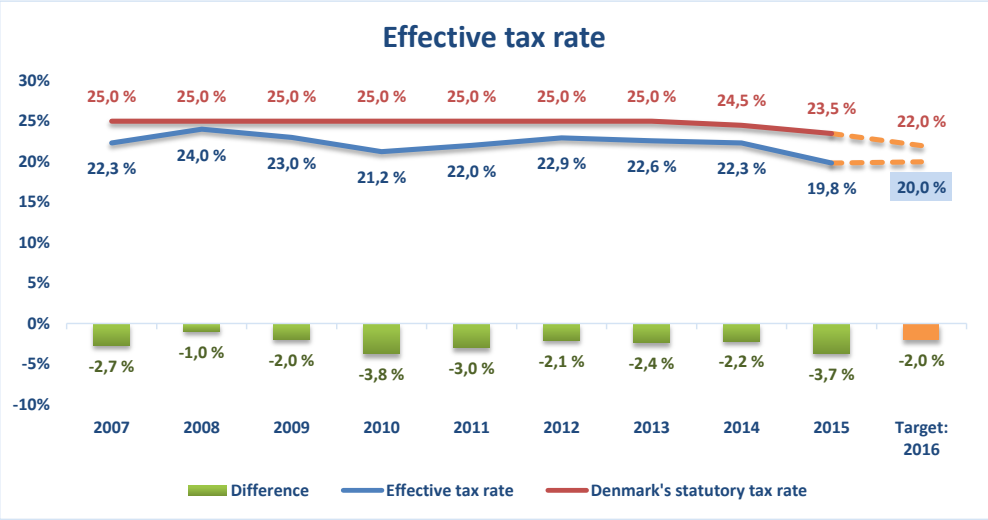
- NOA Turnover (NOAT), defined as $Sales_{t+1}/NOA_t$, increases as sales growth is higher than growth in operating assets (in which the main increase stems from R&D capitalisation)
- All excess cash (financial cash) is assumed to be gradually distributed to shareholders, leaving financial assets equal to 0 (measured as "ΔFCFE from reduction of FinA")
- Although Novo Nordisk does not employ any long-term debt, there exist an implicit liability to be capitalised from the leasing costs. However, with a market value of equity at DKK 862 billion, as of 31.12.2015, this yields a gearing ratio (or net financial leverage – MFLEV) eventually stabilising at 3%. Thus, as previously discussed, the negligible use of debt should not have any real impact on the valuation.

6.2.4 Tax rate

When deciding on the effective tax rate for use in the prognosis period there are several relevant factors to take into consideration:

- As a general rule of thumb, the size and speed associated with the immediate expensing of costs of an intangible nature indicates a lower effective tax rate than the nominal (e.g. R&D-costs). This is further advocated by the high growth of the company. The less capital-intensive growth (measured by book values), however, indicates a higher effective tax rate than the nominal (Kinserdal, 2014).
- As further outlined in section 3.5.1 on "Novo Nordisk's tax approach", Novo Nordisk's finance policy includes the intention of "*pursuing a competitive tax level in a responsible way*" (Novo Nordisk, tax approach, 2016). According to an expert in tax matters, Søren Bo Nielsen, from the Copenhagen Business School "large global companies such as Novo Nordisk, in effect decide how much they pay in corporate tax, but they often choose a neutral policy like Novo Nordisk" (Business.dk, 2012). As part of this "neutral policy" is the underlying goal to keep the tax level stable and predictable.
- As illustrated in the figure below, the effective tax rate have been relatively "stable & predictable" when it comes to the annual difference between Denmark's statutory tax rate and the effective tax rate stated by Novo Nordisk; averaging at **-2.6%**.

Figure 51 – Novo Nordisk's historical reported effective tax rate vs. estimate for 2016



Source: KPMG

Thus, taking into consideration a further reduction in Denmark's statutory tax rate by 1.5 percentage points in 2016, from 23.5% to 22.0%, combined with an average deviation of -2.6% between the statutory tax rate and Novo Nordisk's effective tax rate, I subjectively set the effective tax rate at **20.0 %** for the explicit prognosis period (KPMG, 2016). This lower-than-historical computed tax rate should emphasise both the drop in the corporate statutory tax rate by 3 percentage points in Denmark the last three years, the net negative average impact from the foreign affiliates of -2.6%, and Novo Nordisk's own "goodwill" to show dual accountability above both investors & foreign jurisdictions through APA's.

For the terminal value calculation, on the other hand, I subjectively adjust the effective tax rate upwards to **21 %**. Assuming limited growth will prevail, this should reflect a smoothing out of differences related to accelerated tax depreciations vs. the straight-line accounting treatment. Also, this should allow amortisations to keep up with immediately expensed R&D-costs. Overall, this yields the following estimated tax rate for the prognosis period:

Table 25 - Effective tax rate, prognosis Novo Nordisk

	2015	2016e	2017e	2018e	2019e	2020e	2021e	2022e	2023e	2024e	2025e	Terminal value
Effective tax rate	19,8 %	20,0 %	20,0 %	20,0 %	20,0 %	20,0 %	20,0 %	20,0 %	20,0 %	20,0 %	20,0 %	21,0 %

6.2.5 Prognosis: base-case scenario

The base-case scenario of the prognosis period is presented in the table below. As the table illustrates, beside a gradual payout of "excess cash" from 2016 to 2018, free cash flow to equity (FCFE) increases steadily throughout the entire period. Although the company reaches steady state in 2026 (T+1), four additional years are included to let the lagging amortisation schedule play fetch up.

Table 26 – Pro forma financial statement, Novo Nordisk

(*in DKK million*)	2015	2016e	2017e	2018e	2019e	2020e	2021e	2022e	2023e	2024e	2025e	T+1	T+2	T+3	T+4	T+5
Income statement																
Sales revenue	**96266**	104448	112804	121828	131575	142101	152048	161171	169229	175998	181278	184904	188602	192374	196221	200146
Operating expenses		-59701	-66255	-71701	-77448	-83841	-89729	-95238	-100209	-104481	-107900	-110363	-112856	-115261	-117617	-119969
Operating margin		42,8 %	41,3 %	41,1 %	41,1 %	41,0 %	41,0 %	40,9 %	40,8 %	40,6 %	40,5 %	40,3 %	40,2 %	40,1 %	40,1 %	40,1 %
Taxes		-8949	-9310	-10025	-10825	-11652	-12464	-13187	-13804	-14303	-14676	-15654	-15907	-16194	-16507	-16837
NOPLAT		35 798	37 239	40 102	43 302	46 607	49 855	52 746	55 216	57 214	58 702	58 887	59 839	60 919	62 098	63 340
Net financial expenses		-200	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Implicit leasing expense		-441	-476	-514	-555	-600	-642	-680	-714	-743	-765	-780	-796	-812	-828	-845
Net profit		35 285	36 858	39 690	42 857	46 128	49 341	52 202	54 645	56 620	58 090	58 270	59 210	60 278	61 444	62 672
Balance sheet																
Net Operating Asset	**65378**	65118	67456	70719	74236	77875	81579	85124	88375	91222	93584	95380	96859	98251	99606	100988
IBD (-) / FinA (+)	**3149**	-5504	-11658	-17905	-19252	-20706	-22080	-23341	-24454	-25389	-26119	-26620	-27130	-27652	-28183	-28725
Adjusted Equity	**68527**	59614	55798	52814	54984	57169	59499	61783	63921	65833	67466	68761	69729	70600	71423	72262
Cash flows statement																
NOPLAT		35 798	37 239	40 102	43 302	46 607	49 855	52 746	55 216	57 214	58 702	58 887	59 839	60 919	62 098	63 340
Change in NOA		-260	2338	3263	3516	3639	3704	3544	3251	2847	2362	1796	1479	1392	1355	1382
Free cash flow to the firm		36 057	34 901	36 838	39 785	42 968	46 151	49 202	51 965	54 367	56 340	57 091	58 360	59 527	60 743	61 958
Changes in shareholder equity (clean surplus relation)																
Adjusted Equity (IB)		68527	59614	55798	52814	54984	57169	59499	61783	63921	65833	67466	68761	69729	70600	71423
Net profit		35285	36858	39690	42857	46128	49341	52202	54645	56620	58090	58270	59210	60278	61444	62672
FCFE		-44198	-40674	-42674	-40688	-43943	-47012	-49918	-52507	-54708	-56457	-56975	-58242	-59407	-60620	-61833
Adjusted Equity (OB	**68527**	59614	55798	52814	54984	57169	59499	61783	63921	65833	67466	68761	69729	70600	71423	72262
Summary of all finance flows																
FCFE		44 198	40 674	42 674	40 688	43 943	47 012	49 918	52 507	54 708	56 457	56 975	58 242	59 407	60 620	61 833
FCFD		-8140	-5774	-5835	-902	-974	-861	-716	-542	-341	-117	116	118	120	123	125
FCFF		36 057	34 901	36 838	39 785	42 968	46 151	49 202	51 965	54 367	56 340	57 091	58 360	59 527	60 743	61 958

As highlighted in bold, the choice of starting point for the prognosis fell on 2015; with sales adjusted for that years exchange rate gain, the remaining balance sheet items have already been adjusted & normalised in section 5 on the "Strategic financial statement analysis". Hence, the prognosis should not suffer from the potential impact of any snowball effect.

Also, as non-normal financial activities ("net financial expenses"), in theory, represents a zero-sum game they will not be modelled in the pro forma income statement above (this is backed up by the fact that net non-normal financial activities in the period 2000-2015 – benchmarked against sales – had a value-weighted average of -0.2%, i.e. close to zero)). However, given Novo Nordisk's explicit expectation of a loss equal to DKK -200 million in 2016, this has been included in 2016e.

Discounting the free cash flows to equity (FCFE) in the table below, the estimated value of Novo Nordisk's equity sums up to **DKK 1042 billion**. All else equal, this translates into a share price of **DKK 409 – all else equal, implying a 13% upside from the current market price of DKK 362.90 (as of 29.04.2016)**.

Table 27 – Valuation: Base-case scenario, Novo Nordisk

Valuation: base-case scenario		*Explicit forecast period*										*Implicit forecast: Continuing value*				
(*in DKK million*)		**2016e**	**2017e**	**2018e**	**2019e**	**2020e**	**2021e**	**2022e**	**2023e**	**2024e**	**2025e**	**T+1**	**T+2**	**T+3**	**T+4**	**T+5**
FCFE		44 198	40 674	42 674	40 688	43 943	47 012	49 918	52 507	54 708	56 457	56 975	58 242	59 407	60 620	61 833
Discount factor (Cost of equity)		0,95	0,91	0,86	0,82	0,78	0,74	0,70	0,66	0,63	0,59	0,56	0,52	0,49	0,45	
Present value		42 073	36 858	36 811	33 347	34 218	34 782	34 990	34 869	34 421	33 590	31 695	30 295	28 892	27 567	
Value in explicit forecast period	355 958	34,1 %														
Continuing value (CV)																
Discount factor (Cost of equity)	6,95 %															
Growth rate	2,00 %															
Present value of CV	686 493	65,9 %														
Market value of AdjEQ	1 042 451															
Share price	**409**															

Discussion:

In my analysis, I make the strong assumption that most value (66%) is generated in the unforeseeable implicit forecast period. A major reason for doing this is that the currently booked assets' historical values are much lower than the assets' true market values – e.g., brand names, market exclusivity & established distribution systems are not given any value in the reported statements. This indicates an enhanced value through future cash flows, and, all else equal, that outstanding performance is likely to be sustained further into the future than for the average company.

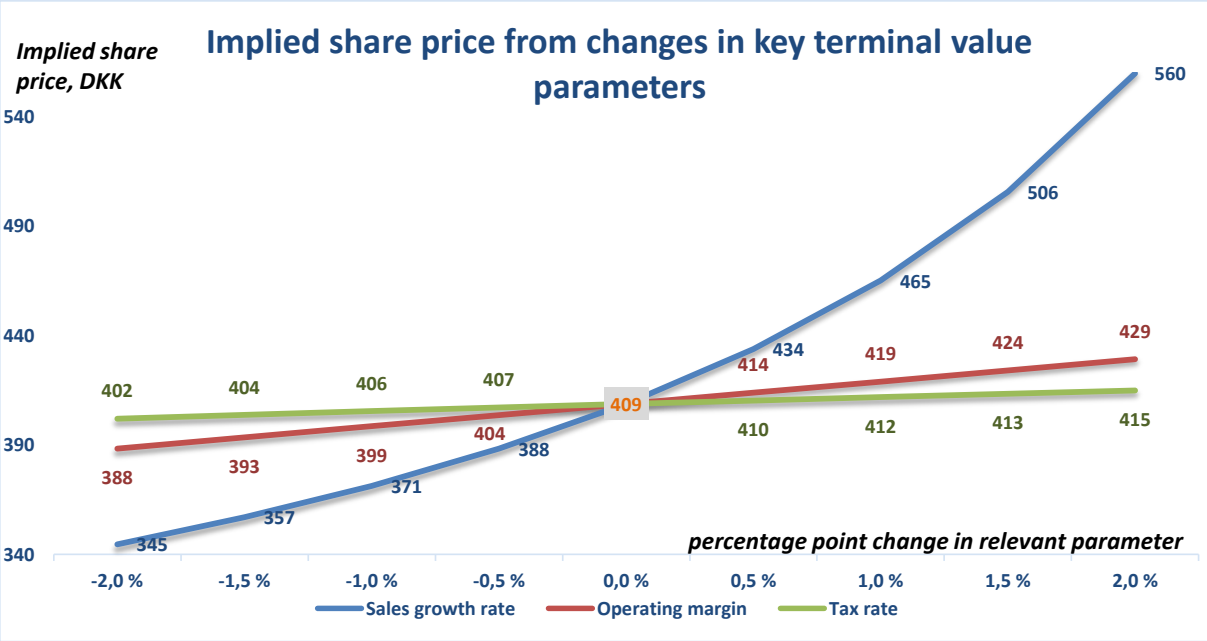
The sensitivities of key model parameters in the terminal value calculation is explored further in the sensitivity analysis below.

6.2.6 Sensitivity analysis

As 65.9% of Novo Nordisk's estimated market value stems from the terminal value calculation, it is important to highlight the sensitivity of key input factors when estimating this value:

1. First, assuming a constant discount rate of 6.95% in the terminal value calculation, the figure below illustrates the implied value impact if key company parameters like sales growth, operating margin or the tax rate should change.

Figure 52 – Sensitivity of key input parameters in the terminal value calculation, base-case scenario



Note that all lines are crossing the graph at DKK 409 when assuming a 0 percentage point change in the underlying input parameter – by definition exactly equal to the share price obtained in the base-case scenario.

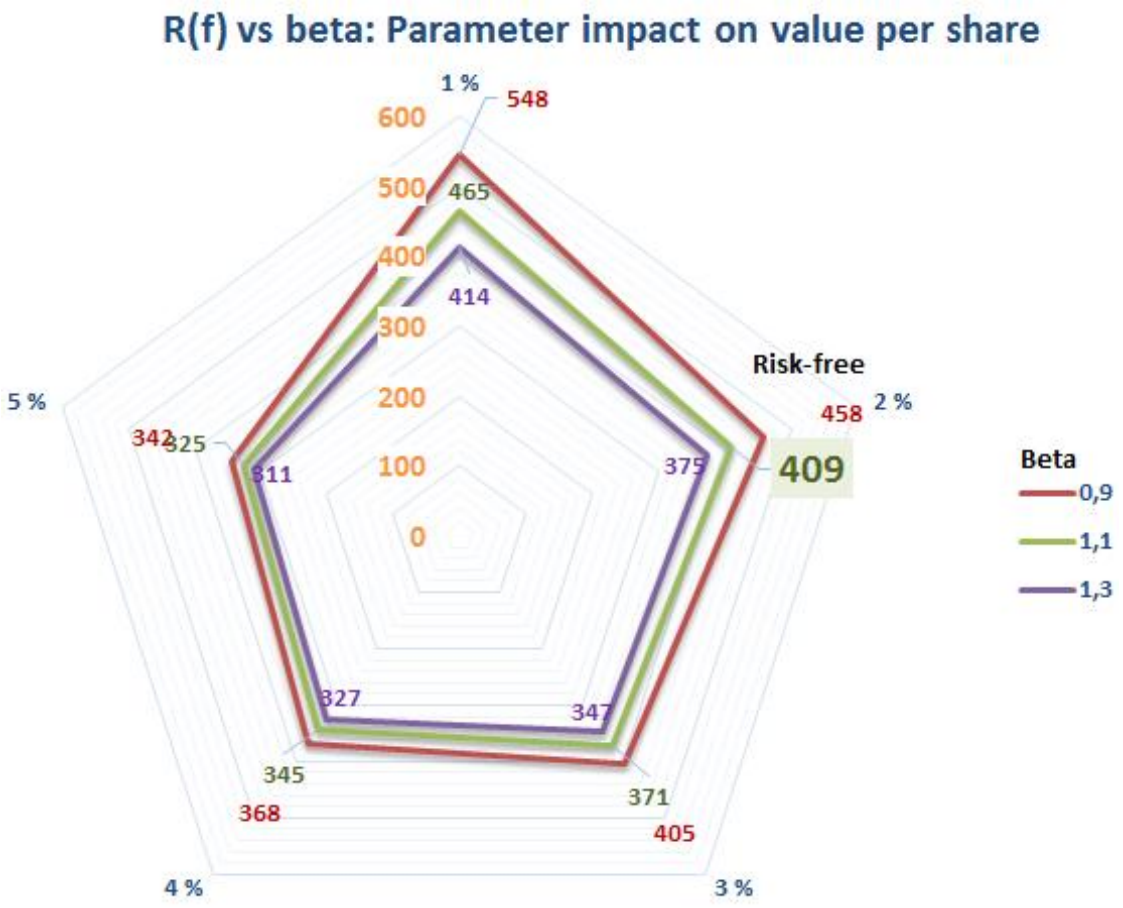
All else equal, the terminal value calculation appear to be most sensitive to changes in the underlying sales growth rate. E.g., if growth declines by 2 percentage points to 0.0% in the terminal value, then the implied share price would be estimated at DKK 345 a share. To defend a share price above today's market price of DKK 363, then a growth rate of >~0.5% should be needed. Given the increasing patient population, this should be more than justifiable (specifically, a possible *cure* for diabetes would render the biggest threat).

At the same time, a small percentage point change in both the operating margin & tax rate are not influencing value as much as one could have anticipated. All else equal, an extrapolation of the approximate DKK 10 a share deviation for every percentage point

change in the operating margin should indicate that any margin higher than **~35%** in terminal value could defend today's market price. In other words, the development of regulatory pricing pressures and/or possible long-term patent expirations should be monitored with care. Any change in the regulatory tax rate, on the other hand, is likely to be of a negligible nature.

2. Second, turning the table and assuming a constant growth rate, operating margin & tax rate in terminal value of 2%, 40% & 21%, respectively, the figure below illustrates the implied value impact of changing other critical input factors in the discount rate estimation, i.e. the beta & the risk-free rate. This compares to the current estimate of **DKK 409** when employing a beta of **1.1** and a risk-free rate of **2.0%**.

Figure 53 – Input factors in the discount rate estimation and its sensitivity on value per share (DKK) from the terminal value calculation, base-case scenario



Note that the writing in orange marks the overall value of Novo Nordisk in DKK a share. The various beta values are marked in red, green & purple colours, while the risk-free rates are given in each corner of the radar plot. The resulting values in DKK a share are plotted in colours within the diagram.

As illustrated in figure above – holding the beta constant at 1.1 – a normalisation of the risk-free rate to a higher historical level in the terminal value calculation would have removed the present DKK 46 share upside if the risk-free rate were to stabilise at a level of ~3% or higher. For the record, this compares to Denmark's present 30-year government bonds YTM of <1%.

However, as Novo Nordisk operates in a "non-cyclical" industry and with limited debt, it could also be argued that the level of systematic risk should be lower than for the economy as a whole – e.g., holding the risk-free rate constant at 2% a beta of 0.9 would imply a share price of **DKK 458**. Combining the beta of 0.9 and with the risk-free rate of 3%, on the other hand, would leave the overall share price at DKK 405 – all else equal, indicating that the current market price is fair.

6.3 Prognosis period: Scenario analysis

To dig deeper into the uncertainties related to my forecasts – particularly concerning aggregate sales growth & operating margins – I have performed a scenario analysis. The analysis contains three scenarios; a bear-case, a base-case and a bull-case scenario, in which the differences relates to considerations in the strategic analysis in section 3.

The table below provides a summary of the considerations that, all else equal, are likely to have a substantial impact on Novo Nordisk and its operations, but that can take many paths. As just calculated, the equity value in the base-case scenario was estimated at DKK 409 a share.

Table 28 – Scenario analysis, considerations

	Bear-case	Base-case	Bull-case
Sales growth	- Limited reimbursement opportunities and austerity measures hindering growth through price increases - Failure/delay of key pipeline products → Overall loss of market shares, but expanding market secures some growth	- Increased diabetes prevalence & adherence to medicines - Higher discounts & sales rebates limits growth through price increases - Innovative products securing market leadership →Overall slowdown of growth rates	- Promising pipeline securing today's market shares - Semaglutide platform fully applicable into OAD-segment (phase 3), obesity (phase 3), NASH (phase 3) and Alzheimer (phase 2) - Expansion of biopharmaceutical niches → Historical growth rates sustained
Operating margin	- The combination of consolidations in the healthcare payer market increasing pricing pressure and a higher uptake of generics & biosimilars, implies higher future discounts & rebate levels - Pipeline of competitors eradicates competitive edge in the long-term →This implies decreasing margins, trending downwards to slightly above average of peers	- Scalability of operations secures high barriers to entry & protects the downside of margins - Innovative products replaces outgoing patents → Allows operating margins to be sustained around today's level	- Strong position in the new-generation- & GLP-1 diabetes segments yields increased leverage in negotiations - Limited competition & continued high prices in the biopharmaceutical niches - Scalability of operations still to reach final peak →Operating margin continues trend upwards

Quantifying the assumptions related to the uncertain development in both sales- & operating margins in the bull-case- & the bear-case scenarios, respectively, and employing

them in a Monte Carlo simulation yields the distribution of results as illustrated in the figures below. Note that the assumptions used in each scenario have been simulated a 1000 times to provide a more accurate estimate of value.

Figure 54 – Distribution of implied share price from 1000 simulations, bull-case scenario

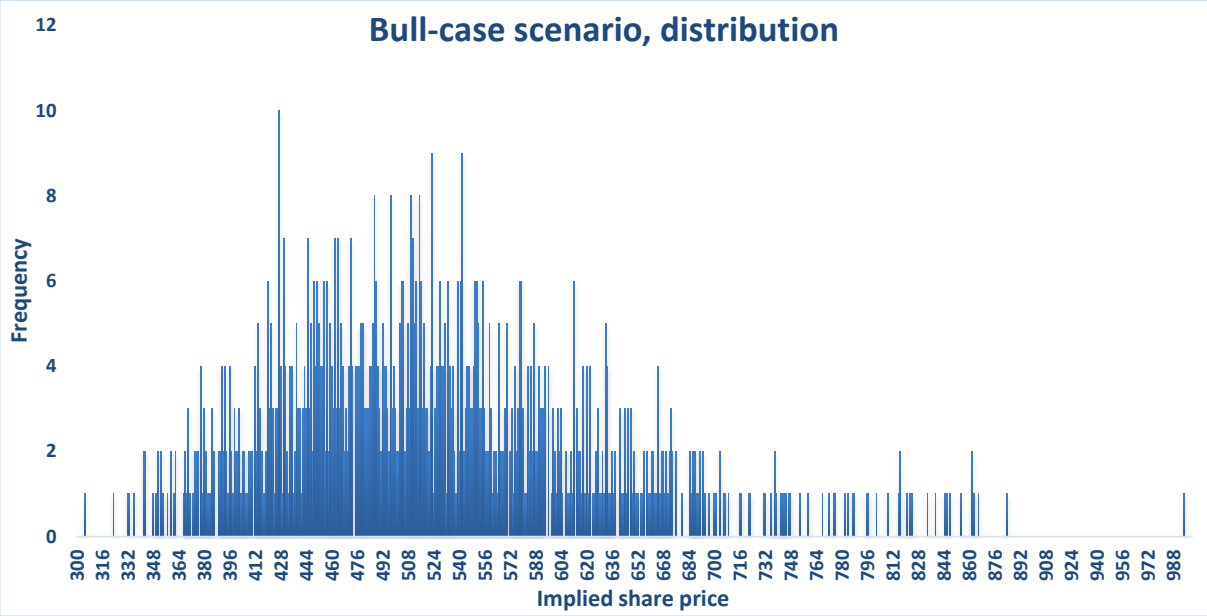
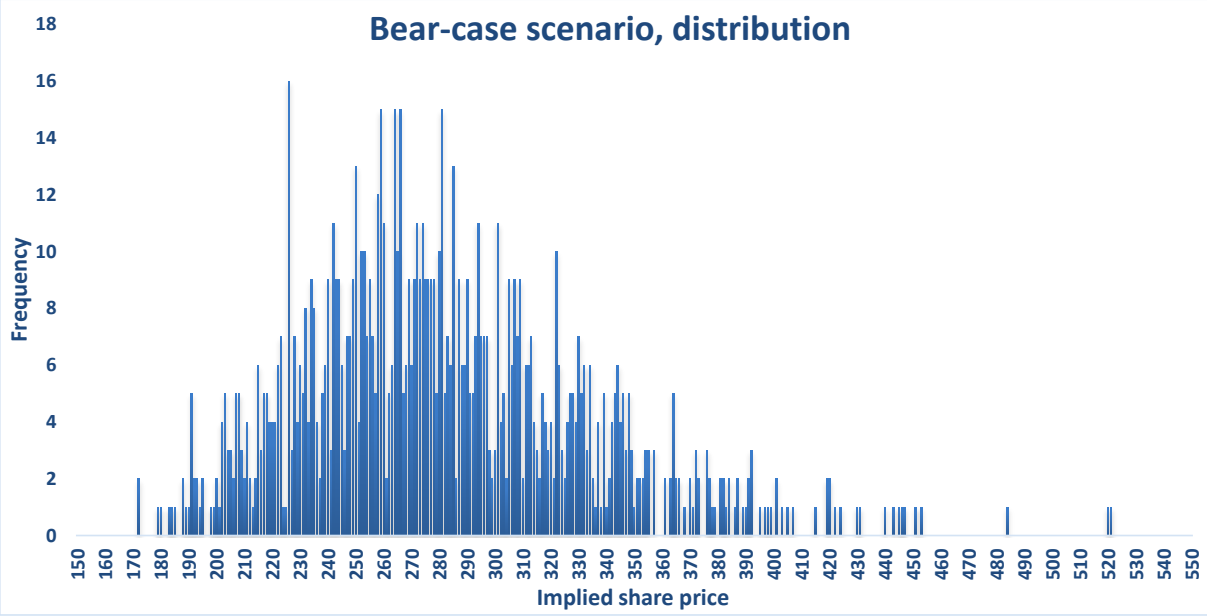


Figure 55 – Distribution of implied share price from 1000 simulations, bear-case scenario



Going further, the distribution of results from the Monte Carlo simulations is used to represent two alternative share prices relative to the base-case scenario. Given the average share price obtained from the distribution of results in the figures above, the scenario analysis give a range for the share price from **DKK 280** to **DKK 545** (29.04.2016).

The bear-case scenario, with an example of its quantified assumptions illustrated in the table below, gives an average share price of DKK 280, or approximately 23% below the quoted market price the same day (as of 29.04.2016).

Table 29 – Example of the development of sales growth & operating margin in one of the 1000 simulated bear-case scenarios

(*In DKK million*)	2015	2016e	2017e	2018e	2019e	2020e	2021e	2022e	2023e	2024e	2025e	Terminal value
Sales revenue	96 266	103 323	106 719	108 539	106 658	108 947	112 772	122 814	121 458	127 515	131 978	133 241
Growth : g = μ + σ*Z		7,3 %	3,3 %	1,7 %	-1,7 %	2,1 %	3,5 %	8,9 %	-1,1 %	5,0 %	3,5 %	1,0 %
Operating margin		42,8 %	42,7 %	41,0 %	40,4 %	39,0 %	39,0 %	38,8 %	36,7 %	36,1 %	33,8 %	33,4 %
Growth : g = μ + σ*Z			-0,4 %	-3,8 %	-1,7 %	-3,3 %	-0,1 %	-0,4 %	-5,6 %	-1,6 %	-6,5 %	-0,9 %
Taxes		-8 853	-9 106	-8 909	-8 608	-8 502	-8 796	-9 541	-8 911	-9 205	-8 911	-8 912
NOPLAT		35 412	36 425	35 636	34 433	34 008	35 183	38 163	35 644	36 822	35 643	35 647
Other adjustments to Cash Flows		8 400	3 435	2 572	-2 614	-2 665	-2 843	-2 828	-2 710	-2 506	-2 245	-1 912
Cash Flows		**43 812**	**39 860**	**38 208**	**31 819**	**31 343**	**32 340**	**35 334**	**32 935**	**34 316**	**33 398**	**33735**

The bull-case scenario, with an example of its quantified assumptions illustrated in the table below, gives an average share price of DKK 545, or approximately 50% above the quoted market price the same day (as of 29.04.2016).

Table 30 – Example of the development of sales growth & operating margin in one of the 1000 simulated bull-case scenarios

(*In DKK million*)	2015	2016e	2017e	2018e	2019e	2020e	2021e	2022e	2023e	2024e	2025e	Terminal value
Sales revenue	96 266	103 932	112 564	117 153	122 666	137 752	139 347	138 243	150 569	161 457	184 872	188 138
Growth : g = μ + σ*Z		8,0 %	8,3 %	4,1 %	4,7 %	12,3 %	1,2 %	-0,8 %	8,9 %	7,2 %	14,5 %	1,8 %
Operating margin		42,8 %	44,4 %	45,0 %	45,1 %	46,9 %	47,1 %	48,7 %	49,6 %	50,9 %	52,6 %	52,6 %
Growth : g = μ + σ*Z			3,6 %	1,5 %	0,2 %	4,0 %	0,4 %	3,3 %	1,9 %	2,8 %	3,2 %	0,0 %
Taxes		-8 905	-9 994	-10 555	-11 071	-12 928	-13 124	-13 455	-14 928	-16 448	-19 431	-19 778
NOPLAT		35 621	39 976	42 220	44 286	51 712	52 495	53 820	59 711	65 794	77 725	79 111
Other adjustments to Cash Flows		8 400	3 435	2 572	-2 614	-2 665	-2 843	-2 828	-2 710	-2 506	-2 245	-1 912
Cash Flows		**44 021**	**43 411**	**44 792**	**41 672**	**49 047**	**49 652**	**50 992**	**57 001**	**63 288**	**75 480**	**77 199**

According to the strategic analysis, and relative to the base-case scenario, it should be more likely that the growth opportunities in terms of the bear-case scenario (*e.g. limited price increases*) plays out rather than what is assumed in the bull-case scenario. However, given the patent protected nature of Novo Nordisk's business and the firm's general position of focused market leaderships, I find a sustainability of today's margins more probable than a "sudden" turnaround towards the average level of less focused peers.

Based on these arguments I have concluded to weight the bear-case-, the base-case- & the bull-case scenarios with 20%, 60% & 20%, respectively (note, however, that the higher weighting of the base-case scenario reflects the assumption of it being the main scenario most likely to develop). Applying the weights in the table below, I get an overall market capitalisation of Novo Nordisk of **DKK 1046 billion** – equivalent to a weighted share price of

DKK 410. All else equal, this represents an **upside of ~13%** compared to the quoted market price of DKK 362.90 the same day (as of 29.04.2016).

Table 31 – Weighted scenario analysis

(in DKK)	Weight	Share price
bull-case scenario, average	20 %	545
base-case scenario	60 %	409
bear-case scenario, average	20 %	280
Weighted share price	**100 %**	**410**

For an analysis & discussion of the real option opportunity of the (phase 3) semaglutide-molecule related to a strengthened re-entrance into Oral Anti-Diabetic (OAD)-segment I refer to appendix 3.

6.4 Using relative valuation to triangulate results

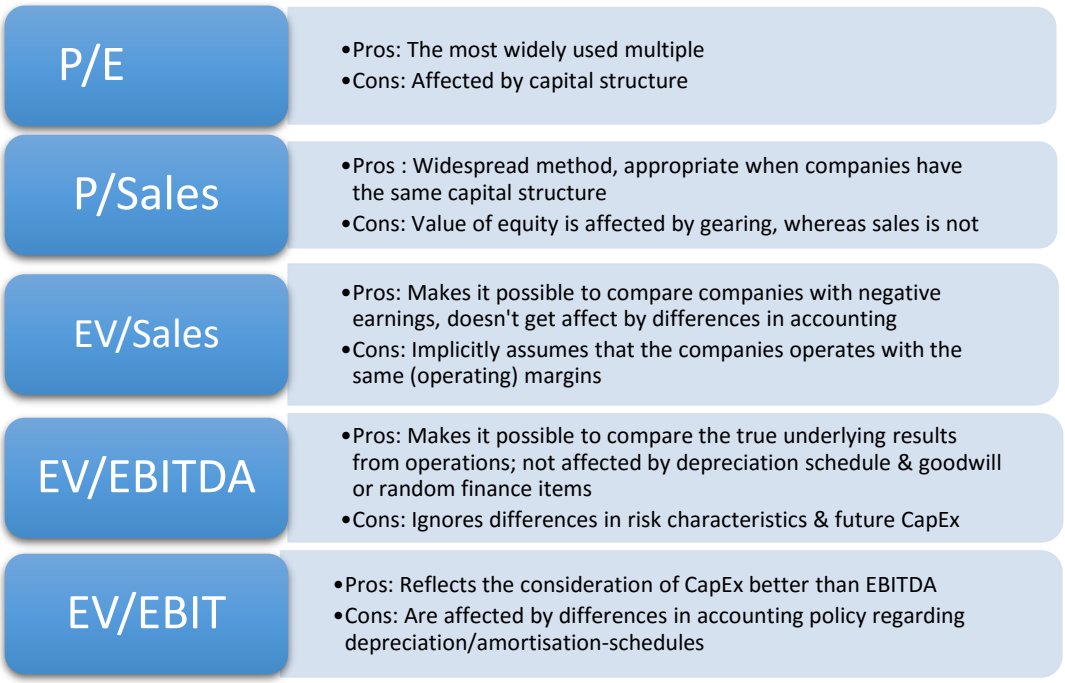
While the scenario analysis above used the projected cash flows, growth and risk characteristics of Novo Nordisk itself to arrive at the value of equity, the relative valuation assumes that these same characteristics are likely to be found in companies operating in the same sector. Thus, the current equity price of comparable companies can be used to arrive at the implicit equity value of Novo Nordisk.

As reporting standards in the biotech/pharma-industry limit the comparability between reported book values in the balance sheet, the focus in this analysis will rely on two types of multiples, namely *Enterprise Value* multiples and *Equity* multiples:

- Enterprise Value (EV) is defined as Market Capitalisation + Net Debt (i.e. debt-cash).
- Equity multiples are based on the market value of equity of the comparable companies.

The relevant multiples are highlighted & briefly discussed in the figure below.

Figure 56 - Multiples, pros & cons



Source: Kaldestad & Møller, 2011, p.157-160

In essence, the relative valuation method is based on a relatively basic principle; that the value of Novo Nordisk can be derived through certain multiples (*financial ratios*) of comparable companies. Based on the notion that these companies are likely to be found in

the pharmaceutical industry, I start of by identifying potential peers to be *diabetes players* and/or *big pharma* companies. To identify these companies in specific, I differentiate between two groups of peers:

- The first peer group contains the most representative sample in terms of the largest players in the diabetes treatment market. In this case, the list of the best-selling diabetes drugs in the table below gives a decent overview. In addition to Sanofi, Merck and Eli Lilly, Bristol-Myers Squibb & AstraZeneca should also be considered forces to be reckoned with. However, given the diversity of their business I choose to include them in the "big pharma" group below.

Table 32 – Best-selling diabetes drugs in 2013

Best-selling diabetes drugs in 2013	Sales in 2013	Company (US ticker)
Lantus	USD 7592 billion	Sanofi (SNY)
Januvia	USD 4013 billion	Merck (MRK)
NovoLog/NovoRapid	USD 3001 billion	Novo Nordisk (NVO)
Humalog	USD 2611 billion	Eli Lilly (LLY)
Victoza	USD 2072 billion	Novo Nordisk (NVO)
Levemir	USD 2057 billion	Novo Nordisk (NVO)
Human insulin and devices	USD 1936 billion	Novo Nordisk (NVO)
Janumet	USD 1829 billion	Merck (MRK)
NovoMix 30	USD 1738 billion	Novo Nordisk (NVO)
Humulin R	USD 1316 billion	Eli Lilly (LLY)

Source: Fierce Pharma, 2014

- In the second group, I identify the largest pharmaceutical companies ranked by global sales (in 2014). Excluding Sanofi & Merck already included in the sample above, these are Novartis, Pfizer, Roche, Johnson & Johnson, GlaxoSmithKline, Gilead Sciences, Astra-Zeneca & Bristol-Myers Club (pmlive.com, 2016).

Financial characteristics for the companies are provided in the table below (note that "*expected 2015-2020 CAGR*" is based on a public research report from Goldman Sachs):

Table 33 – Input used to construct the multiples, fiscal year 2015 (reporting in local currencies)

(reported currencies)	Novo Nordisk	Sanofi SA	Merck & Co	Eli Lilly	Bristol-Myers S.	AstraZeneca	Novartis	Pfizer	Roche	Johnson & J.	GlaxoSmithKline	Gilead Sciences
Key Financial data												
Sales revenue (2015)	107 927	34 542	39 498	19 959	16 560	24 708	49 440	48 851	50 403	70 074	23 923	32 639
Sales (2014)	88 806	31 694	42 237	19 616	15 879	26 547	52 419	49 605	49 866	74 331	23 006	24 890
Trailing growth, y-on-y	21,5 %	9,0 %	-6,5 %	1,7 %	4,3 %	-6,9 %	-5,7 %	-1,5 %	1,1 %	-5,7 %	4,0 %	31,1 %
*Expected 2015-2020 CAGR **	*8,1 %*	*N/A*	*7,0 %*	*12,0 %*	*22,0 %*	*N/A*	*N/A*	*7,0 %*	*N/A*	*4,0 %*	*N/A*	*-4,0 %*
(Adjusted numbers marked in orange)												
EBITDA	68 362	8 528	11 920	4 136	2 908	6 966	14 486	14 480	17 721	23 990	12 788	23 291
EBITDA-margin	*63,3 %*	*24,7 %*	*30,2 %*	*20,7 %*	*17,6 %*	*28,2 %*	*29,3 %*	*29,6 %*	*35,2 %*	*34,2 %*	*53,5 %*	*71,4 %*
EBIT	54 108	5 624	5 401	2 709	2 340	4 114	8 911	9 843	13 821	19 620	10 336	22 193
EBIT-margin	*50,1 %*	*16,3 %*	*13,7 %*	*13,6 %*	*14,1 %*	*16,7 %*	*18,0 %*	*20,1 %*	*27,4 %*	*28,0 %*	*43,2 %*	*68,0 %*
Pre-tax profit	53 690	5 243	5 018	2 790	2 077	3 069	8 134	8 965	11 987	19 196	10 526	21 659
Net profit	43 043	4 287	4 442	2 408	1 565	2 826	7 028	6 975	8 863	15 409	8 422	18 108
Profit-margin	*39,9 %*	*12,4 %*	*11,2 %*	*12,1 %*	*9,5 %*	*11,4 %*	*14,2 %*	*14,3 %*	*17,6 %*	*22,0 %*	*35,2 %*	*55,5 %*
Cash	16 923	9 148	8 524	3 666	2 385	6 240	4 674	3 614	3 731	13 732	5 830	12 851
Debt	14 373	16 554	26 514	7 979	6 689	15 053	20 256	38 978	23 251	19 861	16 632	22 178
Net debt	-2 550	7 406	17 990	4 312	4 304	8 813	15 582	35 364	19 520	6 129	10 802	9 327
Market capitalisation	960 585	101 832	157 597	85 499	116 365	115 796	204 897	205 499	218 689	312 796	73 134	136 914
Enterprise value (EV)	958 035	109 238	175 587	89 811	120 669	124 609	220 479	240 863	238 209	318 925	83 936	146 241
Net debt/equity-ratio	*-0,3 %*	*7,3 %*	*11,4 %*	*5,0 %*	*3,7 %*	*7,6 %*	*7,6 %*	*17,2 %*	*8,9 %*	*2,0 %*	*14,8 %*	*6,8 %*

*Sources: *Goldman Sachs Global Investments research (2015) at valuewalk.com, Annual reports (2015), Bloomberg (market capitalisations updated 29.04.2016).*

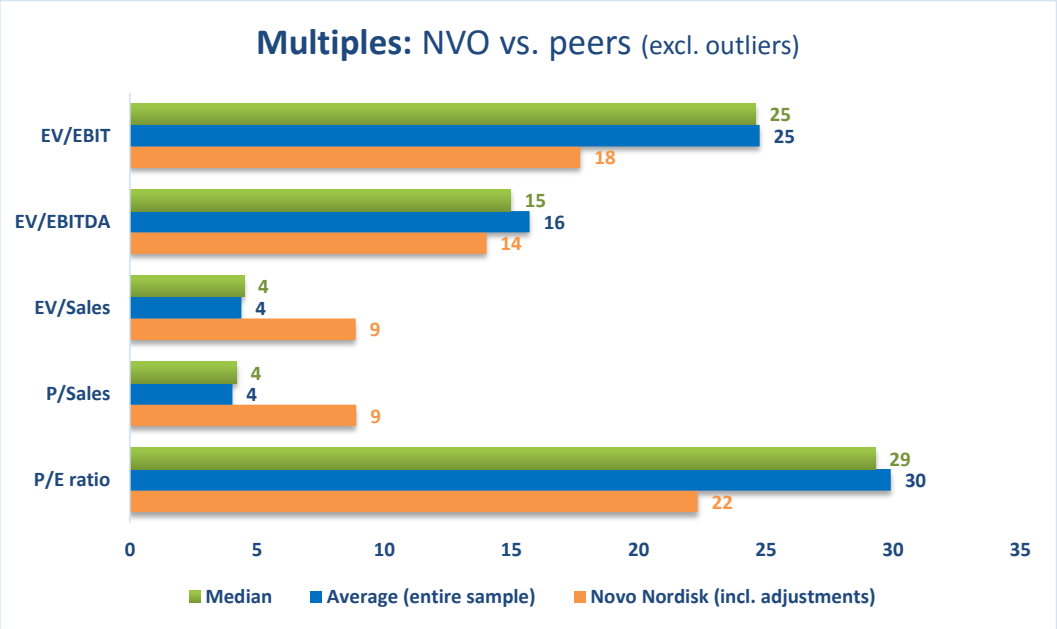
By assessing the financial characteristics of the selected sample, it is possible to observe a number of problems:

1. First, the criteria of comparable companies having similar growth characteristics (*trailing and/or expected growth*) might not be sufficiently satisfied. Also, the operating margins on most companies differs significantly from Novo Nordisk.
2. Second, most peers seems to employ a higher level of debt than what characterises Novo Nordisk's capital structure.
3. The third problems concerns the size of the sample. In terms of having a significant presence in the diabetes sector, the sample contains only three companies (Sanofi, Merck & Eli Lilly) that can be considered "highly" comparable – a statement that may not be accurate based on the above arguments. Likewise, the diversified product portfolios of the eight other "big pharma" companies may entail different risk profiles than what is implied from Novo Nordisk's specialised focus.
4. In addition, all data are based on reported balance sheet numbers except for Novo Nordisk where all accounting adjustments have been applied (*marked in orange*). Thus, if there is a systematic skewness in the reporting of the other companies as well, the bias could potentially distort the valuation multiples.

Despite the magnitude of some of these mentioned problems, my perception is that in order to secure a representative sample, all companies should be included. Instead, to rule out potential outliers, a careful consideration regarding the multiples themselves will be given. Thus, before estimating the average of the sample's multiples the numerical values diverging the most from the sample have been excluded. Also, to ensure that the sample is uniform the median has been estimated; with all outliers being excluded, the sample is roughly converging.

Hence, based on the key financial input in the table above, it is possible to deduce what might yield representative financial ratios. This is done in the figure below.

Table 34 – Multiples of Novo Nordisk relative to comparable companies



As illustrated above, Novo Nordisk appears to be traded at a premium based on the sales-linked multiples whereas it appears at a discount relative to the margin-related ratios. This should not come as a surprise. As briefly labelled as a drawback/con with the sales-linked multiples in the overview, these multiples implicitly assumes that all the benchmarked companies operates with the same (operating) margin as Novo Nordisk. Quickly revealed by the key financial data, however, in 2015 it was only GlaxoSmithKline and Gilead Sciences that delivered margins on the same (outperforming) level as Novo Nordisk.

This last consideration is reflected through a lower weighting of the sales-linked multiples in the table below. Regarding each multiple in specific, the weighting incorporates the following additional considerations:

- **P/E**: Should work reasonably well with most companies having a low debt capital structure. No reason to deviate from average weighting of 20%.
- **P/Sales & EV/Sales**: As just explained, the assumption of all peers operating with the same operating margin is not valid; Novo Nordisk has on average *twice* as high operating margin as the rest of the peer group. Thus, I arbitrarily adjust the weighting of these multiples downwards by 5 percentage points each.
- **EV/EBITDA & EV/EBIT**: With large differences in accounting policy, these measures should provide the most unbiased & reliable estimate of the underlying

results from operations. Thus, I adjust the weighting of these multiples upwards by 5 percentage points each.

In total, this yields the final, arbitrary weighting of the multiples as illustrated in the table below:

Table 35 – Estimated market value of Novo Nordisk's equity (based on derived multiples of peers), DKK million

Multiple	Company parameter	Multiplier (entire sample excl. outliers)	Market Value	Enterprise Value	Net Debt	Full Value of Equity	Weight	Weighted Market Value of equity
P/E ratio	43 043	31,6	1 359 199	-	-	1 359 199	20 %	271 840
P/Sales	107 927	3,7	403 714	-	-	403 714	15 %	60 557
EV/Sales	107 927	4,0	-	435 586	-2 550	438 135	15 %	65 720
EV/EBITDA	68 362	16,4	-	1 122 353	-2 550	1 124 903	25 %	281 226
EV/EBIT	54 108	28,4	-	1 534 720	-2 550	1 537 270	25 %	384 317
Unadjusted Market Value of Equity							100 %	**1 063 660**
Implied share price								**417**

With a value estimate of Novo Nordisk's equity ranging from a **share price of DKK 158 to DKK 603**, the table above presents the process of estimating the total market value of Novo Nordisk's equity based on the derived multiples of peers. Hence, the market value of *Equity* and *Enterprise Value* is estimated based on the corresponding financial data of Novo Nordisk. Note that net debt becomes negative (due to a higher level of cash than debt) and resultantly must be added (*not subtracted*) from Enterprise Value to determine the market capitalisation of the company.

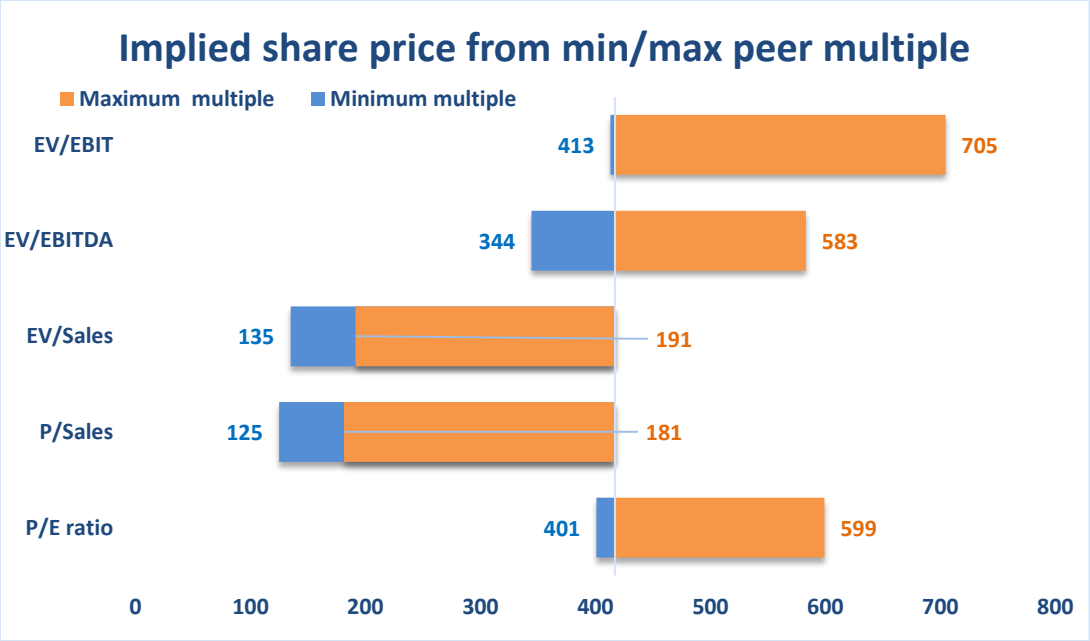
In summary – using the comparable multiples approach – the weighted market value of Novo Nordisk's equity is estimated at **DKK 1064 billion**. This implies a share price of **DKK 417.** All else equal, this should indicate an upside of **~15%** compared to the share price of DKK 363 as of 29.04.2016.

Discussion:

Relative to the scenario analysis and the weighted share price of DKK 410, the comparable valuation method should complement the understanding of Novo Nordisk's key value drivers. In this case, it certainly enhances the indirect importance of today's margins. Thus, if it for some reason turns out that Novo Nordisk's margins should not be sustainable in the longer term, it can quickly translate into dramatic effects on the implied share price.

In addition, given the wide range of multiplier-intervals obtained from the sample it is interesting to highlight the implied valuation impact if Novo Nordisk were to be priced on either the minimum or maximum multiplier from each company (*excl. outliers*). Defining the most relevant peers as the *diabetes players* – i.e., Sanofi SA, Merck & Co and Eli Lilly – and comparing the value impact against the weighted overall share price of DKK 417, the figure below illustrates how the implied share price of Novo Nordisk would change. As seen & previously discussed, whereas the margin-linked multiples mostly indicates a further upside potential the sales-linked multiples indicates a significant overpricing.

Figure 57 – Novo Nordisk's implied valuation interval when benchmarked against minimum/maximum (diabetes-) peer multiple



Thus, while the estimated ~15% upside between the derived value and the actual market capitalisation of Novo Nordisk can be considered huge in terms of a pure alpha-return, the relative valuation is highly sensitive to the selection of the sample and weighting of the multiples

7 Conclusion

The objective of this thesis has been to find the value of Novo Nordisk's equity and its corresponding share price. Complemented by a relative valuation, the main valuation methodology is based on the present value of Free Cash Flows to Equity (FCFE) through the means of a scenario analysis.

In summary, the results obtained are as illustrated in the table below:

Table 36 – Final weighting of equity estimates obtained from various valuation methodologies, Novo Nordisk

Methodology	Results (DKK a share)
Weighted estimate from scenario analysis	**410**
Relative valuation	**417**

Relative to the market price of Novo Nordisk's stock of DKK 363 – as of 29.04.2016 – on average, the estimated values of Novo Nordisk's equity should indicate a further upside potential of 13% to 15%.

There are however large uncertainties in both estimates to be aware of. While the different outcomes in the scenario analysis ranges from an average low of DKK 280 a share to an average high of DKK 545 a share, the multiples approach indicates an even more extreme pricing interval. However, as the relative valuation mainly is included as a consistency check against the estimate from the scenario analysis, it could be argued that the closely related estimate from this first-mentioned approach should enhance the reliability of the weighted scenario outcome. As such, it is tempting to conclude that Novo Nordisk A/S is more likely to continue its trend of providing excess returns to investors rather than the other way around.

Thus, despite the variability of results and sensitivity of key model parameters, I recommend overweighting Novo Nordisk in a diversified portfolio.

Stock recommendation: Buy

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Appendix 1: Scientific background

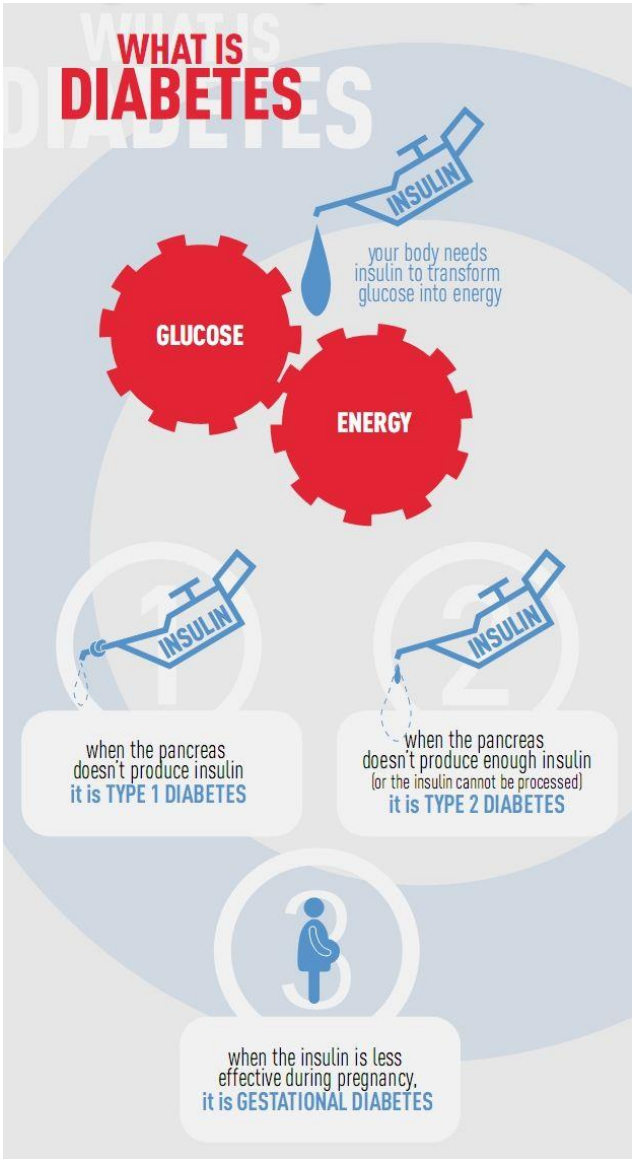
In the following sections, a thorough review of the scientific background of Novo Nordisk's segments will be provided. Starting with a quick look at the classification of different types of diabetes, coupled with a quick look at the related obesity segment, the section rounds of with a further elaboration into the biopharmaceutical area of bleeding- & growth disorders.

What is diabetes?

Diabetes mellitus, commonly referred to as diabetes, is a group of chronic, metabolic diseases (*see textbox below*) that occurs when the body cannot produce enough insulin or cannot use insulin, and is characterised by an elevated level of blood glucose (/blood sugar) over a prolonged period of time. (WHO, 2016).

Today, it's estimated that out of the 415 million people affected by diabetes, approximately 90% suffers from type 2 diabetes, while the rest suffers from type 1- and other specific types of diabetes (e.g. gestational diabetes). As indicated, diabetes doubles, at minimum, a person's risk of death. In 2015, diabetes is estimated to have resulted in 5 million deaths (IDF, Diabetes Atlas, p.13).

Figure 58 - Illustrative figure showing the relevant mechanisms identifying different types of diabetes



Source: Idf.org (International Diabetes Federation)

In plain speaking, diabetes affects the way the body uses food for growth and energy. Typical symptoms include frequent urination, increased thirst, and increased hunger. If left untreated, the long-term complications (mostly due to high blood glucose levels) include stroke, blindness, kidney failure, amputation and

cardiovascular disease (heart attack). More acute are the medical emergency of diabetic ketoacidosis and hyperosmolar hyperglycaemic state *(see relevant textbox below)*.

In effect, diabetes is due to either the pancreas – *a digestive organ behind the stomach producing important hormones,* e.g. insulin – not producing enough insulin or the cells of the body not responding properly to the insulin produced. Insulin and two of the main types of diabetes, Type 1 & Type 2, are outlined in more detail below. A third main form for diabetes, gestational diabetes, occurs when pregnant women without a previous history of diabetes develop high blood-sugar levels.

Insulin

As mentioned, insulin is a hormone produced in the pancreas; it is required to transport glucose from the bloodstream into the body's cells where it is used as energy. The lack, or ineffectiveness, of insulin means that glucose remains circulating in the blood. Over time, the resulting high levels of glucose in the blood (hyperglycaemia) causes to damage to many tissues in the body, leading to the development of disabling and life-threatening health complications (IDF, Diabetes Atlas, p.22)

As illustrated in the figure below, insulin enables glucose to become energy both by facilitating uptake of blood sugar into cells, and by inhibiting glucose release from the liver:

Metabolic disorder

"A *metabolic disorder* can happen when abnormal chemical reactions in the body alter normal *metabolic processes*.

Metabolism is the set of life-sustaining chemical transformations within the cells of living organisms. These enzyme-catalysed reactions allow organisms to grow and reproduce, maintain their structures, and respond to their environments.

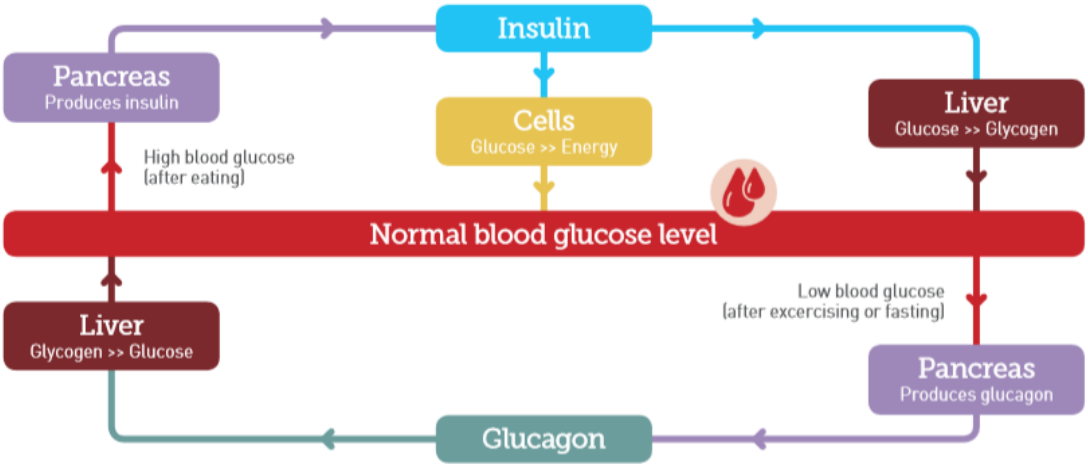
Metabolism is usually divided into two categories: *catabolism*, the *breaking down* of organic matter by way of cellular respiration and *anabolism*, the building up of components of cells such as proteins and nucleic acids. Usually, breaking down releases energy and building up consumes energy." – Wikipedia, January 2016.

Acute diabetes complications

"*Diabetic ketoacidosis* (DKA) is a potentially life-threatening complication that results from a shortage of insulin (diabetes type 1); in response, the body switches to burning fatty acids and producing acidic ketone bodies (water-soluble molecules). The resulting removal of water and electrolytes from the blood leads to dehydration and may be fatal.

Hyperosmolar hyperglycaemic state (HHS) is a complication of diabetes (type 2) in which high blood sugars cause severe dehydration and a high risk of complications, coma and death. As indicated, HHS is related to DKA (above). "– Wikipedia, January 2016.

Figure 59 - Insulin production and action



Source: IDF, Diabetes Atlas, p.31

In total, 45-50 million people worldwide are using insulin. A significant challenge in managing diabetes with insulin is to maintain appropriate blood glucose levels. Adjusting insulin dosing is necessary to balance the impact of food and exercise to avoid either too high blood glucose levels (*hyperglycaemia*), or too low blood glucose levels (*hypoglycaemia*) – both of which are associated with the severe complications cited above (Novo Nordisk, Annual report 2014, p.28).

Type 1 diabetes

Type 1 diabetes is caused by an autoimmune reaction, in which the body's defence system attacks the insulin-secreting beta cells in the pancreas. As a result, the body can no longer produce the insulin it needs. Exactly why this occurs is not fully understood. (IDF, Diabetes Atlas, p.22)

People with type 1 diabetes lacks the insulin needed to keep blood sugar levels within optimal ranges. If left untreated, this leads to high blood sugar and the array of associated symptoms. Type 1 diabetes develops in people of all ages but is mostly onset before adulthood. For type 1 diabetics, insulin injections are critical for survival (Wikipedia, 2016).

Type 2 diabetes

Type 2 diabetes is the most common form of diabetes, usually occurring in adults. The causes for high blood sugar in this form of diabetes usually are a combination of insulin resistance and impaired insulin secretion, with both genetic and environmental factors

playing an important role in the development of the disease. People with type 2 diabetes may still produce their own insulin, but over time the amount becomes insufficient to restore the balance of glucose in the blood. In contrast to type 1 diabetes, most people with type 2 diabetes do not require daily insulin treatment to survive; the cornerstone is the adoption of a healthy diet, increased physical activity, and maintenance of a normal body weight. As the disease progresses, however, more medicines may be needed (IDF, Diabetes Atlas, p.23).

Obesity

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have a negative effect on health, leading to reduced life expectancy and/or increased health problems (WHO, fact sheet 311). Although dieting and exercising are the main treatments, anti-obesity drugs may be taken to reduce appetite or decrease fat absorption (combined with a suitable diet).

A crude measure of obesity is obtained using the body mass index (BMI) (*see textbox*), in which a person with a BMI of 30 or more is generally considered obese. Major risk factors includes type 2 diabetes, cardiovascular diseases and cancer, i.e. some of the leading causes of preventable death (WHO, 2016).

Despite having reached pandemic proportions with an estimated prevalence of >600 million adults, there are currently few pharmaceutical treatment options available to treat obesity, and reimbursement for these medications is limited. Amongst other, this is evidenced by the fact that the global pharmaceutical market for obesity products only amounts to around DKK 10 billion (Novo Nordisk, annual report 2015, p.17).

BMI – Body mass index

The BMI is defined as the body mass divided by the square of the body height:

$$\mathrm{BMI} = \frac{\mathrm{mass}_{\mathrm{kg}}}{\mathrm{height}^2_{\mathrm{m}}}$$

The BMI is an attempt to quantify the amount of tissue mass in an individual, and then categorize that person as *underweight, normal weight, overweight,* or *obese* based on that value. BMI itself, however, does not define health risk.

Commonly accepted BMI ranges are underweight: <18.5, normal weight: 18.5-25, overweight 25-30, obese: >30 (Wikipedia, January 2016).

Biopharmaceuticals

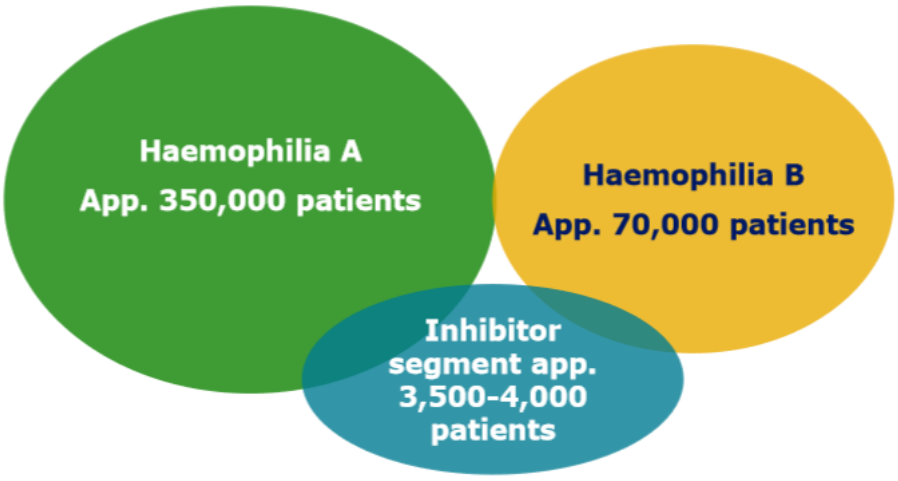
A biopharmaceutical is a biological medicinal drug produced using biotechnology. They are proteins (including antibodies), nucleic acids (DNA, RNA) and sugars – mostly involving recombinant DNA technology – used for therapeutic or diagnostic purposes and are produced by means other than direct extraction from a (non-engineered) biological source. The biologic compounds are isolated from humans, animals, or microorganisms. The first such substance ever approved for therapeutic use was recombinant human insulin (Science Daily, 2016).

Major classes of biopharmaceuticals include biologics extracted from living systems (e.g. human insulin), **recombinant DNA technology** (blood factors, hormones (e.g. insulin & growth hormones) etc.), vaccines & gene therapy (Wikipedia, January 2016).

Investment in research and development, by the biopharmaceutical industry, stood at USD 140 billion in 2014 (Schulze, Bädeker, Chen & Greber, 2015).

Haemophilia

Figure 60 – Number of people with haemophilia A and B and haemophilia with inhibitors



Source: Novo Nordisk, Q4 2015 roadshow presentation, p.88

Haemophilia, also spelled Hemophilia, is a group of inherited or acquired genetic disorders that impairs the **body's** ability to control blood clotting. The disorder is due to defects in the blood vessels, the coagulation mechanism, or the blood platelets. As a result, when coagulation factors are missing or deficient, the blood does not clot properly and an affected

individual may bleed spontaneously or for longer than a healthy person may after injury (Medical News Today, 2016).

- *Haemophilia A* (coagulation factor VIII deficiency) is the most common form of the disorder, present in about 1 in 5000-10.000 male births.
- *Haemophilia B* (factor IX deficiency) occurs in around 1 in about 20.000-34.000 male births.
- (*The male manifestation is due to the sex-linked X chromosome of the disorder in which females have two X chromosomes and males only have one. Hence, the defective gene is guaranteed to manifest in any male who carries it (Wikipedia, January 2016*)

The average lifespan of a person suffering from haemophilia is approximately 10 years shorter than an unaffected male. Although there is no absolute cure for haemophilia, treatment still allows a good quality of life. Genetically engineered clotting factor medications have in the last decades dominated as the main treatment. These medications are given as an injection, usually in response to prolonged bleeding (NHS, 2014).

Pituitary gland

The pituitary gland is a small gland about the size of a pea. It's located at the base of the brain and secretes eight hormones. Some of these hormones control thyroid activity (*hormones essential to your metabolism*) and body temperature (Healthline, 2016)

The global haemophilia pharmaceutical market has a value of around DKK 75 billion and has grown by around 5% annually in recent years (Novo Nordisk, annual report 2015, p.17).

Growth disorders

Growth hormone deficiency (GHD) is a medical condition, caused by problems in the pituitary gland (*see textbox*), in which the body does not produce enough growth hormone for the normal development and maintenance of the body. The growth hormone, called **somatropin**, stimulates growth and cell reproduction. With a deficiency, a variety of growth-related disorders can occur (Wikipedia, January 2016).

With a total estimated prevalence of >2 million people, a deficiency is most common for children, and rare for adults. With common effects as growth failure and short stature, the standard treatment is once-daily growth hormone injections. Known causes include genetic

conditions and congenital malformations. The condition can also be a symptom of several genetic diseases, including Turner syndrome (chromosome abnormality) (Healthline, 2016).

According to GlobalData, the global market for growth hormone deficiency will rise in value from USD 1.26 billion in 2014 to approximately USD 1.88 by 2024. This represent a CAGR of 4.08 %, compared to the 2 % annual growth rate the last couple of years (European Pharmaceutical Review, 2016).

Novo Nordisk's complete list of products, pipeline & patent portfolio

Novo Nordisk's list of products

Table 37 - Novo Nordisk complete product overview

Therapeutic Area	Trade name	Generic name
Diabetes care		
New generation insulins	Tresiba®	Insulin degludec
	Ryzodeg® 70/30	Insulin degludec/insulin aspart
	Xultophy®	Insulin degludec/liraglutide (NDA submitted)
Glucagon-Like Peptide-1	Victoza®	Liraglutide
Modern insulins	NovoRapid® (NovoLog®)	Insulin aspart
	NovoRapid® PumpCart®	Prefilled insulin pump cartridge
	Levemir®	Insulin detemir
	NovoMix® 30	Biphasic insulin aspart
	NovoMix® 50	Biphasic insulin aspart
	NovoMix® 70	Biphasic insulin aspart
Human insulins	Insulatard®	Human insulin
	Actrapid®	Human insulin
	Mixtard® 30	Biphasic human insulin
	Mixtard® 40	Biphasic human insulin
	Mixtard® 50	Biphasic human insulin
Obesity care	Saxenda®	Liraglutide 3 mg
Oral antidiabetic agents	NovoNorm®	Repaglinide

	PrandiMet®	Repaglinide/metformin
Diabetes devices	FlexTouch®	Prefilled insulin delivery system
	FlexPen®	Prefilled insulin delivery system
	NovoPen® 4	Durable insulin delivery system
	NovoPen® 5	Durable insulin delivery system with memory function
	NovoPen Echo®	Durable insulin delivery system
	InnoLet®	Prefilled insulin delivery system
	NovoFine®	Needle
	NovoFine® Plus	Needle
	NovoFine® AutoCover®	Needle
	NovoTwist®	Needle
	GlucaGen®	Glucagon
Biopharmaceuticals		
Haemostasis	Novoseven®	Recombinant factor VIIa
	NovoEight®	Recombinant factor VIII
	NovoThirteen®	Recombinant factor XIII
Human growth hormone	Norditropin®	Somatropin (rDNA origin)
	Norditropin® FlexPro®	Prefilled multidose delivery system
	Norditropin® Nordiflex	Prefilled multidose delivery system
	NordiPen®	Prefilled multidose delivery system
	PenMate®	Prefilled multidose delivery system
	NordiLet®	Prefilled multidose delivery system
Hormone replacement therapy	Activelle®	Estradiol/norethisterone acetate
	Estrofem®	Estradiol
	Novofem®	Estradiol/norethisterone acetate
	Vagifem®	Estradiol hemihydrate

Source: Novo Nordisk

Novo Nordisk's list of R&D-projects

Table 38 - Novo Nordisk R&D-pipeline overview

Compound (study ID)	Indication	Description	Phase
Diabetes			
Xultophy® (NN9068)	Type 2 diabetes	*A combination of insulin degludec and liraglutide in a once-daily single injection. Approved in Europe.*	Filed / regulatory approval
Faster-acting insulin aspart (NN1218)	Type 1 and 2 diabetes	*A new formulation of insulin aspart intended to accelerate onset of action, with the potential for increased flexibility of dosing.*	Filed / regulatory approval
Semaglutide (NN9535)	Type 2 diabetes	*A once-weekly GLP-1 analogue intended to offer the clinical benefits of a GLP-1 analogue with less frequent injections to people with type 2 diabetes.*	Phase 3
OG217SC (NN9924)	Type 2 diabetes	*A long-acting oral GLP-1 analogue intended as a once-daily tablet treatment for people with type 2 diabetes.*	Phase 2
OI338GT (NN1953)	Type 1 and 2 diabetes	*A long-acting basal insulin analogue intended to offer the clinical benefits of a basal insulin analogue in a once-daily tablet.*	Phase 2
Anti-IL-21 T1D (NN9828)	Type 1 diabetes	*Intended as a beta-cell preservation treatment for people who are newly diagnosed with type 1 diabetes.*	Phase 2
Dual-agonist (NN9709)	Type 2 diabetes	*A GLP-1/GIP dual-agonist intended as a once-daily treatment for people with type 2 diabetes.*	Phase 2
LAI287 (NN1436)	Type 1 and 2 diabetes	*A long-acting basal insulin analogue intended for once-weekly dosing.*	Phase 1
Mealtime (NN1406)	Type 1 and 2 diabetes	*A liver-preferential mealtime insulin analogue.*	Phase 1
OI320GT (NN1957)	Type 2 diabetes	*A long-acting basal insulin in an oral formulation intended as a once-daily tablet treatment.*	Phase 1
PYY 1562 (NN9748)	Type 2 diabetes	*An appetite-regulating hormone, peptide tyrosine, for the treatment of diabetes.*	Phase 1

Obesity			
Semaglutide (NN9536)	Obesity	*A long-acting GLP-1 analogue intended as a once-daily treatment for obesity.*	Phase 2
AM833 (NN9838)	Obesity	*A novel amylin analogue intended as a once-weekly treatment for obesity.*	Phase 1
G530L (NN9030)	Obesity	*A novel glucagon analogue, which, in combination with liraglutide, is intended for the treatment of obesity.*	Phase 1
PYY 1562 (NN9747)	Obesity	*An appetite-regulating hormone, peptide tyrosine, which, alone or in combination with semaglutide, is intended for the treatment of obesity.*	Phase 1
Haemophilia			
N9-GP (NN7999)	Haemophilia B	*A glycopegylated long-acting recombinant coagulation factor IX intended to offer prophylaxis and treatment of bleeds.*	Filed / regulatory approval
N8-GP (NN7088)	Haemophilia A	*A glycopegylated long-acting recombinant coagulation factor VIII intended to offer prophylaxis and treatment of bleeds*	Phase 3
Concizumab (NN7415)	Haemophilia A and B	*A monoclonal antibody against Tissue Factor Pathway Inhibitor (TFPI) intended for bleeding prevention after subcutaneous administration.*	Phase 1
Growth disorders			
Somapacitan (NN8640)	Growth disorders	*A long-acting human growth hormone intended to offer once weekly injections.*	Phase 3

Source: Novo Nordisk, annual report 2015, p.20-21.

Novo Nordisk's list of patent expiration dates

Table 39 - Patent expiration dates related to current product portfolio

Marketed products in key markets (active ingredients)	US	Germany	China	Japan
Diabetes care				
NovoRapid® (NovoLog®)	Expired[3]	Expired[1]	Expired[1]	Expired[1]
NovoMix® 30 (NovoLog® Mix 70/30)	Expired[1]	Expired	Expired	Expired
Levemir®	2019	2019	Expired	2019
NovoNorm® (Prandin®)	Expired	Expired	Expired	2016
Victoza®	2022	2022	2017	2022
Tresiba®	2029	2028	2024	2027
Ryzodeg®	2030	2028	2024	2027
Xultophy®	2029	2028	2024	2027
Obesity:				
Saxenda®	2022	2022	2017	2017
Biopharmaceuticals				
Norditropin® (Norditropin® SimpleXx®)	2017[4]	2017[2]	2017[2]	2017[2]
NovoSeven®	Expired[5]	Expired[3]	Expired[3]	Expired[3]
NovoEight	N/A[6]	N/A[4]	N/A[4]	N/A[4]
NovoThirteen® (TRETTEN®)	2021[7]	Expired[8]	N/A[6]	N/A[6]
Vagifem® 10mcg	2022[9, 10]	2021[7]	N/A	2021[7]

Source: Novo Nordisk, annual report 2015, p.99-100

The dates provided are for patent expiry on the active ingredient and include extensions of patent term. In addition to the compound patent, Novo Nordisk holds other patents on manufacturing processes, formulations and/or uses that may prolong the effective patent maturity date.

[3] Formulation patent until 2017
[4] Formulation patent providing exclusivity to the composition of excipients used in the drug products
[5] Room temperature-stable formulation patent until 2023
[6] Process patent until 2028 in China, German and Japan and until 2030 in the US.
[7] Data protection runs until 2025.
[8] Formulation patent expiring in 2016.
[9] Patent covers low-dose treatment regimen.
[10] Licensed to three generic manufacturer beginning in October 2016.

Appendix 2: Strategic financial statement analysis

Congruent accounting adjustments

This section enhance the accounting analysis by introducing different forms of adjustments in a congruent accounting system. Because the financial statements are part of an accounting system, any adjustment in the system has consequences for more than one financial statement. In the end, the intention is to improve the understanding of a sustainable level of earnings and the resources that generate sustainable earnings.

Methods to normalise historical performance

Generally, there are two methods to employ when earnings are to be adjusted (or normalised) (Hamberg, 2015):

- **The income statement method** involves adjustments to the expenses in the income statement
- **The balance sheet method** is more sophisticated because adjustments are made to both the income statement and the balance sheet

The purpose with the income statement method (ISM) is to provide a better understanding of past performance by adjusting expenses to a normalised level – a level that is identified by scaling with sales revenues or total assets. The historical average represents such a plausible representative level. In this approach, adjustments are made as the difference between the actual expense level in a given year against the normalised level to earnings.

The purpose with the balance sheet methods (BSM) is to provide a better understanding of past performance by capitalising past investments as assets and substitute depreciation/amortisation expenses for the immediate investment charge. The procedure is suitable for investments in research and other expenditures that can have long-term consequences on performance (but that is immediately expensed according to accounting rules). This, of course, assumes that the investments are made in valuable resources worthy of being capitalised.

R&D Capitalisation

One inherent problem of modern accounting is that companies rely on different resources where some can be capitalised whereas others cannot. Although the capital nature of

research and development (R&D) expenditures is widely accepted, recognition of such internally generated assets are not. Consequently, it is more difficult to understand the resources that are available to management in their implementation of the company's strategic plan.

Background: IAS 38

IAS 38 *Intangible Asset* outlines the accounting requirements for intangible assets. The standard requires an entity to recognise an intangible asset if – and only *if* – certain criteria are met (Deloitte, 2015):

"Intangible asset: an identifiable nonmonetary asset without physical substance. An asset is a resource that is controlled by the entity as a result of past events and from which future economic benefits are expected. Thus, the three critical attributes of an intangible asset are:

- Identifiability
- Control
- Future economic benefits

Initial Recognition: Research and Development Costs

- Charge all research cost to expense.
- Development costs are capitalised only after technical and commercial feasibility of the asset for sale or use have been established. This means that the entity must intend and be able to complete the intangible asset and either use it or sell it and be able to demonstrate how the asset will generate future economic benefits."

In practice, this means that acquired resources are capitalised, while internally developed resources are not. The effect is a discrimination of organic growing companies, like Novo Nordisk, not only complicating comparisons between firms that grow their businesses differently, but also resulting in a too conservative balance sheet (known as accounting conservatism).

Assumptions

Assuming research leads to a patent portfolio, which is a valuable resource, four assumptions regarding capitalisation are emphasised:

i. It is only relevant employee costs and internal and external costs related to execution of studies, including manufacturing costs and facility costs of the research centres that are capitalised. In order to avoid "double-counting", depreciation, amortisation and impairment losses are excluded (as they by definition already must be reflected in the balance sheet). See table below for details.

Table 40 – Details on Novo Nordisk's research and development cost

Details on Research and development costs	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Internal and external research and developmen	2010	2567	2497	2492	2421	2759	3590	4520	4343	4118	5445	5015	6136	6587	7646	7352
Employee costs	1215	1253	1387	1504	1713	2095	2424	2813	3040	3218	3697	3980	4298	4680	5200	5584
Depreciation, amortisation and impairment los	165	150	255	197	218	231	302	1205	473	528	460	633	463	466	916	672
Total research and development costs	3390	3970	4139	4193	4352	5085	6316	8538	7856	7864	9602	9628	10897	11733	13762	13608
Relevant part to be capitalised	3225	3820	3884	3996	4134	4854	6014	7333	7383	7336	9142	8995	10434	11267	12846	12936

ii. When capitalising a R&D-asset it is important to reflect over how long the effective economic life of the asset should be – a longer economic life increases the value of the asset. With new drugs typically being commercialized after 12 to 15 years of R&D activity, there are many pitfalls along the way (Torreya Partners, 2013):

- Most studies indicates that less than 25 percent of R&D projects ultimately lead to commercial drugs, suggesting a low input-to-output ratio. All else equal, this would point to an effective economic life of the asset of about (15 years*20% probability of success=) 3 years. Strict regulatory monitoring, intense worldwide competition, and sizable cash requirements also contribute to uncertainty.
- However, knowing that potential failures will come at different phases in the R&D-process, the distribution of investments in each project should translate into a larger weight on the ones that actually goes through all phases with final patent approval. With the effective market life of a patent being around 15 years this should, all else equal, increase the estimate (Grabowski et al., 2015).

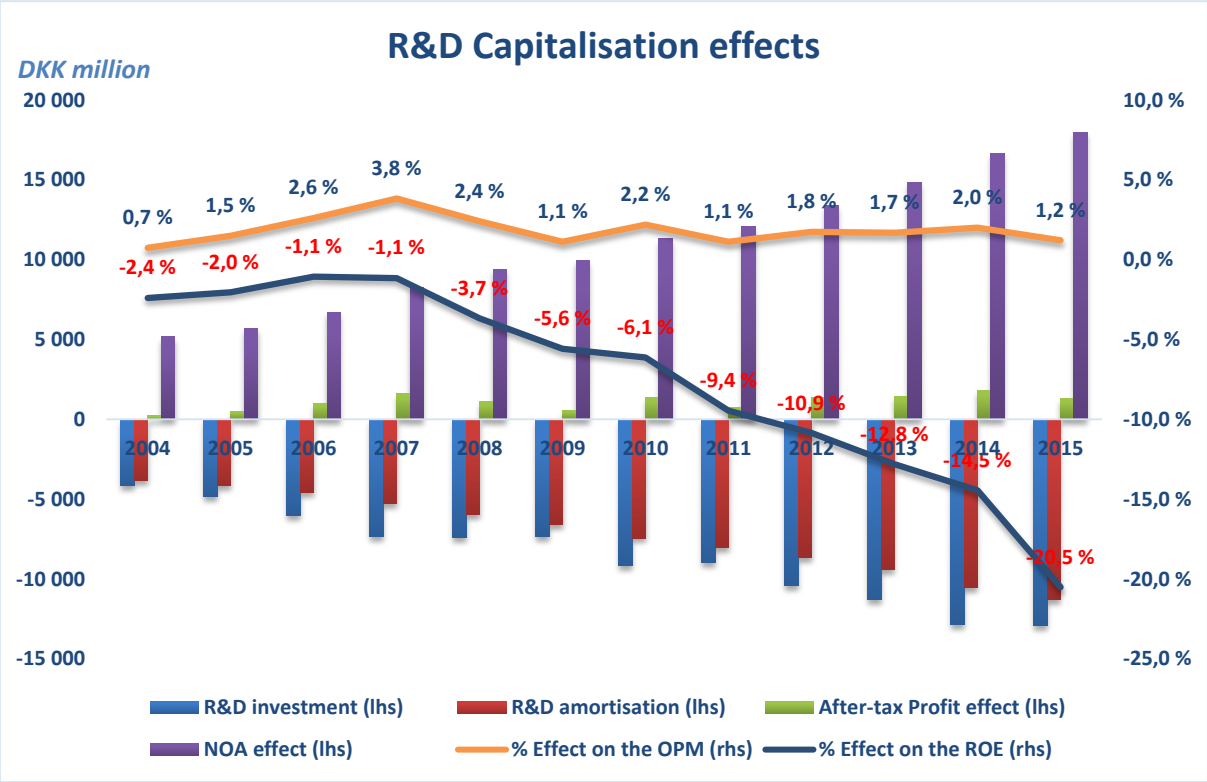
Taking both arguments in consideration, I have concluded that a rough estimate should yield an effective economic life of the R&D-asset in the neighbourhood of ~5 years. This corresponds to the simple, optimistic average of (5/15=) 33% of all projects being successful, but as pinpointed this should be more than justified by the higher share of investments being employed in the successful ones. Thus, the amortisation plan is based on an effective economic life of 5 years.

iii. Because the investments are continuous, the usage pattern should be evenly distributed over time and a straight-line depreciation plan is preferable.

iv. Finally, I assume that the R&D asset has no residual value after five years (e.g. patents has close to no value after expiration).

Construction of Novo Nordisk's R&D asset: Using the balance sheet approach

Figure 61 - R&D capitalisation effects for Novo Nordisk, balance sheet method



Starting to capitalise investments in R&D from year 2000, the asset needs 5 years to build itself up, meaning it reaches steady state in 2004. Consequently, the analysis is for 2004 to 2015 only.

Due to increasing historical investments, adjustments increase profits and operating assets. In reality, taxes are paid on such profits. Employing the effective tax rate in each individual year, these adjustments create deferred tax liabilities. With continuous growth in the R&D-investments, the effect continues throughout the period. With all adjustments happening in a congruent framework, this means that both net profit and net operating assets (NOA) are increasing.

With the denominator (adjusted equity) increasing relatively more than the increase in the numerator (net profits), the result is an overall decrease in the return on equity (ROE). The

operating profit margin, on the other hand, is positively affected. The most important result, however, is the introduction of a R&D asset with a value of DKK 24.65 billion at the end of 2015.

A summary of the congruent adjustments are presented in table below. Spreadsheet & data are also enclosed.

Table 41 – R&D asset adjustments for Novo Nordisk in a congruent financial statement

Summary	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
R&D expenditures	-3225	-3820	-3884	-3996	-4134	-4854	-6014	-7333	-7383	-7336	-9142	-8995	-10434	-11267	-12846	-12936
R&D amortisations, total	-645	-1409	-2186	-2985	-3812	-4138	-4576	-5266	-5944	-6584	-7442	-8038	-8658	-9435	-10537	-11296
Adjustment effect on profit	2580	2411	1698	1011	322	716	1438	2067	1439	752	1700	957	1776	1832	2309	1640
Deferred tax (*effective tax rate*	-938	-873	-594	-349	-106	-206	-425	-461	-346	-173	-361	-211	-407	-414	-516	-325
Accumulated deferred tax	938	1811	2404	2753	2858	3065	3490	3952	4297	4470	4832	5042	5450	5864	6380	6705
R&D asset (OB)	2580	4991	6689	7700	8022	8739	10176	12243	13683	14435	16135	17092	18868	20700	23010	24650
ΔOperating assets	2580	4991	6689	7700	8022	8739	10176	12243	13683	14435	16135	17092	18868	20700	23010	24650
ΔDeferred tax liability	938	1811	2404	2753	2858	3065	3490	3952	4297	4470	4832	5042	5450	5864	6380	6705
ΔAdjusted equity (& ΔNOA)	1642	3180	4285	4947	5164	5674	6686	8292	9385	9964	11303	12050	13419	14837	16630	17945
Effect on profits, pre-tax					322	716	1438	2067	1439	752	1700	957	1776	1832	2309	1640
Effect on deferred taxes					106	206	425	461	346	173	361	211	407	414	516	325
Effect on profits, after-tax					217	510	1012	1605	1094	579	1339	746	1369	1418	1793	1315
% Effect on the OPM					0,7 %	1,5 %	2,6 %	3,8 %	2,4 %	1,1 %	2,2 %	1,1 %	1,8 %	1,7 %	2,0 %	1,2 %
% Effect on the ROE					-2,4 %	-2,0 %	-1,1 %	-1,1 %	-3,7 %	-5,6 %	-6,1 %	-9,4 %	-10,9 %	-12,8 %	-14,5 %	-20,5 %

R&D Capitalisation: Spreadsheets & data

Table 42 – Constructing an R&D asset for Novo Nordisk, using the balance sheet method

Balance sheet approach:	*Build-up phase*															
5 year straight-line	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
R&D asset (IB)	0	2580	4991	6689	7700	8022	8739	10176	12243	13683	14435	16135	17092	18868	20700	23010
New investment	3225	3820	3884	3996	4134	4854	6014	7333	7383	7336	9142	8995	10434	11267	12846	12936
R&D amortization, (-00 investme	-645	-645	-645	-645	-645											
R&D amortization, (-01 investment)		-764	-764	-764	-764	-764										
R&D amortization, (-02 investment)			-777	-777	-777	-777	-777									
R&D amortization, (-03 investment)				-799	-799	-799	-799	-799								
R&D amortization, (-04 investment)					-827	-827	-827	-827	-827							
R&D amortization, (-05 investment)						-971	-971	-971	-971	-971						
R&D amortization, (-06 investment)							-1203	-1203	-1203	-1203	-1203					
R&D amortization, (-07 investment)								-1467	-1467	-1467	-1467	-1467				
R&D amortization, (-08 investment)									-1477	-1477	-1477	-1477	-1477			
R&D amortization, (-09 investment)										-1467	-1467	-1467	-1467	-1467		
R&D amortization, (-10 investment)											-1828	-1828	-1828	-1828	-1828	
R&D amortization, (-11 investment)												-1799	-1799	-1799	-1799	-1799
R&D amortization, (-12 investment)													-2087	-2087	-2087	-2087
R&D amortization, (-13 investment)														-2253	-2253	-2253
R&D amortization, (-14 investment)															-2569	-2569
R&D amortization, (-15 investment)																-2587
R&D asset (OB)	2580	4991	6689	7700	8022	8739	10176	12243	13683	14435	16135	17092	18868	20700	23010	24650
R&D amortisations	-645	-1409	-2186	-2985	-3812	-4138	-4576	-5266	-5944	-6584	-7442	-8038	-8658	-9435	-10537	-11296
Difference	2580	2411	1698	1011	322	716	1438	2067	1439	752	1700	957	1776	1832	2309	1640
Tax shield loss (effective tax rate	938	873	594	349	106	206	425	461	346	173	361	211	407	414	516	325
Accumulated tax shield loss	938	1811	2404	2753	2858	3065	3490	3952	4297	4470	4832	5042	5450	5864	6380	6705
Deferred tax effect	-938	-1811	-2404	-2753	-2858	-3065	-3490	-3952	-4297	-4470	-4832	-5042	-5450	-5864	-6380	-6705
Net NOA effect	1642	3180	4285	4947	5164	5674	6686	8292	9385	9964	11303	12050	13419	14837	16630	17945

For simplicity reasons, I assume that in each year all R&D cash and value outflows are in January.

Earnings effect	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
R&D investment	-3225	-3820	-3884	-3996	-4134	-4854	-6014	-7333	-7383	-7336	-9142	-8995	-10434	-11267	-12846	-12936
R&D amortisation	-645	-1409	-2186	-2985	-3812	-4138	-4576	-5266	-5944	-6584	-7442	-8038	-8658	-9435	-10537	-11296
Pre-tax effect					322	716	1438	2067	1439	752	1700	957	1776	1832	2309	1640
Tax shield (effective tax rate)					-106	-206	-425	-461	-346	-173	-361	-211	-407	-414	-516	-325
After-tax Profit effect					217	510	1012	1605	1094	579	1339	746	1369	1418	1793	1315
Change in Net profit					217	510	1012	1605	1094	579	1339	746	1369	1418	1793	1315
Change in NOA					5164	5674	6686	8292	9385	9964	11303	12050	13419	14837	16630	17945
% Effect on the OPM					0,7 %	1,5 %	2,6 %	3,8 %	2,4 %	1,1 %	2,2 %	1,1 %	1,8 %	1,7 %	2,0 %	1,2 %
% Effect on the ROE					-2,4 %	-2,0 %	-1,1 %	-1,1 %	-3,7 %	-5,6 %	-6,1 %	-9,4 %	-10,9 %	-12,8 %	-14,5 %	-20,5 %

Operating provisions

Adjustments to the income statement numbers can target liabilities as well as assets. The table below provides an analysis of operating provisions in Novo Nordisk. In each year, Novo Nordisk makes provision for future sales rebates, intellectual property right infringements (legal disputes), product returns and other. Provisions are operating expenses and they have direct effect on operating profits. Employing a value-weighted average of 8.8% of sales, from 2004 to 2015 (limited info before this point), earnings are adjusted to what is believed to be a more representative level. The annual adjustment is measured as:

$$\boldsymbol{Adjustment = \mathbf{OperProvisions_{OB} - OperProvisions_{IB} - ValueFlows + CashFlows}}$$

Table 43 - Identifying the target operating provision in Novo Nordisk

Identifying target operating provisions	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
Sales rebates	924	1795	1775	1744	2281	2623	4364	5666	7352	7950	11002	16508	
Legal disputes							1371	555	1057	1151	936	1397	
Product returns	403	496	609	593	594	588	534	1554	582	681	797	803	
Other provisions	391	428	983	1303	911	1187	398	499	572	711	896	1116	
Total non-tax operating provisions	*1718*	*2719*	*3367*	*3640*	*3786*	*4398*	*6667*	*8274*	*9563*	*10493*	*13631*	*19824*	
Sales revenue	29031	33760	38743	41831	45553	51078	60776	66346	78026	83572	88806	107927	
Provision-to-sales	3,2 %	5,3 %	4,6 %	4,2 %	5,0 %	5,1 %	7,2 %	8,5 %	9,4 %	9,5 %	12,4 %	15,3 %	8,8 %
Provision target, %	8,8 %	8,8 %	8,8 %	8,8 %	8,8 %	8,8 %	8,8 %	8,8 %	8,8 %	8,8 %	8,8 %	8,8 %	
Provisions target (OB)	2561	2978	3417	3689	4018	4505	5360	5852	6882	7371	7833	9519	
Operating provisions, IB (target)	2307	2561	2978	3417	3689	4018	4505	5360	5852	6882	7371	7833	
Value flows (reported)	1607	2853	2967	3004	3701	5350	8183	9835	12554	16423	27892	47914	
Cash flows (reported)	-1200	-1852	-2319	-2731	-3555	-4738	-5914	-8228	-11255	-15493	-24754	-41721	
Adjustment	-154	-584	-209	-1	182	-125	-1414	-1116	-269	-441	-2676	-4507	
Operating provisions, OB (target)	2561	2978	3417	3689	4018	4505	5360	5852	6882	7371	7833	9519	

The justification for an overall downward revision of the operating provisions is the fact that the value inflows in every single year in the period are larger than the cash outflows. Despite the tendency for both numbers to increase over the period, in both absolute & relative terms, this translates into Novo Nordisk being a bit overly cautious in their estimates.

The table below shows the level of operating provisions and the annual adjustment effect in a congruent financial statement. In this case, the adjusted item is an operating liability (i.e., operating provisions) and the congruent adjustment is also an operating liability (i.e., deferred tax provisions). With only one exception, in 2008, the adjustments are negative and profits increase. Higher profits also increases taxes (the deferred tax provision), with the net effect being an overall increase in adjusted equity. Because the adjusted item is on the liabilities side of the balance sheet, it has no effect on total assets.

Table 44 - Operating provision adjustments in a congruent financial statement

Operating provisions, adjustments	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Adjustment	-154	-584	-209	-1	182	-125	-1414	-1116	-269	-441	-2676	-4507
Effect on operating profit, pre-tax	154	584	209	1	-182	125	1414	1116	269	441	2676	4507
Deferred tax income rate (*effective rate*)	32,8 %	28,8 %	29,6 %	22,3 %	24,0 %	23,0 %	21,2 %	22,0 %	22,9 %	22,6 %	22,3 %	19,8 %
Deferred tax provision effect	-50	-168	-62	0	44	-29	-300	-246	-62	-100	-598	-894
Effect on operating profit, after-tax	103	416	147	0	-138	96	1113	870	207	341	2079	3613
Adjustment effects												
Provisions (+ = increase)	-154	-584	-209	-1	182	-125	-1414	-1116	-269	-441	-2676	-4507
Deferred tax provision	50	168	62	0	-44	29	300	246	62	100	598	894
Operating liabilities, net effect	-103	-416	-147	0	138	-96	-1113	-870	-207	-341	-2079	-3613
Total asset are unaffect by adjustments												
Adjustment effect, Adjusted Equity	103	416	147	0	-138	96	1113	870	207	341	2079	3613

Leasing arrangements

Novo Nordisk's overall approach to managing assets is to "retain assets for research, development and production activities under the company's own control, and generally to lease non-core assets related to administration and distribution" (Annual report 2015, p.72).

The accounting of leased assets will vary depending on its classification as either finance leases or operating leases. A lease is classified as a finance lease if it transfers substantially all the risks and rewards incident to ownership, while all other leases are classified as operating leases. In plain speaking, this means that while financial leases give rise to an asset and liability recognition, only an expense are recognised when it comes to the operational lease (Deloitte, 2015). Without going into details, this is similar to the dilemma regarding the immediate expensing of research expenditures.

There are many assumptions that underlie adjustments of leasing arrangements. For example, when I make adjustments for all operating lease arrangements (and capitalise them as assets), I implicitly claim that all operating leases are incorrectly accounted for. While this might seem a bit far-fetched, IASB has already issued IFRS 16 'Leasing' with effective date as of 1 January 2019. According to Novo Nordisk themselves, this change in accounting will require a lease capitalisation representing up to 10% of total assets (and interest bearing debt).

Assuming the leased assets are similar to owned assets, in steady-state and with an even usage pattern, I can use a fairly simple formula suggesting that debt financed leased assets have the same interest rate (k_d) and economic life as debt-financed owned assets. Then the value of leased assets can be calculated as (Hamberg, 2015):

$$\boldsymbol{Leased\ asset\ value\ =\ Rental\ expense\ /\ (k_d\ +\ 1/Economic\ life)}$$

The table below contains information for Novo Nordisk in the years 2000 to 2015. To calculate the cost of debt, I compare the results from a number of methods. Due to the limited use of debt in Novo Nordisk's history, the interest rate obtained from dividing interest expenses with the average interest bearing debt, as well as the reported long-term interest rate, appear biased (/not representative) at best. Thus, I conclude the most representative rate to be the one calculated from the implied credit spread obtained from official company ratings from Moody and S&P, and 10-year treasury rates (U.S. risk-free rate for consistency with observed historical spreads). The input used in the calculation of the leased asset values are all market in bold.

Operating leases, capitalisation	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Average**
Rental expense	**404**	**428**	**570**	**586**	**662**	**752**	**806**	**886**	**547**	**615**	**933**	**1059**	**1100**	**1175**	**1310**	**1293**	
Interest rate implied by credit rating																	
U.S 10-year treasury rate (start of ye	6,7 %	5,2 %	5,0 %	4,1 %	4,2 %	4,2 %	4,4 %	4,8 %	3,7 %	2,5 %	3,7 %	3,4 %	2,0 %	1,9 %	2,9 %	1,9 %	
Credit rating (Moody's / S&P's)	N/A	N/A	N/A	N/A	A2 / A-	A2 / A-	A2 / A-	A2 / A-	A2 / A	A2 / A	A2 / A	A2 / A+	A1 / A+	A1 / AA-	A1 / AA-	A1 / AA-	
Implied spread, average of ratings	1,50 %	1,50 %	1,50 %	1,50 %	1,50 %	1,50 %	1,50 %	1,50 %	1,25 %	1,25 %	1,25 %	1,18 %	1,10 %	1,18 %	1,18 %	1,18 %	
Implied interest rate (kd)	8,2 %	6,7 %	6,5 %	5,6 %	5,7 %	5,7 %	5,9 %	6,3 %	5,0 %	3,8 %	5,0 %	4,6 %	3,1 %	3,1 %	4,0 %	3,1 %	
Interest rate implied by financial statements																	
Interest expenses	142	105	110	184	107	254	296	324	246	384	500	275	58	55	39	67	
Average debt	1771	1726	1534	1558	1712	2194	2102	1439	1840	1851	1227	960	677	358	468	897	
Implied interest rate (kd)	8,0 %	6,1 %	7,2 %	11,8 %	6,3 %	11,6 %	14,1 %	22,5 %	13,4 %	20,7 %	40,7 %	28,7 %	8,6 %	15,4 %	8,3 %	7,5 %	
Weighted average long-term interest rate, reported	N/A	N/A	N/A	3,9 %	4,7 %	5,0 %	2,9 %	0,8 %	1,3 %	N/A	N/A	N/A	N/A	N/A			
Choice of interest rate=credit rating	**8,2 %**	**6,7 %**	**6,5 %**	**5,6 %**	**5,6 %**	**5,6 %**	**5,6 %**	**5,6 %**	**5,0 %**	**3,8 %**	**3,8 %**	**3,8 %**	**3,1 %**	**3,1 %**	**3,1 %**	**3,1 %**	
Acquisition cost, land & buildings	6982	7179	7765	8957	9030	10017	11525	12208	12280	12855	13598	14600	15345	16184	17391	18003	
Depreciation expense, land & buildin	242	243	280	322	344	369	486	500	516	528	581	623	655	688	855	761	
Economic life, land & buildings	28,9	29,5	27,7	27,8	26,3	27,1	23,7	24,4	23,8	24,3	23,4	23,4	23,4	23,5	20,3	23,7	**24,5**
Acquisition cost, other equipment	2528	2579	2726	2799	2272	2492	2623	2289	2620	2740	2861	3080	3359	3457	3882	3516	
Depreciation expense, other equipm	285	284	294	290	230	231	226	226	265	297	285	289	313	337	362	328	
Economic life, other equipment	8,9	9,1	9,3	9,7	9,9	10,8	11,6	10,1	9,9	9,2	10,0	10,7	10,7	10,3	10,7	10,7	**10,1**
1 / Economic life (15 years)	**0,067**	**0,067**	**0,067**	**0,067**	**0,067**	**0,067**	**0,067**	**0,067**	**0,067**	**0,067**	**0,067**	**0,067**	**0,067**	**0,067**	**0,067**	**0,067**	
Leased asset value	2725	3212	4316	4797	5419	6156	6598	7252	4693	5893	8940	10147	11298	12049	13454	13300	

Source: Damodaran Online, Moody's, Reuters, Multpl.com, New Europe, 4-traders.com.

In addition, to estimate the economic life of the leased assets, I study the economic lives of owned assets. Taking into consideration that Novo Nordisk's operating leases are related to "premises, company cars and office equipment" – but not the weight within each class – I compare the differences between the effective economic life of stated classifications of leases and subjectively set the economic life of leased assets to 15 years (Annual report 2015, p.91). Although the value-weighted average between the two types of reported PPE is around 22 years, I believe that it is less likely that leasing arrangements stretch much further than 15 years into the future. All else equal, if the true economic life of the leased assets are shorter, the leased assets' values will decrease.

Based on the table above, the overall interpretation is that leased assets are worth around DKK 13.3 billion in 2015. Compared with the booked operating assets worth around DKK 74.3 billion, this indicates that leased assets are of some importance in the analysis of Novo Nordisk.

Table 46 - Leasing adjustments in congruent financial statements

Congruent leasing adjustments	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Rental expense	404	428	570	586	662	752	806	886	547	615	933	1059	1100	1175	1310	1293
Interest rate, credit rating	8,2 %	6,7 %	6,5 %	5,6 %	5,6 %	5,6 %	5,6 %	5,6 %	5,0 %	3,8 %	3,8 %	3,8 %	3,1 %	3,1 %	3,1 %	3,1 %
ΔInterest bearing debt	2725	3212	4316	4797	5419	6156	6598	7252	4693	5893	8940	10147	11298	12049	13454	13300
Implicit financial expense	222	214	282	266	301	342	366	403	234	222	337	383	347	372	413	406
ΔOperating expenses	-222	-214	-282	-266	-301	-342	-366	-403	-234	-222	-337	-383	-347	-372	-413	-406
ΔFinancial expenses	222	214	282	266	301	342	366	403	234	222	337	383	347	372	413	406
ΔOperating assets	2725	3212	4316	4797	5419	6156	6598	7252	4693	5893	8940	10147	11298	12049	13454	13300
ΔInterest bearing debt	2725	3212	4316	4797	5419	6156	6598	7252	4693	5893	8940	10147	11298	12049	13454	13300
ΔDeferred taxes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

As a final step, I adjust for the leasing arrangements in congruent financial statements. The table above contains information on these adjustments. As mentioned, the value of operating assets increases. Because leased assets are debt financed, the value of interest bearing debt also increases. Profits, however, are not altered and there is no effect on deferred taxes and no effect on operating liabilities. **The only difference in the income statement is the reallocation of some of the implicit financial expense included in the rental expense, from the operating section to the financial section**. Thus, the leasing adjustment increases operating profit, but decreases net financial income.

Non-normal items

In financial statement analyses, the company's normal operating performance is the most important to understand. To gain such understanding, I must identify non-normal activities and exclude (or normalise) their effects on reported earnings. Using lengthy intervals, it is

usually possible to identify a normalised level measured as a percentage of sales. Generally, the relevant earning items can be of four different types (Hamberg, 2015):

i. Asset impairments

First, they can be losses arising because retained assets have values that are booked at excessively high values and have to be written down. The impairment of an asset tends to be the most common identifiable "non-normal" item in financial statements. In Novo Nordisk's case, with an already conservative balance sheet, asset impairments appear stable and normal right of the bat. In addition, with the items being of a negligible nature, there is no point to make an adjustment.

ii. Asset and liability sales

Second, they can be proceeds from the sale of an asset/liability where the price differed from the book value. In the biotech-sector, licence income, sale of intellectual property rights, royalties and other related income might be just as important.

For example, in 2015, Novo Nordisk received DKK 2376 million in non-recurring income from the partial divestment of NNIT A/S, an IT service and consultancy company, and DKK 449 million in non-recurring income related to the out-licensing of assets for inflammatory disorders. While this abnormal gain can be perceived as non-recurring income, it is important to keep in mind that Novo Nordisk constantly researches and cultivates new opportunities. While new business areas might emerge and fall outside the defined business areas tomorrow, they do so unpredictably. Thus, a normalised level is preferred.

iii. Gains and losses caused by past business activities

This type of "non-normal" business activity has already been adjusted for in the section above, under "operating provisions".

iv. Voluntary non-normal expenses

Fourth, they can be voluntary non-normal expenses, e.g., restructuring provisions. With the main effect being an improvement in the future level of sustainable performance, the danger is that a company might disclose that earnings are depressed because management voluntarily increased the expenses by introducing non-normal activities. It is not obvious

that these activities must be adjusted for, however. The important thing is to determine if they are recurring or non-recurring – as with the point above, also this type of non-normal earning item has implicitly been taken care of in the section on "operating provisions".

Thus, the only non-normal earning item to be analysed further regards item ii) asset and liabilities sales. Specifically, when the potentially non-normal gains and/or losses are aggregated across asset types and time it is often evident that they recur. This is done in the table below.

The potentially non-normal items

Table 47 - Potential gains and losses in Novo Nordisk, 2000-2016

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
Sales revenue	20811	23776	24866	26158	29031	33760	38743	41831	45553	51078	60776	66346	78026	83572	88806	107927	
Asset and liability sales																	
Gains when selling	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2376	
Losses when selling	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Patent settlement	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	
Total licence income, sale of intellectual property rights & other income	552	819	758	1036	575	403	272	321	286	341	557	494	666	682	770	1106	
Sum	552	819	758	1036	575	403	272	321	286	341	657	494	666	682	770	3482	
Total, as % of sales	2,7 %	3,4 %	3,0 %	4,0 %	2,0 %	1,2 %	0,7 %	0,8 %	0,6 %	0,7 %	1,1 %	0,7 %	0,9 %	0,8 %	0,9 %	3,2 %	**1,5 %**

As implied, some of these "non-normal" items are close to impossible to predict the future effect of in a valuation. Nevertheless, it is a fair assumption that the overall level of "non-normal" operating activities will continue to fluctuate, on average, in the same manner in the future as in the past.

Adjusting for non-normal activities

With the potentially non-normal items identified, they need to be assessed and adjusted for. The normalisation builds on a representative level: in this case, the value-weighted average from 2000 to 2015 of 1.5 %. The separation of normal and non-normal items will not change the bottom-line net profit. Instead, the focus of the analysis is shifted to the section that contains normal operating performance. The table below contain summarised calculations for Novo Nordisk based on the input in the table above:

Table 48 - Adjustments for non-normal operating items in Novo Nordisk

Non-normal items	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Sales revenue	20811	23776	24866	26158	29031	33760	38743	41831	45553	51078	60776	66346	78026	83572	88806	107927
Asset and liability sales	552	819	758	1036	575	403	272	321	286	341	657	494	666	682	770	3482
Non-normal operating items, total	552	819	758	1036	575	403	272	321	286	341	657	494	666	682	770	3482
Operating profit, excl. non-normal	4248	4796	5241	5327	6288	8004	8587	9854	11963	14537	19304	21880	28808	30811	33722	45962
Potentially non-normal items	552	819	758	1036	575	403	272	321	286	341	657	494	666	682	770	3482
Operating profit, reported	4800	5615	5999	6363	6863	8407	8859	10175	12249	14878	19961	22374	29474	31493	34492	49444
Adjustable items, %	2,7 %	3,4 %	3,0 %	4,0 %	2,0 %	1,2 %	0,7 %	0,8 %	0,6 %	0,7 %	1,1 %	0,7 %	0,9 %	0,8 %	0,9 %	3,2 %
Target level (average), %	1,5 %	1,5 %	1,5 %	1,5 %	1,5 %	1,5 %	1,5 %	1,5 %	1,5 %	1,5 %	1,5 %	1,5 %	1,5 %	1,5 %	1,5 %	1,5 %
Non-normal adjustment items, %	1,2 %	2,0 %	1,6 %	2,5 %	0,5 %	-0,3 %	-0,8 %	-0,7 %	-0,8 %	-0,8 %	-0,4 %	-0,7 %	-0,6 %	-0,7 %	-0,6 %	1,8 %
Operating profit, excl. non-normal	4248	4796	5241	5327	6288	8004	8587	9854	11963	14537	19304	21880	28808	30811	33722	45962
Normal adjustment items	307	351	367	386	428	498	572	617	672	754	897	979	1151	1233	1310	1592
Normalised operating profit	4555	5147	5608	5713	6716	8502	9159	10471	12635	15291	20201	22859	29959	32044	35032	47554
Non-normal adjustment items	245	468	391	650	147	-95	-300	-296	-386	-413	-240	-485	-485	-551	-540	1890
Operating profit, reported	4800	5615	5999	6363	6863	8407	8859	10175	12249	14878	19961	22374	29474	31493	34492	49444

As illustrated, the non-normal adjustable items are larger than average in 2015, meaning Novo Nordisk's result contain more positive non-normal items than in the previous year. The normalised profit is thus adjusted downwards and the non-normal adjustment items are positive.

Rearrangements

While the traditional layouts of the financial statements are useful when analysing a company's performance, their format can be enhanced. In the analytical models used throughout this section, assets are classified based on how they are used and liabilities according to where they come from. This allows for a consistent matching between the statements.

Specifically, I will rearrange Novo Nordisk's financial statements to define an accounting system in which the valuation eventually will occur. By rearranging and aligning the income-, balance sheet and cash flow statement, these statements will subsequently form the basis of a performance assessment and lay the groundwork in a pro-forma valuation model.

The income statement

Starting with the income statement, the aim is to paint a more representative picture of the core results from operations. The flows between Novo Nordisk and its products- & capital markets, can be measured using a "cash-flow-oriented income statement". Illustrated in the table below, the main attention should be given to the concept of **Net operating profit less adjusted taxes** (*NOPLAT*) – a refined measure of operating performance that is the core of the valuation-oriented analysis.

Table 49 - A valuation-oriented historical income statement

	+	Sales revenue	
	-	Operating expenses (standard)	
1.	-	Operating investments	
2.	-/+	Non-normal operating income and expenses	
3.	-/+	Rearranged non-normal financial items	
4.	-	Full income tax	
5.		Incomprehensive income items	
	∑	**Net operating profit less adjusted taxes**	**NOPLAT**
	+	Financial income related to FinA	
	-	Financial expenses related to IBD	
	-	Full income tax	
	∑	**Net financial expense**	
	-	Minority income	
	∑	Net profit (comprehensive)	

Source: Hamberg, 2015

Thus, by rearranging the items in a comprehensive model, the overall layout is improved. Including the 5 considerations marked in the table above, this makes the model more transparent before any further evaluations of performance can begin:

1. In the table, expenses are separated in standard operating expenses and operating investments. The point is that some expenses are immediately expensed investments (i.e., research) that have positive effects on future reporting periods, and, hence, do no generate revenue now. This is implicitly accounted for in the recapitalisation of previously expensed R&D in the first section.
2. Similar to operating investments, potential non-normal items such as “other operating income”, are consolidated and normalised as part of “non-normal”-items, presented in the first section. Given that the financial statements are congruent and all items in the income statement ought to be allocated somewhere, the non-normal items will also be part of the historical NOPLAT.
3. The third adjustment concerns financial items that are not directly attributable to financial assets and interest bearing debt. From the company’s notes, the following details on the financial items are available:

Table 50 – Details on Novo Nordisk's financial income statement items

Details on financial income statement items	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Interest income	326	297	164	285	235	210	369	322	631	313	235	274	124	56	101	56
Financial gain from forward contracts (net)	0	202	882	1195	663	288	409	911	462	62	86	240	0	1631	0	0
Financial gain from currency options (net)	0	0	0	0	0	0	0	70	34	0	61	0	0	0	32	0
Capital gain on investments etc (net)	56	0	0	2	0	0	153	0	0	0	0	0	0	0	34	15
Financial gain/loss from other financial assets	0	0	0	0	0	0	0	0	0	0	0	0	1	15	0	0
Result of associated company	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
Financial income	382	499	1046	1482	898	498	931	1303	1127	375	382	514	125	1702	167	85
Interest expenses	-142	-105	-110	-184	-107	-254	-296	-324	-246	-384	-500	-275	-58	-55	-39	-67
Foreign exchange loss (net)	-195	0	-510	-229	-130	0	-268	-71	-355	0	0	-256	-161	-435	-288	-504
Financial loss from forward contracts (net)	0	0	0	0	0	-328	0	0	0	-757	-1406	-106	-1221	0	-125	-5232
Financial loss from currency options (net)	0	0	0	0	0	0	0	0	0	-56	-82	-200	-147	-50	0	-162
Capital loss on investments etc (net)	0	-18	-53	0	-12	-20	0	-60	-28	-16	-23	-27	-118	-20	0	0
Other financial expenses	-24	-9	-44	-56	-55	-69	-62	-52	-52	-52	-46	-99	-83	-96	-111	-81
Financial expenses	-361	-132	-717	-469	-304	-671	-626	-507	-681	-1265	-2057	-963	-1788	-656	-563	-6046

As illustrated in the table, by disaggregating the data it is possible to separate interest income & expenses from the rest of the more "fluctuating" items. As only interest income/expenses are directly attributable to financial assets and interest-bearing debt, all other items should by definition be reallocated as "non-normal" financial items in the operating section – after all, these items only occur as a result of operating activities.

4. Based on the adjustments so far, full income taxes have to be allocated to the operating activities. This means that all income taxes from the accounting period must be allocated and divided between the operating and the financial section. Based on the annual effective tax rate, this is done in a proportionate manner in the final rearranged income statement in the table below.
5. The last adjustment concerns the incomprehensive income items as shown in the table below. In this case, I allocate all of them to the operating section.

In summary, this gives a value of historical NOPLAT. The final rearranged & adjusted income statement of Novo Nordisk are presented in the table below. For comparison, the original reported income statements are enclosed in appendix 4.

Table 51 – Rearranged income statement for Novo Nordisk

Comprehensive model	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Net sales	20811	23776	24866	26158	29031	33760	38743	41831	45553	51078	60776	66346	78026	83572	88806	107927
Cost of sales	-5044	-5979	-6598	-7409	-8050	-9177	-9585	-9793	-10109	-10438	-11680	-12589	-13465	-14140	-14562	-16188
Gross profit	15767	17797	18268	18749	20981	24583	29158	32038	35444	40640	49096	53757	64561	69432	74244	91739
Sales and distribution costs	-6254	-7215	-7187	-7451	-8280	-9691	-11608	-12371	-12866	-15420	-18195	-19004	-21544	-23380	-23223	-28312
R&D costs	-3390	-3970	-3952	-4055	-4352	-5085	-6316	-8538	-7856	-7864	-9602	-9628	-10897	-11733	-13762	-13608
Administrative costs	-1878	-1865	-1960	-1857	-1944	-2122	-2387	-2508	-2635	-2764	-3065	-3245	-3312	-3508	-3537	-3857
Income from investments in associated companies,	3	49	72	-59	-117	319	-260	1233	-124	-55	1070	0	0	0	0	0
Normal portion of other income/expenses (1.5%)	307	351	367	386	428	498	572	617	672	754	897	979	1151	1233	1310	1592
ΔOperating profit, from adjustments*	222	214	282	266	777	1642	2012	2470	1491	1099	3451	2455	2392	2645	5399	6553
Normalised before-tax operating profit	4777	5361	5890	5979	7493	10144	11171	12941	14126	16389	23652	25314	32351	34689	40431	54108
Taxes, proportionately allocated	-1737	-1940	-2059	-2061	-2456	-2920	-3306	-2889	-3394	-3773	-5022	-5574	-7420	-7841	-9030	-10730
NOPLAT, normal items	3040	3421	3831	3918	5037	7224	7865	10052	10732	12617	18629	19740	24931	26848	31401	43378
Non-normal portion of other income/expenses (<>1	245	468	391	650	147	-95	-300	-296	-386	-413	-240	-485	-485	-551	-540	1890
Non-normal portion of operating adjustments	0	0	0	0	-476	-1300	-1646	-2067	-1257	-877	-3114	-2073	-2045	-2273	-4986	-6147
Non-normal financial activities, reallocated	-163	175	275	912	466	-129	232	798	61	-819	-1410	-448	-1729	1045	-458	-5950
Taxes, proportionately allocated	-30	-233	-233	-539	-45	439	507	349	380	485	1012	662	977	402	1336	2024
Incomprehensive income items	238	77	145	237	-6	-551	658	223	-1962	1773	-415	-515	1026	-131	-2652	1108
NOPLAT, non-normal items	290	487	578	1261	86	-1637	-549	-993	-3164	150	-4167	-2859	-2256	-1508	-7299	-7075
Financial activities																
Interest income and similar credits	326	297	164	285	235	210	369	322	631	313	235	274	124	56	101	56
Interest expenses and similar charges	-142	-105	-110	-184	-107	-254	-296	-324	-246	-384	-500	-275	-58	-55	-39	-67
Implicit interest expense, from adjustments*	-222	-214	-282	-266	-301	-342	-366	-403	-234	-222	-337	-383	-347	-372	-413	-406
Normal financial income/expenses, net	-38	-22	-228	-165	-173	-386	-293	-405	151	-293	-602	-384	-281	-371	-351	-417
Taxes, proportionately allocated	14	8	80	57	57	111	87	90	-36	67	128	84	64	84	78	83
Normal financial activities, after-tax	-24	-14	-148	-108	-116	-275	-206	-314	115	-226	-474	-299	-216	-287	-273	-335
SUMMARY	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Normal after-tax operating profit/loss	3040	3421	3831	3918	5037	7224	7865	10052	10732	12617	18629	19740	24931	26848	31401	43378
Non-normal after-tax operating profit/loss	290	487	578	1261	86	-1637	-549	-993	-3164	150	-4167	-2859	-2256	-1508	-7299	-7075
Normal after-tax financial profit/loss	-24	-14	-148	-108	-116	-275	-206	-314	115	-226	-474	-299	-216	-287	-273	-335
Total comprehensive income	3306	3894	4261	5070	5007	5313	7110	8745	7683	12541	13988	16582	22458	25053	23829	35968

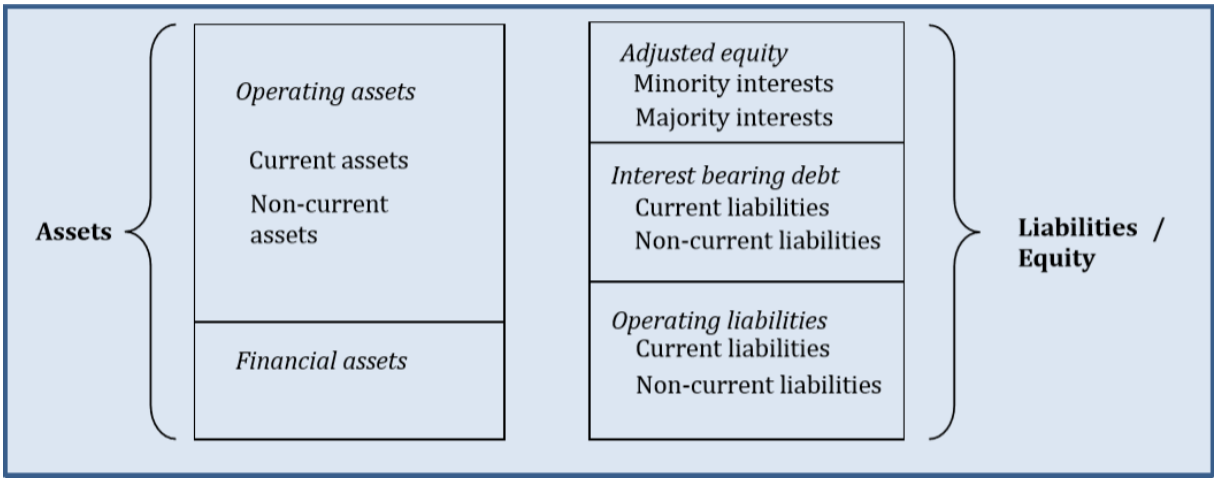
**See appendix for details*

Evidence on that the clean surplus relationship holds and that taxes allocated sums up to taxes paid – before any adjustments to accounting items – are provided for at the end of the section (along with computational details).

The balance sheet

The figure below illustrates the five analytical components that are employed in the forthcoming rearrangements; operating assets, financial assets, operating liabilities, interest bearing debt and adjusted equity:

Figure 62 - The balance sheet and its main components



Source: Hamberg, 2015

The idea behind the rearrangements is that assets are capitalised investments in valuable resources, while the operating liabilities, interest bearing debt and adjusted equity are used to finance these assets (Hamberg, 2015). Mathematically this translates into the following relationships

$$Total\ assets\ (TotA) = OperA + FinA = OperL + IBD + AdjEQ$$

In which,

$OperA = Operating\ assets,$ $FinA = Financial\ assets,$

$OperL = Operating\ liabilities,$ $IBD = Interest\ bearing\ debt,$

$AdjEQ = Adjusted\ Equity$

The reclassification of the individual balance sheet items into the framework provided in the lectures of Hamberg (2015), are – when it comes to Novo Nordisk – mostly a straight-forward task (*see classifications in table below)*:

Table 52 – Novo Nordisk's reported balance sheet

Classification	Reported balance sheet	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
OperA	Intangible assets	32	14	240	331	314	485	639	671	788	1037	1458	1489	1495	1615	1378	2158
OperA	Property, plant and equipment	10899	13626	16205	16342	17559	19941	20350	19605	18639	19226	20507	20931	21539	21882	23136	25545
FinA	Investments in associated com	1134	1401	1202	1040	883	926	788	500	222	176	43	39	0	0	0	811
OperA	Deferred income tax assets	0	0	0	579	769	879	1911	2522	1696	1455	1847	2414	2244	4231	5399	6806
FinA	Other financial assets	0	0	77	80	159	169	169	131	194	182	254	234	228	551	856	1339
	Total-non current assets	12065	15041	17724	18372	19684	22400	23857	23429	21539	22076	24109	25107	25506	28279	30769	36659
OperA	Inventories	3972	4760	5919	6531	7163	7782	8400	9020	9611	10016	9689	9433	9543	9552	11357	12758
OperA	Trade receivables	3396	3882	3811	3785	4062	4794	5163	6092	6581	7063	8500	9349	9639	10907	13041	15485
OperA	Tax receivables	234	399	431	134	710	504	385	319	1010	799	650	883	1240	3155	3210	3871
OperA	Other receivables and prepayn	1408	1761	1873	2652	1040	1455	1784	1493	1704	1962	2403	2376	2705	2454	2750	2257
FinA/OperA	Marketables securities	2567	1402	315	1828	1341	1722	1833	2555	1377	1530	3926	4094	4552	3741	1509	3542
FinA/OperA	Derivative financial instrument	0	0	0	0	0	0	0	0	0	0	108	48	931	1521	30	304
FinA/OperA	Cash at bank and on hand	1278	1660	1423	1262	3433	3303	3270	4823	8781	11296	12017	13408	11553	10728	14396	16923
	Total current assets	12855	13864	13772	16192	17749	19560	20835	24302	29064	32666	37293	39591	40163	42058	46293	55140
	Total assets	**24920**	**28905**	**31496**	**34564**	**37433**	**41960**	**44692**	**47731**	**50603**	**54742**	**61402**	**64698**	**65669**	**70337**	**77062**	**91799**
	Share capital	754	709	709	709	709	709	674	647	634	620	600	580	560	550	530	520
	Treasury shares	0	0	-19	-33	-45	-61	-39	-26	-26	-32	-28	-24	-17	-21	-11	-10
	Share premium account	2565	2565	2565	2565	2565	0	0	0	0	0	0	0	0	0	0	0
	Retained earnings	13289	16461	19067	20925	22671	26962	28810	30661	33433	34435	36097	37111	39001	41137	41277	46816
	Other reserves	373	402	606	610	604	24	677	900	-1062	711	296	-219	1088	903	-1502	-357
AdjEQ	Total equity	16981	20137	22928	24776	26504	27634	30122	32182	32979	35734	36965	37448	40632	42569	40294	46969
IBD	Loans	950	863	824	753	1188	1248	1174	961	980	970	504	502	0	0	0	0
OperL	Deferred income tax liabilities	970	1358	1122	1510	1853	1846	1998	2346	2404	3010	2865	3206	732	672	7	6
OperL	Retirement benefit obligations	0	0	283	222	250	316	330	362	419	456	569	439	760	688	1031	1186
OperL	(Other) Provisions	523	541	206	271	358	335	911	1239	863	1157	2023	2324	1907	2183	2041	2765
	Total non-current liabilities	2443	2762	2435	2756	3649	3745	4413	4908	4666	5593	5961	6471	3399	3543	3079	3957
IBD	Current debt (& financial deriv	821	817	564	975	507	1444	338	405	1334	418	562	351	500	215	720	1073
OperL	Trade payables	977	970	864	1008	1061	1500	1712	1947	2281	2242	2906	3291	3859	4092	4950	4927
OperL	Tax payables	138	62	271	643	631	676	788	929	567	701	1252	1171	593	2222	2771	3777
OperL	Other liabilities	3560	4157	4270	3366	3721	4577	4863	4959	5853	6813	7954	8534	8982	9386	11051	12655
OperL	Derivative financial instrument	0	0	0	0	0	0	0	0	0	0	1158	1492	48	0	2607	1382
OperL	Provisions			164	1040	1360	2384	2456	2401	2923	3241	4644	5940	7656	8310	11590	17059
	Total current liabilities	5496	6006	6133	7032	7280	10581	10157	10641	12958	13415	18476	20779	21638	24225	33689	40873
	Total liabilities	7939	8768	8568	9788	10929	14326	14570	15549	17624	19008	24437	27250	25037	27768	36768	44830
	Total equity and liabilities	**24920**	**28905**	**31496**	**34564**	**37433**	**41960**	**44692**	**47731**	**50603**	**54742**	**61402**	**64698**	**65669**	**70337**	**77062**	**91799**

Given the classification in the table above, no comments except one elaboration related to the identification of operating cash should be necessary. Monetary assets can be both operating and financial depending on how much cash is needed to run operations. While excess cash is believed to be financial, the remaining is, by definition, considered to be operating. The challenge is where to subjectively draw this line.

Looking at Novo Nordisk as an individual case, the following factors should be relevant:

- Novo Nordisk's business is extremely capital-intensive; It takes a lot of money and time to research, test a medication, get regulatory approval, and finally bring a drug to market (not to speak of the large manufacturing facilities and marketing/sales teams necessary to make it a success). Hence, money outflows can fluctuate according to such milestones. All else equal, this translates into the need for more cash on hand.
- Notoriously known for sticking to the core of its strategy – organic growth – Novo Nordisk are only considering potential acquisitions if there is a fit in research

competencies. Thus, with limited acquisition of intangible assets or businesses in general, all else equal, this translates into the need for relatively less cash on hand.

- Although Novo Nordisk need some financial flexibility to secure its operations, they have a unique ability to generate cash on its own. Further increasing this financial flexibility is the fact that Novo Nordisk had undrawn committed credit facilities of DKK 8.2 billion at the end of 2015 – the facility is committed by a portfolio of international banks and matures in 2019 (Novo Nordisk, annual report 2015, p.84). All else equal, this translates into a substantial smaller need for cash on hand.

In summary, to sustain operations Novo Nordisk should not have the need for keeping a high level of cash. In this case, a simple rule-of-thumb says that most firms can get by with a cash level that is 5% of sales revenue (Hamberg, 2015). Thus, I have chosen to subjectively target Novo Nordisk's operational cash at 5% of sales. The split between operational and financial (excess) cash is illustrated in the table below:

Table 53 – Operating cash analysis: A split between operating & financial cash

Operating cash analysis	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Target**
Sales revenue	20811	23776	24866	26158	29031	33760	38743	41831	45553	51078	60776	66346	78026	83572	88806	107927	
Marketable securities	2567	1402	315	1828	1341	1722	1833	2555	1377	1530	3926	4094	4552	3741	1509	3542	
Derivative financial instrument	0	0	0	0	0	0	0	0	0	0	108	48	931	1521	30	304	
Cash and cash equivalents	1278	1660	1423	1262	3433	3303	3270	4823	8781	11296	12017	13408	11553	10728	14396	16923	
Cash %	18,5 %	12,9 %	7,0 %	11,8 %	16,4 %	14,9 %	13,2 %	17,6 %	22,3 %	25,1 %	26,4 %	26,5 %	21,8 %	19,1 %	17,9 %	19,2 %	**5,0 %**
Operating cash (5% of sales)	1041	1189	1243	1308	1452	1688	1937	2092	2278	2554	3039	3317	3901	4179	4440	5396	
Excess cash (>5% of sales)	2804	1873	495	1782	3322	3337	3166	5286	7880	10272	13012	14233	13135	11811	11495	15373	

With all adjustments completed, the final rearranged balance sheet can be presented as summarised in the table below.

Table 54 - Novo Nordisk's rearranged balance sheet, including all adjustments

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Rearranged assets																
Operating assets	20982	25631	29722	31662	33069	37528	40569	41814	42307	44112	48093	50192	52306	57975	64711	74276
Financial assets	3938	3274	1774	2902	4364	4432	4123	5917	8296	10630	13309	14506	13363	12362	12351	17523
Rearranged liabilites and equity																
Operating liabilities	6168	7088	7180	8060	9234	11634	13058	14183	15310	17620	23371	26397	24537	27553	36048	43757
Interest bearing debt	1771	1680	1388	1728	1695	2692	1512	1366	2314	1388	1066	853	500	215	720	1073
Adjusted Equity	16981	20137	22928	24776	26504	27634	30122	32182	32979	35734	36965	37448	40632	42569	40294	46969
Capital Employed	18752	21817	24316	26504	28199	30326	31634	33548	35293	37122	38031	38301	41132	42784	41014	48042
Interest bearing debt	1771	1680	1388	1728	1695	2692	1512	1366	2314	1388	1066	853	500	215	720	1073
Adjusted equity	16981	20137	22928	24776	26504	27634	30122	32182	32979	35734	36965	37448	40632	42569	40294	46969
Operating assets	20982	25631	29722	31662	33069	37528	40569	41814	42307	44112	48093	50192	52306	57975	64711	74276
Financial assets	3938	3274	1774	2902	4364	4432	4123	5917	8296	10630	13309	14506	13363	12362	12351	17523
Operating liabilities	-6168	-7088	-7180	-8060	-9234	-11634	-13058	-14183	-15310	-17620	-23371	-26397	-24537	-27553	-36048	-43757
Net Operating Assets (NOA)	14814	18543	22542	23602	23835	25894	27511	27631	26997	26492	24722	23795	27769	30422	28663	30519
Operating assets	20982	25631	29722	31662	33069	37528	40569	41814	42307	44112	48093	50192	52306	57975	64711	74276
Operating liabilities	-6168	-7088	-7180	-8060	-9234	-11634	-13058	-14183	-15310	-17620	-23371	-26397	-24537	-27553	-36048	-43757
Adjusted equity	16981	20137	22928	24776	26504	27634	30122	32182	32979	35734	36965	37448	40632	42569	40294	46969
Interest bearing debt	1771	1680	1388	1728	1695	2692	1512	1366	2314	1388	1066	853	500	215	720	1073
Financial assets	-3938	-3274	-1774	-2902	-4364	-4432	-4123	-5917	-8296	-10630	-13309	-14506	-13363	-12362	-12351	-17523

In the table, there is also provided definitions of **Capital Employed (CE)** and **Net Operating Assets (NOA)**:

- Capital employed is defined the capital that comes from external financiers through interest bearing debt and adjusted equity:

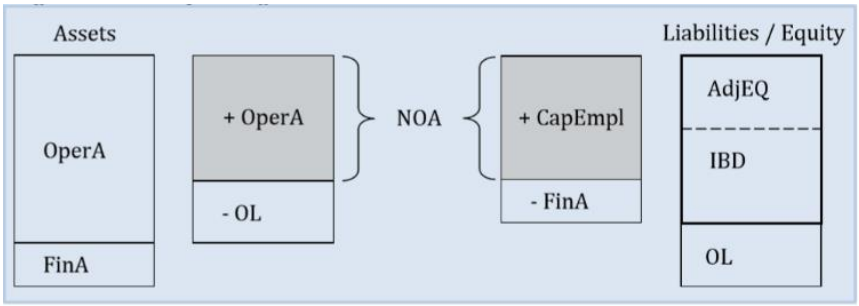
$$Capital\ employed = CE = AdjEQ + IBD = TotA - OperL$$

- Net operating assets are defined as the book value of past investments in resources to be used in the company's operations:

$$Net\ operating\ assets = NOA = OperA - OperL = AdjEQ + IBD - FinA$$

Due to the importance of these concepts in the performance assessment, a further illustration is provided in the figure below. The definitions should be self-explanatory.

Figure 63 – The concept of NOA and Capital Employed (CE)



Source: Hamberg, 2015

The statement of cash flows

The reported cash flow statement is perfectly connected with the income statement & balance sheet when it comes to representing the company's value flows. The design of the reported cash flow statement, however, is not optimal when it comes to determining company value. Amongst other, the entire structure might be misleading in that the cash flow statement only explain changes in cash during an accounting period. This have little to do with the creation of value, and – assuming investors are interested in cash flows that can be distributed to them – they should be interested in cash flows from operations and operating investments necessary to ensure those future cash flows. It's not helping the case that some of the cash flows presented as "financial" might in fact be "operating", & vice versa.

Given the objective to determine the value of operations, the statement should at least avoid the mixing of financial and operating investments. To deal with the mentioned problems, and a couple more, the table below contains a rearranged cash flows statement (the reported statement is enclosed in appendix 4). The purpose with this statement is to report cash inflows and outflows associated with the operating activities separately as net operating cash flows, and the cash inflows and outflows from financial activities separately as net financing cash flows. The sum of these two flows is the shareholders' distributable cash flows. Some of these flows are distributed whereas the remaining amount is retained as cash. With the exception of tax cash flows, all other flows have simply been moved around. The tax cash flows have been separated and proportionally allocated into operating and financial flows (Hamberg, 2015):

Table 55 – Rearranged cash flows for Novo Nordisk

Rearranged cash flow statement	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Net profit	3068	3817	4116	4833	5013	5864	6452	8522	9645	10768	14403	17097	21432	25184	26481	34860
Adjustment for accruals	2847	3531	3742	4388	5226	5453	5740	5403	5721	6701	8449	9117	11253	10738	15213	14964
Taxes paid on operating activities, prop. allocate	-1837	-1813	-1833	-2147	-2424	-2349	-3289	-2410	-2958	-1951	-4060	-5520	-11088	-9596	-7389	-9315
Cash flow from operating activities	*4078*	*5535*	*6025*	*7074*	*7815*	*8968*	*8903*	*11515*	*12408*	*15518*	*18792*	*20694*	*21597*	*26326*	*34305*	*40509*
Investments in net working capital	909	-1456	-845	-1335	107	-394	-1035	-1302	260	-279	297	434	274	-265	-2148	-2157
Capital expenditures	-2056	-3829	-4341	-2263	-2999	-4015	-2787	-2327	-1754	-2631	-3308	-3003	-3319	-3207	-3986	-5209
Investmens in other operating assets	755	-305	-81	-40	-312	-264	-419	-118	-264	-433	1676	-259	-250	-406	-345	-1191
Cash flows from operating investment activities	*-392*	*-5590*	*-5267*	*-3638*	*-3204*	*-4673*	*-4241*	*-3747*	*-1758*	*-3343*	*-1335*	*-2828*	*-3295*	*-3878*	*-6479*	*-8557*
Foreign exchange adjustment	18	-27	-22	-14	-14	154	39	-6	-2	21	46	-16	-8	-70	68	86
Net operating cash flows	*3704*	*-82*	*736*	*3422*	*4597*	*4449*	*4701*	*7762*	*10648*	*12196*	*17503*	*17850*	*18294*	*22378*	*27894*	*32038*
Changes in interest bearing debt	4	-39	-18	453	-69	-29	-23	-18	-153	0	0	-507	-502	0	0	0
Interest paid/received	154	280	120	67	109	-73	95	-29	409	186	-34	117	146	92	53	-6
Other financial items paid/received	-427	0	52	0	0	400	175	0	0	0	0	0	0	29	35	32
Investments in financial assets	0	0	1085	-1516	1310	-1032	514	-541	466	0	-2913	-197	-501	811	2232	-2033
Other financial cash flows	0	0	0	0	0	0	0	1470	170	18	8	0	0	0	0	2303
Taxes paid on financial acitivites, prop. allocated	98	-87	-433	343	-442	211	-225	-197	-214	-47	624	129	197	-211	-518	-59
Net financing cash flows	*-171*	*154*	*806*	*-653*	*908*	*-523*	*536*	*685*	*678*	*157*	*-2315*	*-458*	*-660*	*721*	*1802*	*237*
Distributable cash flows	**3533**	**72**	**1542**	**2769**	**5505**	**3926**	**5237**	**8447**	**11326**	**12353**	**15188**	**17392**	**17634**	**23099**	**29696**	**32275**
of which dividends	691	916	1161	1243	1488	1594	1945	2221	2795	3650	4400	5700	7742	9715	11866	12905
of which non-dividend changes in equity	2283	-10	347	1604	1895	2812	2790	4594	4422	6395	8820	10595	11896	13924	14667	17196
Total cash flows distributed to shareholders	2974	906	1508	2847	3383	4406	4735	6815	7217	10045	13220	16295	19638	23639	26533	30101
Retained part of distributable cash flows	559	-834	34	-78	2122	-480	502	1632	4109	2308	1968	1097	-2004	-540	3163	2174

Additional details related to the rearrangements: The income statement

Table 56 – Summary of main effects in the income statement rearrangements

Summary	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
NOPLAT	3040	3421	3831	3918	5037	7224	7865	10052	10732	12617	18629	19740	24931	26848	31401	43378
Non-normal activities, after-tax	52	410	433	1024	92	-1086	-1207	-1216	-1202	-1623	-3752	-2344	-3282	-1377	-4647	-8183
Normal financial activities, after-tax	-24	-14	-148	-108	-116	-275	-206	-314	115	-226	-474	-299	-216	-287	-273	-335
Dirty surplus	238	77	145	237	-6	-551	658	223	-1962	1773	-415	-515	1026	-131	-2652	1108
Sum, comprehensive income	3306	3894	4261	5070	5007	5313	7110	8745	7683	12541	13988	16582	22458	25053	23829	35968

(NOPLAT = net operating profit less adjusted taxes)

Table 57 – Clean surplus accounting details

Incomprehensive income items	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Exchange rate adjustments of investments in sub	-108	112	-85	6	39	182	14	65	-482	528	300	-173	-172	-435	-39	-669
Cash flow hedges, realisation of previously deferred (gain	-327	-116	-391	-513	-461	345	-363	-615	900	-422	658	1182	-809	-1229	2216	
Cash flow hedges, deferred gains/(losses) incurre	327	188	391	513	461	-345	420	634	-940	352	-643	-1170	849	1195	-2225	-681
Other items	19	104	-45	109	7	73	-121	-20	-6	18	4	-20	35	75	111	366
Remeasurements of defined benefit plans	0	0	0	0	0	0	0	0	0	0	0	0	-281	54	-247	-37
Tax on OCI, income/(expense)	0	0	0	0	0	0	0	-93	81	-25	346	190	-587	-211	977	-87
Sum, other comprehensive income, net of tax	238	77	145	237	-6	-551	658	223	-1962	1773	-415	-515	1026	-131	-2652	1108
Total comprehensive income, reported	3306	3894	4261	5070	5007	5313	7110	8745	7683	12541	13988	16582	22458	25053	23829	35968
Accounting standard changes	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
				-451												
Transactions with shareholders	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Dividends	-691	-916	-1161	-1243	-1488	-1594	-1945	-2221	-2795	-3650	-4400	-5700	-7742	-9715	-11866	-12905
Share-based payments	0	168	38	76	104	223	113	130	331	259	463	319	308	409	371	442
Tax credit related to share option scheme	0	0	0	0	0	0	0	0	0	0	0	0	56	114	58	366
Purchase of treasury shares	-2472	-24	-386	-1619	-1982	-3018	-3000	-4835	-4717	-6512	-9498	-10839	-12162	-13989	-14728	-17229
Sale of treasury shares	962	34	39	15	87	206	210	241	295	117	678	121	266	65	61	33
Reduction of the B share capital	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sum, transactions with shareholders	-2201	-738	-1470	-2771	-3279	-4183	-4622	-6685	-6886	-9786	-12757	-16099	-19274	-23116	-26104	-29293

Table 58 – The clean surplus relationship

Changes in shareholders equity	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Shareholders equity, IB	15876	16981	20137	22928	24776	26504	27634	30122	32182	32979	35734	36965	37448	40632	42569	40294
Accounting standard changes	0	0	0	-451	0	0	0	0	0	0	0	0	0	0	0	0
Net profit	3068	3817	4116	4833	5013	5864	6452	8522	9645	10768	14403	17097	21432	25184	26481	34860
Sum, other comprehensive income items	238	77	145	237	-6	-551	658	223	-1962	1773	-415	-515	1026	-131	-2652	1108
Transactions with shareholders	-2201	-738	-1470	-2771	-3279	-4183	-4622	-6685	-6886	-9786	-12757	-16099	-19274	-23116	-26104	-29293
Shareholders equity, OB	16981	20137	22928	24776	26504	27634	30122	32182	32979	35734	36965	37448	40632	42569	40294	46969

Table 59 – The allocation of taxes

Tax calculations	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Income taxes	-1753	-2165	-2212	-2543	-2444	-2370	-2712	-2449	-3050	-3220	-3883	-4828	-6379	-7355	-7615	-8623
Profit after financial items	4821	5982	6328	7376	7457	8234	9164	10971	12695	13988	18286	21925	27811	32539	34096	43483
Tax rate	36,4 %	36,2 %	35,0 %	34,5 %	32,8 %	28,8 %	29,6 %	22,3 %	24,0 %	23,0 %	21,2 %	22,0 %	22,9 %	22,6 %	22,3 %	19,8 %
Normal operating activities	4777	5361	5890	5979	7493	10144	11171	12941	14126	16389	23652	25314	32351	34689	40431	54108
Non-normal operating activities	245	468	391	650	-329	-1395	-1946	-2364	-1643	-1289	-3354	-2558	-2530	-2824	-5526	-4257
Non-normal financial activities	-163	175	275	912	466	-129	232	798	61	-819	-1410	-448	-1729	1045	-458	-5950
Normal financial activites	-38	-22	-228	-165	-173	-386	-293	-405	151	-293	-602	-384	-281	-371	-351	-417
Sum, all taxable activities	4821	5982	6328	7376	7457	8234	9164	10971	12695	13988	18286	21925	27811	32539	34096	43483

Additional details related to the rearrangements: The balance sheet

The original rearranged balance sheet based on unadjusted numbers are presented in the table below:

Table 60 – Rearranged balance sheet for Novo Nordisk

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Rearranged assets																
Operating assets	20982	25631	29722	31662	33069	37528	40569	41814	42307	44112	48093	50192	52306	57975	64711	74276
Financial assets	3938	3274	1774	2902	4364	4432	4123	5917	8296	10630	13309	14506	13363	12362	12351	17523
Rearranged liabilites and equity																
Operating liabilities	6168	7088	7180	8060	9234	11634	13058	14183	15310	17620	23371	26397	24537	27553	36048	43757
Interest bearing debt	1771	1680	1388	1728	1695	2692	1512	1366	2314	1388	1066	853	500	215	720	1073
Adjusted Equity	16981	20137	22928	24776	26504	27634	30122	32182	32979	35734	36965	37448	40632	42569	40294	46969
Capital Employed	18752	21817	24316	26504	28199	30326	31634	33548	35293	37122	38031	38301	41132	42784	41014	48042
Interest bearing debt	1771	1680	1388	1728	1695	2692	1512	1366	2314	1388	1066	853	500	215	720	1073
Adjusted equity	16981	20137	22928	24776	26504	27634	30122	32182	32979	35734	36965	37448	40632	42569	40294	46969
Operating assets	20982	25631	29722	31662	33069	37528	40569	41814	42307	44112	48093	50192	52306	57975	64711	74276
Financial assets	3938	3274	1774	2902	4364	4432	4123	5917	8296	10630	13309	14506	13363	12362	12351	17523
Operating liabilities	-6168	-7088	-7180	-8060	-9234	-11634	-13058	-14183	-15310	-17620	-23371	-26397	-24537	-27553	-36048	-43757
Net Operating Assets (NOA	14814	18543	22542	23602	23835	25894	27511	27631	26997	26492	24722	23795	27769	30422	28663	30519
Operating assets	20982	25631	29722	31662	33069	37528	40569	41814	42307	44112	48093	50192	52306	57975	64711	74276
Operating liabilities	-6168	-7088	-7180	-8060	-9234	-11634	-13058	-14183	-15310	-17620	-23371	-26397	-24537	-27553	-36048	-43757
Adjusted equity	16981	20137	22928	24776	26504	27634	30122	32182	32979	35734	36965	37448	40632	42569	40294	46969
Interest bearing debt	1771	1680	1388	1728	1695	2692	1512	1366	2314	1388	1066	853	500	215	720	1073
Financial assets	-3938	-3274	-1774	-2902	-4364	-4432	-4123	-5917	-8296	-10630	-13309	-14506	-13363	-12362	-12351	-17523

Tables & data related to the financial ratio analysis

Table 61 – Financial statement summaries (after all adjustments) used in in the ratio analysis

(*in DKK million*)	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Panel A - Income statement																
Sales revenue	20811	23776	24866	26158	29031	33760	38743	41831	45553	51078	60776	66346	78026	83572	88806	107927
Operating expenses	16034	18415	18976	20179	21538	23616	27572	28890	31427	34689	37124	41032	45675	48883	48375	53819
Operating profit, reported	4800	5615	5999	6363	6863	8407	8859	10175	12249	14878	19961	22374	29474	31493	34492	49444
Operating profit, adjusted	4777	5361	5890	5979	7493	10144	11171	12941	14126	16389	23652	25314	32351	34689	40431	54108
Non-normal portion of other income/	245	468	391	650	147	-95	-300	-296	-386	-413	-240	-485	-485	-551	-540	1890
Interest income	326	297	164	285	235	210	369	322	631	313	235	274	124	56	101	56
Interest expenses	-364	-319	-392	-450	-408	-596	-662	-727	-480	-606	-837	-658	-405	-427	-452	-473
Non-normal financial activities, net	-163	175	275	912	466	-129	232	798	61	-819	-1410	-448	-1729	1045	-458	-5950
Profit before taxes	4821	5982	6328	7376	7933	9534	10810	13038	13952	14865	21400	23998	29856	34812	39082	49630
Income taxes (*effective tax rate*)	-1753	-2165	-2212	-2543	-2600	-2744	-3199	-2911	-3352	-3422	-4544	-5284	-6848	-7869	-8728	-9842
Net profit, total	3068	3817	4116	4833	5333	6790	7611	10128	10600	11443	16856	18713	23008	26943	30353	39788
Incomprehensive income items	238	77	145	237	-6	-551	658	223	-1962	1773	-415	-515	1026	-131	-2652	1108
Comprehensive income, total	3306	3894	4261	5070	5327	6239	8269	10351	8638	13216	16441	18198	24034	26812	27701	40896
Panel B - Cash flow statements																
Cash flows from operating activities, r	4078	5535	6025	7074	7815	8968	8903	11515	12408	15518	18792	20694	21597	26326	34305	40509
Cash flows from operating investmen	-392	-5590	-5267	-3638	-3204	-4673	-4241	-3747	-1758	-3343	-1335	-2828	-3295	-3878	-6479	-8557
Operating cash flows, rearranged	3704	-82	736	3422	4597	4449	4701	7762	10648	12196	17503	17850	18294	22378	27894	32038
Financing cash flows	-171	154	806	-653	908	-523	536	685	678	157	-2315	-458	-660	721	1802	237
Distributable cash flows	3533	72	1542	2769	5505	3926	5237	8447	11326	12353	15188	17392	17634	23099	29696	32275
Cash flows distributed to shareholder	2974	906	1508	2847	3383	4406	4735	6815	7217	10045	13220	16295	19638	23639	26533	30101
Panel C -Balance sheets																
Operating assets	26286	33833	40728	44159	46510	52422	57343	61309	60682	64439	73167	77431	82472	90724	101175	112227
of which intangible assets	2612	5005	6929	8610	9105	10103	12726	15436	16167	16927	19440	20995	22607	26546	29787	33614
of which operating cash	1041	1189	1243	1308	1452	1688	1937	2092	2278	2554	3039	3317	3901	4179	4440	5396
Financial assets	3938	3274	1774	2902	4364	4432	4123	5917	8296	10630	13309	14506	13363	12362	12351	17523
Total assets	30225	37108	42501	47061	50874	56854	61466	67227	68978	75069	86477	91937	95835	103087	113526	129749
Operating liabilities	7106	8899	9584	10813	11989	14283	16401	18134	19746	21994	27089	30569	29779	33076	40349	46849
of which operating provisions	523	541	370	1311	1718	2719	3367	3640	3786	4398	6667	8264	9563	10493	13631	19824
Interest bearing debt	4496	4892	5704	6525	7114	8848	8110	8618	7007	7281	10006	11000	11798	12264	14174	14373
Adjusted equity	18623	23317	27213	29723	31771	33724	36955	40474	42226	45794	49382	50368	54258	57747	59003	68527
Market value equity	98507	118563	70613	81494	99341	115000	124000	172000	136000	159000	292000	296000	399000	419000	535000	804000
Capital employed	23119	28209	32917	36248	38885	42571	45065	49093	49232	53075	59388	61368	66055	70011	73177	82900
Net operating assets (NOA)	19180	24935	31143	33346	34521	38139	40942	43175	40936	42445	46078	46862	52693	57649	60826	65378
Panel D - Net operating asset items																
Operating cash	1041	1189	1243	1308	1452	1688	1937	2092	2278	2554	3039	3317	3901	4179	4440	5396
Customer receivables	3396	3882	3811	3785	4062	4794	5163	6092	6581	7063	8500	9349	9639	10907	13041	15485
Inventories	3972	4760	5919	6531	7163	7782	8400	9020	9611	10016	9689	9433	9543	9552	11357	12758
Other current operating assets	1642	2160	2304	2786	1750	1959	2169	1812	2714	2761	3053	3259	3945	5609	5960	6128
Working capital assets, total	10051	11991	13277	14410	14427	16223	17669	19016	21184	22394	24281	25358	27028	30247	34798	39767
Supplier credits	977	970	864	1008	1061	1500	1712	1947	2281	2242	2906	3291	3859	4092	4950	4927
Operating provisions	523	541	370	1311	1718	2719	3367	3640	3786	4398	6667	8264	9563	10493	13631	19824
Other current operating liabilities	3698	4219	4541	4009	4352	5253	5651	5888	6420	7514	9206	9705	9575	11608	13822	16432
Working capital liabilities, total	5198	5730	5775	6328	7131	9472	10730	11475	12487	14154	18779	21260	22997	26193	32403	41183
Working capital, net	4853	6261	7502	8082	7296	6751	6939	7541	8697	8240	5502	4098	4031	4054	2395	-1416
Tangible non-current operating assets	14758	18239	21723	22179	23861	27023	27736	27357	23554	25295	29490	31117	32837	33931	36590	39656
Intangible non-current operating asse	2612	5005	6929	8610	9105	10103	12726	15436	16167	16927	19440	20995	22607	26546	29787	33614
Other non-current operating assets	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 64 – Novo Nordisk Performance assessment

The Operating Profit Margin	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Value-weighted**
NOPLAT (t), normal	3040	3421	3831	3918	5037	7224	7865	10052	10732	12617	18629	19740	24931	26848	31401	43378	**average**
Sales (t)	20811	23776	24866	26158	29031	33760	38743	41831	45553	51078	60776	66346	78026	83572	88806	107927	
Operating profit margin, normal	14,6 %	14,4 %	15,4 %	15,0 %	17,4 %	21,4 %	20,3 %	24,0 %	23,6 %	24,7 %	30,7 %	29,8 %	32,0 %	32,1 %	35,4 %	40,2 %	**28,3 %**
NOPLAT (t), non-normal	290	487	578	1261	86	-1637	-549	-993	-3164	150	-4167	-2859	-2256	-1508	-7299	-7075	
Sales (t)	20811	23776	24866	26158	29031	33760	38743	41831	45553	51078	60776	66346	78026	83572	88806	107927	
Operating profit margin, non-norm	1,4 %	2,1 %	2,3 %	4,8 %	0,3 %	-4,8 %	-1,4 %	-2,4 %	-6,9 %	0,3 %	-6,9 %	-4,3 %	-2,9 %	-1,8 %	-8,2 %	-6,6 %	**-3,5 %**
OPM (NOPLAT), normal	14,6 %	14,4 %	15,4 %	15,0 %	17,4 %	21,4 %	20,3 %	24,0 %	23,6 %	24,7 %	30,7 %	29,8 %	32,0 %	32,1 %	35,4 %	40,2 %	
OPM (NOPLAT), non-normal	1,4 %	2,1 %	2,3 %	4,8 %	0,3 %	-4,8 %	-1,4 %	-2,4 %	-6,9 %	0,3 %	-6,9 %	-4,3 %	-2,9 %	-1,8 %	-8,2 %	-6,6 %	
Comprehensive operating profit m	16,0 %	16,4 %	17,7 %	19,8 %	17,6 %	16,6 %	18,9 %	21,7 %	16,6 %	25,0 %	23,8 %	25,4 %	29,1 %	30,3 %	27,1 %	33,6 %	**24,8 %**

The Net Operating Asset Turnover	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Value-weighted**
Sales (rhs)	23776	24866	26158	29031	33760	38743	41831	45553	51078	60776	66346	78026	83572	88806	107927	**average**
Net Operating Assets (t)	24935	31143	33346	34521	38139	40942	43175	40936	42445	46078	46862	52693	57649	60826	65378	
Net Operating Assets (t-1)	19180	24935	31143	33346	34521	38139	40942	43175	40936	42445	46078	46862	52693	57649	60826	
Net Operating Assets, average (rhs)	22057	28039	32245	33933	36330	39541	42058	42056	41690	44262	46470	49777	55171	59237	63102	
Net Operating Assets Turnover (lhs)	1,08	0,89	0,81	0,86	0,93	0,98	0,99	1,08	1,23	1,37	1,43	1,57	1,51	1,50	1,71	**1,33**

The Return of Net Operating Assets	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Value-weighted**
Comprehensive operating profit margin (lh	16,4 %	17,7 %	19,8 %	17,6 %	16,6 %	18,9 %	21,7 %	16,6 %	25,0 %	23,8 %	25,4 %	29,1 %	30,3 %	27,1 %	33,6 %	**average**
Net Operating Asset Turnover (rhs)	1,08	0,89	0,81	0,86	0,93	0,98	0,99	1,08	1,23	1,37	1,43	1,57	1,51	1,50	1,71	
Return on Net Operating Assets (lhs)	17,7 %	15,7 %	16,1 %	15,1 %	15,4 %	18,5 %	21,5 %	18,0 %	30,6 %	32,7 %	36,3 %	45,6 %	45,9 %	40,7 %	57,5 %	**34,7 %**

The Net profit Margin	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Value-weighted**
Comprehensive income	3306	3894	4261	5070	5327	6239	8269	10351	8638	13216	16441	18198	24034	26812	27701	40896	**average**
Sales (t)	20811	23776	24866	26158	29031	33760	38743	41831	45553	51078	60776	66346	78026	83572	88806	107927	
Net profit margin	15,9 %	16,4 %	17,1 %	19,4 %	18,3 %	18,5 %	21,3 %	24,7 %	19,0 %	25,9 %	27,1 %	27,4 %	30,8 %	32,1 %	31,2 %	37,9 %	**27,1 %**

The Equity Turnover	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Value-weighted**
Sales (t)		23776	24866	26158	29031	33760	38743	41831	45553	51078	60776	66346	78026	83572	88806	107927	**average**
Adjusted Equity (t)		23317	27213	29723	31771	33724	36955	40474	42226	45794	49382	50368	54258	57747	59003	68527	
Adjusted Equity (t-1)		18623	23317	27213	29723	31771	33724	36955	40474	42226	45794	49382	50368	54258	57747	59003	
Adjusted Equity, average		20970	25265	28468	30747	32748	35339	38715	41350	44010	47588	49875	52313	56002	58375	63765	
Equity turnover		1,13	0,98	0,92	0,94	1,03	1,10	1,08	1,10	1,16	1,28	1,33	1,49	1,49	1,52	1,69	**1,32**

The Return on Equity	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Value-weighted**
Net profit margin (lhs)		16,4 %	17,1 %	19,4 %	18,3 %	18,5 %	21,3 %	24,7 %	19,0 %	25,9 %	27,1 %	27,4 %	30,8 %	32,1 %	31,2 %	37,9 %	**average**
Equity turnover (rhs)		1,13	0,98	0,92	0,94	1,03	1,10	1,08	1,10	1,16	1,28	1,33	1,49	1,49	1,52	1,69	
Book return on equity (lhs)		18,6 %	16,9 %	17,8 %	17,3 %	19,1 %	23,4 %	26,7 %	20,9 %	30,0 %	34,5 %	36,5 %	45,9 %	47,9 %	47,5 %	64,1 %	**37,8 %**

Definiton	Financial ratios	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	Novo Nordisk's performance															
Net profit/ ((AdjEQ$_{IB}$+ AdjEQ$_{OB}$)/2)	Return on Equity (ROE)	18,2 %	16,3 %	17,0 %	17,3 %	20,7 %	21,5 %	26,2 %	25,6 %	26,0 %	35,4 %	37,5 %	44,0 %	48,1 %	52,0 %	62,4 %
Net profit / Market value Equity$_{IB}$	Market return on equity (lhs)	4,0 %	3,6 %	7,2 %	6,5 %	6,3 %	7,2 %	8,3 %	5,0 %	9,7 %	10,3 %	6,2 %	8,1 %	6,7 %	6,6 %	7,6 %
EBIT(1-t) / ((Capital Employed$_{IB}$ +Capital Employed$_{OB}$)/2)	Return on capital employed (ROCE)	15,7 %	14,3 %	14,8 %	14,9 %	17,7 %	18,4 %	22,7 %	22,3 %	23,3 %	31,1 %	31,8 %	36,6 %	40,1 %	42,9 %	51,5 %
Operating profit*(1-tax rate) - Δ_{NOA} / (NOA_{IB}+ NOA_{OB})/2)	Cash flow return on net operating asset:	-10,6 %	-8,5 %	5,3 %	11,4 %	9,9 %	12,8 %	18,6 %	30,8 %	26,6 %	33,9 %	40,8 %	38,4 %	39,7 %	47,6 %	61,5 %
Operating profit / Sales	Operating profit margin (OPM), reporte	23,6 %	24,1 %	24,3 %	23,6 %	24,9 %	22,9 %	24,3 %	26,9 %	29,1 %	32,8 %	33,7 %	37,8 %	37,7 %	38,8 %	45,8 %
Adjusted operating profit / Sales	Operating profit margin (OPM), adjustec	22,5 %	23,7 %	22,9 %	25,8 %	30,0 %	28,8 %	30,9 %	31,0 %	32,1 %	38,9 %	38,2 %	41,5 %	41,5 %	45,5 %	50,1 %
Net profit / Sales	Net profit margin (NPM)	16,1 %	16,6 %	18,5 %	18,4 %	20,1 %	19,6 %	24,2 %	23,3 %	22,4 %	27,7 %	28,2 %	29,5 %	32,2 %	34,2 %	36,9 %
	Novo Nordisk's financial position															
(IBD_{OB} - $FinA_{OB}$) / $AdjEQ_{OB}$	Net financial leverage (FLEV)	0,069	0,144	0,122	0,087	0,131	0,108	0,067	-0,031	-0,073	-0,067	-0,070	-0,029	-0,002	0,031	-0,046
(IBD_{OB} - $FinA_{OB}$) / Market value equity	Market-based capital structure (MFLEV)	0,014	0,056	0,044	0,028	0,038	0,032	0,016	-0,009	-0,021	-0,011	-0,012	-0,004	0,000	0,003	-0,004
$AdjEQ_{OB}$ / Total $assets_{OB}$	Solvency	62,8 %	64,0 %	63,2 %	62,5 %	59,3 %	60,1 %	60,2 %	61,2 %	61,0 %	57,1 %	54,8 %	56,6 %	56,0 %	52,0 %	52,8 %
Interest Expense / ((Interest bearing $debt_{IB}$+Interest bearing $debt_{OB}$)/2)	Return on interest bearing debt (RIBD)	-6,8 %	-7,4 %	-7,4 %	-6,0 %	-7,5 %	-7,8 %	-8,7 %	-6,1 %	-8,5 %	-9,7 %	-6,3 %	-3,6 %	-3,5 %	-3,4 %	-3,3 %
Interest Income / (($Financial\ assets_{IB}$+$Financial\ assets_{OB}$)/2)	Return on financial assets (RFA)	8,2 %	6,5 %	12,2 %	6,5 %	4,8 %	8,6 %	6,4 %	8,9 %	3,3 %	2,0 %	2,0 %	0,9 %	0,4 %	0,8 %	0,4 %
(Interest expense-Interest income) / (Interest bearing $debt_{AVG}$ - Financial $assets_{AVG}$)	Return on net interest bearing debt (RNIBD)	-56,6 %	-20,1 %	-19,5 %	-20,2 %	-22,5 %	-24,5 %	-31,4 %	-157,5 %	39,6 %	32,2 %	27,4 %	20,9 %	58,0 %	-64,1 %	79,8 %
(reported) cash + marketable securities) / Sales	Cash position	12,9 %	7,0 %	11,8 %	16,4 %	14,9 %	13,2 %	17,6 %	22,3 %	25,1 %	26,4 %	26,5 %	21,8 %	19,1 %	17,9 %	19,2 %
Operating profit / Interest expense	Interest cover margin	17	15	13	18	17	17	18	29	27	28	38	80	81	89	114
Operating cash flow / CapEx (incl.R&D-capitalisation)	CapEx coverage	0,72	0,73	1,13	1,10	1,01	1,01	1,19	1,36	1,56	1,51	1,72	1,57	1,82	2,04	2,23
	CapEx coverage, excluding R&D capitalisa	*1,45*	*1,39*	*3,13*	*2,61*	*2,23*	*3,19*	*4,95*	*7,07*	*5,90*	*5,68*	*6,89*	*6,51*	*8,21*	*8,61*	*7,78*
	Novo Nordisk's production efficiency - measured in days															
	Net operating assets turnover (NOAT)	338,6	411,6	449,9	426,6	392,8	372,5	367,0	337,0	297,9	265,8	255,7	232,9	241,0	243,5	213,4
	Working capital turnover	85,3	101,0	108,7	96,7	75,9	64,5	63,2	65,1	60,5	41,3	26,4	19,0	17,7	13,3	1,7
	Operating current assets	169,2	185,5	193,2	181,3	165,7	159,6	160,0	161,1	155,7	140,2	136,5	122,5	125,1	133,7	126,1
	Inventories	67,0	78,4	86,9	86,1	80,8	76,2	76,0	74,6	70,1	59,2	52,6	44,4	41,7	43,0	40,8
	Customer receivables	55,9	56,5	53,0	49,3	47,9	46,9	49,1	50,8	48,7	46,7	49,1	44,4	44,9	49,2	48,2
	(Reported) cash	17,1	17,9	17,8	17,3	17,0	17,1	17,6	17,5	17,3	16,8	17,5	16,9	17,6	17,7	16,6
	Other current assets	29,2	32,8	35,5	28,5	20,1	19,4	17,4	18,1	19,6	17,5	17,4	16,8	20,9	23,8	20,4
	Total operating liabilities	83,9	84,4	84,4	84,6	89,8	95,2	96,9	96,0	95,2	98,9	110,1	103,5	107,4	120,4	124,4
	Supplier credits	14,9	13,5	13,1	13,0	13,8	15,1	16,0	16,9	16,2	15,5	17,0	16,7	17,4	18,6	16,7
	Provisions	8,2	6,7	11,7	19,0	24,0	28,7	30,6	29,8	29,2	33,2	41,1	41,7	43,8	49,6	56,6
	Other operating liabilities	60,8	64,3	59,7	52,6	51,9	51,4	50,3	49,3	49,8	50,2	52,0	45,1	46,3	52,3	51,2
	Non-current operating assets	311,7	380,9	414,7	400,8	378,9	365,5	363,2	330,6	292,8	273,7	277,9	251,6	253,1	260,7	236,1
	Property, plant and Equipment	253,3	293,3	306,3	289,4	275,1	257,9	240,4	204,0	174,5	164,5	166,7	149,6	145,8	144,9	128,9
	Intangible assets	58,5	87,6	108,4	111,4	103,8	107,5	122,9	126,6	118,2	109,2	111,2	102,0	107,3	115,8	107,2

Tables related to the common-size analysis

Table 62 - Novo Nordisk's common size income statement, benchmarked against sales revenues

Novo Nordisk - Common size income statement																	Value-weighte
Reported income statemer	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**average**
Net sales	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	**100 %**
Cost of goods sold	24,2 %	25,1 %	26,5 %	28,3 %	27,7 %	27,2 %	24,7 %	23,4 %	22,2 %	20,4 %	19,2 %	19,0 %	17,3 %	16,9 %	16,4 %	15,0 %	**20,1 %**
Gross profit	75,8 %	74,9 %	73,5 %	71,7 %	72,3 %	72,8 %	75,3 %	76,6 %	77,8 %	79,6 %	80,8 %	81,0 %	82,7 %	83,1 %	83,6 %	85,0 %	**79,9 %**
Sales and distribution costs	30,1 %	30,3 %	28,9 %	28,5 %	28,5 %	28,7 %	30,0 %	29,6 %	28,2 %	30,2 %	29,9 %	28,6 %	27,6 %	28,0 %	26,2 %	26,2 %	**28,3 %**
R&D costs	16,3 %	16,7 %	15,9 %	15,5 %	15,0 %	15,1 %	16,3 %	20,4 %	17,2 %	15,4 %	15,8 %	14,5 %	14,0 %	14,0 %	15,5 %	12,6 %	**15,2 %**
Administrative costs	9,0 %	7,8 %	7,9 %	7,1 %	6,7 %	6,3 %	6,2 %	6,0 %	5,8 %	5,4 %	5,0 %	4,9 %	4,2 %	4,2 %	4,0 %	3,6 %	**5,2 %**
Licence fees & other operat	2,7 %	3,4 %	3,0 %	4,0 %	2,0 %	1,2 %	0,7 %	0,8 %	0,6 %	0,7 %	1,1 %	0,7 %	0,9 %	0,8 %	0,9 %	1,0 %	**1,2 %**
Non recurring income from	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 %	0,0 %	2,2 %	**0,3 %**
Operating profit	23,1 %	23,4 %	23,8 %	24,6 %	24,0 %	24,0 %	23,5 %	21,4 %	27,2 %	29,2 %	31,1 %	33,7 %	37,8 %	37,7 %	38,8 %	45,8 %	**32,8 %**
Share of profit/(loss) of ass	0,0 %	0,2 %	0,3 %	-0,2 %	-0,4 %	0,9 %	-0,7 %	2,9 %	-0,3 %	-0,1 %	1,8 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	**0,3 %**
Financial income	1,8 %	2,1 %	4,2 %	5,7 %	3,1 %	1,5 %	2,4 %	3,1 %	2,5 %	0,7 %	0,6 %	0,8 %	0,2 %	2,0 %	0,2 %	0,1 %	**1,4 %**
Financial expenses	1,7 %	0,6 %	2,9 %	1,8 %	1,0 %	2,0 %	1,6 %	1,2 %	1,5 %	2,5 %	3,4 %	1,5 %	2,3 %	0,8 %	0,6 %	5,6 %	**2,2 %**
Profit before income taxes	23,2 %	25,2 %	25,4 %	28,2 %	25,7 %	24,4 %	23,7 %	26,2 %	27,9 %	27,4 %	30,1 %	33,0 %	35,6 %	38,9 %	38,4 %	40,3 %	**32,3 %**
Income taxes	8,4 %	9,1 %	8,9 %	9,7 %	8,4 %	7,0 %	7,0 %	5,9 %	6,7 %	6,3 %	6,4 %	7,3 %	8,2 %	8,8 %	8,6 %	8,0 %	**7,7 %**
Net profit	14,7 %	16,1 %	16,6 %	18,5 %	17,3 %	17,4 %	16,7 %	20,4 %	21,2 %	21,1 %	23,7 %	25,8 %	27,5 %	30,1 %	29,8 %	32,3 %	**24,5 %**

Table 63 - Novo Nordisk common size cash flow statement, benchmarked against sales revenues

Novo Nordisk - Common size rearranged cash flow statement																	Value-weightec
Rearranged cash flows	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**average**
Net profit	14,7 %	16,1 %	16,6 %	18,5 %	17,3 %	17,4 %	16,7 %	20,4 %	21,2 %	21,1 %	23,7 %	25,8 %	27,5 %	30,1 %	29,8 %	32,3 %	**24,5 %**
Adjustment for accruals	13,7 %	14,9 %	15,0 %	16,8 %	18,0 %	16,2 %	14,8 %	12,9 %	12,6 %	13,1 %	13,9 %	13,7 %	14,4 %	12,8 %	17,1 %	13,9 %	**14,4 %**
Taxes paid on operating acti	-8,8 %	-7,6 %	-7,4 %	-8,2 %	-8,3 %	-7,0 %	-8,5 %	-5,8 %	-6,5 %	-3,8 %	-6,7 %	-8,3 %	-14,2 %	-11,5 %	-8,3 %	-8,6 %	**-8,5 %**
Cash flow from operating act	*19,6 %*	*23,3 %*	*24,2 %*	*27,0 %*	*26,9 %*	*26,6 %*	*23,0 %*	*27,5 %*	*27,2 %*	*30,4 %*	*30,9 %*	*31,2 %*	*27,7 %*	*31,5 %*	*38,6 %*	*37,5 %*	***30,5 %***
Investments in net working (	4,4 %	-6,1 %	-3,4 %	-5,1 %	0,4 %	-1,2 %	-2,7 %	-3,1 %	0,6 %	-0,5 %	0,5 %	0,7 %	0,4 %	-0,3 %	-2,4 %	-2,0 %	**-1,1 %**
Capital expenditures	-9,9 %	-16,1 %	-17,5 %	-8,7 %	-10,3 %	-11,9 %	-7,2 %	-5,6 %	-3,9 %	-5,2 %	-5,4 %	-4,5 %	-4,3 %	-3,8 %	-4,5 %	-4,8 %	**-6,2 %**
Investmens in other operati	3,6 %	-1,3 %	-0,3 %	-0,2 %	-1,1 %	-0,8 %	-1,1 %	-0,3 %	-0,6 %	-0,8 %	2,8 %	-0,4 %	-0,3 %	-0,5 %	-0,4 %	-1,1 %	**-0,3 %**
Cash flows from operating in	*-1,9 %*	*-23,5 %*	*-21,2 %*	*-13,9 %*	*-11,0 %*	*-13,8 %*	*-10,9 %*	*-9,0 %*	*-3,9 %*	*-6,5 %*	*-2,2 %*	*-4,3 %*	*-4,2 %*	*-4,6 %*	*-7,3 %*	*-7,9 %*	***-7,6 %***
Foreign exchange adjustmer	0,1 %	-0,1 %	-0,1 %	-0,1 %	0,0 %	0,5 %	0,1 %	0,0 %	0,0 %	0,0 %	0,1 %	0,0 %	0,0 %	-0,1 %	0,1 %	0,1 %	**0,0 %**
Net operating cash flows	*17,8 %*	*-0,3 %*	*3,0 %*	*13,1 %*	*15,8 %*	*13,2 %*	*12,1 %*	*18,6 %*	*23,4 %*	*23,9 %*	*28,8 %*	*26,9 %*	*23,4 %*	*26,8 %*	*31,4 %*	*29,7 %*	***22,9 %***
Changes in interest bearing (	0,0 %	-0,2 %	-0,1 %	1,7 %	-0,2 %	-0,1 %	-0,1 %	0,0 %	-0,3 %	0,0 %	0,0 %	-0,8 %	-0,6 %	0,0 %	0,0 %	0,0 %	**-0,1 %**
Interest paid/received	0,7 %	1,2 %	0,5 %	0,3 %	0,4 %	-0,2 %	0,2 %	-0,1 %	0,9 %	0,4 %	-0,1 %	0,2 %	0,2 %	0,1 %	0,1 %	0,0 %	**0,2 %**
Other financial items paid/r	-2,1 %	0,0 %	0,2 %	0,0 %	0,0 %	1,2 %	0,5 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	**0,0 %**
Investments in financial asse	0,0 %	0,0 %	4,4 %	-5,8 %	4,5 %	-3,1 %	1,3 %	-1,3 %	1,0 %	0,0 %	-4,8 %	-0,3 %	-0,6 %	1,0 %	2,5 %	-1,9 %	**-0,3 %**
Other financial cash flows	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	3,5 %	0,4 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	2,1 %	**0,5 %**
Taxes paid on financial activ	0,5 %	-0,4 %	-1,7 %	1,3 %	-1,5 %	0,6 %	-0,6 %	-0,5 %	-0,5 %	-0,1 %	1,0 %	0,2 %	0,3 %	-0,3 %	-0,6 %	-0,1 %	**-0,1 %**
Net financing cash flows	*-0,8 %*	*0,6 %*	*3,2 %*	*-2,5 %*	*3,1 %*	*-1,5 %*	*1,4 %*	*1,6 %*	*1,5 %*	*0,3 %*	*-3,8 %*	*-0,7 %*	*-0,8 %*	*0,9 %*	*2,0 %*	*0,2 %*	***0,2 %***
Distributable cash flows	17,0 %	0,3 %	6,2 %	10,6 %	19,0 %	11,6 %	13,5 %	20,2 %	24,9 %	24,2 %	25,0 %	26,2 %	22,6 %	27,6 %	33,4 %	29,9 %	**23,1 %**
of which dividends	3,3 %	3,9 %	4,7 %	4,8 %	5,1 %	4,7 %	5,0 %	5,3 %	6,1 %	7,1 %	7,2 %	8,6 %	9,9 %	11,6 %	13,4 %	12,0 %	**8,5 %**
of which non-dividend cha	11,0 %	0,0 %	1,4 %	6,1 %	6,5 %	8,3 %	7,2 %	11,0 %	9,7 %	12,5 %	14,5 %	16,0 %	15,2 %	16,7 %	16,5 %	15,9 %	**12,7 %**
Total cash flows distributed	14,3 %	3,8 %	6,1 %	10,9 %	11,7 %	13,1 %	12,2 %	16,3 %	15,8 %	19,7 %	21,8 %	24,6 %	25,2 %	28,3 %	29,9 %	27,9 %	**21,2 %**
Retained part of distributabl	2,7 %	-3,5 %	0,1 %	-0,3 %	7,3 %	-1,4 %	1,3 %	3,9 %	9,0 %	4,5 %	3,2 %	1,7 %	-2,6 %	-0,6 %	3,6 %	2,0 %	**1,9 %**

Table 64 - Novo Nordisk common size balance sheet benchmarked against total assets

Novo Nordisk - Common size balance sheet																	Value-weighte
Balance sheet	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**average**
Intangible assets	0,1 %	0,0 %	0,8 %	1,0 %	0,8 %	1,2 %	1,4 %	1,4 %	1,6 %	1,9 %	2,4 %	2,3 %	2,3 %	2,3 %	1,8 %	2,4 %	**1,7 %**
Property, plant and equipm	43,7 %	47,1 %	51,5 %	47,3 %	46,9 %	47,5 %	45,5 %	41,1 %	36,8 %	35,1 %	33,4 %	32,4 %	32,8 %	31,1 %	30,0 %	27,8 %	**36,9 %**
Investments in associated c	4,6 %	4,8 %	3,8 %	3,0 %	2,4 %	2,2 %	1,8 %	1,0 %	0,4 %	0,3 %	0,1 %	0,1 %	0,0 %	0,0 %	0,0 %	0,9 %	**1,1 %**
Deferred income tax assets	0,0 %	0,0 %	0,0 %	1,7 %	2,1 %	2,1 %	4,3 %	5,3 %	3,4 %	2,7 %	3,0 %	3,7 %	3,4 %	6,0 %	7,0 %	7,4 %	**4,0 %**
Other financial assets	0,0 %	0,0 %	0,2 %	0,2 %	0,4 %	0,4 %	0,4 %	0,3 %	0,4 %	0,3 %	0,4 %	0,4 %	0,3 %	0,8 %	1,1 %	1,5 %	**0,6 %**
Total-non current assets	48,4 %	52,0 %	56,3 %	53,2 %	52,6 %	53,4 %	53,4 %	49,1 %	42,6 %	40,3 %	39,3 %	38,8 %	38,8 %	40,2 %	39,9 %	39,9 %	**44,3 %**
Inventories	15,9 %	16,5 %	18,8 %	18,9 %	19,1 %	18,5 %	18,8 %	18,9 %	19,0 %	18,3 %	15,8 %	14,6 %	14,5 %	13,6 %	14,7 %	13,9 %	**16,4 %**
Trade receivables	13,6 %	13,4 %	12,1 %	11,0 %	10,9 %	11,4 %	11,6 %	12,8 %	13,0 %	12,9 %	13,8 %	14,5 %	14,7 %	15,5 %	16,9 %	16,9 %	**14,0 %**
Tax receivables	0,9 %	1,4 %	1,4 %	0,4 %	1,9 %	1,2 %	0,9 %	0,7 %	2,0 %	1,5 %	1,1 %	1,4 %	1,9 %	4,5 %	4,2 %	4,2 %	**2,2 %**
Other receivables and prep	5,7 %	6,1 %	5,9 %	7,7 %	2,8 %	3,5 %	4,0 %	3,1 %	3,4 %	3,6 %	3,9 %	3,7 %	4,1 %	3,5 %	3,6 %	2,5 %	**3,9 %**
Marketables securities	10,3 %	4,9 %	1,0 %	5,3 %	3,6 %	4,1 %	4,1 %	5,4 %	2,7 %	2,8 %	6,4 %	6,3 %	6,9 %	5,3 %	2,0 %	3,9 %	**4,6 %**
Derivative financial instruments		0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,2 %	0,1 %	1,4 %	2,2 %	0,0 %	0,3 %	**0,4 %**
Cash at bank and on hand	5,1 %	5,7 %	4,5 %	3,7 %	9,2 %	7,9 %	7,3 %	10,1 %	17,4 %	20,6 %	19,6 %	20,7 %	17,6 %	15,3 %	18,7 %	18,4 %	**14,4 %**
Total current assets	51,6 %	48,0 %	43,7 %	46,8 %	47,4 %	46,6 %	46,6 %	50,9 %	57,4 %	59,7 %	60,7 %	61,2 %	61,2 %	59,8 %	60,1 %	60,1 %	**55,7 %**
Total assets	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	**100 %**
Share capital	3,0 %	2,5 %	2,3 %	2,1 %	1,9 %	1,7 %	1,5 %	1,4 %	1,3 %	1,1 %	1,0 %	0,9 %	0,9 %	0,8 %	0,7 %	0,6 %	**1,2 %**
Treasury shares	0,0 %	0,0 %	-0,1 %	-0,1 %	-0,1 %	-0,1 %	-0,1 %	-0,1 %	-0,1 %	-0,1 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	**0,0 %**
Share premium account	10,3 %	8,9 %	8,1 %	7,4 %	6,9 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	**1,5 %**
Retained earnings	53,3 %	56,9 %	60,5 %	60,5 %	60,6 %	64,3 %	64,5 %	64,2 %	66,1 %	62,9 %	58,8 %	57,4 %	59,4 %	58,5 %	53,6 %	51,0 %	**59,0 %**
Other reserves	1,5 %	1,4 %	1,9 %	1,8 %	1,6 %	0,1 %	1,5 %	1,9 %	-2,1 %	1,3 %	0,5 %	-0,3 %	1,7 %	1,3 %	-1,9 %	-0,4 %	**0,5 %**
Total equity	68,1 %	69,7 %	72,8 %	71,7 %	70,8 %	65,9 %	67,4 %	67,4 %	65,2 %	65,3 %	60,2 %	57,9 %	61,9 %	60,5 %	52,3 %	51,2 %	**62,2 %**
Loans	3,8 %	3,0 %	2,6 %	2,2 %	3,2 %	3,0 %	2,6 %	2,0 %	1,9 %	1,8 %	0,8 %	0,8 %	0,0 %	0,0 %	0,0 %	0,0 %	**1,3 %**
Deferred income tax liabilit	3,9 %	4,7 %	3,6 %	4,4 %	5,0 %	4,4 %	4,5 %	4,9 %	4,8 %	5,5 %	4,7 %	5,0 %	1,1 %	1,0 %	0,0 %	0,0 %	**3,1 %**
Retirement benefit obligati	0,0 %	0,0 %	0,9 %	0,6 %	0,7 %	0,8 %	0,7 %	0,8 %	0,8 %	0,8 %	0,9 %	0,7 %	1,2 %	1,0 %	1,3 %	1,3 %	**0,9 %**
(Other) Provisions	2,1 %	1,9 %	0,7 %	0,8 %	1,0 %	0,8 %	2,0 %	2,6 %	1,7 %	2,1 %	3,3 %	3,6 %	2,9 %	3,1 %	2,6 %	3,0 %	**2,4 %**
Total non-current liabilities	9,8 %	9,6 %	7,7 %	8,0 %	9,7 %	8,9 %	9,9 %	10,3 %	9,2 %	10,2 %	9,7 %	10,0 %	5,2 %	5,0 %	4,0 %	4,3 %	**7,7 %**
Current debt (& financial d	3,3 %	2,8 %	1,8 %	2,8 %	1,4 %	3,4 %	0,8 %	0,8 %	2,6 %	0,8 %	0,9 %	0,5 %	0,8 %	0,3 %	0,9 %	1,2 %	**1,3 %**
Trade payables	3,9 %	3,4 %	2,7 %	2,9 %	2,8 %	3,6 %	3,8 %	4,1 %	4,5 %	4,1 %	4,7 %	5,1 %	5,9 %	5,8 %	6,4 %	5,4 %	**4,7 %**
Tax payables	0,6 %	0,2 %	0,9 %	1,9 %	1,7 %	1,6 %	1,8 %	1,9 %	1,1 %	1,3 %	2,0 %	1,8 %	0,9 %	3,2 %	3,6 %	4,1 %	**2,1 %**
Other liabilities	14,3 %	14,4 %	13,6 %	9,7 %	9,9 %	10,9 %	10,9 %	10,4 %	11,6 %	12,4 %	13,0 %	13,2 %	13,7 %	13,3 %	14,3 %	13,8 %	**12,6 %**
Derivative financial instrum	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	0,0 %	1,9 %	2,3 %	0,1 %	0,0 %	3,4 %	1,5 %	**0,8 %**
Provisions	0,0 %	0,0 %	0,5 %	3,0 %	3,6 %	5,7 %	5,5 %	5,0 %	5,8 %	5,9 %	7,6 %	9,2 %	11,7 %	11,8 %	15,0 %	18,6 %	**8,6 %**
Total current liabilities	22,1 %	20,8 %	19,5 %	20,3 %	19,4 %	25,2 %	22,7 %	22,3 %	25,6 %	24,5 %	30,1 %	32,1 %	33,0 %	34,4 %	43,7 %	44,5 %	**30,1 %**
Total liabilities	31,9 %	30,3 %	27,2 %	28,3 %	29,2 %	34,1 %	32,6 %	32,6 %	34,8 %	34,7 %	39,8 %	42,1 %	38,1 %	39,5 %	47,7 %	48,8 %	**37,8 %**
Total equity and liabilities	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	**100 %**

Appendix 3: Real option valuation

As discussed in the section on valuation theory, a traditional fundamental analysis will in certain situations understate the real value of a company. As elaborated, this is due to a common ignorance of the value-potential in the right, but not the obligation, to make specific types of action:

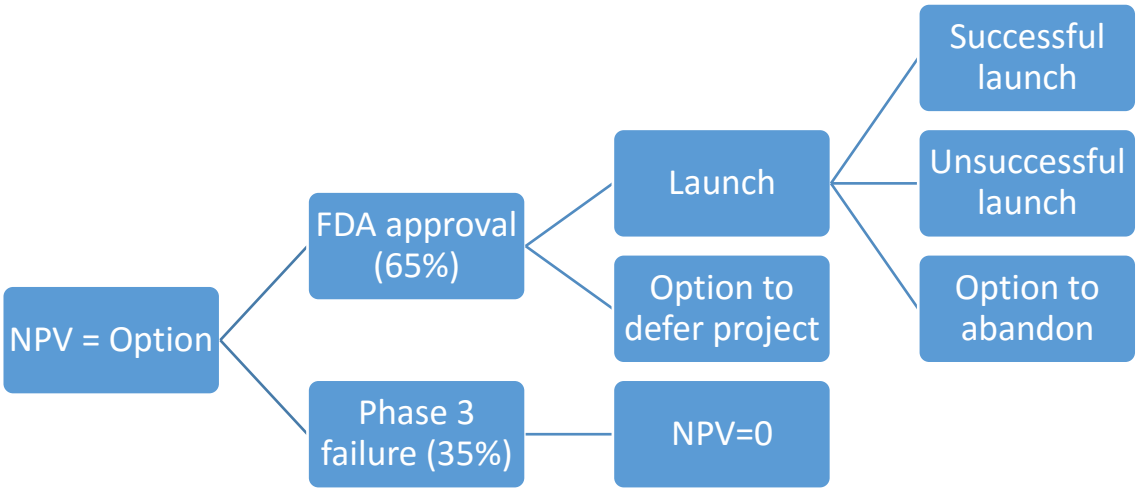
$$V_0 = \overbrace{V_{"as\ is"}}^{Fundamental\ value} + \overbrace{present\ value\ of\ flexibility}^{Option\ value}$$

In the case of Novo Nordisk, I would like to assume that the value of the company "as is" equals the value estimates obtained from the bear-case & base-case of the scenario analysis of DKK 280 & DKK 409 a share, respectively (*this is further discussed at the end of the section*). The option value of "flexibility", on the other hand, is targeted around the research on the semaglutide-molecule; specifically in regards to a strengthened repositioning into the oral anti-diabetic (OAD)-segment. Thus, in an attempt to avoid double-counting I must make some assumptions:

- First, I implicitly assume that this option value is already incorporated into the value estimate obtained from the bull-case scenario – in fact, this is explicitly discussed in the table on "considerations" in the scenario analysis.
- Second – regarding the bear- & base-case scenarios – this further assumes that cash flows from the majority of today's pipeline goes towards defending Novo Nordisk's position in the segments the company already has an established presence. Taking into account the additional consideration that sales from Novo Nordisk's business segment "Other diabetes and obesity care" (*predominantly **OAD products**, needles and Saxenda® (obesity treatment)*) amounted to merely DKK 4730 million in 2015, or **3.6% of total sales** – this should be a fair assumption.

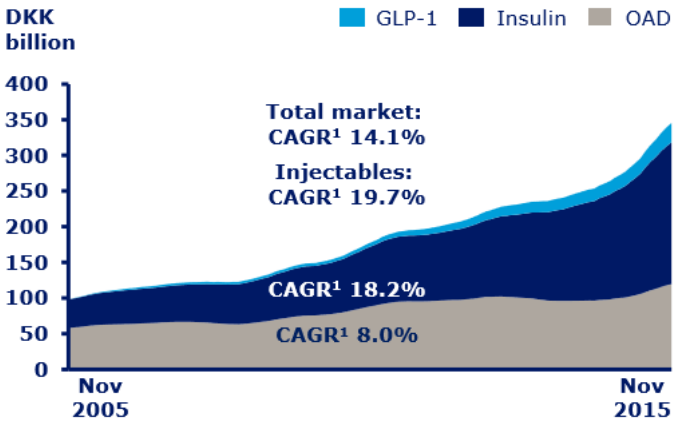
Hence, the additional value of flexibility is targeted at the (mega-) blockbuster potential surrounding the research on the semaglutide-molecule and its delivery as an oral formulation. An illustration of how this opportunity will be modelled – reflecting both technological & commercial risk – is presented in the figure below:

Figure 66 – Modelling flexibility using decision tree analysis



Background:

Figure 67 – Global historical diabetes care market by treatment class

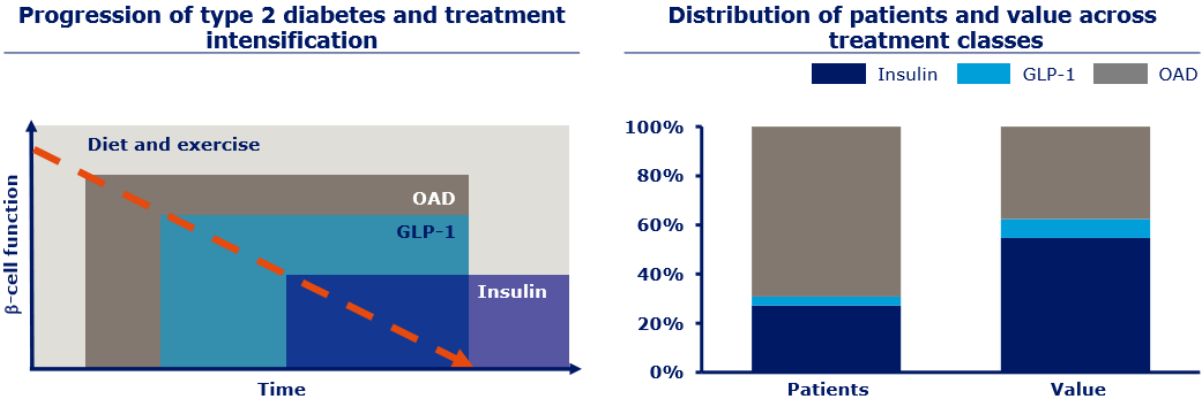


Source: Novo Nordisk, Q4 2015 roadshow presentation, p.29

As illustrated in the figure above, the OAD-segment represents an annual DKK ~130 billion opportunity. With Novo Nordisk having close to no representation in this segment, the current R&D-pipeline of a phase 3 oral formulation of semaglutide (as well a phase 2 and a phase 1 development project), should offer the company the option to gain market shares and rebuild a stronger presence.

Furthermore, as indicated in the figure below, this could really complement Novo Nordisk's spectrum of diabetes treatments: besides offering a value proposition targeted at less serious incidents, the oral formulation could capture a part of the drug treatment market that would not constitute the biggest threat in regards of cannibalising sales in the rest of the company's product portfolio.

Figure 68 – Progression of type 2 diabetes & treatment intensification (lhs) and distribution of patients and value across treatment classes (rhs)



Source: Novo Nordisk, Q4 2015 roadshow presentation, p.39

Before estimating a value on this specific market opportunity, however, it is necessary to make some assumptions:

- Novo Nordisk's current portfolio in the OAD-segment consist of NovoNorm® and repaglinide. Sales from these products should be considered negligible.
- The oral form of semaglutide is in phase 3 trials and should statistically be expected to be launched in about four years; for simplicity potential full launch are expected in year 2021.
- Given final FDA-approval and only two scenarios regarding commercial launch (either "successful" or "not so successful"), weighting of scenarios are subjectively set at 50%. Hence, the outcome is believed to be entirely binomial. The background for these outcomes are discussed in the relevant scenarios below.
- **Unsuccessful launch scenario**: In 2011, due to a declining return on investment, Novo Nordisk actually pulled all its resources related to research on diabetes pills to focus on the company's core competency – insulin and other injectable diabetes meds. Thus, in an unsuccessful launch scenario pills might commoditize the market and thereby eliminate any high margins. In addition, it is uncertain to what degree sales from this segment will "steal" market shares from e.g. the closely related GLP-1 segment (*see figure above*) where Novo Nordisk already dominates the market with a global market share of 64%. Through cannibalisation, this would deteriorate the value of the project further.

- **Successful launch scenario**: On the other side of the sword, in an era when the market for many pills are shrinking thanks to patent expirations and safety worries, a new (mega-) blockbuster with superior characteristics is exactly what should be needed to eliminate competition and to increase compliance & treatment rates. With Novo Nordisk potentially offering ***the first approved oral version of insulin ever*** this could potentially revolutionise therapy and thus expand the total market – all else equal, implying a lower degree of cannibalisation from e.g. the GLP-1 segment. To back up this relatively bold statement with actual market data I refer to the table below.

Table 65 – Increase in sales when changing mode of delivery in other therapies, through reformulation

Indication	Original Formulation	Reformulation	Bump in sales
Psoriasis	Topical	Oral	2.7x
Erectile Dysfunction	Injection	Oral	5.7x
Pain	Injection	Oral	217x
Addiction	Injection	Sublingual	19x
Migraine	Nasal	Oral	6.8x

Source: http://ir.baystreet.ca/article.aspx?id=208&1458558081 (2016)

As seen, the table demonstrates how other therapies have achieved a significant bump in sales when changing mode of delivery into an oral reformulation. The reason for this general tendency of a strong sales multiplier effect when changing mode of delivery is (obviously) that oral versions of injectables have advantages that lead to better patient experiences. As semaglutide, in essence, is "only" an improved version of injectable Victoza®, the market potential could be deduced from making this medication mainstream through a pill formulation. Specifically, among the reasons this multiplier-table should be applicable to oral semaglutide includes the following advantages that an oral delivery should have relative to its injectable counterparts:

1. **Improved patient compliance**; as many patients are reluctant to begin self-injections, oral medications are likely to improve compliance.
2. **Improved patient outcomes**; so far, Novo Nordisk's clinical trials have shown that oral dosing can provide pharmacological advantages relative to injections.
3. **Formulary acceptance**; offering performance improvements through increased patient compliance and transformation into a previously unavailable delivery mode

could possibly circumvent pricing issues with PBMs and make for an easier formulary acceptance.

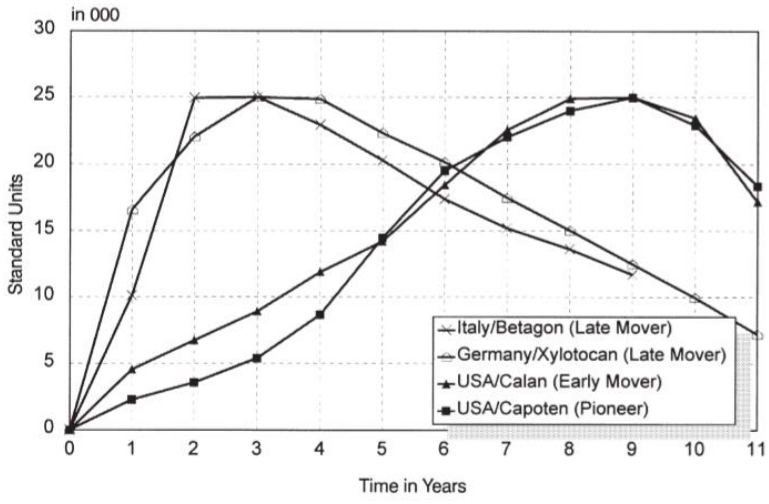
4. **Lifecycle extension**; being the first to market an oral GLP-1 analogue with semaglutide should give the company an extended market presence without significant oral GLP-1 competition. In addition, reformulation of injectable into orals can extend the lifecycle value of active pharmaceutical ingredients without the huge early-stage R&D-costs associated with development of an entirely new product.

Based on this background I can quantify some of the assumptions in the section below.

Technical assumptions:

- **Sales revenues**: Development in sales are expressed in terms of the GLP-1 sales multiplier, in which peak sales are estimated in year 5. As illustrated in the figure below, this estimate should reflect the mixed consideration of being the first oral pill delivering insulin (i.e. pioneer/early mover) and at the same time being a relatively later mover regarding the OAD-segment in general. Assuming Novo Nordisk's other development projects will reach the market to justify a certain market share, it is assumed that sales will stabilise at a constant growth rate of 2% in terminal value (in both scenarios).

Figure 69 – Typical sales histories of pioneer/early mover versus late mover drugs



Source: Bauer & Fischer, 2000, p.703

- **Cash flows**: Assuming that working capital needs are covered as part of rest of operations, I assume that the only Capex will come from an initial investment in a new DKK 5 billion manufacturing facility. Hence, it should be possible to approximate cash

flows through NOPLAT. Also, for simplicity the initial investment is assumed to be incurred simultaneously as sales starts in 2021, i.e. *after* the potential decision to abandon the project is made.

- Based on the discussion in the section above, other assumptions regarding e.g. operating margins & cannibalisation on sales from the rest of Novo Nordisk's product portfolio are modelled as illustrated in the tables below (*assuming patents expires 10 years after initial launch of the main product, margins are expected to drop accordingly*). As seen, the sales multiplier in both scenarios is (conservatively) estimated below the average, or median, bump in sales relative to the similar reformulations in the table above:

Table 66 – Successful launch scenario related to entrance into OAD-segment

bull-case scenario (in DKK billion)	2021e	2022e	2023e	2024e	2025e	2026e	2027e	2028e	2029e	2030e	Terminal value
GLP-1 sales multiplier (2015 sales)	*0,5*	*1*	*2,0*	*3,0*	*4,0*	*5,0*	*4,5*	*4,0*	*3,5*	*3,0*	*3,0*
Sales revenue	9,0	18,0	36,1	54,1	72,1	90,1	81,1	72,1	63,1	54,1	54,1
Operating expenses	-5,4	-10,8	-21,6	-32,4	-43,3	-54,1	-48,7	-43,3	-37,9	-32,4	-43,3
Operating margin	*40 %*	*40 %*	*40 %*	*40 %*	*40 %*	*40 %*	*40 %*	*40 %*	*40 %*	*40 %*	*20 %*
Taxes	-0,7	-1,4	-2,9	-4,3	-5,8	-7,2	-6,5	-5,8	-5,0	-4,3	-2,3
NOPLAT	2,9	5,8	11,5	17,3	23,1	28,8	26,0	23,1	20,2	17,3	8,5
Sales cannibalisation (20%)	-1,8	-3,6	-7,2	-10,8	-14,4	-18,0	-16,2	-14,4	-12,6	-10,8	-10,8
Operating profit impact (40% margin)	-0,7	-1,4	-2,9	-4,3	-5,8	-7,2	-6,5	-5,8	-5,0	-4,3	-4,3
Lost NOPLAT (from cannibalisation)	-0,6	-1,2	-2,3	-3,5	-4,6	-5,8	-5,2	-4,6	-4,0	-3,5	-3,4
Investment in new manufacturing facility	-5,0										
Net FCFE	**-2,7**	**4,6**	**9,2**	**13,8**	**18,5**	**23,1**	**20,8**	**18,5**	**16,2**	**13,8**	**5,1**

Table 67 – Unsuccessful launch scenario related to entrance into OAD-segment

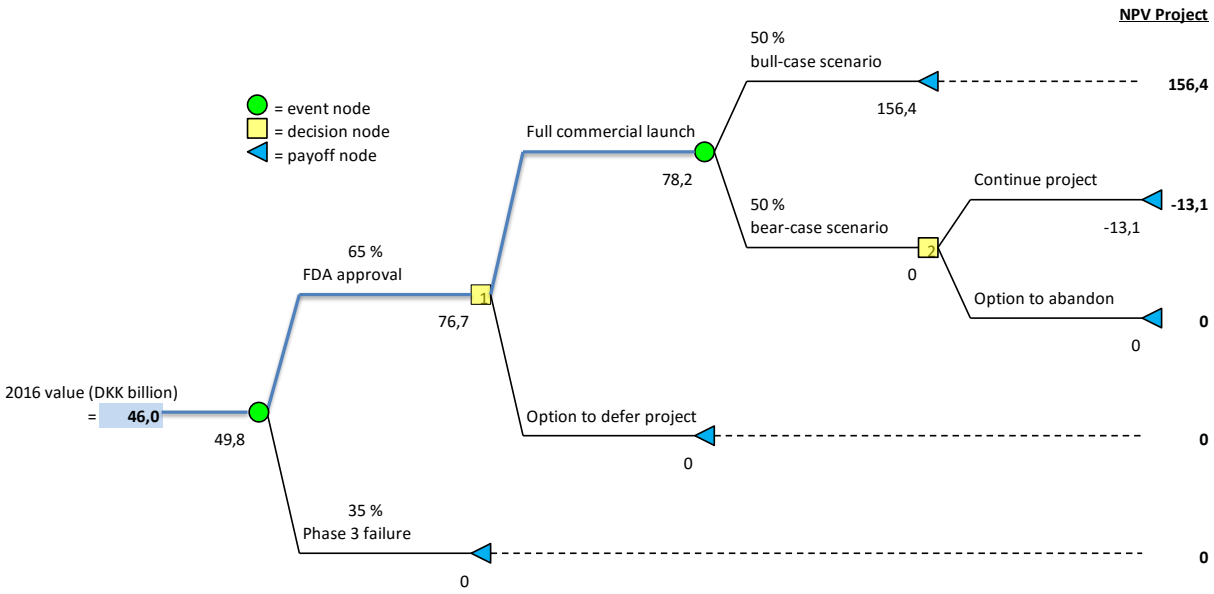
bear-case scenario (in DKK billion)	2021e	2022e	2023e	2024e	2025e	2026e	2027e	2028e	2029e	2030e	Terminal value
GLP-1 sales multiplier (2015 sales)	*0,25*	*0,50*	*1,0*	*1,5*	*2,0*	*2,5*	*2,0*	*1,5*	*1,0*	*1,0*	*1,0*
Sales revenue	4,5	9,0	18,0	27,0	36,1	45,1	36,1	27,0	18,0	18,0	18,0
Operating expenses	-3,6	-7,2	-14,4	-21,6	-28,8	-36,1	-28,8	-21,6	-14,4	-14,4	-15,3
Operating margin	*20 %*	*20 %*	*20 %*	*20 %*	*20 %*	*20 %*	*20 %*	*20 %*	*20 %*	*20 %*	*15 %*
Taxes	-0,2	-0,4	-0,7	-1,1	-1,4	-1,8	-1,4	-1,1	-0,7	-0,7	-0,6
NOPLAT	0,7	1,4	2,9	4,3	5,8	7,2	5,8	4,3	2,9	2,9	2,1
Sales cannibalisation (50%)	-2,3	-4,5	-9,0	-13,5	-18,0	-22,5	-18,0	-13,5	-9,0	-9,0	-9,0
Operating profit impact (40% margin)	-0,9	-1,8	-3,6	-5,4	-7,2	-9,0	-7,2	-5,4	-3,6	-3,6	-3,6
Lost NOPLAT (from cannibalisation)	-0,7	-1,4	-2,9	-4,3	-5,8	-7,2	-5,8	-4,3	-2,9	-2,9	-2,8
Investment in new manufacturing facility	-5,0										
Net FCFE	**-5,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**0,0**	**-0,7**

- **Option to abandon/defer project:** Assuming these options will have a negligible value impact on overall valuation (except of preventing a loss in the unsuccessful launch scenario) I set these values at 0.
- **Discount rate:** Cash flows are discounted using a cost of capital of 7%, while the time spent "waiting" on FDA-approval from 2016 to 2021 are discounted at the risk-free

rate of 2% (both based on the capital costs obtained from terminal value calculations in the prognosis period).

Hence, by deducting the probability of a product not reaching final FDA approval when entered in phase 3 (35%) the real option value of the oral semaglutide opportunity could be valued through a decision tree analysis. This process is illustrated in the figure below:

Figure 70 – Decision tree analysis of option to enter OAD-segment, numbers in DKK billion



Summary & discussion

As illustrated in the figure above, the real option value of the oral semaglutide opportunity is estimated at **DKK 46 billion**. Relative to the original "as is" estimate in the bear- & base-case scenarios of DKK 280 & DKK 409 a share, respectively, the "additional value of flexibility" contributes with a share increase of **DKK 18**. This enhances the value of the weighted scenario analysis by DKK 14.5 a share, all else equal, yielding a combined equity value of Novo Nordisk of **DKK 425 a share** (rounded). Furthermore, this implies an upside of ~17% relative to the market price as of 29.04.2016.

There are, however, several drawbacks with this method. Amongst the considerations that could distort the use of the option value includes the following:

- Firstly – as assumed in the section's introduction – adding the option value to the equity estimate obtained from the bear- & base-case scenarios implies that nothing of this pipeline potential have been reflected in the valuation already. While this

might overestimate the combined equity estimate by double counting sales revenues from this segment, the fact that the "Other diabetes & obesity care"-segment currently is of a negligible nature might justify such an approach.

- A closely related issue that arises, however, is if the main assumption on the option value only being incorporated into the bull-case scenario really is valid or not. If it is, then the value of the base-case scenario plus the option value of flexibility should be roughly equal to the estimate obtained in the bull-case scenario. In example, the combined base-case value + option value of (409+18=) DKK 427 a share is far away from the bull-case scenario value of DKK 545 a share. While the bull-case scenario also includes some other value-enhancing assumptions (*e.g. higher growth & margins in general*), all else equal, **this might indicate that the entire foundation that this option valuation rests on is flawed.**
- Secondly, limiting the option potential to a repositioning inside the OAD-segment excludes the potential value impact from other promising real option opportunities, like e.g. NASH (a liver disease) & Alzheimer's. All else equal, this would understate the true value of flexibility.

In summary, given a scenario analysis based on aggregate sales data, I believe that the foundation of this additional real option valuation – whether intentionally or not – is likely to be flawed. Consequently, I have chosen to exclude the option value from the overall valuation.

The reason I have chosen to include the section at all is that the approach might offer some valuable insight into which future growth trajectory regarding sales in the relevant scenarios should be most likely to play out:

- All else equal, starting with the formal FDA-approval or disapproval this should decrease or increase, respectively, the likelihood of the bear-case scenario to play out.
- Given FDA-approval, the initial sales development from launch (in ~2021) should enhance the insight in terms of which growth rates from the base-case or bull-case scenario to be most likely to play out.

Table 68 – Historical reported income statements

Reported income statement	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Net sales	20811	23776	24866	26158	29031	33760	38743	41831	45553	51078	60776	66346	78026	83572	88806	107927
Cost of goods sold	-5044	-5979	-6598	-7409	-8050	-9177	-9585	-9793	-10109	-10438	-11680	-12589	-13465	-14140	-14562	-16188
Gross profit	15767	17797	18268	18749	20981	24583	29158	32038	35444	40640	49096	53757	64561	69432	74244	91739
Sales and distribution costs	-6254	-7215	-7187	-7451	-8280	-9691	-11608	-12371	-12866	-15420	-18195	-19004	-21544	-23380	-23223	-28312
R&D costs	-3390	-3970	-3952	-4055	-4352	-5085	-6316	-8538	-7856	-7864	-9602	-9628	-10897	-11733	-13762	-13608
Administrative costs	-1878	-1865	-1960	-1857	-1944	-2122	-2387	-2508	-2635	-2764	-3065	-3245	-3312	-3508	-3537	-3857
Licence fees & other operating income	552	819	758	1036	575	403	272	321	286	341	657	494	666	682	770	1106
Non recurring income from the partial divestment of NNIT A/S																2376
Operating profit	4797	5566	5927	6422	6980	8088	9119	8942	12373	14933	18891	22374	29474	31493	34492	49444
Share of profit/(loss) of associated companies, net of tax	3	49	72	-59	-117	319	-260	1233	-124	-55	1070	0	0	0	0	0
Financial income	382	499	1046	1482	898	498	931	1303	1127	375	382	514	125	1702	167	85
Financial expenses	-361	-132	-717	-469	-304	-671	-626	-507	-681	-1265	-2057	-963	-1788	-656	-563	-6046
Profit before income taxes	4821	5982	6328	7376	7457	8234	9164	10971	12695	13988	18286	21925	27811	32539	34096	43483
Income taxes	-1753	-2165	-2212	-2543	-2444	-2370	-2712	-2449	-3050	-3220	-3883	-4828	-6379	-7355	-7615	-8623
Net profit	**3068**	**3817**	**4116**	**4833**	**5013**	**5864**	**6452**	**8522**	**9645**	**10768**	**14403**	**17097**	**21432**	**25184**	**26481**	**34860**
% sales growth	26,7 %	14,2 %	4,6 %	5,2 %	11,0 %	16,3 %	14,8 %	8,0 %	8,9 %	12,1 %	19,0 %	9,2 %	17,6 %	7,1 %	6,3 %	21,5 %
Operating profit margin	23,1 %	23,4 %	23,8 %	24,6 %	24,0 %	24,0 %	23,5 %	21,4 %	27,2 %	29,2 %	31,1 %	33,7 %	37,8 %	37,7 %	38,8 %	45,8 %
Net profit margin	14,7 %	16,1 %	16,6 %	18,5 %	17,3 %	17,4 %	16,7 %	20,4 %	21,2 %	21,1 %	23,7 %	25,8 %	27,5 %	30,1 %	29,8 %	32,3 %
Average number of shares outstandin	349	346	347	341	337	655	642	632	616	599	580	2827	2742	2679	2621	2574
Average, incl. Diluted	350	348	347	342	338	658	645	636	621	604	585	2851	2758	2694	2630	2580
EPS (DKK), diluted	8,8	11,0	11,9	14,1	14,8	8,9	10,0	13,4	15,5	17,8	24,6	6,0	7,8	9,3	10,1	13,5

Table 69 – Historical reported balance sheets

Reported balance sheet	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Intangible assets	32	14	240	331	314	485	639	671	788	1037	1458	1489	1495	1615	1378	2158
Property, plant and equipment	10899	13626	16205	16342	17559	19941	20350	19605	18639	19226	20507	20931	21539	21882	23136	25545
Investments in associated companie	1134	1401	1202	1040	883	926	788	500	222	176	43	39	0	0	0	811
Deferred income tax assets	0	0	0	579	769	879	1911	2522	1696	1455	1847	2414	2244	4231	5399	6806
Other financial assets	0	0	77	80	159	169	169	131	194	182	254	234	228	551	856	1339
Total-non current assets	12065	15041	17724	18372	19684	22400	23857	23429	21539	22076	24109	25107	25506	28279	30769	36659
Inventories	3972	4760	5919	6531	7163	7782	8400	9020	9611	10016	9689	9433	9543	9552	11357	12758
Trade receivables	3396	3882	3811	3785	4062	4794	5163	6092	6581	7063	8500	9349	9639	10907	13041	15485
Tax receivables	234	399	431	134	710	504	385	319	1010	799	650	883	1240	3155	3210	3871
Other receivables and prepayments	1408	1761	1873	2652	1040	1455	1784	1493	1704	1962	2403	2376	2705	2454	2750	2257
Marketables securities	2567	1402	315	1828	1341	1722	1833	2555	1377	1530	3926	4094	4552	3741	1509	3542
Derivative financial instruments	0	0	0	0	0	0	0	0	0	0	108	48	931	1521	30	304
Cash at bank and on hand	1278	1660	1423	1262	3433	3303	3270	4823	8781	11296	12017	13408	11553	10728	14396	16923
Total current assets	12855	13864	13772	16192	17749	19560	20835	24302	29064	32666	37293	39591	40163	42058	46293	55140
Total assets	**24920**	**28905**	**31496**	**34564**	**37433**	**41960**	**44692**	**47731**	**50603**	**54742**	**61402**	**64698**	**65669**	**70337**	**77062**	**91799**
Share capital	754	709	709	709	709	709	674	647	634	620	600	580	560	550	530	520
Treasury shares	0	0	-19	-33	-45	-61	-39	-26	-26	-32	-28	-24	-17	-21	-11	-10
Share premium account	2565	2565	2565	2565	2565	0	0	0	0	0	0	0	0	0	0	0
Retained earnings	13289	16461	19067	20925	22671	26962	28810	30661	33433	34435	36097	37111	39001	41137	41277	46816
Other reserves	373	402	606	610	604	24	677	900	-1062	711	296	-219	1088	903	-1502	-357
Total equity	16981	20137	22928	24776	26504	27634	30122	32182	32979	35734	36965	37448	40632	42569	40294	46969
Loans	950	863	824	753	1188	1248	1174	961	980	970	504	502	0	0	0	0
Deferred income tax liabilities	970	1358	1122	1510	1853	1846	1998	2346	2404	3010	2865	3206	732	672	7	6
Retirement benefit obligations	0	0	283	222	250	316	330	362	419	456	569	439	760	688	1031	1186
(Other) Provisions	523	541	206	271	358	335	911	1239	863	1157	2023	2324	1907	2183	2041	2765
Total non-current liabilities	2443	2762	2435	2756	3649	3745	4413	4908	4666	5593	5961	6471	3399	3543	3079	3957
Current debt (& financial derivatives	821	817	564	975	507	1444	338	405	1334	418	562	351	500	215	720	1073
Trade payables	977	970	864	1008	1061	1500	1712	1947	2281	2242	2906	3291	3859	4092	4950	4927
Tax payables	138	62	271	643	631	676	788	929	567	701	1252	1171	593	2222	2771	3777
Other liabilities	3560	4157	4270	3366	3721	4577	4863	4959	5853	6813	7954	8534	8982	9386	11051	12655
Derivative financial instruments	0	0	0	0	0	0	0	0	0	0	1158	1492	48	0	2607	1382
Provisions			164	1040	1360	2384	2456	2401	2923	3241	4644	5940	7656	8310	11590	17059
Total current liabilities	5496	6006	6133	7032	7280	10581	10157	10641	12958	13415	18476	20779	21638	24225	33689	40873
Total liabilities	7939	8768	8568	9788	10929	14326	14570	15549	17624	19008	24437	27250	25037	27768	36768	44830
Total equity and liabilities	**24920**	**28905**	**31496**	**34564**	**37433**	**41960**	**44692**	**47731**	**50603**	**54742**	**61402**	**64698**	**65669**	**70337**	**77062**	**91799**

Reported statement of cash flows	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Net profit	3068	3817	4116	4833	5013	5864	6452	8522	9645	10768	14403	17097	21432	25184	26481	34860
Adjustment for non-cash items	2847	3531	3742	4388	5226	5453	5740	5403	5721	6701	8449	9117	11253	10738	15213	14964
Income taxes	1753	2165	2212	2543	2444	2370	2712	2449	3050	0	0	0	6379	7355	7615	8623
Depr., amort., and impairments losses	1038	1081	1293	1581	1892	1930	2142	3007	2442	0	0	0	2693	2799	3435	2959
Other non-cash items	56	285	237	264	890	1153	886	-53	229	0	0	0	2181	584	4163	3382
Change in working capital	909	-1456	-845	-1335	107	-394	-1035	-1302	260	-279	297	434	274	-265	-2148	-2157
Interest received	0	0	0	0	0	0	391	295	656	284	218	332	207	131	131	55
Interest paid (net)	154	280	120	67	109	-73	-296	-324	-247	-98	-252	-215	-61	-39	-78	-61
Income taxes paid	-1739	-1900	-2266	-1804	-2866	-2138	-3514	-2607	-3172	-1998	-3436	-5391	-10891	-9807	-7907	-9374
Net cash generated from operating activities	*5239*	*4272*	*4867*	*6149*	*7589*	*8712*	*7738*	*9987*	*12863*	*15378*	*19679*	*21374*	*22214*	*25942*	*31692*	*38287*
Proceeds from the divestment of ZymoGenetics, Inc.	0	0	0	0	0	0	0	0	0	0	1155	0	0	0	0	0
Proceeds from the partial divestment of NNIT A/S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2303
Proceeds from sale of other financial assets	-427	0	52	0	0	400	175	0	0	0	0	0	0	29	35	32
Purchase of intangible assets and other financial assets	-63	-305	-81	-40	-312	-264	-419	-118	-264	-433	521	-259	-250	-406	-345	-1191
Proceeds from sale of PPE	310	114	50	185	140	234	111	40	18	1	68	70	53	31	4	15
Purchase of PPE	-2366	-3943	-4391	-2448	-3139	-4249	-2898	-2367	-1772	-2632	-3376	-3073	-3372	-3238	-3990	-5224
Sale/(purchase) of marketable securities	0	0	1085	-1516	1310	-1032	514	-541	466	0	-2913	-197	-501	811	2232	-2033
Dividend received	0	0	0	0	0	0	0	1470	170	18	8	0	0	0	0	0
Net cash used in investing activities	*-2546*	*-4134*	*-3285*	*-3819*	*-2001*	*-4911*	*-2517*	*-1516*	*-1382*	*-3046*	*-4537*	*-3459*	*-4070*	*-2773*	*-2064*	*-6098*
New long-term debt	0	0	0	476	505	0	0	0	0	0	0	0	0	0	0	0
Repayment of loans	4	-39	-18	-23	-574	-29	-23	-18	-153	0	0	-507	-502	0	0	0
Purchase of treasury shares, net	-2283	10	-347	-1604	-1895	-2812	-2790	-4594	-4422	-6395	-8820	-10595	-11896	-13924	-14667	-17196
Demerger of Novozymes	818	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dividends paid	-691	-916	-1161	-1243	-1488	-1594	-1945	-2221	-2795	-3650	-4400	-5700	-7742	-9715	-11866	-12905
Net cash used in financing activities	*-2152*	*-945*	*-1526*	*-2394*	*-3452*	*-4435*	*-4758*	*-6833*	*-7370*	*-10045*	*-13220*	*-16802*	*-20140*	*-23639*	*-26533*	*-30101*
Net cash generated from activities	**560**	**-759**	**56**	**-64**	**2136**	**-634**	**463**	**1638**	**4111**	**2287**	**1922**	**1113**	**-1996**	**-470**	**3095**	**2088**
Cash and cash equivalents at the beginning of the year	2495	3073	885	919	841	2963	2483	2985	4617	8726	11034	11960	13057	11053	10513	13676
Exchange gains/(losses) on cash and cash equivalents	18	-27	-22	-14	-14	154	39	-6	-2	21	46	-16	-8	-70	68	86
Cash and cash equivalents at the end of the year	**3073**	**2287**	**919**	**841**	**2963**	**2483**	**2985**	**4617**	**8726**	**11034**	**13002**	**13057**	**11053**	**10513**	**13676**	**15850**