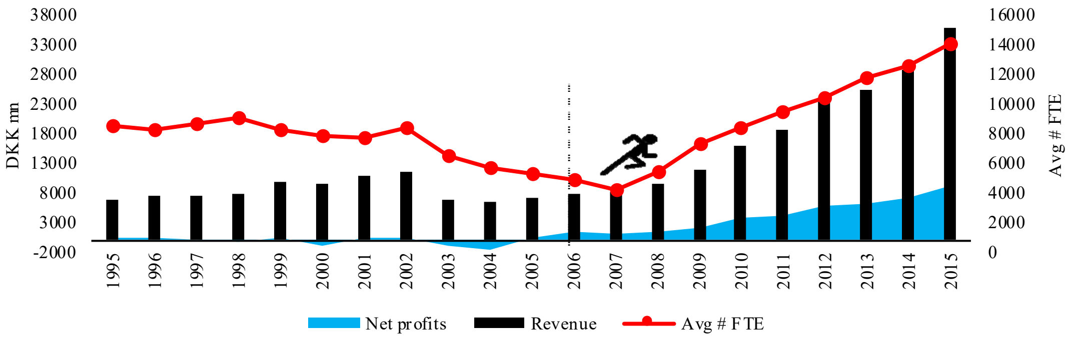
Valuation of Lego

DCF, Fourier analysis and Monte Carlo Simulation



MASTER THESIS

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ABSTRACT

This thesis aims at estimating a fair value of Lego. The discounted cash flow model serves as the overall guideline in relation to the computational valuation. Thirty financial statements from 2006 to 2015 are reformulated and analyzed – ten statements from Lego and a sum of twenty from Lego's largest competitors Hasbro and Mattel. The case of Lego is interesting because in just ten years, the firm went from near-bankruptcy to becoming the second largest toy-manufacturing firm in the world measured by revenue. In addition, Lego is an unlisted firm and having no access to the inner workings in the research of Lego proves to be a challenge during the process. The research relies heavily on historical public record data and information asymmetry is therefor expected, which may yield a 'less true' valuation than otherwise possible. Lego's famous product, the Lego Brick, is today the single most sold toy product across the global toy and games industry.

A strategic analysis is conducted on macro and micro levels, while meso level analysis in general is avoided due to the sheer scale and scope of Lego.

In the practical part of forecasting time series data (10-year government bond interest rates, revenue and NOPLAT), the data was first checked to rule out randomness by using Fisher's Kappa test statistic, as well as Bartlett's Kolmogorov-Smirnov test statistic. Depending on results, Fourier analysis is employed to reveal any periodicity, and later benchmarked against various regression models. However, for the data at hand, and although only in a minor degree, Fourier transformation proves to be inferior compared to the regression model. In accordance with the research design chosen, regression modeling takes the precedence over Fourier analysis.

After benchmarking, forecasting and calculating the final valuation, it is put into perspective against peer firms. In addition, to try simulating "*what if scenarios*" of possible enterprise values, the thesis incorporates Monte Carlo modeling on one and two dimensions.

The resulting valuation is found to be DKK ~460bn using 10 year budget from 2016-2025. The strategical analysis indicates an exciting future for Lego, which gives credit to the valuation, and as such, it is assumed that the valuation is fair given the limitations of thesis.

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PART I

Introductory Remarks

2 Introduction and research design

2.1 Background

The valuation process is an interesting but also challenging endeavor. While many approaches exist to determine the value of a firm, valuation practice is often misunderstood: According to Damodaran (2013), a well-known scholar in the field, firm valuation is often misconstrued as an objective search for a true and precise value and where quantitative methods over qualitative ones yield better results. However, practical valuation is typically encompassed with human bias, thus preventing an objective valuation. Damodaran (2013) continues to argue that instead of being too focused on objectivity, one should be concerned with bias magnitude. The debate on quantitative versus qualitative research methods has been ongoing for decades (Guba & Lincoln, 1994; Sale, Lohfeld, & Brazil, 2002), and arguments for one or the other, or a combination exist (Fine & Elsbach, 2000; Shah & Corley, 2006). In reflection, it can be argued that depending on which epistemological and ontological school the valuation practitioner abides by, in fact a true and precise valuation is achievable just by using quantitative methods (Creswell, 2003; Guba, 1990). The positivistic paradigm subscribes to such reality by disregarding human interference as well as bias in research methods (Guba, 1990). In contrast, this thesis abides by the neo-positivistic paradigm, which reckons that all questions have true answers but verification of truth is impossible because of human bias as well as lack of empirical testing on such truth. Valuation requires one to look at current value, how value is and will be created, as well as be sustained and for how long (Brealey, Myers, & Allen, 2011; Damodaran, 2013; Koller, Goedhart, & Wessels, 2010). For reasons mentioned, one can simply not practice valuation just by working with quantitative data from e.g. financial statements but is necessarily forced to incorporate qualitative data detailing strategy, market and future perspectives as well. While the human bias factor is established as a valuation challenge, information asymmetry generates another factor to worry about – as firms differ on many parameters (e.g. scope and scale, market, customers and more), so do information and availability of such. Economic theory describes an inverse relationship between perceived uncertainty and pay-off for risk averse investors, i.e. the more risk, the higher a pay-off required (Baker, Jensen, & Murphy, 1988). Studies of information asymmetry reveal that firms in imperfect markets are perceived more risky by investors than peers under perfect market conditions (Armstrong, Core, Taylor, & Verrecchia, 2011). The aspect of information asymmetry makes valuing non-public firms both a challenging but also an interesting endeavor. Non-public firms are not facing same reporting requirements and scrutiny as their public counterparts (Michaely & Roberts, 2012), therefore fueling the perceived information asymmetry as seen from an external point of view (Cohen & Dean, 2005). Lego, the famous Danish toy-manufacturing firm is a privately held entity, which makes the firm an interesting case for valuation for aforementioned reasons.

Founded in 1916, Lego can celebrate 100 years of operation in 2016 – though not with manufacturing of toys at first. Initially founded as a carpentry shop, toy manufacturing only began in 1932, while the Lego brick was not introduced until 1949. Only a few times in its long history, has Lego lost money – the latest in 2004, nearly bankrupting the firm. During the last 10-12 years, Lego has been through massive lay-offs and new-hirings, out-sourcing, in-sourcing, divestitures, an oil crisis and the 2008 global financial crisis. Nevertheless, Lego has managed to increase both top- and bottom-line and surpass past performance consistently since 2004. In 2014, Lego reached position as the second largest toy-manufacturing firm in the world, fiercely competing to beat current number one, Mattel, USA. In 2014, for the first time in Lego's history, the firm generated more revenue in its second fiscal quarter than the world's number one. Lego continued being the lead over Mattel in its second quarter of 2015 but was still holding second position when measured in terms of revenue on a yearly basis with translated currency. Lego booked revenues in 2015 close to DKK 36bn with products sold in more than 140 countries (LEGO, 2015a). Lego's initial toy products were made of wooden materials. Today, plastic construction bricks and elements are the main products for Lego with about 72 billion pieces produced in 2015. Even though plastic material was patented in 1856 (Parkes, 1862), it took nearly one hundred years before plastic toys became a mass-market category. Lego's first plastic toy became available in 1949 – almost 17 years after its first wooden toy product had reached the shelves. As of 2015, the firm has produced more than 832[1] billion plastic bricks and elements since 1949 (LEGO, 2016a), equal to around 120 bricks and elements for each of the 7 billion people on earth. The firm has close to 14,000 full-time employees with own production facilities in Denmark, Hungary, Czech Republic, Mexico and a new production facility under construction in China scheduled for prime-time in 2017.

1 Estimated number based on 2014 reported numbers of 760 billion elements plus 2015 production of 72 billion elements.

2.2 Motivation and research question

As Lego is an unlisted firm, valuation poses various challenges compared to listed firms; for one, valuation is not simply a multiplication of share price, amount of shares and some calculated markup based on forecasting. Instead, the valuation practice of unlisted firms makes case for the use of various valuation models and peer group analysis. Second, unlisted firms have less public reporting requirements than listed firms do, and per se, the degree of information scarcity concerning the unlisted firm can be higher (Michaely & Roberts, 2012). In turn, this could fuel a risk compensation requirement (Armstrong et al., 2011), eventually leading to an in-optimal valuation. Third, according to theory, all firms and industries are unique and each of them are thus affected by different mechanisms and market forces (value drivers) (Ang, 1991; Balakrishnan & Fox, 1993; Fama & Jensen, 1985).

These challenges serves as my motivation to write this thesis, which leads to the following research question:

What is a fair valuation of Lego?

Fair valuation is in this thesis defined as a valuation that tries to reduce information asymmetry as well as model different scenarios.

2.3 Structure

Structure of the thesis is outlined below:

Chapter		Content
Part I	Introductory remarks	Scientific framework
Part II	Firm & market analysis	Supporting data for valuation
Part III	Budgeting & valuation	Results
Part IV	Concluding remarks	Discussion & conclusion

Table 2-1 – Thesis structure

2.4 Methodology and delimitation

The reader of this thesis is assumed familiar with valuation, accounting, finance, statistics and strategy. The case study approach to analysis is selected. While various valuation methods and theories exist, the thesis does not discuss these due to the limited size of the thesis. This is a limitation of the thesis. Instead, the thesis is based on valuation practice from the book "Valuation: Measuring and Managing the Value of Companies", McKinsey &

Company by Koller et al., (2010) as well as incorporates best valuation practice suggested by Damodaran (2013).

Only LEGO A/S (Lego) is valued while affiliated entities, Kirkbi A/S, the LEGO Foundation and LEGO Invest A/S[2] are not included in the valuation. For the sake of scope, this thesis will largely consider peer firms, Hasbro and Mattel as Lego's competitors and therefor only benchmark Lego against these two firms. Lego changed accounting policies in 2007 to International Financial Reporting Standards (IFRS). A few numbers from pre-IFRS periods are used if said change to IFRS do not impact results. In accordance thereof, financial statement analysis only considers the period 2006-2015, while earlier financial statements and numbers are included for historic perspective. All financial statements are audited, except for various items in the financial statements for 2015 for peer firms Hasbro and Mattel, as they were not published at the time of writing. Instead, respective SEC 10-K filings with only minor unaudited items are employed. The overall impact is considered minor or non-existent.

The strategic analysis employs data from before and after 2006-2015 even if the financial statement analysis covers only the period 2006-2015. This is chosen for the thesis to provide more perspective and thoroughness than otherwise possible.

Data of different type and origin has been collected and employed but the thesis lacks access to primary data. Lego has declined requests for any information other than public record information, such as external financial statements, and various third-party interviews with the CEO of Lego. In contrast, and in a real world scenario, a prospective investor would in the spirit of good due-diligence, require access to primary data such as internal financial statements, inner workings, contractual obligations and more to reduce risk (Perry & Herd, 2004). In gist, a prospective investor would necessarily need to conduct interviews with internal and external firm stakeholders, including management, employees, suppliers and customers to illuminate potential problems as well as opportunities. A lack of access to information about the inner workings of Lego such as internal financial statements and areas of future strategic interest, will, all else equal, affect the valuation and may give a less

2 Organizational chart available in appendix 8.1 accurate valuation than would have been possible otherwise. Essentially, primary data scarcity necessarily lead to a less thorough due-diligence than otherwise, which can result in a market valuation surrounded with higher uncertainty.

Secondary data obtained involves market reports, third-party interviews, articles and various websites. Typically, secondary data has the disadvantage of lower validity as the data is often produced for other purposes than e.g. answering the research question at hand (Kvale & Brinkmann, 2009). However, even though data is not produced with the sole purpose of answering the research question, secondary data is used for obtaining perspective and allowing for reflection. Before any data is used, a critical, though subjective assessment has been employed and all data is used with the aim of answering the research question. Layers of both quantitative and qualitative data are examined. Research data is considered a mix of quantitative and qualitative data. Market reports are of statistical nature and may produce skewed numbers.

Peer group analysis is comprised of the firms that Lego itself deems main competitors, specifically US firms Hasbro and Mattel. Analysis of major patent infringement cases and mainstream media have pinpointed a few additional competitors. However, it is deemed out of scale and scope of this thesis to incorporate other firms for peer group analysis and data usage, albeit many firms are competing with Lego in the arena "time spent in playing and learning". In relation hereof, Lego mentions for example the computer gaming industry as a competing force (Knudstorp, 2014). The peer group analysis is limited to only two major firms and calculation of values, such as beta and comparison of benchmark numbers are c. p. limited in nature.

2.5 Scientific framework

2.5.1 Science theory

The underlying research methodology for this thesis is based on the *neo-positivistic* paradigm described by E. Guba (1990). This paradigm reckons all questions have *true* answers, but as human beings, we reckon it is impossible to verify whether an answer is in fact true or not; human beings are affected, perhaps even constrained, by their values, beliefs, emotions, cognitive abilities and other biological features. The end goal is always to reach truth, but it is fully accepted that the truth is not verifiable with the neo-positivistic paradigm. Other paradigms exist including *positivism*, which has different opinions on truth, but it is out of the scope to deal in depth with these here. In contrast to the natural sciences, social sciences rarely, if ever, allow one to put up a formula for predicting outcome of a given scenario and expect it to hold true later or in different settings. To illustrate this, it is difficult to predict the behavior of an entity, such as a firm – simply for the reasons that a given firm is not a well-defined construct, comes in many forms and sizes, let alone has more or less unpredictable behavior at any given time and in any given environment. In other words, albeit an assumption, most firms are not part of a simple homogenous mass of similar size, technology, competitive situation, and environment etc., and so firms naturally varies. In the case of Lego, firm management might decide to increase production output, but it is not easily predictable how, when, where or whether this will happen, let alone what impacts will be. These challenges are in contrast to the underlying mechanisms of natural sciences like physics and chemistry, which often adheres to the positivistic paradigm. In natural sciences, a given object is typically well defined and described by laws, and therefore has very predictable behavior in both time and environment, for example heating a water molecule to 100°C will cause it to vaporize under normal circumstances. The positivistic paradigm subscribes to the idea that a true answer is obtainable (even by humans) – and in order to verify truth any scientific postulate must be quantifiable, reproducible, objective and unequivocal (Kvale & Brinkmann, 2009). In economic sciences, however, reproduction, quantification and equivocality of scientific postulates can be a difficult venture, as entities researched (like firms and markets) can exhibit a heterogeneity that develops and adjusts over time. The behavior of such entities are therefore not easy – perhaps even impossible – to fully determine antecedently. Instead, the researcher must rely to some extent on prediction and forecasting instead (Kvale & Brinkmann, 2009). Friedman (1953) argued that what really matters are empirical observations for comparison of predictions. The variation within firms and industries may lead to scenarios where an external (or internal) factor, i.e. value driver has an effect on one firm or industry, but perhaps less on others. A simplified example hereof could be that age and educational level of children has a major influence on revenue generated in one toy firm, where factors such as geography and income level may play an impactful role in others. Deciding which value drivers are optimal to include for valuation is therefore challenging. Furthermore, verification of empirical data can pose challenges for reasons of the heterogeneity scenario described above; in philosophical sense, if all firms are unique, a true empirical verification is impossible, as there is no prior and equal firm to compare to. Instead, one must rely on similar (peer) firms and scenarios at best, for comparison. Determining what information is *relevant* and *accurate,* adds an additional layer of complexity. Contrary to the public firm, an unlisted one can itself determine – with the exception of annual reporting and other mandatory regulated reporting - if, when and how much data to disclose publicly. This leads to situations where one party may have more information than others do. The point here is that information asymmetry (market inefficiency) is likely to have an influence on valuation. In relation hereof, Healy & Palepu's (2001) review on empirical literature related to financial disclosures, information asymmetry and capital markets, provides a number of relevant insights: Financial disclosure is linked to firm ownership, stock performance and coverage by financial analysts. For example, it is argued that analysts reduce market inefficiency, assumingly by the incorporation of timely market data in forecasting models, in contrast to simple time series models (Brown & Rozeff, 1978; Fried & Givoly, 1982). On the other hand, financial analysts are arguably 'burdened' by incentive structures as for example was seen during the dotcom bubble, where analysts hyped the securities they owned themselves (Ljungqvist & Wilhelm, 2003). Moreover, Healy & Palepu's review tells us that financial disclosure is in general informative to investors, but actual value of information varies with micro and macro factors and that managerial *choice* of such disclosure is associated with capital market considerations, contracting decisions as well as political costs. Hendrikse (2003, p. 158) mentions that *"informational advantage can be used at the other party's expense"*, which extrapolated to valuation practice, can lead to in-optimal parameter estimations in the valuation model, resulting in erroneous valuation. Simply put, an asset holder (e.g. Lego's owners) could choose to withhold information relevant to the investor and thereby achieve a higher valuation price at the expense of an investor. The asset holder could for example choose to withhold information about future growth, perhaps even exaggerate to achieve a better valuation. On the other hand, if an investor believes not all information is available, the investor could perceive the asset as more risky and rationally demand compensation. Various studies have found empirical evidence that information asymmetry in fact impacts the valuation of firms under imperfect market competitions by affecting the cost of capital factor upwards (Armstrong et al., 2011; Lambert, Leuz, & Verrecchia, 2012). Similar findings by

Francis, Nanda & Olsson (2008) indicates that voluntary disclosures lead to a lower cost of capital. In essence, the cost of capital factor is a measure of risk and can amongst others, be used to discount future cash flows of assets for profitability evaluation purposes. According to generally accepted economic theory, the higher a cost of capital factor the more risky an asset is perceived and vice versa (Modigliani & Miller, 1958). Fons, Levy & Sarnat, Myers (1994; 1994; 1968) concluded that most investors are risk averse thus requiring compensation for risk taking. Juxtaposing a relationship between risk and compensation to valuation, additional risk due to information asymmetry would result in a lower valuation at the expense of the seller (e.g. Lego's owners). However, not all investors are risk averse, but instead have different risk attitudes and in accordance, compensation for risk-taking will vary. As such, the valuation should reflect on the risk profile. Conversely, in perfectly competitive markets, information asymmetry seems to have no effect on the cost of capital, instead the average precision of data obtained by the investors is the driving force (Lambert et al., 2012). The competitive landscape is therefore important to take into account when conducting valuations, as the cost of capital factor might be influenced. Koller et al., (2010), describes the principles behind valuation as a binary concept of value creation and value conservation, where the driver of value creation is a mix of *growth* and *return on invested capital* (ROIC) relative to cost of capital and furthermore, that cash-flow decreasing activities destroy value. It then follows that such value creating *or destroying* activities in relation to firm value must be constrained by the dynamics of the market environment in which the firm operates. I will therefore assume a cause-and-effect relationship between drivers of value creation/destruction and a given firm is deterministic of valuation. It follows then, that a correct identification and estimation of value drivers will cp. provide a true valuation as correctly identifying and estimating these value drivers will allow for zero residual effects. However, correct identification and estimation is not an easy undertaking, and perhaps even impossible considering that in theory an infinite amount of possible value drivers can affect a given firm. In addition, when implications of the aforementioned information asymmetry, human bias and neo-positivistic mindset is reviewed, the result is basically that one cannot know whether the valuation is correct, but instead should assume the valuation is likely encompassed with errors. A simple equation to illustrate the cause-effect relationship mathematically can be written like so:

$$V(t) = \sum_{i=1}^{\infty} P_i(t) + \varepsilon_n(t) \qquad \lim_{n\to\infty} \varepsilon_n(t) = \mp\infty \quad \text{for all } t \tag{1}$$

Own creation

For a given time, t, V is a single true and fair value of a firm, comprised of a correctly estimated amount of P_i-value drivers, and remainder $\epsilon_n(t)$ as n possible residual effects (information asymmetry). For V to be true and fair, there be must zero residual effects. Due to infinity (i.e. an infinite amount of possible value drivers), it will be impractical to ever reach a true and fair value of a firm using equation (1), as verification and a result is impossible to obtain if one can continue to add more parameters that may affect the valuation. Further, the equation results in at least a few more mathematical implications such as negative values of V suggesting that an investor would require payment in order to acquire the asset or firm. In addition, problems about negative and positive infinity springs to mind. For practical reasons, ignoring infinity is required but in general it is out of the scope of this thesis to deal with these implications for conveying the assumption that, the more of correct value drivers identified, all else equal, a V with less uncertainty can be calculated. In simple terms, the equation suggests that the more correctly interpreted data ((P_i)-value drivers) obtained, the higher accuracy of V can be achieved, whereas unexplained phenomena and information asymmetry (i.e. untrue valuation), is captured in the residual $\epsilon_n(t)$. Applying equation (1) to an illustrative example could yield the following:

$$V(t) = \text{amount of customers * customer expenditure * average buying rate} + \text{future performance} = \text{USD 10bn} \qquad (2)$$

As can be seen from the example, a few parameters are included to calculate a valuation but it is impossible to empirically verify whether residual effects are present or not, thus failing to conclude if this model provides true and correct valuation. Equation (1) implies that a valuation could be over-, underestimated or correct depending on the value of $\epsilon_n(t)$. The following table serves an illustration of this implication between the valuation and residual effects $\epsilon_n(t)$ in economic terms in equation (1):

Residual effects	Valuation
$\epsilon_n(t) > 0$	Overestimated
$\epsilon_n(t) < 0$	Underestimated
$\epsilon_n(t) = 0$	True

Table 2-2 – Valuation reliability vs. residual component

Correlation between residual effects and valuation reliability if residual effects are measured in economic terms. Own creation.

This is in line with the neo-positivistic paradigm, where it is generally accepted that a phenomenon (here in relation to value drivers) is impossible to *describe* in complete even if the phenomenon in itself is complete (Cook, Campbell, & Day, 1979). Adhering to the neo-positivistic mindset, the result is a situation, where it is considered impossible to verify whether a valuation is correct or not, even when the contract between two parties is agreed upon. Instead, one is necessarily forced to assume presence of residual (unexplained) effects – and in equation (1), this effect is captured with the $\epsilon_n(t)$ component. Juxtaposing this to real life, a valuation is no better than the due diligence behind. Applying the *positivistic* mindset, the proposed equation (1) could instead look like this, having no unaccounted/unexplained phenomena $\epsilon_n(t)$:

$$V(t) = \sum_{i=1}^{\infty} P_i(t) \tag{3}$$

Own creation

With the aforementioned problems of quantification, reproducibility, objectivity and indisputability of scientific postulation that are required to use this equation, it will simply not be applicable in the social sciences for mentioned reasons. Considering the applicability of equation (3) with the neo-positivistic mindset will cause problems, as verification of whatever result (valuation), is still impossible. Even though equation (3) is a construct that try to explain a correlation between valuation and value drivers, it might not even be valid in the first place – i.e. results might not be reproducible at all. E. Guba (1990) argued in the sense of epistemology that the ideal of the neo-positivist is to seek objectivity and to try to minimize human bias. Guba further argued that in order to approximate this, benchmarking and applying multiple methods for scientific investigations is essential. In addition, any scientific investigations should occur in natural settings.

A term from the field of entrepreneurship coined *discontinuous innovation* (DI) describes a theory that when one *acquires* and *examines knowledge*, new ideas are formed in the process (Gertsen, Lassen, & Hansen, 2008). This process is often non-linear but instead argues for iteration and re-iteration. Juxtaposed to the realm of due diligence and valuation the result of the DI process could be that e.g. new markets, different forecasting methods and predictions are developed during knowledge acquisition process (Carrero, Peiro, & Salanova, 2000; Damanpour, 1996). The DI methodology is typically applicable for investigation of new business ideas and developing businesses from "ground up"

(Veryzer, 1998). In order to test and benchmark assumptions about the future of a firm like Lego, i.e. budgeting and forecasting, an iterative tactic such as the discontinuous innovation approach is assumed useful, as it will allow one to modify and adapt the assumptions along the way. The DI approach inspires for creation of knowledge and can possibly help to illustrate drawbacks, advantages, and opportunities of a given firm, perhaps resulting in a more complete valuation. On the other hand, the DI approach is a balance between objectivity and subjectivity in the sense that, the DI operator could manufacture own ideas, i.e. thinking too much out of the box in a given situation instead of adhering to factual data at hand. In such situations, the quality of acquired knowledge could suffer and thereby affect the quality of the valuation. It is paramount to highlight that the DI approach is only applied in general, all while adhering strictly to the principles of reliability and validity in order to obtain quality and robustness of the thesis. Reliability deals with the question of reproducibility i.e. can the same result be achieved again at a different point of time by other researchers? Reliability of data that stems directly from people, goes against the quest of reaching objectivity; people might be affected by the settings in which they provide an answer to a certain question and today's answer might not be the same as tomorrow's, thus violating the rule of reliability. Further, the DI operator may introduce bias – both in the interpretation phase but also when acquiring data. Validity asks the question if a method is actually investigating what it claims, i.e. can a conclusion be obtained using the specified method. Conversely, the quality criteria for the neo-positivist does not stop with reliability and validity but also requires a discussion of any challenges emerged in the quest to honor these criteria. Accordingly, the valuation will be benchmarked with sensitivity analyses, calculated with various methods and any challenges in relation to obtaining quality requires discussion and reflection. Even with these precautions, it is imperative to realize that whether the valuation is correct or not will be impossible to determine but instead a fair valuation can be proposed.

2.5.2 Reflection on models for strategic analysis

Grant argues that successful strategies can be measured by 'implementation effectiveness' of *"simple, consistent, long-term goals"*, a *"profound understanding of the competitive environment"*, and *"objective appraisal of resources"* (2010, p. 12). This serves as the underpinnings for the strategic analysis (as well as the financial analysis). To highlight non-economic factors that are thought to lead to value creation (or destruction), strategic perspectives are included[3] but only on a firm (micro-level) and market level (macro-level). The analysis is in risk of providing full transparency for given reasons; 1) Lego's large scope and scale of operations with footprints in more than 140 countries, 2) due to the limitation requirements of the thesis. Therefore, meso-level research is entirely avoided. As argued by various scholars, every market and country have unique characteristics and conversely the impact on Lego as a firm will vary with the market/country (Ang, 1991; Balakrishnan & Fox, 1993; Fama & Jensen, 1985). Lacking access to primary data concerning each market and detailed operations of Lego, such impact is assumed difficult to gauge apart from an overall and general fashion. Since market size and other general industry data can be "easily" obtained, strategic analysis on macro level is included but only where factors are deemed highly relevant. Micro level data has to do with the internals of the firm and has in general been easy to obtain as well. The contribution to value creation or destruction of both analyses can be derived. However, I assume this can only at best be on a general level. In the selection process of models, the Five Forces framework described by Porter (1979) was considered for the meso level analysis to pinpoint supplier and buyer factors as well as the interrelation between global and local aspects of firm and market. However, Five Forces focus solely on the meso level to explain competitive advantage and value creation (destruction) and fails to include macro and micro levels (Barney, 1995). Lack of meso level analysis, is assumed to fuel the challenges with information asymmetry and may affect the valuation negatively. In gist, the same argumentation may hold true for research for the macro and micro level, where firm performance on a micro level market is unknown, and impact on firm in a macro level context is unknown as well.

The discussion and analysis takes its onset from the concepts in the STEEP/PESTLE framework for macro level and follows up with VRIN/VRIO for micro level. The VRIN framework classifies a firm's resources and capabilities by four parameters, 'Value', 'Rarity', 'Imitation cost' and 'Non-substitutable' to explain competitive advantage. VRIN was originally described by Barney (1991, 1995) and later modified by Rothaermel (2015) to VRIO to ask the question "is the capability/resource exploitable by the Organization?". An overview of the VRIO framework is provided here:

[3] A generalized overview of the various levels which served as founded for the analysis is provided in appendix 8.2.

Valuable	Rare	Costly to imitate	Exploitable by the organization	Implication	Economic performance
No				Competitive disadvantage	Below normal
Yes	No			Competitive parity	Normal
Yes	Yes	No		Temporary comp. advantage	Above normal
Yes	Yes	Yes	Yes	Sustained comp. advantage	Above normal

Table 2-3 – VRIO framework

Source: Based on Barney (1991, 1995) adapted by Rothaermel (2015, p. 105)

As can be seen from the table, competitive advantage and economic performance are correlated to the four parameters. The most elementary resources/capabilities are financial, physical and human capital (Robert M. Grant, 2010, p. 155) and as such the analysis will take its onset there. Arguably, the VRIO framework can be seen as limited and simplistic requiring only four parameters to describe competitive advantage and economic performance. On the other hand, it is assumed a good fit to provide an overview of the internals of Lego. Only resources/capabilities with attributes assumed at least 'valuable' are included in the analysis, as it is assumed the economic performance of Lego is not 'below normal' in the period researched.

Sometimes it is seen that other analyzes of firms include a 'SWOT' framework in conjunction with, micro, macro and meso level analysis. The SWOT framework relates internal and external environments in a 'strength, weakness, opportunity or threat" categorization. As argued by Grant (2010), the SWOT taxonomy is arbitrary in nature as parameters can be seen from multiple angles, therefore making the framework limited. For this reason, SWOT is excluded from the analysis.

2.5.3 Time Series Analysis

The following section will give a brief description of time series analysis. One of the challenges that arise when working parameters of time nature is the involvement of future aspects, making estimation and prediction difficult. In relation to valuation where 'growth' is one key component for value creation, it follows that optimal forecasting of growth is a necessity in order to reduce residual effects. Time series data can be approximated with various methods – among others are regression techniques and moving averages. However, depending on data complexity like linearity, periodicity and randomness, not all methods work equally well resulting in non-optimal approximation or increased residuals (Newbold, Carlson, & Thorne, 2010). Moreover, time series data can exhibit large random fluctuations and applying regression methods to such data for forecasting can lead to a low coefficient of determination. In turn, phenomena such as fluctuations and randomness may fuel the perception of information asymmetry which all else equal will decrease firm valuation. The following section will dive into forecasting of time series by exploiting *Fourier analysis*.

2.5.3.1 Fourier analysis in brief

The idea behind Fourier analysis is to transform any data in the time series domain into a frequency domain. This transformation is generally referred to as a *Fourier Transform (FT)*. FT are often applied within physics, chemistry and engineering but in economics it has found practice too, including option valuation (Carr & Madan, 1999), demand forecasting (Fumi, Pepe, Scarabotti, & Schiraldi, 2013) and modelling of inflation rates (Omekara, Ekpenyong, & Ekerete, 2013). Fourier analysis is attributed to the French mathematician Jean-Baptiste J. Fourier, whom discovered some 200 years ago that general functions can be described as a sum of sinusoids (Coppel, 1969). The beauty of the discovery by Fourier is that many functions, even complex functions with seemingly stochastic features, can be approximated. FT works by employing algorithmic decomposition of data from the time series domain to complex numbers, which are eventually transformed into *frequency domain data* comprising amplitude, phase and frequency (Matsuda, 2004). Applied correctly, the FT can reveal periodicity or harmonic oscillations in the transformed data (Bloomfield, 2000; Duhamel & Vetterli, 1990; Fumi et al., 2013). The periodicity can then be factored into the valuation model, if appropriate. Algorithms for calculating the FT exist in many variants typically with the goal of being computationally fast, hence referred to as *Fast Fourier Transform (FFT)* algorithms (Bloomfield, 2000; Duhamel & Vetterli, 1990). For this thesis, computer programs, Microsoft Excel 2013 (Excel) and MathWorks MATLAB R2015a (Matlab) are used interchangeably for Fourier analysis while the FT was done solely in Matlab for algorithmic consistency. Before demonstrating the applicability of Fourier Transform of functions, a few concepts related to Fourier analysis and the study of functions are described.

2.5.3.1.1 Wave, frequency, amplitude and phase

When transforming time series data into a frequency spectrum, trigonometric functions sine and cosine are used. A brief brush-up on basic trigonometry is included to serve as a foundation for the more advanced concept of Fourier analysis. Time series data or signals can be viewed as wave functions, and in turn simple circles. Circles can be measured in angle degrees, e.g. 360 degrees for a full circle. However, for the sake of simplicity when working with Fourier analysis, it is convention to use radians instead of degrees to measure circles. 1 circle of 360° is equal to 2π radians, i.e. $360° = 2 * 3.14159 = 6.28319\, radians$, then $1\, radian = \frac{360°}{2\pi} = 57.2958°$, and $1° = \frac{2\pi}{360°} = 0.01745\, radians$.

Important as well is the concept of a 'wavelength λ', defined as the distance between peaks or troughs in a wave function:

$$\lambda \equiv \frac{distance}{cycle} \equiv \frac{v\left(\frac{distance}{second}\right)}{f\left(\frac{cycle}{second}\right)} => f \equiv \frac{v}{\lambda} => v \equiv f * \lambda \tag{4}$$

One complete cycle of a wave equals one wavelength λ, such that f is the frequency measured in cycles per second (also known as Hertz, 1 Hz = 1 cycle per second), and v is the distance per second. As waves typically move at various speed, T is introduced as the time it takes for a wave to complete one wavelength.

$$T \equiv \frac{seconds}{1\, wavelength\, \lambda} \equiv \frac{1}{f} \equiv (seconds\ per\ cycle) \tag{5}$$

Translated into radians per second or "angular frequency" ω, the following is produced:

$$\omega = \frac{360°}{T} = \frac{2\pi}{T} = \frac{6.28319\, radians}{T} = 2\pi f \tag{6}$$

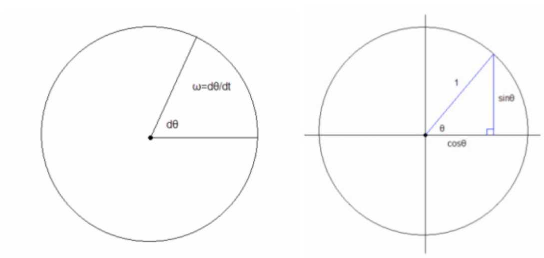


Figure 2-1 – Angular frequency
Source: (Matsuda, 2004)

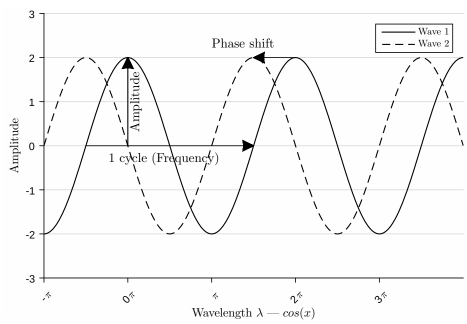


Figure 2-2 – Plot of wave functions

Figure 2-1 shows the relation between angular frequency and circles, as well the relation between angle θ and periodic sine and cosine waves. Figure 2-2 shows samples of two cosine waves both with a frequency of 1 Hz. Wave #1 $w_1(t)$ starts at -0.5π and completes full cycle at 1.5π, and again 1.5π until 3.5π and so on. Wave #2 $w_2(t)$ shows the same wave function just shifted left to -1.5π, meaning that the wave starts earlier. This shift is referred to as a phase-shift and can be in any direction. In generalized format, wave functions can be described mathematically (Young, Freedman, Ford, Sears, & Zemansky, 2012, p. 477):

$$f(t) = A * \cos(2\pi ft + \phi) = A * \cos(\omega t + \phi) \tag{7}$$

Where A is the amplitude and ϕ is the phase (starting point in radians). In other words, the amplitude reveals the magnitude or height of the wave function, phase-shift indicates starting point, and frequency determines the harmonic occurrence. Combining frequency and magnitude reveals pattern(s), which then can be used for inputs in forecasting. The wave functions in figure 2-2 can be described mathematically by the following:

$$w_1(t) = 2 * \cos(2\pi * 1Hz * 1 + 0) \qquad w_2(t) = 2 * cos(2\pi * 1Hz * 1 - 1.5\pi)$$

Calculating angular frequency for $w_1(t)$ we get $\omega = 2\pi * 1 = 2\pi\ Hz$ or 2π radians per second. T yields the following: $T = \frac{1}{f} = \frac{1}{1} = 1$ second/cycle. An arbitrary wave of e.g. 12 Hz, gives $\omega = 24\pi\, radians \approx 75.396\, radians$ per second and period $T = \frac{1}{12\ Hz} =$ 0.0833 seconds/cycle. Fast forwarding, an adapted generalized form of a Fourier transformed time series is shown below (Davis, 1941, p. 63),

$$g(t) = a_0 + \sum_{n=1}^{N} \left(a_n \cos\frac{n\pi t}{L} + b_n \sin\frac{n\pi t}{L}\right) \tag{8}$$

$$a_0 = \frac{1}{2L} \int_{-L}^{L} f(t)\delta t \tag{9}$$

$$a_n = \frac{1}{L} \int_{-L}^{L} f(t) \cos\left(\frac{n\pi t}{L}\right) \delta t \tag{10}$$

$$b_n = \frac{1}{L} \int_{-L}^{L} f(t) \sin\left(\frac{n\pi t}{L}\right) \delta t \tag{11}$$

where t is a point in time and a function $g(t)$ is comprised of a mean term a_0 and sum of n harmonic components, cosine and sine waves. The challenging part is to model a_0, a_n and b_n coefficients and as can be seen, the FT decomposes time series data into a sum of sinusoids revealing the coefficients. The coefficients are represented by complex numbers. The basic intuition behind above definitions is this: Let $2L = 2\pi \implies L = \pi$, meaning L equals one half-cycle keeping in mind that 2π is full cycle of a given wave. By integrating from $-L \rightarrow L$, a full cycle of the time domain function (i.e. from $-L \rightarrow 0 = L$ and from $0 \rightarrow L = L$, in total $2L = 2\pi$) can be transformed and represented as frequency, amplitude and phase. Next, the sampling rate f_s Hz (samples/second) is important to consider as well, as incorrect sampling rate can distort the approximation of FT. This distortion is referred to as aliasing and may be avoided by using only half (N/2) of the sampled data (N) according to the Nyquist-Shannon rule (Matsuda, 2004, p. 62). This rule is not described however as it is out of scope.

$$f_s = \frac{1}{\Delta t} \tag{12}$$

Now, the list of complex numbers produced by the FT, needs treatment to extract phase and amplitude. Excel contain simple functions to extract phase ϕ_i and amplitude A_i from complex numbers c_i, although Matlab can be used as well but Excel was chosen for simplicity:

$$\phi_i = IMARGUMENT(c_i) \tag{13}$$

$$A_i = \frac{IMABS(c_i)}{N/2} \tag{14}$$

Where IMARGUMENT returns the angle degree in radians equal to $\tan^{-1}(i/r)$ or phase ϕ_i, where i is the imaginary coefficient of the complex number and r the real, e.g. $IMARGUMENT(\text{"10+12i"}) = 0.876$ radians. IMABS returns an absolute value, such that IMABS is equal to $\sqrt{r^2 + i^2}$, e.g. $IMABS(\text{"}10 + 12i\text{"}) = 15.621$, which yields the amplitude. Conversely, it is out of the scope to dive more into the mathematical definitions here. Instead, this thesis rely on the computational power of Matlab and Excel to do the “hard work”. All calculations are available in the Excel file.

2.5.3.1.2 Fourier Transform applied on constructed data

Below, in figure 2-3, are so-called periodograms (FT Periodogram) of various transformations into the frequency domain using samples of time series data, i.e. the ‘Raw Plots’. Although the time series are artificial functions that resembles perhaps unreal data in relation to valuation, the capabilities of the Fourier Transform is evident, I believe. The periodograms reveal a clear indication of periodicity, i.e. recurring events that “stand out”. In the periodograms this is shown in the form of peeks at different frequencies (x-axis) of some magnitude (y-axis) corresponding to the original functions. Such data recurrence will ‘ceteris paribus’ increase reliability in the forecasting model, if one knows that in ‘x’ time ‘y’ will reoccur, e.g. an interest rate may drop/increase or sales will go down/up and so on.

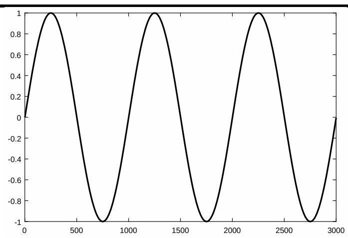
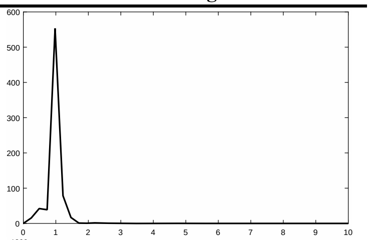
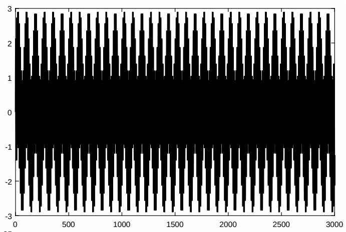
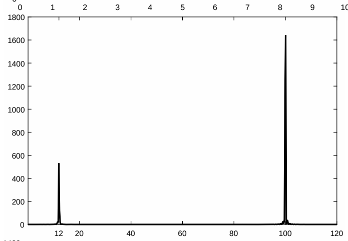
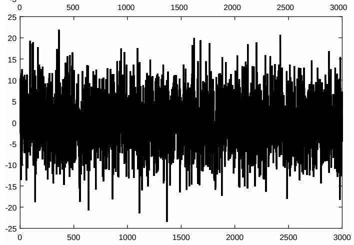
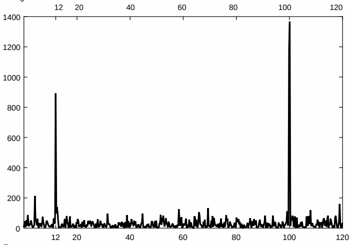
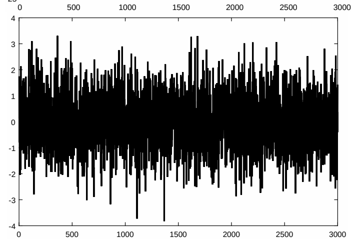
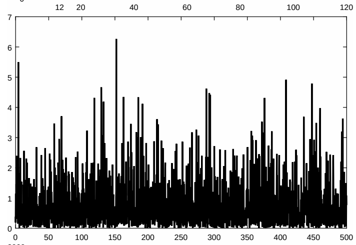
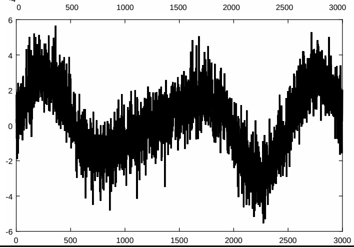
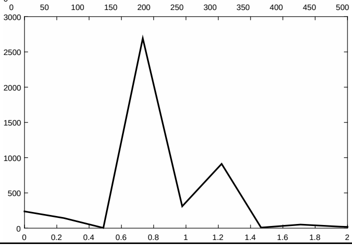
Plot #	$A * \sin(2\pi ft)$	Raw Plot	FT Periodogram
1)	1 Hz (1 amp) No Gaussian noise		
2)	100 Hz (2 amps) 12 Hz (1 amp) No Gaussian noise		
3)	100 Hz (2 amps) 12 Hz (1 amp) + 6 * Gaussian noise		
4)	Pure Gaussian noise		
5)	1.2 Hz (1 amp) 0.8 Hz (2 amps) + 1 * Gaussian noise		

Figure 2-3 – Plots of sample wave functions and periodograms

All functions were mapped in 3 second windows using a sampling rate of 1,000 – in total 3,000 samples to avoid aliasing although the sampling rate could easily be less given the simple constructed signals. The source code is available for inspection in Appendix 8.3.

In accordance with the science theory, the FT shown here was 'stress tested' by introducing Gaussian noise[4] in some of the time series. While the raw plots containing Gaussian noise look random, the randomness is downplayed at varying degrees in the corresponding periodograms and instead indications of harmonic data are displayed. As specified, the functions plotted are known beforehand to contain periodicity so the revelation by the FT does not come as a surprise. In real life, however, a mathematical notion of a wave function for time series is typically not revealed so periodicity is not quantified beforehand. In gist, FT is only able to approximate a function as well as reveal an approximate periodicity if any (Matsuda, 2004). In other words, FT could be thought of as "function approximation". As mentioned earlier, FT has successfully been applied on real life economic data, as well as being used extensively in the physics and engineering fields. In contrast to the rest of the plots in figure 2-3, the time series data in Plot #4 consists of pure Gaussian noise. By using visual inspection, it would be easy to conclude that the wave function is random, as there are many peeks shown and none are distinct. In accordance with the validity criteria and instead of relying solely on visual inspection, the analysis use proven statistical methods to test data and quantify randomness. The next section will briefly describe the methods selected to check for randomness in time series data.

2.5.3.1.3 Testing for randomness

To check time series for randomness (white noise), a null hypothesis H_0 is created, i.e. "is the data white noise". As shown by Davis and Fuller (1941; 1996), Fisher's Kappa (FK) test statistic (Fisher, 1929) can be used to test for randomness. The equation below is from Fuller (1996, p. 363),

$$\xi = \left(\frac{1}{\mathrm{m}}\sum_{k=1}^{m} I_n(\omega_k)\right)^{-1} I_n(L) \text{ or adapted} = \frac{\left(\left(-1+\frac{m}{2}\right) * \ max(m)\right)}{\Sigma(m)} \tag{15}$$

4 Matlab's built-in function to produce randomized noise from a standard normal distribution was used where $I_n(L)$ is the largest periodogram value of a sample with m periodogram values having two degrees of freedom. The FK test statistic ξ is compared against the Fisher distribution in Fuller (1996, p. 364). In similar fashion, Bartlett's Kolmogorov-Smirnov (KS) test statistic to test for white noise is employed (Massey, 1951; Smirnov, 1948). The KS test extracts similarity (D_n) value between two distributions (F^1 and F^2) and reveals the maximum discrepancy between the two:

$$D_n = \max_x |F_n^1(x) - F_n^2(x)| \quad (16)$$

D_n is then compared against critical values to either reject or accept the null hypothesis. KS critical values are calculated using α-leve l 5% = $1.36\sqrt{\frac{1}{sample\ size-1}}$ and α-leve l 1% = $1.63\sqrt{\frac{1}{sample\ size-1}}$ (Massey, 1951; Smirnov, 1948). FK is generally better at handling a single sinusoid that is noise-buried, while KS is more sensitive to broad discrepancies in the white noise spectrum (Massey, 1951; Shimshoni, 1971). It is therefore expected that small sample sizes may yield mixed results. For these reasons, both tests are conducted in the practical part of analyzing time series data in later chapters. If both the FK test statistic is larger than a threshold value at indicated α-levels, and the KS test statistic as well exceeds threshold values, then H_0 is rejected and further analysis using Fourier Transform is avoided. Critical values for KS was taken from Massey (1951). For FK critical values, it was necessary to run a custom created software program to create a distribution table for the purpose, as published tables (Fuller, 1996; Nowroozi, 1967; Shimshoni, 1971) lacked critical values for the data sizes investigated. The source code for the software as well as the FK distribution table are located in Appendix 8.4 + 8.5. In reference to the sample plots above in figure 2-3, the following results are revealed, where the test statistics were calculated on the sample functions to illustrate applicability of white noise testing:

Plot	Function	Fisher's Kappa	Kolmogorov-Smirnov	Outcome	Critical values
Plot #1	1 Hz (1 amp) No Gaussian noise	1499.000 (<0.0001)	0.999 (<0.0001)	Reject H0	Fisher's Kappa: 5%: 10.9610 1%: 12.585 Kolmogorov-Smirnov: 5%: 0.02483 1%: 0.02976
Plot #2	100 Hz (2 amps) 12 Hz (1 amp) No Gaussian noise	1199.200 (<0.0001)	0.800 (<0.0001)	Reject H0	
Plot #3	100 Hz (2 amps) 12 Hz (1 amp) + 6 * Gaussian noise	68.146 (<0.0001)	0.048 (0.002)	Reject H0	
Plot #4	Pure Gaussian noise	7.202 (0.675)	0.019 (0.653)	H0 cannot be rejected	

Plot #5	1.2 Hz (1 amp) 0.8 Hz (2 amps) + 1 * Gaussian noise	696.387 (<0.0001)	0.720 (<0.0001)	Reject H0

Table 2-4 – Fisher's Kappa and Kolmogorov-Smirnov tests on sample functions

P-values in brackets. Critical values are shown for n=3000.

As outlined in Table 2-4, and in line with the expected results, FK and KS numerical analysis produce the same conclusions as the visual inspection of the periodograms in Figure 2-3. All plots except for Plot #4 show test values well above the critical values arguing for non-randomness in the sampled time series data. These tests will be conducted in later analysis and are deemed reliable in assessing the periodicity of time series data.

2.5.3.1.4 Inverse Fourier Transform

Once a wave function or signal is decomposed, it can be transformed back into a close approximation of the original by taking the inverse of the FT. The following shows an inverse Fourier Transform (IFT):

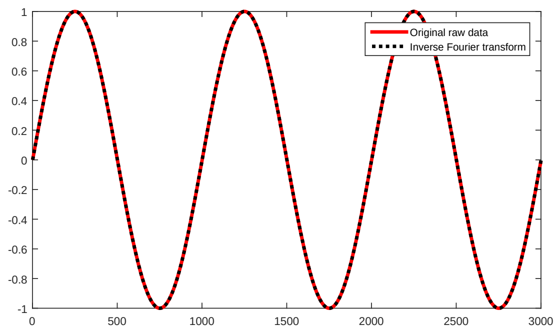


Figure 2-4 – Inverse Fourier transform of sin(2π)

Samples, n = 3000

The inverse matches the original signal perfectly. To be fair, the wave function is simple and has a large sample of periodic data. However, IFT of other signals with more stochastic appearance is approximated nicely as demonstrated later in the case analysis. Both FK and KS tests demonstrate capability at detecting randomness, and FT demonstrates capabilities at extracting cyclical patterns. It being understood, however, that FT exhibits a few challenges, 1) the FT is constrained by the stochastic features of the underlying data, and therefore mixed results can happen and 2) forecasting with FT cannot be used to predict the future but only at best yield an approximation based on historic data. On the other hand, FT has shown to produce reliable results in other studies. In light of the science theory described and given the above challenges, FT is benchmarked to determine which forecasting tool provides better for the time series at hand.

2.5.4 Monte Carlo Simulation in brief

For conducting sensitivity analysis on results, a Monte Carlo (MC) approach (Metropolis & Ulam, 1949) is used to provide a list of all possible scenarios within certain range. The range is defined based on prior data, while keeping in mind the arguments by Brealey et al., (2011) on the 'Garbage-In, Garbage-Out' principle. It is understood that MC scenarios generated, are not based on the likelihood that a given scenario *will* or *can* happen in real life. The MC simulation is provided purely in the sense of 'what if scenarios', rather than 'reasonable will-happen scenarios'. That being said, all MC scenarios modelled are based on parameters that are assumed to be in "sensible" ranges, although results may not yield reasonable scenarios. To try to achieve balanced MC scenarios, selected parameters in the MC simulation will follow a standard normal distribution, albeit recognized that Lego may not be a suitable candidate to follow such distribution at all.

PART II

Firm & Market Analysis

3 Strategic Analysis

The purpose of this chapter is to assess non-financial value drivers parameters that affect Lego. These value drivers are kept in mind in later chapters to align budgeting and forecasting models. Lego (LEGO A/S) is privately owned by Kirkbi A/S and the LEGO Foundation. The Kirk family, third generation of the original founder, Ole Kirk Christiansen, controls all entities. Lego operates in the industry for traditional toys and games[5] on a global scale and with a focus on the construction toys segment. Majority of the firm's income stem from the construction toys segment. A "rundown" of Lego, the firm's history and growth during more than 80 years of operation in the toy manufacturing industry is included and considered important to help illuminate the inner workings of the firm in strategic perspective later on. A description of the firm's strategy, perspectives and possibilities is incorporated. For a summarized overview of the Lego history, see Appendix 8.6.

3.1 Firm introduction

3.1.1 History of firm in strategic perspective

In 1891, Mr. Ole Kirk Christiansen (OKC), the yet-to-become-founder of Lego, was born as the 10th son of an underprivileged family from Jutland. When OKC was still a young man, his older brother trained him in carpentry. After a few years of training, OKC went abroad for five years to further his skills and gain experience with the carpentry industry. In 1916, he returned to set up a carpentry shop in Billund, Denmark called "*Billund Maskinsnedkeri og Tømrerforretning*" *(The Billund Carpentry Shop and Lumberyard).* The carpentry shop did general carpentry work, mainly building construction. During OKC's time abroad, he met his wife to-be, Kirstine Sørensen. Together they had four sons.

In 1924, two of the sons, Godtfred Kirk Christiansen (GKC) and Karl Georg Kirk Christiansen played around in the carpentry shop with some wood shavings and a hot glue gun. A fire was accidently started by the two boys and the carpentry shop and nearby residence of the family was lost. Following the fire, OKC had an architect draw up plans for a new and larger building featuring shop and residence for the family. During the 1920's the

[5] The thesis sticks to the definition from Euromonitor of the market. This is for consistency and to use numbers later on for forecasting and projection. "This is the aggregation of baby (0-18 months), infant (19-36 months), pre-school (3-4 years), construction, arts & crafts, scientific/educational, dressing up & role play, dolls & accessories, action figures & accessories, plush, model vehicles, radio/remote control toys, games & puzzles, outdoor & sports toys, ride-on vehicles and other traditional toys and games. Traditional toys and games are objects of play which do not involve a video game component. (Euromonitor, 2015d)"

carpentry shop became well-known for its quality work and despite a few larger projects were commissioned, the business was often close to bankruptcy – mainly due to lack of demand (Hughes, 2010). In perspective hereof, Billund's population was only around 300 in 1930.

In 1930, the Great Depression reached Denmark shortly after the US Stock Market crash in October 1929. The Christiansen family struggled even harder to survive with almost no carpentry work commissioned. To relief the situation, OKC switched strategy from general carpentry work and instead started to make minor households items, including Christmas tree stands, stepladders, and more – all of which were mainly sold to farmers in neighboring areas (Mortensen, 2012). 1932 turned out to be an eventful year in the history of the Christiansen family; OKC's wife dies leaving him to raise their sons alone. Same year, a lightning strikes and the carpentry shop is once again lost in a fire. According to history (Hughes, 2010; LEGO, 2012b; Mortensen, 2012), OKC found inspiration amidst the 'challenging' situation of being a single parent; by using some leftover wooden materials from the carpentry shop he created a wooden toy for his sons to play with. He noticed his sons enjoyed the toy – the basics for wooden toy manufacturing was established. Same year (1932), GKC, now twelve years old, joins the family business.

Kiddikraft a competing British firm also started producing wooden toys. As Lego had its struggling beginnings so did Kiddikraft and was also near bankruptcy mainly caused by lack of demand (Saunter & Hughes, 2008). Besides wooden materials, Kiddikraft's founder, Mr. Hilary Fisher Page experimented with plastics as he was unhappy with the wooden materials for "hygienic reasons" (Saunter & Hughes, 2008). As Page described it much later (1946) *" [...] for generations we have tried to find some type of paint or enamel which cannot be sucked or gnawed off, in view of the fact that practically every toy or plaything given to a baby or a young child goes straight to his mouth. [...] "*. In 1939, Page filed a patent for the invention of the first plastic brick and would later be awarded several other patents related to plastic bricks (Page, 1940, 1949).

In 1934, the Billund carpentry had grown to seven employees (Mortensen, 2012) and main products were toys and various household items – all made of wooden materials. The firm took a name change to *Lego Fabrikken Billund, Fabrik for Trævare og Legetøj (The Lego Factory Billund for Wood ware and Toys)*. "Lego" is a contraction of the two Danish words, *Leg Godt* (*Play Well*). Unbeknownst to OKC at the time, Lego is also

Latin for *"to gather, collect, select"*, and more loosely interpreted, *"put together"*. By 1939, Lego had grown to 10 employees and for the first time, started to be profitable (LEGO, 2012b). World War II breaks out. Before the war, Germany was the largest exporter of toys to Denmark. As the war intensified, German firms shifted to production of war related equipment and German toy exports grinded to a halt. Danish toy manufacturing firms (Lego and a few others) would eventually more or less occupy the entire Danish market space themselves now that German firms had stopped exporting.

The 1940's signals a pivotal point for Lego; in 1942, the firm had grown to 15 employees. The carpentry shop burned down for the third time[6] and OKC decided to have a new and larger building constructed – this time featuring assembly line production. By 1943, Lego had grown to around 40 employees – still producing wooden toys and household items. During the war, it was common with shortages of various raw materials including crude oil, iron, coal and other materials. When the war ended, raw materials for plastic[7] became readily available again, and the demand for plastic surged, not only for toys but also in use for other consumer items. Kiddikraft had at this point been working with plastic toys for almost a decade and naturally had a head start. Kiddikraft introduced product lines called *Sensible Toys*, including the *Interlocking Building Cubes*, also known as *Bri-Plax*. Mr. Page invented the Bri-Plax and patented the building blocks before the war broke out.

In 1947, the arrival of a plastic injection-molding machine takes place at Lego after OKC had seen a demonstration of the machine's capabilities at a tradeshow. Soon after, Lego began production and introduced its first line of plastic toys. Mr. Page visited Lego in Billund and Lego received both samples and drawings of Kiddikraft's toys. Lego (perhaps) felt inspired as the firm two years later, in 1949, launched its own plastic bricks called the *Automatic Binding Bricks* – which were remarkably similar to Page's Interlocking Building Cubes (LEGO, 1997). Arguably, the Automatic Bindings Bricks laid the foundations for the "Lego Empire", in the sense that majority of Lego's products would later be based on the concept of assembling and disassembling bricks for play and learning. Besides the Automatic Binding Bricks, Lego continued to produce wooden toys but also a few other plastic toys without the binding functionality. In 1948, Lego had grown to 50 employees. At

[6] A short circuit in the electrical installations caused the fire.
[7] Crude oil is the main component of plastic, but plastic includes other components as well that varies depending on the type of plastic

the end of 1949, the firm produced around 200 different plastic and wooden toy items, including the Automatic Binding Brick.

In 1951, half of the firm's output was plastic toys (Knowledge@Wharton, 2012) – most of the toys were not plastic bricks but instead larger plastic items such as plastic cars and tractors. In 1953, Automatic Binding Bricks were renamed LEGO Mursten ("LEGO Bricks"). However, only around 5% of total sales were LEGO Bricks (Saunter & Hughes, 2008) at that time. Two years later, the "System of Play" philosophy was born, which essentially put Lego bricks into a more formal "play system" enabling play with multiple but different Lego product sets at once. The aim was to increase value of play. The System of Play idea was sparked after GKC met a toy buyer from Denmark who expressed concerns that most toys were *"[...] 'one-off' items and [...] no cohesive toy system available"* (Hughes, 2010). The philosophy of putting play in system was quite unheard of at the time but GKC picked up the idea. Mr. Page did not take much notice of the LEGO Bricks, perhaps because he was occupied with trying to successfully commercialize his own Bri-Plax products at that time (Saunter & Hughes, 2008). After years of struggling financially with his business, Mr. Page committed suicide in 1957. Kiddikraft, however, continued to operate for another twenty years. In 1957, GKC was appointed managing director of Lego. By 1958, Lego had grown to 140 employees. Same year, Lego was granted a patent for the "stud-and-tube" coupling system that is used in Lego bricks today. The previous Lego bricks lacked what Lego refers to as "clutch power". Without clutch power, the bricks could easily fall apart. With the stud-and-tube bricks (shown below) binding power between the bricks would be stronger and at the same time be easy to assemble and disassemble.

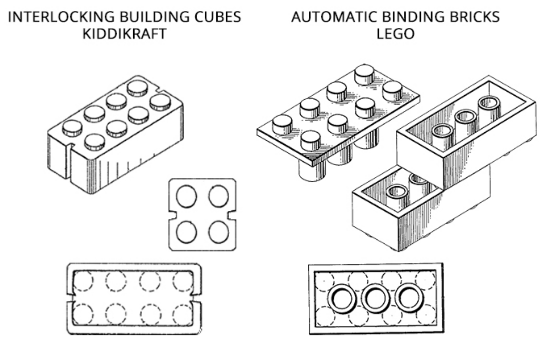


Figure 3-1 – Kiddikraft cubes and Lego bricks

Left: Interlocking Building Cubes from Kiddikraft. Right: The Automatic Binding Brick from 1958 by Lego featuring studs and tubes for better interlocking mechanism than Lego's previous bricks due to friction.

Looking at the figure above, the bricks look somewhat similar. Years later, Lego described the design process as follows: *"With the cooperation of a tooling works in Copenhagen, we modified the design of the Kiddikraft brick, and molds were made. The modifications in relation to the Kiddikraft bricks included straightening round corners and converting inches to cm and mm, which altered the size of the brick by approx. 0.1 mm in relation to the Kiddikraft brick. The studs on the bricks were also flattened on top."* (LEGO, 1997).

At the beginning of the 1960's, Lego employed around 450 people and at the end of the decade around 850. During that period, expansion continued with five new sales offices in Europe, a production factory in Germany, and total sales in 42 countries. In 1960, the wooden toys product lines were entirely discontinued after a fire stroke the wooden toys manufacturing department for the fourth time in Lego's history. By discontinuing the wooden toys production, Lego became strategically more focused, as it now "only" had to be concerned with plastic toys. Research of British manufacturing firms has shown that product diversity does not equate profitability (R. M. Grant, Jammine, & Thomas, 1988). Following the discontinuation of wooden toys, all non-"System of Play" toys were discontinued entirely and upwards 90 % of the entire toy product line was removed (Kipp & Robertson, 2013). When Lego closed down the production of wooden toys, GKC's brothers, Karl Georg and Gerhard set up a new firm called Bilofix, resuming wooden toys production outside of Lego.

Lego established sales in the USA and Canada in 1961 via an exclusive license and distribution agreement with Samsonite Corporation[8]. In 1965, Samsonite Corp. erected a production facility in the USA entirely devoted to production of Lego toys. At this time, production of Lego elements were globally 706 million. Due to a disagreement between Lego and Samsonite, the license agreement ended in 1972. Instead, Lego established its own sales office, to handle sales for the North-American market, although Samsonite kept distribution rights for Canada until 1984. In 1968, Lego opened its first theme park called LEGOLAND in Denmark – which was visited by more than 500,000 people in its first season, and a combined 5 million visitors six years later displaying the interest for Lego.

In the 1970's expansion continued – Lego had grown to 3,000 employees with more offices and sales channels established around the world. In 1972, global production

[8] *Samsonite Corp. is today known for manufacturing luggage items and suitcases.*

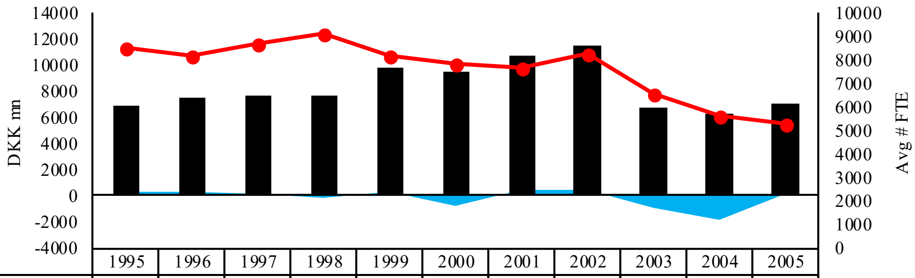
reached 1.8 billion Lego elements per year. In 1977, Kjeld Kirk Kristiansen (KKK), GKC's son, joins management of Lego. Kiddikraft was sold to Hestair, a conglomerate producing various toys and consumer stationary. At this time, Kiddikraft had 30 patents, which Lego acquired in 1981 in full as it entered legal battles with US firm Tyco[9]. In 1978, LEGO Mini Figures were introduced. Mini figures are essentially miniaturized plastic figures of various sorts like firefighters, police officers, astronauts and more. Simultaneously, the entire line of Lego products were scaled to a more natural height/width ratio to be more in harmony with the proportions of mini figures. Previously, without the scaling, Mini Figures products could be taller than some product sets, for example buildings and machinery. The "scaling move" may seem insignificant at first but before that, the interoperability/System of Play was not optimal as the Mini Figures would not fit well with particular products and therefore take away "play value" from owning certain product sets (Kipp & Robertson, 2013; D. C. Robertson & Breen, 2013). With Lego's strategic move to scale of all its product sets to a common ratio, customers were now able to mix all product sets across product lines. The key point here is that, the more product sets a customer bought even more value than previously could now be derived by combining with previously acquired Lego sets. Arguably, the scaling move further strengthened the System of Play, as all products would now be proportional as well as compatible and playable across product lines.

In the years, 1978-1983 the firm showed a 14 % revenue growth every year. KKK took over as CEO in 1979 and in 1983, the patent for the stud-and-tube coupling system expired but the ideas described in the patent still remains the foundation for Lego bricks sold today. Lego had grown to 3,700 employees worldwide and two years later in 1985 to 5,000 with the majority of the employees situated in Billund (around 3,000 in total). Lego started a collaboration with the Massachusetts Institute of Technology Media Lab, USA (MIT). The aim was to understand technology and learning processes better and to enable Lego to introduce new products in the educational space. In 1986, the collaboration enabled Lego to introduce its first learning product called "LEGO Technic Control" to various schools in the USA. The product enabled users to program behavior of their Lego constructions via a computer. The product however, required technical knowledge of computers and programming and was not easily playable by students without a fair amount

[9] *Tyco was a firm marketing toy bricks similar to the Lego bricks*

of learning. The introduction of Technic products in conjunction with computers marks Lego's first entry into the digital age. Also in 1986, GKC resigned as chair and KKK took over. In 1987, Lego products were available in 115 countries and the firm had grown to 6,000 employees, all while steadily introducing new products. Overall the 1980's signified growth but also changes in the markets, including the advent of the digital age, shorter product life cycles, consolidation among Lego's larger customers and competitors outsourcing (Lunde, 2012). According to Grant (2010), changes in demand growth and technology over an industry's life cycle, will naturally have implications on both competition and competitive advantage for the players within said industry. Since the toy industry have shown to be generally fast paced and short-cycled, it generally requires firms to foster a high degree of innovation to avoid falling behind competition. In 1987, Lego internally indicated, that the firm was in beginning trouble due to market changes all while employee growth and revenue continued (Lunde, 2012). The trouble became evident in the 1990's as Lego faced economic turmoil and entered a decade signified by major strategic changes. In 1990, Lego became one of the world's 10 largest toy manufacturers (Mortensen, 2012), and had grown to around 7,500 employees in 1991. In 1993, KKK steps down temporarily because of illness; a constituted CEO takes over but no real leadership is evident (Lunde, 2012). Lego continued on its growth path but profitability and revenue did not follow and were more or less stagnant. From the side it became apparent to KKK that Lego required changes – in his own words KKK described the organization as "*rigid and too focused on reporting*" (Lunde, 2012). In 1994, KKK recovered and returned to Lego. In his absence, Lego had grown to 8,800 employees but economic results were still lacking. Meanwhile, Lego continued to spew out new products in steady pace. KKK returned to Lego with new ideas and a plan called Compass Management. The sole purpose of this plan was to inspire for creativity and revitalize energy within the firm. Compass Management also aimed at ending bureaucracy and centralization, enabling employees to act more on their own. Despite full of good intentions, the plan failed and was perceived by Lego employees as uninspiring and lack of visions (Lunde, 2012). In an interview to a Danish media in May 1995, KKK said the following about his thoughts for the next 10 years: *"We will sell double of what we do today, perhaps three times as much and our employee count will grow 50-100 %. Today, half of our employees are in Billund - most of the growth will occur on the factories abroad – Switzerland, USA, Korea etc. Hopefully will we at that time have opened four new*

LEGOLAND parks - in all cases, will we be driven by growth" (Lunde, 2012). The quote illustrates Lego's high focus on growth. As argued by various scholars (Davidsson, Steffens, & Fitzsimmons, 2009), a firms' focus on sales growth, rather than growth from profits may make things worse in subsequent periods. Markman & Gartner (2002) argue, that growth in terms of sales and employee count does not equate into profitability. The following figure provides an overview of Lego's performance from 1995-2005.



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Net profits	240	259	74	-194	273	-831	433	428	-888	-1800	214
Revenue	6844	7534	7616	7680	9808	9467	10670	11426	6770	6295	7027
Avg # FTE	8535	8178	8668	9079	8190	7880	7641	8297	6535	5603	5302

Figure 3-2 – Lego revenue, profits and average full-time employee count 1995-2005

Note: The figure is created based on non-IFRS and non-reformulated data from the offical LEGO financial reports.
The numbers here cannot be directly compared with performance metrics shown in later chapters.
All numbers except for 'Avg # full-time employees (FTE)' are in DKK mn.

As evident from the figure, Lego was undergoing major structural changes; during the ten year period outlined in the figure, Lego faced deficits four times – first in 1998 (the first time since 1945), and again in 2000, then 2003 and 2004. In 1995, the firm generated around DKK 6.8bn with more than 8,500 full-time employees but 10 years later, that number had dropped to 5,300 employees. Revenues increased DKK 200mn over the period, however with fewer employees. In 1997-1998 Lego introduced its first computer game, called Lego Island. In 1998, Lego introduced Lego Mindstorms for building robots using simple programming and plastic bricks. Lego Mindstorms has later become a popular toy amongst kids and adults in the educational space, enabling the firm to capitalize on the digital age. In 1999, Lego began establishing license agreements to use Star Wars, and later Harry Potter and Indiana Jones and other movie franchises for its product offerings. These license agreements have since contributed significantly to Lego's growth and earnings according to the official financial statements. While these license agreements contributed significantly to Lego's revenue quickly after signing, in 2003, Lego was close to going bankrupt. A new CEO, Jørgen Vig Knudstorp (JVK) was appointed in 2004 to fix problems. As JVK said in an interview that Lego was too focused on churning out products, instead of asking what customers wanted and focusing on the core business (Knudstorp, 2014). JVK shifted the view from growth to profitability. Lego outsourced major parts of its manufacturing capabilities in 2006-2007 to Flextronics, a large manufacturing company in order to reduce costs further. However, this led to quality issues in the production but also to the loss of production skills – something which later was pointed out by JVK as part of Lego's core competences (Knudstorp, 2014). In light of this, Lego started insourcing manufacturing again in 2008-2009 but this time with a higher emphasis on low-wage countries than previously (Larsen, Pedersen, & Slepniov, 2010) to stay in 'the game' as competition were increasingly using China and other low-wage countries for production of their toys.

In 2010, Lego introduced the online computer game "Lego Universe" based on a part freemium / part subscription-based business model. The game reached almost 2 million users before it was shut down in January 2012. Despite positive feedback Lego was unable to develop a "*satisfactory revenue model*" for the game (Simonsen, 2011); essentially, majority of the 2 million users were non-paying with Lego only being able to convert a minor fraction into paying users. In 2014, Lego released a movie franchise called The Lego Movie in cooperation with Warner Bros. Pictures' animation studio. The Lego Movie had a high impact on Lego's subsequent financial result and Lego stated that the movie drove an increase in sales in the first half of 2015 by almost DKK 1bn compared to the first half of 2014. A movie sequel is planned for 2017. In 2015, TT Games[10] introduced "Lego Worlds", an online computer game franchising the idea behind Lego bricks, mini figures and other elements from the Lego brand. Lego Worlds is similar to the popular computer game called Minecraft. Minecraft was originally developed in Sweden but acquired by the US computer software giant Microsoft in 2014 for USD 2.5bn. Both games allow users to build and model digital worlds; Minecraft uses computer-modelled cubes, and Lego Worlds uses computer-modelled Lego bricks. Media has commented that the differences between the two games are hard to point out (Gilbert, 2015) while others see LEGO Worlds as a more advanced computer game (A. Robertson, 2015). In September 2015, Lego launched the "Toys-to-life" product called LEGO Dimensions. Toys-to-life products combine "offline" play with computer games. Other firms' including Activision, Disney and Nintendo have also launched products in the Toys-to-life genre. The Lego

[10] *Some of the Lego employees who originally developed LEGO Universe at Lego founded TT Games. In 2007, Warner Bros. acquired TT Games.*

Dimension game was well received and provided a strong revenue boost for Lego during the holiday season of 2015.

According to Lego, the firm's main competitors today are American firms Mattel, famous for Barbie products, and Hasbro with action figure products and board games like Monopoly, Scrabble and Yahtzee. Though Lego mentions these firms as main competitors, other firms such as the computer software giant Microsoft and the computer gaming industry are also competing in the market for toys and playing. Table 3-1 gives an overview of Lego's economic performance from 2006 until 2015.

Performance - DKK mn - Dec 31	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Revenue	7798	8027	9526	11661	16014	18731	23405	25294	28578	35780
Δ %		3%	19%	22%	37%	17%	25%	8%	13%	25%
Gross profit	4957	5606	6678	8459	11956	13653	17176	18469	21270	26820
Δ %		13%	19%	27%	41%	14%	26%	8%	15%	26%
EBITDA	1263	1752	2465	3403	5687	6422	8749	9268	10826	13538
Δ %		39%	41%	38%	67%	13%	36%	6%	17%	25%
EBIT	1325	1499	2175	2974	5081	5785	8095	8504	9879	12457
Δ %		13%	45%	37%	71%	14%	40%	5%	16%	26%
NOPLAT	1334	1104	1608	2288	3890	4372	6077	6359	7360	9459
Δ %		-17%	46%	42%	70%	12%	39%	5%	16%	29%
FTE	4908	4199	5388	7286	8365	9374	10400	11755	12582	13974
Δ %		-14%	28%	35%	15%	12%	11%	13%	7%	11%
Yearly production (in billions)	19	20	25	31	36	36	46	55	60	72
Revenue (DKK) / element	0.41	0.40	0.38	0.38	0.44	0.52	0.51	0.46	0.48	0.50
Δ %		-2%	-5%	-1%	18%	17%	-2%	-10%	4%	4%

Table 3-1 – Overview of performance, Lego 2006-2015

All production numbers are averaged, and 2007-2008 production numbers are estimated. Economic data is reformulated. The reformulation model employed is explained in later chapters. Numbers are rounded for display.

As can be seen from the table, Lego has shown consistent growth since 2006 quadrupling the top-line, and almost eight doubling the bottom-line, while setting records each year in the history of Lego. Employee count went from around 5,000 employees to almost 14,000 full time employees. While Lego generates revenue on other products than Lego plastic elements, an isolated view on its *revenue (DKK) per plastic element* indicates that for each element produced, Lego generates around DKK 0.5, equivalent to an almost 20 % increase from 2006. Summing up the last 10 years since 2005, Lego has returned to profitability and produced record-breaking results. Focus has shifted towards in-house production and continued emphasis on quality and core business, more licensed franchises, digital offerings, more of own shops, as well as more production facilities to cater for increasing demand. The firm's main activities are development, production, marketing and sale of play products (LEGO, 2015a). The following section outlines the products that Lego is currently involved with.

3.1.2 Products

Lego's products are all targeted at persons aged from 18 months and up. According to the firm, the core business offerings are, however, aimed at children in the age 18 months to 11 years old but in general, Lego's products can be used by anyone, though it is not the focus of the firm (LEGO, 2015b). All product ranges encourages play and aim to stimulate learning and skills (LEGO, 2015b). These toys are also referred to as STEAM toys and are toys that combine play with science, technology, engineering, arts and math. Other firms also produce STEAM toys, which is covered in later sections. The range of products include both physical products based on the traditional plastic bricks but also digital offerings such as computer and smartphone games through third parties. Besides traditional bricks, Lego offers additional compatible elements like plastic wheels, mini figures, motors, sensors and more. Some of Lego's product sets are based on movie franchises including Indiana Jones, Star Wars as well as Marvels' (owned by Disney) and DC Comics' (Warner Bros.) super heroes' themes featuring characters like Batman, Superman and others. The table below provides an overview of the products.

Area	Description	Target (years)
Pre-school	Duplo bricks	1.5-5
Juniors	Brick sets as transitional products to convert Duplo users to Lego brick users	4-7
Classic	Brick set without instruction manuals	4+
Play themes	Brick sets based on movies, books, and stories	5+
Bricks & More	Lego and Duplo bricks in bulk (buckets of bricks)	4+
Advanced	Brick sets with a "technical touch" - for building e.g. cars, planes, and robots	10+
Education	Products for class rooms and after school programs (pre-school, elem. and middle school)	Students / teachers
Board games	A combination of social play and bricks. Users build the games out of bricks, then play	7+
Digital	Digital offerings for computers, smartphones and consoles	7+

Table 3-2 – Overview of Lego's current product matrix

For the 'Pre-school' target group Lego offers the Duplo products. In essence, Duplo is oversized Lego bricks (i.e. twice the size of standard bricks) aimed at 18 months - 5 year olds. The dimension is an important aspect for that particular age group. The age is particular known for putting toys in their mouth (Saunter & Hughes, 2008). The size of Duplo bricks prevents the kids from swallowing the toys making Duplo safe to play with and therefore allowing Lego to aim products at this market. Duplo bricks and standard bricks can be used interchangeably as the stud-and-tube coupling between the two types are compatible. The Classic product lines are simply product sets consisting of bricks but without the instruction manuals that many of the Lego product sets feature – the aim is to inspire for creativity. Play Themes comprise the largest product offering from the firm. Play themes are built around a story, and include themes like the Star Wars universe, Jurassic Park and others, where some are licensed and others developed in-house. Advanced offerings include Technic and Mindstorms and are found in the STEAM toy category. The age range is from 10 years and up and the products require more skill and time to assemble than the average brick sets. Technic brick sets are bricks with technical features like pneumatic systems and motors. Mindstorms enables the user to build and program behavior of robots by employing various sensors for motion, sound and light. In addition, Mindstorms can be controlled with computers and smartphones. Educational products are targeted at pre-school, elementary and middle school students and teachers. Using a pre-developed curriculum in conjunction with various Lego bricks, educational products teach topics such as math, language, architecture, engineering, science and more and therefore falls within the STEAM category of toy products. Board games comprise of games in the same spirit as Monopoly, Ludo and similar. The difference here is that users have to build the games before they can play. Finally, Digital offerings comprise computer and console games like Lego Star Wars, the relatively new online game Lego Worlds and the Toys-to-life game, Dimensions. Dimensions is Lego's product offering that combines offline and online play in one concept. The product includes; 1) a computer game for popular gaming platforms 2) an interface between the computer (or console) called a "Toy Pad" and 3) classic Lego bricks some of which contain near-field communication technology that can be recognized by the computer game once moved to the Toy Pad. The idea is that consumers build game characters in the real world that are then playable in the computer game. The "starter pack" contains the three items described. 'Upgrades' can be added later on including new characters and options. Considering that the starter pack is around USD 100 and additional packs are around USD 30 at the time of writing, it is a relatively expensive product considering that the average toy price for example is around USD 10 in the USA (Toy Industry Association, 2015). No computer games are developed or owned by Lego itself, essentially leaving this part into the hands of others. TT Games, owned by Warner Bros., is developing majority of the Lego franchise computer games. The digital offerings are generally available on different platforms including computers, tablets, and smartphones and popular gaming consoles like Sony PlayStation, Microsoft Xbox and Nintendo Wii. According to Lego, the aim of the digital offerings is to *"provide digital content, play experiences, and tools that inspire and motivate children to live and share stories of their own creation."* (LEGO, 2015b, p. 5).

3.2 Market environment

The following sections contain a discussion of risk factors and likely drivers of value creation (destruction), which is assumed to affect Lego and in general the toy industry. As Lego operates in the industry for traditional toys and games and more narrowly in the category for construction toys both segments are considered when deemed relevant. An outlook of the future is included. The analysis will correlate and serve as foundation for the actual budgeting and valuation in later chapters. Factors such as currency fluctuations, recessions, and impacts of corporate taxation are not included. While these characteristics have impact on many, if not all, firms, they are assumed too general to describe here. The discussion and analysis takes its onset at the macro level and follows up with a micro level analysis.

3.2.1 Market outlook and competitive situation

According to Euromonitor, 60 different firms accounted for 50.20 % of the traditional toys and games sub-segment equivalent to USD 43bn RSP in 2014. Private label firms (1.9 %) and others (47.9 %) aggregated the rest. Using the Herfindahl–Hirschman Index (Herfindahl, 1950; Hirschman, 1945, 1964) to calculate firm concentration tells us that the traditional toys and games industry ranges in perfect competition with the HHI = 2.81%[11] for the top 60 firms and within this group, HHI equals 11.16 %, which still ranges in the perfect competition category. The insight tell us initially that in order to stay profitable under these market conditions, a high degree of innovation is required. However, competition amongst

[11] *The HHI number was calculated using the 60 largest firms' market shares as reported by Euromonitor, accounting for 50.2 % of the total market shares. Euromonitor aggregates both 'private label' (1.9%) and 'others' (47.9%) which makes it impossible to calculate the HHI precisely. Nevertheless it is fair to assume the concentration ratio will go down as all numbers are reported in descending order. For calculations, please see appendix 8.11.*

the largest firms tells us that the three firms (Mattel, Hasbro and Lego) combined cover 54.2% of firm shares, which c.p. increases the firm concentration ratio on supply side.

Firm	HQ	Products	2008	2009	2010	2011	2012	2013	2014
Mattel	USA	Barbie dolls, Fisher-Price, Mega Bloks, STEAM toys	12.0	12.0	12.2	12.1	12.2	12.0	11.7
Hasbro	USA	Action figures, board games (Monopoly, Yahtzee)	8.5	8.7	8.4	8.2	7.8	7.8	8.0
LEGO	Denmark	Lego bricks, STEAM toys	3.6	4.3	4.9	5.5	6.3	6.8	7.5
BANDAI NAMCO	Japan	Various toys, video games arcades and anime	1.8	2.0	2.2	2.3	2.2	1.9	2.0
Takara Tomy	Japan	Action figures, STEAM toys	2.2	2.4	2.5	2.8	2.5	2.1	1.9
Vtech	Hong Kong	Various infant learning toys	1.4	1.4	1.4	1.5	1.6	1.8	1.8
Hallmark Cards	USA	Crayola, greeting cards and gift cards	1.4	1.7	1.6	1.5	1.6	1.6	1.6
MGA Entertainment	USA	Bratz dolls	1.3	1.2	1.3	1.4	1.4	1.4	1.4
Brandstätter	Germany	Playmobil	1.1	1.1	1.1	1.1	1.1	1.1	1.2
LeapFrog	USA	Interactive and electronic learning toys	1.0	1.0	1.1	1.2	1.3	1.3	1.2
Spin Master	Canada	Meccano STEAM toys, and other	1.0	1.3	1.5	1.3	1.1	1.2	1.2
Simba-Dickie	Germany	Various and plastic toys wooden toys	0.9	0.9	0.9	1.0	1.0	1.0	1.0

Table 3-3 – Market share in % for traditional toys and games

Own creation. The figure shows list sorted firm shares in percent from 2008-2014 (latest available data). The list covers 40 % of the worldwide market equivalent to USD 34bn Retail Selling Price (RSP[12]). Lego overtook Hasbro in 2014 in terms of revenue and the numbers here reflect retail sales prices and cannot be compared directly. Source: (Euromonitor, 2015a)

The figure above shows the distribution of firms by market share in percent in the traditional toys and games sub-segment, with various firms operating in the STEAM toys category and thus in direct competition with Lego. As can be seen, Mattel, Hasbro and Lego captures four-five times the market share compared to the nearest firm BANDAI NAMCO having “only” 2.0 %. As indicated, a large number of firms exist in the traditional toys and games sub-segment. Other firms in the construction toys segment sell plastic bricks similar to those of Lego as the main patents for Lego bricks have expired. Even with direct competition, Lego remains dominant in the construction toys segment.

According to Lego (2015a), USA is the largest market for Lego, followed by the Western Europe region. Those regions account for a combined projected sales volume of 70 % (Euromonitor, 2015b). Major markets within the Western European region include UK, France, Germany, and Italy, which in 2015 saw double digit growth (LEGO, 2015a). Lego in China also experienced double digit growth in 2015 and is the single largest Asian market for Lego (Euromonitor, 2015b). Central and Northern European countries followed by single digit growth in 2015. Growth is expected to continue on Lego’s major markets in the coming years, and Asia Pacific will contribute significantly as well.

[12]*Euromonitor: “Historic regional/global values are the aggregation of local currency country data at current prices converted into the common currency using y-o-y exchange rates”*

Top selling products in 2015 were core products (Lego Bricks and Duplo) but new products like Lego Dimensions showed good performance as well (LEGO, 2015a) and is expected to grow in the coming years. The most popular toy within the traditional toys and games sub-segment are the Lego Brick products, which accounted for almost 8 % of the entire brand share value RSP in 2014 (Euromonitor, 2015a). In addition, Lego bricks brand share RSP is more than twice the size (USD 6058mn RSP) of the next competing product, Fisher-Price from Mattel (USD 2823mn RSP). Mattel's Mega Bloks account for around 10 % the size of Lego's total USD 6bn RSP but the Mega Bloks has been doubling over the period signaling general popularity of the bricks 'idea'. Historically Lego has dominated the construction toys segment and is expected to continue capturing most of the market in the near future (Euromonitor, 2015b). The following figure provides an overview of the most popular products sold in the toys and games industry measured by USD mn RSP.

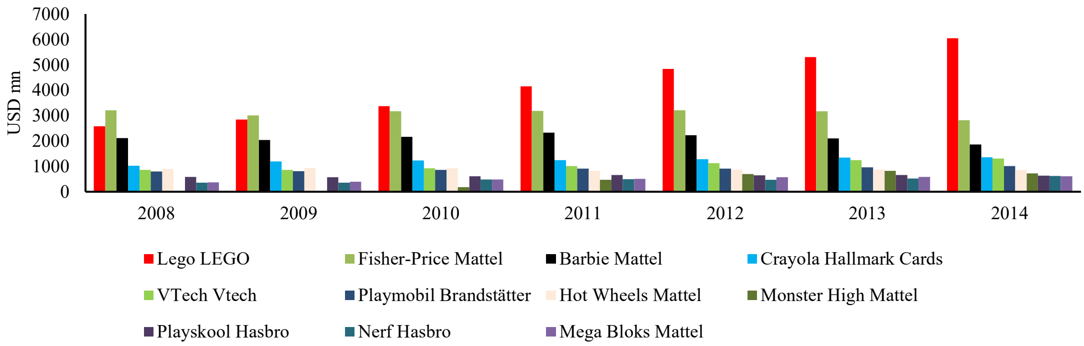


Figure 3-3 – Top products in the traditional toy and games industry

Own creation. 11 of the most popular products are included here – Mega Bloks is the smallest of them all.
For more products and numbers, please refer to Appendix 8.7.
The values are provided are in USD mn RSP. Source data (Euromonitor, 2015a)

As can been seen from the figure, Lego Bricks are well ahead of competition when measured on single product sales. Over the period, Lego is steadily growing. The figure above illustrates that Lego continued to grow over the period, and that it has the single most popular item in the toys industry.

According to the latest estimates from Euromonitor (2015b), the total (global) market size in retail sales for toys and games is USD 151.2bn in RSP, whereas the traditional toys and games sub-segment accounts for USD 85.1bn RSP including construction toys accounting for USD 8.3bn RSP worldwide. The following figure shows projected growth over the next 10 years, roughly indicating a yearly USD 2.7bn RSP growth in the traditional toys and games segment, where USD 0.8bn growth is expected in the construction toys segment.

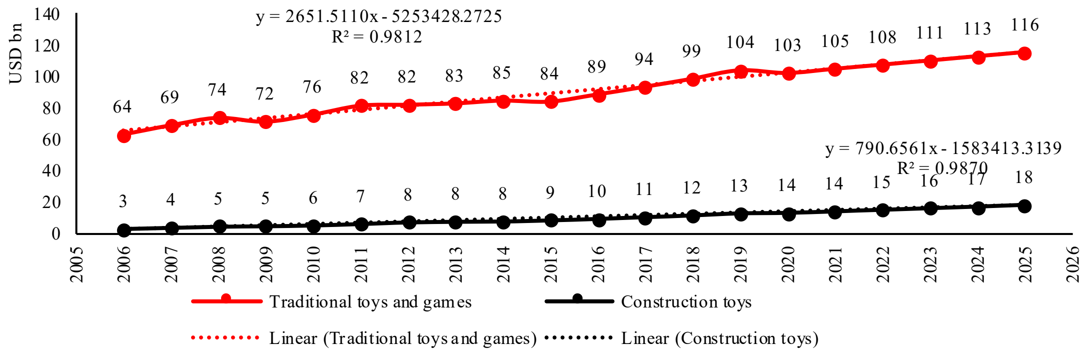


Figure 3-4 – Global market size in retails sales prices and projected growth

The figure shows projected growth in retail sales prices in billions from 2006-2025 using 2014 currency. All numbers are rounded in display. Traditional toys and games numbers from 2006-2019 are sourced from Euromonitor (2015c) estimates while Construction toys numbers are projected and forecasted based on numbers from 2009-2014 - also from Euromonitor (2015c). The projections are made using simple linear OLS estimation – Fourier analysis was avoided.

According to projections, the traditional toys and games sub-segment shows a CAGR of 3.048 % over the period (2006-2025) roughly doubling from USD 64-116bn, while construction toys show a CAGR of 8.884 % (increasing around six times from USD 3bn to 18bn). The Video Games segment (not shown in the figure above), more than doubles from USD 41b RSP to USD 91bn RSP over the period indicating the digital segment's popularity (being 91/18=5 times larger than the construction toys segment). In 2025, the traditional toys and games sub-segment is projected to grow annually by 2.34%[13]. This metric is used later as the growth factor for forecasting terminal sales growth for Lego. Worldwide there are around 4.04 billion potential consumers aged 0-14 in 2025, up from 3.34 billion in 2006 (Euromonitor, 2015a).

The following figure shows population by region and indicates that Northern America and Europe, Lego's largest markets are currently the smallest in terms of population.

[13] The number is calculated based on historic growth in the construction toys segment. For calculation and full numbers (including Video Games segment) please see Appendix 8.8.

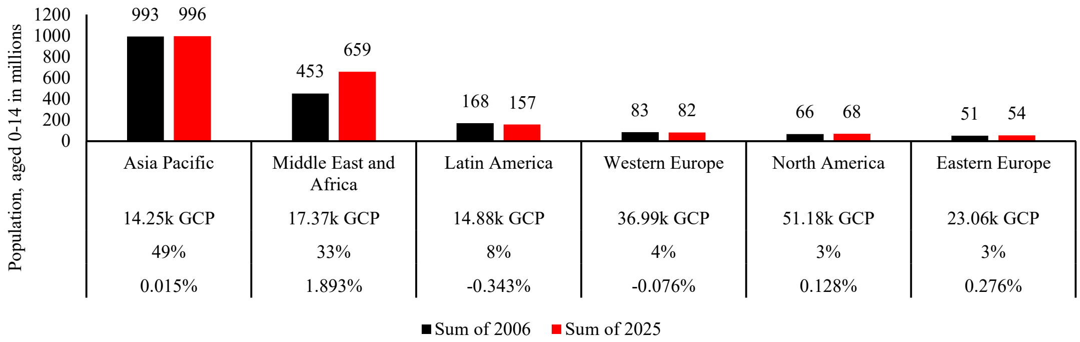


Figure 3-5 – Population by region, CAGR and GCP

The figure shows the distribution of population aged 0-14 years old by region. GCP means "GDP per Capita, PPP" using the latest number from 2014 calculated on constant USD 2011. Top the percentages show the share size compared to the world, i.e. 49 % of children aged 0-14 are located in Asia Pacific. The bottom percentages show the CAGR from 2006-2025. Own creation. Source data: (Euromonitor, 2015a; World Bank, 2016)

In total, North America and Europe account for a projected aggregate 204 million consumers aged 0-14 in 2025, whereas Asia Pacific alone is projected around five times that size in terms of consumers. This reveals the potential of the different regions.

3.2.2 Macro environment

The following table provides an overview of major market characteristics categorized by the STEEP/PESTLE model. The characteristics are explained in the following sections.

Category	Characteristic
Socio-cultural	Short product life cycles and digitization/mediatization of toys
Legal	Safety and product recalls Intellectual property
Technology	Oil

Table 3-4 – Overview of macro characteristics

Most socio-cultural characteristics are related to changing market trends in the toy industry. Legal characteristics deal with the implications of product quality, as well as intellectual property rights. Finally, oil in relation to technology, is investigated as Lego's product offerings largely consist of oil-based product parts.

3.2.2.1 Socio-cultural

3.2.2.1.1 Short product life cycles, digitization/mediatization of toys

Short product life cycles as well as seasonality continues to be a challenge for firms in the toy industry. According to Lego, approximately 60 % of sales every year come from new products. The firm explains that: "*[...] positive results are closely related to the constant and innovative expansion of the product portfolio [...]*" (LEGO, 2012a, 2013a, 2014, 2015a). This goes well in hand with the competitive landscape previously described, fostering a high degree of innovation. Lego has constantly introduced new products and innovation throughout its entire history (Mortensen, 2012) but prior to Lego's turnaround in 2003-2004, the firm's management ascribed long periods spent on product development as one of the reasons for the firm's losses (D. C. Robertson & Breen, 2013). Johnson (2001) explains that "*The toy industry faces relentless change and an unpredictable buying public, which creates immense challenges in anticipating best sellers and predicting volume. Like the high-technology industry, toys also suffer from many supply chain ailments including short product life, rapid product turnover, and seasonal demand".* Research from 2005 finds that supply-chain management 'know-how' in the toy industry lacks capabilities at handling seasonality and volatility (Wong, Arlbjørn, & Johansen, 2005). In fact, seasonal demand has challenged Lego's supply chain towards Christmas in various years since 2005, causing the firm to report 'sold out, out of stock' on items such as Duplo, City, Star Wars and Technic (Andersen, 2005; Berger, 2014; Carstensen, 2006; Haugaard, 2007; Henriksen, 2010; Ildor, 2015; Jørgensen, 2012).

Internet, movies and computer games, referred to as the 'mediatization and digitization challenge' produce another threat (or opportunity) for toy firms as consumers have more options for leisure time activities than possible just 10-20 years ago (Hjarvard, 2004). According to the Lego annual reports a large part of the firm's revenue stems from license agreements signed with the movie industry. In December 2015, the movie "Star Wars: The Force Awakens" was released. As mentioned earlier, Lego has franchised the Star Wars brand, and similar to previous Star Wars movies, the new movie release is expected to impact the toy industry positively (Euromonitor, 2015c). Moreover, Lego has franchised popular movie themes like Harry Potter, Indiana Jones, Batman and Spiderman. Three movie studios, The Walt Disney Company (Disney), Sony and Warner Brothers (WB, owned by Time Warner), control majority of popular movie themes franchised (IMDB, 2016). These studios often release new movies and spillover effects have historically been seen in the toy and games industry. Lego does not publicly disclose details about its license arrangements, i.e. when/if they will cease to exist. As the Lego Star Wars franchise is major revenue stream for Lego (LEGO, 2015a), it makes the firm's revenue vulnerable to large decreases should the license agreements terminate. Lego's own movie in collaboration with WB, The Lego Movie has previously fueled revenue growth for the firm.

Traditional bricks and toys are typically products that can be played/used solo or together with others but it requires physical presence of all participants. Modern computer games connected to the internet, offers solo as well as the 'social aspect' but does not require physical presence and in theory be played anywhere and across geographic and demographic borders as long as internet is present. Lego tries to capture the best of both worlds with its Toys-to-life product, Lego Dimensions. The game is anticipated to generate large revenue streams for the firm in the coming years (Euromonitor, 2016) and was according to Lego well-received at launch (LEGO, 2015a).

These findings indicate that innovation, agile product development, digital and media offerings, as well as franchised movie themes are resources to growth and valuation creation.

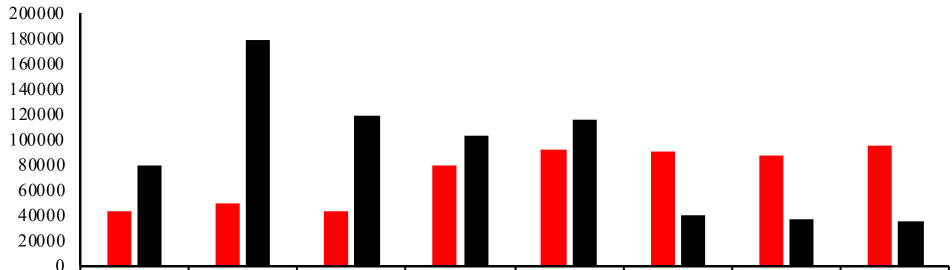
3.2.2.2 Legal

3.2.2.2.1 Safety and product recalls

The European and North American safety regulations for toys have a major impact on the toy industry and can result in product recalls as well as ban of products. For example, a component in one of Lego's products could be determined hazardous forcing both a product recall, but also force the firm to find a replacement component, which is extremely expensive. In 2010, concerns surfaced about a chemical called Bisphenol A (BPA). BPA is a chemical that hardens plastic and is found in Lego's Duplo products. BPA has been linked to cancer, decreased reproduction capability, and more. According to Lego, a ban of BPA would force Lego to shut down its entire Duplo product line, which is a major revenue driver for the firm (Mainz, 2010). Reports from the European Food Safety Authority have however concluded that BPA poses no risks to consumers at current exposure levels (EFSA, 2015). The BPA issue did not force Lego to shut down the Duplo line but bad press and media may create trust issues and reduce customers' incentive to buy products if they are perceived unsafe. In 2009, Lego recalled a remote control containing a battery in danger of overheating; although the impact in this case was limited, product recalls in general can be extremely expensive and may have a major impact on results (LEGO, 2009b). Since 2009, Lego has had zero product recalls. With Lego's new factory in China scheduled for major production in 2017, the firm is arguably subduing itself to increased risk exposure. According to studies by various scholars, Asia poses extraordinary challenges compared to more developed parts of the world. Anwar (2014) finds that most of recalled toys are manufactured in China, and in addition, Ahsan & Gunawan (2014) find that *"kids' products are recalled due to design and manufacturing faults, and for all types of products most recalls are initiated by the manufacturer."*. The situation signals that Asia on one hand is interesting given the growth opportunities but on the other may pose risk for the firm. As Lego is setting up its own factory, it is assumed that the risk exposure can be controlled.

3.2.2.2.2 Intellectual Property Rights

A recent report from the European Union Intellectual Property Office (OHIM, 2015) estimates that DKK ~10.5bn are annually lost in sales across firms in the EU toys and games sector due to counterfeiting products. This equals 13.2 % of losses in the entire toys and games sector, which was valued at DKK ~79bn in 2014. An additional DKK ~6.8bn in sales were lost in related sectors (OHIM, 2015). In 2014, EU Customs seized toys equivalent to only DKK ~320mn. Toys are the second largest category of products (10%) detained at the EU customs due to IPR infringement, while cigarettes account for 35 % (European Commission, 2015). According to the European Commission, China is the main country of provenance of suspected goods infringing IPR in the EU. Upwards 80 % of detained products in EU customs in 2014 came from China, closely followed by 8 % originating from Hong Kong (European Commission, 2015). The following figure shows the total number IPR infringement cases recorded in the EU from 2007.



	2007	2008	2009	2010	2011	2012	2013	2014
■ Cases	43671	49381	43572	79112	91254	90473	86854	95194
■ Articles (in thousands)	79076	178908	117959	103307	114773	39917	35940	35569

Figure 3-6 – IPR infringement cases in the EU

The number of cases can involve anything for 1 detained article to several million per case and can cover several different categories besides toys and games. It serves to illustrate that either EU has an increasing focus on IPR infringement, or more cases are recorded due to increased activity. On average 260 cases were recorded per day. According to the European Commission the recorded cases equaled value "only" DKK ~4.5 bn across all sectors (European Commission, 2015).

Similar reports have not been obtainable for the North American market at the time of analysis but it is expected to be similar in this region.

According to the Google Patents search database, Lego has an arsenal of close to 1,000 intellectual properties. Some patents are long expired and the original patent for the stud-and-tube-coupling system expired in 1978. Subsequently other firms have started to produce products similar to the Lego bricks. The name "Lego" is a globally registered trademark. Some of Lego's other trademarks involve product packaging, which the firm has proactively been using to fight copycat products with success (The New York Times, 2008). Other cases involve the product called "Mega Bloks", developed by Mega Brands and launched in 1984. Lego's largest competitor, Mattel acquired Mega Brands in 2013. With the acquisition, Mattel entered the STEAM toys category, in which many of Lego's products are also found. Mega Bloks are essentially doubled-sized bricks that fit well with Lego's original bricks. Mega Brands has won fourteen lawsuits filed by Lego all around the world. The legal battles involved Mega Brands' use of the stud-and-tube coupling brick system but Lego has lost on most accounts. Other lawsuits were filed on the ground that Lego's bricks have distinctive knobs on the top and therefore are eligible in trademark senses. However, courts did not rule in favor of Lego, preventing the firm from trademarking the design of the Lego brick (The New York Times, 2008). In 2002, Lego won a case against the Chinese firm Tianjin Coko Toy Co. for copyright infringement. The Chinese firm was issued a cease and desist order from the trial court. With Lego's growing focus on the Asia Pacific market, China is deemed a medium risk, as Lego's products and brand most likely will grow in popularity and be a sought-after commodity. This in turn may fuel growth of copycats and put a pressure on legal activities.

In relation hereof, the legal system in China is relatively young with its introduction only in 1979. To encourage foreign investment, the Chinese government has gradually developed its legal system and despite improvement over the years, China is notorious for its poor enforcement of IPR.

3.2.2.3 Technology

3.2.2.3.1 Oil

Lego's plastic bricks are made of a plastic resin called *ABS*[14] *Novodur*, which in turn is manufactured with crude oil. The German chemical firm Styrolution is the supplier of Lego's plastic resin pellets (BASF, 2015). It takes around two kilograms of raw material (crude oil plus energy) to produce one kilogram of ABS. According to latest available data, Lego used around 6,000 metric tons of plastic granulates in 2013 of which 70 % were ABS (Miel, 2014). Crude oil has historically shown to be a volatile commodity as can been seen from the figure below showing spot prices on Brent crude. Spot price movements of crude oil are naturally determined by supply/demand but according to the United States Energy Information Administration, crude oil prices also react heavily to geopolitical and major economic events (USA EIA, 2015). As can be seen from the figure, war, economic growth, financial crises, and spare capacity/supply all happened with price movements to follow. From 1987 to 1999 prices of Brent crude averaged USD 20/barrel[15], then moved to USD 40/barrel in 2000. In years 2003-2008 oil prices increased substantially and peaked in 2008 to USD 143.95/barrel when the global financial collapse set in. By 2015, crudes were trading at around USD 50/barrel. Prices on Brent and other types of crude oil move relatively close to each other due to arbitrage factors, though quality of the different oil types vary (USA EIA, 2015).

[14] Short for Acrylonitrile Butadiene Styrene, the technical name for component used to manufacture plastic resin pellets. Crude oils Brent and WTI (West Texas Intermediate produced in the USA) are the main oil types. There are different qualities of crude oil, and most are benchmarked and priced against Brent (crude from the North Sea), WTI and Dubai/Oman crude oil. WTI is a lighter variant of oil than Brent and has a higher yield in the oil-refining process. Dubai/Oman crude is typically of less grade than Brent and WTI.

[15] Around 4 % of a barrel of oil goes to the production of plastic, the remaining for gasoline, diesel and others (Ryrsø, 2014).

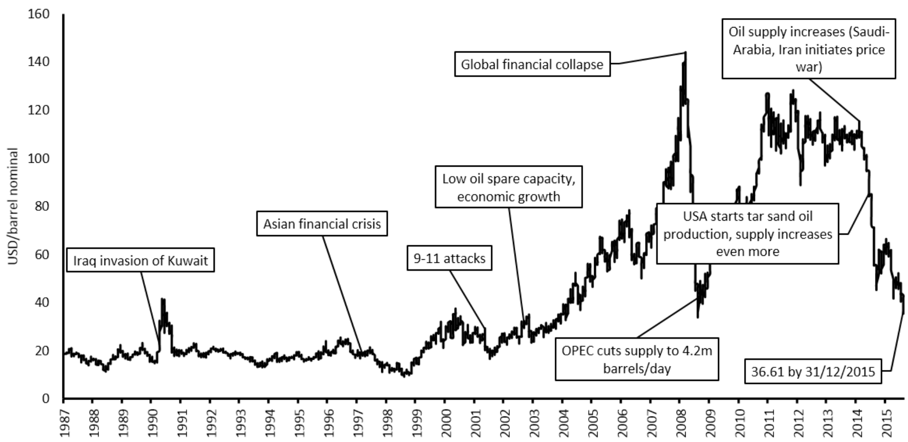


Figure 3-7 – Europe Brent crude oil spot prices 1987-2015

Own creation. Source date: (USA DOE, 2015)

As Lego's products are manufactured using refined crude oil, the oil prices have an impact on Lego. Lego does not mention to which degree oil prices affect earnings, just that 'earnings are affected', and sometimes in millions of DKK (Knudstorp, 2008; C. F. Schrøder, 2007; J. Schrøder, 2005). Using 6,000 tons of plastic raw material as a benchmark requires 12m kilograms of crude oil and energy. A barrel is ~139.9 kg, meaning it would require 12mn kg / ~139.9 kg ≈ 85.776 barrels of oil to produce 6,000 tons of plastic material. At a raw material price of e.g. USD 100 / barrel, raw material cost for crude oil is USD 8.6mn (DKK 56mn), with every one dollar price increase costing ~DKK 560,000 in raw material. As mentioned, Lego buys its granulate mostly from Styrolution, and with markups expected, price of sourced plastic material will naturally be more expensive than raw crude oil material prices. According to Lego, the firm has contracts on raw materials to hedge against price risk on the short term. In 2013, Lego's total production costs were DKK 7.4b. With an average crude oil price of USD 108.6 / barrel, Lego's raw material costs for crude oil were estimated USD 9.5mn (DKK 61.2mn), equivalent to 8‰ of total production costs (excluding any sales markup for final plastic granulate). Should such markup be even 100 %, raw material costs would double but account for only 16‰ of total production costs. Oil prices is a risk factor but it is not considered major given above assumptions. Conversely, Lego has recently decided to invest around DKK 1bn to find alternatives for oil based plastic resins before 2030 (Dengsøe, 2015; Trangbæk, 2015). Lego mentions that the investment is solely to be "*for research in sustainable materials with the aim of finding replacements for CO_2-heavy oil based products*" indicating focus on CSR rather than cost issues (Trangbæk, 2015).

Overall, the price of oil as well the usage of oil in production is considered a low risk factor for Lego.

3.2.3 Micro environment

The micro level environment is analyzed using the VRIO framework. According to Lego, the firm's strategy is focused on innovation and globalization of the System of Play (SP) products (LEGO, 2015b). Lego aims to 1) grow existing core business (i.e. products aimed at 1½-11 years old) and 2) develop new product lines to keep up with innovation pace, 3) expand presence globally so that the firm eventually is in every country. Moreover, Lego tries to leverage digitalization by combining physical play with digital play aiming to make physical play more "attractive and exciting" (LEGO, 2015b). In accordance with the VRIO framework model, the following sections describe the resources that are considered the most relevant at explaining Lego's economic performance.

3.2.3.1 System of Play

Many of Lego's products before the SP philosophy was developed, were not interoperable in the sense that they did not "fit well" together. Some products were in wooden materials, others in plastic, some were without stud-and-tubes, and some in different dimensions hereby causing lack of consistency and focus in product lines. By introducing the System of Play, it enabled the customer to buy e.g. a Lego farm product set at one time, and then combine this with e.g. a Lego airplane set at another time. In essence, the customer would derive "play value" from the farm product set itself, but adding play value by utilizing and combining it with other product sets. Once a customer has bought a Lego brick set, purchasing a new product that does not fit well with the Lego product may induce a perceived loss of value. In simple terms, the *perceived* value of buying e.g. two Lego's brick sets may be "1" for each (in total 2), but the 'play combination' may equal a perceived total value greater than "2". Should this hold true, the SP assumingly fosters the creation of a (perceived) lock-in situation. Such situation would reduce customers wanting to purchase other toy products, as customers would lose additional play value from not buying Lego toys. However, perception may change and customers are in general assumed to have low switching costs enabling them to find other suppliers of toys (and even plastic bricks), which work against the lock-in. Moreover, low switching costs will according to theory, lower prices (Farrell & Klemperer, 2007; Hendrikse, 2003). From a seller's point-of-view the play system enables a 'cross selling' strategy. Cross selling is the encouragement of a customer to buy product A but also product B from Lego. As argued by scholars Knott, Hayes and Neslin (2002), the challenge of cross selling lie in determining which products to target to which customers. Knott, Hayes and Neslin's research found that the single most crucial predictor for determining which product is bought next by a customer is the customer's current product ownership. These findings go well in hand with that of other scholars in the field, who find that profitability of marketing effects can be increased by utilizing purchasing history to increase cross-selling (Rossi, McCulloch, & Allenby, 1996). Juxtaposing these findings to the case of Lego, it illustrates why System of Play is an important strategic decision for the firm. It can be argued, that SP enables Lego to optimize marketing efforts and lower marketing costs in the sense that Lego customers' existing product purchases would encourage them to buy more products from Lego with less marketing efforts. Additional purchases will facilitate increased play value for customers and eventually generate more revenue for Lego. Furthermore, it can be argued that the strategy of SP also established foundations for a "technology ecosystem". The standardized stud-and-tube-coupling mechanism on bricks by Lego have introduced competitors to create compatible bricks (i.e. bricks that fit with Lego bricks, e.g. MegaBloks). In contrast to customized technology, well-known (standardized) technology assumingly fosters easier product adoption by leveraging on behavioral aspects of a given consumer: from game theory, the optimal choice is the one with the highest pay-off in a given situation (J. Nash, 1951). Comparing learning curves for successful usage of two substitutable products where one is well-known (i.e. less steep learning curve), and assuming a steeper learning curve is equal to lower pay-off, consumers will favor the "flatter learning curve product" as the pay-off here will be higher. Of course, this is a simplified scenario and other consumer aspects may work in opposite directions. For instance, consumers' willingness to improve cognitive abilities by challenging themselves using "steeper learning curve products" may encourage users to buy new and different products. In gist, Lego's real goal may be to find the right combination of learning (challenges) and play for a given customer group.

From a co-development perspective (i.e. other players that leverage existing technology to build their own products), standardization c. p. enables easier adoption. Examples hereof includes Microsoft's Robotics Studio, a software package that allows software programmers to develop programs and logic for the LEGO Mindstorms product sets. Microsoft essentially exploits existing technology (Lego bricks) to develop their own products. In contrast, if SP comprised of parts with differing sizes and interfaces, adoption by other firms would c. p. be slower (and perhaps lower too) and more costly due to a "steeper learning curve" (i.e. more parameters to account for). A good example of such anomaly was the "Lego Galidor" series, essentially products that did not work well with existing Lego products by employing many new plastic parts. Some of these parts would only work with the product set in which they were sold (Feloni, 2014). Eventually, the Lego Galidor series was discontinued because it did not fit well with the SP philosophy, hindered cross-selling, taking away play value etc.

Other firms and institutions embrace the System of Play philosophy by using Lego products in areas such as education, design and architecture. Furthermore, Lego bricks and mini figures are used in both computer games and movies. Essentially, System of Play has fostered the creation of a mini eco-system where disparate stakeholders derive and create value from Lego's product offerings. In my point of view, this is where the real value of Lego lies: System of Play is a well-known and more or less standardized technology that 1) is c. p. very simple in form and function and 2) allows for "unlimited" creativity, and in the end foster a competitive advantage for Lego. In summary, System of Play is arguably, one of the (if not the one) most valuable, rare, and costly to imitate resource developed as well as exploited by Lego. All products from the firm work together across product lines, enabling easy cross selling, foster increased play and learning value all while assumingly lowering marketing costs (as explained in previous sections). According to VRIO theory, when all four parameters are fulfilled, sustained competitive advantage can be achieved.

3.2.3.2 Brand

Lego has established a brand name with a long history since 1932. The brand signals amongst others quality and good and safe products according to the brand values promoted by Lego (Appendix 8.9). The following figure shows a development of 'reputation' over time measured by the Reputation Institute (2016).

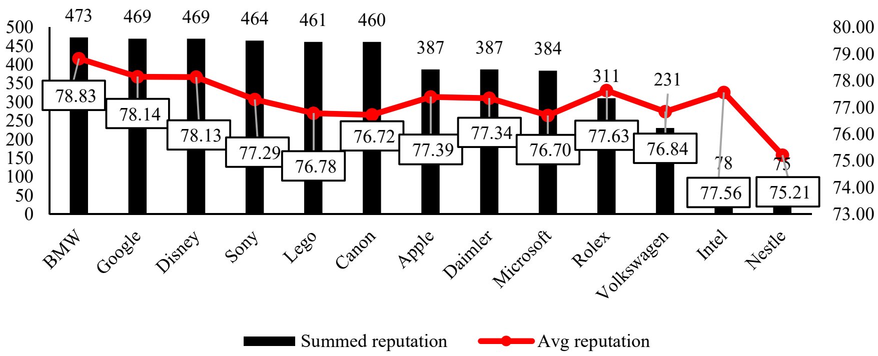


Figure 3-8 – Brand reputation 2011-Q12016

The figure list the most reputed brands in aggregated view with summed and average reputation for the period 2011-Q12016. The higher the score the better. The numbers are calculated based on global top 10 brands in the world per year. For more info on the numbers please see Appendix 8.10. Data: (Reputation Institute, 2016)

Lego is ranking in the Top 10 in all years and is on average no. 5 on a global scale. No other toy firms exist on the list. On a regional level, Lego is on average the most reputed brand in North America, typically scoring first or second place. The same holds true for Europe (Reputation Institute, 2016). However, in Latin America and Asia Pacific the firm is not even in Top 5 over the period. Arguably, the Lego brand is valuable as it is difficult achieve that level of reputation. It is rare as in no other construction toy firm ranks in top 100 (Nintendo, Japan is the closest here, but this firm resides in the video games segment). Further, achieving the same level of reputation is assumed costly. The brand is a VRIO-resource.

3.2.3.3 Stores + ambassadors

Arguably, Lego's brand stores are an important resource for the firm, given the short product life cycles in the industry. By having direct access to consumers through own stores (and not through independent retailers), it may enable Lego to capture market trends in relation to its products from first hand. This in turn may provide valuable feedback for product innovation and design teams at Lego. Lego currently operates 112 stores around the globe and expects to continue investing in this part of the supply chain. The stores promote only Lego branded products and therefore eliminates 'in-store' competition. However, just as operating own stores and promoting own products may enable direct access to consumers as well as lower the overall bargaining power of retailers, it may also increase the risk of losing retailers if they fear direct competition from Lego. Lego's brand stores are assumed valuable, costly to imitate (requires capex), and 'somewhat' rare as most toy firms sell products through independent retailers. Brand ambassadors include Lego's six LEGOLAND theme parks operated by Merlin Entertainments (ME), plus an additional three scheduled to open 2016-2018 in Dubai, Japan, Korea, and perhaps China or USA (exact schedule unknown). In addition, thirteen Lego Discovery Centers (indoor Lego attractions), also acts as ambassadors for the Lego brand. The new theme parks will cost around USD 300m a piece and for competitors would be costly to replicate. In 2015, 12.1 million visitors experienced the existing theme parks, generating GBP 429m. ME announced in their latest financial reporting, that they *"[…] firmly believe that there is scope for over 20 parks worldwide"* (Merlin Entertainments, 2015). None of Lego's major competitors operate theme parks besides Disney, who operates the most popular theme parks and attractions in the world with a combined 134m visitors per year (TEA, 2015). Lego's brand stores and ambassadors are assumed VRIO resources.

3.2.3.4 Production capabilities

According to the financial statements, Lego has large cash reserves. This allows the firm to react on market changes, invest in innovation and production capabilities. Production of plastic toys 'in-house' requires large capital expenditures, which may decrease the threat of new competition. For example, Lego's factory in China is projected to cost a 3 digit million figure EUR once completed in 2017 (LEGO, 2013b). The factory will cover 120,000 square meters and employ 2,000 workers. For industry entrants and existing competition, out-sourcing of production is possible but as indicated earlier, high quality and safety is key aspects of the toy industry. Many firms, including Mattel and Hasbro are already producing in low-wage countries like China to keep costs down. However, especially in China, safety and quality concerns have historically been low; outsourcing of production arguably yields a risk for new competitors. I consider Lego's production capabilities a VRIO resource for these reasons.

The following table provides an overview of the identified VRIO resources. The VRIO resources may according to theory on the topic, explain the economic performance of the firm.

Resource	Valuable	Rare	Costly to imitate	Exploited	Implication	Econ. performance
System of Play	Yes	Yes	Yes	Yes	Sust. comp. advantage	Above normal

Resource	Valuable	Rare	Costly to imitate	Exploited	Implication	Econ. performance
Brand	Yes	Yes	Yes	Yes	Sust. comp. advantage	Above normal
Stores + ambassadors	Yes	Somewhat	Yes	Yes	Competitive parity	Normal
Production capabilities	Yes	Yes	Yes	Yes	Sust. comp. advantage	Above normal

Table 3-5 – Overview of identified VRIO-resources

3.3 Summary

The strategic analysis of Lego and the industry has arguably revealed an exciting future ahead. Various risk, resources and capabilities were identified and the overall assumption is that Lego is prepared for growth. The next sections will dive into the Lego's as well as peer firms Hasbro's and Mattel's financials, to illuminate whether such growth assumption is reasonable.

4 Financial Analysis

The purpose of the following sections is to provide a thorough understanding of the economic operation and financing aspects of Lego and its competitors (peer group firms) by analyzing their respective financial statements. Financial statements, including income, balance and reformulation can be found in Appendix 8.13.

4.1 Accounting policies and reformulation notes

In total, 30 financial statements of three different firms are analyzed and reformulated. Peer firms were selected based on the findings in the strategic analysis, which indicated that Mattel and Hasbro were the closest competition in terms of current revenue and market size. However, growth and development over the period 2006-2015 shows little resemblance among the firms, which therefor can indicate an 'in-optimal' peer group selection. It is assumed that Mattel and Hasbro are the best possible candidates available.

Reformulation of financial statements is conducted to separate operating activities from financing activities. The reformulation and separation of line items is based, to a large extent on valuation guidelines provided by Sørensen (2009) and Koller et al. (2010). Using reformulated numbers, a Du Pont analysis is performed to gauge and compare the performance of the individual peer firms. Net operating profit less adjusted taxes (NOPLAT) and Return on Invested Capital (ROIC) are used as main components for budgeting and valuation in later sections.

The financial statement analysis used as foundation for valuation, covers a period of ten years from 2006-2015. Prior to 2007, the Lego financial statements were not following IFRS. When Lego changed to IFRS in 2007, rules of International Accounting Standards §1 and IFRS 1, states that "*[…] at least one year of comparative prior period financial information be presented"* (Deloitte, 2013) and as such the 2006 financial statement was adopted to comply with the rules set out. In contrast to Lego, peer firms Hasbro and Mattel employ United States Generally Accepted Accounting Policies (GAAP). This can lead to comparison problems as various items in the financial statements can be treated differently using GAAP vs IFRS. IFRS is currently adopted by 116 countries including the European Union (Pacter, 2015), while GAAP is only employed within the USA. Major differences between IFRS and GAAP relates to the way intangibles, inventories, and write-downs (Nguyen, 2010) are treated in financial statements. As example, GAAP permits inventories to be treated on cost-basis using the Last-in, First-out (LIFO) accounting method, while IFRS does only permit First-in, First-out (FIFO)-method. All peer firms are using the FIFO-method, so in this particular example, comparison is not considered an issue. Similarly, intangibles are treated differently – with IFRS intangibles are only recognized if they have "*future economic benefit and has measured reliability*" (Nguyen, 2010), while GAAP recognizes all intangibles at fair value. The fair value measurement was aligned for IFRS and GAAP in 2011 to eliminate cross-border comparison difficulties (IFRS, 2011). Comparison of peer firms' financial statements in relation to intangibles has raised no concerns. Write-downs can give mixed results in comparison when using either IFRS or GAAP accounting, as each method use different measurements of carrying value for the inventories. In the financial statements Mattel and Hasbro states they use "*lower of cost or market*", while Lego uses "*lower of cost and net realizable value*" for measuring value of their inventories. According to GAAP Accounting Standards Codification (ASC) 330-10-20, "*market*" is defined as *"current replacement cost (by purchase or by reproduction, as the case may be)"*, and in addition "market" shall not exceed net realizable value or be lower than net realizable value less profit margin. Net realizable value is defined in both IRFS and GAAP as *"estimated selling price in the ordinary course of business less reasonably predictable costs of completion and disposal*". It is assumed that the different measurements of inventory value will have no impact on the analysis in this thesis.

Lego reports gross sales as "*revenue*", while Hasbro and Mattel use either the term "*net revenue*" or "*net sales*". Mattel specifies that net sales is calculated as gross sales less sales adjustments (trade discounts and other allowances), which are recorded in Mattel's financial systems at the time of sale. The numbers are assumed comparable even if they have terms. This thesis will use the term "revenue" but it can cover both net revenue (Hasbro) and net sales (Mattel).

All financial statements, including reformulations are reported in their respective nominal currencies (DKK for Lego and USD for Hasbro and Mattel). As all firms trade internationally in various currencies, the impact of currency translation to local currencies is on average within a $\mp$ 1-3 % range for all years, and is assumed not to skew metrics and comparison in a major degree (Hasbro, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015; LEGO, 2006, 2007, 2008, 2009a, 2010, 2011, 2012a, 2013a, 2014, 2015a; Mattel, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015a). All numbers are rounded in presentation but all underlying calculations are made with all available decimals.

4.2 Reformulation of balance sheets

The balance sheets classify assets based on a liquidity criteria in current and non-current assets, and liabilities on a duration criteria, i.e. either short term or long term.
Balance sheets are reformulated into operating and financial non-current and current assets and liabilities. The reformulated operating assets are verified against a reformulation of financial assets to check for inconsistencies in the reformulation. The overall aim of balance sheet reformulation is to isolate various key metrics, including Invested Capital (IC) which is used in later chapters. IC is calculated as the sum of Net operating working capital (NOWC) and Net operating non-current assets (NONCA):

$$IC = NOWC + NONCA \tag{17}$$

NOWC is calculated as the difference between operating current liabilities and assets, and NONCA as the difference between operating non-current assets and liabilities, like the following:

$$NOWC = \text{operating current assets} - \text{operating current liabilities} \tag{18}$$

$$NONCA = \text{operating non-current assets} - \text{operating non-current liabilities} \tag{19}$$

The Appendix 8.12 specifies the line items for both NOWC and NONCA. The line items classification follows the guidelines indicated previously and will not be commented as such. A few of the line items, however, is described below as these are calculated and subsequently added to the reformulated balance sheets. These items include operating cash and operating leases.

4.2.1 Operating cash

Operating cash is added manually to the balance sheets for all peer firms, as the firms themselves do not report numbers. Instead, all peer firms state combined *cash and cash equivalents (CCE)*. Operating cash is calculated as the difference between CCE and *excess cash*, which in turn is also not reported in the peer firms' financial statements. Empirical evidence have shown that operating cash varies from industry to industry (Chudson, 1945), and that larger firms typically have a lower cash-to-sales ratio than smaller firms (D'Mello, Krishnaswami, & Larkin, 2008; Vogel & Maddala, 1967). In similar fashion, Opler, Pinkowitz, Stulz, & Williamson (1999) found evidence that firms with high credit ratings as well as larger firms with easy access to capital markets often have lower cash-to-sales ratios than comparable but minor peers and furthermore that cash-to-assets ratio has declined over the past fifty years or so. Koller et al. (2010), concluded from a study of all the S&P 500 non-financial firms between 1993-2000, that operating cash-ratios were as low as 2% of sales for some firms. Given these findings and the fact that Lego and peers are all large firms, a 2 % rate of revenue is assumed a good benchmark for calculating the operating cash line item.

4.2.2 Operating leases

All peers in the peer group including Lego employ operating leases to claim rights to various tangible assets instead of purchasing these. The operating leases include e.g. retail and office space, warehouses, plant and machinery. In contrast to debt acquisition (to acquire rights for assets), operating leases do not figure in a balance sheet. Instead, expenses related to leases are recorded in the income statements. This practice is referred to as *off-balance sheet (OBS) financing*. OBS financing can produce skewed financial ratios, thus hide true performance, making it difficult to compare peer firms' key figures like Return on Invested Capital (ROIC) and others (Koller et al., 2010). Lego and peers specify in their respective statements that their operating leasing contracts have different lengths and terms. A value estimation of the leases is conducted to approach and counter any imbalanced financial ratios. The operating leases are valued using the following equation:

$$Asset\ Value_{t-1} = \frac{Operating\ lease\ expense_t}{R_L + \frac{1}{asset\ life}} \tag{20}$$

Where t is time, $"asset\ life"$ is the expected life of the lease, and R_L equals cost of debt on the lease. Asset life is calculated as an average of asset life for all peer firms. Please see table 4-1 below.

Asset life (years)	**Buildings**	**Installations**	**Plant & mach**	**Moulds**	**Fittings**	**Average**
Lego	40.0	12.5	10.0	2.0	6.5	14.2
Hasbro	20.0	17.0	7.5			14.8
Mattel	20.0	15.0	6.5	3.0		11.1
					Average across peers:	13.4

Table 4-1 – Average asset life (years) for peer firms

Data from (Hasbro, 2015; LEGO, 2015a; Mattel, 2015a)

While the reported asset life for e.g. buildings typically are higher than for the remaining assets, the average across peers (13.4 years) is on par with previous research conducted by Lim, Mann & Mihov (2003). In 2003, they studied more than 7,000 firms in relation to market valuation of off-balance sheet items and concluded that the median useful life for OBS items (property, plant and equipment) was 10.9 years. The average asset life differs among Lego, Hasbro and Mattel but 13.4 years life is employed at all firms to equalize comparison. As leases are secured by the underlying assets and, thereby less risky than a firm's unsecured debt, Koller et al., (2010), specifies that R_L "*can be estimated by using AA-rated yields"*. The average *US Aaa Corporate Bond by Moody's* (Federal Reserve System (US), 2016) is calculated to 4.67 % yielding a discount factor of $(R_L + \frac{1}{13.4}) = 0.121$.

Bond yields – Dec 31	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Avg**
US Aaa corporate bond	5.56%	5.63%	5.31%	4.94%	4.64%	3.67%	4.24%	4.16%	3.89%	**4.67%**
Asset life	13.4									
Discount factor	0.121									

Table 4-2 – US Aaa Corporate bond yields

Data from (Federal Reserve System (US), 2016)

The capital value of the operating leases (COL) are located in Appendix 8.13.2.

4.3 Reformulation of income statements

All peer firms employ dirty surplus accounting thus impacting comprehensive income. To avoid skewed income data, dirty surplus items are cleaned. These items differ in both size and character amongst peers and relate largely to cash flow hedging, currency translation, tax items, reclassification of revenue, and pension plans.

4.4 Profitability analysis

To compare the individual performance of the peer firms, the Du Pont framework is employed. The Du Pont framework decomposes firm performance into *profitability drivers* related to operating activities and financing activities. Du Pont has an emphasis on return on equity (ROE). It is, however, argued by Koller et al. (2010, p. 166) that ROIC is a better performance indicator than ROE because ROE mixes operating activities with capital structure, thus making comparison amongst peers less meaningful. ROIC is a measure that indicates how well a firm is using its capital (free of financing) to generate value for its investors. Koller et al. (2010, p. 4) continues to argue, that ROIC relative to cost with a combination of growth is what drives value. Therefore, to avoid a skewed picture of true value creation, ROIC is used as the main metric in performance comparison. In the following sections, however, all profitability drivers are calculated and compared against peer group firms, as this will provide an overview of origin of performance (i.e. financing and/or operating activities). The value drivers are used as reference points for the valuation and reflection thereof in later chapters.

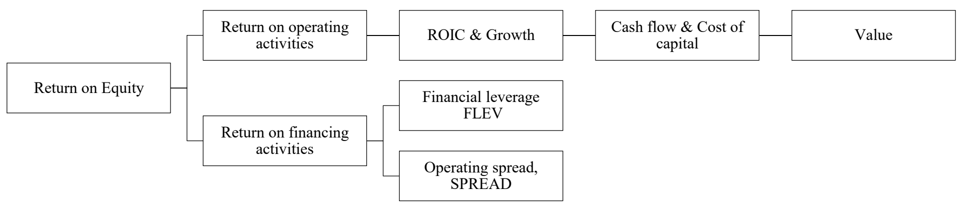


Figure 4-1 – Adapted Du Pont framework
Source: (Koller et al., 2010, p. 18; Sørensen, 2009, p. 255).

The entire Du Pont framework breakdown is located in Appendix 8.13.3.

4.4.1 Peer performance comparison

Comparing peer firms on top-line growth gives an indication on how sales are developing for the respective firms. A host of different elements, including standard demand and supply, capacity utilization and more, can fuel growth. The following figure compares Year-on-Year (Δ%) revenue growth rates unadjusted for currency impact.

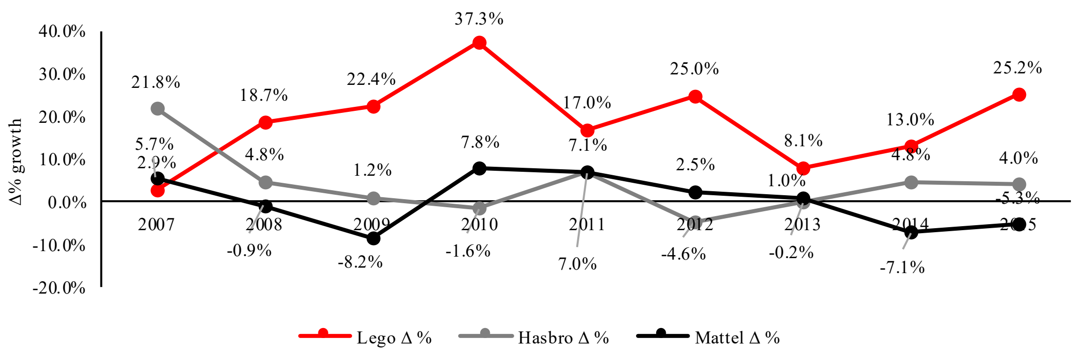


Figure 4-2 – Revenue growth compared to previous year

Over the period, Lego is showing larger year-on-year growth than peer firms, except for 2007. While a large increase in the average dollar rate (equivalent to more than DKK 1.00) to some extent has increased revenue "artificially" for Lego, according to the firm, adjustments for currency translation shrink the actual growth to 19% vs. 25.2 % (LEGO, 2015a). In previous years 2006-2014, the USD/DKK currency conversion rates have been somewhat steady (average of USD/DKK 5.54), hence only a minor impact due to currency. Without comparing the underlying numbers, growth percentages can give a distorted picture. In order to compare top-line performance among the firms, a currency translation between USD and DKK is made using yearly averaged currency rates. The following table is produced which shows Lego is growing more in absolute terms, than peer firms are. With an annual average growth rate over the period by Lego of DKK 3.10bn vs. ~DKK 0.81bn for Hasbro and only a negative ~DKK 0.033bn for Mattel, Lego has historically been performing better than peers. The compounded annual growth rates (CAGR[16]) show a similar trend with Lego toping the charts: ~16% annual growth versus 3.5% and 0.09 % for Hasbro and Mattel. Lego surpassed Hasbro in 2013 to become the world's second largest

[16] $CAGR = \left(\frac{Revenue_{2015}}{Revenue_{2006}}\right)^{\frac{1}{10}} - 1$

toy manufacturing firm, measured on revenue. Throughout the period, Mattel has larger sales than Lego, albeit the gap between Lego and Mattel seems to be narrowing (~DKK 26bn in 2006 and only ~DKK 2.6bn in 2015). Using an average USD/DKK rate of 5.54 (based on 2006-2014 numbers instead of 6.726 for 2015), Lego generates more revenue in DKK, than Mattel, all else equal, would have. DKK 35.8bn for Lego versus "only" 5.54 * 5703 = DKK 31.6bn for Mattel. This would make Lego the largest toy-manufacturing firm by revenue as of 2015.

Income ratios - Dec 31	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Sub
USD/DKK ultimo:	5.944	5.445	5.093	5.354	5.622	5.356	5.794	5.618	5.618	6.726	
Revenue											**Accum**
Lego, DKK mn	7798	8027	9526	11661	16014	18731	23405	25294	28578	35780	184814
Hasbro, ~DKK mn	18733	20895	20480	21779	22500	22954	23691	22932	24028	29914	227905
Mattel, ~DKK mn	33585	32507	30138	29075	32923	33561	37202	36429	33840	38356	337617
Hasbro, USD mn	3151	3838	4022	4068	4002	4286	4089	4082	4277	4448	40262
Mattel, USD mn	5650	5970	5918	5431	5856	6266	6421	6485	6024	5703	59724
Revenue growth YoY %											**CAGR**
Lego Δ %		2.9%	18.7%	22.4%	37.3%	17.0%	25.0%	8.1%	13.0%	25.2%	16.46%
Hasbro Δ %		21.8%	4.8%	1.2%	-1.6%	7.1%	-4.6%	-0.2%	4.8%	4.0%	3.50%
Mattel Δ %		5.7%	-0.9%	-8.2%	7.8%	7.0%	2.5%	1.0%	-7.1%	-5.3%	0.09%
Revenue growth YoY											**Average**
Lego, DKK mn		229	1499	2135	4353	2717	4674	1889	3284	7202	3109
Hasbro, ~DKK mn		3736	937	249	-370	1518	-1139	-38	1096	1145	810
Mattel, ~DKK mn		1742	-265	-2608	2391	2195	897	360	-2590	-2160	33
Hasbro, USD mn		686	184	46	-66	283	-197	-7	195	170	144
Mattel, USD mn		320	-52	-487	425	410	155	64	-461	-321	6

Table 4-3 – Revenue comparison in DKK mn

Currency translation between USD/DKK is made for easy comparison. Currencies are yearly average. From the table it can be seen that Mattel almost has had twice the amount of accumulated sales as Lego (DKK 338bn vs. DKK 185bn) over the period. Average growth YoY for converted numbers (Hasbro ~DKK mn and Mattel ~DKK mn) is using annual average currency rates shown in the first row.

4.4.2 Profitability drivers

ROE, Return on Equity is a measurement of the return that investors receive from all capital employed in a firm, including capital from both financing and operations. As an example, a ROE of 20 % means that for DKK 1.0 invested in equity, DKK 0.2 is generated. The ROE is calculated with following components:

$$ROE = ROIC + (FLEV * SPREAD) * MSR \quad (21)$$

$$ROIC = \frac{NOPLAT}{(IC_{t-1} + IC_t) * 0{,}5} \quad (22)$$

$$FLEV = \frac{(NIBD_{t-1} + NIBD_t) * 0{,}5}{\left((E_{t-1} + E_t) * 0{,}5\right) + \left((MIN_{t-1} + MIN_t) * 0{,}5\right)} \quad (23)$$

$$SPREAD = ROIC - r \quad (24)$$

$$MSR = \frac{Comprehensive\ income\ /\ Comprehensive\ income\ before\ minorities}{\left((E_{t-1} + E_t) * 0{,}5\right) / \left(\left((E_{t-1} + E_t) * 0{,}5\right) + \left((MIN_{t-1} + MIN_t) * 0{,}5\right) \right)} \quad (25)$$

All equations adapted from (Koller et al., 2010; Sørensen, 2009)

Where FLEV is financial leverage of a firm, that measures impact of financing sources equity and debt, SPREAD is the difference between ROIC and r[17] and MSR is the minority shares ratio. SPREAD measures the rate of return on operating activities (invested capital) minus financing rents. MSR is calculated only for Lego and Hasbro as Mattel has no minority interest (MIN). In accordance, FLEV is calculated without the MIN term for Mattel. Net interest bearing debt (NIBD) is calculated as the difference between Invested Capital (IC) and Equity (incl. MIN). A few of the equations use two-year averages to avoid over-estimating numbers, as firms have changed capital-wise during the year, while the financial statements reported only annually. The two-year average construct removes 2006 from some of the tables. All components are described and calculated in the following.

Figure 4-3 further down, shows a comparison of the profitability drivers for all peers and indicates that Lego is outperforming its competitors in terms of both ROE and ROIC for all years.

In 2007-2009 Lego is more leveraged (FLEV of 223 %, 147 % and 101 %) than its peers are, which is also captured in the high ROE of 75 % for 2007. The leverage stems primarily from the restructuring of Lego (LEGO, 2006, 2007, 2008, 2009b). The numbers show that Lego's ROE was more than halved to 35 %, still with a relatively high FLEV of 147 % in 2008. The reason behind this is a large negative net financial income in 2008 for Lego, mixed with a better utilization of IC (24 % vs. 35 % ROIC) and payoff on debt regarding firm restructuring. In 2006-2008, a subordinated loan capital line item is high as well but finally eliminated in 2009. However, the two-year averaging explained previously, results in the full impact to be visible first in 2010 where FLEV has fallen to 68 %. Operating spread, SPREAD captures the effect in similar fashion, where Lego's ROIC increases more than Lego's net borrowing costs therefore yielding a growing SPREAD.

[17] *r not to be confused with r in discount factor, r is net borrowing costs measured as the ratio between net financial income/expenses after tax and a two-year average of net financial obligations (NFO avg). NFO is the difference between total financial liabilities and assets.*

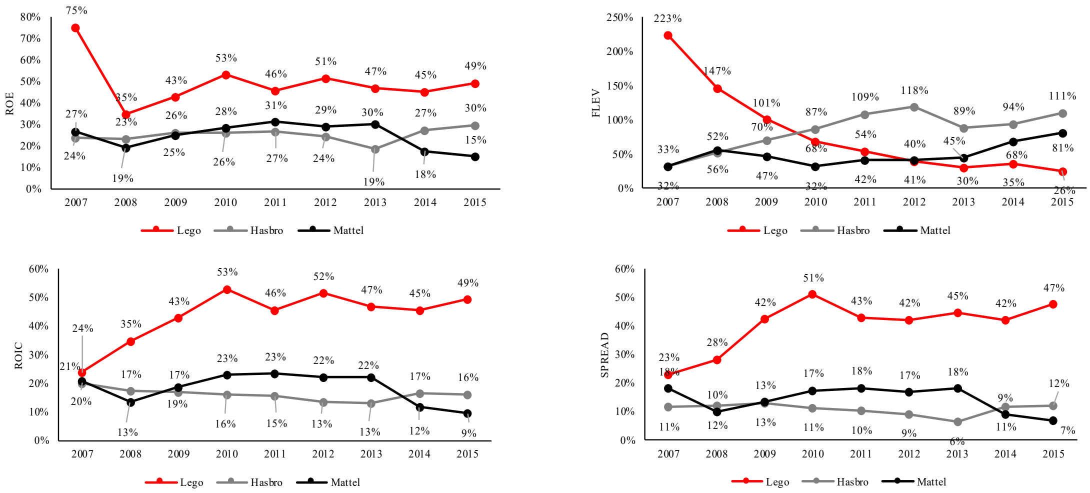


Figure 4-3 – Du Pont framework profitability drivers for all peers

2006 is not shown as many of the calculations includes two-year averages

As can be seen from figure as well, FLEV continues to drop steadily for Lego while competitors are funding their operations with a higher degree of debt. Hasbro and Mattel are on around 1.5-4 times more leveraged than Lego. Capitalized operating leases affect financial leverage as well, as the value of these impacts the NIBD to a large degree. Figure 4-3 also shows that ROE and ROIC metrics for Lego almost are the same for all years, except 2007. The reason of the general equality between ROE and ROIC for Lego has to do with the degree of leverage – most of Lego's recent performance is created without financial leverage.

As explained previously a ROE will produce a skewed indicator of real performance as ROE incorporates financing activities. ROIC does not have this "drawback" and instead only measures performance of operating activities. Before diving more into ROIC, IC will be explained in the following section.

4.4.2.1 Invested Capital, IC

The IC in a firm can comprise of various items. For Lego, the breakdown of line items are shown below in figure 4-4. In the period 2006-2015, Lego's IC grew from DKK 4.4bn to 20.4bn (~4.6x). Comparatively speaking, Hasbro and Mattel IC grew from USD 1.9bn to 3.3bn (1.8x) and USD 2.9bn to 4.5bn (1.6x). While a lower IC factor does not indicate a badly performing firm, the strategic analysis indicated that continued investment in product development and innovation are key in the industry. In gist, a survey conducted on more than 400 US CEOs revealed that 55% of CEOs would prevent investing in "very positive" NPV projects if it meant failing projected earnings targets (Graham, Harvey, & Rajgopal, 2005). The reason being that uncertainty hurt stock prices. This may explain some of the peer firms' lower investment rates, although this is purely a speculation. The three largest drivers of the IC in Lego is NOWC, Property, plant & equipment (PPE) and as well as capitalized operating leases (COL). In total, these drivers comprise around 100 % of Lego's invested capital. From the figure, it is clear that Lego is investing its capital for the most part in PPE – growing from 34% (DKK 1.5bn) to 52% (DKK 10.6bn). The PPE line item indicates that Lego is investing heavily in own production facilities. NOWC and COL have largely been decreasing, however in absolute terms still growing over the period.

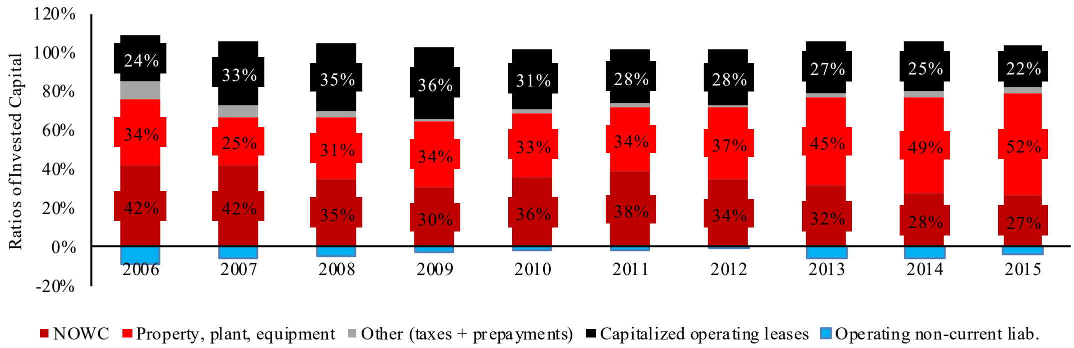


Figure 4-4 – Lego, line items of Invested Capital

Suming all line items will yield 100 % Invested Capital. Percentages for operating non-current liabilities as well as "other" are not shown. Similar graphs for Hasbro and Mattel are available in Appendix 8.13.5.

The next section, describes how well Lego is allocating IC as measured by the ROIC ratio.

4.4.2.2 Return on Invested Capital

ROIC assesses a firm's efficiency at allocating capital into profitable investments. A ROIC of 50 % means that for DKK 1.00 invested, a return (NOPLAT) of DKK 0.50 is generated.

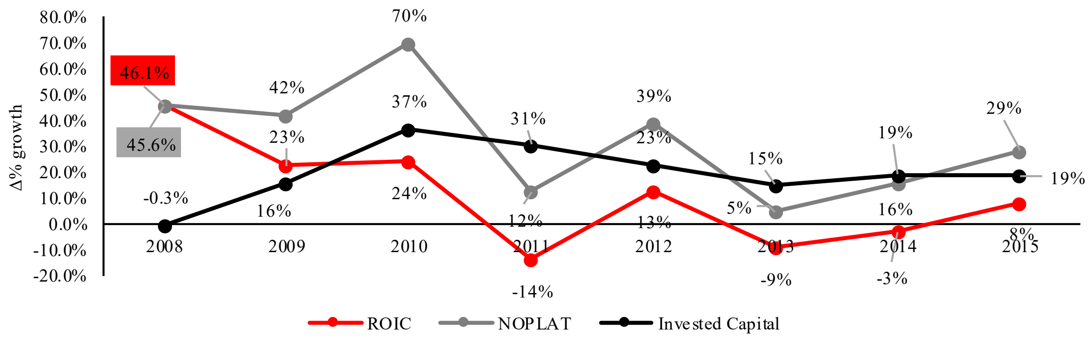


Figure 4-5 – ROIC, NOPLAT and Invested Capital growth YoY

Both 2006 and 2007 are excluded from the figure to include only data having two-year averages.
Similar figures for Mattel and Hasbro can be located in Appendix 8.13.3.

Figure 4-5 shows year-on-year growth in ROIC, NOPLAT and IC. The movements largely follow each other for Lego, indicating a strong focus on value creation rather than value destruction. It generally follows, when IC grows more than NOPLAT, then ROIC will suffer and vice versa.

4.4.2.3 Net operating profit less adjusted taxes, NOPLAT

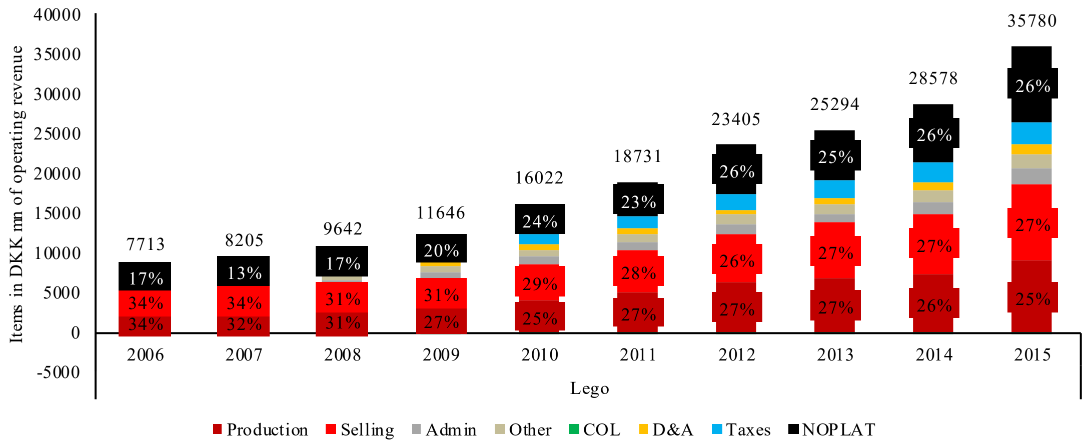


Figure 4-6 – Lego, financial statement items as a ratio of operating revenue.

The above figure shows the distribution of operations for Lego[18]. Operating revenue more than quadrupled in the period from DKK 7.7bn to DKK 35.8bn. NOPLAT has been increasing from 17 % to 26 % of operating revenue and in absolute terms from DKK 1.3bn

[18] *Operating revenue calculated as revenue minus other operating income and removal restructuring costs. Operating revenue is shown instead of revenue to avoid skewness, as 2006-2009 included items related to restructuring and others, albeit these items only account for value in the range DKK -15mn to 209mn.*

to 9.4bn, equivalent to a seven doubling of NOPLAT in 10 years. Selling, administrative and other costs combined have steadily been falling from 74 % (DKK 3.6bn) in 2006 to 58 % (DKK 13.5bn) of operating revenue in 2015. From this can be inferred that Lego over the period has become better at utilizing production- and sales capabilities (i.e. operating at lower costs), while operating revenue at the same time have increased, indicating larger sales. From Lego's annual reports, it is evident that Lego does not grow by mergers and acquisitions but instead via growth in sales. It is unknown whether higher-priced products, more customers or a combination of both fuels larger revenue. However, for the most part, more customers and products seems to be the major drivers as a seven-fold increase in selling prices, c. p. would affect revenues and bottom-line negatively. While selling, administrative and other costs have been falling steadily so has production costs. For the most part the fall in production costs is attributed to production facility investments in countries featuring lower wage costs and more automation, as well as recycling/reutilizing of production materials, as well as insourcing of production capabilities.

Compared to peers, Lego's NOPLAT ratio of revenue is 3 times larger (26%) in 2015, than that of Mattel's (8%), and two times larger than Hasbro's (12%). Throughout the period Lego's NOPLAT ratio have been higher than both Hasbro's and Mattel's. This indicates that Lego is effectively returning a larger bottom-line on the products it sells compared to Mattel and Hasbro. For full overview on peers, see Appendix 8.13.6.

4.4.2.4 Asset turnover ratio and inverse

Asset turnover ratio (ATR) demonstrates a firm's ability to "convert" assets effectively into revenue generation. ATR is calculated as the ratio between average invested capital and revenue. With Lego's invested capital equaling DKK 20.4bn in 2015, using an ATR of 1.86 would yield the revenue of Lego (i.e. 20.4 * 1.86 = DKK 37.9bn[19]). The Inverse of ATR (1/ATR) tells how much capital is required to generate DKK 1.00 of revenue. E.g. 1/1.86 = DKK 0.54 to create DKK 1.00 of revenue.

[19] 37.9b is 2.0b larger than Lego's actual revenue of 2015. The reason is that the IC capital is a two-year average distorts the picture in a minor degree. Using a non-averaged IC, the ATR is 1.75.

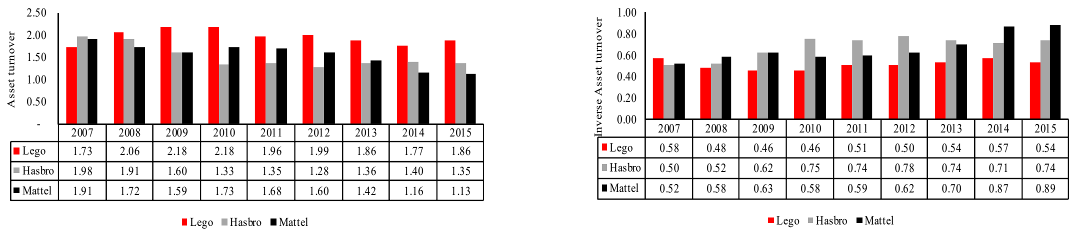


Figure 4-7 – Comparison of Asset turnover ratio and inverse ATR

Left: Asset turnover ratio. Right: Inverse ATR.

It is evident that Lego outperforms its peers on ATR in every year except for 2007 (again caused by the impact of restructuring costs). Hasbro and Mattel are, on average over the full period performing equally (i.e. Hasbro's ATR_{avg} of 1.51 vs Mattel's ATR_{avg} 1.55), while Lego's average ATR clocking in at 1.96.

4.4.2.5 Net operating profit margin, NOPM

This figure shows how peer firms stack up in terms of net operating profit margin, NOPM (calculated as NOPLAT / revenue). NOPM indicates how much revenue contributes to bottom-line, NOPLAT. Lego is ahead of both Mattel and Hasbro with more than double the profit margins.

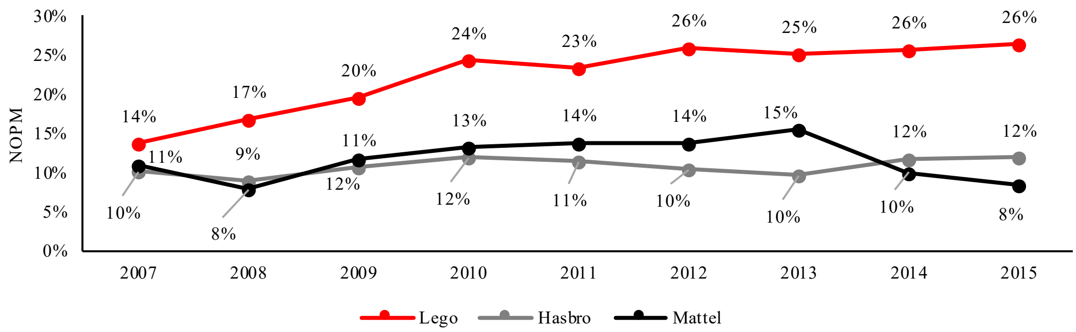


Figure 4-8 – Net operating profit margin for all peers

Overall, Mattel seemingly underperforms throughout the period despite generating the largest revenue of the three firms.

4.5 Summary

The purpose of this chapter was to provide financial insights of Lego in comparison to its peer firms, Hasbro and Mattel during the 10 years of 2006-2015.

Lego has shown higher growth rates than peers and Lego is currently placed second in terms of revenue but is closing the gap to Mattel. Lego's revenue more than quadrupled from DKK 7.8bn in 2006 to DKK 35.8bn in 2015, resulting in a CAGR of 16.46 %. Hasbro almost doubled its revenue in the same period to DKK 29bn (converted from USD), yielding a CAGR of 3.50 %. Mattel showed a period CAGR of only 0.09% resulting in a revenue for 2015 of DKK 38.4bn largely fueled by a high increase in USD/DKK compared to previous years as Mattel's revenues fell year-on-year. NOPLAT for Lego more than seven doubled in period. Selling, administrative and other costs combined ratio fell from 74 % (DKK 3.6bn) in 2006 to 58 % (DKK 13.5bn) in 2015.

The findings reveal that Lego has undergone a transformation from a highly leveraged firm in 2006-2010 to a leverage ratio (FLEV) below that of its peers, while still performing better than peers in terms of ROE, ROIC, ATR and NOPM. FLEV for Lego felt from 223 % to 23 % in the period, while peers have maintained double and triple digit FLEV ratios throughout the period. The findings also revealed that Lego has invested majority of its capital in properties, plants and equipment, starting with 34 % in 2006, ending with 52 % in 2015. Furthermore, Lego has shown to be better at utilizing invested capital by yielding more revenue from production facilities and other assets, than both its competitors have managed.

Overall, it is concluded, that Lego has increased its spending in PPE, it has become better at utilizing its production- and sales capabilities (i.e. operating at lower costs), while revenue and NOPLAT at the same time have increased, indicating larger sales and market shares and overall a better performing company than its peers. These findings indicate that, all else equal, Lego calls for a higher valuation that its peers. In addition, the strong historic development of Lego is expected to continue. The next section will dive into the valuation of Lego and benchmark the firm against peers.

PART III

Budgeting & Valuation

5 Valuation of Lego

For valuation of firms, a number of models are available, including Discounted Cash Flow (DCF), Real Option pricing and others. This valuation employs the DCF model. The purpose of the DCF model is to calculate an enterprise value (EV) or valuation of a firm based on a number of cash flows. As stated previously, this thesis' chosen paradigm calls for testing various methods and benchmarks in the research process. In line with the discontinuous innovation approach described in the first chapter, methods and calculations of relevancy are included along the analysis process to test interim results. The following sections demonstrate the methods selected.

5.1 Discounted Cash flow model

The DCF model is a sum of present values of forecasted free cash flows (FCFs) as well as a terminal value (horizon value). To calculate the present values, a discount rate r is used. The equation for the DCF model is shown below:

$$EV = \sum PV(FCFs) + PV(\text{horizon value}) = \sum_{t=1}^{n} \left(\frac{FCF_t}{(1+r)^t} \right) + \frac{1}{(1+r)^n} * \frac{FCF_n}{r-g} \qquad (26)$$

The DCF model relies on forecasting of n amount of free cash flows, FCFs, discount rate r and a growth rate g. In relation to the cause-relationship effect, previously illustrated with equation (1), EV in equation (26) would be equal to $V(t)$ yielding the following equation:

$$EV = V(t) = \sum_{i=1}^{\infty} P_i(t) + \varepsilon_n(t) \quad \lim_{n \to \infty} \varepsilon_n(t) = \mp\infty \text{ for all } t \qquad (27)$$

Recall that $\epsilon_n(t)$ can be zero and hence result in a true and fair valuation but as explained previously it is impossible to determine whether the valuation is true and fair.

Using 'going concern qualification', a reflection hereby inevitably leads to question how many free cash flows a potential investor can or should expect, as the equation allows for an infinite amount. In accordance, the forecasting practice easily becomes a tradeoff between uncertainty and flexibility, i.e. if the forecasting period is non-optimal, it may not match the required risk and return profile. As argued by Brealey et al. (2011) and Damodaran (2013), the amount n of $FCFs$ varies case by case and whatever amount is selected will naturally impact the valuation. For Lego I have opted for a 10 year forecasting (9 years + 1 year horizon) for a couple of reasons; First, taking into perspective both market- and technology outlooks described in previous chapters, 10 years is assumed a fair period. Second, the 10 years follows the 10-year risk-free interest rate government bond duration. It can be argued, that a simulation accounting for cash flow duration of varying length, would provide perspective. However, this is avoided for brevity, and instead a simulation of the discount factor is included. In similar fashion for the terminal value, a constant growth rate g in perpetuity is assumed. Moreover, assuming that a firm will continue in perpetuity and with a constant growth rate, is perhaps too optimistic. The discount rate r, or opportunity cost in the DCF model can be calculated by different methods. In accordance with best practice by Koller et al., (2010) and Damodaran (2013), I have opted for a calculation using the Weighted Average Cost of Capital (WACC) equation. The WACC takes into account the cost of debt and equity as proposed by Modigliani & Miller (1958, 1963). WACC is described in the next section.

5.1.1 Weighted Average Cost of Capital, WACC

WACC is calculated using the following parameters:

$$WACC = \frac{D}{V} * R_d * (1 - T_c) + \frac{E}{V} * R_e \tag{28}$$

As Lego employs operating leases, the WACC is adjusted according to Lim et al. (2003) and Damodaran (1999), yielding the following:

$$WACC_{adj} = \frac{D}{V_{adj}} * R_d * (1 - T_c) + \frac{E}{V_{adj}} * R_e + \frac{L}{V_{adj}} * R_L * (1 - T_c) \tag{29}$$

Parameters	
$\boldsymbol{V_{adj} = D + E + L}$ = adjusted enterprise value	$\boldsymbol{R_e}$ = cost of equity
$\boldsymbol{D}$ = debt	$\boldsymbol{T_c}$ = corporate tax rate
$\boldsymbol{R_d}$ = cost of debt	$\boldsymbol{L}$ = capitalized operating lease value
$\boldsymbol{r_f}$ = risk-free interest rate	$\boldsymbol{R_L}$ = Cost of operating lease
$\boldsymbol{r_c}$ = corporate default spread	$\boldsymbol{\beta_e}$ = beta of equity, $\boldsymbol{r_m}$ = market risk premium
$\boldsymbol{E}$ = equity	

Table 5-1 – Parameters for adjusted WACC

The risk-free interest rate r_f is not shown in the equations for WACC and $WACC_{adj}$ but is instead "concealed" as a component of both cost of equity and cost of debt. All parameters are calculated in the following sections.

5.1.1.1 Corporate tax rate

The Danish corporate tax T_c is 23.5 % for 2015, however Lego's effective tax rate for 2015 was 24.48 %. The effective rate is used in subsequent calculations for Lego. Similarly, tax rate calculations for Hasbro and Mattel is based on their effective tax rates yielding 26.00 % and 20.37 % respectively.

5.1.1.2 Risk-free interest rate

The risk-free interest rate is a rate of return, which an investor can earn at virtually no risk. Typically, the risk-free rate is linked to a risk profile of a country in the form of government issued bonds. Such bonds rarely default, hence providing a good measure of something "risk-free". To determine the risk-free interest rate for the WACC, the Danish 10-years central government bond is used, shown in the figure below.

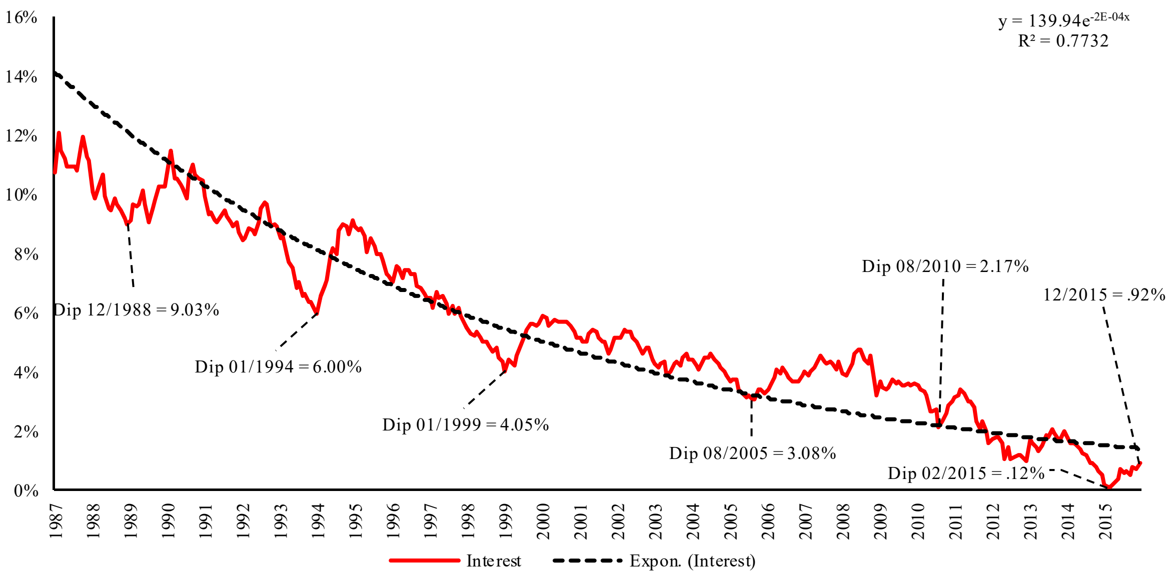


Figure 5-1 – 10-year Danish government bond, nominal (1987/1/1 - 2015/12/1)

All available and comparable data was taken from (Danmarks Nationalbank, 2016)

As evident from the figure, during the last 30 years interest rates of said bond have not been stable but instead been steadily declining from an average of 11.2% in 1987 to a yearly average of 0.51 % in 2015. Major dips seem to be occurring every 5-6 years in an overall exponential trend. Given this development in interest rates, I asked the question: *"Can historic data be used to forecast the future interest rate, and if so, what is the optimal amount of historic interest rate data to select that yields the best forecast?"*. As the future is uncertain, I opted to illuminate an answer by setting up several datasets of varying historic calibration data and tested against known data points. The interest rate can be viewed as time series and is first tested for the null hypothesis H_0"*Is the time series white noise?*". The sampled interested rates contained 348 data points (1987/1/1-2015/12/1). Next section reveals the results of the white noise tests.

5.1.1.2.1 Results of white noise test for risk-free interest rate

The results of the FK and KS tests for white noise are displayed below:

Function	Fisher's Kappa	Kolmogorov-Smirnov	Outcome	Critical values
Interest rates	86.857 (<0.0001)	0.881 (<0.0001)	Reject H0	Fisher's Kappa: 5%: 8.742 1%: 10.328 Kolmogorov-Smirnov: 5%: 0.07301 1%: 0.08750

Table 5-2 – FK and KS white noise results of historic interest rates

The period analysis is 1987/1/1 - 2015/12/1. P-values are in brackets. Critical values are shown for n=348. A normal distribution of the interest rate is provided in Appendix 8.14.

Both the KS and FK test statistics exceed the critical values at α-level 1% and 5% so the null hypothesis is rejected, i.e. the interest rates appear not random data at these confidence levels. Next, the Fourier Transform is applied to highlight any periodicity, which produces the following periodogram in figure 5-2:

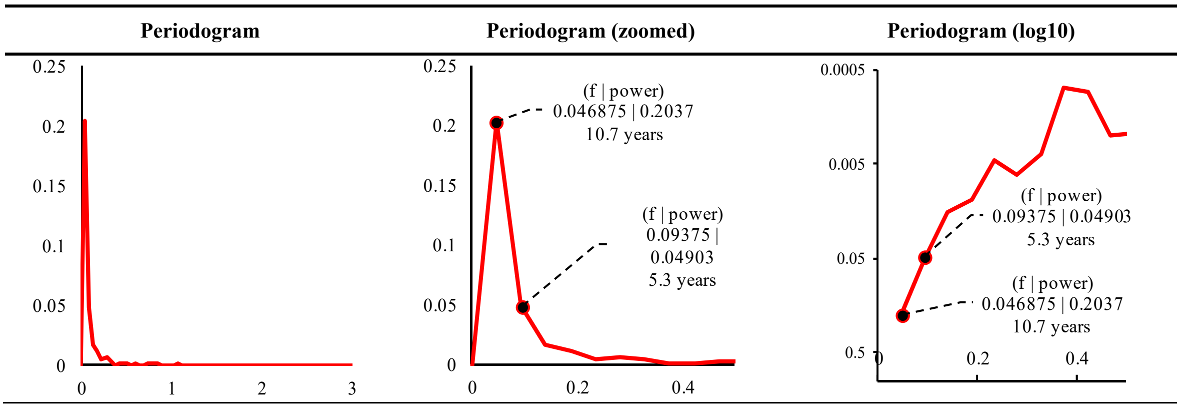


Figure 5-2 – Fourier Transform Periodogram of interest rates (frequency (x), power (y))

The figure reveal periodicity at 5.3 years but interestingly the FT highlighted a stronger periodicity every 10.7 years. The result of the FT therefor indicates major cyclical behavior every ~5 or ~11 years. The ~5 years was as expected according to the visual inspection of the raw plot of interest rates. A few minor periods are not highlighted in the plots, as the magnitudes are deemed too small (evident in the logarithmic plot). The next plot contains the Inverse Fourier Transform, which visually speaking demonstrates that FT is capable of first decomposing the relatively complex signal of interest rates and then back into an approximation of the original signal via the IFT.

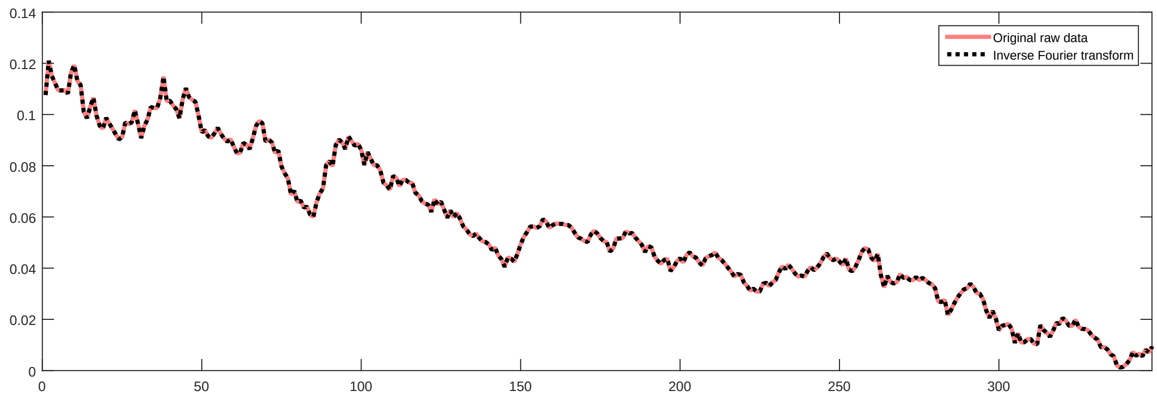


Figure 5-3 – Inverse Fourier Transform of 10-year Danish government bond

The next section reveals the results of the employed forecasting methods.

5.1.1.2.2 Forecasting of the interest rate

Both linear regression (OLS estimation) as well as Fourier analysis was used to find the optimal period of historic data for the sampled interest rates. The periodograms in figure 5-2 indicate periodicity at both ~11 and ~5 years. In accordance with the methodological challenges and theory described in the introduction chapter, other periods are included in the analysis for benchmarking purposes. To benchmark results, mean absolute deviation (MAD) was used. While other methods such as the squared standard deviation exist, MAD was selected as it expresses accuracy in the same units as the input data. MAD was calculated with the following equation:

$$\frac{1}{n} * \sum_{t=1}^{n} |y_t - \hat{y_t}| \tag{30}$$

y_t equals benchmarked data, $\hat{y}_t$ forecasted values and n the amount of data. In this case, varying amounts of historic (calibration) data was used to forecast months 1 to 12 of 2015 $(= \hat{y}_t)$ and finally benchmarked against the real data for 2015 (y_t) to expose the MAD. Benchmarks are shown in table 5-3.

Calibration data	**MAD**
Detrending 5:1 (2010-2014 : 2015)	0.398%
Detrending 6 months (2015 : 2015)	0.542%
Detrending 10:1 (2005-2014 : 2015)	0.606%
Detrending 3:1 (2012-2014 : 2015)	0.647%
Fourier (2009-2014 [apr] : 2015)	0.701%
Detrending 1:1 (2014 : 2015)	0.702%
Detrending 20:1 (1995-2014 : 2015)	0.721%
Detrending 5:5 (2006-2010 : 2011-2015)	1.045%
Fourier (2000-2010 [aug] : 2011-2015)	2.048%
Fourier (2004-2014 [aug] : 2015)	2.371%
Fourier (1993-2014 [aug] : 2015)	2.965%
Tests conducted	**11**
Median of tests conducted	0.702%
Mean of tests conducted	1.159%
Std. dev. of tests conducted	0.835%

Table 5-3 – Interest rate forecasts benchmarked using MAD

The table lists the results of regression and Fourier analysis with calibration data of varying length. The total data analysis comprised of around 36,000 data points which were too large to fit in the appendix – instead, please refer to the Excel spreadsheet for data.

Detrending 5:1 (2010-2014 : 2015) means: 5 years, i.e. 2010-2014 of historical data was used for calibration and 1 year, i.e. 2015 was forecasted and finally benchmarked with MAD. In general, OLS estimation seems to produce a lower MAD than Fourier Transform albeit the difference between the OLS estimation with lowest MAD (0.398 %) is relatively close to the FT with lowest MAD (0.701 %). For all tests, Excel was used. Excels' built-in Fourier Analysis algorithm requires the amount of calibration data to be a power of 2 (i.e. 2, 4, 8, … 64, 128 etc), which is why some calibration periods are selected to end at April or August instead of selecting a full year. This means that not all tests are directly comparable, which, c. p. yields skewed results. However, I assume this not to be a major drawback.

Below are plots of the OLS estimation and Fourier Transform with the lowest MAD.

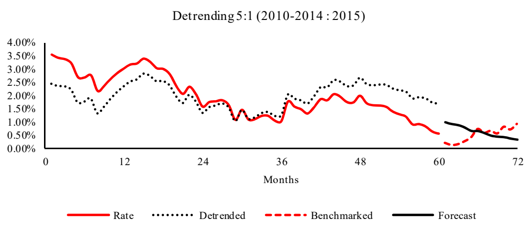


Figure 5-4 – Interest rate OLS estimation and forecast

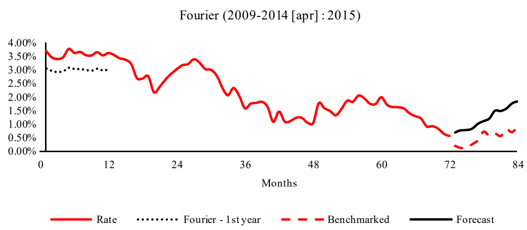


Figure 5-5 – Interest rate Fourier Transform estimation and forecast

As shown from the plots, the OLS estimation forecast follows the downward trend of previous data as expected (Newbold et al., 2010), while the FT forecast quickly resumes to the trend of the benchmarked data but in this case lies above the actual benchmark. I ascribe this deviation from the benchmarked data as the way the Fourier algorithm works, only being able to approximate the original data. In accordance with testing multiple methods, illuminating FT errors using sum of squared deviation (SSD) yields a number of only 0.00063, i.e. less than one per mille of deviation from the original data. SSD for the OLS estimation was even lower with only 0.00028 and since the error term is lower here, OLS estimation is used for forecasting instead of FT. Only at best, the results illuminate the latter part of the aforementioned question (i.e. *what is the optimal amount of historic interest rate data to select that yields the best forecast*). Still, the results do not indicate the applicability of using historical data for forecasting a future interest rate. In other words, can the last *n* amount of years be used to say something credible about *x* amount of future years? In general, we cannot say so. Research conducted on a period from 1875-2003 has, however, indicated that interest rates tend to stabilize over time (Abildgren, 2005); the research concluded that long-term bond interest rates average around 3-5 %. Said research was conducted on American, British, German, and Nordic long-term government bonds. Although interest rates for the 10-year Danish central government bond have been falling largely since 1987 and nearing 0 % in 2015, it is assumed it will eventually resume to an average. To select the risk-free interest rate r_f, an arithmetic average of 9 years (2016-2024) of forecasted interest rates is calculated using lowest MAD as the underlying model for forecasting. A long-term average is selected as the value for the horizon period, while keeping in mind the projected industry growth. The r_f for 2016-jan - 2024-dec (108 months) is calculated:

$$r_{f_9} = \frac{1}{108} * (0.4412 \; + \cdots + -3.0556) = -\,0.016425 = \; -1.6425\,\% \qquad (31)$$

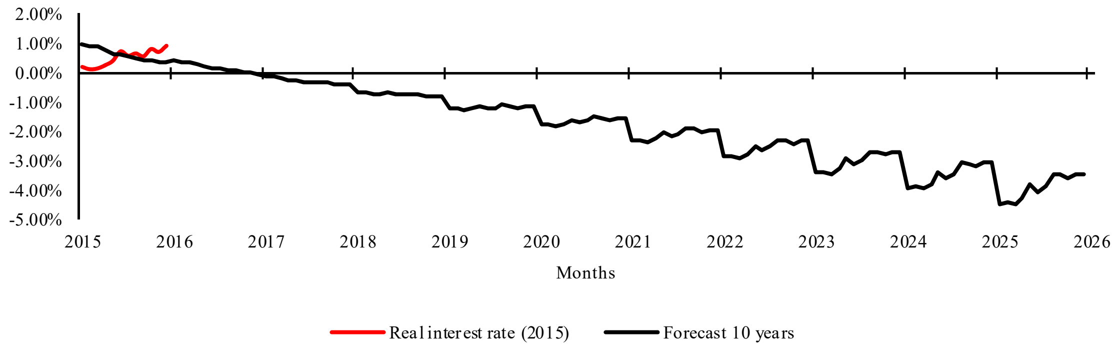


Figure 5-6 – 10 year interest rate forecast using Detrending 5:1 (2010-2014 : 2015)

The figure shows a forecast yielding negative interest rates on the 10-year DK government bond.
At the time of writing the latest rates have been falling, i.e. 0.92 %, 0.62 %, and 0.44 % (2015-12, 2016-01, 2016-02). However, this does not guarantee that interest rates will keep falling. The figure exhibits an almost cyclical pattern of growing magnitude. I ascribe this to the underlying forecasting model using 12 months OLS estimators amplified as the period progresses. In historic comparison, this pattern is irregular.

From the figure above the risk-free r_{f_9} interest rate becomes negative over time, which translates into "paying for safety" for holding the risk-free government bond, rather than earning an economic return. The bond interest rate is calculated in nominal terms and the real interest rate will naturally be offset by the fluctuations of inflation. It is assumed, that holding a risk-free government bond, does not equate into investors changing behavior, i.e. wanting to "pay for safety". Investors may simply go somewhere else and invest in other securities even if these are more risky. Assuming that interest rates must be positive in the long term, the OLS forecasting model fails at approximation. While we cannot know if past data is a good measure for prediction, we know from empirical evidence that interest rates generally return to an average. In light of these findings, and to match the selected DCF period, 10 years of average historical interest rates will be used to predict the next 10 years. However, it being understood that this may be an over-simplification of the prediction model possibly fueling the residual effect challenges described in the scientific framework section. The arithmetic average of monthly interest rates of past 10 years (2006-2015) yields a risk-free rate of 2.6225:

$$r_f = \frac{1}{120} * (0.0345 \ \dots + 0.009200) = 0.026225 = 2.6225\ \% \qquad (32)$$

5.1.1.3 Corporate default spread

The corporate default spread r_c measures the credit risk of the firm in question. Lego's own estimation of its latest credit risk (LEGO, 2015a), is considered "low". Using the interest coverage ratio (ITR) by Damodaran (2016a) yields an "AAA" rating equal to a r_c of 0.75 %. Conjugating this with Standard & Poor's definition of "AAA" means *"The obligor's (Lego) capacity to meet its financial commitment on the obligation is extremely strong"* (Standard & Poor's, 2011, p. 3). This definition is assumed a good approximation for Lego given the firm's strong financial performance since 2005-2006.

5.1.1.4 Cost of debt

The cost of debt R_d is the effective rate a firm pays on its debt. The following shows the calculation of the cost of debt:

$$R_d = \mathrm{r_c} + r_f = 0.75\ \% + 2.6225\ \% = 3.373\ \% \qquad (33)$$

5.1.1.5 Capital structure for Lego

The general idea behind selecting an optimal capital structure is to select one that maximizes firm value. Firm value is inversely related with cost of capital, e.g. PV/WACC and by using debt financing a firm can lower its capital costs while increasing firm value. However, a higher degree of debt financing leads to an increased risk profile for the firm. To calculate the capital structure, typically the market values of debt and equity are used but since Lego is a private firm these values are not available and instead only the book values can be obtained. This poses an obstacle since the market values are needed for deriving a beta value and later the WACC. Various approaches exist to mitigate the obstacle – for example using peer values (Brealey et al., 2011; Damodaran, 2013; Koller et al., 2010). Using debt and equity from peers suggests that Lego should be performing similarly. However, the study of all peers' financials indicate that Lego is generally a better performing firm. Due to this finding, I find it inappropriate to rely solely on peers as benchmarks for the Lego's market values of debt and equity. Instead, I will assume Lego's latest book capital structure mixed with a weighted average of peer beta values is optimal. While this does not produce true market values of equity and beta, it is assumed that this will provide good approximated ratios for later calculations.

$$V_{adj} = D + E + L \tag{34}$$

$$V_{adj} = 2679 + 17751 + 4555 = 24985 \tag{35}$$

5.1.1.6 Beta of equity

The beta value β is a measurement of sensitivity of an asset's movements in relation to the market. A beta of one indicates that in theory the underlying asset will be just as volatile as the market itself, while an asset beta of e.g. 0.7 indicates 30 % less volatility than the market. Since Lego is an unlisted firm, Lego's beta value is derived based on weighted averages of beta values of Lego's peers, Hasbro and Mattel. As beta values for the peers are reported on levered equity β_L, the beta values are first unlevered β_U and then the beta for Lego is calculated. The standard Modigliani & Miller (M&M) beta relation, also known as Hamada's equation (Hamada, 1972)
is used to derive the unlevered beta values:

$$\beta_U = \frac{\beta_L}{1 + (1 - T_c) * \frac{D}{E}} \tag{36}$$

Rearranging gets the levered beta:

$$\beta_L = \beta_u * (1 + (1 - T_c) * \frac{D}{E}) \quad (37)$$

As pointed out by Hansen & Erhardi (2002), M&M's beta relation implicitly assumes constant debt in infinity and in similar fashion, that future cash flows remain constant in infinity. To avoid such scenario, they highlight the benefits of using the beta relation described by Chambers, Harris & Pringle (1982): if the levered firm rebalances its debt to maintain a constant debt/value ratio, the beta value will depend on operations rather than constant debt. However, this requires forecasting of the debt, which will be avoided for brevity. The following table shows the calculated unlevered and levered beta value for Lego using the M&M beta relation:

Firm	Beta lev	Debt USD mn	Share price	# million shares	Equity USD mn	Debt/equity	Tax rate	Beta unlev
Hasbro	0.9703	1269	24.86	124.975	3107	40.8%	26.00%	0.7451
Mattel	0.8931	1190	27.17	339.748	9231	12.9%	20.37%	0.8099
Averages	0.9317					26.9%		0.7775
Lego	**0.9858**					**15.1%**	**24.48%**	**0.8849**

Table 5-4 – Beta values for Lego

All numbers are ultimo 2015. Debt is calculated as NIBD minus capitalized operating leases. Beta unlevered is using a weighted average with more weight (76 % = [1-(12.9%/(40.8%+12.9%))]) to Mattel than Hasbro's debt/equity. The reason for the weighted average is because Mattel has a lower debt/equity ratio than Hasbro. Lego's debt/equity ratio is using book values adjusted for operating leases. Beta values are taken from YCharts which are calculated using 60 months average market return.

Lego's levered beta value is calculated to **0.9858.**

5.1.1.7 Expected market risk premium

The market risk premium r_m captures the additional risk (return) an investor requires to acquire a given asset. While the topic and methods for calculations is widely debated, Koller et al. (2010) have found the appropriate market risk premium to be somewhere in the range of 4.5 - 5.5 %. Koller et al. reached this conclusion by looking at research on market risk premiums using extrapolation, regression analysis and DCF calculations related to market risk premiums. In reflection, Lego is a Danish company, and so a market risk premium for Denmark is taken into consideration. Damodaran (2015a) calculates the market risk premium for Denmark to 5.81 %. Using an arithmetic average of 4.5 %, 5.5% and 5.81 % yields a market risk premium of 5.27 %, which is used in the following sections.

5.1.1.8 Cost of equity

To calculate the cost of equity, the original capital asset pricing model (CAPM) described by Sharpe (1964), Lintner (1965) and Black (1972) is used. Grounded in portfolio theory by Markowitz (1959), the CAPM specifies a linear relationship between risk-free rate and expected market return to derive expected return on an asset R_e.

$$E[\mathrm{R_e}] = r_f + \beta_e * (E[r_m] - r_f) + \epsilon \tag{38}$$

Arguably, the CAPM has its shortcomings as pointed out by various scholars. Banz (1981) for example, found that there is a difference between smaller and larger firms when risk adjusting returns. On average, smaller firms have higher adjustments than larger firms do and moreover the relationship is not linear. In contrast, the risk adjustment effects for equally sized firms were found to be minor. Other scholars such as Fama & French (1993, 1996) have found empirical evidence that more factors should be included to estimate cost of capital, denouncing the original specifications of the CAPM. Fama & French (1993, 1996) proposes a multiple regression model consisting of three factors i.e. market return minus risk free rate and proxies for both firm size and book-to-market value. The beta values from Hasbro and Mattel shown in a previous section follow the three-factor model but as this model requires calculation on the return of an asset and Lego is unlisted firm, the model cannot be applied to Lego. Instead, I have opted for CAPM for Lego using the averaged peer betas (which actually are based on the three factor model). The result is weighted values of the Fama & French three-factor model, applied within the original CAPM. All parameters are already calculated in previous sections and the result of the CAPM is then revealed:

$$E[\mathrm{R_e}] = 0.026225 + 0.9848 * (0.0527 - 0.026255) = 4.9631\,\% \tag{39}$$

5.1.1.9 Adjusted WACC

The adjusted WACC can now be derived. Since debt and operating leases are impacted by taxes, the WACC is adjusted accordingly. The following table shows the adjusted WACC and ROIC-WACC spread for all firms in 2015.

Parameter	Lego	Hasbro	Mattel
WACCadj	4.4423%	3.9948%	4.4800%
ROIC	49.29%	16.08%	9.41%
ROIC-WACCadj spread	44.85%	12.09%	4.93%

Table 5-5 – ROIC-WACC spread for all firms

For calculation of WACCadj please refer to Appendix 8.15

The spread is a measure of an investors expected return on an investment in a given firm. For instance, a spread of 20.00 % means that pure economic value of 0.2000 is created for each unit of currency invested. In reflection of these numbers, Lego has published the firm's overall WACC in the annual reports for 2010, 2011, and 2012, equal to 13.54% (LEGO, 2010, 2011, 2012a). The Lego WACC is in relatively sharp contrast to the 4.4423 % calculated here, even considering the time difference of 4-6 years. This highlights the problem with information asymmetry and/or the input parameters in the WACC model. For example, debt, equity and value ratios can differ among investors. Here we rely solely on reformulated book values for debt (i.e. NIBD) but other investors may use a different metric for debt. Kirkbi A/S's annual report for 2015 reveals a WACC of 8% for both 2014 and 2015, albeit related only to Lego's trademarks and not the Lego firm as a whole (Kirkbi, 2015). Damodaran calculates the industry cost of capital[20] (global perspective) to 8.32 % in 2015 based on a sample size of 293 firms in the "recreational" sector. This recreational sector includes both toy firms (e.g. Hasbro and Mattel) but also unrelated firms such as local traveling, sports and amusement park firms (Damodaran, 2015b) and as such is not the best comparison. Although the calculated WACC differs from the 'WACC by Lego', it is used in the following sections to arrive at a valuation of Lego.

5.2 Budgeting

The budgeting takes into account the strategic and financial analyses explained in previous chapters. Lego's historic revenue was tested for randomness to determine whether FT should be used for forecasting. NOPLAT was tested as well to see if this was a better parameter for forecasting. However, test results are questionable (see Appendix 8.16) and instead, OLS estimation, lowest R squared, and lowest Euclidean Distance (ED) as determining factors are used for best model selection to forecast the budget. To forecast the budget I have opted for revenue as the main driver. The budgeted numbers in general appear to be in-line with historical growth, indicating that the budget is not deviating from the norm. The growth rate

[20] *Damodaran notes: "The weighted average of the cost of equity and after-tax cost of debt, weighted by the market values of equity and debt: Cost of Capital = Cost of Equity (E/(D+E)) + After-tax Cost of Debt (D/(D+E)) - For the weights, we use cumulated market values for the entire sector."(Damodaran, 2016b)*

‘g’ was estimated in previous chapters to 2.34 % and is used for the terminal period. The budget is found in Appendix 8.17.

5.3 Valuation with DCF

The following shows the valuation of Lego. The valuation uses the adjusted WACC and growth rates calculated in previous sections.

Lego, DCF, DKK mn		Budget									Terminal
		1	2	3	4	5	6	7	8	9	10
		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Free Cash Flow (FCF)		8155	9084	9965	10780	11509	12134	12635	12994	13191	11811
Discount factor		0.9575	0.9167	0.8777	0.8404	0.8046	0.7704	0.7376	0.7062	0.6762	0.6762
PV of FCF		7808	8327	8747	9059	9261	9348	9320	9177	8920	7986
Terminal value	379918										
WACC	4.4439%										
Growth rate, terminal (g)	2.34%										
Valuation:											
Sum FCF (budget)	79966										
Sum FCF (terminal)	379918										
= Enterprise value	**459884**										
NIBD	2679										
= Equity value	457205										

Table 5-6 – Valuation of Lego

The enterprise value of Lego is calculated to the sum of DKK ~460bn and is put into perspective in the following.

5.3.1 Sensitivity analysis with Monte Carlo simulation

The adjusted WACC comprises constant parameters that fail to account for changing scenarios, including but not limited to cases where a firm changes capital structure, or the markets change perception of a firm’s risk profile. As explained previously, firms are not static entities and utilizing constant parameters will c.p. result in skewed valuation as it is expected that parameters can and perhaps will change over time. To illuminate these dynamics, a WACC sensitivity analysis is created using Monte Carlo simulation. The following figure is produced by mapping WACC against growth rate.

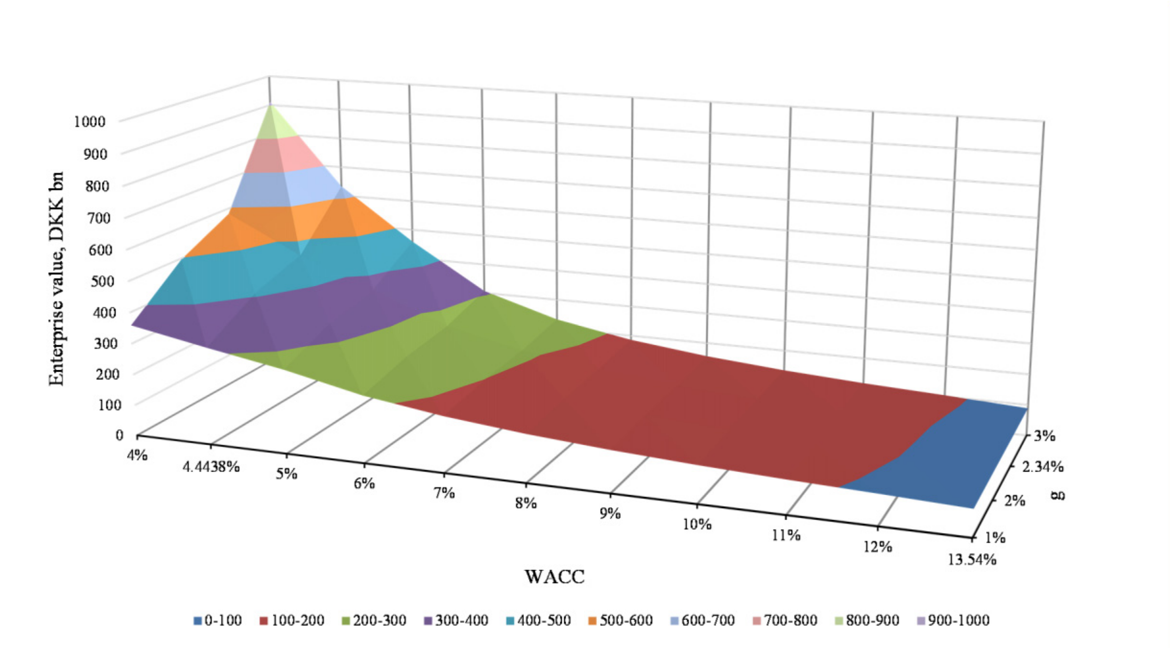


Figure 5-7 – EV sensitivity analysis – two dimensions

The plot shows a mapping of the two dimensions WACC and growth g yielding various enterprise values for Lego. The upper bound WACC rate is the one calculated by Lego (13.54%) while the lower bound is 4.4439 %. On the z-axis, growth rate ranges from 1-3%. Actual numbers can be found in the appendix. Coloring may be difficult to discern in print.

Included in appendix 8.18 is a normal distribution plot of a one-side sensitivity analysis holding growth constant (2.34%) while keeping the WACC variable in the same range as above. This distribution is also reflected in the figure above albeit with less detail. The normal plot indicates that majority of the valuation is in the range DKK 87bn-354bn with a mean value of DKK 178bn. It also indicates that the enterprise value is rather sensitive to 'small' changes in WACC and g.

5.3.2 Comparison with peer companies

To put the valuation of Lego into perspective, the firm is compared against the peer group current valuation of 2015.

Valuation Dec 31 - DKK bn	2007	2008	2009	2010	2011	2012	2013	2014	2015
Hasbro market cap	20.22	20.68	23.53	36.45	21.97	26.82	40.50	38.47	56.46
NIBD	3.46	4.05	6.91	8.53	9.53	9.74	6.47	10.18	11.06
Hasbro EV	23.69	24.73	30.44	44.97	31.50	36.56	46.97	48.65	67.52
Mattel	37.46	29.21	38.71	49.91	50.11	72.63	90.69	58.79	62.02
NIBD	5.95	7.04	4.22	4.71	7.30	5.58	10.40	13.36	14.37
Mattel EV	43.41	36.26	42.93	54.62	57.41	78.20	101.09	72.14	76.39

Figure 5-8 – EV, Hasbro, Mattel in DKK bn

Stock prices are annual averages. Market cap data from Bloomberg and Yahoo Finance. All numbers are converted to DKK using annual averaged currency exchange rates.

Lego EV was calculated to DKK ~460 and Hasbro's and Mattel's EVs in 2015 are 8x and 6x lower as can be seen from the table above. It is worth noting that EVs for peer firms may or may not include forward-looking views in term of projected cash flows, i.e. investors may have 'variable-length perspectives' and value the firm differently. It is fair to assume that reported market caps are averages of all investors. However, even averages may still not reflect optimal EVs as investors can still be biased and speculative causing market caps (and therefore EVs) to be skewed. Accordingly, benchmarking against peers may therefor produce skewed conclusions. The valuation of Lego can seem high but when factoring in Lego's current growth as well as its potential strategically and economically, its historically larger cash flows, higher performance and underlying budgeting, the valuation is assumed a fair approximation. In reflection hereof and in relation to the research design, the underlying data, models and chosen framework may be incomplete and not capture all aspects of the firm and market situation thus changing the resulting valuation.

PART IV

Concluding Remarks

6 Conclusion

The aim of this thesis has been to arrive at a fair valuation of Lego. The valuation of Lego is estimated to be DKK ~460bn using a 10 year budget of discounted cash flows, covering the period 2016-2025. The WACC rate was calculated to 4.4439 % and the terminal growth rate, g to 2.34 %.

Lego being an unlisted firm and analyzing from an outside perspective, indicates challenges with information asymmetry and as such, the research design was adapted. A cause-and-effect relationship between drivers of value creation/destruction and a given firm was assumed deterministic of valuation. As argued, a correct identification and estimation of such value drivers is not easy and perhaps impossible. Furthermore, bias and information asymmetry makes the valuation a challenging endeavor. The results is that one cannot know if the valuation is correct, but instead should anticipate a valuation encompassed with errors. Furthermore, it was argued that the 'trueness' of valuations cannot be empirically verified. In light of this, theory asks to try to minimize potential errors, bias and to answer the research question by using benchmark testing, reflection of model selection, as well as peer group comparison.

Various models were benchmarked against each other in accordance with the research design. As the valuation relies (amongst others) on time series data, Fourier function approximation was included to try to minimize anticipated errors. The 10-year Danish government bond interest rate, as well as metrics based on reformulated financials, revenue and NOPLAT, were tested for white noise before any use of Fourier. The testing for revenue and NOPLAT revealed mixed results and Fourier analysis was therefore avoided. On the other hand, interest rates showed no randomness at 1% and 5% α-levels and Fourier analysis revealed major fluctuations at ~5 and ~11 years intervals for the interest rate data, making it an exciting case for further analysis. The time series transform was benchmarked against regression models to see which would be better at forecasting. It was found that regression performed marginally better than Fourier forecasting of the interest rates did. Forecasting of interest rates yielded negative values and therefore an average interest rate based on historic data was used instead for further calculations.

To derive a budget for Lego, 10 years of prior data using revenue as guiding factor was modelled. The budget was in line with the strategic analysis and financial analysis of Lego, Lego's two main competitors Hasbro and Mattel, as well the toys and games industry. To include the 'fairness' definition, the valuation was simulated with Monte Carlo on one- and two dimensions to yield 'what if' scenarios. The simulation indicated majority of the estimated enterprise values to be in the range DKK 87bn-354bn with a mean value of DKK 178bn. The original valuation of DKK ~460bn showed to be 8x-6x higher than peer firms Hasbro and Mattel. It was argued that Lego has been performing better according to financial statement analysis than the peer firms. Furthermore, the strategical analysis indicated an exciting future for Lego, which gives credit to the original valuation, and as such, it is assumed that the valuation is fair.

6.1 Future research

As the findings in this thesis are based on secondary data, naturally it would be interesting to see if primary data would reveal different results and perhaps narrow the gap between the WACC rate calculated and the one Lego has reported. As outlined previously in the strategic analysis sections, demand in the toy industry is highly seasonal and driven by short product life cycles. In addition, Lego has been struggling to keep up with demands during holiday seasons, therefore missing sales. According to the firm, the number of temporary workers in Lego's brand stores increased in 2015 from around an average of 300 people to around 750 during the last quarter of the year. Managing the supply chain optimally is expected to become an even larger challenge given the projected growth over the next 10 years. In relation thereof, two areas of further research could be interesting to dive into: 1) forecasting of demand for toys by applying Fourier analysis on daily time series sales data from Lego and 2) applying machine learning (ML) to grasp demographic factors' impact in relation to sales demand. The nature (e.g. characteristic, size and most importantly timing) of data material related to demographics, such as population composition (age, wealth, education level, age compression, transition to adulthood) gathered on an entire population could yield large and complex datasets consisting of perhaps millions or even billions of data points. This is where machine learning comes in handy as the scope, scale and time constraints require fast response in order for the supply chain to cope with the ever-changing demand situation in the toy industry. Billari, Fürnkranz, and Prskawetz (2006) have previously successfully used ML in a related field (specifically related to people in Italy and Austria). They used ML to identify “pathways” into adulthood, i.e. “what events mark transition into adulthood?”. Empirically we know that customers eventually grow too old to be considered primary users of toys – in Lego’s case the primary age group is 1½-11 years old, even if adults still use their products. Knowing exact pathways into adulthood is something that could be important for toy firms to know, especially in relation to supply chain optimization to avoid over-stocking but also to develop new products aimed at maintaining existing customers longer. Keeping these findings in mind as well as the socio-cultural challenges Lego and the toy industry faces, I think that makes ML in combination with demand forecasting an interesting further topic of research. Analogous to research conducted on fast moving consumer goods (i.e. fashion items) by Fumi et al., (2013), Fourier and ML research may reveal how Lego’s supply chain could be further optimized in relation to “out-of-stock”-situations or overstocked stores and warehouses. Further optimizing the supply chain at Lego with stronger demand forecasting tools could result in improved financials, c. p. yielding an even higher valuation.

7 References

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8 Appendix

All tables and calculations are available in the Excel file attached to the thesis.

8.1 Organizational Chart

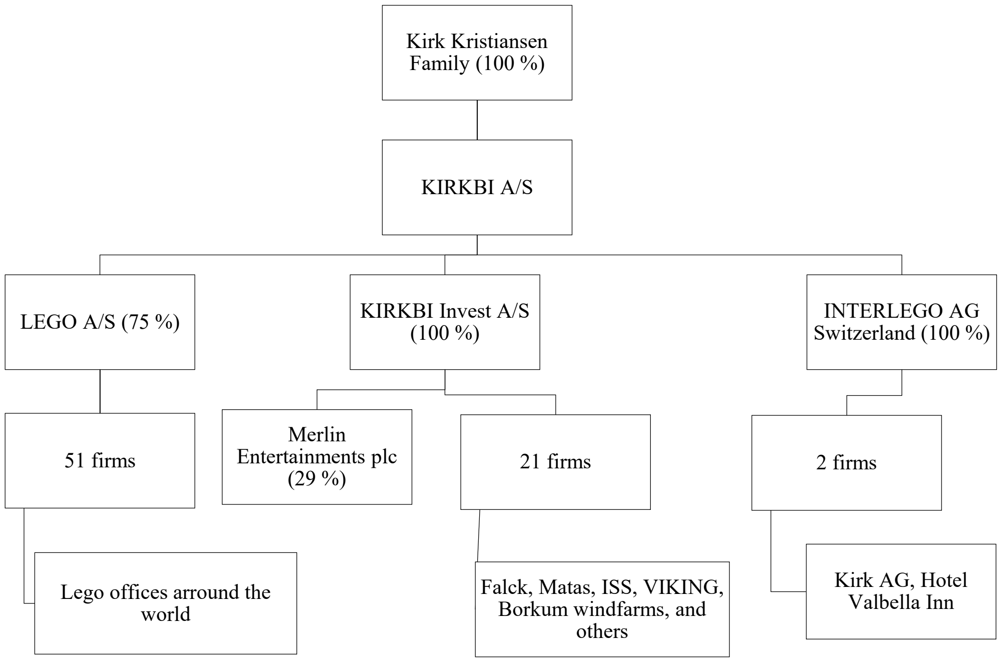


Figure 8-1 – LEGO A/S - Ownership structure 2015

The figure shows the ownership structure of Lego. 75 % is owned by the KIRKBI A/S Foundation, and the rest by members of the Kirk Kristiansen family. Merlin Entertainments plc operates the LEGOLAND parks

8.2 Macro, Meso, and Micro Environment

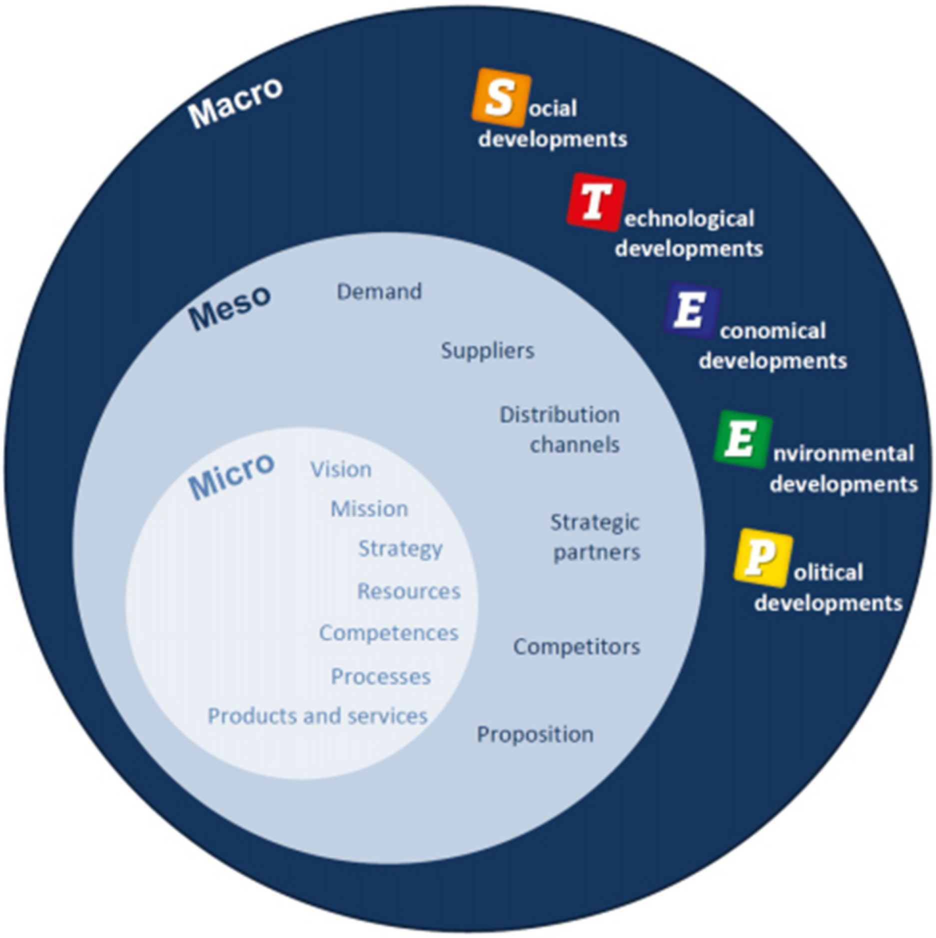


Figure 8-2 – Macro, meso, and micro environment

The figure depicts a general view of the environment at various levels. (IVTO, 2016)

8.3 Matlab Source Code for Fourier Transform

The Matlab source code includes two programs – one for creation of sample waves and one for analyzing the Fourier Transform of interest rates (and other time series for that matter). Both programs produce plots as well numerical data. In the analysis, numerical data was transferred to Excel for easier treatment and improved plotting.

For creation of sample waves:

```
clc; close all; % clear / close all figures

%% ### Basic setup for naming of plots
dummy=1;

%% ### Sample frequency (Hz)
fs = 1000;

%% ### Sample length - i.e ... 0:1/fs:1, sampled at 1/fs
t = 0:1/fs:3-1/fs;

%% ### Sample functions - e.g. 100 Hz + 12 Hz + Gaussian noise; uncomment any of below
% x = sin(2*pi*t);
% x = 2 * sin(2*pi*100*t) + sin(2*pi*12*t);
% x = 2 * sin(2*pi*100*t) + sin(2*pi*12*t) + 6 *gallery('normaldata',size(t),2);
% x = gallery('normaldata',size(t),2);
% x = sin(2*pi*1.2*t) + 2*sin(2*pi*0.8*t) +gallery('normaldata',size(t),2);

%% tightfig from here: http://www.mathworks.com/matlabcentral/fileexchange/34055-
tightfig/content/tightfig.m

figure; plot(x,'k'); tightfig; % plot raw data, fix whitespace around figure

%% ### Save figure
set(gcf,'PaperUnits','inches','PaperPosition',[0 0 6 4]);
print('-f1',strcat('graphs/plot',int2str(dummy)),'-deps','-r200');

%% ### Employ fft to compute the FT and magnitude.
m = length(x);           % Window length
n = pow2(nextpow2(m));   % Transform length
y = fft(x,n);            % FT
f = (0:n-1)*(fs/n);      % Frequency range
power = y.*conj(y)/n;    % Power of the FT

%% ### Create periodogram and rearrange data for 0-centered periodogram
y0 = fftshift(y);           % Rearrange y values
f0 = (-n/2:n/2-1)*(fs/n);   % 0-centered frequency range, x values
power0 = y0.*conj(y0)/n;    % 0-centered power, y values

figure; plot(f0,power0,'k'); % plot periodogram
xlim([0 120]); % modify x-axis scaling
tightfig; % fix whitespace around figure

xtick = get(gca, 'XTick');
xtick(1) = 12; % add tick mark
set(gca, 'XTick', xtick);

%% ### Save figure
set(gcf,'PaperUnits','inches','PaperPosition',[0 0 6 4]);
print('-f2',strcat('graphs/periodogram',int2str(dummy)),'-deps','-r200');
```

For analyzing interest rate time series data:

```
clc; close all;
fontSize = 10;
lineWidth = 2;
markerSize = 8;
set(0,'defaultTextFontSize',fontSize);
set(0,'defaultLineLineWidth',lineWidth);
set(0,'defaultLineMarkerSize',markerSize);
set(0,'defaultTextInterpreter','latex');
%% tightfig from here: http://www.mathworks.com/matlabcentral/fileexchange/34055-
tightfig/content/tightfig.m

%% Configuration (choose dataset file)
datasetset = 'interest';  % hasbro mattel interest
dataset = load(strcat('data/', datasetset, '.txt'));
savefile = 1; % 0 don't save files, 1 save files.
subtitle = ''; %' $$\dataset$$ - ';


%% Sampling configuration
fs = 24;                % Samples/unit time
m = length(dataset);    % Window length (number of samples)
i = 1;                  % increment variable for plot windows.

%% Plot raw dataset, k = black line
figure; plot(dataset, 'k'); tightfig;

    title(strcat(datasetset, subtitle, ' \bf', sprintf(' Raw dataset - %d samples', m)));
    xlabel('months', 'Interpreter','latex');
    ylabel('$$rate$$', 'Interpreter','latex');

    if savefile == 1
        set(gcf,'PaperUnits','inches','PaperPosition',[0 0 6 4]);
        print(strcat('graphs\', datasetset,'-',int2str(i)),'-deps','-r200');
    end


%% Compute discrete Fourier of dataset
n = pow2(nextpow2(m));
Y = fft(dataset,n);
f = (0:n-1)*(fs/n);
power = Y.*conj(Y)/n;


%%  Single-sided periodogram
% Compute two-sided spectrum P2. Then compute the single-sided spectrum P1
% based on P2 and the even-valued signal length L.

P2 = abs(Y/m);
P1 = P2(1:m/2+1);
P1(2:end-1) = 2*P1(2:end-1);
f = fs*(0:(m/2))/m;

figure; plot(f,P1,'k'); tightfig;
xlim([-.5 3]); % added limit here for better overview

    title(strcat(datasetset, subtitle, ' {\bf DFT - Single-sided periodogram}'));
    xlabel('Frequency (Hz)', 'Interpreter','latex');
    ylabel('Power', 'Interpreter','latex');

    if savefile == 1
        i=i+1;set(gcf,'PaperUnits','inches','PaperPosition',[0 0 6 4]);
        print(strcat('graphs\', datasetset,'-',int2str(i)),'-deps','-r200');
    end
```

8.4 Fisher's Test for Significance – Distribution Table

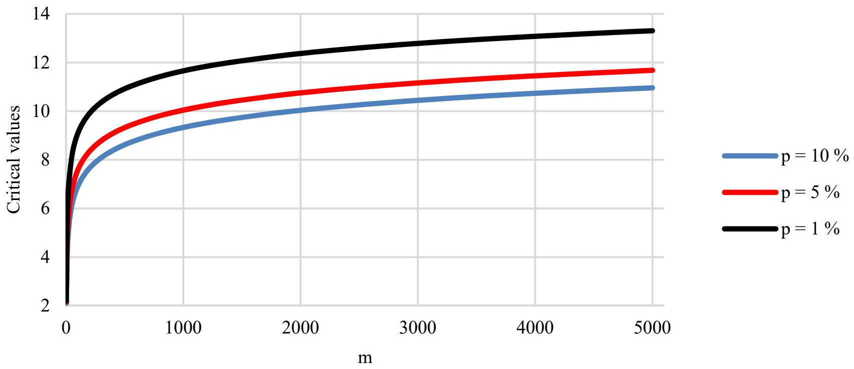


Figure 8-3 – Fisher's test of significance critical values

Own creation

m	p = 10 %	p = 5 %	p = 1 %
2	1.900	1.950	1.990
3	2.452	2.613	2.827
4	2.830	3.072	3.457
5	3.120	3.419	3.943
6	3.354	3.697	4.331
7	3.552	3.928	4.651
8	3.722	4.125	4.921
9	3.872	4.297	5.154
10	4.005	4.450	5.358
11	4.125	4.586	5.539
12	4.234	4.709	5.701
13	4.334	4.821	5.848
14	4.426	4.924	5.981
15	4.511	5.019	6.103
16	4.590	5.108	6.216
17	4.665	5.190	6.321
18	4.734	5.267	6.418
19	4.800	5.340	6.509
20	4.862	5.408	6.594
21	4.921	5.473	6.675
22	4.977	5.534	6.750
23	5.031	5.592	6.822
24	5.081	5.648	6.890
25	5.130	5.701	6.955
26	5.177	5.752	7.016
27	5.222	5.801	7.075
28	5.265	5.847	7.132
29	5.306	5.892	7.186
30	5.346	5.935	7.237
31	5.385	5.977	7.287
32	5.422	6.017	7.335
33	5.458	6.056	7.381
34	5.493	6.093	7.425
35	5.527	6.130	7.468
36	5.559	6.165	7.510
37	5.591	6.199	7.550
38	5.622	6.232	7.588
39	5.652	6.264	7.626
40	5.681	6.295	7.663
41	5.710	6.326	7.698
42	5.738	6.355	7.732
43	5.765	6.384	7.766
44	5.791	6.412	7.798
45	5.817	6.440	7.830
46	5.842	6.466	7.861
47	5.867	6.493	7.891
48	5.891	6.518	7.920
49	5.914	6.543	7.949
50	5.937	6.567	7.977
51	5.960	6.591	8.004
52	5.982	6.615	8.031
53	6.004	6.637	8.057
54	6.025	6.660	8.082
55	6.046	6.682	8.107
56	6.066	6.703	8.132
57	6.086	6.724	8.156
58	6.106	6.745	8.179
59	6.125	6.765	8.202
60	6.144	6.785	8.225
61	6.162	6.805	8.247
62	6.181	6.824	8.268
63	6.199	6.843	8.290
64	6.216	6.862	8.311
65	6.234	6.880	8.331
66	6.251	6.898	8.351
67	6.268	6.915	8.371
68	6.284	6.933	8.390
69	6.300	6.950	8.410
70	6.317	6.967	8.428
71	6.332	6.983	8.447
72	6.348	7.000	8.465
73	6.363	7.016	8.483
74	6.378	7.032	8.501
75	6.393	7.047	8.518
76	6.408	7.063	8.535
77	6.423	7.078	8.552
78	6.437	7.093	8.569
79	6.451	7.108	8.585
80	6.465	7.122	8.601
81	6.479	7.136	8.617
82	6.492	7.151	8.632
83	6.506	7.165	8.648
84	6.519	7.178	8.663
85	6.532	7.192	8.678
86	6.545	7.205	8.693
87	6.558	7.219	8.708
88	6.570	7.232	8.722
89	6.583	7.245	8.736
90	6.595	7.258	8.750
91	6.607	7.270	8.764
92	6.619	7.283	8.778
93	6.631	7.295	8.792
94	6.643	7.307	8.805
95	6.655	7.319	8.818
96	6.666	7.331	8.831
97	6.677	7.343	8.844
98	6.689	7.355	8.857
99	6.700	7.366	8.869
100	6.711	7.378	8.882
101	6.722	7.389	8.894
102	6.732	7.400	8.906
103	6.743	7.411	8.919
104	6.754	7.422	8.930
105	6.764	7.433	8.942
106	6.774	7.444	8.954
107	6.785	7.455	8.965
108	6.795	7.465	8.977
109	6.805	7.475	8.988
110	6.815	7.486	8.999
111	6.825	7.496	9.010
112	6.835	7.506	9.021
113	6.844	7.516	9.032
114	6.854	7.526	9.043
115	6.863	7.536	9.054
116	6.873	7.546	9.064
117	6.882	7.555	9.075
118	6.891	7.565	9.085
119	6.900	7.574	9.095
120	6.910	7.584	9.105
121	6.919	7.593	9.115
122	6.927	7.602	9.125
123	6.936	7.611	9.135
124	6.945	7.620	9.145
125	6.954	7.629	9.155
126	6.962	7.638	9.164
127	6.971	7.647	9.174
128	6.979	7.656	9.183
129	6.988	7.665	9.193
130	6.996	7.673	9.202
131	7.005	7.682	9.211
132	7.013	7.690	9.220
133	7.021	7.699	9.229
134	7.029	7.707	9.238
135	7.037	7.715	9.247
136	7.045	7.723	9.256
137	7.053	7.732	9.265
138	7.061	7.740	9.273
139	7.069	7.748	9.282
140	7.076	7.756	9.290
141	7.084	7.764	9.299
142	7.092	7.771	9.307
143	7.099	7.779	9.316

144	7.107	7.787	9.324	**218**	7.549	8.241	9.805	**292**	7.857	8.555	10.134
145	7.114	7.795	9.332	**219**	7.554	8.246	9.810	**293**	7.861	8.559	10.138
146	7.121	7.802	9.340	**220**	7.559	8.251	9.816	**294**	7.865	8.562	10.141
147	7.129	7.810	9.348	**221**	7.564	8.256	9.821	**295**	7.868	8.566	10.145
148	7.136	7.817	9.356	**222**	7.569	8.260	9.826	**296**	7.872	8.569	10.149
149	7.143	7.825	9.364	**223**	7.573	8.265	9.831	**297**	7.875	8.573	10.153
150	7.151	7.832	9.372	**224**	7.578	8.270	9.836	**298**	7.879	8.577	10.156
151	7.158	7.839	9.380	**225**	7.583	8.275	9.841	**299**	7.882	8.580	10.160
152	7.165	7.847	9.388	**226**	7.588	8.280	9.846	**300**	7.886	8.584	10.164
153	7.172	7.854	9.396	**227**	7.592	8.285	9.851	**301**	7.889	8.587	10.167
154	7.179	7.861	9.403	**228**	7.597	8.289	9.856	**302**	7.893	8.591	10.171
155	7.186	7.868	9.411	**229**	7.601	8.294	9.861	**303**	7.896	8.594	10.175
156	7.193	7.875	9.418	**230**	7.606	8.299	9.866	**304**	7.900	8.598	10.178
157	7.199	7.882	9.426	**231**	7.611	8.303	9.871	**305**	7.903	8.601	10.182
158	7.206	7.889	9.433	**232**	7.615	8.308	9.876	**306**	7.907	8.605	10.186
159	7.213	7.896	9.441	**233**	7.620	8.313	9.881	**307**	7.910	8.608	10.189
160	7.220	7.903	9.448	**234**	7.624	8.317	9.886	**308**	7.913	8.612	10.193
161	7.226	7.910	9.455	**235**	7.629	8.322	9.890	**309**	7.917	8.615	10.197
162	7.233	7.917	9.463	**236**	7.633	8.327	9.895	**310**	7.920	8.619	10.200
163	7.240	7.924	9.470	**237**	7.638	8.331	9.900	**311**	7.924	8.622	10.204
164	7.246	7.930	9.477	**238**	7.642	8.336	9.905	**312**	7.927	8.626	10.207
165	7.253	7.937	9.484	**239**	7.647	8.340	9.909	**313**	7.930	8.629	10.211
166	7.259	7.944	9.491	**240**	7.651	8.345	9.914	**314**	7.934	8.632	10.214
167	7.266	7.950	9.498	**241**	7.655	8.349	9.919	**315**	7.937	8.636	10.218
168	7.272	7.957	9.505	**242**	7.660	8.354	9.924	**316**	7.940	8.639	10.221
169	7.278	7.963	9.512	**243**	7.664	8.358	9.928	**317**	7.944	8.642	10.225
170	7.285	7.970	9.519	**244**	7.668	8.362	9.933	**318**	7.947	8.646	10.228
171	7.291	7.976	9.526	**245**	7.673	8.367	9.937	**319**	7.950	8.649	10.232
172	7.297	7.983	9.533	**246**	7.677	8.371	9.942	**320**	7.953	8.652	10.235
173	7.303	7.989	9.539	**247**	7.681	8.376	9.947	**321**	7.957	8.656	10.239
174	7.310	7.995	9.546	**248**	7.686	8.380	9.951	**322**	7.960	8.659	10.242
175	7.316	8.002	9.553	**249**	7.690	8.384	9.956	**323**	7.963	8.662	10.246
176	7.322	8.008	9.559	**250**	7.694	8.389	9.960	**324**	7.966	8.666	10.249
177	7.328	8.014	9.566	**251**	7.698	8.393	9.965	**325**	7.970	8.669	10.252
178	7.334	8.020	9.572	**252**	7.703	8.397	9.969	**326**	7.973	8.672	10.256
179	7.340	8.026	9.579	**253**	7.707	8.401	9.974	**327**	7.976	8.675	10.259
180	7.346	8.032	9.585	**254**	7.711	8.406	9.978	**328**	7.979	8.679	10.262
181	7.352	8.039	9.592	**255**	7.715	8.410	9.982	**329**	7.982	8.682	10.266
182	7.358	8.045	9.598	**256**	7.719	8.414	9.987	**330**	7.986	8.685	10.269
183	7.363	8.051	9.604	**257**	7.723	8.418	9.991	**331**	7.989	8.688	10.272
184	7.369	8.056	9.611	**258**	7.727	8.422	9.996	**332**	7.992	8.692	10.276
185	7.375	8.062	9.617	**259**	7.731	8.427	10.000	**333**	7.995	8.695	10.279
186	7.381	8.068	9.623	**260**	7.735	8.431	10.004	**334**	7.998	8.698	10.282
187	7.386	8.074	9.629	**261**	7.739	8.435	10.009	**335**	8.001	8.701	10.286
188	7.392	8.080	9.636	**262**	7.743	8.439	10.013	**336**	8.004	8.704	10.289
189	7.398	8.086	9.642	**263**	7.748	8.443	10.017	**337**	8.007	8.707	10.292
190	7.403	8.092	9.648	**264**	7.752	8.447	10.021	**338**	8.011	8.711	10.296
191	7.409	8.097	9.654	**265**	7.755	8.451	10.026	**339**	8.014	8.714	10.299
192	7.415	8.103	9.660	**266**	7.759	8.455	10.030	**340**	8.017	8.717	10.302
193	7.420	8.109	9.666	**267**	7.763	8.459	10.034	**341**	8.020	8.720	10.305
194	7.426	8.114	9.672	**268**	7.767	8.463	10.038	**342**	8.023	8.723	10.308
195	7.431	8.120	9.678	**269**	7.771	8.467	10.042	**343**	8.026	8.726	10.312
196	7.436	8.125	9.684	**270**	7.775	8.471	10.046	**344**	8.029	8.729	10.315
197	7.442	8.131	9.689	**271**	7.779	8.475	10.051	**345**	8.032	8.732	10.318
198	7.447	8.136	9.695	**272**	7.783	8.479	10.055	**346**	8.035	8.735	10.321
199	7.453	8.142	9.701	**273**	7.787	8.483	10.059	**347**	8.038	8.738	10.324
200	7.458	8.147	9.707	**274**	7.791	8.487	10.063	**348**	8.041	8.742	10.328
201	7.463	8.153	9.713	**275**	7.794	8.491	10.067	**349**	8.044	8.745	10.331
202	7.468	8.158	9.718	**276**	7.798	8.495	10.071	**350**	8.047	8.748	10.334
203	7.474	8.164	9.724	**277**	7.802	8.499	10.075	**351**	8.050	8.751	10.337
204	7.479	8.169	9.729	**278**	7.806	8.502	10.079	**352**	8.053	8.754	10.340
205	7.484	8.174	9.735	**279**	7.810	8.506	10.083	**353**	8.056	8.757	10.343
206	7.489	8.179	9.741	**280**	7.813	8.510	10.087	**354**	8.059	8.760	10.346
207	7.494	8.185	9.746	**281**	7.817	8.514	10.091	**355**	8.062	8.763	10.349
208	7.500	8.190	9.752	**282**	7.821	8.518	10.095	**356**	8.065	8.766	10.352
209	7.505	8.195	9.757	**283**	7.825	8.521	10.099	**357**	8.068	8.769	10.356
210	7.510	8.200	9.763	**284**	7.828	8.525	10.103	**358**	8.071	8.772	10.359
211	7.515	8.205	9.768	**285**	7.832	8.529	10.107	**359**	8.074	8.774	10.362
212	7.520	8.211	9.773	**286**	7.836	8.533	10.111	**360**	8.076	8.777	10.365
213	7.525	8.216	9.779	**287**	7.839	8.536	10.115	**361**	8.079	8.780	10.368
214	7.530	8.221	9.784	**288**	7.843	8.540	10.118	**362**	8.082	8.783	10.371
215	7.535	8.226	9.789	**289**	7.847	8.544	10.122	**363**	8.085	8.786	10.374
216	7.540	8.231	9.795	**290**	7.850	8.548	10.126	**364**	8.088	8.789	10.377
217	7.544	8.236	9.800	**291**	7.854	8.551	10.130	**365**	8.091	8.792	10.380

366	8.094	8.795	10.383
367	8.096	8.798	10.386
368	8.099	8.801	10.389
369	8.102	8.804	10.392
370	8.105	8.806	10.395
371	8.108	8.809	10.398
372	8.111	8.812	10.401
373	8.113	8.815	10.404
374	8.116	8.818	10.406
375	8.119	8.821	10.409
376	8.122	8.823	10.412
377	8.125	8.826	10.415
378	8.127	8.829	10.418
379	8.130	8.832	10.421
380	8.133	8.835	10.424
381	8.135	8.837	10.427
382	8.138	8.840	10.430
383	8.141	8.843	10.432
384	8.144	8.846	10.435
385	8.146	8.848	10.438
386	8.149	8.851	10.441
387	8.152	8.854	10.444
388	8.154	8.857	10.447
389	8.157	8.859	10.449
390	8.160	8.862	10.452
391	8.162	8.865	10.455
392	8.165	8.867	10.458
393	8.168	8.870	10.460
394	8.170	8.873	10.463
395	8.173	8.875	10.466
396	8.176	8.878	10.469
397	8.178	8.881	10.472
398	8.181	8.883	10.474
399	8.184	8.886	10.477
400	8.186	8.889	10.480
401	8.189	8.891	10.482
402	8.191	8.894	10.485
403	8.194	8.897	10.488
404	8.196	8.899	10.491
405	8.199	8.902	10.493
406	8.202	8.904	10.496
407	8.204	8.907	10.499
408	8.207	8.910	10.501
409	8.209	8.912	10.504
410	8.212	8.915	10.507
411	8.214	8.917	10.509
412	8.217	8.920	10.512
413	8.219	8.922	10.514
414	8.222	8.925	10.517
415	8.224	8.928	10.520
416	8.227	8.930	10.522
417	8.229	8.933	10.525
418	8.232	8.935	10.528
419	8.234	8.938	10.530
420	8.237	8.940	10.533
421	8.239	8.943	10.535
422	8.242	8.945	10.538
423	8.244	8.948	10.540
424	8.247	8.950	10.543
425	8.249	8.953	10.546
426	8.252	8.955	10.548
427	8.254	8.958	10.551
428	8.256	8.960	10.553
429	8.259	8.962	10.556
430	8.261	8.965	10.558
431	8.264	8.967	10.561
432	8.266	8.970	10.563
433	8.268	8.972	10.566
434	8.271	8.975	10.568
435	8.273	8.977	10.571
436	8.276	8.979	10.573
437	8.278	8.982	10.576
438	8.280	8.984	10.578
439	8.283	8.987	10.581
440	8.285	8.989	10.583
441	8.287	8.991	10.586
442	8.290	8.994	10.588
443	8.292	8.996	10.590
444	8.295	8.999	10.593
445	8.297	9.001	10.595
446	8.299	9.003	10.598
447	8.302	9.006	10.600
448	8.304	9.008	10.603
449	8.306	9.010	10.605
450	8.308	9.013	10.607
451	8.311	9.015	10.610
452	8.313	9.017	10.612
453	8.315	9.020	10.615
454	8.318	9.022	10.617
455	8.320	9.024	10.619
456	8.322	9.027	10.622
457	8.324	9.029	10.624
458	8.327	9.031	10.626
459	8.329	9.033	10.629
460	8.331	9.036	10.631
461	8.333	9.038	10.633
462	8.336	9.040	10.636
463	8.338	9.043	10.638
464	8.340	9.045	10.640
465	8.342	9.047	10.643
466	8.345	9.049	10.645
467	8.347	9.052	10.647
468	8.349	9.054	10.650
469	8.351	9.056	10.652
470	8.354	9.058	10.654
471	8.356	9.060	10.657
472	8.358	9.063	10.659
473	8.360	9.065	10.661
474	8.362	9.067	10.663
475	8.364	9.069	10.666
476	8.367	9.072	10.668
477	8.369	9.074	10.670
478	8.371	9.076	10.673
479	8.373	9.078	10.675
480	8.375	9.080	10.677
481	8.377	9.083	10.679
482	8.380	9.085	10.681
483	8.382	9.087	10.684
484	8.384	9.089	10.686
485	8.386	9.091	10.688
486	8.388	9.093	10.690
487	8.390	9.095	10.693
488	8.392	9.098	10.695
489	8.395	9.100	10.697
490	8.397	9.102	10.699
491	8.399	9.104	10.701
492	8.401	9.106	10.704
493	8.403	9.108	10.706
494	8.405	9.110	10.708
495	8.407	9.113	10.710
496	8.409	9.115	10.712
497	8.411	9.117	10.714
498	8.413	9.119	10.717
499	8.415	9.121	10.719
500	8.418	9.123	10.721
600	8.606	9.313	10.916
700	8.764	9.473	11.079
800	8.901	9.612	11.220
900	9.022	9.733	11.344
1000	9.130	9.842	11.454
1100	9.227	9.939	11.553
1200	9.316	10.029	11.644
1300	9.397	10.111	11.727
1400	9.473	10.186	11.803
1500	9.543	10.257	11.875
1600	9.608	10.323	11.941
1700	9.670	10.384	12.003
1800	9.728	10.443	12.062
1900	9.783	10.498	12.118
2000	9.834	10.550	12.170
2100	9.884	10.599	12.220
2200	9.931	10.647	12.268
2300	9.976	10.692	12.313
2400	10.019	10.735	12.357
2500	10.060	10.776	12.399
2600	10.100	10.816	12.439
2700	10.138	10.854	12.477
2800	10.175	10.891	12.514
2900	10.210	10.927	12.550
3000	10.244	10.961	12.585
3100	10.278	10.994	12.618
3200	10.310	11.026	12.650
3300	10.341	11.058	12.681
3400	10.371	11.088	12.712
3500	10.400	11.117	12.741
3600	10.428	11.146	12.770
3700	10.456	11.173	12.798
3800	10.483	11.200	12.825
3900	10.509	11.226	12.851
4000	10.535	11.252	12.877
4100	10.560	11.277	12.902
4200	10.584	11.301	12.926
4300	10.607	11.325	12.950
4400	10.631	11.348	12.973
4500	10.653	11.371	12.996
4600	10.675	11.393	13.019
4700	10.697	11.415	13.040
4800	10.718	11.436	13.062
4900	10.739	11.457	13.082
5000	10.759	11.477	13.103

8.5 R-language Source Code for producing Fisher's Test of significance table

The ξ distribution (Fuller, 1996, p. 364):

$$P\{m^{-1}\xi > g\} = \sum_{j=1}^{k}(-1)^{j-1}\binom{m}{j}(1-jg)^{m-1}$$

Source code in R:

####################

```
f = function(g, m) {
  if (g >= 1) {
    return(0)
  } else if (g <= 0) {
    return(1)
  }

  k = floor(1 / g)
  if (k > 150) {
    k = 150
  }
  xi = sapply(1:k, function(j) {(-1)^(j - 1) * choose(m, j) * (1 - j * g)^(m - 1)})

  return(sum(xi))
}

fisherKappa = function(m, p) {
  u = 1
  l = 0
  x = (u + l) / 2
  y = f(x, m) - p
  while (abs(y) >= 1e-08) {
    if (sign(y) == sign(f(u, m) - p)) {
      u = x
    } else {
      l = x
    }

    x = (u + l) / 2
    y = f(x, m) - p
  }
  return(x)
}

# change 5000 to a different size here as well as step for different sized table.
m = seq(2, 5000, by = 1)
xi1 = m * sapply(m, fisherKappa, p = 0.1)
xi2 = m * sapply(m, fisherKappa, p = 0.05)
xi3 = m * sapply(m, fisherKappa, p = 0.01)
xi = cbind(xi1, xi2, xi3)
colnames(xi) = c("0.10", "0.05", "0.01")
rownames(xi) = m
round(xi, 3)
```

####################

The source code is very similar to source code from Cross Validated (2016), which in turn is based on A. A. Nowroozi (1967).

8.6 Condensed History of Lego

Year	Event	Strategic events
1891	Ole Kirk Christiansen (OKC), coming founder of LEGO is born.	
1916	OKC purchases woodworking shop, Billund Maskinsnedkeri og Tømrerforretning, in Billund, Denmark. Products were carpentry and furniture.	Manufacturing / sales
1920	Godtfred Kirk Christiansen (GKC), OKCs third son is born. GKC later becomes CEO	
1924	Shop burns down - new larger shop is built.	
1930	Around the Great Depression the shop struggles with fewer customers. To survive OCK forced to focus on small projects.	
1932	Shop burns down again. OKC is inspired to construct wooden toys. Main products are still household products. Kiddikraft, a British competitor is established.	Development of own products
1934	Firm changes name to *"LEGO Fabrikken Billund, Fabrik for Trævare og Legetøj"*	
1935	6-7 employees. Starts manufacturing of its first wooden toy - a duck on four wheels. In addition LEGO markets its first construction toy, "Kirks Sandgame"	Technology shift
1937	GKC starts creating the first toy models.	
1939	10 employees	
1940	GKC, now 20 years old, becomes manager at LEGO	
1942	Shop burns down for the third time. Production of wooden toys continues.	
1943	40 employees	
1945	Deficit	
1946	LEGO buys plastic-injection molding machine; arrives in 1947.	Advent of new technology for production of plastic. Technology shift
1947	A test series of wooden toys is shipped to India. Educational traffic board game is created. Kjeld Kirk Kristiansen (KKK), GKC's son is born.	
1949	50 employees. The precursor to the well-known LEGO brick, the "LEGO Automatic Binding Brick" is created. Exclusively sold in DK. 200 different products	First plastic brick sold
1953	The LEGO Automatic Binding Brick is renamed to LEGO Brick. Application for trademark.	
1955	System of Play is born. First real export begins - country is Sweden.	System of Play born. First real exports occurred. Strategy
1956	First foreign sales company is established - country is Germany	First foreign sales office
1957	LEGO Schweiz is established	
1958	140 employees. The stud-and-tube coupling system used in todays LEGO Bricks is patented. OKC dies and son GKC becomes CEO	Improved design on bricks for better fit. Strategy
1959	LEGO France, British LEGO Ltd., LEGO Belgium and LEGO Sweden are established. Market analysis dept. established. Product development dept. has 5 employees.	
1960	450 employees. LEGO factory burns down for the fourth time. Wooden toys product lines are discontinued.	Discontinuation of wooden toys product lines. 90 % product lines cut.
1961	LEGO Italy established. Sales in the US / Canada via license agreement with Samsonite.	Outsourced sales to US/Canada
1962	LEGO Australia established. Sales start in Singapore, Hong Kong, Australia, Morocco and Japan.	
1963	LEGO Austria established. Procurement dept. established. Quality of "brick's clutch power" is improved by using different plastic, called ABS	Sales in Asian countries. Technology improvements
1964	"Jumbo bricks" produced by license partner Samsonite in the US. Production plant in Germany opens. First sales to the Middle East - Lebanon	Outsourced production of some products
1965	600 employees.	First sales in Spain.
1966	LEGO is now sold in 42 countries	
1968	LEGOLAND Billund theme park is opened. First sales to Latin America, Curacao and Peru.	Enters new industry - "theme parks"
1970	1000 employees	
1971	First sales to Far East	
1972	License agreement with Samsonite in the US, ends. First sales to Czech Republic	Outsourced sales ends in USA/Canada. Strategy
1973	LEGO USA established. LEGO Portugal established. First sales to Eastern Europe (Hungary). LEGOLAND Germany opens. 5m in total have visited LEGOLAND parks	Establishes on sales office in USA
1974	LEGO Spain established. LEGO Figures, the biggest selling product to date, is introduced	
1975	2500 employees. LEGO Portugal established. Procurement in US established.	
1977	KKK joins management.	
1978	LEGO Japan (Nihon LEGO K. K.) established. The next 5 years, annual growth rates averages 14 %	
1979	LEGO Singapore established. KKK is appointed President and CEO	
1980	Educational Products Department (EP) established. New factory in Denmark	The 1980's signals the beginning of the digital age
1981	Plant for decorating, assembly, packing, warehousing opens in Switzerland - closes again in 2001	Lego acquires original Kiddikraft patents. Strategy
1982	LEGO South Africa established	
1983	3700 employees. LEGO Overseas holds its first World Distributor Conference.	
1984	LEGO Brazil + LEGO Korea established. Co-promotion with McDonalds in USA/Canada	
1985	5000 employees total (3000 in DK). Procurement department established in Korea.	Collaboration with MIT on learning. Strategy
1986	Another factory in Brazil opened. KKK takes over after father resigns as chairman	Results of collaboration launched, Lego Technic. Technology
1987	6000 employees. Products are sold in 115 countries. LEGO South Africa closed.	
1988	LEGO Canada established.	
1989	Educational Products Dep. changes name to LEGO Dacta. Dacta means "the study of purpose, means and substance of learning and the learning process"	
1990	Lego Malaysia established. LEGO Group among the 10 largest toy manufacturers in the world + only one in Europe (others are American and Japanese.)	Enters Top 10 list of toy manufacturers. Signs of economic turmoil
1991	7550 employees. 5 manufacturing sites	
1992	LEGO Japan (not Nihon K.K. from 1978) established. LEGO Hungary too. Large scale introduction of LEGO products in China	
1993	LEGO South Africa re-established. New factory for DUPLO opens in Switzerland, closes again in 2006	
1994	8880 employees total, around half in DK. LEGO Mexico established. First ever TV-campaign in China	
1995	Fusion between LEGO Belgium and LEGO Netherlands to LEGO Benelux. Various LEGO exhibitions and happenings in different countries	Compass Management fails, enters decade with focus on growth
1996	LEGO website (www.lego.com) established. Factory (only packaging) in Korea established	
1997	LEGO kids wear shop opens in London, UK. LEGO Imagination Center is opened in Florida, US	

1998	First deficit since 1945. Factories in DK, Switzerland, USA, Brazil and Korea is 360,000 m2. Around 80 % is in DK. Close to 10,000 employees	Lego Mindstorms launched based on MIT collaboration. Technology
1999	Undergoes restructuring, 1000 employees laid off. LEGOLAND California, US opens. License deal with Lucas Film on LEGO Star Wars franchise.	Franchise license agreement
2000	DKK 0.8bn deficit. Factory in Czech Republic opens. Partnership deal with Warner Bros on Harry Potter franchise	Franchise license agreement. Deficit again, too much focus on growth
2001	Refocus to core business "which is materials for open-ended play for children", Poul Plougmann LEGO COO - due to deficit previous year. Profits DKK 400mn	
2002	Retail stores in Germany, England, and Russia. LEGOLAND Germany opens. Profits DKK 400mn	
2003	Revenue drops DKK 4.5bn. DKK 0.9bn deficit. COO Poul Plougmann leaves LEGO. Around 300 employees fired from production and corporate functions.	Deficit, COO leaves Lego
2004	New CEO, Jørgen Vig Knudstorp is appointed in October. Year ends with DKK 1.0bn deficit	Deficit, new CEO from outside the Kirk family
2005	LEGOLAND parks divested, 1/3 ownership is transferred to Kirkbi parent company. Packaging factory in Korea closes, 60 employees fired. Sales office in Seoul remains. Result DKK 200mn.	Divestiture of theme parks to parent company
2006	5000 employees. Factory in Switzerland closes. Plans to outsource major parts of production. Outsourcing agreement with Flextronics.	Major parts of manufacturing outsourced
2007	4200 employees. License agreement with Lucasfilm on LEGO Indiana Jones. Distribution for all EU/Asian markets moved to Czech Republic.	
2008	5400 employees. Production is insourced again after outsourcing to Flextronics proved to be wrong decision.	Production insourced
2009	7000 employees. LEGO Group is 5th largest toy manufacturer (sales). License deal with Disney on entire Disney and Pixar franchise. LEGO Board Games product line launched	Franchise license agreements. New industry entered "Board games"
2010	8400 employees. Online gaming industry entered (LEGO Universe)	New industry entered "online gaming"
2011	9400 employees. Now third largest toy manufacturer (sales). LEGOLAND Florida opens	
2012	10400 employees. Management reduced from 22 employees to 6. Digital game, LEGO Universe shut down	Leaves "online gaming" industry.
2013	11800 employees. Plan commenced for factory in China by 2017	
2014	12500 employees. Lego name has 80-year birthday. The Lego Movie premieres. Significant impact on the result next year. Now 2nd largest toy manufacturing firm	First movie launched
2015	14000 employees. Lego Worlds online game introduced. Another record-breaking year. Now no. 1 globally when using an averaged currency translation	Enters online gaming again
2016		
2017	Factory opens in China. Additional 2000 employees	Factory in Asia. Sequel movie to be launched

Ovn creation

8.7 Top products in the traditional toy and games industry

Brand	Firm	2008	2009	2010	2011	2012	2013	2014
Hannah Montana	JAKKS Pacific	249	295	72	24	1	-	0
Lamaze	RC2 Corp	151	157	161	-	-	-	0
Learning Curve	RC2 Corp	228	211	197	-	-	-	0
Mega Bloks	Mega Brands Inc	367	391	475	503	562	586	0
Rastar	Xinghui Auto Model Co	14	21	33	54	80	95	0
Total	**Total**	**74140**	**71679**	**76158**	**81861**	**82476**	**83313**	**85091**
Others	**Others**	**48003**	**44808**	**46378**	**48895**	**48596**	**48896**	**49571**
Lego	LEGO	2584	2844	3367	4152	4841	5311	6058
Fisher-Price	Mattel	3212	3011	3173	3183	3205	3173	2823
Barbie	Mattel	2119	2041	2169	2332	2228	2098	1857
Private label	Private Label	1527	1491	1597	1737	1737	1650	1624
Crayola	Hallmark Cards	1025	1192	1233	1244	1288	1347	1357
VTech	Vtech	861	854	921	1008	1126	1244	1310
Playmobil	Brandstätter	797	803	857	911	905	953	1007
Hot Wheels	Mattel	893	933	914	822	870	866	854
Monster High	Mattel	0	0	178	470	694	823	716
Playskool	Hasbro	580	565	601	653	644	650	629
Nerf	Hasbro	355	351	481	493	472	523	621
MEGA Bloks	Mattel	-	-	-	-	-	-	612
Ravensburger	Ravensburger	490	494	501	510	453	501	488
LeapFrog	LeapFrog Enterprises	269	288	327	373	382	414	440
My Little Pony	Hasbro	53	86	153	217	282	354	421
Play-Doh	Hasbro	282	289	325	339	343	367	403
Disney Princess	Mattel	82	255	385	414	444	433	401
Monopoly	Hasbro	399	382	382	395	387	390	401
Transformers	Hasbro	453	511	440	506	392	325	390
Nabi	Fuhu Inc	-	0	23	83	144	244	387
Little Tikes	MGA Entertainment	372	339	368	371	358	365	379
Star Wars	Hasbro	378	375	382	381	377	347	377
Lalaloopsy	MGA Entertainment	-	-	86	246	335	340	366
Teenage Mutant Ninja Turtles	Playmates Toys	2	3	3	10	58	225	361
American Girl	Mattel	278	279	282	293	321	362	352
Magic: The Gathering	Hasbro	148	158	222	252	286	315	329
Frozen	Mattel	-	-	-	-	-	40	321
Yaoji Poker	Shanghai Yaoji Playing Cards Co	130	164	208	238	250	284	294
Smoby	Simba-Dickie	253	237	255	288	282	282	272
Littlest Pet Shop	Hasbro	289	277	290	288	260	244	257
Chicco	Artsana, Gruppo	197	196	206	226	225	238	242
Air Hogs	Spin Master	185	190	200	217	223	230	240

Brand	Firm	2008	2009	2010	2011	2012	2013	2014
Cars	Mattel	263	237	245	547	427	272	240
Yo-Kai Watch	BANDAI NAMCO	-	-	-	-	-	-	229
Build-a-bear	Build-A-Bear Workshop Inc	318	241	234	207	197	193	204
Matchbox	Mattel	170	171	190	213	206	199	191
Tomy	Takara Tomy	218	226	257	231	221	189	185
FurReal Friends	Hasbro	234	219	240	232	196	189	185
LeapPad	LeapFrog Enterprises	-	0	0	129	203	236	184
Haba	Habermaass GmbH	161	155	161	179	171	178	181
Power Rangers	BANDAI NAMCO	104	105	126	153	169	187	175
World Wrestling Entertainment	Mattel	87	71	95	183	197	186	173
Uno	Mattel	139	127	130	170	175	179	172
Lego Games	LEGO	-	155	220	217	208	168	170
Furby	Hasbro	1	-	-	-	61	178	167
Bratz	MGA Entertainment	479	296	263	245	211	197	167
TOMICA	Takara Tomy	140	141	170	184	175	153	146
Auby	Guangdong Alpha Animation & Culture Co	58	42	54	84	111	132	143
Yu-Gi-Oh!	Konami Corp	167	186	192	240	220	154	138
K'NEX	K'NEX Industries	114	104	106	119	128	129	138
Bandai	BANDAI NAMCO	75	95	119	183	186	153	136
Mobile Suit Gundam	BANDAI NAMCO	115	119	132	152	160	140	135
Moxie Girlz	MGA Entertainment	12	76	130	135	137	142	135
Sylvanian Families	Epoch Co	37	53	112	131	139	136	134
Beanie Babies	Ty Inc	203	172	167	142	124	125	133
Duel Masters	Takara Tomy	214	253	275	239	198	144	132
Learning Curve	Takara Tomy	-	-	-	191	142	135	128
Simba	Simba-Dickie	83	85	94	109	117	125	127
Lamaze	Takara Tomy	-	-	-	161	138	136	126
Carrera	Stadlbauer Marketing + Vertrieb GmbH	108	105	105	117	119	119	126
Tonka	Hasbro	144	139	152	150	143	135	126
Trivial Pursuit	Hasbro	133	134	139	139	128	126	125
Masked Rider	BANDAI NAMCO	94	131	141	168	168	140	125
Mega House	Mega House Corp	151	158	168	186	185	139	123
Max Steel	Mattel	105	99	128	136	131	134	121
AAA-Poker	Ningbo Three A Group Co	63	76	87	101	106	113	117
Planes	Mattel	-	-	-	-	-	112	116
Brio	Brio AB	79	77	93	109	103	105	116
Tyco	Mattel	191	154	131	130	123	118	114
Liv	Spin Master	-	70	118	118	119	109	111
Ben 10	BANDAI NAMCO	267	272	296	238	180	134	111
Disney Princess	JAKKS Pacific	178	75	101	97	94	91	111
Scrabble	Mattel	112	102	104	115	114	113	110
Gundam	BANDAI NAMCO	65	61	80	101	108	108	109
KRE-O	Hasbro	1	1	18	80	92	84	108
Clementoni	Clementoni SpA	88	94	96	108	104	113	106
Rastar	Rastar Group	-	-	-	-	-	-	105
Lego Duplo	LEGO	44	54	70	79	90	94	102
Race Tin Flash & Dash	Guangdong Alpha Animation & Culture Co	31	27	46	62	75	88	98
QunXing	Guangdong Qunxing Toys Joint-Stock Co	57	69	78	80	87	94	96
Revell	Hobbico Inc	-	-	-	-	82	86	95
Battle of King	Guangdong Alpha Animation & Culture Co	-	-	-	-	39	55	93
Hasbro	Hasbro	94	85	87	92	93	95	91
Wanshengda	Zhejiang Wanshengda Industry Co	48	58	66	77	84	88	91
Leapster	LeapFrog Enterprises	87	94	114	92	118	108	90
Frozen	JAKKS Pacific	-	-	-	-	-	-	89
Moon Sand	Spin Master	60	67	80	87	88	90	88
Meccano	Spin Master	-	-	-	-	-	76	87
Silverlit	Silverlit Toys Manufactory	68	68	73	79	78	85	86
BanBao	BanBao Co	4	17	40	63	81	82	86
Estrela	Manufatura de Brinquedos Estrela SA	60	59	73	78	82	84	85
The Settlers of Catan	Mayfair Games Inc	0	37	70	79	81	82	84
Beyblade	Hasbro	3	17	103	335	232	114	83
Armor Hero	Guangdong Alpha Animation & Culture Co	-	51	90	103	57	66	82
Pinoccio	Agatsuma Co	89	94	98	103	101	82	77
Vanguard	Bushiroad Inc	11	26	40	83	112	84	75
Sega	Sega Sammy Holdings Inc	136	140	132	97	91	76	74
Zoobles	Spin Master	-	3	60	125	104	84	72
Scrabble	Hasbro	55	52	88	83	77	77	72
Nenuco	FAMOSA - Fábricasrupadas de Muñecas de Onil SA	73	74	71	76	70	66	63
Toy Story	Walt Disney Co, The	59	64	139	87	69	63	63

Brand	Firm	2008	2009	2010	2011	2012	2013	2014
Baby Born	Zapf Creation	87	79	79	80	73	68	62
Plarail	Takara Tomy	55	59	77	89	82	68	61
Cicciobello	Giochi Preziosi SpA	60	66	70	81	81	63	59
Bakugan	Spin Master	306	394	402	228	125	83	58
Battle Spirits	BANDAI NAMCO	29	28	57	91	87	65	57
HTI	HTI Group	81	74	77	71	55	49	50
Zhu Zhu Pets	Cepia LLC	2	106	130	135	100	42	36
Moon Dough	Spin Master	-	1	31	34	118	36	35
High School Musical	Mattel	81	84	55	57	58	47	30
Gormiti	Giochi Preziosi SpA	71	73	49	43	25	16	16

Table 8-1 – Top products in the traditional toy and games industry – full list

Source: (Euromonitor, 2015a)

8.8 Global market size in retails sales prices and projected growth

Market size - Dec 31 - bnUSD	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Toys and games	104357	126414	141093	135663	140047	147887	144676	145856	151192	151543	160355	169025	177735	186809	**183858**	**188537**	**193217**	**197896**	**202576**	**207256**
Video games	40796	57012	66954	63984	63889	66025	62200	62544	66101	67107	71316	75186	78785	82426	**81234**	**83262**	**85290**	**87318**	**89346**	**91374**
As percentage of Toys and games	39%	45%	47%	47%	46%	45%	43%	43%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%	44%
Traditional toys and games	63561	69401	74140	71679	76158	81861	82476	83313	85091	84436	89039	93839	98950	104383	**102624**	**105275**	**107927**	**110578**	**113230**	**115881**
YoY growth		9.19%	6.83%	-3.32%	6.25%	7.49%	0.75%	1.01%	2.13%	-0.77%	5.45%	5.39%	5.45%	5.49%	-1.68%	2.58%	2.52%	2.46%	2.40%	**2.34%**
Construction toys	**3396**	**4096**	**4790**	5100	5600	6500	7500	7900	8100	**8759**	**9734**	**10783**	**11924**	**13162**	**13514**	**14451**	**15418**	**16415**	**17442**	**18498**
YoY growth		20.61%	16.94%	6.47%	9.80%	16.07%	15.38%	5.33%	2.53%	8.14%	11.13%	10.78%	10.57%	10.38%	2.67%	6.94%	6.69%	6.47%	6.25%	6.06%
As a percentage of Toys and games	3.25%	3.24%	3.40%	3.76%	4.00%	4.40%	5.18%	5.42%	5.36%	5.78%	6.07%	6.38%	6.71%	7.05%	7.35%	7.66%	7.98%	8.29%	8.61%	8.93%
As a percentage of TT and games	5.34%	5.90%	6.46%	7.12%	7.35%	7.94%	9.09%	9.48%	9.52%	10.37%	10.93%	11.49%	12.05%	12.61%	13.17%	13.73%	14.29%	14.84%	15.40%	15.96%

Projected numbers in bold. Source - own creation from Euromonitor numbers: Market Sizes | Historic/Forecast | Retail Value RSP | US$ mn | Current Prices

CAGR	Market size - Dec 31 - bnUSD
3.490%	Toys and games
4.114%	Video games
3.048%	Traditional toys and games
8.844%	Construction toys

8.9 Lego Brand

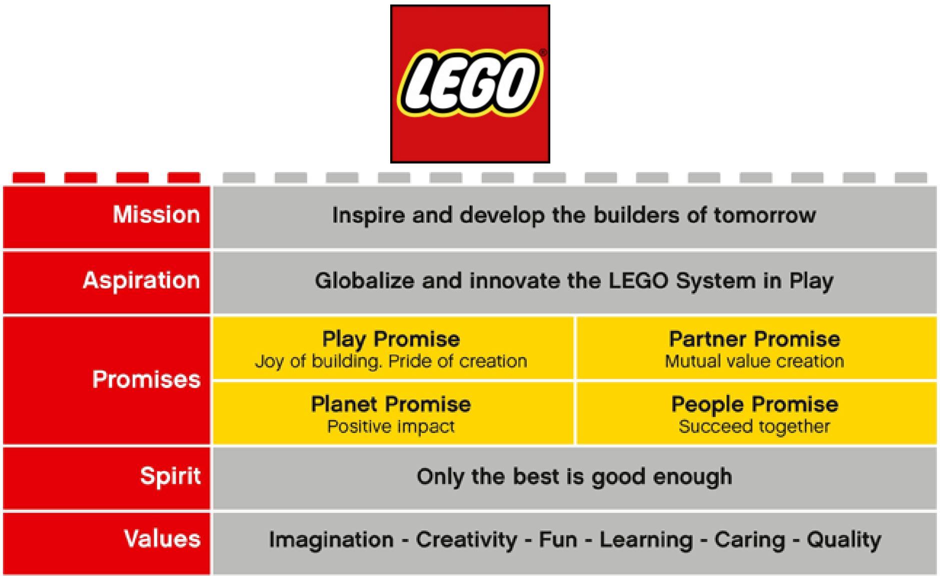


Figure 8-4 – The Lego Brand Framework

Source: (LEGO, 2016b)

Lego describes its brand in the following way (LEGO, 2016b):

"The LEGO brand is more than simply our familiar logo. It is the expectations that people have of the company towards its products and services, and the accountability that the LEGO Group feels towards the world around it. The brand acts as a guarantee of quality and originality.

The LEGO® Brand values

Imagination: *Curiosity asks why? and imagines explanations or possibilities. Playfulness asks what if? and imagines how the ordinary becomes extraordinary, fantasy or fiction. Dreaming it is a first step towards doing it. Free play is how children develop their imagination – the foundation for creativity.*

Creativity: *Creativity is the ability to come up with ideas and things that are new, surprising and valuable. Systematic creativity is a particular form of creativity that combines logic and reasoning with playfulness and imagination.*

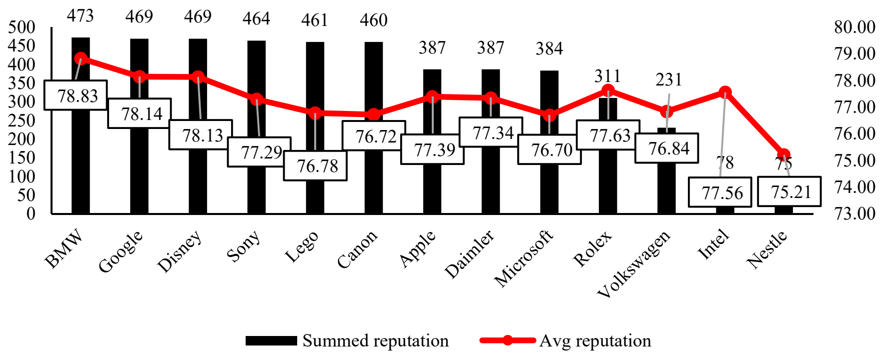
Fun: *Fun is the happiness we experience when we are fully engaged in something (hard fun) that requires mastery, when our abilities are in balance with the challenge at hand and we are making progress towards a goal. Fun is being active together, the thrill of an adventure, the joyful enthusiasm of children and the delight in surprising both yourself and others in what you can do or create.*

Learning: *Learning is about being curious, experimenting and collaborating – expanding our thinking and doing (hands-on, minds-on), helping us develop new insights and new skills. We learn through play by putting things together, taking them apart, and putting them together in different ways, thereby creating new things, and developing new ways of thinking about ourselves, and the world.*

Caring: *Caring is about the desire to make a positive difference in the lives of children, for our partners, colleagues and the world we live in, and considering their perspective in everything we do. Doing that little extra, not because we have to – but because it feels right and because we care.*

Quality: *From a reputation for manufacturing excellence to becoming trusted by all – we believe in quality that speaks for itself and earns us the recommendation of all. For us quality means the challenge of continuous improvement to be the best play material, the best for children and their development and the best to our community and partners."*

8.10 Brand reputation



Firm	2011	2012	2013	2014	2015	2016	Sum	Avg
BMW	79.42	80.08	79.39	77.2	78.98	77.9	473	78.83
Google	79.99	78.05	77.15	77.3	78.26	78.1	469	78.14
Disney	79.51	78.92	77.76	77.3	77.11	78.2	469	78.13
Sony	79.05	79.31	76.3	75.9	76.49	76.7	464	77.29
Lego	79.26	76.35	75.02	75.1	77.55	77.4	461	76.78
Canon	78.07	76.98	76.02	75.7	76.64	76.9	460	76.72
Apple	79.77	78.49		75.6	76.5	76.6	387	77.39
Daimler	79.03	75.54	76.58		77.85	77.7	387	77.34
Microsoft	77.29	77.98	76.23	75		77	384	76.70
Rolex			77.23	77.2	77.68	78.4	311	77.63
Volkswagen	77.33	77.04			76.16		231	76.84
Intel	77.56						78	77.56
Nestle			75.21				75	75.21

The data is produced by measuring 7 dimesions of reputation: products & services, innovation, workplace, governance, citizenship, leadership, performance. The numbers are based on a range 160,000-240,000 ratings, 50,000-61,000 interviews in 15 of the largest economies and of the 100 most 'highly regarded' firms in the period: Australia, Brazil, Canada, China, France, Germany, India, Italy, Japan, Mexico, Russia, South Korea, Spain, United Lingdom, USA. Source data: (Reputation Institute, 2016)

Reputation Institute explains the dimensions and score like this (2016):

"Product/Services: Offers high quality products and services - it offers excellent products and reliable services

Innovation: Is an innovative company - it makes or sells innovative products or innovates in the way it does business

Workplace: Is an appealing place to work - it treats its employees well

Governance: Is a responsibly-run company - it behaves ethically and is open & transparent in its business dealings

Citizenship: Is a good corporate citizen - it supports good causes & protects the environment

Leadership: Is a company with strong leadership - it has visible leaders & is managed effectively

Performance: Is a high-performance company - it delivers good financial results

Above 80 Excellent/Top Tier

70-79 Strong/Robust

60-69 Average/Moderate

40-59 Weak/Vulnerable

Below 40 Poor/Bottom Tier

"

8.11 Firm concentration ratio

	Firm	2014%	HHI %	C60	HHI, C60
1	Mattel	11.7	136.89	23.31%	5.432%
2	Hasbro	8.0	64.00	15.94%	2.540%
3	LEGO Group	7.5	56.25	14.94%	2.232%
4	BANDAI NAMCO	2.0	4.00	3.98%	0.159%
5	Takara Tomy	1.9	3.61	3.78%	0.143%
6	Vtech	1.8	3.24	3.59%	0.129%
7	Hallmark Cards	1.6	2.56	3.19%	0.102%
8	MGA Entertainment	1.4	1.96	2.79%	0.078%
9	Brandstätter Group	1.2	1.44	2.39%	0.057%
10	LeapFrog	1.2	1.44	2.39%	0.057%
11	Spin Master	1.2	1.44	2.39%	0.057%
12	Simba-Dickie Group	1.0	1.00	1.99%	0.040%
13	JAKKS Pacific	0.8	0.64	1.59%	0.025%
14	Giochi Preziosi	0.6	0.36	1.20%	0.014%
15	Ravensburger	0.6	0.36	1.20%	0.014%
16	Guangdong Alpha Animation & Culture	0.6	0.36	1.20%	0.014%
17	Fuhu	0.5	0.25	1.00%	0.010%
18	Walt Disney, The	0.4	0.16	0.80%	0.006%
19	Playmates Toys	0.4	0.16	0.80%	0.006%
20	FAMOSA	0.3	0.09	0.60%	0.004%
21	Clementoni	0.3	0.09	0.60%	0.004%
22	Artsana, Gruppo	0.3	0.09	0.60%	0.004%
23	Epoch	0.3	0.09	0.60%	0.004%
24	Shanghai Yaoji Playing Cards	0.3	0.09	0.60%	0.004%
25	Build-A-Bear Workshop	0.2	0.04	0.40%	0.002%
26	Zapf Creation	0.2	0.04	0.40%	0.002%
27	Konamirp	0.2	0.04	0.40%	0.002%
28	Ty	0.2	0.04	0.40%	0.002%
29	Habermaass	0.2	0.04	0.40%	0.002%
30	Candide Indústria emércio a	0.2	0.04	0.40%	0.002%
31	K'NEX Industries	0.2	0.04	0.40%	0.002%
32	Brio	0.2	0.04	0.40%	0.002%
33	Grow Jogos e Brinquedos	0.2	0.04	0.40%	0.002%
34	Manufatura de Brinquedos Estrela	0.2	0.04	0.40%	0.002%
35	Asmodee Group	0.2	0.04	0.40%	0.002%
36	Bushiroad	0.2	0.04	0.40%	0.002%
37	Segammy Holdings	0.1	0.01	0.20%	0.000%
38	Mega Houserp	0.1	0.01	0.20%	0.000%
39	Hornby	0.1	0.01	0.20%	0.000%
40	HTI Group	0.1	0.01	0.20%	0.000%
41	Character Group	0.1	0.01	0.20%	0.000%
42	Stadlbauer Marketing + Vertrieb	0.1	0.01	0.20%	0.000%
43	Tamiya	0.1	0.01	0.20%	0.000%
44	Agatsuma	0.1	0.01	0.20%	0.000%
45	Silverlit Toys Manufactory	0.1	0.01	0.20%	0.000%
46	Vivid Imagination	0.1	0.01	0.20%	0.000%
47	Ningbo Three A Group	0.1	0.01	0.20%	0.000%
48	Guangdong Qunxing Toys Joint-Stock	0.1	0.01	0.20%	0.000%
49	Zhejiang Wanshengda Industry	0.1	0.01	0.20%	0.000%
50	Toyroyal	0.1	0.01	0.20%	0.000%
51	Young Toys	0.1	0.01	0.20%	0.000%
52	BanBao	0.1	0.01	0.20%	0.000%
53	Mayfair Games	0.1	0.01	0.20%	0.000%
54	Rastar Group	0.1	0.01	0.20%	0.000%
55	Hobbico	0.1	0.01	0.20%	0.000%
56	RC2rp	-	-	0.00%	0.000%
57	Mega Brands	-	-	0.00%	0.000%
58	Revell	-	-	0.00%	0.000%
59	Xinghui Auto Model	-	-	0.00%	0.000%
60	Cepia	-	-	0.00%	0.000%
	Total	**50.2**	**2.81%**	**100.0%**	**11.160%**

Table 8-2 – Firm concentration ratio

HHI = Herfindal-Hirschman Index, C60 calculated as percent of total 50.2 %.
Market share source data from (Euromonitor, 2015a).

8.12 Line items Reclassification

Net operating working capital (NOWC)	
Operating current assets	Operating current liabilities
Current tax receivables	Accrued liabilities
Inventories	Current portion of long-term debt
Operating cash	Current tax liabilities
Other receivables	Provisions
Prepaid Expenses and Other	Short term debt
Prepayments	Trade payables
Trade receivables	VAT and other indirect taxes
	Wage related payables and other charges

Net operating non-current assets (NONCA)	
Operating non-current assets	Operating non-current liabilities
Capitalized Operating leases	Debt to related parties
Deferred tax assets	Deferred tax liabilities
Dev. projects + prepaym for intangible assets	Operating non-current liabilities
Fixed assets u. constr. + prepaym for tangible assets	Pension obligations
Goodwill	Provisions
Land, building and installations	
Licenses, patents and other rights	
Non-current assets held for sale	
Operating non-current assets Other	
Other fixtures, fittings, tools and equipment	
Other intangibles, net	
Plant and machinery	
Prepayments	
Property Plant & Equipment, net	
Software	

The table list line items included in NOWC and NONCA. A few line items such as “prepaid expenses and others” and “prepayments” are the same but the financial statements for firms in the peer group use differing terms.

8.13 Income statements, Balance Sheets and Reformulation

Lego - Income

Income - Dec 31 - DKK mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Revenue	7798	8027	9526	11661	16014	18731	23405	25294	28578	35780
Production costs	-2739	-2812	-3165	-3463	-4413	-5519	-6758	-7423	-8071	-9814
Gross profit	5059	5215	6361	8198	11601	13212	16647	17871	20507	25966
Other operating income	141	224	0	0	0	0	0	0	0	0
Sales and distributions expenses	-2655	-2794	-2969	-3602	-4627	-5455	-6150	-7026	-7782	-9765
Administrative expenses	-496	-575	-645	-855	-931	-1104	-1326	-1200	-1444	-2239
Other operating expenses	-644	-599	-743	-739	-928	-987	-1219	-1309	-1584	-1718
Operating profit	1405	1471	2004	3002	5115	5666	7952	8336	9697	12244
Depreciation of non-current assets	270	24	-20	-85	-150	0	0	0	0	0
Restructuring costs and other special items	-350	-46	116	-15	8	0	0	0	0	0
Earnings before interest and taxes (EBIT)	1325	1449	2100	2902	4973	5666	7952	8336	9697	12244
Result in associated companies before taxes	0	-1	0	0	0	0	0	0	0	0
Financial income	135	123	41	131	21	34	19	13	12	12
Financial expenses	-179	-157	-289	-146	-105	-158	-449	-110	-218	-108
Earnings before income taxes (EBT)	1281	1414	1852	2887	4889	5542	7522	8239	9491	12148
Tax on profits for the year	9	-386	-500	-683	-1171	-1382	-1909	-2120	-2466	-2974
Net profits	1290	1028	1352	2204	3718	4160	5613	6119	7025	9174
Allocated as follows										
Parent company shareholders	1286	1023	1343	2197	3696	4137	5583	6076	7025	9174
Non-controlling interests	4	5	9	7	22	23	30	43	0	0
Total	1290	1028	1352	2204	3718	4160	5613	6119	7025	9174

Consol. statement - Dec 31 - DKK mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Net profits	1290	1028	1352	2204	3718	4160	5613	6119	7025	9174
Change in market value of cash flow hedges	27	-7	37	0	-223	-228	42	258	-378	-537
Revenue in income statement	0	0	0	0	0	44	346	-167	40	734
Production costs in income statement	0	0	0	0	0	0	0	-18	4	20
Tax on cash flow hedges	-8	1	-10	0	38	46	-97	-18	83	-53
Currency translation differences	-184	-135	17	21	143	-2	23	-257	12	79
Remeasurements of defined benefit plans	0	0	0	0	0	0	0	-1	14	2
Total other compreh. income for the year	1125	887	1396	2225	3676	4020	5927	5916	6800	9419

Lego – Reformulated Income

Reformulated Income - Dec 31 - DKK mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Revenue	7798	8027	9526	11661	16014	18731	23405	25294	28578	35780
Other operating income	141	224	0	0	0	0	0	0	0	0
Restructuring costs and other special items	-350	-46	116	-15	8	0	0	0	0	0
Operating revenue	7589	8205	9642	11646	16022	18731	23405	25294	28578	35780
Production costs	-2739	-2812	-3165	-3463	-4413	-5519	-6758	-7423	-8071	-9814
Production costs adjustments	107	213	201	276	347	441	529	598	763	854
= Gross profit	**4957**	**5606**	**6678**	**8459**	**11956**	**13653**	**17176**	**###**	**21270**	**###**
- Sales and distributions expenses	-2655	-2794	-2969	-3602	-4627	-5455	-6150	-7026	-7782	-9765
-/+ Sales and distributions expenses, adjusted	42	26	25	27	59	125	111	109	122	131
- Administrative expenses	-496	-575	-645	-855	-931	-1104	-1326	-1200	-1444	-2239
-/+ Administrative expenses, adjusted	58	37	41	40	49	70	13	57	62	96
- Other operating expenses	-644	-599	-743	-739	-928	-987	-1219	-1309	-1584	-1718
-/+ Other operating expenses, adjusted	1	1	3	1	1	1	1	0	0	0
Interest expense, operating lease	*0*	*50*	*75*	*72*	*108*	*119*	*143*	*168*	*182*	*213*
= EBITDA	**1263**	**1752**	**2465**	**3403**	**5687**	**6422**	**8749**	**9268**	**###**	**13538**
- Depreciation and amortization	-208	-277	-270	-344	-456	-637	-654	-764	-947	-1081
-/+ Reversal of impairment of fixed assets	270	24	-20	-85	-150	0	0	0	0	0
= EBIT	**1325**	**1499**	**2175**	**2974**	**5081**	**5785**	**8095**	**8504**	**9879**	**12457**
Taxes										
Tax on profits for the year	9	-386	-500	-683	-1171	-1382	-1909	-2120	-2466	-2974
Net financial income/expenses	-44	-35	-248	-15	-84	-124	-430	-97	-206	-96
Tax rate	-0.7%	27.3%	27.0%	23.7%	24.0%	24.9%	25.4%	25.7%	26.0%	24.5%
Tax shield, net financial income/expenses	0	-10	-67	-4	-20	-31	-109	-25	-54	-24
Total tax	9	-396	-567	-687	-1191	-1413	-2018	-2145	-2520	-2998
NOPLAT	**1334**	**1104**	**1608**	**2288**	**3890**	**4372**	**6077**	**6359**	**7360**	**9459**
Net financial income after tax	-44	-25	-181	-11	-64	-93	-321	-72	-152	-72
Interest expense, operating lease	*0*	*-50*	*-75*	*-72*	*-108*	*-119*	*-143*	*-168*	*-182*	*-213*
Dirty surplus	-161	-136	44	21	-20	-140	314	-203	-225	245
Net comprehensive income	1129	892	1396	2225	3698	4020	5927	5916	6800	9419
Non-controlling interests	4	5	9	7	22	23	30	43	0	0
Comprehensive income	1125	887	1387	2218	3676	3997	5897	5873	6800	9419
Verification, comprehensive income	0	0	0	0	0	0	0	0	0	0

Lego – Balance

Balance - Dec 31 - DKK mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
ASSETS										
Non-current assets										
Development projects, and prepaym intan assets	0	30	90	116	78	12	37	71	85	139
Software	0		13	33	26	102	104	131	126	138
Licenses, patents and other rights	0	4	2	83	81	76	68	58	60	55
Intangible assets	0	34	105	232	185	190	209	260	271	332
Land, buildings and installations	705	543	549	699	863	1140	1688	1777	3299	5016
Plant and machinery	358	431	500	766	983	1239	1615	2114	2494	3033
Other fixtures and fittings, tools and equipment	97	126	139	246	384	502	746	846	1072	1176
Fixed assets u. constr. + prepaym for tan assets	38	54	78	219	338	514	517	1553	1591	1076
Property, plant and equipment	1198	1154	1266	1930	2568	3395	4566	6290	8456	10301
Deferred tax assets	388	281	132	94	180	114	131	140	494	419
Investments in associated companies	0	3	3	3	3	3	3	3	3	3
Other capital shares	75	0	0	0	0	0	0	0	0	0
Prepayments	0	0	0	0	0	0	0	146	162	169
Other non-current assets	463	284	135	97	183	117	134	289	659	591
Total non-current assets	1661	1472	1506	2259	2936	3702	4909	6839	9386	11224
Current assets										
Inventories	930	946	870	1056	1327	1541	1705	1824	2182	2747
Trade receivables	1824	1796	1822	2128	3321	3845	4950	4870	5891	6410
Other receivables	421	681	439	604	618	603	630	946	733	920
Prepayments	0	0	0	0	0	462	226	74	99	179
Current tax receivables	71	71	130	111	12	244	22	65	48	254
Receivables from related parties	0	0	600	0	1956	1950	3442	2310	2598	4932
Cash at banks	1697	1001	1129	1630	802	557	468	1024	482	1211
Non-current assets classified as held for sale	303	42	0	0	0	0	0	0	0	0
Total current assets	5246	4537	4990	5529	8036	9202	11443	11113	12033	16653
TOTAL ASSETS	6907	6009	6496	7788	10972	12904	16352	17952	21419	27877

Balance - Dec 31 - DKK mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
EQUITY AND LIABILITIES										
EQUITY										
Share capital	20	20	20	20	20	20	20	20	20	20
Reserve for hedge accounting	23	22	49	49	-114	-252	39	94	-158	6
Reserve for currency translation	-184	-319	-302	-281	-138	-140	-117	-374	-362	-283
Retained earnings	1325	1948	2291	3488	5684	7321	9888	11335	13332	18008
LEGO A/S' share of equity	1184	1671	2058	3276	5452	6949	9830	11075	12832	17751
Non-controlling interest (minority shares)	7	8	8	15	21	26	34	0	0	0
TOTAL EQUITY	1191	1679	2066	3291	5473	6975	9864	11075	12832	17751
LIABILITIES										
Non-current liabilities										
Subordinate loan capital	1100	1100	500	0	0	0	0	0	0	0
Borrowings	376	237	839	832	826	818	210	205	196	187
Deferred tax liabilities	127	128	98	82	21	50	21	126	209	29
Pension obligations	62	63	50	56	52	55	54	57	82	95
Provisions	215	93	63	20	75	72	71	88	95	64
Debt to related parties	0	0	0	0	0	0	0	600	600	600
Other long-term debt	78	79	72	71	92	63	72	68	96	98

Total non-current liabilities	1958	1700	1622	1061	1066	1058	428	1144	1278	1073
Current liabilities										
Liabilities related to restructuring of the firm	1288	0	0	0	0	0	0	0	0	0
Borrowings	4	77	4	5	6	7	608	88	162	189
Trade payables	749	778	1036	1336	1518	1611	2112	2201	2530	3143
Current tax liabilities	108	121	83	94	297	97	96	85	154	230
Provisions	176	174	138	100	3	34	64	110	228	158
Other current liabilities (short term debt)	1433	1480	1547	1901	2609	3122	3180	3249	4235	5333
Total current liabilities	3758	2630	2808	3436	4433	4871	6060	5733	7309	9053
TOTAL LIABILITIES	5716	4330	4430	4497	5499	5929	6488	6877	8587	10126
TOTAL EQUITY AND LIABILITIES	6907	6009	6496	7788	10972	12904	16352	17952	21419	27877

Lego – Reformulated Balance

Operating assets - Dec 31 - DKK mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Operating current assets										
Inventories	930	946	870	1056	1327	1541	1705	1824	2182	2747
Trade receivables	1824	1796	1822	2128	3321	3845	4950	4870	5891	6410
Other receivables	421	681	439	604	618	603	630	946	733	920
Prepayments	0	0	0	0	0	462	226	74	99	179
Current tax receivables	71	71	130	111	12	244	22	65	48	254
+ Operating cash	156	161	191	233	320	375	468	506	572	716
Total operating currents assets	3402	3655	3452	4132	5598	7070	8001	8285	9525	11226
Operating current liabilities										
Trade payables	749	778	1036	1336	1518	1611	2112	2201	2530	3143
Current tax liabilities	108	121	83	94	297	97	96	85	154	230
Wage related payables and other charges	518	566	649	679	780	915	1074	1084	1282	1844
VAT and other indirect taxes						188	262	266	330	408
Provisions	176	174	138	100	3	103	64	110	228	158
Total operating current liabilities	1551	1639	1906	2209	2598	2914	3608	3746	4524	5783
NOWC	1851	2016	1546	1923	3000	4156	4393	4539	5001	5443
Operating non-current assets										
Deferred tax assets	388	281	132	94	180	114	131	140	494	419
Development projects + prepay for intan assets	0	30	90	116	78	12	37	71	85	139
Software	0	0	13	33	26	102	104	131	126	138
Licenses, patents and other rights	0	4	2	83	81	76	68	58	60	55
Land, building and installations	705	543	549	699	863	1140	1688	1777	3299	5016
Plant and machinery	358	431	500	766	983	1239	1615	2114	2494	3033
Other fixtures, fittings, tools and equipment	97	126	139	246	384	571	746	846	1072	1176
Fixed assets u. constr. + prepaym for tan assets	38	54	78	219	338	514	517	1553	1591	1076
Non-current assets held for sale	303	42	0	0	0	0	0	0	0	0
Prepayments								146	162	169
+ Capitalized operating leases	1079	1598	1548	2306	2553	3064	3599	3904	4555	4555
Total operating non-current assets	2968	3109	3051	4562	5486	6832	8505	10740	13938	15776
Operating non-current liabilities										
Deferred tax liabilities	127	128	98	82	21	50	21	126	209	29
Pension obligations	62	63	50	56	52	55	54	57	82	95
Provisions	215	93	63	20	75	72	71	88	95	64
Debt to related parties								600	600	600
Total operating non-current liabilities	404	284	211	158	148	177	146	871	986	788
NONCA	2564	2825	2840	4404	5338	6655	8359	9869	12952	14988
Invested capital	4415	4840	4386	6327	8338	10810	12752	14408	17952	20430

Financial assets - Dec 31 - DKK mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Financial assets										
Remaining cash and cash equivalents (excess cash)	1541	840	938	1397	482	182	0	518	-90	495
Marketable securities (bonds)	75	0	0	0	0	0	0	0	0	0
Investments in associates	0	3	3	3	3	3	3	3	3	3
Receivables from related parties	0	0	600	0	1956	1950	3442	2310	2598	4932
Total financial assets	1616	843	1541	1400	2441	2135	3445	2831	2511	5430
Financial liabilities										
Subordinate loan capital	1100	1100	500	0	0	0	0	0	0	0
Borrowings, credit institutions - non-current	376	237	839	832	826	818	210	205	196	187

Borrowings, credit institutions - current	4	77	4	5	6	7	608	88	162	189
Financial leasing	87	93	86	71	62	36	32	31	28	27
Debt regarding group restructuring	1288	0	0	0	0	0	0	0	0	0
Debt to related parties	222	123	127	183	209	242	317	315	374	521
Other current liabilities	684	777	757	1039	1650	1804	1567	1621	2317	2631
+ Capitalized operating leases	1079	1598	1548	2306	2553	3064	3599	3904	4555	4555
Total financial liabilities	4840	4005	3861	4436	5306	5971	6333	6164	7632	8110
NET FINANCIAL ASSETS	-3224	-3161	-2320	-3036	-2865	-3835	-2888	-3333	-5120	-2679
EQUITY INCL. MINORITIES	1191	1679	2066	3291	5473	6975	9864	11075	12832	17751
Invested capital	4415	4840	4386	6327	8338	10810	12752	14408	17952	20430
Verification diff. Invested Capital	0	0	0	0	0	0	0	0	0	0

Equity adjustments - DKK mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Equity - Jan 01	563	1191	1679	2066	3291	5473	6975	9864	11075	12832
Non-controlling interest	4	7	8	8	15	21	26	34	0	0
Equity minus non-controlling interest	559	1184	1671	2058	3276	5452	6949	9830	11075	12832
Equity - Dec 31	1184	1671	2058	3276	5452	6949	9830	11075	12832	17751
Equity changes	625	487	387	1218	2176	1497	2881	1245	1757	4919
Cashflows with owners										
Dividends	-500	-400	-1000	-1000	-1500	-2500	-3000	-4500	-5000	-4500
Total	-500	-400	-1000	-1000	-1500	-2500	-3000	-4500	-5000	-4500
Total income										
Net profits	1290	1028	1352	2204	3718	4160	5613	6119	7025	9174
Cash flow hedges	31	-2	37	0	-201	-228	42	258	-378	-537
Revenue in income statement	0	0	0	0	0	44	346	-167	40	734
Production costs in income statement	0	0	0	0	0	0	0	-18	4	20
Tax	-8	1	-10	0	38	46	-97	-18	83	-53
Currency translation differences	-184	-135	17	21	143	-2	23	-257	12	79
Remeasurements of defined benefit plans	0	0	0	0	0	0	0	-1	14	2
Dirty surplus	-161	-136	44	21	-20	-140	314	-203	-225	245
Total	1129	892	1396	2225	3698	4020	5927	5916	6800	9419
Other Income/expenses for non-controllling int.	4	5	9	7	22	23	30	43	0	0
Total comprehensve less non-controlling interests	1125	887	1387	2218	3676	3997	5897	5873	6800	9419
Diff other income/expenses non-controlling int.	4	5	9	7	22	23	46	171	43	0
Acquisition of non-control int. | Retained earnings	0	0	0	0	0	0	16	129	43	0
Verification	625	487	387	1218	2176	1497	2881	1245	1757	4919
Verification, diff	0	0	0	0	0	0	0	0	0	0

Hasbro - Income

Income - Dec 31 - USD mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Net revenue	3151	3838	4022	4068	4002	4286	4089	4082	4277	4448
Production costs	-1304	-1577	-1693	-1676	-1690	-1836	-1672	-1673	-1698	-1677
Gross profit	1848	2261	2329	2392	2312	2449	2417	2409	2579	2770
Royalties	-170	-317	-313	-331	-249	-339	-302	-339	-305	-379
Product development	-171	-167	-191	-181	-201	-198	-201	-208	-223	-243
Advertising	-369	-435	-455	-413	-421	-414	-422	-398	-420	-409
Amortization of intangibles	-79	-68	-78	-85	-50	-47	-51	-78	-53	-44
Program production cost amortization	0	0	0	0	-22	-36	-42	-48	-47	-42
Selling, distribution and administration	-682	-755	-797	-794	-781	-822	-847	-872	-896	-961
Total operating expenses	-1471	-1742	-1834	-1803	-1724	-1855	-1865	-1942	-1943	-2079
Operating profit	376	519	494	589	588	594	552	467	635	692
Other Non-Operating Income/Expense - Net	-35	-52	-24	0	-4	-25	-14	-15	-6	6
Interest Income	28	30	18	3	6	7	6	5	4	3
Interest Expense	-28	-35	-47	-62	-82	-89	-91	-106	-93	-97
Income Before Income Taxes	341	462	441	530	508	486	453	352	540	604
Income tax	-111	-129	-134	-155	-110	-101	-117	-68	-127	-157
Profit after tax before minority	230	333	307	375	398	385	336	284	413	447
Minorities	0	0	0	0	0	0	0	-2	-3	-5
Net profits | net earnings	230	333	307	375	398	385	336	286	416	452

Hasbro - Reformulated Income

Reformulated Income - Dec 31 - USD mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Net revenue	3151	3838	4022	4068	4002	4286	4089	4082	4277	4448
Production costs	-1304	-1577	-1693	-1676	-1690	-1836	-1672	-1673	-1698	-1677
= Gross profit	**1848**	**2261**	**2329**	**2392**	**2312**	**2449**	**2417**	**2409**	**2579**	**2770**
Royalties	-170	-317	-313	-331	-249	-339	-302	-339	-305	-379
Product development	-171	-167	-191	-181	-201	-198	-201	-208	-223	-243
Advertising	-369	-435	-455	-413	-421	-414	-422	-398	-420	-409
Selling, distribution and administration	-682	-755	-797	-794	-781	-822	-847	-872	-896	-961
Total	*-1392*	*-1674*	*-1756*	*-1718*	*-1652*	*-1773*	*-1773*	*-1816*	*-1844*	*-1992*
Interest expense, operating lease	*0*	*14*	*17*	*17*	*16*	*18*	*18*	*17*	*18*	*18*
= EBITDA	**523**	**690**	**677**	**786**	**772**	**808**	**762**	**713**	**859**	**907**
Depreciation	-68	-89	-88	-96	-96	-114	-100	-103	-105	-112
Amortization of intangibles	-79	-68	-78	-85	-50	-47	-51	-78	-53	-44
Program production cost amortization	0	0	0	0	-22	-36	-42	-48	-47	-42
Depreciation and amortization, net	-147	-157	-166	-181	-168	-196	-192	-229	-205	-198
= EBIT	**376**	**534**	**511**	**605**	**604**	**612**	**570**	**484**	**653**	**709**
Taxes										
Income tax	-111	-129	-134	-155	-110	-101	-117	-68	-127	-157
Net financial income/expenses	-35	-57	-53	-59	-80	-108	-98	-115	-95	-88
Tax rate	32.6%	28.0%	30.4%	29.2%	21.7%	20.8%	25.9%	19.3%	23.5%	26.0%
Tax shield, net financial income/expenses	-11	-16	-16	-17	-17	-22	-25	-22	-22	-23
Total tax	-123	-145	-150	-172	-127	-123	-143	-90	-149	-180
NOPLAT	**254**	**388**	**361**	**433**	**477**	**489**	**427**	**394**	**504**	**530**
Net financial income after tax	-24	-41	-37	-42	-63	-85	-73	-93	-73	-65
Interest expense, operating lease	*0*	*-14*	*-17*	*-17*	*-16*	*-18*	*-18*	*-17*	*-18*	*-18*
Dirty surplus	23	56	-13	-4	-50	-44	-36	38	-61	-51
Net comprehensive income	253	389	294	371	347	341	300	322	352	396
Minorities	0	0	0	0	0	0	0	-2	-3	-5
Comprehensive income	253	389	294	371	347	341	300	324	355	401
Verification, comprehensive income	0	0	0	0	0	0	0	2	3	5

Hasbro – Balance

Balance - Dec 31 - USD mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
ASSETS										
Current assets										
Cash and cash equivalents	715	774	630	636	728	642	850	682	893	977
Trade receivables	556	655	612	1039	961	1035	1030	1094	1095	1218
Inventories	203	259	300	208	364	334	316	349	340	384
Prepaid expenses	243	200	171	162	168	243	312	356	392	287
Total current assets	1718	1888	1714	2045	2221	2254	2508	2480	2719	2866
Non-current assets										
Property, plant and equipment										
Gross property, plant and equipment	561	589	615	652	664	672	712	737	746	601
Accumulated Depreciation	-379	-401	-403	-432	-430	-454	-482	-500	-509	-364
Net property, plant and equipment	182	188	212	221	234	218	230	236	237	238
Goodwill	470	471	474	476	475	475	475	594	593	593
Intangible assets	532	486	568	555	501	467	417	376	325	281
Other long-term assets	195	203	200	601	663	717	695	715	658	744
Total non-current assets	1379	1349	1455	1852	1872	1877	1817	1922	1813	1855
TOTAL ASSETS	3097	3237	3169	3897	4093	4131	4325	4402	4532	4721

Balance - Dec 31 - USD mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
EQUITY AND LIABILITIES										
LIABILITIES										
Current liabilities										
Short-term debt	11	10	8	14	15	180	224	8	252	165
Current portion of long-term debt	0	135	0	0	0	0	0	428	0	0
Trade payables	160	186	184	173	133	135	140	199	213	241
Taxes payable	0	0	0	0	0	53	41	0	0	0
Accrued liabilities	735	556	608	628	572	574	555	728	610	659
Total current liabilities	906	888	800	816	719	942	960	1363	1075	1065
Non-current liabilities										
Long-term debt	495	710	710	1132	1398	1401	1396	960	1560	1547
Other long-term liabilities	158	255	268	354	361	370	461	397	432	445
Total non-current liabilities	653	964	978	1486	1759	1771	1858	1357	1992	1992
TOTAL LIABILITIES	1559	1852	1778	2302	2478	2713	2818	2720	3066	3057
EQUITY										
Common stock	105	105	105	105	105	105	105	105	105	105
Additional paid-in capital	322	369	450	467	626	630	656	734	806	894
Retained earnings	2020	2262	2457	2721	2978	3205	3355	3432	3630	3852
Treasury stock	-921	-1425	-1683	-1756	-2102	-2487	-2536	-2555	-2980	-3041
Accumulated other comprehensive income	11	75	62	59	8	-36	-72	-34	-95	-146
TOTAL EQUITY	1538	1385	1391	1595	1615	1418	1507	1682	1466	1664
TOTAL EQUITY AND LIABILITIES	3097	3237	3169	3897	4093	4131	4325	4402	4532	4721
Verification	0	0	0	0	0	0	0	0	0	0

Hasbro – Reformulated Balance

Operating assets - Dec 31 - USD mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Operating current assets										
Inventories	203	259	300	208	364	334	316	349	340	384
Trade receivables	556	655	612	1039	961	1035	1030	1094	1095	1218
Prepaid Expenses and Other	243	200	171	162	168	243	312	356	392	287
+ Operating cash	63	77	80	81	80	86	82	82	86	89
Total operating currents assets	1066	1191	1164	1490	1573	1698	1740	1880	1911	1978
Operating current liabilities										
Trade payables	160	186	184	173	133	135	140	199	213	241
Taxes payable	0	0	0	0	0	53	41	0	0	0
Accrued liabilities	735	556	608	628	572	574	555	728	610	659
Current portion of long-term debt	0	135	0	0	0	0	0	428	0	0
Total operating current liabilities	895	877	792	802	704	762	736	1355	822	900
NOWC	171	313	372	689	869	936	1004	525	1089	1078
Operating non-current assets										
Property Plant & Equipment, net	182	188	212	221	234	218	230	236	237	238
Goodwill	470	471	474	476	475	475	475	594	593	593
Other intangibles, net	532	486	568	555	501	467	417	376	325	281
Other	195	203	200	601	663	717	695	715	658	744
+ Capitalized operating leases	304	359	359	345	391	384	367	387	376	376
Total operating non-current assets	1682	1708	1814	2197	2263	2261	2184	2309	2189	2231
Total operating non-current liabilities	0	0	0	0	0	0	0	0	0	0
NONCA	1682	1708	1814	2197	2263	2261	2184	2309	2189	2231
Invested capital	1853	2021	2185	2886	3132	3197	3188	2834	3278	3308

Financial assets - Dec 31 - USD mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Financial assets										
Remaining cash and cash equivalents (excess cash)	652	698	550	555	648	556	768	601	808	888
Total financial assets	652	698	550	555	648	556	768	601	808	888
Financial liabilities										
Short term borrowings	11	10	8	14	15	180	224	8	252	165
Long term debt	495	710	710	1132	1398	1401	1396	960	1560	1547
Other non current financial liabilities	158	255	268	354	361	370	461	351	389	405
+ Capitalized operating leases	304	359	359	345	391	384	367	387	376	376
Total financial liabilities	968	1334	1344	1846	2164	2335	2449	1707	2577	2492
NET FINANCIAL ASSETS	-315	-636	-795	-1291	-1517	-1779	-1681	-1106	-1769	-1604
Redeemable noncontrolling interests	0	0	0	0	0	0	0	45	43	40
EQUITY INCL. MINORITIES	1538	1385	1391	1595	1615	1418	1507	1682	1466	1664
Invested capital	1853	2021	2185	2886	3132	3197	3188	2834	3278	3308
Verification, diff. Invested Capital	0	0	0	0	0	0	0	0	0	0

Equity adjustments - USD mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Equity - Jan 01	1723	1538	1385	1391	1595	1615	1418	1507	1682	1466
Non-controlling interest	0	0	0	0	0	0	0	-2	-3	-5
Equity - Dec 31	1538	1385	1391	1595	1615	1418	1507	1682	1466	1664
Equity changes	-186	-153	6	204	21	-198	90	173	-219	193

Cashflows with owners										
Option + warrant transactions	101	100	0	0	0	0	0	0	0	0
Conversion of debentures	0	0	0	0	307	0	0	0	0	0
Purchases, common stock	-457	-587	-358	-91	-637	-423	-100	-103	-461	-85
Stock-based compensation	23	29	35	30	33	12	19	21	36	54
Dividends declared	-79	-98	-112	-111	-140	-158	-187	-209	-218	-230
Various adjustments and compensation trans.	-27	14	146	5	109	30	58	140	71	58
Total	-438	-542	-288	-167	-327	-539	-210	-149	-571	-203
Total income										
Net profits	230	333	307	375	398	385	336	286	416	452
Currency translation differences	26	36	-34	24	-32	-22	8	-11	-66	-96
Changes in available-for-sale securities	-2	0	-3	1	0	0	-4	0	2	-1
Cash flow hedges	-7	-16	73	-24	10	-9	-38	-3	48	86
Remeasurements of defined benefit plans	2	27	-53	8	-2	-20	-7	47	-51	7
Cash flow hedging adjustments	0	7	1	-19	-15	3	5	-3	3	-51
Available for sale securities adjustments	0	-1	1	0	-11	0	0	0	0	0
Amortization of unrecognized pension/retire	0	2	1	7	0	3	0	9	3	3
Reclassification to income	4	0	0	0	0	0	0	0	0	0
Dirty surplus	23	56	-13	-4	-50	-44	-36	38	-61	-51
Total	253	389	294	371	347	341	300	324	355	401
Other Income/expenses for non-controllling int.	0	0	0	0	0	0	0	-2	-3	-5
Total comprehensive income	253	389	294	371	347	341	300	322	352	396
Verification	-186	-153	6	204	21	-198	90	173	-219	193
Verification, diff	0	0	0	0	0	0	0	0	0	0

Mattel - Income

Income - Dec 31 - USD mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Net sales	5650	5970	5918	5431	5856	6266	6421	6485	6024	5703
Production costs	-3038	-3193	-3234	-2716	-2901	-3120	-3012	-3006	-3023	-2896
Gross profit	2612	2777	2684	2715	2955	3146	3409	3479	3001	2806
Selling General and Administrative Expenses	-1232	-1338	-1423	-1374	-1406	-1405	-1670	-1561	-1614	-1548
Sales/Marketing/Advertising Expenses	-651	-709	-719	-610	-647	-699	-718	-750	-733	-718
Operating income	729	730	542	731	902	1041	1021	1168	654	541
Other Non-Operating Income/Expense - Net	4	11	3	-7	1	-3	6	4	5	1
Interest Income	30	33	25	8	8	8	7	6	7	7
Interest Expense	-80	-71	-82	-72	-65	-75	-89	-79	-79	-85
Income Before Income Taxes	684	703	488	660	847	971	945	1099	587	464
Income tax	-91	-103	-108	-131	-162	-202	-169	-195	-88	-94
Net profits	593	600	380	529	685	769	776	904	499	369

Mattel - Reformulated Income

Reformulated Income - Dec 31 - USD mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Net sales	5650	5970	5918	5431	5856	6266	6421	6485	6024	5703
Production costs	-3038	-3193	-3234	-2716	-2901	-3120	-3012	-3006	-3023	-2896
= Gross profit	**2612**	**2777**	**2684**	**2715**	**2955**	**3146**	**3409**	**3479**	**3001**	**2806**
Selling General and Administrative Expenses	-1232	-1338	-1423	-1374	-1406	-1405	-1670	-1561	-1614	-1548
Sales/Marketing/Advertising Expenses	-651	-709	-719	-610	-647	-699	-718	-750	-733	-718
Total	*-1883*	*-2047*	*-2143*	*-1984*	*-2053*	*-2105*	*-2388*	*-2311*	*-2347*	*-2265*
Interest expense, operating lease	*0*	*36*	*41*	*47*	*45*	*44*	*45*	*43*	*47*	*44*
= EBITDA	**901**	**938**	**754**	**948**	**1113**	**1246**	**1240**	**1407**	**949**	**851**
Depreciation	-166	-161	-160	-152	-150	-147	-158	-179	-208	-233
Amortization	-6	-11	-12	-18	-16	-14	-17	-17	-41	-32.4
Depreciation and amortization, net	-172	-172	-172	-170	-166	-161	-174	-196	-249	-265
= EBIT	**729**	**766**	**582**	**778**	**947**	**1085**	**1066**	**1211**	**700**	**585**
Taxes										
Income tax	-91	-103	-108	-131	-162	-202	-169	-195	-88	-94
Net financial income/expenses	-45	-27	-54	-71	-55	-70	-76	-69	-67	-77
Tax rate	13.3%	14.7%	22.2%	19.9%	19.1%	20.8%	17.8%	17.8%	15.0%	20.4%
Tax shield, net financial income/expenses	-6	-4	-12	-14	-11	-15	-14	-12	-10	-16
Total tax	-97	-107	-120	-145	-172	-217	-182	-207	-98	-110
NOPLAT	**632**	**659**	**462**	**633**	**775**	**868**	**884**	**1003**	**602**	**475**
Net financial income after tax	-39	-23	-42	-57	-45	-56	-62	-57	-57	-61
Interest expense, operating lease	0	-36	-41	-47	-45	-44	-45	-43	-47	-44
Dirty surplus	80	101	-255	51	20	-87	-18	21	-178	-227
Net comprehensive income	673	701	125	580	705	681	759	925	320	143
Comprehensive income	673	701	125	580	705	681	759	925	320	143
Verification, comprehensive income	0	0	0	0	0	0	0	0	0	0

Mattel – Balance

Balance - Dec 31 - USD mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
ASSETS										
Current assets										
Cash and cash equivalents	1206	901	618	1117	1281	1369	1336	1039	972	893
Trade receivables	944	991	874	749	1146	1247	1227	1260	1093	1145
Inventories	383	429	486	356	464	487	465	569	562	588
Prepaid expenses	318	272	410	333	336	341	529	510	559	571
Total current assets	2850	2593	2387	2555	3227	3444	3557	3378	3186	3197
Non-current assets										
Property, plant and equipment										
Gross property, plant and equipment	1716	1820	1753	1823	1876	1986	2133	2240	2395	2508
Accumulated Depreciation	-1180	-1301	-1217	-1318	-1391	-1462	-1540	-1580	-1657	-1767
Net property, plant and equipment	537	519	536	505	485	524	593	659	####	741
Goodwill	845	846	816	828	824	822	1081	1083	1394	1385
Intangible assets	71	199	236	216	214	207	706	681	739	700
Deferred income taxes	503	468	524	481	477	474	375	374	385	317
Other long-term assets	150	182	176	196	192	201	215	265	280	212
Total non-current assets	2106	2213	2288	2226	2191	2228	2970	3062	3536	3356
TOTAL ASSETS	4956	4805	4675	4781	5418	5672	6527	6440	6722	6553

Balance - Dec 31 - USD mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
EQUITY AND LIABILITIES										
LIABILITIES										
Current liabilities										
Short term debt / Current portion of long-term debt	64	50	150	52	250	58	410	4	0	317
Trade payables	376	441	422	351	406	335	385	375	430	652
Taxes payable	162	17	39	40	52	87	33	98	19	19
Accrued liabilities	980	713	649	618	642	239	888	570	640	658
Other current liabilities	0	349	0	0	0	320	0	0	0	0
Total current liabilities	1583	1570	1260	1061	1350	1039	1716	1047	1089	1646
Non-current liabilities										
Long-term debt	636	550	750	700	950	1500	1100	1600	2100	1800
Other long-term liabilities	305	378	548	489	489	522	644	541	584	474
Total non-current liabilities	940	928	1298	1189	1439	2022	1744	2141	2684	2274
TOTAL LIABILITIES	2523	2499	2558	2250	2789	3061	3460	3188	3773	3919
EQUITY										
Common stock	441	441	441	441	441	441	441	441	441	441
Additional paid-in capital	1613	1635	1642	1685	1706	1690	1728	1784	1767	1790
Retained earnings	1652	1977	2086	2340	2721	3168	3515	3918	3896	3746
Treasury stock	-997	-1572	-1621	-1555	-1881	-2243	-2153	-2449	-2534	-2495
Accumulated other comprehensive income	-277	-176	-431	-380	-359	-447	-464	-444	-622	-849
TOTAL EQUITY	2432.960	2307	2117	2531	2629	2611	3067	3252	2949	2633
TOTAL EQUITY AND LIABILITIES	4956	4805	4675	4781	5418	5672	6527	6440	6722	6553
Verification	0	0	0	0	0	0	0	0	0	0

Mattel – Reformulated Balance

Operating assets - Dec 31 - USD mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Operating current assets										
Inventories	383	429	486	356	464	487	465	569	562	588
Trade receivables	944	991	874	749	1146	1247	1227	1260	1093	1145
Prepaid Expenses and Other	318	272	410	333	336	341	529	510	559	571
+ Operating cash	113	119	118	109	117	125	128	130	120	114
Total operating currents assets	1758	1811	1888	1546	2063	2200	2350	2468	2335	2418
Operating current liabilities										
Trade payables	376	441	422	351	406	335	385	375	430	652
Income taxes accrued	162	17	39	40	52	27	33	28	19	19
Accrued liabilities	980	713	649	618	642	619	888	640	640	658
Short term debt	64	50	150	50	250	50	400	0	0	317
Total operating current liabilities	1583	1221	1260	1059	1350	1031	1706	1043	1089	1646
NOWC	175	590	628	487	712	1169	643	1425	1246	773
Operating non-current assets										
Property Plant & Equipment	537	519	536	505	485	524	593	659	####	741
Goodwill	845	846	816	828	824	822	1081	1083	1394	1385
Other non-current assets	724	848	936	893	882	882	1296	1319	1404	1230
+ Capitalized operating leases	766	867	1004	970	933	960	914	996	946	946
Total operating non-current assets	2872	3080	3292	3196	3124	3187	3884	4057	4482	4302
Operating non-current liabilities										
Deferred tax liabilities	9	121	133	109	114	104	214	186	171	109
Pension obligations	177	149	287	255	257	278	285	193	230	196
Total operating non-current liabilities	185	270	419	364	371	382	498	379	401	305
NONCA	2686	2810	2873	2832	2754	2805	3386	3678	4081	3997
Invested capital	2861	3400	3500	3320	3466	3974	4029	5104	5327	4770

Financial assets - Dec 31 - USD mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Financial assets										
Remaining cash and cash equivalents (excess cash)	1093	782	499	1008	1164	1244	1207	910	851	779
Total financial assets	1093	782	499	1008	1164	1244	1207	910	851	779
Financial liabilities										
Short term borrowings	0	349	0	2	0	8	10	4	0	0
Long term debt	636	550	750	700	950	1500	1100	1600	2100	1800
Other non current financial liabilities	119	109	129	125	118	140	145	162	183	169
+ Capitalized operating leases	766	867	1004	970	933	960	914	996	946	946
Total financial liabilities	1521	1875	1883	1797	2001	2607	2170	2762	3229	2915
NET FINANCIAL ASSETS	-428	-1093	-1383	-789	-837	-1364	-962	-1852	-2378	-2137
EQUITY INCL. MINORITIES	2433	2307	2117	2531	2629	2611	3067	3252	2949	2633
Invested capital	2861	3400	3500	3320	3466	3974	4029	5104	5327	4770
Verification diff. Invested Capital	0	0	0	0	0	0	0	0	0	0

Equity adjustments - USD mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Equity - Jan 01	2102	2433	2307	2117	2531	2629	2611	3067	3252	2949
Equity - Dec 31	2433	2307	2117	2531	2629	2611	3067	3252	2949	2633
Equity changes	331	-126	-190	414	98	-18	456	185	-302	-316

Cashflows with owners										
Purchase of treasury stock	-193	-806	-91		-447	-536	-78	-469	-177	0
Issuance of treasury stock for stock option exercises	119	220	18	31	73	116	123	135	42	15
Other issuance of treasury stock	0	0	0		0	0	0	0	0	0
Restricted stock units		0	-5	-8	-11	-36	-19			
Deferred compensation		6	1	-1	5	0	0	0	0	
Share-based compensation	28	22	36	50	67	53	63	62	52	57
Taxes related to shares and options	9	6	-2	37	8	24	36	50	21	-3
Dividend equivalents for restricted stock units	-1	-2	-3	-3	-3	-4	-4	-4	-4	-3
Dividends declared	-250	-272	-269	-271	-291	-317	-423	-494	-515	-515
Various adjustments and compensation trans.	-54				-9			-19	-43	-9
Total	-342	-827	-314	-166	-608	-699	-302	-740	-623	-458
Total income										
Net profits	593	600	380	529	685	769	776	904	499	369
Currency translation differences	70	87	-193	52	1	-77	28	-30	-190	-214
Change, pension plans	21	28	-88	19	8	-38	-18	59	-30	2
Derivates	-11	-14	25	-20	12	28	-27	-8	41	-15
Dirty surplus	80	101	-255	51	20	-87	-18	21	-178	-227
Total	673	701	125	580	705	681	759	925	320	143
Total comprehensive income	673	701	125	580	705	681	759	925	320	143
Verification	331	-126	-190	414	98	-18	456	185	-302	-316
Verification, diff	0	0	0	0	0	0	0	0	0	0

8.13.1 Income ratios

Income ratios - Dec 31	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Gross profit										
Lego	63.6%	69.8%	70.1%	72.5%	74.7%	72.9%	73.4%	73.0%	74.4%	75.0%
Hasbro	58.6%	58.9%	57.9%	58.8%	57.8%	57.2%	59.1%	59.0%	60.3%	62.3%
Mattel	46.2%	46.5%	45.4%	50.0%	50.5%	50.2%	53.1%	53.6%	49.8%	49.2%
EBITDA										
Lego	16.2%	21.8%	25.9%	29.2%	35.5%	34.3%	37.4%	36.6%	37.9%	37.8%
Hasbro	16.6%	18.0%	16.8%	19.3%	19.3%	18.9%	18.6%	17.5%	20.1%	20.4%
Mattel	15.9%	15.7%	12.7%	17.5%	19.0%	19.9%	19.3%	21.7%	15.8%	14.9%
EBIT										
Lego	17.0%	18.7%	22.8%	25.5%	31.7%	30.9%	34.6%	33.6%	34.6%	34.8%
Hasbro	11.9%	13.9%	12.7%	14.9%	15.1%	14.3%	13.9%	11.9%	15.3%	16.0%
Mattel	12.9%	12.8%	9.8%	14.3%	16.2%	17.3%	16.6%	18.7%	11.6%	10.3%
NOPLAT										
Lego	17.1%	13.8%	16.9%	19.6%	24.3%	23.3%	26.0%	25.1%	25.8%	26.4%
Hasbro	8.0%	10.1%	9.0%	10.7%	11.9%	11.4%	10.4%	9.7%	11.8%	11.9%
Mattel	11.2%	11.0%	7.8%	11.6%	13.2%	13.9%	13.8%	15.5%	10.0%	8.3%

8.13.2 Capitalized Operating Leases

Lego – COL

Operating lease - Dec 31 - DKK mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Operating lease expense	143	131	194	188	280	310	372	437	474	553
Asset value	1079	1598	1548	2306	2553	3064	3599	3904	4555	4555
Interest expense		50	75	72	108	119	143	168	182	213
Depreciation		81	119	116	172	191	229	269	292	340

Hasbro – COL

Operating lease - Dec 31 - USD mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Operating lease expense	35	37	44	44	42	47	47	45	47	46
Asset value	304	359	359	345	391	384	367	387	376	376
Interest expense		14	17	17	16	18	18	17	18	18
Depreciation		23	27	27	26	29	29	27	29	28

Mattel – COL

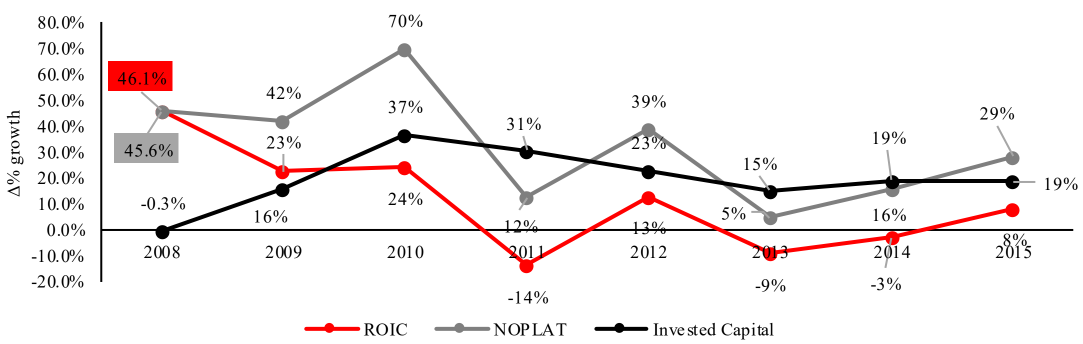
Operating lease - Dec 31 - USD mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Operating lease expense	87	93	105	122	118	113	117	111	121	115
Asset value	766	867	1004	970	933	960	914	996	946	946
Interest expense		36	41	47	45	44	45	43	47	44
Depreciation		57	65	75	72	70	72	68	74	71

8.13.3 Du Pont framework breakdown – level 1 & 2

Lego – Du Pont

Du Pont Analysis, level 1 - Dec 31 - DKK mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
IC	4415	4840	4386	6327	8338	10810	12752	14408	17952	20430
IC avg		4628	4613	5357	7333	9574	11781	13580	16180	19191
NOPLAT	1334	1104	1608	2288	3890	4372	6077	6359	7360	9459
ROIC (NOPLAT / IC avg)		24%	35%	43%	53%	46%	52%	47%	45%	49%
Net interest bearing debt (NIBD)	3231	3169	2328	3051	2886	3861	2922	3333	5120	2679
NIBD (avg)		3200	2749	2690	2969	3374	3392	3128	4227	3900
Equity	1184	1671	2058	3276	5452	6949	9830	11075	12832	17751
Equity (avg)		1428	1865	2667	4364	6201	8390	10453	11954	15292
MIN	4	5	9	7	22	23	30	43	0	0
MIN (avg)		5	7	8	15	23	27	37	22	0
Financial leverage, FLEV		223%	147%	101%	68%	54%	40%	30%	35%	26%
Net financial income/expenses (after tax)	-44.31	-25.45	-181.05	-11.45	-63.88	-93.08	####	-72.04	-152.48	-72.50
Net financial obligations, NFO	3224	3161	2320	3036	2865	3835	2888	3333	5120	2679
NFO avg		3193	2741	2678	2951	3350	3362	3111	4227	3900
r		1%	7%	0%	2%	3%	10%	2%	4%	2%
SPREAD (ROIC - |r|)		23%	28%	42%	51%	43%	42%	45%	42%	47%
		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
		1.00	0.99	0.99	1.00	0.99	0.99	0.99	0.99	1.00
MSR		1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00
ROE = (ROIC + (FLEV * SPREAD)) * MSR		75%	35%	43%	53%	46%	51%	47%	45%	49%

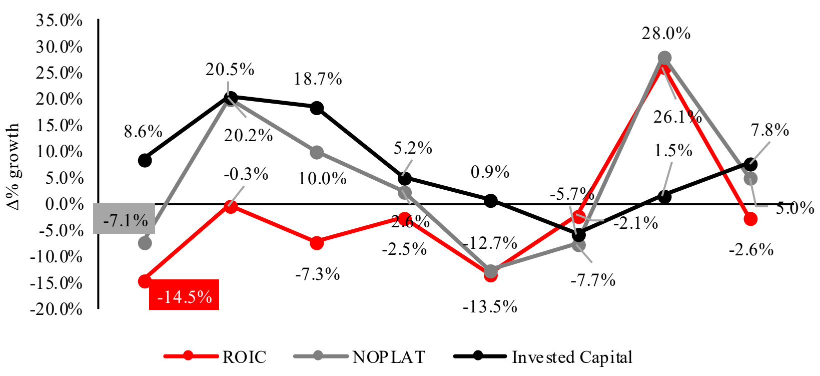
Du Pont Analysis, level 2 - Dec 31 - DKK mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Revenue	7798	8027	9526	11661	16014	18731	23405	25294	28578	35780
Net Operating Profit Margin (NOPM)	17%	14%	17%	20%	24%	23%	26%	25%	26%	26%
IC	4415	4840	4386	6327	8338	10810	12752	14408	17952	20430
IC avg		4628	4613	5357	7333	9574	11781	13580	16180	19191
Asset turnover ratio = Revenue / IC avg		1.73	2.06	2.18	2.18	1.96	1.99	1.86	1.77	1.86
1 / Asset turnover ratio		0.58	0.48	0.46	0.46	0.51	0.50	0.54	0.57	0.54
ROIC = NOPM * Asset turnover ratio		24%	35%	43%	53%	46%	52%	47%	45%	49%
Verification, ROIC		0	0	0	0	0	0	0	0	0



Hasbro – Du Pont

Du Pont Analysis, level 1 - Dec 31 - USD mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
IC	1853	2021	2185	2886	3132	3197	3188	2834	3278	3308
IC avg		1937	2103	2535	3009	3164	3192	3011	3056	3293
NOPLAT	254	388	361	433	477	489	427	394	504	530
ROIC (NOPLAT / IC avg)		20%	17%	17%	16%	15%	13%	13%	17%	16%
Net interest bearing debt (NIBD)	315	636	795	1291	1517	1779	1681	1151	1812	1644
NIBD (avg)		476	715	1043	1404	1648	1730	1416	1482	1728
Equity	1538	1385	1391	1595	1615	1418	1507	1682	1466	1664
Equity (avg)		1461	1388	1493	1605	1516	1462	1595	1574	1565
MIN	0	0	0	0	0	0	0	-2	-3	-5
MIN (avg)		0	0	0	0	0	0	-1	-2	-4
Financial leverage, FLEV		33%	52%	70%	87%	109%	118%	89%	94%	111%
Net financial income/expenses (after tax)	-24	-41	-37	-42	-63	-85	-73	-93	-73	-65
Net financial obligations, NFO	315	636	795	1291	1517	1779	1681	1106	1769	1604
NFO avg		476	715	1043	1404	1648	1730	1393	1438	1687
r		9%	5%	4%	4%	5%	4%	7%	5%	4%
SPREAD (ROIC - |r|)		11%	12%	13%	11%	10%	9%	6%	11%	12%
		1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1
MSR		1	1	1	1	1	1	1	1	1
ROE = (ROIC + (FLEV * SPREAD)) * MSR		24%	23%	26%	26%	27%	24%	19%	27%	30%

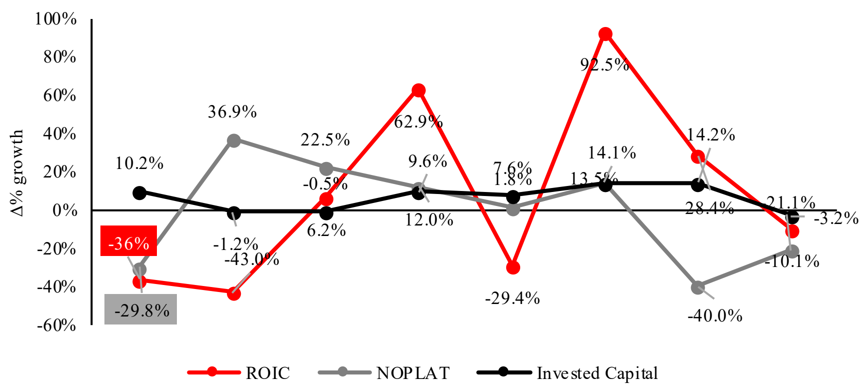
Du Pont Analysis, level 2 - Dec 31 - USD mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Net sales	3151	3838	4022	4068	4002	4286	4089	4082	4277	4448
Net Operating Profit Margin (NOPM)	8%	10%	9%	11%	12%	11%	10%	10%	12%	12%
IC	1853	2021	2185	2886	3132	3197	3188	2834	3278	3308
IC avg		1937	2103	2535	3009	3164	3192	3011	3056	3293
Asset turnover ratio = Net sales / IC avg		1.98	1.91	1.60	1.33	1.35	1.28	1.36	1.40	1.35
1 / Asset turnover ratio		0.50	0.52	0.62	0.75	0.74	0.78	0.74	0.71	0.74
ROIC = NOPM * Asset turnover ratio		20%	17%	17%	16%	15%	13%	13%	17%	16%
Verification, ROIC		0	0	0	0	0	0	0	0	0



Mattel – Du Pont

Du Pont Analysis, level 1 - Dec 31 - USD mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
IC	2861	3400	3500	3320	3466	3974	4029	5104	5327	4770
IC avg		3131	3450	3410	3393	3720	4002	4566	5215	5049
NOPLAT	632	659	462	633	775	868	884	1003	602	475
ROIC (NOPLAT / IC)		21%	13%	19%	23%	23%	22%	22%	12%	9%
Net interest bearing debt (NIBD)	428	1093	1383	789	837	1364	962	1852	2378	2137
NIBD (avg)		761	1238	1086	813	1100	1163	1407	2115	2257
Equity	2433	2307	2117	2531	2629	2611	3067	3252	2949	2633
Equity (avg)		2370	2212	2324	2580	2620	2839	3159	3100	2791
Financial leverage, FLEV		32%	56%	47%	32%	42%	41%	45%	68%	81%
Net financial income/expenses (after tax)	-39	-23	-42	-57	-45	-56	-62	-57	-57	-61
Net financial obligations, NFO	428	1093	1383	789	837	1364	962	1852	2378	2137
NFO avg		761	1238	1086	813	1100	1163	1407	2115	2257
r		3%	3%	5%	5%	5%	5%	4%	3%	3%
SPREAD (ROIC - |r|)		18%	10%	13%	17%	18%	17%	18%	9%	7%
ROE = (ROIC + (FLEV * SPREAD))		27%	19%	25%	28%	31%	29%	30%	18%	15%

Du Pont Analysis, level 2 - Dec 31 - USD mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Net sales	5650	5970	5918	5431	5856	6266	6421	6485	6024	5703
Net Operating Profit Margin (NOPM)	11%	11%	8%	12%	13%	14%	14%	15%	10%	8%
IC	2861	3400	3500	3320	3466	3974	4029	5104	5327	4770
IC avg		3131	3450	3410	3393	3720	4002	4566	5215	5049
Asset turnover ratio = Net sales / IC avg		1.91	1.72	1.59	1.73	1.68	1.60	1.42	1.16	1.13
1 / Asset turnover ratio		0.52	0.58	0.63	0.58	0.59	0.62	0.70	0.87	0.89
ROIC = NOPM * Asset turnover ratio		21%	13%	19%	23%	23%	22%	22%	12%	9%
Verification, ROIC		0	0	0	0	0	0	0	0	0



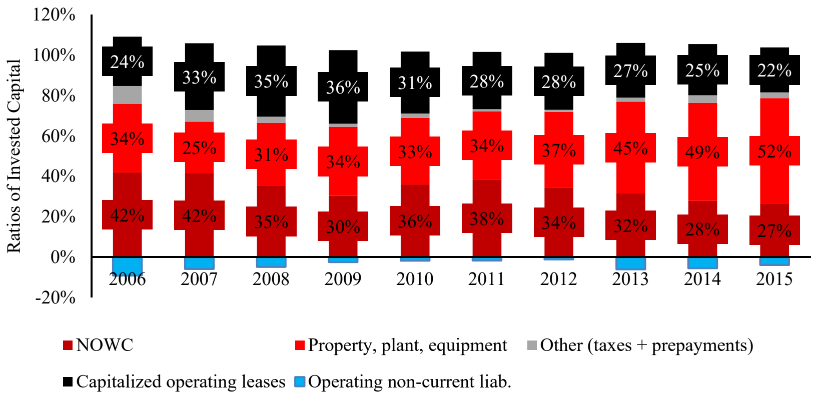
8.13.4 Du Pont Ratios

Du Pont ratios - Dec 31	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
ROE										
Lego		75%	35%	43%	53%	46%	51%	47%	45%	49%
Hasbro		24%	23%	26%	26%	27%	24%	19%	27%	30%
Mattel		27%	19%	25%	28%	31%	29%	30%	18%	15%
ROIC										
Lego		24%	35%	43%	53%	46%	52%	47%	45%	49%
Hasbro		20%	17%	17%	16%	15%	13%	13%	17%	16%
Mattel		21%	13%	19%	23%	23%	22%	22%	12%	9%
FLEV										
Lego		223%	147%	101%	68%	54%	40%	30%	35%	26%
Hasbro		**33%**	52%	70%	87%	109%	118%	89%	94%	111%
Mattel		32%	56%	47%	32%	42%	41%	45%	68%	81%
SPREAD										
Lego		23%	28%	42%	51%	43%	42%	45%	42%	47%
Hasbro		11%	12%	13%	11%	10%	9%	6%	11%	12%
Mattel		18%	10%	13%	17%	18%	17%	18%	9%	7%
NOPM										
Lego		14%	17%	20%	24%	23%	26%	25%	26%	26%
Hasbro		10%	9%	11%	12%	11%	10%	10%	12%	12%
Mattel		11%	8%	12%	13%	14%	14%	15%	10%	8%
Asset turnover										
Lego		1.73	2.06	2.18	2.18	1.96	1.99	1.86	1.77	1.86
Hasbro		1.98	1.91	1.60	1.33	1.35	1.28	1.36	1.40	1.35
Mattel		1.91	1.72	1.59	1.73	1.68	1.60	1.42	1.16	1.13
Inverse Asset turnover										
Lego		0.58	0.48	0.46	0.46	0.51	0.50	0.54	0.57	0.54
Hasbro		0.50	0.52	0.62	0.75	0.74	0.78	0.74	0.71	0.74
Mattel		0.52	0.58	0.63	0.58	0.59	0.62	0.70	0.87	0.89

8.13.5 Invested Capital line items

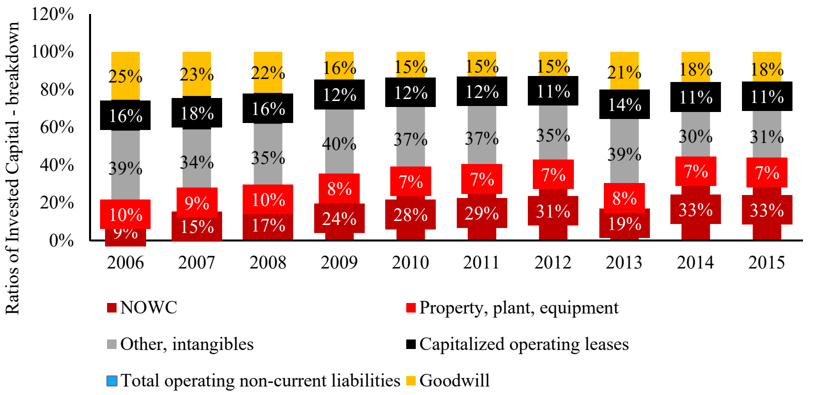
Lego – Invested Capital, Line Items

Invested Capital breakdown - Dec 31	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Invested Capital	4415	4840	4386	6327	8338	10810	12752	14408	17952	20430
NOWC	1851	2016	1546	1923	3000	4156	4393	4539	5001	5443
Property, plant, equipment	1501	1230	1371	2162	2753	3654	4775	6550	8727	10633
Other (taxes + prepayments)	388	281	132	94	180	114	131	286	656	588
Capitalized operating leases	1079	1598	1548	2306	2553	3064	3599	3904	4555	4555
Total operating non-current liabilities	-404	-284	-211	-158	-148	-177	-146	-871	-986	-788
Verification	0	0	0	0	0	0	0	0	0	0
Ratios of Invested Capital										
NOWC	42%	42%	35%	30%	36%	38%	34%	32%	28%	27%
Property, plant, equipment	34%	25%	31%	34%	33%	34%	37%	45%	49%	52%
Other (taxes + prepayments)	9%	6%	3%	1%	2%	1%	1%	2%	4%	3%
Capitalized operating leases	24%	33%	35%	36%	31%	28%	28%	27%	25%	22%
Operating non-current liab.	-9%	-6%	-5%	-2%	-2%	-2%	-1%	-6%	-5%	-4%



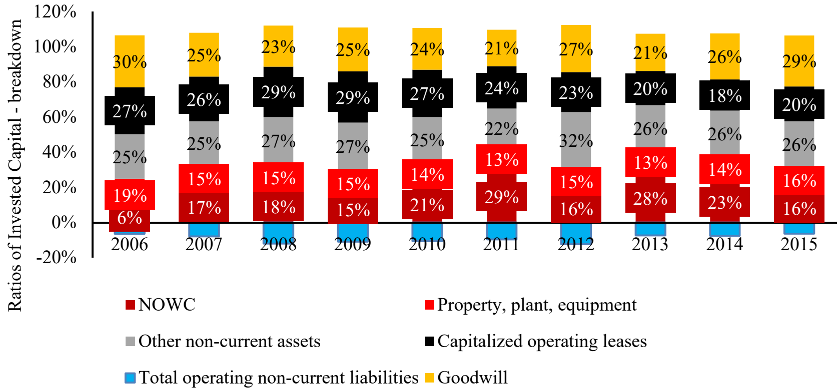
Hasbro – Invested Capital, Line Items

Invested Capital breakdown - Dec 31	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Invested Capital	1853	2021	2185	2886	3132	3197	3188	2834	3278	3308
NOWC	171	313	372	689	869	936	1004	525	1089	1078
Property, plant, equipment	182	188	212	221	234	218	230	236	237	238
Other, intangibles	727	690	769	1155	1164	1184	1112	1091	982	1025
Capitalized operating leases	304	359	359	345	391	384	367	387	376	376
Total operating non-current liabilities	0	0	0	0	0	0	0	0	0	0
Goodwill	470	471	474	476	475	475	475	594	593	593
Verification	0	0	0	0	0	0	0	0	0	0
Ratios of Invested Capital - breakdown										
NOWC	9%	15%	17%	24%	28%	29%	31%	19%	33%	33%
Property, plant, equipment	10%	9%	10%	8%	7%	7%	7%	8%	7%	7%
Other, intangibles	39%	34%	35%	40%	37%	37%	35%	39%	30%	31%
Capitalized operating leases	16%	18%	16%	12%	12%	12%	11%	14%	11%	11%
Total operating non-current liabilities	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Goodwill	25%	23%	22%	16%	15%	15%	15%	21%	18%	18%



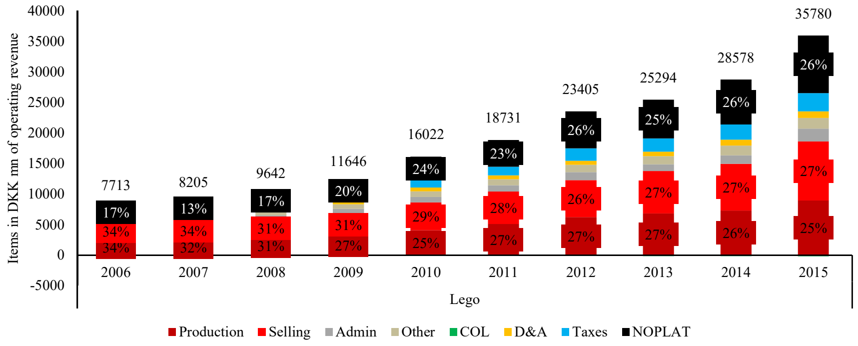
Mattel – Invested Capital, Line Items

Invested Capital breakdown - Dec 31	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Invested Capital	2861	3400	3500	3320	3466	3974	4029	5104	5327	4770
NOWC	175	590	628	487	712	1169	643	1425	1246	773
Property, plant, equipment	537	519	536	505	485	524	593	659	738	741
Other non-current assets	724	848	936	893	882	882	1296	1319	1404	1230
Capitalized operating leases	766	867	1004	970	933	960	914	996	946	946
Total operating non-current liabilities	-185	-270	-419	-364	-371	-382	-498	-379	-401	-305
Goodwill	845	846	816	828	824	822	1081	1083	1394	1385
Verification	0	0	0	0	0	0	0	0	0	0
Ratios of Invested Capital - breakdown										
NOWC	6%	17%	18%	15%	21%	29%	16%	28%	23%	16%
Property, plant, equipment	19%	15%	15%	15%	14%	13%	15%	13%	14%	16%
Other non-current assets	25%	25%	27%	27%	25%	22%	32%	26%	26%	26%
Capitalized operating leases	27%	26%	29%	29%	27%	24%	23%	20%	18%	20%
Total operating non-current liabilities	-6%	-8%	-12%	-11%	-11%	-10%	-12%	-7%	-8%	-6%
Goodwill	30%	25%	23%	25%	24%	21%	27%	21%	26%	29%

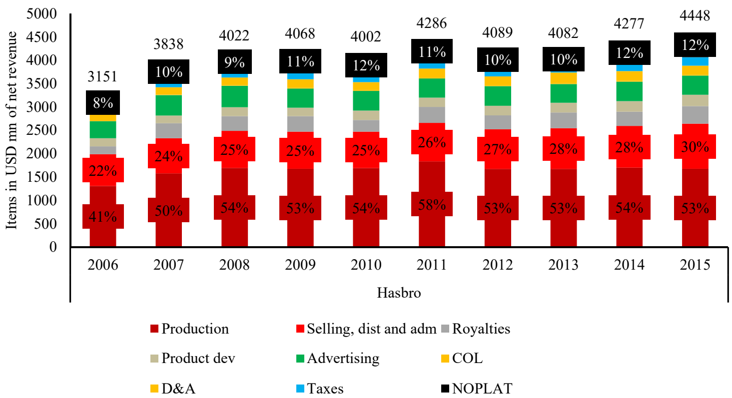


8.13.6 Net operating profit less adjusted taxes, NOPLAT

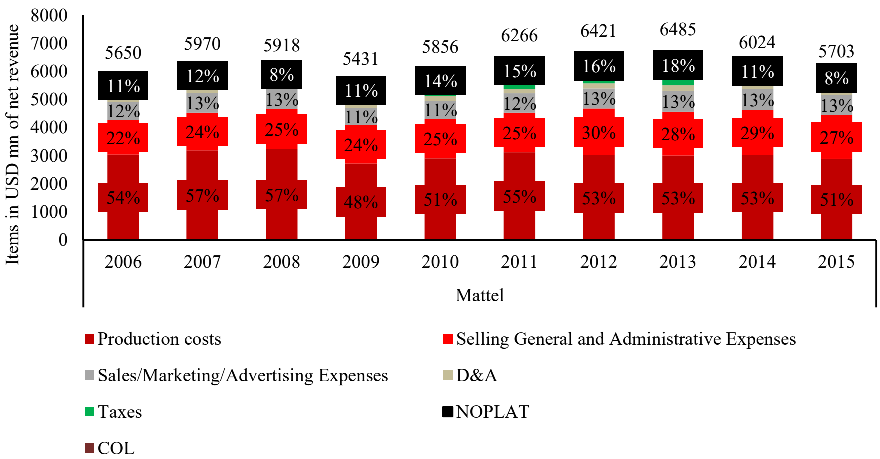
Lego



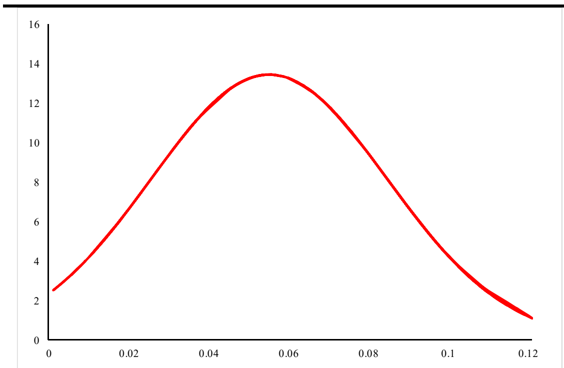
Hasbro



Mattel



8.14 Normal Distribution of the 10-year Danish Government Bond



Mean	0.0553
Standard Error	0.0016
Median	0.0497
Mode	0.0432
Standard Deviation	0.0296
Sample Variance	0.0009
Kurtosis	-0.8615
Skewness	0.2863
Range	0.1198
Minimum	0.12%
Maximum	12.10%
Count	348

Figure 8-5 – Normal distribution 10-year Danish government bond

The period covered is 1987/1/1 - 2015/12/1

8.15 Calculation of WACC

WACC	**Lego**	**Hasbro**	**Mattel**
rf	2.623%	2.623%	2.623%
Corporate default spread, rc	0.750%	1.000%	1.000%
rm	5.270%	5.270%	5.270%
Lego beta	0.8849	0.7451	0.8099
Tax, Tc (effective)	24.48%	26.00%	20.37%
1-Tax	75.52%	74.00%	79.63%
Cost of debt, Rd	3.37%	3.62%	3.62%
E[rm] = Cost of equity (capm)	4.9653%	4.60%	4.77%
Cost of lease, RL	4.67%	4.67%	4.67%
D	2679	1269	1190
E	17751	3107	9231
L	4555	376	946
Vadj	24985	4751	11368
D/Vadj	11%	27%	10%
E/Vadj	71%	65%	81%
L/Vadj	18%	8%	8%
D/E	15.09%	40.84%	12.90%
Parameter	**Lego**	**Hasbro**	**Mattel**
WACCadj	4.4439%	3.9939%	4.4825%
ROIC	49.29%	16.08%	9.41%
ROIC-WACCadj spread	44.85%	12.09%	4.93%

$$WACC_{adj} = \frac{D}{V_{adj}} * R_d * (1 - T_c) + \frac{E}{V_{adj}} * R_e + \frac{L}{V_{adj}} * R_L * (1 - T_c)$$

8.16 Budgeting notes

Below table indicates mixed results of testing for randomness of Revenue and NOPLAT, i.e. the data may or may not be random. While a small sample size (10 data points) may be the culprit, the use of FT is avoided for forecasting given the results.

Function	Fisher's Kappa	Kolmogorov-Smirnov	Outcome	Critical values
Revenue	2.700 (0.137)	0.675 (0.027)	Mixed results with FK and KS	Fisher's Kappa: 5%: 4.450 1%: 5.358
NOPLAT	2.724 (0.130)	0.681 (0.025)	Mixed results with FK and KS	Kolmogorov-Smirnov: 5%: 0.45333 1%: 0.54333

Table 8-3 – FK and KS white noise results of Revenue and NOPLAT

P-values are in brackets. Critical values are shown for n=10 (i.e. 2006-2015)

Arguably, increasing the order of polynomial functions tend to produce higher R squared values, and relying on R squared (and Euclidean Distance for that matter) for model selection has a drawback and may not be valid at all. As the results reveal below, all OLS estimation models indicate relatively high R squared values as well as low ED.

Method	ED	R^2
3rd poly	1264	0.996776
2nd poly	2670	0.985615
Exponential	3608	0.978384
Linear	3924	0.968935

Table 8-4 – Results of model selecting for forecasting

For consistency to previous forecasting, regressed revenue data from 2006-2014 is benchmarked against 2015. The optimal regression method is then used the full period 2006-2015 to yield coefficients. If the method is still optimal, three sets of OLS coefficients (one for each of revenue, NOPLAT, and Depreciation, Amortization and Impairments) are used for forecasting of 2016-2024. For specifics of the calculations please see the Excel spreadsheet.

The OLS estimations indicate that third order, second order and exponential polynomials are a better fit than linear OLS, albeit all[21] OLS estimations, comparatively speaking, exhibit good model fits with low R squared and ED values.

The actual calculations are presented on the next pages.

[21] *As the line items "Depreciation, Amortization and Impairment" contains negative values, OLS estimation using an exponential approach is not doable and as such results cannot be obtained and compared to the rest of the OLS estimations. However, third order polynomial OLS estimation exhibits the best on all accounts so this is not thought to pose a major drawback.*

x	y	y_noplat	y_D&A,I
2006	7798	1334	62
2007	8027	1104	-253
2008	9526	1608	-290
2009	11661	2288	-429
2010	16014	3890	-606
2011	18731	4372	-637
2012	23405	6077	-654
2013	25294	6359	-764
2014	28578	7360	-947
2015	35780	9459	-1081

Table 8-5 – Budgeting: Input data for model building

The input data is used to estimate coefficients for OLS and results are shown in the next table.

	2006-2014	2006-2015		
	Revenue	Revenue	NOPLAT	D&A,I
3rd poly	y = (c3 * x^3) + (c2 * x^2) + (c1 *x) + b			
c3	-62.29	-11.85	-6.97	-2.79
c2	375800	71701	42116	16819
c1	-755684446	-144575254	-84792248	-33820756
b	506524453749	97169309586	56903080311	22669520051
ED	1264	6311		
r2	0.9968	0.9899	0.9823	0.9844
3rd poly forecasting is selected because 2006-2014 shows lowest ED & highest r2				
2nd poly	y = (c2 * x^2) + (c1 *x) + b			
c2	163.83	210.91	59.01	2.88
c1	-655785	-844959	-236372	-11701
b	656236298	846290000	236687828	11873125
ED	2670	3379		
r2	0.9856	0.9894	0.9803	0.9615
Linear	y = c * x + b			
c	2829.15	3105.96	924.39	-110.43
b	-5670032	-6226058	-1854099	221460
ED	3924	6415		
r2	0.9689	0.9611	0.9554	0.9573
Exponential	y = c *e ^(b * x)			
c	2.767E-155	7.665E-154	2.9409E-213	-
b	1.818E-01	1.802E-01	0.247461691	-
ED	3608	3772		
r2	0.9784	0.9837	0.9516	-

Table 8-6 – Budgeting: estimated model coefficients

The table shows estimated model coefficients for various regression models (1-3 order polynomials) and exponetial regression as well. 2006-2014 is benchmarked on 2015 data. For consistency, the full period 2006-2015 was benchmarked again with all OLS models to see if ED and R squared still shows good results. Coefficients are determined with Excel's LINEST function, e.g. =INDEX(MMULT(LINEST(y;(x-AVERAGE(x))^{1,2,3});IFERROR(COMBIN({3;2;1;0};{3,2,1,0})*(-AVERAGE(x))^({3;2;1;0}-{3,2,1,0});0));1) to determine c3 coefficient for '3rd poly'. The results are shown in the next table.

Forecasting robustess - Dec 31 - DKK mn	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Revenue	7798	8027	9526	11661	16014	18731	23405	25294	28578	35780
3rd poly										
Revenue	7818	7931	9492	12129	15467	19133	22753	25952	28359	29597
Error	20	-96	-34	468	-547	402	-652	658	-219	-6183
Squared Error	416	9237	1133	219030	299095	161500	425707	433410	48178	38226149
Euclidean Distance (ED)	20	98	104	479	727	831	1056	1245	1264	6311
2nd poly										
Revenue	6772	8454	10464	12802	15467	18460	21781	25429	29405	33709
Error	-1026	427	938	1141	-547	-271	-1624	135	827	-2071
Squared Error	1052974	182469	880110	1301398	299095	73393	2638215	18242	684019	4290225
Euclidean Distance (ED)	1026	1112	1454	1848	1928	1947	2535	2539	2670	3379
Linear										
Revenue	5243	8072	10901	13730	16559	19388	22218	25047	27876	30705
Error	-2555	45	1375	2069	545	657	-1187	-247	-702	-5075
Squared Error	6529388	2015	1890717	4281520	297388	432284	1409840	61116	492898	25754779
Euclidean Distance (ED)	2555	2556	2902	3564	3606	3665	3853	3861	3924	6415
Exponential										
Revenue	7179	8611	10328	12388	14858	17821	21375	25637	30749	36881
Error	-619	584	802	727	-1156	-910	-2030	343	2171	1101
Squared Error	382931	340864	643175	527882	1336701	828562	4122919	117607	4714872	1212903
Euclidean Distance (ED)	619	851	1169	1377	1798	2015	2861	2881	3608	3772

Table 8-7 – Budgeting: applied coefficients

The table shows the results of applying previously described coefficients. Euclidean Distance was calculated using

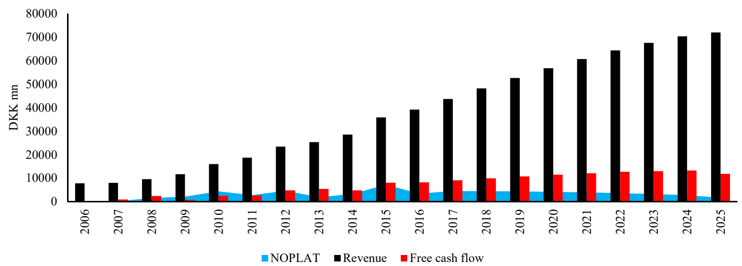
$$\sqrt{\sum_{i=1}^{n}\left(revenue_{actual_i} - revenue_{forecast_i}\right)^2}$$

8.17 Budget

Forecasting of FCF		Historical										Budget									Terminal
FCF - Dec 31 - DKK mn		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Revenue		7798	8027	9526	11661	16014	18731	23405	25294	28578	35780	39187	43715	48202	52577	56770	60709	64323	67541	70292	71938
growth g			2.9%	15.7%	18.3%	27.2%	14.5%	20.0%	7.5%	11.5%	20.1%	8.7%	10.4%	9.3%	8.3%	7.4%	6.5%	5.6%	4.8%	3.9%	**2.34%**
Δ growth			229	1499	2135	4353	2717	4674	1889	3284	7202	3407	4527	4487	4375	4193	3939	3614	3218	2751	1646
NOPLAT		1334	1104	1608	2288	3890	4372	6077	6359	7360	9459	10169	11149	11975	12605	12998	13111	12903	12332	11356	9933
Depreciation, amort and impairment		62	-253	-290	-429	-606	-637	-654	-764	-947	-1081	-1343	-1680	-2120	-2679	-3375	-4224	-5243	-6449	-7857	-8041
Gross cash flow		1272	1357	1898	2717	4496	5009	6731	7123	8307	10540	11512	12829	14095	15284	16373	17335	18146	18781	19213	17974
Δ Invested capital			425	-454	1941	2011	2472	1942	1656	3544	2478	3357	3745	4130	4504	4864	5201	5511	5786	6022	6163
Free cash flow			931	2352	775	2484	2537	4789	5468	4762	8062	8155	9084	9965	10780	11509	12134	12635	12994	13191	11811
FCF - Dec 31		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
% of revenue:	*Historical avg.*																				
NOPLAT	*22.35%*	17.11%	13.75%	16.88%	19.62%	24.29%	23.34%	25.96%	25.14%	25.75%	26.44%	25.95%	25.50%	24.84%	23.97%	22.90%	21.60%	20.06%	18.26%	16.16%	13.81%
Depreciation, amort and impairment	*-3.25%*	0.80%	-3.15%	-3.04%	-3.68%	-3.78%	-3.40%	-2.79%	-3.02%	-3.31%	-3.02%	-3.43%	-3.84%	-4.40%	-5.10%	-5.95%	-6.96%	-8.15%	-9.55%	-11.18%	-11.18%
Gross cash flow	*25.60%*	16.32%	16.90%	19.92%	23.30%	28.07%	26.74%	28.76%	28.16%	29.07%	29.46%	29.38%	29.35%	29.24%	29.07%	28.84%	28.55%	28.21%	27.81%	27.33%	24.99%
Δ Invested capital	*8.57%*		5.30%	-4.77%	16.65%	12.56%	13.20%	8.30%	6.55%	12.40%	6.93%	8.57%	8.57%	8.57%	8.57%	8.57%	8.57%	8.57%	8.57%	8.57%	8.57%
Free cash flow	*17.03%*		11.60%	24.69%	6.65%	15.51%	13.55%	20.46%	21.62%	16.66%	22.53%	20.81%	20.78%	20.67%	20.50%	20.27%	19.99%	19.64%	19.24%	18.77%	16.42%

Table 8-8 – Budgeting: using third order polynomials

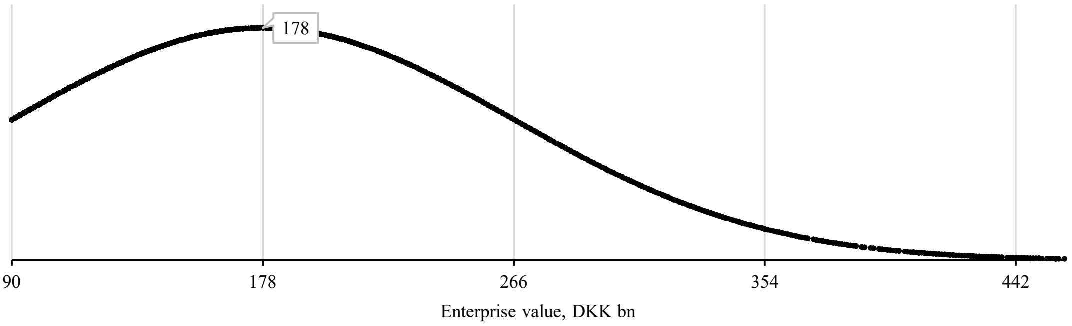
Third order polynomials was applied to Revenue, NOPLAT, D, A and Imp., in the budget period. A sum of these values yield the ‘gross cash flow’. Deducted with ‘Δ invested capital’ from the balance, the ‘Free cash flow’ is derived.



8.18 Sensitivity analysis

WACC | g	1%	2%	2.34%	3%
4%	358	497	582	912
4.4438%	312	407	460	633
5%	268	332	364	459
6%	214	249	265	307
7%	178	199	209	231
8%	152	166	172	186
9%	133	143	146	155
10%	118	125	127	133
11%	105	111	113	117
12%	96	99	101	104
13.54%	84	86	87	89

Table 8-9 – Sensitivity analysis – two dimensions, numbers



Enterprise value	
Mean	178379
Standard Error	1250
Median	147667
Standard Deviation	88369
Sample Variance	7809135958
Kurtosis	0.8793
Skewness	1.2709
Range	372087
Minimum	87037
Maximum	459125
Sum	891894294
Count	5000
Confidence Level(95.0%)	2450

Figure 8-6 – Normal distribution plot EV

The plot is generated based on 5000 samples in a Monte Carlo simulation. Lower/Upper: 4.4439%-13.54%. A kurtosis of 0.8793 (calculated in the appendix) indicates fewer extreme outliers compared to a standard normal distribution

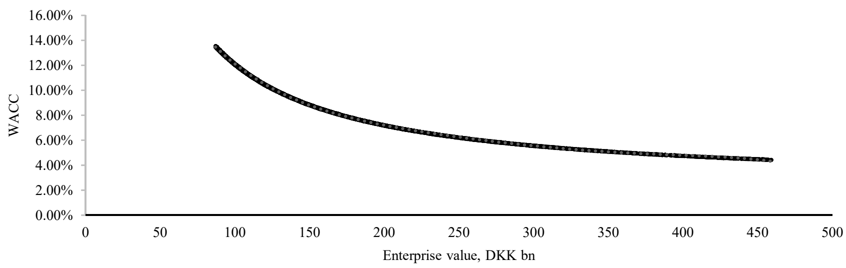


Figure 8-7 – Sensitivity analysis – one dimension

WACC is variable, growth rate is constant 2.34%