Monte Carlo Simulations in M&A Valuation

The Acquisition of Tiffany & Co. by LVMH

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Abstract

The value of a firm is a quantity contingent on its beholder, which is showcased explicitly in the setting of mergers and acquisitions. For the buying party, inherent uncertainties surrounding valuation inputs and outputs raise the complexity of pricing both the target and expected synergies. This thesis investigates how extending the classical DCF model by Monte Carlo simulations can provide additional insights to acquirers in assessing and determining deal prices in light of uncertainty.

To illustrate the issue at hand, we built on the acquisition of Tiffany & Co. by LVMH in 2021. Framed by the circumstances of the Covid-19 crisis, this deal accentuates the challenge of target pricing even for LVMH as a serial acquirer. In this context, we determined the firm value of Tiffany & Co. from the viewpoint of October 28, 2020, using two approaches. First, we conducted a deterministic DCF valuation with a resulting standalone share price of 113.0 USD and 146.4 USD for the share value including anticipated synergies. Second, we approached the valuation of Tiffany & Co. using Monte Carlo simulations to account for the uncertainty embedded in the parameters of the DCF model. The obtained distribution of the comprehensive share value displayed a mean of 146.7 USD, as well as positive skewness and high kurtosis.

Our findings from the static DCF model suggest that at a final transaction price per share of 131.5 USD, LVMH paid a considerable premium relative to the standalone market price of 114.0 USD and our estimated standalone price of 113.0 USD. Nevertheless, the deal is considered underpriced relative to the expected fair value of 146.4 USD when including synergies. However, these deterministic results obscure relevant information on the uncertainty of outcomes. The simulation outcomes demonstrate that due to the skewness of the distribution, the mean of 146.7 USD should not be considered the ceiling price that LVMH is willing to pay at most. This proposition is due to a lower median of 136.4 USD, inferring a higher chance of Tiffany's value falling below the mean than above. In effect, we find a probability of 45.8% that the deal will prove overpriced at 131.5 USD. To conclude, we deem Monte Carlo simulations a compelling tool for acquirers to account for variability in input parameters and accordingly base their pricing decision on a probabilistic range of firm values instead of a point estimate.

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List of Abbreviations

APAC	Asia-Pacific
ATO	Asset turnover
B2B	Business to business
CAGR	Compounded annual growth rate
CapEx	Capital expenditures
CAPM	Capital asset pricing model
CCC	Cash conversion cycle
CEO	Chief executive officer
CRSP	Center for Research in Security Prices
CS	Credit spread
D	Debt
D&A	Depreciation and amortization
DCF	Discounted cash flow
DTC	Diamond Trading Company
E	Equity
e.g.	Exempli gratia
EBIT	Earnings before interest and taxes
EBITDA	Earnings before interest, taxes, depreciation, and amortization
EBT	Earnings before taxes
EU	European Union
EV	Enterprise value
FCFF	Free cash flow to the firm
FY	Fiscal year
GDP	Gross domestic product
Gen Y	Generation Y
Gen Z	Generation Z
i.e.	Id est
IDEX	International Diamond Exchange
IMF	International Monetary Fund
LBO	Leveraged buyout
LVMH	Louis Vuitton Moët-Hennessey
M&A	Mergers and acquisitions

MLE	Maximum likelihood estimation
MRP	Market risk premium
mUSD	million US dollar
NIBL	Net interest-bearing liabilities
NOPAT	Net operating profit after tax
NWC	Net working capital
OECD	Organisation for Economic Co-operation and Development
PEST	Political, economic, social, and technological
pp	Percentage point(s)
PPE	Property, plant, and equipment
PV	Present value
Q3	Third quarter of the year
Q4	Fourth quarter of the year
R&D	Research and development
ROIC	Return on invested capital
RV	Random variable
S&P	Standard and Poor’s
SG&A	Selling, general, and administrative
SWOT	Strengths, weaknesses, opportunities, and threats
Tiffany	Tiffany & Co.
U.S.	United States
VRIO	Valuable, rare, inimitable, and, organized
WACC	Weighted average cost of capital
YoY	Year-on-year
YTD	Year-to-date
YTM	Yield to maturity

1 Introduction

The objective of mergers and acquisitions (M&A) is to achieve organizational growth by creating an entity more valuable than the sum of its parts. Under this premise, companies have engaged in more than 790,000 transactions with a cumulative value of over 57 trillion USD since 2000 (IMAA, 2023). Despite the tremendous economic value involved in such endeavors and their potential to shape entire industries, pivotal shortcomings in M&A deal-making have not yet been overcome. In specific, the common overpricing of targets and relative underperformance overshadow the reality of acquisitions across industries (Eccles et al., 1999; Karaevli & Özcan, 2022).

To understand the complexity of pricing a target and where acquirers may fall short in their assessment, the applied valuation tools reveal points of contention. The discounted cash flow (DCF) model presents the most popular choice among practitioners. It builds on the fundamental idea that the intrinsic value of any firm is destined by its projected future cash flows discounted at a risk-adjusting rate. The key assumption underlying the DCF model as well as any related approach is the predictability of the firm's future value creation. Analysts spend enormous efforts on formulating deceivingly precise forecasts whilst often in denial that regardless of the sophistication of their approach, any deterministic estimate is prone to uncertainty (Damodaran, 2013).

One method of accounting for the uncertainty embedded in valuation is through Monte Carlo simulations. In understanding input parameters not as point estimates but as stochastic variables that follow a probability distribution, this valuation method arrives at a spectrum of firm values and respective probabilities. While analysts once neglected such approaches due to technological limitations, the increasing availability of data and analytical tools now favor their application (Damodaran, 2018). In effect, valuation models can become more adept in reflecting the dynamics of a rapidly changing and hence, less predictable market environment.

Reiterating the prevailing issues in M&A, the acquisition of Tiffany & Co. by LVMH in 2021 presents a compelling case for applying Monte Carlo simulations to incorporate uncertainty and address the fallacy of overpaying. Specifically, the unforeseeable outbreak of a global pandemic intensified the ambiguity in pricing faced by the acquiring firm. Covid-19 caused one of the most prominent peaks of uncertainty in recent history, but it is certainly not the last event where valuers are confronted with the vulnerability of deterministic forecasts. In this light, the formal consideration of uncertainty remains a pressing matter in the sphere of M&A as well as for any purpose of firm valuation.

1.1 Problem statement

The purpose of this thesis is to examine the use of Monte Carlo simulations both in addition as well as in comparison to the classic DCF model for valuations in the context of M&A. For most external analysts, firm valuations ultimately lead to whether to buy or sell a stock at a given market price. However, the price of a company in an M&A case is unspecified until settled in bilateral negotiations. While this implies that both parties have considerable influence on the final price, it also poses a great responsibility to the acquirer. Specifically, the challenge of determining their willingness to pay while simultaneously identifying attached risks is crucial to realizing a gain from the acquisition.

To underline the materiality of the issues at hand, the thesis applies the two valuation models to the acquisition of Tiffany & Co. by LVMH. Considering that LVMH has earned the reputation of an experienced serial acquirer, it appears particularly striking that they would agree on the highest deal price recorded in the luxury industry only to attempt to renounce this agreement months later. Whilst the outbreak of a global pandemic and its economic repercussions are far beyond any means of predictability, the question arises whether the identification of a firm value or value range reflective of general uncertainty could have enhanced the pricing decision of LVMH. In this context, the key research question of this thesis will be:

Can incorporating uncertainty in the valuation model through Monte Carlo simulations provide insights relevant to the pricing and related risk assessment of the acquisition of Tiffany & Co.?

In the pursuit of answering this primary question, the following sub-questions will be scrutinized:

– *What is the fair value of Tiffany & Co. in the standalone case on October 28, 2020, according to the deterministic DCF model?*
– *What is the fair acquisition price for Tiffany & Co., i.e., the fair value including synergies from integration into LVMH, on October 28, 2020, according to the deterministic DCF model?*
– *How can a fair acquisition price of Tiffany & Co. be determined from the valuation approach using Monte Carlo simulations and what is this price on October 28, 2020?*

The deliberate distinction between the main research question and sub-questions emphasizes that the aspiration of the following chapters is *not* the determination of an exact and rightful acquisition price. On the contrary, the premise of this thesis is to acknowledge and manage the absence of any precise estimates.

1.2 Methodology and delimitations

The methodology employed to investigate the above-presented problem statement builds on selected theories and formal valuation methods. As the main body of this thesis builds on a financial understanding of the research question, related strategic analyses are conducted on a supplementary level. Thus, we consider analytical frameworks, including PEST, Porter's Five Forces, VRIO, and SWOT sufficient to capture the dynamics of Tiffany & Co.'s strategic context.

The theoretical pillars for the valuation constitute the standard DCF model and a probabilistic extension using Monte Carlo simulations. We adopt combined, and if necessary adjusted, methodological procedures as presented by Plenborg and Kinserdal (2021) and Koller et al. (2020) for the DCF valuation and necessary estimations. Respectively, we follow Raychaudhuri (2008) for the design of Monte Carlo simulations and perform the simulations using the software package Crystal Ball by Oracle. To discuss the presented problem statement in depth, the valuation of LVMH as well as valuations of distinct synergies and opportunities using option pricing are delimited from the scope of this thesis. Due to the same reason, we will not investigate additional terms of the acquisition apart from the settled price, such as the means of payment.

Based on the date of the final acquisition offer by LVMH, October 28, 2020, our valuation and all related analyses include information up until the end of the day prior, i.e., October 27, 2020. As we primarily presume an ex-ante view on the acquisition, this cut-off date is set to mirror the circumstances of the case as closely as possible. Nonetheless, we acknowledge an inevitable bias in our judgments due to the influence of extended knowledge ex-post.

Further elaborating on the information employed, the valuations are based primarily on publicly available annual reports and quarterly reports provided as Form 10-Ks and 10-Qs to the U.S. Securities and Exchange Commission (SEC). Additional data sources used include S&P Capital IQ and CRSP, as well as industry reports, press releases, and various media articles. Due to the extensive informational transparency of both the target and acquirer, we consider public information adequate to address our research statement. However, in practice, this research topic is more likely to apply to decision-makers with inside information, which should be employed if available.

Finally, it is requisite for the reader to be acquainted with fundamental concepts in finance and strategic management, as well as in elementary statistics. Whilst the focus of our work limits detailed explanations thereof, we will provide a brief review of applied theories to solidify common grounds for the understanding of later chapters.

1.3 Related research

The most widely examined approach to formally embed uncertainty in financial valuations is through the definition of real options (Armstrong et al., 2004). The application of what Faulkner (1996) designates as “option thinking” in the sphere of corporate finance is often connotated with distinct capital investments as well as R&D and technology-driven projects (Remer et al., 2001). In different terms, real options considered means to account for uncertainty and flexibility if the condition thereof underlies explicit business opportunities (Armstrong et al., 2004).

In terms of incorporating uncertainty on a more comprehensive rather than project-specific level, Monte Carlo simulations are often discussed alongside other probabilistic approaches, including scenario analyses (Damodaran, 2013). The scrutinization of uncertainty in model parameters is further elaborated by Elsner and Krumholz (2013). Their investigation of the ambiguous estimation of the cost of capital demonstrates that this pivotal input to the DCF model is commonly distorted by estimation errors, resulting in biased outcomes of firm value. While these studies are inherently related to the premise of our thesis and reveal the potential of probability-based evaluations, their practical implications primarily center around risk analysis and do not extend to pricing decisions (Hertz, 1979).

A sector where Monte Carlo simulations already received considerable attention in their practical application is real estate investments (Loizou & French, 2012). Various blueprints for modeling uncertainty in real estate properties are proposed to aid professionals in decision-making and risk assessment (French & Gabrielli, 2005; Hoesli et al., 2005; Kelliher & Mahoney, 2000). Further specifying the employment of simulations, French and Gabrielli (2004) assessed various probability distributions for their fit to describe property value, which shows potential for extrapolation to the valuation of other assets.

Building on these related works, our study discusses the application of Monte Carlo simulations for firm valuation in mergers and acquisitions. We aim to address a gap in the existing body of literature and derive insights equally relevant to practitioners.

1.4 Thesis outline

The thesis approaches the discussed problem statement in ten chapters, whereby the introductory background frames the beginning of this work as Chapter 1.

Chapter 2 reviews the general theoretical background on the value components in M&A and outlines elementary concepts of the DCF model and Monte Carlo simulations. The specific background of the case study, including company profiles on Tiffany & Co. and LVMH, is subsequently provided in Chapter 3.

The main body of analyses begins in Chapter 4 where the strategic analysis of Tiffany & Co. is conducted on external and internal dimensions. After specifying strategic drivers in the SWOT analysis, Chapter 5 advances with the financial analysis. The reformulation of financial statements and analysis of historical performance in this section build the foundation for formulating forecasts in the following.

Chapter 6 is dedicated to projecting Tiffany's future performance based on previously identified value drivers and historical developments. Subsequently, the cost of capital and business dynamics in the terminal period are derived before the deterministic estimates for the fair value of Tiffany & Co. are presented in Chapter 7. This chapter concludes with a sensitivity analysis of the DCF model as a first approach to address deviations from point estimates.

Building on the idea of variability in input parameters, the sole focus of Chapter 8 is constructing and performing the valuation of Tiffany & Co. using Monte Carlo simulations. The outcomes thereof are presented at the end of this chapter. Chapter 9 provides a thorough discussion of the obtained results relative to the static DCF valuation as well as in response to the key research question of this thesis. This thesis concludes in Chapter 10 where key findings and their relevancy are highlighted.

2 Theoretical background

Before delving into case-specific analyses, this chapter aims to provide a common understanding of the theoretical background. We begin by exploring the definitions of firm value in the context of mergers and acquisitions. Subsequently, the DCF valuation model is introduced, along with addressing the inherent uncertainty in input parameters. The last part of this section provides a brief review of statistical concepts and outlines the setup of Monte Carlo simulations.

2.1 Valuation in mergers and acquisition

In the context of mergers and acquisitions (M&A), the value of a firm represents a multifaceted quantity contingent on its beholder. Most fundamentally, the different values the buyer and seller assign to the focal firm form the cornerstones for negotiating an adequate acquisition price. However, apart from the two parties on the inside of the deal, the market also forms an external opinion on the valuation of a given deal – particularly if the target and/or the acquirer are listed firms.

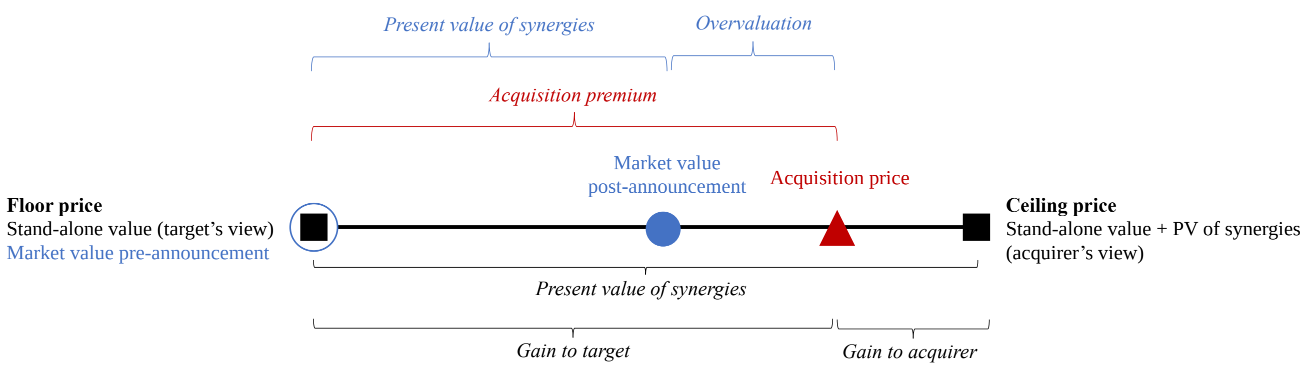
Naturally, the selling firm has an own assessment of its intrinsic value. Due to the possession of inside information unavailable to any other party, it can be inferred that this is the most accurate representation of the target's standalone value (Rhodes-Kropf & Viswanathan, 2004). This value typically establishes the floor price that the seller is willing to accept in a takeover, knowing that there are motivations for acquirers to pay a premium. In specific, the acquirer assesses the value of the target in two additive components: its standalone value, based on information and judgments proprietary to the buyer, and the present value of expected synergies (Berk & DeMarzo, 2017). This corresponds to the ceiling price of the acquisition, which the buyer is willing to pay at most.

Successful negotiations typically lead to a transaction price within or at the boundaries spanned by the two counterparties. For the target company, the sale is favorable whenever the price is higher than the 'insider view' on the standalone value. On the other hand, for the acquirer, a positive NPV from the deal is yielded whenever the final amount paid is lower than the estimated value of the target firm, including synergies (Berk & DeMarzo, 2017).

For publicly traded targets, the frame of reference for a given acquisition price is expanded by observed market values. Once an acquisition is announced, the share price of the target commonly surges in anticipation of an acquisition premium (Adnan & Hossain, 2016). This increase mirrors the distinct expectations of the market on the additional value created by the deal and may not correspond to the synergy estimation of the acquirer. Put differently, the market value of the target post-announcement indicates whether external agents believe an acquisition is mispriced. Furthermore, the acquisition premium is commonly denoted relative to the target's observed standalone value in the market. It represents the difference between the final acquisition price and the market capitalization of the target pre-announcement (Berk & DeMarzo, 2017).

Figure 1 illustrates the different values assigned to an acquisition target. In this simplified example, we assume that all parties agree on the same standalone value of the target. However, the general market (indicated by blue notations) does not share the acquirer's assessment of synergies, suggesting that the deal is overvalued relative to market expectations.

Figure 1: Firm values in acquisition pricing (own illustration)



It is evident that due to their hypothetical nature, the valuation of synergies bears high degrees of uncertainty for the acquirer. Most acquisitions are shown to fall short in realizing the once high-priced synergies, rendering these deals overpriced ex-post (Eccles et al., 1999). One consideration to mitigate this pitfall early on is to acknowledge that the environment of the acquisition may already determine the potential for synergy realization. In the luxury industry, as the focal market segment of this thesis, brands often remain separated post-merger despite vast opportunities for synergies. The key reason is that the extensive exploitation of synergies can erode the value of individual brands (Ijaouane & Kapferer, 2012). Consequently, integrating synergetic value into the acquisition price should follow a more conservative approach than in an industry where shared resources and opportunities are tangible and sought-after through mergers.

Furthermore, the standalone value can influence the value attributed to synergies. Whilst ideally, the acquisition premium should purely reflect additional value gains expected from synergies, it imperatively assumes that the standalone value of the target is represented correctly in the market. Rhodes-Kropf and Viswanathan (2004) show that if the market value of the target is overvalued, this will positively impact the valuation of synergies and artificially inflate the occurrence of mergers. Effectively, this can create a driver for entire merger waves, which indicates a periodical persistence of mispricing (Rhodes-Kropf & Viswanathan, 2004).

In light of this background, the fundamental approach to defining an acquisition price is of utmost importance for the buyer to avoid overpaying. Renegotiations as an exhibit of buyer's remorse or due to changes in the external environment are found to be common and costly for both parties, even if successful (Bhagwat et al., 2016; Officer, 2004).

2.2 Discounted Cash Flow model

The Discounted Cash Flow (DCF) model became the best practice for the valuation of corporations in the 1970s and is still one of the most used approaches by analysts to date (Luehrman, 1997; Demirakos et al., 2004). This valuation model aims to arrive at the enterprise value (EV) of the firm defined as:

$$Enterprise\ Value = Market\ Value\ of\ Equity + Market\ Value\ of\ Debt - Cash$$

Given the case of an acquisition, the acquirer usually takes over all liabilities of the target company, i.e., equity and debt (Steiger, 2008). Therefore, the enterprise value can be understood as the amount the acquiring firm paid for the target's equity while paying off the corporate debt with cash reserves.

Using this equation, it is also straightforward to infer the firm's equity value E_0 and to determine the price per share implied by the DCF valuation of EV as follows (Berk & DeMarzo, 2017):

$$P_0 = \frac{EV_0 - Debt + Cash}{Number\ of\ shares\ outstanding} = \frac{E_0}{Number\ of\ shares\ outstanding}$$

To follow the assumptions and mechanics behind the valuation process, three key determinants require in-depth consideration. These factors are derived from understanding the firm value EV_0 as a function of (1) forecasted cash flows, (2) their timing, and (3) their riskiness as defined in the formula below (Luehrman, 1997).

$$EV_0 = \sum_{t=1}^{N} \frac{FCFF_t}{(1 + r_{WACC})^t} + \frac{FCFF_{N+1}}{r_{WACC} - g} \times \frac{1}{(1 + r_{WACC})^N}$$

Free Cash Flows

The first critical input parameters are the free cash flows generated from the firm's operations, i.e., the cash available to debt and equity holders after deducting operating tax. The specification of operating cash flows for historical evaluation and forecasting requires reformulating financial statements into their analytical forms (Plenborg & Kinserdal, 2021). The resulting distinction between operating activities from financing activities allows for the derivation of the free cash flow to the firm (FCFF) as follows:

$$FCFF = NOPAT + D\&A - CapEx - Increase\ in\ NWC$$

The Net Operating Profit After-Tax (NOPAT) is the final operating result in the analytical income statement and is deduced from EBIT using the firm's effective tax rate. The latter refers to the rate implied by the reported tax expense paid on EBT.

$$NOPAT = EBIT * (1 - Effective\ Tax\ Rate)$$

Whilst depreciation and amortization (D&A) are recognized as operating expenses in the regular income statement, both items are not cash flow relevant, which is why D&A is added to the operating result. It is further assumed that the firm is required to invest in non-current and current assets to run operations (Koller et al., 2020). Thus, capital expenditures (CapEx) and increases in net working capital (NWC) regularly cause tie-ups or outflows of cash and are reflected through deductions from NOPAT. The periodical development of non-current assets and working capital can be extracted from analytical balance sheets.

Other related approaches for explicit firm valuation employ the free cash flow to equity (FCFE) or economic value added (EVA) instead of FCFF (Berk & DeMarzo, 2017; Plenborg & Kinserdal, 2021). In theory, the choice of these value measures is arbitrary for the overall outcome. However, it is crucial to consider which quantity the valuation directly aims for, i.e., the enterprise value or equity value, and use the corresponding discount rate (Berk & DeMarzo, 2017).

Two-stage valuation approach

While the time value of money affects the *present* value of any financial asset, there is an additional time-contingent development of the *future* value of FCFF in the DCF model. In mathematical terms, timing does not impact the denominating discount rate but also the cash flow quantities in the numerators of the valuation equation. The valuation of FCFF is commonly split into two stages: a forecasting period and a terminal period.

The forecasting period usually spans a discrete time horizon of 5-15 years (Koller et al., 2020; Steiger, 2008). For these years, deterministic assumptions are made about line items of the income statement and balance sheet, such that FCFF can be forecasted and discounted to present value year by year, as presented in the formula below. The development of cash flows can reflect the company's historical performance as well as expected changes in the future (Steiger, 2008).

$$V_{FC} = \frac{FCFF_1}{1 + r_{WACC}} + \frac{FCFF_2}{(1 + r_{WACC})^2} + \cdots + \frac{FCFF_N}{(1 + r_{WACC})^N}$$

At the end of the forecasting horizon, FCFF growth is assumed to reach a steady state at the long-term growth rate g. It is suggested that g should be in the range of GDP growth as sustainable business growth will not outrun general economic growth in continuity (Steiger, 2008). The terminal value of the firm can then be computed as the perpetuity given by Gordon's Dividend Model:

$$V_{Terminal} = \frac{FCF_{N+1}}{r_{WACC} - g}$$

Discounting this terminal value to the present day and adding the sum of discounted cash flows from the forecast period leads to the final firm value.

Cost of Capital

The final key determinant in the DCF valuation model is the riskiness of cash flows incorporated through a composite discount rate. The weighted average cost of capital (WACC) is the average rate that debt and equity holders require to finance the company's operations:

$$WACC = \frac{E}{D + E} r_e + \frac{D}{D + E} r_d (1 - t)$$

As the inputs to this formula are not comprehensively observable, the calculation of WACC is based on estimations and the use of proxies. Respective limitations include that first, the weighting factors are based on market values of equity and debt which may be especially difficult to obtain for non-traded companies. Furthermore, the extrapolation of the present WACC as a discount rate for future cash flows is conditional on the constancy of capital structure. In any other case, the WACC needs to be recalculated for every planned change of leverage in the future (Brealey et al., 2011).

Secondly, the WACC is inversely related to the marginal tax rate, i.e., due to the tax shield created by interest payments, a higher tax rate lowers the overall cost of capital. However, corporate taxation follows a complex framework of policies that differs across geographies, subsidiaries, and types of debt instruments (Plenborg & Kinserdal, 2021). As a result, a great degree of simplification is required to arrive at a single effective tax rate for adjusting the cost of capital (Luehrman, 1997).

Further assumptions and estimations concern the two required rates of returns composing the WACC: cost of equity and cost of debt.

Cost of equity

Following a basic premise of investment decisions, any rational equity investor will only provide financing to a firm if, at the given level of risk, the expected returns from this investment are the best available returns he can yield in the market (Brealey et al., 2011). This represents the price for a firm to attract equity funding, i.e., its cost of equity. The fundamental model in financial theory for pricing the risk-return relationship is the Capital Asset Pricing Model (CAPM), as defined below:

$$r_e = r_f + \beta\left(E[r_m] - r_f\right)$$

The CAPM states that in addition to the market risk premium, i.e., the expected excess return of the market portfolio, investors demand a firm-specific premium. The scale of this additional return is determined by the sensitivity of the firm to the market β. Note that it is assumed that investors can eliminate idiosyncratic risk through diversification and are only compensated for the systematic risk. The inputs to the CAPM equation need to be derived further from observable quantities.

The risk-free rate

The risk-free rate in the context of firm valuation is usually proxied by using the price of zero-coupon government bonds of stable economies, which are deemed virtually default-free (Koller et al., 2020). Given the belief of the DCF model that the company will generate cash flows indefinitely far into the future, it is common to consider a government bond with a long time-to-maturity, e.g., 30 years, and presume flatness of the term structure.

Market risk premium

The market risk premium (MRP) reflects the excess return investors demand for bearing the general risk of the market. Most commonly, the premium is estimated based on the average difference between historical returns on a proxy of the stock market and a risk-free investment. However, applying backward-looking risk premia in a future context may not only introduce a bias but is furthermore subject to variation depending on the historical period considered (Berk & DeMarzo, 2017; Brealey et al., 2011). In this context, a tradeoff arises between analyzing a sufficiently large number of observations and the relevancy of data far in the past. While point predictions vary across economists, it is reasonable to presume an MRP in the range of 5% to 8% (Brealey et al., 2011).

Beta

The sensitivity of a firm to movements in the market is given by its beta, which also represents a measure of the firm's market risk (Brealey et al., 2011). Depending on the direction and extent of co-movement, companies inhibit beta values higher, lower, or equal to the market beta of 1. However, as these betas are not explicitly observable, a derivation is required using the available quantities of the firm and the market. In specific, the linear regression of excess returns of the firm against market excess returns results in an estimate of beta as the slope coefficient in the equation below:

$$r_{i,t} = \alpha_i + \beta_i r_{m,t} + \varepsilon_{i,t}$$

However, this derivation is subject to issues in data quality, the choice of the market proxy, and biases, for instance, due to illiquid trading. More explicitly, non-continuous trading of a stock may paint a misleading picture about the stability of returns and hence, a lower beta (Koller et al., 2020).

To address this noisiness, it is proposed to smooth the raw beta obtained from the regression above or derive an implicit beta using a peer group (Berk & DeMarzo, 2017; Koller et al., 2020). The latter alternative uses observations from a set of comparable firms for regressions to mitigate the fallacies caused by regressing the returns of a singular firm. Nonetheless, the accuracy of this derivation faces new limitations due to the discretionary choice of the peer group. Betas amongst competitors in one industry may differ considerably due to firm-specific factors (Da et al., 2009).

Cost of debt

The riskiness of a company does not only affect equity returns, but debt holders equally demand compensation for bearing credit risk. Credit risk arises through possible future developments in which the company cannot pay the creditor its promised debt obligations (Plenborg & Kinserdal, 2021). Thus, it is important to stress that the *expected* return on corporate debt instruments reflects the true cost of debt today. In practice, however, r_D is often approximated using the promised yield of these securities (Koller et al., 2020). For a traded corporate coupon bond with a price P_0, the yield to maturity (YTM) can be derived as follows:

$$P_0 = \frac{Coupon}{1 + YTM} + \frac{Coupon}{(1 + YTM)^2} + \cdots + \frac{Coupon + Face\ Value}{(1 + YTM)^N}$$

While for investment-grade bonds this approximation for the cost of debt holds, the YTM overstates the expected return on corporate bonds with higher default probabilities. Suggested alternatives include the use of debt betas or different valuation models, such as the adjusted present value model (Berk & DeMarzo, 2007). Furthermore, in case debt instruments are not traded, the yield can be constructed using the credit spread implied by the firm's credit rating (Koller et al., 2020).

2.3 Uncertainty in the DCF valuation

One of the fundamental critiques of the DCF model draws upon its heavy reliance on estimating numerous input factors, particularly in light of uncertainty. To improve risk assessment and avoid investor overconfidence in the deterministic output of the DCF model, we introduce the concept of uncertainty and methods to explicitly consider uncertainty in the valuation (Koller et al., 2020).

Definition and classification of uncertainty

In order to understand the sources of uncertainty in the DCF valuation model, Damodaran (2013) proposes a classifying estimation and economic uncertainty. Estimation uncertainty refers to weaknesses in the methodology, which can be mitigated to a certain extent by employing higher-quality data and tools if available. However, even the best-in-class valuation models are subject to economic uncertainty as it is impossible to accurately predict future changes in a firm's environment.

Circling back on the discount rate used in the DCF model, one might wonder whether this measure already reflects economic uncertainty since it includes market risk by design. At this point, it is crucial to explicitly highlight the difference between risk and uncertainty. The definition of these two quantities varies across literature, however, the most famously discussed one is given by Knight (1921). According to the theory of Knightian uncertainty, risk refers to situations where the outcome is unknown, but there is sufficient information to infer the underlying probability distribution of possible outcomes. On the other hand, uncertainty is defined as a lack of information to judge the odds of possible outcomes. In this context, as there is no reliable information on the probabilities of the paths the market can take (otherwise there would be predictable markets), the assessment of market "risk" by investors is purely based on assumptions about uncertainty. Particularly when the state of the economy deviates from the ex-ante expectations of the market, i.e., for market crashes and macroeconomic crises, investors are confronted with the true uncertain nature and often resort to irrational behavioral responses (Damodaran, 2013; Dizikes, 2010).

Economists often criticize the distinction made by Knight as overblown since it acknowledges almost no true risk in the reality of the market but only inherently unquantifiable uncertainty (Dizikes, 2010). Hence, for the remainder of this work, we refer to an understanding of uncertainty that is more accommodating to the objective of valuation. By modeling a range of possible outcomes for an input variable and assigning respective probabilities, we attempt to approximate uncertainty for valuation purposes. Although capturing the full economic uncertainty is impossible by nature, evaluating a range of probable valuation outputs takes far more of the uncertainty into consideration than a point estimate of the firm value can capture (Damodaran, 2013). In this context, risk can be understood as a measure of the deviation from the expected outcome based on assumptions about uncertainty.

Regarding the relationship between uncertainty and discount rates, it can be inferred that market risk reflects and prices the expectations of the market on future outcomes. However, as this cannot include all possible events, the economic uncertainty is never reflected in the risk premium to its full extent. Furthermore, it is argued that incorporating discrete events into the discount rate can inflate the required rate of return to an economically unreasonable point (Damodaran, 2013). Therefore, other tools are necessary to formally incorporate uncertainty into the DCF valuation model.

Sensitivity analysis

The sensitivity analysis is one of the most common practices to acknowledge possible deviations from the point estimates of DCF inputs. By changing the estimate values, individually or jointly, the analysis illustrates which input factors drive the model output the most. Therefore, this evaluation focuses on the impact of parameter variations on the resulting firm value. Given that for most firms the terminal component contributes the most to total firm value, DCF results tend to be particularly sensitive to the inputs of the perpetuity calculation (Koller et al., 2020). In specific, that is the cash flow in the last forecast year, the long-term growth rate, and the cost of capital (Steiger, 2008).

Overall, the sensitivity analysis can illustrate the effects of uncertainty on the valuation output and provide a first idea of the span of thinkable firm values. However, as it does not allow for inferences on how probable these outcomes are, it provides only limited additional insights for the investment decision and price negotiation in the acquisition context.

Scenario analysis

The basis of scenario analyses is the construction of discrete states of the future world. Usually, the analysis narrows down to three scenarios: a base case, i.e., the basic DCF model that uses the most probable values as input estimates, as well as an optimistic and pessimistic case (Damodaran, 2018). For the latter scenarios, the values of input parameters are adjusted accordingly to a reasonable best or worst realization (Berk & DeMarzo, 2017). These results can be interpreted as a lower and upper bound to consider in M&A-related negotiations. Furthermore, the resulting variance between best and worst provides an indicative measure of risk (Damodaran, 2018).

However, to further refine the interpretation for decision-making the valuer faces the challenge of assigning discrete probabilities to each case. Whilst a comprehensive consideration of uncertainty favors a large number of scenarios, each scenario needs to be outlined based on realistic expectations, which increases the complexity of creating too many projections (Damodaran, 2018). One way of extending the idea of scenario analysis to cover a broader range of possible paths is presented by simulations. This approach to address uncertainty is explored in the following.

2.4 Monte Carlo simulations

Monte Carlo simulations represent a systematic way to evaluate a continuous spectrum of possible outcomes of input parameters and the resulting firm value of the DCF model. We provide a short introduction to probability distributions to follow the subsequent five-step process for applying simulations to the valuation context.

2.4.1 Basics of statistical distributions

Monte Carlo simulations are a statistical tool used by researchers and practitioners of various fields to generate possible outcomes of a process. The fundamental idea builds on the repeated simulation of samples from one or multiple probability distributions to analyze the statistical results. To assess how these simulations can be linked to DCF models, it is crucial to understand the underlying statistical concepts.

A random variable (RV) X is said to be uncertain in its outcome. Its probability distribution represents the set of all possible realizations and their respective probabilities. While random variables in discrete distributions can only take on a finite number of values, continuous distributions allow RVs to realize any number in a range of real numbers. Most variables used in financial calculations are more likely to fit the definition of continuous distributions, but discrete random variables can be suitable for modeling events with few possible outcomes (Damodaran, 2018). In the following, we present selected probability distributions deemed relevant for our simulations and refer to Damodaran (2018) for a more exhaustive overview of distributional choices.

Normal distribution

The normal distribution is one of the best-understood statistical distributions and is also popular in application as it can be defined by only two parameters: the mean μ and standard deviation σ. A special case of the normal distribution is the standard normal which defined by $\mu = 0$ and $\sigma = 1$. Its random variables can be obtained by transforming any normal RV. The probability mass of the normal distribution is centered around the mean and the symmetry around the mean reflects zero skewness. Furthermore, the normal kurtosis of 3 is generally used as a relative value to define the excess kurtosis of other distributions. These so-called leptokurtic distributions have fatter tails than the normal distribution, i.e., higher probabilities of extreme values. For instance, the former convention of assuming normality for asset returns was dismissed by empirical observations on non-normal skewness and kurtosis (Cont, 2001). Furthermore, it is important to note that the range of possible realizations of the normal RV is not bound (Damodaran, 2018). Thus, this distribution is deemed unsuitable to model quantities that are considered non-negative, for instance, asset prices.

Lognormal distribution

A widely used distribution to represent the development of asset prices is the lognormal distribution (Brealey et al., 2011). It describes the distribution of a random variable for which the logarithm is normally distributed. Due to the nature of the logarithmic function, the random variable of the lognormal distribution can only take on positive values, i.e., the distribution is bound on the left side. Unlike the normal distribution, the skewness is positive indicating that the right-hand tail is heavier. The lognormal distribution is defined by its mean and standard deviation. It is important to note that these parameters apply to the distribution of the *natural logarithm* of the random variable and can be obtained by transforming the μ and σ of the corresponding normal distribution.

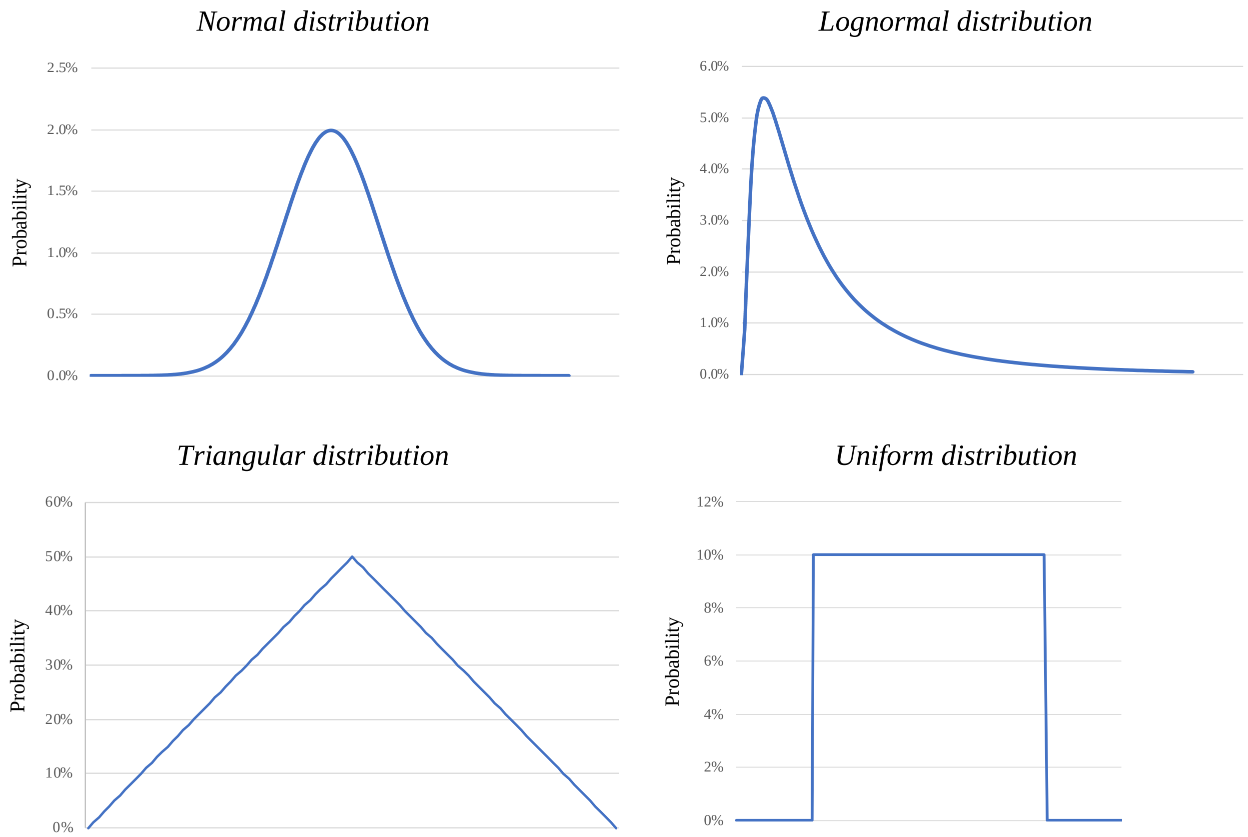
Triangular distribution

For the representation of input values which require a limitation of possible outcomes on the upper and lower end, we can either a) use a regularly non-bounded distribution and disregard the values outside of the limits or b) assume a triangular distribution (French & Gabrielli, 2004). This distribution is defined by its minimum and maximum boundaries as well as a mean or median where the probability density function peaks. However, this distribution typically overestimates the variance if, regardless of the limits, the underlying data tends towards a normal distribution (French & Gabrielli, 2004).

Uniform distribution

The previous distributions all assume that observations are centered around a mean or median, and the probability of occurrence decreases as we move away from the central value towards extreme outcomes. The uniform distribution reflects a different idea of probabilities. In this case, the random variable can take on any value between a lower and upper bound. However, the same probability applies to all possible realizations. The minimum and maximum values defining the boundaries are the characteristic parameters to be set for the uniform distribution. An illustrative overview of all presented distributions is given in Figure 2 below.

Figure 2: Overview of selected probability distributions



2.4.2 Monte Carlo methodology

Simulations are closely related to the concept of random experiments, where draws occur under distinct experimental conditions (Raychaudhuri, 2008). For modeling physical processes using Monte Carlo simulations, Raychaudhuri (2008) presents a generic four-step process. In the following, we extend this methodology by related literature for application to DCF valuation.

Step 1: Definition of the DCF model and uncertain inputs

The construction of the static DCF model sets the starting point for the construction of simulations. As introduced above, this includes the choice of all relevant inputs and sub-models, such as the CAPM. These estimations processes are deterministic in that they use point expectations of inputs to deliver a single output value, i.e., the firm value. In contrast, the objective of our Monte Carlo simulation is to understand inputs as random variables with stochastic distributions (Damodaran, 2013). It is recommended to choose only a limited number of inputs for modeling through simulations to reduce complexity (Damodaran, 2018). The selection of the input parameters can be argued by their relevance to the final output as identified in a sensitivity analysis, the degree of uncertainty surrounding the factor, or other managerial judgments.

Step 2: Determination of the input distribution

Identifying a probability distribution suitable for a given input parameter presents the greatest challenge in the simulation process (Damodaran, 2018). In general, it is possible to perform Monte Carlo simulations without assuming a formal statistical distribution, whereby random draws are only made from a given set of empirical observations (Alexander, 2008; Raychaudhuri, 2008). However, as the limited availability of observations may distort the output of these bootstrapped simulations, this thesis focuses on modeling input factors through defined probability distributions.

Whilst in most simulation software, distribution fitting and identification are automated within the application, understanding the underlying mechanisms is crucial to validate or question the simulation outputs. Precisely, distribution fitting refers to reverse engineering a probability distribution that would generate values close to the physical observations (Raychaudhuri, 2008). Given the vast number of possible distributions, a formal evaluation is required for each input variable. As a prerequisite for assessing distributions, distributional properties must be chosen such that the highest possible fit to the historical data is achieved.

There are various methods to estimate the parameters of a fitted distribution whereby according to Raychaudhuri (2008), the maximum likelihood estimation (MLE) is the most used approach. MLE is based on solving an optimization problem of the likelihood function L, more specifically, of its logarithm, as presented in the formulas below.

$$L(\boldsymbol{\theta}|\mathbf{x}) = \prod_{i=1}^{n} f(x_i|\boldsymbol{\theta})$$

$$\max \ \ln(\boldsymbol{\theta}|\mathbf{x}) = \sum_{i=1}^{n} \ln f(x_i|\boldsymbol{\theta})$$

L defines the likelihood of obtaining an observation x_i from the data sample $\mathbf{x} = (x_1, \dots, x_n)'$ of a probability density function f with the parameter vector $\boldsymbol{\theta}$. To determine for which value of $\boldsymbol{\theta}$ the likelihood function is maximized, it is more convenient to maximize the log-likelihood function, which nonetheless leads to the same ML estimator (Alexander, 2008).

Going further, different probability distributions with parameters respectively fitted to the sample data can be compared using goodness-of-fit statistics, e.g., the Kolmogorov-Smirnov statistic and the Anderson-Darling statistic. Their interpretation indicates the statistical distribution best suited to describe the physical behavior of an input parameter (Raychaudhuri, 2008).

Step 3: Definition of input correlations

Two random variables X and Y are considered correlated if, for a change in the value of X, the value of Y also changes – either in the same or opposite direction. Perfect correlations occur when the two variables move exactly to the same extent, suggesting correlations of +1 for the positive case and –1 for the negative case. While imperfect correlations take on any number between +1 and –1, a value of zero shows independence between X and Y.

When modeling input parameters of the DCF model as random variables, the co-movement or countermovement of variables can multiply or offset individual effects on the final valuation figure (Damodaran, 2018). Consequently, the valuer must specify correlations of inputs to capture the real-world dynamics as closely as possible. However, as one could presume that all underlying assumptions are connected to some degree, only distinct correlations should be deemed relevant for modeling. The strength of these relationships can be deduced from analyses of historical input data as well as the discretionary judgment of the analyst (French & Gabrielli, 2005).

Step 4: Generation of random variables

The random values from the previously specified probability distribution are generated through a uniform distribution from which numbers between 0 and 1 are drawn. To resemble true randomness, the sequence of draws should not repeat itself or only allow repetition after a long sequence, thereby showing high periodicity (Alexander, 2008). Any generated number u from the sequence is interpreted as a probability, hence the restriction of $0 \leq u \leq 1$. To determine a random value x from a chosen continuous distribution $f(x)$, the inverse of its cumulative distribution function is used, i.e., $F^{-1}(u) = x$. This exercise is repeated to generate a sufficiently large number of possible outcomes, whereby the precision of the resulting distribution increases in the number of simulation runs (Raychaudhuri, 2008).

Step 5: Analysis of simulation output

The simulated realizations of uncertain input parameters feed into the DCF model from *Step 1* and generate an outcome of the firm value with each run. The entirety of the results can be aggregated into a distribution of firm value for which the histogram approximates the shape of its probability density function. Considering the simulated values as a sample population, it is possible to use sample statistics to derive inferences for decision-making, specifically regarding price and risk (Raychaudhuri, 2008). While we acknowledge that the value or price of an asset always depends on its risk, the statistical figures that an investor uses for evaluating both quantities can be distinct (French & Gabrielli, 2004).

In particular, the mean, median, and confidence intervals around the peak of the distribution can frame a relevant price range for M&A deal negotiations. The overall risk of the acquisition is further given by the standard deviation, which reflects the dispersity of probable firm values (French & Gabrielli, 2005). The simulation output also allows for an evaluation of tail risk through skewness and kurtosis. Specific points of interest include whether extreme realizations of firm value are on the upside or downside as well as how much of the probability mass is assigned to such outliers.

Nonetheless, it is necessary to recall that this probabilistic approach is highly assumptive of probability distributions and correlations of inputs. Their definition further increases the complexity of the overall valuation model and the risk of misspecification (Damodaran, 2007). Hence, as with any valuation model, it is important to acknowledge limitations and judge the plausibility of results (Damodaran, 2018).

3 Case introduction

The subsequent sections present a company profile of Tiffany & Co. (‘Tiffany’) as the primary focus of this case study. In addition, this chapter briefly introduces the purchasing entity LVMH. By retracting LVMH’s acquisition process of Tiffany, we demonstrate why this deal makes a compelling case for using Monte Carlo simulations later on.

3.1 Tiffany & Co.

Tiffany & Co. was founded in 1837 in New York City by Charles Lew Tiffany and John B. Young as an upscale stationery store. After re-shifting their strategic focus to jewelry early on, the company emerged to become the leading luxury jewelry retailer and manufacturer in the United States. Moreover, Tiffany developed a celebrated brand iconography, most prominently illustrated in Truman Capote’s “Breakfast at Tiffany’s” (1958). Today, the patented shade of ‘Tiffany Blue’ is recognized globally, and the brand has become a symbol of status and love (Hughes et al., 2016).

While jewelry makes up the core of Tiffany’s product portfolio, their offering also includes watches, stationery, fragrances, as well as other home and personal accessories. The prices for jewelry range from $165 for a pair of sterling silver earrings to figures well over $100,000 for extremely precious gems. Apart from gold and silver, Tiffany is particularly known for diamond jewelry, including their selection of engagement rings. Overall, the majority of jewelry products is manufactured in-house while the remainder is procured from third parties.

In 2019, the single-brand retailer operated over 320 stores and employed over 14,900 employees globally. The Americas and Asia-Pacific constitute the most important markets, shown in Figure 3.

Figure 3: Tiffany & Co. sales split (2019)

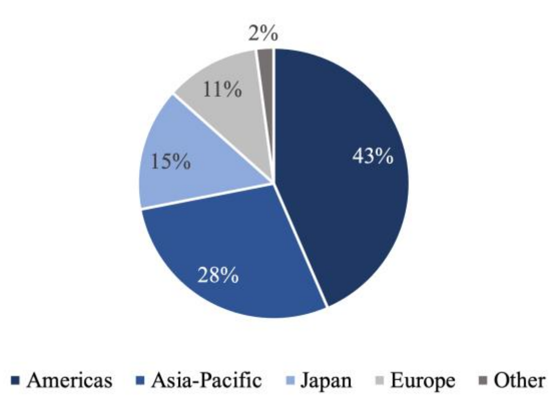
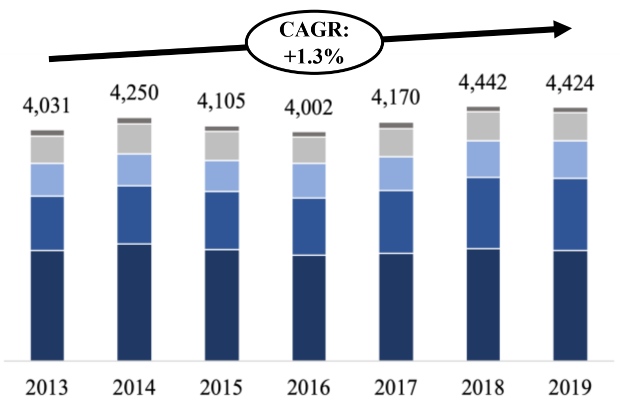


Figure 4: Tiffany & Co. sales growth in mUSD



Despite maintaining its position as one of the leading players in the fine jewelry market, Tiffany & Co. faced stagnating sales in recent years, as exhibited in Figure 4. Like many established luxury houses, they have been challenged to modernize a traditional image for younger target generations (Abtan et al., 2016). In this attempt at reinvention, the company was subsequently led by three different CEOs between 2015 and 2017, the latest being Alessandro Bogolio, who remained CEO until the acquisition by LVMH. Tiffany & Co. has been listed on the New York Stock Exchange since 1987 and was only delisted in the post-merger integration into LVMH in 2021.

3.2 LVMH and acquisition rationale

The French company Louis Vuitton Moët Hennessy (LVMH) is the largest luxury conglomerate and one of the most valuable firms worldwide at a market capitalization of 317 billion EUR end of 2020. Created through the merger of Louis Vuitton and Moët Hennessy in 1987, the group's portfolio now encompasses over 70 of the most prestigious luxury brands across various market segments. In 2019, LVMH reported a record in revenues of 53.7 billion EUR suggesting a growth of 15% from the previous year. This success throughout LVMH's history is attributed to the effective integration and management of new additions to the brand portfolio (Cavender & Kincade, 2014).

Given this background, it is important to understand the rationale behind the Tiffany acquisition as the backdrop of our valuation. LVMH is known for maintaining a large degree of operational independence between their brands to preserve unique selling points (Cavender & Kincade, 2014). Effectively, neither cost efficiencies from economies of scale nor cross-selling effects are considered key acquisition objectives for the multi-brand conglomerate (Ijaouane & Kapferer, 2012). Instead, the interest in Tiffany & Co. appears to be driven by the pursuit of market share. LVMH's portfolio is dominated by European luxury brands, none of which show a core focus on the American market. Furthermore, the addition of Tiffany will strengthen LVMH's footprint in the jewelry market, which contributed only 8% to the group's sales in 2019.

In fact, the Tiffany case resembles a past acquisition of LVMH in the jewelry segment. Tiffany's direct competitor Bulgari joined the conglomerate in 2011, and LVMH's transformation of the struggling brand successfully translated into improvements of Bulgari's top and bottom lines (Muret, 2019). Thus, a similar turnaround of Tiffany presents one of the main sources for value creation by LVMH (Arnett, 2019). The industry-leading expertise and capabilities of LVMH can unlock growth potential that Tiffany may not be able to realize outside of the conglomerate.

3.3 Timeline of the acquisition

Despite LVMH's track record in acquiring key players within the luxury segment, the takeover of Tiffany & Co. was coined by the complications of a global pandemic and resulting tensions between the two parties. We break down the acquisition process from 2019 until 2021 into three phases.

Phase 1: Initial agreement (October 2019 – September 2020)

On October 15, 2019, LVMH submitted their first bid to acquire Tiffany & Co. for 14.5 billion USD and a corresponding share price of 120.0 USD. In effect, Tiffany's stock price surged by 32%, but the target rejected the offer. A month later, LVMH responded with a second bid valuing the acquisition at 16.2 billion USD and a share price of 135.0 USD, which Tiffany accepted this time. The acquisition was contractually defined to be completed by July 2020 but latest by November 2020.

In Spring 2020, Covid-19 put the world into a stillstand. As of April 30, 2020, 70% of all Tiffany stores were closed, and the company reported a decline in sales by -45% for the first quarter of 2020. Moreover, due to political frictions between the U.S. and the EU, a direct intervention of the French government threatened to prolong the deal completion (White & Aloisi, 2020).

Phase 2: Legal battle (September 2020 – October 2020)

On September 9, 2020, LVMH set off a domino effect by announcing their official withdrawal from the uncompleted deal. In the successive back and forth of legal countersuits it became apparent that LVMH's retraction was based on a perceived mismanagement of Tiffany during the Covid-19 crisis. The conglomerate claimed that the target firm breached contractual obligations by paying out dividends to shareholders despite the financial damage caused by the pandemic (White & Aloisi, 2020). Finally, this legal battle was set to be resolved in a court trial in January 2021.

Phase 3: Renegotiations and deal closing (October 2020 – January 2021)

In October 2020, LVMH and Tiffany re-opened negotiations. On October 28, 2020, both parties agreed to dropping the lawsuits and completing the acquisition with a reduced deal value of 15.8 billion USD and a share price of 131.5 USD. After approval by Tiffany's shareholders on December 30, 2020, the deal was completed on January 7, 2021 – over one year after the first offer by LVMH.

4 Strategic analysis

The strategic analysis sets the groundwork for understanding the context in which Tiffany & Co. operates and how the firm competes in this environment. This section starts by assessing external factors on the macroeconomic and industry level through the lens of PEST analysis and Porter's Five Forces. Regarding the internal conditions, we evaluate the capabilities and resources that shape Tiffany's strategy in the VRIO analysis. We conclude this chapter by synthesizing findings in the SWOT framework, thereby accentuating the identified strategic drivers for firm value.

4.1 PEST analysis

Macro-level dynamics in the market represent ubiquitous forces to different industries and their incumbents. Precisely because individual firms are unable to influence most of these factors, it is crucial for the acquirer to understand the external conditions under which a target company operates. The following sections investigate the macroeconomic environment of Tiffany & Co. along political, economic, social, and technological dimensions.

4.1.1 Political

In general, the market for luxury personal goods is not subject to extensive regulatory restrictions, according to the McLaughlin-Sherouse List of Most Regulated Industries (2014). Nevertheless, political climate and policy changes in the core markets of Tiffany & Co. can significantly impact the firm's top and bottom lines. This augments the role of the U.S., which represents the largest geographical contributor to sales and further accommodates critical manufacturing processes. Moreover, as Tiffany's operations are not limited to North America, global trade relations pose additional factors of influence.

Regarding the national political environment, the perception of U.S. citizens on the democracy of the country showed considerable impairment under the Trump administration (Bright Line Watch, 2020). The resulting socio-economic tensions eventually hit the luxury market when prevalent structural issues culminated in 2020. In the course of the Black Lives Matter movement in May 2020, many businesses, especially consumer-facing brands such as Tiffany, faced the public obligation to position themselves on political matters (Jensen, 2020). Furthermore, the 2020 U.S. presidential elections, which are yet to be carried out at our time of consideration, leave further uncertainty for Tiffany, for instance, regarding the development of tax policies and internal political stability.

The outcome of the elections also affects foreign affairs, such as the ongoing trade war between the U.S. and China. A pivot to the preceding trend of global trade liberalization, the recent dispute between the two economic leaders particularly threatens companies with operations and sales spanning across both markets (He, 2020). However, the direct risk is deemed lower for luxury brands as a tariff-induced price increase for the Chinese market is not expected to harm demand at large. This effect is due to lower customer price sensitivity for luxury goods (Bargeron, 2019). For companies like Tiffany, the indirect repercussions may prove more relevant as the trade war already caused Chinese consumers to boycott selected American brands such as Apple (Bargeron, 2019).

Lastly, Covid-19 brought about a heightened sensitivity for retailers toward local regulators. As of October 2020, the heavy dependence of the luxury industry on in-store sales and tourism for revenue generation exacerbates Tiffany's susceptibility to local restrictions for an unforeseeable time (D'arpizio & Levato, 2020).

4.1.2 Economic

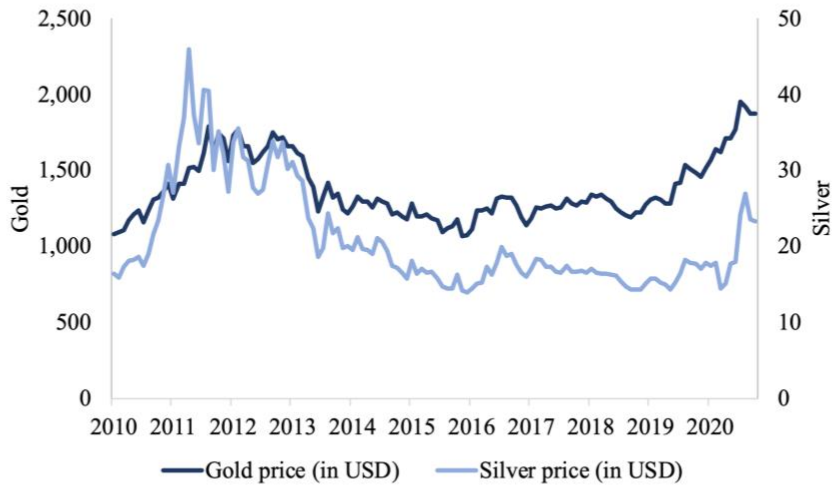
In the context of luxury consumer goods, the products of Tiffany & Co. are considered non-essential. The disposable income allocated to such purchases is effectively driven by economic prosperity. The global market for personal luxury goods has been growing at a CAGR of 5.6% from 1996 to 2019 when the market size was 281 billion EUR (D'arpizio & Levato, 2020). While this development is in line with global economic growth in the last decades, the boom of the Chinese economy catalyzed the demand for luxury goods. However, this momentum will most likely not fully persist during the next decade. For the next 10 years starting in 2020, China's real GDP growth is expected to slow down to an average of 4.6% (S&P Global Ratings, 2019).

Concerning the most recent developments, the outbreak of Covid-19 caused a sharp decline in all markets leading to an expected real GDP decline of -4.4% globally for 2020 (IMF, 2020). Despite injecting additional cash into households via stimulus packages, consumption expenditures declined drastically in the second quarter of 2020 across all OECD countries (OECD, 2020). For a globally operating firm like Tiffany, it remains uncertain when and at which pace local economies and the luxury market can fully rebound from the Covid recession.

Furthermore, the financial results of multinational corporations are exposed to exchange rate fluctuations. While a great part of Tiffany's manufacturing sites is located in the U.S., and respective costs are denominated in USD, far more than 50% of historic annual revenues were generated outside the U.S. in foreign currencies. In effect, a depreciation of the USD against currencies, including EUR and CNY, affects the financial performance positively and vice versa. From January 2010 until October 2020, USD has appreciated from a rate of 0.70 EUR/USD to 0.85 EUR/USD with an adverse effect on Tiffany's profitability. In the same period, the exchange rate between USD and CNY is roughly 6.80 CNY/USD at both points in time. However, strong fluctuations within this period also indicate considerable currency risk for the Chinese market.

Lastly, the raw material prices of diamonds and precious metals influence both the firm's sales and cost of sales. Prices of gold and silver saw large periodical movements over the past decade while sharing similar trajectories, which are visualized in Figure 5 below. As for most commodities with transparent market prices, hedging instruments against these price movements are traded and already part of Tiffany's investments. However, this does not apply to the opaque diamond market, where regulated spot trading was virtually inexistent in 2020. Aggregated secondary data from a 2019 Bain & Company market report suggest prices of raw and polished diamonds have overall decreased since 2011 (full chart displayed in Appendix 1). Nonetheless, the associated commodity risk should not be underestimated due to the limited possibilities to hedge against price increases of this asset class.

Figure 5: Gold and silver spot prices in USD (01/2010-10/2020)



Source: S&P Capital IQ

4.1.3 Social

On the social dimension, luxury brands are challenged by ever-changing consumer preferences. These evolutions are stimulated by multiple factors including generational shifts, penetration of digital technologies, and current events. Firstly, 'Gen Z', i.e., young adults born between 1997 and 2002, is expected to make up more than 20% of the personal goods luxury market by 2025 (D'arpizio & Levato, 2020). Combined with the generation of Millennials, also referred to as Gen Y, this group represents the future of high-earning customers whom luxury brands are looking to target. In particular, as both Gen Y and Gen Z advocate discussions on sustainability, a brand's lack of respective awareness can severely damage its performance (Bakhtiari, 2020).

One of the lifestyle changes also driven by older customer segments is the increase in digital or digitally-enabled purchases (Abtan et al., 2016). While especially in the market for luxury goods the share of online purchases was merely at 12% in 2019, this segment is expected to undergo steep growth, especially in the Chinese market (D'arpizio & Levato, 2020).

4.1.4 Technological

In recent years, luxury goods firms have fallen behind other consumer sectors in integrating technologies into their business models (Abtan et al., 2016). Strikingly, the luxury jewelry industry is far from being short of technological progression along the entire value chain.

One of the proposed technological solutions for supply chain traceability is employing blockchain, which is already trialed by DeBeers, one of the largest players in the diamond industry (Stimolo, 2019). Furthermore, new methods, including Chemical Vapor Deposition, present breakthroughs in producing lab-grown diamonds, which are identical in appearance and chemical structure to their natural counterparts. These diamonds can be grown at a lower cost than through mining and without related ethical concerns (Constable, 2020). So far, Tiffany & Co. does not consider these a material suitable for the luxury industry (Crawford, 2021).

In design and production, technologies such as Computer-Aided Design and 3D printing have started transforming the jewelry segment like other manufacturing industries (Bhasin, 2018). Furthermore, on the consumer-facing end of the value chain, the infiltration of "digital everything" drives the utilization of technologies to shape customer relationships. For instance, technologies such as Augmented or Virtual Reality offer new means to enhance the customer experience (Milnes, 2018). Simultaneously, the surge of social media and e-commerce inflates the number of touchpoints and channels for brands to manage, thus, demanding the necessary resources (Abtan et al., 2016).

Sub-conclusion

In the short-term, the future trajectory of the pandemic can still cause significant adversity for Tiffany. In this state of the world, brands face the repercussions of a recession and are susceptible to governmental restrictions to an extent atypical for the industry. Nevertheless, moving beyond Covid-19, the expected long-term rise in economic prosperity as well as the potential to target new audiences and leverage advancements in technology present promising opportunities for Tiffany. However, since social and technological forces are evolving rapidly, a failure to respond to these changes can easily cost Tiffany & Co. their competitive standing. Especially for mature firms, the persistence of "doing things the old way" is a dangerous fallacy (Pellegrino, 2018).

Overall, it is crucial to note that Tiffany is subject to the above-discussed macroeconomic forces in each international market distinctly. Responding to unique local conditions is a common cause of failure for multinationals and a key threat to Tiffany's global positioning (Rugman, 2001).

4.2 Porter's Five Forces

According to Porter (2008), the profitability of an industry is shaped by the five forces of competitive rivalry, the threat of new entrants, the threat of substitution, the bargaining power of suppliers, and the bargaining power of buyers. This systematic approach to analyzing the immediate environment of Tiffany & Co. reveals the positioning of the company within the set of competitive interactions.

4.2.1 Competitive rivalry

The competitive environment of Tiffany & Co. is characterized by a narrow and extended scope of competitors. In the narrow frame, Tiffany competes with specialized jewelry manufacturers and retailers defined by a strong brand, track record in the industry, and global presence. On the high-end side, this includes firms such as Cartier, Bulgari, Chopard, and DeBeers. However, on the level of entry-price products, Tiffany also competes with brands like Pandora. On a wider range, consumers may also compare Tiffany & Co.'s offering with the jewelry segment of luxury apparel brands such as Dior or Louis Vuitton.

Further broadening the competitive scope, it is important to note that branded jewelry only accounts for a small share of the total jewelry market. High-quality jewelry is still mainly sold by local, no-brand jewelers, which cumulatively account for roughly 80% of the market (Gomelsky, 2022). While this high degree of fragmentation suggests an intense rivalry threat for Tiffany, a crucial consideration is the basis of competition. Porter (2008) argues that competition based on differentiation can enhance customer and industry value instead of eroding profitability. The offerings of players in the jewelry market tend to be distinct in product features and brand experience. This differentiation allows Tiffany and their competitors to accommodate diverse customer preferences and sustain high prices. Overall, this nature of competitive rivalry favors high average profitability in the industry.

4.2.2 Threat of new entrants

The potential to capture value through differentiated products raises the attractiveness for new entrants in the fine jewelry industry. However, incumbents benefit from three main barriers to entry. Firstly, capital requirements are high for producing jewelry with high-class materials. Apart from investments into manufacturing, new players are further required to stock inventories of expensive goods, which holds for raw materials and finished jewelry items.

Moreover, retail outlets require additional capital allocation, related to the second barrier: access to distribution channels. Despite the surge of e-commerce, the in-store experience is still crucial to sales of goods with high monetary value and those with high experience value, such as engagement rings and wedding bands (Liu et al., 2013). In effect, prestigious store locations remain crucial to attracting and appealing to customers in the luxury segment (Arrigo, 2015). However, these spaces are scarce and are mostly already occupied by incumbents.

Lastly, it can be extremely difficult for new brands to compete for customers who buy luxury jewelry primarily because of the brand. While brand awareness can be boosted rapidly in times of social media, companies like Tiffany have the advantage of time as brand heritage is conditioned by the extended history of the firm (Wuestefeld et al., 2012). Overall, the threat posed by new entrants is deemed low.

4.2.3 Threat of substitutes

The identification of relevant substitutes requires an understanding of what customers seek in purchasing Tiffany products. For engagement rings and wedding bands, the symbolic connotations of the product are highly unique and deeply rooted in tradition, resulting in a low risk of substitution.

However, a second motivation for buying Tiffany & Co. jewelry is presented by conspicuous consumption. This concept refers to purchasing luxury goods as a status symbol and to transpire the affluence associated with the brand, hence less focused on the product itself (De Kerviler & Rodriguez, 2019). The same effect can be yielded through other luxury brands, possibly even by using counterfeit products, which has been a significant issue in the industry (Wilcox et al., 2009).

Lastly, consumers may resort to purchases from luxury brands as a form of self-reward and hedonistic fulfillment (Truong & McColl, 2011). However, in recent years, this purpose has been increasingly satisfied by spending on experiences, particularly among Millennials (De Kerviler & Rodriguez, 2019). This generational preference for experiencing instead of owning, combined with the variety of available status symbols, suggests a high threat of substitutes. Nevertheless, the strength of the Tiffany brand alleviates some of the substitution risks as brand loyalty is argued to have the same effect as switching costs for customers (Jain & Maheswaran, 2000).

4.2.4 Bargaining power of suppliers

Tiffany & Co. manufactures most of its jewelry offerings in-house but also procures finished products from third parties. This operational model encompasses suppliers for four different types of goods: rough diamonds, polished diamonds, other materials including precious metals and other gemstones, and lastly, finished products.

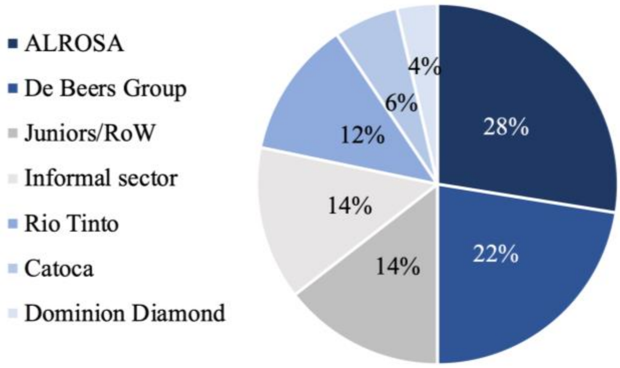
The procurement of these goods except for rough diamonds is generally not regulated by long-term supplier agreements, as to why no material obstacles exist for Tiffany to switch to alternative third parties. Consequently, the bargaining power of these supplier groups is deemed low.

In contrast, the threat posed by rough diamond suppliers is significantly higher. Diamonds are considered one of the last "uncommoditized commodities" not traded on spot markets and with inconsistent commodity prices across diamond characteristics (Popper, 2012). The rough diamond supply market is highly concentrated in five producers accounting for 71% of the entire market in 2019, as presented in Figure 6 (DeBeers Group, 2021). These players exert significant control over the supply and prices of diamonds, for instance, through opening and closing mining sites.

The second largest producer from whom Tiffany procures a large portion of their supply is the Diamond Trading Company (DTC), part of the DeBeers Group. Tiffany's reliance on a single supplier for a good that is essentially impossible to substitute already indicates a high bargaining power of DTC. This threat is intensified since the DeBeers Group is also forwardly integrated into the jewelry market, thus, simultaneously acting as one of Tiffany's direct competitors (Dobbs, 2014).

The degree of supplier power is even higher when considering the limited choice of alternative partners. After the public discovery of cases where proceeds from diamond trades were used to finance terrorist activities, Tiffany & Co. subscribed to the Kimberley Process Certification to prevent the indirect support of such practices through procurement. While all DTC diamonds guarantee this certification, Tiffany would face inevitable switching costs in investigating the legitimacy of new suppliers.

Figure 6: Market shares of rough diamond producers (2019)



Source: DeBeers Group Diamond Insight Report (2021)

4.2.5 Bargaining power of customers

Apart from the direct sales channels of Tiffany & Co., including brick-and-mortar stores, e-commerce, and catalog, the brand also provides a selection of their offering to a few B2B clients and wholesalers. Nonetheless, the majority of customers who determine the effective demand for Tiffany's products are a large number of private consumers. For these buyers, direct switching costs between different brands may be generally low, but in a highly design-driven industry, Tiffany's offerings are very differentiated from those of competitors. Furthermore, as previously acknowledged, brand loyalty yields similar effects to switching costs by reinforcing ties between customers and the firm (Farrell & Klemperer, 2007). While these factors already reveal the low bargaining power of individual customers, it needs to be stressed that consumers in the luxury market exhibit remarkably low sensitivity to the prices set by brands. This behavior is shown in the effect of the annual or semi-annual price hikes of sometimes over 15%, which have become a regular practice in the industry (Biondi, 2020). The demand for these products remains strong, nevertheless.

Sub-conclusion

The analysis of the high-end jewelry market shows that Tiffany's competitive landscape is polarized between multinational brands and small, local jewelry retailers and manufacturers. As competition is based primarily on differentiation and customers are willing to pay for distinctive brand identities, we assess the industry attractiveness as high. However, considering that many clients purchase luxury goods for ulterior motives beyond the product, Tiffany is urged to sustain jewelry as a viable choice in the set of relevant options. Furthermore, the company is challenged by the dynamics of the supplying diamond industry. Especially due to the respective degree of concentration, the supplier bargaining power is difficult to mitigate.

4.3 VRIO analysis

After analyzing the external environment of Tiffany & Co., this section shifts the focus toward the internal elements that determine strategic strength. Even under opportune macroeconomic conditions and in an attractive industry, firms must take the appropriate internal measures to compete successfully. The following evaluation scrutinizes whether the resources and capabilities of Tiffany are valuable (V), rare (R), inimitable (I), and organized (O) to create a sustainable competitive advantage. In specific, we focus on vertical integration, design capabilities, and the Tiffany brand.

Vertical integration

Tiffany & Co. procures its supply of rough diamonds with established suppliers like DTC through their fully-owned subsidiary Laurelton Diamonds. While Tiffany does not own diamond mines, the company ensures that mines of origin are known for all procured diamonds that require registration, i.e., stones over 0.18 carats. After delivery by the supplier, the rough diamonds are cut and polished in workshops in Botswana, Mauritius, Cambodia, Vietnam, and Belgium, which are all proprietary to Tiffany. The company also operates its manufacturing facilities for the final crafting of jewelry items in the U.S. This allows the firm to ensure high-quality standards by employing state-of-the-art machinery and skilled craftspeople.

Through these controlled processes, Tiffany & Co. can be held accountable for their promise that all diamonds in their product offering align with the ethical standards of the Kimberly Process Certification. In times when social responsibility is a pressing topic of discussion, customers demand value chain transparency in addition to high-quality products (Ho et al., 2016). The integration of polishing activities enabled Tiffany to become the first luxury jeweler to disclose the countries where their registered diamonds were sourced *and* where they were processed. This is a rare practice in the industry since many players directly order supplies of polished diamonds. As a result, Tiffany can provide almost end-to-end traceability for the firm’s most characteristic raw material.

This level of vertical integration requires substantial investments, thus presenting a resource costly to imitate. The only competitor with a higher level of integration is the industry giant DeBeers as they are directly engaged in the mining business through DTC.

Lastly, Tiffany’s organizational setup of the integrated value chain activities showcases explicit strategic considerations. In detail, many of the polishing workshops were deliberately established in sourcing countries, and all manufacturing sites, as well as distribution centers, were set up in the U.S.

Brand

In the luxury market, branding and the brand experience play a substantial role in influencing the buying decision (Salehzadeh & Pool, 2017). The rich heritage and prestigious standing that Tiffany & Co. built over more than a century create a unique and strong brand foundation. More recently, higher visibility on social media compared to many competitors and a high engagement rate of followers reflect the firm's success in contemporary marketing activities (Briggs, 2015). Furthermore, as retail outlets still represent a critical channel for sales, Tiffany continues to enhance the in-store experience of the brand. In 2018, the jewelry retailer announced plans to invest more than 250 million USD in remodeling its flagship store, which to this day still links the brand with the iconic movie adaptation of *Breakfast at Tiffany's* (Stoll, 2018).

The value of brands in the luxury market and customers' willingness to pay brand premia are commonly acknowledged (Agrawal, 2016). However, the flip side of the coin is that while Tiffany's brand is inherently unique, it is also one of many luxury brands aiming to convey a similar experience. Imitability for new businesses is nevertheless low since any established brand is formulated through non-replicable elements, including the passing of time and history (Iglesias et al., 2020). Furthermore, Tiffany's brand-centered organization is exemplified by manufacturing exclusively in the U.S. to stick to traditions and to the 'all-American' image of the firm.

Design capabilities

Apart from the brand, design is a valuable differentiator in an industry where customers are attracted by visual appeal. Tiffany & Co. has a long history of partnering with designers, including Jean Schlumberger, Elsa Peretti, and Paloma Picasso. In comparison to other luxury brands where one creative director drives the entire design direction, working with multiple designers broadens the offering for customers. Furthermore, these partnerships can be considered rare and difficult to imitate as Tiffany enters exclusive licensing agreements with these designers on a long-term horizon. The organizational support of design capabilities is provided through Tiffany's proprietary Jewelry Design and Innovation Workshop in New York, where new materials are developed and advanced technologies such as 3D printers are employed for prototyping (Gomelsky, 2022).

4.4 SWOT analysis

The SWOT analysis summarizes the findings from evaluating the external environment using PEST analysis and Porter's Five Forces framework and analyzing internal resources and capabilities based on VRIO. Placing the company's strengths (S) and weaknesses (W) in context to the opportunities (O) and threats (T) from the macroeconomic and industry context highlights where Tiffany's strategy responds well to external factors and where additional attention is required.

Figure 7: SWOT analysis of Tiffany & Co.

INTERNAL FACTORS	
Strengths	**Weaknesses**
– Vertical integration of rough diamond processing allowing for high quality and leading level of diamond traceability – Flexibility in procurement with only few buying obligations with suppliers – Valuable brand bearing century-long heritage and international recognition – Successful digital marketing activities – Established global retail footprint with prestigious store locations – Broad product design portfolio due to licensing with multiple designers	– High dependence on DTC as a supplier with a dual role as a direct competitor – Conservative view on luxury products and materials, e.g., non-acceptance of lab-grown diamonds – Lack of brand re-invention challenging the popularity with younger audiences
EXTERNAL FACTORS	
Opportunities	**Threats**
– Rise of Gen Z as a new target group in addition to Millennials – Slowed but continuing growth of the Chinese market – Technological value chain innovations and new materials – Support of price increases by target customer segment	– Exposure to political tensions, both on a local and global scale – Exposure to currency rate fluctuations – Susceptibility to rapid changes in consumer preferences and consumer activism – Importance of sustainability vs. practice of diamond mining – Uncertainty about further development of Covid-19 and economic recession

5 Financial analysis

Complementing the qualitative assessment of value drivers in the strategic analysis, the financial analysis in this chapter displays the quantified view of Tiffany's competitiveness. For this purpose, a reformulation of financial statements is prerequisite for evaluating the historical financial performance. We consider reported financials from 2013 to Q3 2020 and focus on analyzing historical growth and profitability to infer directives for the formulation of forecasts.

5.1 Reformulation of financial statements

The operating activities of a firm are the driving forces behind value creation and are enabled by the corresponding financing activities (Plenborg & Kinserdal, 2021). Based on this understanding, we reorganize the financial statements of Tiffany & Co. to evaluate the company's operative performance. The obtained analytical statements are further used for forecasting in Chapter 6.

The original reports, which can be found in Appendix 2 and 3, lack a clear distinction between operating and financing items. Therefore, we refer to the notes of Tiffany & Co.'s Form 10-K for additional information. The following sections explain the steps taken for reformulation and selected ambiguous positions.

Analytical income statement

To arrive at the analytical income statement, we made three main adjustments to the regular accounting statement: the computation of NOPAT, the separation between recurring and non-recurring operating items, and the distinction of depreciation and amortization from other expenses.

First, NOPAT is calculated as the profit measure of interest. Given the reported income tax expense and EBT as the income basis for taxation, we derived the effective tax rate of a given fiscal year as follows:

$$Effective\ Tax\ Rate_t = \frac{Income\ tax\ expense_t}{EBT_t}$$

By applying this tax rate to the EBIT instead of EBT, we obtain the after-tax operating profit without the effects of financing expenses. The only exemption to using the derived tax rate is made for the fiscal year 2017 due to the introduction of the U.S. Tax Act. According to Tiffany's reporting, the Tax Act resulted in one-off tax charges of 146.2 million USD on top of regular income taxes, thereby raising the company's effective income tax rate from 32.1% to 51.3% in 2017. Considering an average effective tax rate of 34.4% for the three preceding years, we use the normalized rate of 32.1% to reflect the regular course of business more adequately. The gap of 146.2 million USD from one-off charges is specified separately in the income statement as an unusual tax item.

Nevertheless, the 2017 tax charges are not the only unusual items we separated from recurring items. Income and expenses that occur only once or irregularly do not contain any predictive value for future profitability and should be regarded in isolation (Plenborg & Kinserdal, 2021). In specific, asset impairment losses and expenses related to the merger with LVMH are defined as non-recurring operating expenses for Tiffany. Precisely, we reduce the firm's SG&A, where these expenses were previously included, and display them as separate line items. Thereby, we arrive at NOPAT values before and after non-recurring operating items.

The last adjustment concerns depreciation and amortization (D&A) also recognized as part of SG&A expenses in the original income statements of Tiffany. To extract EBITDA as another measure of operating profit, we list the expense of D&A separately from SG&A. Appendix 4 shows the full analytical income statement.

Analytical balance sheet

Following the same logic of reclassifying between operating and financing items, we derive an analytical balance sheet that places the invested capital into operations opposite to the required financing. In other terms, the invested capital is determined as the difference between operational assets and operational liabilities or by the sum of shareholders' equity and net interest-bearing liabilities (NIBL) (Plenborg & Kinserdal, 2021). While for most positions in the original balance sheet, the distinction between operating and financing purpose is apparent, selected line items are explained below. The full analytical balance sheet is shown in Appendix 5.

Cash and cash equivalents. This position can be technically treated either as liquidity for operations or excess cash (Plenborg & Kinserdal, 2021). Tiffany's cash position has remained stable for most of the regarded period. Moreover, the company follows a share buyback program and dividend payout policy with increasing cash distribution to investors. We infer that in this case, cash is to be treated as excess cash, hence, as a financing asset.

Deferred income taxes and Income taxes payable. While tax items can bear interest in certain jurisdictions, there is no such indication in the Form 10-K of Tiffany. An unspecified proportion of tax liabilities and assets is reported to stem from temporary differences and tax loss carry forwards, which tend to be non-interest-bearing. Both items are classified respectively as an operating asset and liability.

Short-term investments. Time deposits are the only type of short-term investments named by Tiffany & Co. under this category, thus, making this a financing asset.

Short-term borrowings. All short-term borrowings of the company are revolving credit facilities of three years or longer. These are interest-bearing and thereby represent a financial liability.

Other assets. Tiffany & Co. summarizes intangible assets in this line item, including product rights, key money, and trademarks. Therefore, all ‘Other assets’ are considered operating.

Other long-term liabilities. These liabilities encompass deferred compensation plans for executives and other higher management, comparable with pension obligations that are entered with the expectation of a return. Additional items include derivatives with longer maturities and accrued interest, which leads to the conclusion that this position presents a financing liability.

5.2 Historical financial performance

DCF valuation builds on the fundamental idea that a company’s value is created through its cash flows. In this context, cash flow generation can be understood under the evaluation of revenue growth and return on invested capital (ROIC) (Koller et al., 2020). In analyzing these indicators of Tiffany & Co.’s historical performance, we can formulate reasonable forecasts for future cash flows in the subsequent chapter. Therefore, the following section elaborates on the development of net sales and ROIC from 2013 until Q3 2020. We compare selected ratios with the counterparts of LVMH as an industry benchmark and a contrast between acquirer and target performance.

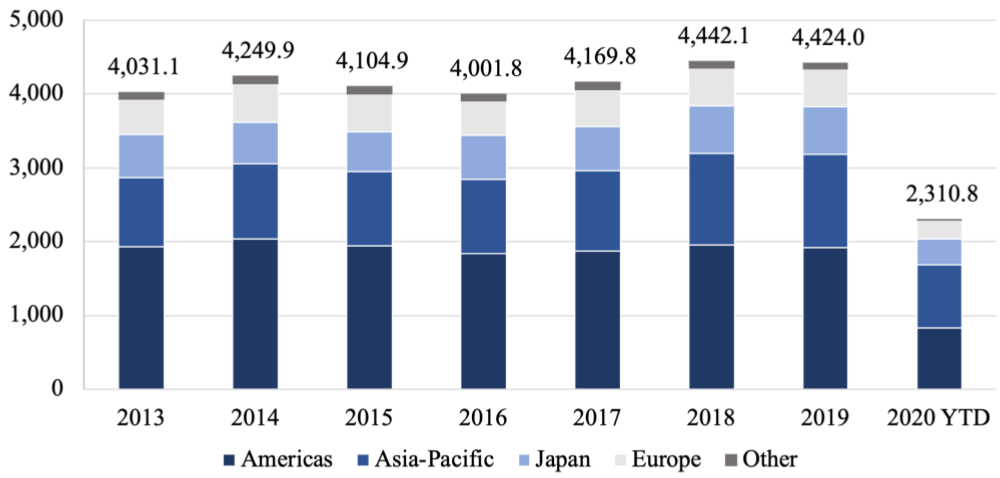
Revenue growth

Tiffany & Co. reports net sales in the geographic markets Americas, Asia-Pacific, Japan, Europe, and Others. The latter segment includes sales in the Emerging Markets region, especially in the Middle East, as well as wholesale sales of diamonds and earnings from licensing agreements. More precisely, the company resells procured diamonds that do not meet internal standards and further licenses the Tiffany trademark to Luxottica and Coty for eyewear and fragrances. These sales adjacent to the core business are summarized as ‘Others’.

The development of historical net sales is presented in Figure 8. As the Americas constitute the largest contributors to total sales, the decline in this segment's revenue from 2014 to 2016 mainly drove the effective reduction in global sales from 4,250 million USD to 4,002 million USD during the same period. Firstly, Tiffany's management attributes this decline to a decrease in spending from foreign tourists due to an appreciation of the U.S. dollar. Secondly, it simultaneously reflects the struggle of the firm to maintain relevancy with a younger clientele (Schlossberg, 2016). The American market recovered slowly after 2016 but did not reach the level of 2014 again. In fact, revenues decreased again by 2% from 2018 to 2019. This trajectory is further worsened by the outbreak of Covid-19 the year after. As of the end of Q3 2020, this crisis caused a decline of -48% in Tiffany's total sales and a drop of -57% in the American market.

The segments Japan, Europe, and Others only saw small changes in sales across the entire period of 2013 until 2019. Asia-Pacific represents the only segment of Tiffany & Co. for which a clear trend in net sales is visible. While sales remained mainly flat from 2014 until 2016, this market underwent continuously positive year-on-year growth after 2016. With a -32% reduction in sales as of 2020 YTD, the Asian-Pacific market further demonstrates the lowest relative impact of the pandemic.

Figure 8: Tiffany & Co.'s net sales by geographical segment in mUSD (2013-2020 YTD)



Although currency conversion effects generally distort the year-on-year revenue growth rates of multinational companies, they did not cause significant deviations in Tiffany's historical sales performance of individual markets. Thus, we find this impact neglectable for our analysis when evaluating the comprehensive sales evolution across multiple years. Alternative growth rates using constant exchange rates, as reported by Tiffany & Co., are stated in Appendix 6.

Return on invested capital (ROIC)

The ROIC of a firm is a measure of the operative return generated on the firm's invested capital as stated by the following formula:

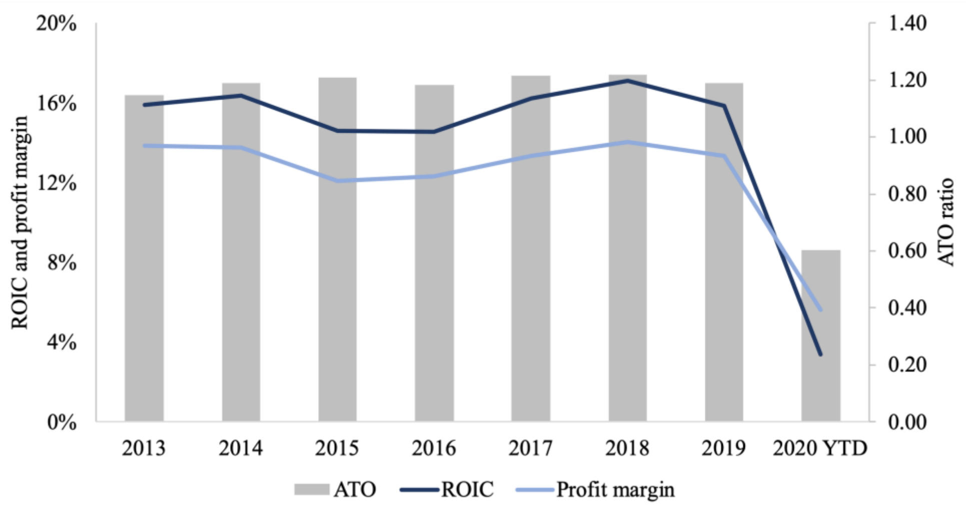
$$ROIC = \frac{NOPAT}{Invested\ capital}$$

Furthermore, this return can be interpreted as the product of the operating profit margin and the turnover rate of invested capital (ATO). While the profit margin sets NOPAT in relation to sales revenue, ATO measures the effectiveness of the firm in using its invested capital to generate revenues (Plenborg & Kinserdal, 2021):

$$Profit\ margin = \frac{NOPAT}{Net\ sales}, \qquad ATO = \frac{Net\ sales}{Invested\ capital}$$

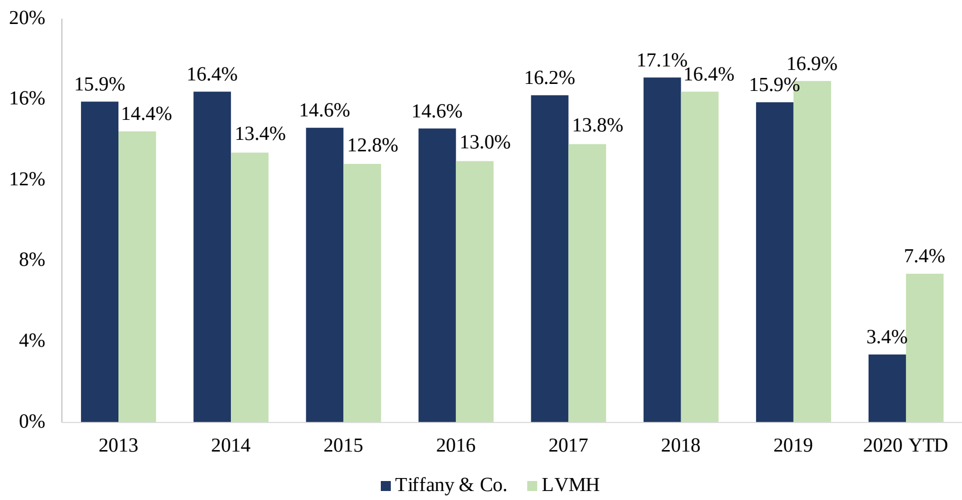
Before the pandemic, Tiffany & Co.'s profitability measures only showed small changes, as illustrated in Figure 9 below. Using the decomposition of ROIC, we can explain the decrease of Tiffany's ROIC between 2014 and 2016 with the decrease in profit margin from 13.8% to 11.9%. However, the visible increase of ROIC from 2016 to 2018 is driven by improvements both in profit margin and ATO ratio, respectively increasing from 11.9% to 14.0% and 1.09 to 1.16. In 2019, all ratios showed a slight decrease from the previous year with ROIC dropping from 16.2% to 15.0%. Most evidently, in 2020, the drop in sales caused by the outbreak of Covid-19 resulted in the most extreme downward movement of all ratios in the period of consideration. All figures are presented in Appendix 7.

Figure 9: Tiffany & Co.'s ROIC, Profit Margin, and ATO (2013-2020 YTD)



When comparing the ROIC of Tiffany & Co. with those of LVMH, we observe values in a very similar range, as displayed in Figure 10 and Appendix 8. This suggests that Tiffany's performance is approximately at the average of the luxury industry, which is reasonable for a mature incumbent (Koller et al., 2020). However, in recent years, LVMH has exhibited a steady improvement of ROIC from 12.8% (2015) to 16.9% (2019). The increase in LVMH's ROIC is mainly driven by the NOPAT margin of the conglomerate, which is also generally higher than Tiffany's, i.e., 15.5% compared to 13.4% in 2019. Furthermore, the pandemic has shown weaker repercussions on LVMH, which is reflected in a reduction of ROIC of -9.5 pp, whereas for Tiffany, the same measure fell by -12.5 pp in 2020 YTD. Although these overall gaps in profitability between the two firms are not extreme, they can imply potentials for LVMH to raise the performance of Tiffany & Co. to par, and in return, allow Tiffany to participate in LVMH's trend of ROIC growth.

Figure 10: ROIC of Tiffany & Co. and LVMH (2013-2020 YTD)



While the operating margin and turnover rate of invested capital can be further decomposed into contributing ratios, we focus on the part of ATO that is driven by the utilization of working capital. The net working capital (NWC) is the difference between current operating assets and current operating liabilities. Throughout the regarded historical period, Tiffany & Co.'s current operating assets account for more than half of total operating assets. Consequently, the efficiency of translating these investments into cash is a critical performance indicator.

For this purpose, we evaluate the cash conversion cycle (CCC) to determine the number of days the firm requires to generate cash using working capital. The CCC is composed of three ratios that describe the days required for the company to sell its inventory, collect outstanding receivables from customers, and settle payables:

$$Days\ inventory\ outstanding\ (DIO) = 365 * \frac{Inventory}{Cost\ of\ sales}$$

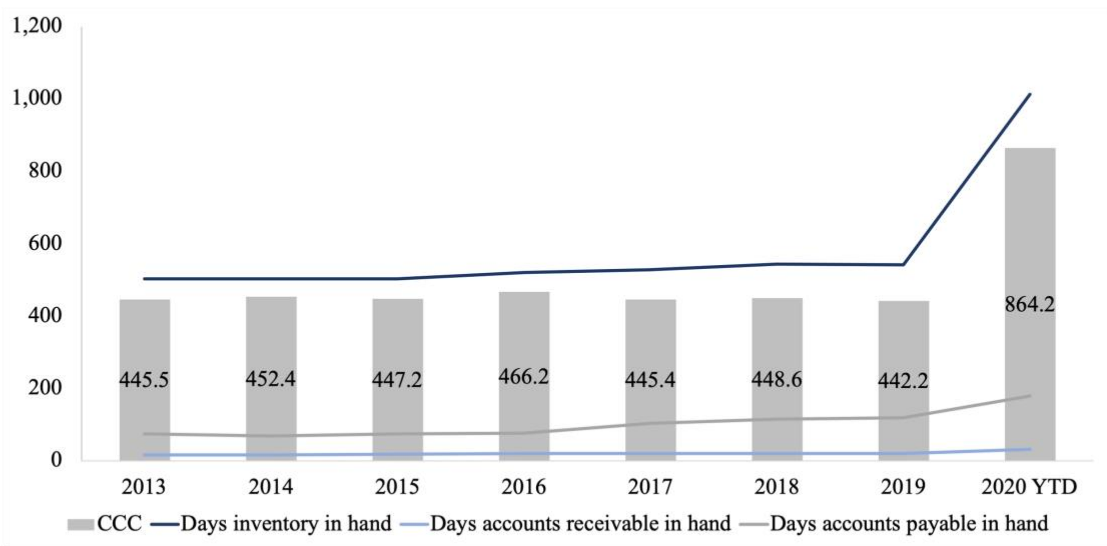
$$Days\ sales\ outstanding\ (DSO) = 365 * \frac{Accounts\ receivables}{Net\ sales}$$

$$Days\ payables\ outstanding\ (DPO) = 365 * \frac{Accounts\ payables}{Cost\ of\ sales}$$

$$CCC = DIO + DSO - DPO$$

The first finding from the CCC evaluation exhibited in Figure 11 is that during the conduct of operations, cash is tied up for approximately 450 days, i.e., well over one year. Since the company sells most of its items directly to customers, we assumed that DSO is primarily driven by payment and banking processing time and thus, has remained stable over the years. While DPO saw a favorable increase from 2013 to 2020 YTD, the DIO also increased, thereby offsetting the effect of DPO. The high figures of DIO primarily drive the length of CCC, exemplified by the required 1.5 years to generate cash from inventory in 2019. This result is well above the industry benchmark proxied by LVMH who, in contrast, has decreased DIO from 310 days in 2013 to 276 days in 2019 (full development stated in Appendix 9). Furthermore, the peak in 2020 YTD showcases that inventory value become unproportionally high in scenarios when sales fall short of expectations. Concluding from this analysis, the inventory management of Tiffany & Co. demonstrates potential for improving efficiency in asset utilization, which in effect, would raise the return on invested capital.

Figure 11: Tiffany & Co.'s CCC in days (2013-2020 YTD)



6 Forecast

The insights from the preceding strategic and financial analyses are applied in this chapter to provide an outlook on Tiffany & Co.'s future performance. We will first detail the defined forecast period from 2020 to 2029, including a respective division into sub-periods. Afterward, Tiffany's pro forma income statements and balance sheets are formulated based on the previously examined value drivers and trends in historical performance.

6.1 Forecast period

When choosing the appropriate forecast period, analysts face the trade-off between the risk of undervaluation due to a too-short period and the uncertainty regarding explicit assumptions too far into the future (Koller et al., 2020). We use a total forecast period of almost ten years, as Koller et al. (2020) suggest for mature firms. These years are divided into three subperiods based on the distinct dynamics that drive the respective forecast.

Firstly, recalling that we conduct this valuation from the viewpoint of October 28, 2020, the actual year-to-date figures until the completion of Q3 2020 are already given. Respectively, the first forecast focuses only on the Q4 performance of Tiffany & Co. to arrive at an expected result for FY 2020. This outcome should effectively reflect the net impact of Covid-19 on the annual performance.

The second period encompasses the subsequent years 2021 and 2022, in which the luxury industry is expected to rebound from the hit taken by the pandemic (D'arpizio & Levato, 2020). As previously discussed, Tiffany is a mature firm within the industry, and thus, recovery is assumed to be driven by similar factors as for the average player. Therefore, we transfer industry expectations to the firm level and consider 2021-2022 as a recovery period for Tiffany to reach its pre-pandemic performance.

Finally, the remaining forecast years from 2023 until 2029 present the period where market dynamics beyond Covid-19 shape the projections for Tiffany's intermediate to long-term economics. Whilst these factors already emerge during the recovery phase, we anticipate their effects to come fully into play after the repercussions of the pandemic have become insignificant.

6.2 Income statement forecast

For forecasting the future annual income of Tiffany & Co., we maintain the analytical view as introduced in the reformulation of the financial statements. In specific, we focus on the operating result by explicitly forecasting the line items that lead to NOPAT before non-recurring items. The projection of future revenues serves as a starting point and simultaneously while also presenting the most critical forecast element. Due to the applied percentage of sales approach, cost items and balance sheet positions will be derived via sales figures (Koller et al., 2020). After considering the costs of sales and SG&A costs, we formulate forecasts of depreciation and amortization expenses as well as income tax paid on EBIT. The full income statement forecast can be found in Appendix 10.

Net Sales

The revenue forecast is the foundation upon which projections of other line items build, therefore enhancing the importance of identifying and applying relevant growth drivers. As Tiffany & Co. operates in a mature industry tied to long-term changes in consumer preferences, we extrapolate third-party forecasts of the industry to the firm level, as proposed by Koller et al. (2020). In our case, we refer to the Bain-Altagamma Global Luxury Market Monitor by D'arpizio and Levato (2020) which is released quarterly and represents a comprehensive market outlook by industry experts. In the following, the respective growth drivers and their quantified impact on sales are explained along the three subperiods, as introduced in the previous section.

Expectation for Q4 2020

A key contributor to the annual revenues of Tiffany & Co. and other luxury brands is presented by holiday sales in the fourth quarter. In this light, we account for this seasonal effect in 2020 by analyzing the historical quarter-on-quarter sales growth from Q3 to Q4. In 2019, this seasonal growth was reported at 34%, mainly driven by sales in the Americas and Europe. We presume that due to the lingering effects of the pandemic in these core geographies, Tiffany's seasonal sales in Q4 2020 will exhibit a weaker but still considerable growth of 28% relative to Q3 2020.

Recovery period (2021-2022)

Based on our expectation for Q4 2020, the pandemic is projected to cause a total sales decline of -19% from 2019 to 2020 for Tiffany. This result is close to the expected year-on-year change for the general luxury industry of -23% (D'arpizio & Levato, 2020). Therefore, we presume that Tiffany's rebound from the crisis similarly follows the recovery pace of the industry. For 2021 and 2022, we project annual growth rates of 10% and 12% respectively, anticipating that Tiffany will reach its 2019 sales level by the end of 2022. Again, this aligns with overall industry expectations (D'arpizio & Levato, 2020). It is important to note that the recovery speed depends primarily on macroeconomic factors, which are particularly difficult to gauge in light of the unfamiliar nature of the pandemic. This condition holds for the entire industry as well as any specific firm.

Post-covid growth (2023-2029)

After the recovery period, the isolated effects from long-term trends, as identified in the strategic analysis, come into play. In specific, we consider the growth of the Chinese market and the growing customer groups of Gen Z and Millennials as the most critical drivers for Tiffany & Co.'s future sales. Although we have also discussed the increasing relevancy of e-commerce, and D'arpizio and Levato (2020) consider this development another key growth factor in the industry, we argue that this development mainly causes a mere shift in the proportional relevance of distribution channels. Secondly, it is reasonable to assume that if indeed any additional sales are generated by e-commerce, they will overlap to a great extent with sales from younger generations and Chinese clients (D'arpizio & Levato, 2020). Therefore, we limit our forecast drivers to the latter two customer groups.

Regarding the Millennial and Gen Z clientele, their combined share in the total market is forecasted to increase from 44% (2019) to at least 65% of the total market by 2025 (D'arpizio & Levato, 2020). We assume this share to expand to 71% at the end of our forecasting horizon, as each year, a fraction of this clientele will gain purchasing power. In other terms, the absolute size of the target group is forecasted to grow at a CAGR of 9% from 2023 to 2029. However, as Tiffany previously struggled to address younger audiences, we need to acknowledge firm-specific limitations in capturing this growth.

For our second driver, the rise of China in becoming the largest luxury market by 2025 is specified by a forecasted geographic market share of 27% in 2025 (D'arpizio & Levato, 2020). We further presume this share to expand to 30% in 2029, translating to a CAGR of 11% from 2023 to 2029. Given the insight from our PEST analysis that China's GDP growth is expected to slow down, this compound rate may appear relatively high. The reasoning is that Chinese consumers who previously shopped for luxury goods while traveling in the U.S. and Europe will shift to buying in their local market (D'arpizio & Levato, 2020). Effectively this will reduce Tiffany's sales in the Western geographies. Furthermore, as the brand is still more coined to the American market, it is deemed unlikely for Tiffany & Co. to realize the full double-digit growth of this customer market.

We note that local Gen Y and Z will contribute considerably to the expansion of the Chinese market, and thus, the results from the two growth drivers share a considerable overlap. Nevertheless, as both expected CAGRs are close in numbers we disregard this overlap for simplicity when deriving the forecast on the firm level.

As identified in the financial analysis, Tiffany faced stagnating sales in the recent past. On the contrary, the luxury industry grew by 33% from 2013 to 2019, suggesting a CAGR of over 4% (D'arpizio & Levato, 2020). This historical underperformance, the strategic challenge to appeal to Gen Y and Z, and losses in sales from tourists lead to the conclusion of comparatively low firm-specific sales growth rates of 4% starting in 2023. However, we expect total sales growth to increase until the end of the forecast period, as first, the company takes the appropriate initiatives to gain market share amongst younger consumers, and second, local Chinese sales overpower lost revenues from tourism. An overview of Tiffany's projected sales growth rates is provided in Table 1 below. The full display of presumed industry growth and growth drivers can be found in Appendix 11.

Table 1: Tiffany & Co.'s Sales Growth Forecast (2020-2029)

	E 2020	**FC 2021**	**FC 2022**	**FC 2023**	**FC 2024**	**FC 2025**	**FC 2026**	**FC 2027**	**FC 2028**	**FC 2029**
Net Sales	-19%	10%	12%	4%	4%	4%	5%	5%	5%	6%
Americas	-30%	9%	10%	2%	2%	2%	3%	3%	3%	4%
APAC	2%	13%	15%	7%	7%	7%	8%	8%	9%	9%
Japan	-21%	7%	9%	2%	2%	2%	2%	2%	2%	2%
Europe	-19%	8%	10%	2%	2%	1%	1%	1%	0%	0%
Other	-51%	10%	13%	2%	2%	3%	3%	4%	4%	5%

Cost of sales

Cost of sales can be regarded as the line item with the closest economic link to revenues as they refer to the expenses directly incurred to generate sales. Historically, Tiffany & Co. has lowered the ratio of cost of sales to net sales from 42% in 2013 to 37% (2018) and 38% (2019). Even more remarkable, as of 2020 YTD, the company has managed to maintain this ratio at 39% even during the pandemic. We presume that for Q4 2020 and 2021, the relative cost of sales will remain at the marginally higher level of 39% due to fixed cost components that cannot be adjusted to lower sales expectations. Starting in 2022, we assume that the cost of sales percentage will decrease until reaching 37% again and will remain at this level until 2029. We argue that given the size and maturity of the firm, the already established degree of vertical integration, and no notable plans to utilize more cost-efficient materials, we see no indications of drastically lower cost of sales in the forecast period. Furthermore, given the commentary in Tiffany's latest Annual Report, cost savings are not considered a key managerial objective presently. Appendix 12 shows the full set of presumed ratios for cost of sales and the following expense items.

SG&A costs

Selling, general, and administrative (SG&A) expenses are further enablers of sales and for our forecasting purposes, determined as a percentage thereof (Koller et al., 2020). In contrast to cost of sales, Tiffany's SG&A costs have been increasing from 34% in 2013 to 40% in 2019, which according to management, is mainly a result of growing investments in advertising and marketing. Since many of the expenses encompassed in SG&A are fixed in nature, the drop in sales due to the pandemic further increased the cost ratio to 45% for 2020 YTD. We believe that due to this fixed component in SG&A, the ratio to sales will not reach the 2019 level of 40% until 2023.

After this recovery period, advertising and marketing will remain highly relevant to drive Tiffany's top-line performance in the long run. This relation argues why we generally do not anticipate a decrease in relative SG&A expenses from 2023 to 2029. If anything, marketing costs can be expected to increase to foster growth in the future. However, due to the shift from physical retail to online sales, store operating expenses are likely to decrease at the same time. Overall, we assume that based on the counter development of these cost elements, total SG&A will remain flat at 40% until 2025 and marginally decrease to 39% thereafter.

Depreciation and amortization

Unlike the cost items presented so far, depreciation and amortization (D&A) expenses are not directly expressed as a percentage of net sales but of total non-current operating assets. Tiffany & Co. depreciates PPE and amortizes its intangible assets on a straight-line basis. Projections of PPE and Other Assets are explicitly discussed in the following section. At this point, it is important to note that the ratio of D&A to these non-current assets has been primarily stable in the past five years, supporting the use of the historical 5-year average of 16.6% for all upcoming years in the forecast period.

Income tax

The U.S. Tax Act introduced in 2017 lowered the national corporate tax rate to 21.0%, thereby leading to a notable reduction of income tax expenses for Tiffany. Due to the firm's international operations and related foreign tax obligations, the effective tax rate of 21.6% in 2019 was slightly higher than the general rate. Nonetheless, the contribution of taxes from foreign operations tends to be small. Therefore, we will apply the average of 21.4% of Tiffany's effective 2018 and 2019 tax rates for the entire forecast period, as we do not anticipate changes in the U.S. corporate taxation policies.

6.3 Balance sheet forecast (operating items)

The forecast of Tiffany's balance sheet items is based on the operational perspective on total invested capital and can be found in Appendix 13. In specific, the forecast determines the annual investments into non-current assets and working capital positions. Based on the economic intuition that these assets are acquired and utilized to generate sales, their forecast will be tied to the projections of revenue and cost of sales, as presented in the previous section (Koller et al., 2020). The capital structure presumed for financing these investments, i.e., the financing side of the analytical balance sheet, will be part of the discussion about the cost of capital in the following chapter.

Non-current operating assets and liabilities

Tiffany & Co.'s non-current operating assets are divided into property, plant, and equipment (PPE) and intangible assets summarized as 'Other Assets'. Given that both types of assets are mainly fixed in nature, their ratios to net sales are expected to be higher in 2020 than in 2019 due to the recent drop in revenue. Conditional on the results until Q3 2020 and historical balance sheet changes between Q3 and Q4, we presume a PPE to net sales relation of 32% and 10% for other assets in the fiscal year 2020, as displayed in the table below.

Table 2: Tiffany & Co. Non-Current Operating Assets and Liabilities Forecast (2020-2029)

In % of net sales	E 2020	FC 2021	FC 2022	FC 2023	FC 2024	FC 2025	FC 2026	FC 2027	FC 2028	FC 2029
PPE, net	32%	30%	30%	28%	28%	28%	26%	26%	25%	23%
Op. lease right-of-use assets	32%	30%	30%	28%	28%	25%	25%	25%	20%	20%
Other assets, net	10%	12%	8%	7%	7%	8%	8%	9%	9%	9%
Op. lease liabilities, LT	29%	25%	25%	24%	24%	23%	23%	23%	20%	20%

For the forecasts from 2023 to 2029 after the recovery period, we presume a slow relative decrease in PPE and other assets. This trend reflects the previously discussed outlook on new technologies and operating models that reduce the need for ownership of PPE as well as the key money component within other assets. The same argument supports an anticipated marginal reduction in lease assets and liabilities. A large share of these items is related to retail real estate, which given the rise of e-commerce, should diminish in relevance even in the luxury market.

Current operating assets and liabilities (net working capital)

The net working capital forecast is based on projections of operating current assets and operating current liabilities. Current assets of Tiffany & Co. are composed of accounts receivables, inventories, as well as 'prepaid expenses and other current assets'. In line with the approach for non-current assets, we define current asset expectations for 2020 based on year-to-date data and historical quarterly trends. For the remaining years, we generally follow the economic linkages of line items to the firm's sales activity. As we tie accounts receivables to net sales, and 'prepaid expenses and other current assets' to cost of sales, they are set at the historical average ratios of 5% and 14% respectively.

In formulating inventory forecasts, we deliberately deviate from the sales-driven approach. As previously discussed, the inventory positions of Tiffany & Co. have been strikingly high in the past. Tiffany's management proclaimed accordingly in the 2019 Annual Report that keeping inventory growth below sales growth is a key long-term objective for the firm. Therefore, we define YoY inventory growth using a delta of -2pp to the corresponding sales growth from 2021 to 2029. Overall, these forecasts of current assets and liabilities lead to a development of the net working capital to sales ratio of 0.6 in 2020 to 0.5 at the end of the forecast period, which is also the historical average from 2013 to 2019.

Table 3: Tiffany & Co. Current Operating Assets and Liabilities Forecast (2020-2029)

	E 2020	**FC 2021**	**FC 2022**	**FC 2023**	**FC 2024**	**FC 2025**	**FC 2026**	**FC 2027**	**FC 2028**	**FC 2029**
In % of net sales										
Acc. receivables, net	6%	6%	6%	6%	6%	6%	5%	5%	5%	5%
Op. lease liabilities, current	6%	5%	5%	5%	5%	5%	4%	4%	4%	4%
Merch. credits and deferred rev.	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
In % of cost of sales										
Prepaid expenses	36%	17%	15%	14%	14%	14%	14%	14%	14%	14%
Acc. payables and accrued liabl.	54%	33%	33%	34%	35%	36%	37%	37%	38%	38%
In -2pp delta to % net sales growth										
Inventories, net	-3%	8%	10%	3%	3%	2%	3%	3%	3%	4%
Net working capital ratio	0.64	0.63	0.57	0.56	0.55	0.54	0.53	0.51	0.50	0.48

The developments of NOPAT margin and ATO ratio resulting from the above-presented forecasts of income statement and balance sheet items can be found in Appendix 14.

7 DCF valuation

By bringing together the results from previous chapters, this section presents the outcome of the deterministic DCF valuation process. Firstly, we compute the appropriate cost of capital for Tiffany and employ this discount rate to forecasted and terminal cash flows. The result is the aimed for estimate of Tiffany & Co.'s firm value, which in the setting of this study can be considered on a standalone basis or in the context of the acquisition by LVMH. In a first advance to address variability in model estimates, we perform a sensitivity analysis for critical input parameters.

7.1 Cost of capital

Tiffany & Co.'s cost of capital presents a critical input to modeling its enterprise value. The constituents of this figure, namely the cost of debt, the cost of equity, and respective weights based on Tiffany's capital structure, are discussed in the following sections. As a result, we arrive at the weighted-average cost of capital which serves as the discount rate for future cash flows.

7.1.1 Cost of debt

As introduced in Chapter 2.2, debt holders bear credit risk when investing in defaultable corporate debt. Based on this understanding, Tiffany's required return on debt can be divided into a risk-free component and the credit spread (CS) that quantifies its firm-specific risk. This composition, including the effect of tax shields on the effective cost of debt, is shown in the following formula:

$$r_D = (r_f + CS)(1 - T)$$

Risk-free rate

The most common proxies for the return on a riskless investment are market yields of government securities with a maturity of at least ten years (Koller et al., 2020). However, as a direct response of the U.S. fiscal policy to the pandemic, government bond yields which had already been low since the financial crisis dropped below 1.0% for the first time. Koller et al. (2020) claim that using these historically low rates in valuation models leads to distorted results as these suggest higher equity market prices than those observed. Although our current focus is the computation of the cost of debt, consistency with equity markets is critical since the risk-free rate also enters subsequent calculations of the required return on equity. Therefore, we choose a risk-free rate of 2.5% as proposed by Kroll (2020). This return normalizes the 20-year U.S. Treasury yield in 2020 for months where the actual market yield of the government security is deemed abnormally low.

Credit spread

Tiffany & Co.'s credit spread defines the incremental risk debt holders incur by choosing the firm's debt instruments over risk-free government securities. As of April 2020, Tiffany received a Baa2 credit rating from Moody's, which translates into a credit spread of 1.56%, according to Damodaran's data. Combining this rate with the riskless return from above and the effective tax rate of 21.4% forecasted in Chapter 6.2, leads to a post-tax cost of debt of 3.19%, as summarized in Table 4.

Table 4: Tiffany & Co.'s cost of debt calculation

Risk-free rate (normalized U.S. Treasury yield with 20-yr maturity)	2.50%
Credit spread for Baa2-rated bonds	1.56%
Cost of debt (pre-tax)	4.06%
Effective tax rate	21.4%
Cost of debt (after-tax)	**3.19%**

7.1.2 Cost of equity

The required return on Tiffany & Co.'s equity is derived through the CAPM model, as reviewed in Chapter 2.2. Using the proxy for the riskless rate from the previous section, the only parameters yet to be determined are the market beta of Tiffany and the risk premium of the equity market.

Beta

A firm's market beta can be understood as its stock's incremental risk relative to the market. In this context, we derive the beta Tiffany & Co. through a regression of the firm's historical stock returns against market returns. Following the recommendations of Koller et al. (2020) and Berk & DeMarzo (2007), we use the S&P 500 as the market benchmark for U.S. firms and historical weekly returns from the past five years. The resulting raw beta for Tiffany & Co. is 0.64, with further details of the regression shown in Appendix 15.

It is important to stress that this procedure is based on backward-looking data, while our objective is to derive a beta for forward-looking valuation. Therefore, we compute a smoothed beta using the Bloomberg formula below that assumes an individual firm's beta to approach the overall market in the future.

$$\beta_{adj} = 0.33 + 0.67\beta_{raw}$$

The resulting adjusted beta for Tiffany & Co. is 0.76.

Given that we obtained a raw regression beta below 1, this adjustment may furthermore alleviate a methodological downward bias from non-continuous trading (Koller et al., 2020). However, for highly liquid stocks as in this case, we do not expect this bias to be strong from the start.

The smoothed beta of Tiffany & Co. is lower than the beta of 0.92 for the global apparel industry, as presented in Damodaran's data sets. Salvidio & Partners (2018) apply a more suitable industry definition of "textile, apparel, and luxury goods" in their beta report. In effect, our result is very close to their industry beta of 0.71 for the U.S. market. The difference to Damodaran's beta can be reasonably argued as demand for luxury goods is driven by high-earning individuals, thus, a clientele less affected by market downturns than the average consumer. All beta values are shown in Table 5.

Table 5: Betas of Tiffany & Co. and related industries

Tiffany & Co.'s raw beta from regression	0.64
Tiffany & Co.'s adjusted beta after smoothing	**0.76**
U.S. industry beta for textile, apparel & luxury goods	0.71
Global industry beta for apparel	0.92

Market risk premium

The market risk premium is determined by the returns of the U.S. equity market in excess of the risk-free rate. As the latter element leads back to the discrepancy caused by the low interest rate environment, we again choose Kroll's normalized MRP of 6.00% for the final calculation of the cost of equity. Table 6 summarizes the chosen and derived parameters for the CAPM formula and presents the resulting required return on equity of 7.05% for Tiffany & Co.

Table 6: Tiffany & Co.'s cost of equity calculation

Risk-free rate (Normalized U.S. Treasury yield with 20-yr maturity)	2.50%
Tiffany & Co.'s adjusted beta after smoothing	0.76
Market risk premium	6.00%
Cost of equity	**7.05%**

7.1.3 Capital structure

As the last constituent to the estimation of Tiffany & Co.'s cost of capital, we determine its target capital structure. In general, the capital structure should be evaluated based on market values of equity and debt (Petersen et al., 2017). Since Tiffany is a publicly traded company, the market value of equity is given by the market capitalization of the firm, i.e., the product of share price and the number of shares outstanding. However, not all corporate debt instruments are publicly traded, thus, obstructing the estimation of their market values. Instead, we consider the book values of NIBL under the presumption that for a company with an investment-grade credit rating, the market value of debt should be close to the book value (Koller et al., 2020).

Historically, Tiffany & Co. has been a primarily equity-financed company, as exhibited in Table 7. Furthermore, between 2013 and 2020 YTD, the company held 23.2% of invested capital on average in cash, additionally contributing to the low leverage ratios. In specific, the average NIBL to enterprise value ratio in the five years prior to the pandemic was 3.4%. This figure is close to the leverage ratio of 3.1% for the industry of personal goods, as presented by Koller et al. (2020). Furthermore, the capital structure of Tiffany has not seen drastic changes in the recent past. Even as new debt was raised in response to the effects of the pandemic, the leverage ratio only saw a slight increase from 2.3% in 2019 to 3.8% as of 2020 YTD. Based on these findings, we believe that Tiffany & Co. has already reached its target capital structure, and we assume the historical 5-year average leverage ratio of 3.4% going forward.

Table 7: Tiffany & Co.'s historical capital structure

mUSD	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**YTD 2020**
Market equity value (end of FY)	10,557	11,116	8,255	9,982	13,342	11,047	16,685	14,064
NIBL	778	724	471	354	185	517	388	552
Leverage ratio	6.9%	6.1%	5.4%	3.4%	1.4%	4.5%	2.3%	3.8%

Compiling the results on capital structure as well as required returns on debt and equity yields a weighted-average cost of capital of 6.9% for Tiffany & Co:

$$r_{WACC} = (1 - 3.4\%) * 7.1\% + 3.4\% * 3.2\% = 6.9\%$$

7.2 DCF valuation results

As the final input to the DCF valuation, we set a terminal growth rate for net sales of Tiffany & Co. before presenting the valuation outputs. Specifically, we distinguish between the standalone value of the firm as well as the acquisition value when incorporating the expectations on synergies. The underlying computations for both firm values can be found in Appendix 16 and 18 respectively.

7.2.1 Terminal growth rate

To determine the perpetual growth rate of Tiffany & Co. beyond 2029, we embed expectations for long-term GDP growth and industry projections. We follow the reasoning that the average firm cannot sustain endless growth beyond its peers or the general economy (Plenborg & Kinserdal, 2021).

Real annual GDP growth until 2060 is forecasted at 2%, whereas the luxury industry is expected to grow at a CAGR of 10% until 2025 (D'arpizio & Levato, 2020; OECD, 2018). While reliable long-term forecasts on the industry level are not available, it is important to recall that the market for luxury goods has historically overperformed the general economy. Between 1996 and 2019, the industry displayed a CAGR of 5.6% whilst the corresponding GDP CAGR was at 3.1%, based on data from The World Bank. However, considering the maturity of our focal firm and the eventual slowdown of the Chinese economy, we set Tiffany's terminal sales growth rate g at 3.0%, only slightly higher than GDP growth. We further assume a terminal NOPAT margin of 16.1% and an ATO ratio of 1.23. Both measures stabilized near these levels at the end of the forecast period, as shown in Appendix 14.

7.2.2 DCF valuation standalone case

Summing the present value of forecasted FCFF and the present value from the terminal period, we arrive at a standalone EV of 14,271 mUSD for Tiffany & Co., as presented in the table below. This result implies a point estimate for the equity value of 13,719 mUSD and a share price of 113.0 USD based on NIBL of 552 million USD and 121.4 million shares outstanding. For comparison, we consider the trading price of 114.0 USD on September 9, 2020, to be the latest reflection of Tiffany's standalone market value since LVMH renounced the acquisition on this day. Accordingly, our valuation suggests a minor overvaluation by 0.9% of the market, which could be due to some residual belief in the market that the merger will eventually succeed. The final acquisition price of 131.5 USD paid by LVMH implies a deal premium of 15.4% over the market price and 16.4% over our estimated share price. The justification for this premium will be evaluated in the next paragraph.

Table 7: Tiffany & Co.'s DCF valuation of the standalone value

PV(Forecast period)	3,928 mUSD
PV(Terminal period)	10,343 mUSD
Estimated enterprise value	**14,271 mUSD**
NIBL	552 mUSD
Estimated equity value	**13,719 mUSD**
Implied share price	**113.0 USD**

7.2.3 DCF valuation including synergies

Given the view on the role of synergies in luxury conglomerates and the acquisition philosophy of LVMH presented in Chapters 2 and 3, we use a simplified approach for quantifying synergies without conducting a comprehensive valuation of the acquirer. The precedent of the Bulgari acquisition shows that LVMH did not report notable spillover effects to other portfolio brands but instead, mainly gained from the rapid improvement of Bulgari's own profit margin. Therefore, we focus on the value added from higher growth in sales and profitability for Tiffany & Co. than in the standalone case. Nevertheless, we acknowledge that the increase of LVMH's market dominance after acquiring Tiffany may improve the cost of financing as well as bargaining power with other stakeholders for the whole group, which we disregard in this valuation.

The full ramp-up of growth and margin improvements throughout the forecasting period is presented in Appendix 17. We highlight the assumptions that for the terminal period, LVMH is anticipated to raise the perpetual sales growth of Tiffany & Co. by 0.5pp to 3.5% and improve the NOPAT margin by 1pp to 17.1% while maintaining ATO at the same level of 1.23.

We arrive at an estimated enterprise value of 18,329 million USD for Tiffany & Co. as part of the LVMH group. According to the interpretation that this figure represents the sum of the standalone EV and the present value of synergies, these synergies account for 4,059 million USD. Therefore, the implied share price of 146.4 USD incorporates the additional value from synergies per share. Table 8 summarizes these findings.

Table 8: Tiffany & Co.'s DCF valuation including synergies with LVMH

PV(Forecast period)	4,281 mUSD
PV(Terminal period)	14,048 mUSD
Estimated enterprise value	**18,329 mUSD**
Standalone estimated enterprise value	14,271 mUSD
PV(Synergies)	4,059 mUSD
NIBL	552 mUSD
Estimated equity value	**17,777 mUSD**
Implied share price	**146.4 USD**

To interpret these results, they are contextualized with corresponding market and transaction values. On October 28, 2020, LVMH and Tiffany agreed upon the acquisition share price of 131.5 USD, and as a result, the trading price increased to 131.0 USD on November 2, 2020[1]. At first glance, the gap between these two prices could indicate that the market expectation of the value of synergies is slightly lower than what LVMH paid for. However, given the background of this merger, this gap may also reflect a certain skepticism on whether both parties will finalize the acquisition this time. This hypothesis is supported by the observation that the trading price approached 131.5 USD when the deal remained stable in the weeks after.

Nevertheless, when choosing a relevant point of reference to evaluate this transaction, it is crucial to note that LVMH can leverage more information than the general market to assess synergetic potential and value. Furthermore, we reiterate that this work focuses on enhancing the pricing decision from the acquirer's perspective. Therefore, we define the estimated share price, including the value of synergies, at 146.4 USD as the cornerstone for the following analyses.

Presuming 146.4 USD as the expected result of successful synergy realizations post-merger, the transaction price of 131.5 USD per share suggests that the deal was underpriced by -10.2%. This verdict is particularly favorable for LVMH as they paid less than the anticipated value of Tiffany to the group. To place valuation results into relation to actual trading and transaction prices, we summarize relevant share prices reflecting different views on Tiffany & Co.'s value in Table 9.

Table 9: Overview of estimated and actual share prices of Tiffany & Co.

Assumption of no acquisition	
Estimated share price in Tiffany & Co.'s standalone case	113.0 USD
Trading price (September 9, 2020)	114.0 USD
Assumption of acquisition by LVMH	
Estimated share price in the case of Tiffany & Co. as part of LVMH	146.4 USD
Accepted acquisition price (October 28, 2020)	131.5 USD
Trading price (November 2, 2020)	131.0 USD

7.3 Sensitivity analysis

After estimating a variety of inputs and employing them in our valuation model, the model sensitivity is scrutinized by identifying parameters with a high impact on the final output. Put differently, we will investigate the inputs for which deviations will change the resulting firm value significantly.

[1] We use the share price three trading days after the announcement to account for possible delays in price reaction

For this sensitivity analysis, we value Tiffany & Co. as part of the LVMH group, i.e., the enterprise value, including synergetic effects, instead of the standalone value. Under the assumption that our computed value is the 'true' value acquired, taking this comprehensive enterprise value allows for direct inferences on the extent of overpaying or underpaying relative to the transaction price. Furthermore, as the terminal value accounts for 76.6% of the total enterprise value, we focus on four parameters that drive the value of the perpetuity: terminal growth rate, WACC, as well as the long-run NOPAT margin, and ATO ratio, which determine the first cash flow in the terminal period.

Figure 12 shows the sensitivity of the enterprise value with respect to variations in the terminal growth rate and the cost of capital. While this provides a first idea of the wide range of firm values resulting from marginal deviations in the point estimates, the assessment of the acquisition becomes more explicit in Figure 13. Using the enterprise values from the analysis in Figure 12, we calculate the implied share prices and set them in relation to the actual acquisition price per share of 131.5 USD. The outcomes showcase in which cases LVMH will have overpaid or underpaid for Tiffany. In the base case, we presume an underpricing of -10.2% to the benefit of LVMH. However, the analysis displays that only minor divergences to a growth rate of 3.0% and a WACC of 7.3% lead to a scenario where LVMH would have overpaid by 11.0%. In absolute terms, this translates into an overpayment by 1.75 billion USD. Consequently, this example underlines the high sensitivity of the assessment of the deal toward the underlying parameters.

Figure 12: Sensitivity analysis of *g* and WACC on Tiffany & Co.'s enterprise value

		Terminal growth rate						
		2.0%	2.5%	3.0%	3.5%	4.0%	4.5%	5.0%
WACC	6.3%	16,138	17,670	19,664	22,364	26,226	32,206	42,706
	6.5%	15,380	16,748	18,504	20,841	24,105	28,981	37,059
	6.7%	14,686	15,913	17,469	19,507	22,295	26,336	32,722
	6.9%	14,049	15,153	16,539	18,329	20,732	24,127	29,287
	7.1%	13,462	14,460	15,700	17,282	19,370	22,255	26,498
	7.3%	12,919	13,824	14,938	16,343	18,172	20,648	24,189
	7.5%	12,416	13,239	14,244	15,499	17,109	19,253	22,246

Figure 13: Sensitivity analysis of g and WACC on over- or underpaying by LVMH

WACC \ Terminal growth rate	2.0%	2.5%	3.0%	3.5%	4.0%	4.5%	5.0%
6.3%	2.4%	-6.7%	-16.5%	-26.8%	-37.8%	-49.6%	-62.1%
6.5%	7.7%	-1.4%	-11.1%	-21.3%	-32.2%	-43.8%	-56.3%
6.7%	12.9%	3.9%	-5.6%	-15.8%	-26.6%	-38.1%	-50.4%
6.9%	18.3%	9.3%	-0.1%	-10.2%	-20.9%	-32.3%	-44.4%
7.1%	23.7%	14.8%	5.4%	-4.6%	-15.2%	-26.4%	-38.5%
7.3%	29.1%	20.3%	11.0%	1.1%	-9.4%	-20.6%	-32.5%
7.5%	34.6%	25.8%	16.6%	6.8%	-3.6%	-14.6%	-26.4%

Apart from the growth and discount rate, the terminal value is also contingent on the first cash flow in 2030. In mathematical terms, this figure scales the value of the perpetuity. In this context, we investigate the terminal NOPAT margin and ATO ratio, as both the operating profit and investments into net operating assets determine FCFF (note that the base case NOPAT margin includes the improvement of 0.5pp by LVMH as presented in Chapter 7.2. and Appendix 17).

The respective sensitivity analysis of the acquisition pricing, as presented in Figure 14, follows the same logic as for WACC and the growth rate. We find that sensitivity towards these inputs is extremely high: The worst case in our analysis, where the NOPAT margin is 13.6% and ATO ratio is 1.14, leads to an implied share price of 78.4 USD and overpayment of 67.7%. Even if we consider the NOPAT margin to be accurate at 16.6%, an overestimation of ATO by only 0.04 suggests that out of the total acquisition price, 9.1% or 1.45 billion USD are not backed by the estimated standalone value of Tiffany & Co. nor the value of the synergies.

Figure 14: Sensitivity analysis of NOPAT margin and ATO ratio on over- or underpaying by LVMH

ATO ratio \ NOPAT margin	13.6%	14.6%	15.6%	16.6%	17.6%	18.6%	19.6%
1.17	67.7%	49.6%	35.0%	23.0%	13.0%	4.5%	-2.8%
1.19	42.9%	29.5%	18.4%	9.1%	1.2%	-5.7%	-11.7%
1.21	25.0%	14.6%	5.9%	-1.6%	-8.2%	-13.9%	-18.9%
1.23	11.5%	3.2%	-4.0%	-10.2%	-15.7%	-20.5%	-24.8%
1.25	0.9%	-5.9%	-11.9%	-17.2%	-21.9%	-26.0%	-29.8%
1.27	-7.6%	-13.3%	-18.4%	-23.0%	-27.0%	-30.7%	-34.0%
1.29	-14.5%	-19.5%	-23.9%	-27.9%	-31.4%	-34.7%	-37.6%

This sensitivity analysis shows that a minor change to the construct of valuation parameters can change the entire outlook on the deal. For a transaction of this scale, these deviations can cost the acquirer billions of dollars in value, which is why we will employ Monte Carlo simulations to address the uncertainty surrounding point estimates.

8 Monte Carlo simulations

After the valuation of Tiffany & Co. using a static DCF model, this chapter will focus on Monte Carlo simulations as a probabilistic approach to determine and interpret the firm value. The fundamental idea relies on explicitly embedding the uncertainty inherent to our point estimates into the model. Consequently, simulations provide insights into the value distribution and the pricing risk that LVMH is exposed to. For this cause, the simulated firm values refer to the comprehensive value of Tiffany & Co. as part of the LVMH group instead of the standalone value. We first explain our case-specific inputs and assumptions before presenting the simulation results and analysis thereof.

8.1 Inputs for simulation

Following Raychaudhuri's (2008) blueprint for Monte Carlo simulations, which we presented in Chapter 2.4, we will propose a set of input variables for simulation by analyzing their uncertainty and assigning respective probability distributions based on their characteristics. If applicable, we will further define correlations between selected variables.

8.1.1 Uncertainty in inputs

The determination of point estimates was preliminary for conducting the DCF valuation of Tiffany. Based on various assumptions, data, and analyses, we derived an expected value that we considered the most probable for a given input parameter. Nevertheless, it is important to question some of these assumptions and recognize the variability of the resulting estimates.

We define a set of inputs for further analysis based on their contribution to the final valuation result. Furthermore, we can pinpoint specific sources of uncertainty for these inputs. Put differently, we have explicit reasons to believe that incorporating variations of these inputs into the valuation model mirrors real-world dynamics. While a combination of estimation and economic uncertainty applies to for all these parameters, we will distinctively discuss the two types of uncertainty in relevant cases. This analysis of input uncertainty sheds light on the limitations of the deterministic DCF model and guides the upcoming examination of probability distributions.

Sales growth in the forecast period

A highly circumstantial source of uncertainty in the forecast period of our valuation is presented by the global pandemic. While we adopted the expectations of industry forecasts on the duration of this recession and respective recovery speed, the Covid crisis is not paralleled by any event in the recent history of the global economy. Such unexpected crashes are prime examples of economic uncertainty and further enhance the estimation uncertainty for this forecast stage since valuers barely have any reference points on which to base future expectations. Consequently, Tiffany's true sales recovery rate may deviate to considerably from our point estimate.

Even beyond the recovery period, forecasts are shaped by macroeconomic and industry trends indicating the direction of sales growth (Koller et al., 2020). However, the often ensuing presumption of linear developments can be challenged by the observation that within the period from 2013 to 2019, the year-on-year sales growth of the firm fluctuated between -3% and 7%. While we do not have sufficient information to project these variations deterministically, simulations will naturally incorporate these into the valuation.

Long-term growth rate

As stated in Chapter 7.2, we derived the long-term growth rate of Tiffany & Co. close to the GDP growth projection, considered a common approach in valuation (Koller et al., 2020). Nevertheless, at least three considerations indicate possible deviations from our point estimate.

Firstly, we need to consider a scenario where the immediate environment of Tiffany & Co., i.e., the luxury industry, perpetuates a faster expansion than the general economy, as shown in past decades. While the rise of the Chinese economy spurred both global GDP growth and industry growth, the effect was stronger on the industry level, which could continue in the long run. Moreover, it has also been shown that companies with valuable brands, particularly in retail, tend to outperform the market (Dorfleitner et al., 2019). In isolation, these observations suggest that GDP growth should present the lower bound of Tiffany & Co.'s probable range of growth rates.

However, focusing on additional gains on top of the forecasted GDP growth, the question arises of whether LVMH will succeed in elevating sales in continuity to realize the presumed long-term synergies. For leveraged buyout (LBO) deals, it has been observed that the new management post-acquisition tends to prioritize short-term goals, such as paying off debt as fast as possible (Lei & Hitt, 1995). This preference comes much at the expense of building a long-term competitive advantage. The total acquisition price of 15.8 billion USD for Tiffany & Co. is unprecedented in the industry and thus, a similar short-sightedness as in the case of LBOs could apply to this case. LVMH may aim for recouping this price in the upcoming years instead of targeting long-term growth. Another indicator for overly optimistic views on terminal sales growth at deal initiation is presented by findings that ex-post, many M&A deals failed in materializing the expected value-add in the long-run (Martynova & Renneboog, 2008).

Lastly, the forecasted GDP growth rate could be inaccurate, especially since we consider a long-term projection of more than 40 years into the future. In practice, this is one of the quantities for which economists have already acknowledged that a single-point estimate conveys insufficient or even biased information (Adrian et al., 2016). As a result, probability distributions of the future development of GDP growth rates are commonly published to reflect the expectations of various experts and forecasters. However, these distributions are generally only available for short-term GDP projections, i.e., one or two years ahead. We explain the probability distributions of GDP growth when discussing the selection of a distribution for our long-term growth rate.

Cost of capital

In Chapter 7.1, it became apparent that the WACC is an input parameter that in itself depends on the interplay of numerous factors. In general, there will always be uncertainty about how each of these constituents may change over time and to which extent historical returns can be extrapolated to form future expectations (Damodaran, 2018). However, the Covid recession as our distinct setting presents additional uncertainties. The ultralow interest rate environment created an ambiguity for us to define a suitable riskless rate, to begin with. While we have followed the proposition to use a synthetic rate, data sets for corporate valuation by Damodaran continue to use U.S. government bond yields as the riskless proxy. In our case, switching to the latter would lead to a difference of almost 2pp only in the risk-free component of Tiffany & Co.'s cost of debt and equity.

Low interest rates could further incentivize Tiffany & Co. to increase debt levels, thus affecting the capital structure, beta, and possibly credit rating. Moreover, particularly in times of economic downturns, volatility in the market is observed to be the highest (Whaley, 2009). It is reasonable to question the reliance on one point estimate, which to some extent will reflect the prevailing market conditions, to discount all future cash flows – including those decades into the future.

Overall, there is a great degree of economic uncertainty underlying how the cost of capital of Tiffany & Co. may change in the future, particularly after integration into LVMH. This is exacerbated by the estimation uncertainty resulting from our methodological proxy choice for the risk-free rate and market risk premium, amongst other modeling assumptions.

NOPAT margin and ATO ratio

The estimated future NOPAT margin and ATO ratio can be considered reflections of the expected ability of Tiffany & Co. to create value from operating activities and related asset utilization. We presumed that LVMH will be able to raise profitability in the forecast period and the long run, based on the success of their Bulgari acquisition. Although we did not anticipate improvements in Tiffany's ATO ratio from the acquisition, some larger firms are found to have better asset utilization, thus, indicating the potential for higher realizations than our expectations (Singh & Davidson, 2003).

However, there has also been strong empirical evidence that while the average acquisition does not deteriorate profitability as suggested by earlier literature, the firm performance also does not undergo the degree of improvement acclaimed at deal initiation (Martynova et al., 2006). As the sensitivity analysis showcased, the NOPAT margin and ATO ratio are critical determinants of the valuation output, enhancing the importance of accounting for uncertainty in projected value creation.

We note that by simulating both quantities throughout the forecast period, we summarize many assumptions made for projecting individual line items in Chapter 6. However, given that the value from this period only contributes less than 25% to the total enterprise value in our DCF valuation, we consider this approach to lead to the most efficient valuation process. We will also keep all deterministic expectations for Q4 2020 fixed as they represent only a minor fraction of the total enterprise value.

8.1.2 Probability distributions

The definition of probability distributions is the greatest challenge in designing Monte Carlo simulations to represent firm value distributions in the real world (Damodaran, 2018). As explained in detail in Chapter 2.4, it is proposed that for a given input, historical data is fitted to a statistical distribution. However, one of the prerequisites is for such data to be satisfactory in quality and quantity (Damodaran, 2018). To ensure that our results are undistorted by limitations in those dimensions, we refer to conclusive academic findings on the probability distributions adequate to describe our input variables.

Sales growth (forecast period and long-term)

Various academic works identified growth rates of firms to follow a tent-shaped distribution with characteristically fatter tails than the normal distribution (Stanley et al., 1996). This observed shape of the distribution is shown to be strikingly similar across various geographies as well as industries

(Bottazzi & Secchi, 2006; Stanley et al., 1996). Bottazzi and Secchi (2006) provide a possible explanation for this tent-shaped nature of firm growth based on the concept of positive feedback. They argue that companies realize growth by capturing business opportunities in the market, which they must compete for. The success of this competition underlies a self-reinforcement effect whereby firms with high growth in the past will attract more opportunities to drive future growth. Consequently, if a few players with many opportunities historically capture a large share of new opportunities the distribution will likely exhibit fat tails. Although this distributional shape seems to hold generally across firms, we highlight that given the significance of brand, retail footprint, and other network factors for sales growth, positive feedback effects apply to Tiffany & Co. explicitly.

The stochastic probability distribution proposed to describe the empirically derived tent shape is the Laplace distribution which is an exponential distribution symmetric around the mean (Stanley et al., 1996). More precisely, this formal distribution is the result of convergence when we let the number of firms from the empirical observations go to infinity, i.e., the number of all firms in the market (Bottazzi & Secchi, 2006). This observation is particularly remarkable as the growth rate of the overall economy, which represents the aggregation of firms, is also shown to be best described by a Laplace distribution (Williams et al., 2017). Based on this knowledge, we solidify our assumption that not only is it viable to derive a point estimate for the long-term growth of Tiffany & Co. from GDP growth, but the linkage to GDP growth persists when we introduce a stochastic model.

Nevertheless, we deliberately choose to use a triangular distribution over the Laplace distribution to model sales growth rates. The use of this alternative is mainly based on the property that the Laplace distribution is unbound, and tails reach into the infinitely negative and positive ranges. However, especially for the terminal growth rate, realizations below zero are difficult to rationalize economically, as firms would generally terminate operations before undergoing negative growth in perpetuity. Therefore, we use the triangular distribution as it allows for the definition of bounds while exhibiting the tent shape from empirical findings. However, a shortfall of this alternative is presented by its limitation in capturing the exponential character of the Laplace distribution (Bottazzi & Secchi, 2006).

In general, we assume that top-line growth in each year follows the same type of probability distribution. Thus, we select the triangular distribution for growth rates in the forecast period and for the long-term growth rate. Nevertheless, we apply different distributional parameters based on the characteristics of each period. Specifically, as we consider the pandemic and corresponding recovery to cause a distinct hike in uncertainty in our valuation model, we model the sales growth in 2021 and 2022 with different parameters than in the remaining years of the forecast period. To reflect the augmented degree of uncertainty on the physical sales recovery rate, we define a greater span between minimum and maximum values of this distribution, as displayed in Table 10.

Cost of capital

Defining a statistical distribution to describe possible realizations of the cost of capital bears the highest ambiguity compared to other inputs in this study. A key issue lies in the inability to observe the true WACC of firms (Bancel et al., 2013). This challenge is further exacerbated by the fact that the estimation of WACC constituents remains to a certain extent discretionary to the valuing analyst, as discussed in the previous section.

While the distributional properties of WACC have not been covered widely by literature, some parameters which condition the cost of capital have been investigated individually. One of the most prominent discussions concerns the market risk premium, i.e., the excess return on the market, for which many financial models assume the lognormal distribution (Leland et al., 1999). More recent views consider mixture normal distributions to perform better at capturing the empirically observed distribution of stock returns (Wong & Chan, 2005). For the term structure of interest rates, i.e., the risk-free component of the WACC, the commonly proposed options are the normal and lognormal distribution (Meucci & Loregian, 2016).

As elaborated before, there are many interdependencies between the components of WACC. For the scope of this study, we will therefore refrain from simulating each element individually and will instead model the cost of capital directly. The choice of the lognormal distribution for this purpose has the inherent benefit that realizations of discount rates will be strictly positive and is further reasoned in related academic works (Elsner & Krumholz, 2013; Jacquier et al., 2005). Simulating the WACC also allows for variations of this rate across the forecast period, whereby we assume the same probability distribution for each year. For the defining parameters of the distribution, we use our point estimate of 6.92% as the mean and a standard deviation of 0.8%.

NOPAT margin and ATO ratio

Parallel to the investigation of firm growth and GDP growth, empirically observed profitability rates across firms are found to be best described by a Laplace distribution (Alfaranoa et al., 2012). Employing of this statistical distribution to model profitability parameters is also contingent on the idea that companies collectively interact in a competitive field, eventually determining their profits (Erlingsson et al., 2012). Referencing the strategic analysis from Chapter 4.2, we have applied the same logic in our deterministic valuation by following the principle of Porter (2008) that the mode of competition shapes the profitability of industry players.

Furthermore, the dynamics of this competition parallel the findings for firm growth, underlining the applicability of the Laplace distribution. In specific, the performances of many firms exhibit profit persistence, i.e., the tendency to stick to past levels of profitability (Gschwandtner, 2010). Linked to the previously introduced concept of positive feedback, this self-reinforcement in profitability implies a similar distributional shape for profitability and growth rates.

Going further, we can transfer the self-reinforcement argument for modeling the ATO ratio since firms equally show persistence in their efficiency (Johnes & Johnes, 2013). Based on the previous knowledge, we interpret that the ATO ratio should follow the same shape of probability distribution as profitability and sales growth rate. Again, we consider it sensible for our modeling purposes to define boundaries on the NOPAT margin and ATO ratio, arguing the choice of using the triangular distribution also for these two input variables.

Table 10 summarizes the defined characteristics of each input distribution. We use the deterministic point estimates or the averages of point estimates across years as the respective means.

Table 10: Probability distributions of input parameters

Input	**Distribution**	**Min**	**Max**	**Mean**	**Std Dev**
Sales growth rate (2021-2022)	Triangular	5.0%	20.0%	10.9%	
Sales growth rate (2023-2029)	Triangular	2.0%	8.0%	4.6%	
Terminal sales growth rate	Triangular	2.0%	5.0%	3.5%	
Cost of capital	Lognormal			6.9%	0.8%
NOPAT margin	Triangular	14.0%	18.0%	16.6%	
ATO ratio	Triangular	1.0	1.3	1.2	

8.1.3 Input correlations

For the Monte Carlo simulation to mirror real-world dynamics as closely as possible, it is crucial to account for inter-relationships between input variables. Historically, the NOPAT margin of Tiffany & Co. has shown co-movement with sales growth. Although the changes in both measures did not occur in perfect linearity, it is evident that for a given year, NOPAT margins were higher compared to the year prior when sales growth was higher – and vice versa.

This observation is also backed by related studies that estimated the respective correlation to fall into the range between 0.06 and 0.17, depending on the applied profitability measure (Cho & Pucik, 2005). Describing the same relationship, Baum and Wally (2003) arrived at a correlation coefficient of 0.13, which is also within the range of Cho and Pucik (2005).

While this interrelatedness between profitability and top-line growth is commonly argued by the impact of innovation, in the case of Tiffany & Co., we justify the phenomenon economically by adding the aspect of pricing (Cho & Pucik, 2005). As presented in the strategic analysis, substantial price hikes well above the inflation rate are standard practice in the luxury industry and are generally well supported by the target clientele (Hwang et al., 2014). Effectively, this can be expected to continue in future periods and will increase – or at least shield – margins when sales units increase.

In our following simulations, we will apply the above-stated estimate of 0.13 as the correlation coefficient between NOPAT margin and sales growth. For all other variables in the simulation, we assume non-correlated distributions. Hence, the random draws for these inputs will occur independently.

8.2 Results and statistical analysis

The Monte Carlo simulation of the firm value of Tiffany & Co. was performed in 10,000 iterations using the Oracle Crystal Ball application. For every iteration, a draw was made from each of the previously defined stochastic input distributions. These random draws as well as remaining fixed estimates entered the DCF model from Chapter 7 to generate possible realizations of the firm value.

Figure 15 and Figure 16 below present the simulated enterprise value and share price distributions of Tiffany & Co. The latter is derived using the same figures of 552 million USD in NIBL and 121.4 million shares outstanding as in the deterministic valuation. Table 11 presents the summary statistics for both distributions, discussed in the following.

Figure 15: Tiffany & Co.'s enterprise value distribution from Monte Carlo simulations

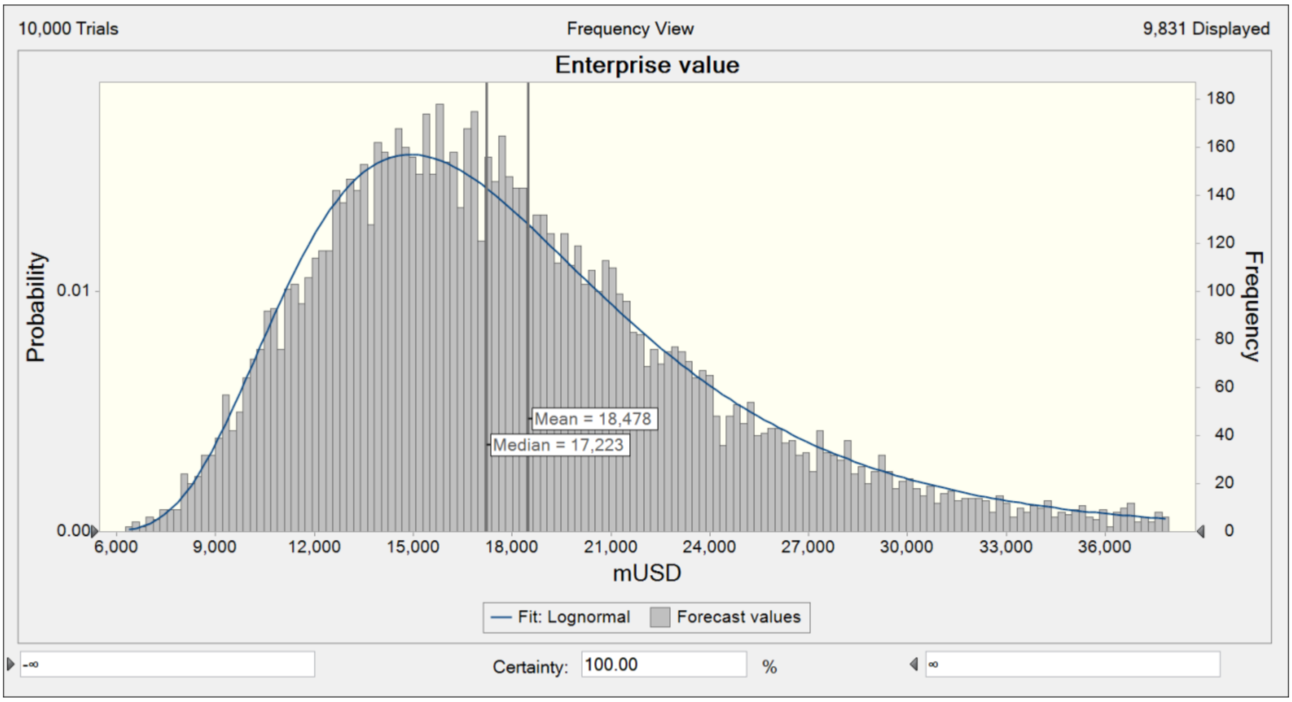


Figure 16: Tiffany & Co.'s share price distribution from Monte Carlo simulations

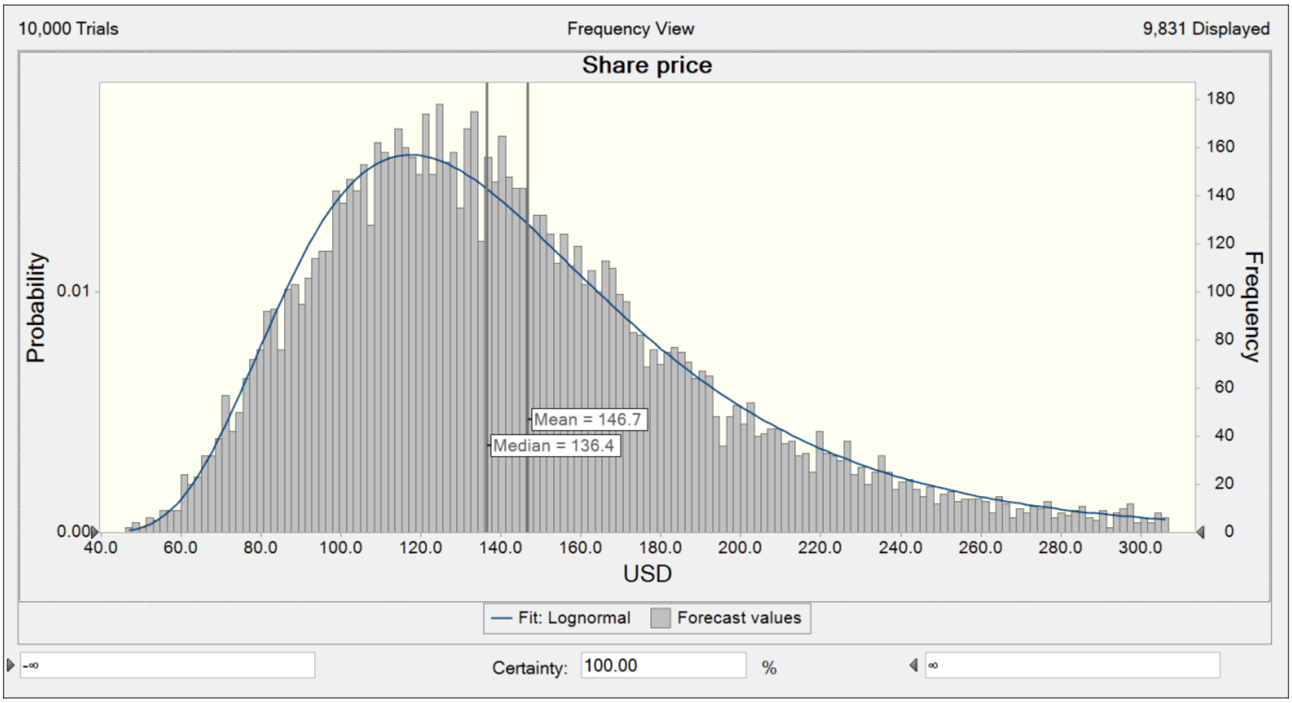


Table 11: Summary statistics for enterprise value and share price distributions

	Enterprise value	Share price
Base case (deterministic DCF valuation)	18,329	146.4
Mean	18,478	146.7
Median	17,223	136.4
Standard Deviation	6,949	57.2
Variance	48,283,351	3,276.1
Skewness	2.11	2.11
Kurtosis	13.55	13.55
Minimum	6,266	46.1
Maximum	100,315	820.8

The simulation distributions demonstrate mean values of 18,478 million USD and 146.7 USD for Tiffany's enterprise value and share price, respectively. Both results are close to the outputs from the deterministic valuation in Chapter 7, where we obtained 18,329 million USD for the enterprise value and a share price of 146.4 USD. This coherence aligns with our expectations as we have defined the point estimates of the static DCF model to be the most likely values of each input variable.

Moving beyond discrete base case comparisons, the distributional representation of firm value provides further insights into the range of possible outcomes and associated risks. On the stock price level, the standard deviation of 57.2 USD measures the variability in Tiffany's estimated equity value per share. This measure reflects both the uncertainty embedded in our valuation methodology and the uncertainty surrounding the physical realization of firm value. In any case, a higher standard deviation or variance indicates an increased risk that the true value of Tiffany & Co. is divergent from our expected value. Effectively, this enhances the riskiness of all decision-making based on the mean estimate, including establishing an acquisition price.

To address this ambiguity, the simulation results can be used to specify certainty ranges, as presented in the table below, exemplary for the share price distribution. Each of these ranges is defined by a given probability, whereby the median share price of 136.4 USD marks the midpoint of each span. The use of the median instead of the mean is argued by the asymmetry of our distributions, which we will further elaborate on in the following. This dissection of the probability distribution illustrates that the narrower the range of potential share prices we take into consideration, the lower the degree of certainty that this range contains the physical outcome.

Table 12: Certainty ranges for simulated share prices

Certainty	**5%**	**10%**	**50%**	**100%**
Range of share prices (in USD)	133.4 – 139.3	130.8 – 141.9	108.9 – 170.9	46.1 – 820.8

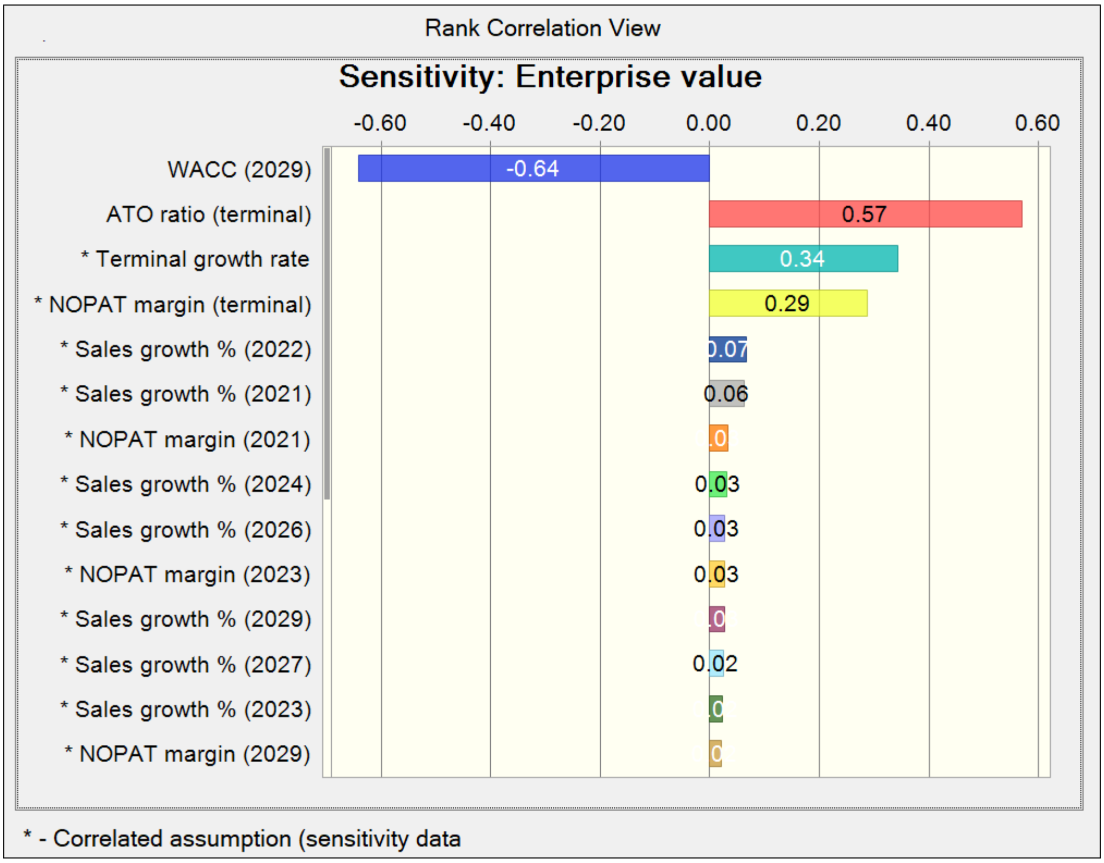
Concerning the statistical properties, the above-presented distributions display a distinct positive skewness of 2.11, indicating that more than 50% of the probability mass is located on the left-hand side of the mean. The relation between the median and the mean further showcases this asymmetry around the mean. While the mean share price from simulations is close to our deterministically derived value, the median share price of 136.4 USD is lower than the mean, a characteristic of positively skewed distributions. The median defines a 50% probability that the actual enterprise value of Tiffany & Co. will be either higher or lower than 17,223 million USD or respectively 136.4 USD on a share price level. In effect, this accentuates that there is a higher chance of 59% that the firm value of Tiffany & Co. sees a realization below the mean.

Furthermore, the positive skewness indicates a distinct direction of outliers. The long tail on the right-hand side illustrates extreme realizations of firm value tend to be higher than the median and the mean. Additionally, further information on the tail behavior is presented by the kurtosis of 13.55, implying leptokurtic distributions. In other terms, enterprise value and share price distributions display fatter right-hand tails than a normal distribution. While this suggests a higher general risk for extreme outcomes, these outliers generally occur rather on the upside than on the downside.

Correspondingly to the procedure of assigning formal probability distributions to input parameters when constructing the Monte Carlo simulations, we can also fit stochastic distributions to the statistical properties of simulation results. Using the Crystal Ball tool, the lognormal distribution was deemed the most suitable to describe simulated values.

Given the sensitivity analysis in Figure 17 below, we can explain this distributional shape with the substantial impact of the WACC on the simulated firm value. Distinct from the sensitivity analysis presented in Chapter 7.3, this assessment compares the importance of all stochastic input variables to the model output. More specifically, the variables in our model are ranked based on the strength of their correlation with the firm value, thereby defining the respective sensitivities. The correlation of -0.64 between enterprise value and the cost of capital implies that the firm value will increase for negative deviations of this rate from its expected value. Due to the strength of this relationship, the terminal WACC presents the most influential variable to the final valuation result.[2] Considering that we simulated realizations of Tiffany's cost of capital using a lognormal distribution, it is straightforward to conclude that the primary determinant of the firm value model also drives the shape of the enterprise value distribution. The same interpretation holds on the share price level.

Figure 17: Sensitivity analysis for the simulation model of Tiffany & Co.'s enterprise value



[2] In our setup, we employ the WACC at the end of the forecast horizon in 2029 also as the terminal WACC

9 Discussion and outlook

To conclude the valuation of Tiffany & Co., this section discusses the findings from the Monte Carlo simulation in contrast to the results of the deterministic model and the actual acquisition terms. Afterward, we outline key limitations of this study and provide an outlook on related fields of application that are relevant to researchers and practitioners alike.

9.1 Discussion of results and limitations

Although firm valuation using Monte Carlo simulations builds on the standard DCF model, the probabilistic analysis of results addresses uncertainties overlooked by the deterministic approach. The central insights from applying both methods for the valuation of Tiffany & Co. concern the determination of an appropriate acquisition price for the target.

The challenge of price setting is created by the divergent interests that the acquiring party and the target must balance in negotiations. While Tiffany will generally plead for the highest transaction price possible to benefit the value of their current shareholders, the willingness to pay by LVMH will be capped at a ceiling value. This limit is due to the acquirer's severe risk of overpaying for the target, presenting a proven fallacy in many acquisitions (Eccles et al., 1999). Consequently, we conducted the valuation of Tiffany & Co. to anchor LVMH's maximum willingness to pay, which equals an acquisition price where we expect no overpaying.

The standard DCF valuation arrives at this price based on the idea that if all input parameters take on their most probable value, the outcome should be the expected fair value of the target firm. This quantity also includes the value of synergies in our presented model. For all negotiated prices below the fair value, LVMH would acquire Tiffany at an expected discount. Vice versa, the acquirer should not accept any price requests of the counterparty above their estimated fair value. Given the expected share price of 146.4 USD and a lower actual acquisition price of 131.5 USD, the resulting underpricing of -10.2% implies that LVMH settled a seemingly 'good' deal for their shareholders.

The Monte Carlo approach to valuation applies a different perspective to determine the buyer's upper price limit. By introducing variability to selected input parameters, we incorporated the notion of uncertainty into the valuation model. Furthermore, this allowed for randomized fluctuations of parameter values instead of assuming stability or distinct trends. In this sense, the simulation model acknowledges the persistent risk that the realized firm value may deviate from the expected value by attaching probabilities to outcomes. The price boundary should be set to reflect the highest probability of overpaying the acquirer is willing to accept. Generally, this consideration is contingent on the risk preference of the buying party and should integrate additional insights from the simulation results, including the tail behavior of the obtained distribution. However, presuming that LVMH does not pursue a deal of this scale to increase their risk exposure, we infer that they will aim for a price where the probability of overpaying is either lower but at least no greater than the chance of underpaying. This threshold is represented by the distributional median of 136.4 USD on the share price level. Strikingly, this entails that the upper price bound should not necessarily be set by the mean value, as inherently assumed by the static DCF model.

Moreover, the actual acquisition price of 131.5 USD is much closer to our simulated median than to the distributional mean of 146.7 USD. While this price satisfies our hypothesized preference for a comparatively lower probability of overpaying, there is still a considerable chance of 45.8% that the realized share price of Tiffany will fall below 131.5 USD. Based on this apprehension, the inference on whether the acquisition price was a ‘good’ deal for LVMH needs to be far more nuanced than the deterministic result suggests. In the static valuation, we assessed the final price relative to the estimate of *expected* firm value. However, overpaying in the probabilistic context refers to the delta between the final price and a possible *realized* firm value. As the physical outcome of Tiffany & Co.’s value is uncertain, the previous judgment that LVMH acquired the target at a favorable discount conceals essential information on the abiding risk. Instead, the probabilistic framing suggests a chance of 41.3% that the acquisition of Tiffany & Co. was priced at a discount of -10.2% or more.

Furthermore, recalling that the initial acquisition price both parties agreed on in 2019 was 135 USD, it is evident that LVMH first settled on a price very close to the median as our presumed upper limit. This initial price suggests that the acquirer was willing to accept a nearly 50:50 chance of either overpaying or underpaying, which the buyer eventually alleviated by lowering the final price to 131.5 USD. However, as previously discussed, renegotiations are burdened with additional costs, particularly when legal action is required to modify a signed deal (Officer, 2004). If uncertainty is accounted for in the integral valuation model the buyer can incorporate considerations of risk adversity from the beginning of negotiations by establishing a lower cap for their maximum price. Furthermore, fundamentally understanding the value of the target within a range of outcomes can alleviate behavioral biases when uncertainty tangibly challenges the point estimate (Damodaran, 2013). The interim decision of LVMH to retract from the deal could be a result of irrational behavior in the face of a sudden global crisis.

Apart from the critical insights from the Monte Carlo simulations, we acknowledge explicit limitations to our approach. Firstly, the design of the simulation model is highly assumption heavy. To address the uncertainty surrounding DCF model assumptions, it was necessary to introduce a variety of new hypotheses on probability distributions and correlations of input variables. However, the observability of the variables' physical behaviors and data availability for distribution fitting challenged the construction of Monte Carlo simulations (Damodaran, 2018). Consequently, there is a remarkable danger of increasing estimation uncertainty in the valuation model due to inaccurate or incomplete assumptions. In practice, this pitfall could be mitigated by using primary data from Tiffany & Co. to analyze the firm's historical dynamics in more detail. Furthermore, the total number of assumptions could be reduced in a second simulation by using the sensitivity analysis of the first runs, which identifies the most influential input variables.

A second limitation faced in our valuation relates to the treatment of synergies. Due to the scope of this thesis, we presented a very coarse approach to assessing the additional value created by the merger. Although our results from both valuations fall into a plausible range with actual trading and transaction prices, the estimation of synergetic effects should be complemented by a more rigorous investigation of the acquiring firm. The value component contributed by synergies is conditioned almost fully by uncertain assumptions, which presents a key concern to acquirers (Kode et al., 2003). For a valuation model to account for this acquisition-specific ambiguity, a refining modification to our approach could be to evaluate synergies separately in simulations.

Finally, it is crucial to point out the potential overestimation of risk in interpreting simulation results. We considered that Tiffany & Co. may realize a value below our expected estimate due to both estimation and economic uncertainty. The latter class includes uncertainties internal and external to the firm. Simultaneously, we discounted the expected future cash flows at a rate that already reflects a priced expectation on market risk. Thus, extending the DCF model, which inherently employs a risk-adjusting mechanism, with the presented format of Monte Carlo simulations leads to a partial double-counting of risk (Damodaran, 2018). This overlap only concerns the treatment of risk factors on the general market level and Tiffany's respective sensitivity. However, we deem that estimation uncertainty and idiosyncratic uncertainty are also relevant in an M&A setting, where the acquiring party is likely to lack perfect diversification. In this context, the discount rate may represent an insufficient adjustment for uncertainty, effectively still arguing the case for simulations. Nonetheless, to avoid unreasoned overcautiousness, it is crucial for decision-makers to explicitly acknowledge which sources of uncertainty the valuation model accounts for and in which ways.

9.2 Outlook

The results from employing Monte Carlo simulations for valuing the acquisition of Tiffany & Co. by LVMH show promising applicability to other facets of M&A and areas beyond. Building on the discussed limitations one topic for further investigation is the valuation of synergies. One of the concepts proposed to derive the value of synergies is the definition of real options for which pricing using Monte Carlo simulations has already become a common practice (Loukianova et al., 2017). However, for future research, an adjacent area of examination is presented by employing simulations to value synergetic effects that cannot be carved out as distinct options. For decision-makers, the exclusive simulation of synergies rather than of comprehensive firm value may already address a considerable part of the total uncertainty inherent to M&A valuation.

Another distinct field in M&A where a probabilistic approach to firm valuation can provide decisive insights is the deal category of Leveraged Buyouts (LBOs). As these acquisitions are primarily financed by debt, the development of the target firm's value becomes even more critical than for an all-equity- or cash-funded deal. In the worst case, the acquirer will default on his debt if the target severely underperforms relative to expectations. A distribution of firm value from Monte Carlo simulations can enable the acquirer to assess the riskiness of the deal based on the probability of default, i.e., the chance that the acquired firm realizes a value below the face value of debt used for financing. Again, the buyer can then determine an appropriate acquisition price and respective debt volume based on the highest probability of default they are willing to take on. Furthermore, since LBOs are commonly conducted by financial investors such as private equity funds, the same acquirer may have debt outstanding for numerous acquisitions. In this context, constructing firm value distributions to determine a transaction price in line with the level of risk can extend to monitoring the acquirer's portfolio risk post-acquisition. This type of risk management often follows a Value at Risk (VaR) reasoning that is inherently based on representing asset values through probability distributions (Brealey et al., 2011).

Further advancing within private equity, Monte Carlo simulations can present a powerful tool for evaluating exit risk. Particularly venture capital investments are coined by increased levels of uncertainty (Da Rin & Hellmann, 2020). The consideration thereof leads to high discount rates irreconcilable with empirically observed returns on stocks or other assets (Bhagat, 2014). Therefore, a probability-based assessment of the value of the venture at the expected exit date would allow for the integration of uncertainty while mitigating the inflation of discount rates.

10 Conclusion

Firm valuation in the context of mergers and acquisitions sheds light on the spectrum of values that the buying party, the selling party, and external agents in the market may assign to the same firm. The commonality shared by all of these opinions is an underlying uncertainty in the estimation process as well as in the real economic outcome. Whilst variability in the market is universally anticipated, sharp economic downturns and crises demonstrate the impact of unexpected risks. One of the most recent examples is presented by the Covid-19 pandemic, which not only induced a general economic recession but also distinctively affected the acquisition of Tiffany & Co. by LVMH. Although the deal was already priced and signed in 2019, LVMH displayed a case of buyer's remorse in the face of the novel uncertainty. It was only after a public legal battle and renegotiations with Tiffany that the conglomerate agreed to complete the acquisition – albeit at a lower price.

Based on this background, this thesis pursued a valuation of Tiffany & Co. as the acquisition target while incorporating notions of uncertainty. Fundamentally, Tiffany operates in an attractive environment where future growth will be driven by the generational shift towards Gen Y and Gen Z, as well as the slowed but continued growth of the Chinese economy. However, the financial performance of Tiffany & Co. in recent history lacks continuity in sales growth with no notable improvements in profitability. While this questions the strategic adeptness of the firm to capture the anticipated growth for the luxury industry, it also underlines the potential for LVMH to turn around a weakened firm in a growing and profit-sustaining industry.

In presuming that LVMH will succeed in realizing synergetic value from improving the target's performance, our deterministic DCF valuation shows that the final acquisition price of 131.5 USD per share underpriced Tiffany & Co. by -10.2% relative to an expected share value of 146.4 USD. However, this result does not fully reflect the uncertainty that this expectation will materialize nor the ambiguity we faced in the estimation process. The construction of Tiffany & Co.'s firm value distribution using Monte Carlo simulations addressed these limitations of the static model. Most strikingly, we observed that due to the positive skewness of the obtained distribution, accepting the mean value as the acquisition price would result in a higher chance of overpaying than underpaying for the target. Thus, a more risk-averse decision maker is recommended to set their highest offer price per share at the median of 136.4 USD or lower. Additionally, information on standard deviation and tail behavior of the firm value distribution further contribute to a more sophisticated apprehension of the riskiness of the deal.

These findings affirm our research question regarding the ability of Monte Carlo simulations to provide relevant insights for the pricing of an acquisition target under uncertainty. On a general note, we reiterate that the estimate of a firm's intrinsic value is a hypothetical construct discretionary to the valuer. Monte Carlo simulations introduce an angle on firm value that reduces reliance on a single 'best estimate' and emphasizes the probabilities and riskiness of outcomes. The distributional understanding allows acquirers to integrate tangible considerations on subjective risk tolerance for decision-making, specifically pricing. Therefore, despite an added level of complexity to the deterministic DCF model, we deem the use of simulations a powerful tool for firm valuation.

Bibliography

Abtan, O., Barton, C., Bonelli, F., Gurzki, H., Mei-Pochtler, A., Pianon, N., & Tsusaka, M. (2016). *Digital or Die: The Choice for Luxury Brands*. Boston Consulting Group.

Adnan, A., & Hossain, A. (2016). Impact of M&A Announcement on Acquiring and Target Firm's Stock Price: An Event Analysis Approach. *International Journal of Finance and Accounting*, *5*(5), 228–232. https://doi.org/10.5923/j.ijfa.20160505.02

Adrian, T., Boyarchenko, N., Giannone, D., Bok, B., Carriero, A., Cochrane, J., Crump, R., Chen, X., Davis, J., Negro, M. Del, Engle, R., Ghysels, E., Hamilton, J., Li, Q., Ludvigson, S., Phillips, P., Schmidt, L., & Vogt, E. (2016). *Vulnerable Growth*. Federal Reserve Bank of New York.

Agrawal, A. (2016). *How Tiffany & Co. Built A Marketing Empire*. Forbes. https://www.forbes.com/sites/ajagrawal/2016/01/04/how-tiffany-and-co-built-a-marketing-empire/?sh=4ec38d701c30

Alexander, C. (2008). *Quantitative Methods in Finance* (Vol. 1). John Wiley & Sons Ltd.

Alfaranoa, S., Milakovićb, M., Irlec, A., & Kauschkec, J. (2012). A statistical equilibrium model of competitive firms. *Journal of Economic Dynamics and Control*, *36*(1), 136–149. https://doi.org/10.1016/j.jedc.2011.07.002

Armstrong, M., Galli, A., Bailey, W., & Couët, B. (2004). Incorporating technical uncertainty in real option valuation of oil projects. *Journal of Petroleum Science and Engineering*, *44*(1–2), 67–82. https://doi.org/10.1016/j.petrol.2004.02.006

Arnett, G. (2019, November 1). *How LVMH might grow Tiffany & Co.* Vogue Business. https://www.voguebusiness.com/companies/lvmh-tiffany-and-co-acquisition-china

Arrigo, E. (2015). The role of the flagship store location in luxury branding. An international exploratory study. *International Journal of Retail and Distribution Management, 43*(6), 518–537. https://doi.org/10.1108/IJRDM-08-2013-0158

Bakhtiari, K. (2020). *Why Brands Need To Pay Attention To Cancel Culture*. Forbes. https://www.forbes.com/sites/kianbakhtiari/2020/09/29/why-brands-need-to-pay-attention-to-cancel-culture/?sh=1af9946d645e

Bancel, F., Lathuille, Q., & Lhuissier, A. (2013). *Why is "your" WACC necessarily wrong?*

Bargeron, S. (2019). *Will Trump's Tariffs Affect Luxury Fashion?* https://www.ordre.com/en/news/will-new-tariffs-in-the-us-affect-luxury-fashion-1217

Baum, J. R., & Wally, S. (2003). Strategic decision speed and firm performance. *Strategic Management Journal*, *24*(11), 1107–1129. https://doi.org/10.1002/smj.343

Berk, J., & DeMarzo, P. (2017). *Corporate Finance* (A. D'Ambrosio, Ed.; 4th ed.). Pearson Education.

Bhagat, S. (2014). Why do venture capitalists use such high discount rates? *Journal of Risk Finance*, *15*(1), 94–98. https://doi.org/10.1108/JRF-08-2013-0055

Bhagwat, V., Dam, R., Harford, J., Burch, T., Chalmers, J., Guercio, D. Del, Gutierrez, R., Krishnan, K., Lewellen, K., Officer, M., & Rau, R. (2016). *The Real Effects of Uncertainty on Merger Activity*.

Bhasin, K. (2018). *Tiffany & Co. Has Built a Secret Lab to Crush Its Rivals*. Bloomberg. https://www.bloomberg.com/news/articles/2018-07-18/tiffany-amp-co-has-built-a-secret-lab-of-shiny-dreams#xj4y7vzkg

Biondi, A. (2020). *Increasing prices in Covid-19? Chanel, Louis Vuitton show it works*. Vogue Business. https://www.voguebusiness.com/companies/price-increase-china-louis-vuitton-chanel-gucci-covid-19

Bottazzi, G., & Secchi, A. (2006). Explaining the Distribution of Firm Growth Rates. *RAND Journal of Economics*, *37*(2), 235–256. https://doi.org/10.1111/j.1756-2171.2006.tb00014.x

Brealey, R. A., Myers, S. C., & Allen, F. (2011). *Principles of corporate finance*. McGraw-Hill/Irwin.

Briggs, F. (2015). *Christian Louboutin, Tiffany & Co. And Valentino Lead Luxury Brands On Social Media, Study Shows*. Forbes. https://www.forbes.com/sites/fionabriggs/2015/12/11/christian-louboutin-tiffany-co-and-valentino-lead-luxury-brands-on-social-media-study-shows/?sh=24c42289368c

Bright Line Watch. (2020). *Impeachment and the state of U.S. democracy - March 2020 survey*. http://brightlinewatch.org/impeachment-and-the-state-of-u-s-democracy-bright-line-watch-march-march-2020-survey/

Cavender, R. C., & Kincade, D. H. (2014). Management of a luxury brand: Dimensions and sub-variables from a case study of LVMH. *Journal of Fashion Marketing and Management*, *18*(2), 231–248. https://doi.org/10.1108/JFMM-03-2013-0041

Cho, H. J., & Pucik, V. (2005). Relationship between innovativeness, quality, growth, profitability, and market value. *Strategic Management Journal*, *26*(6), 555–575. https://doi.org/10.1002/smj.461

Constable, H. (2020). *The sparkling rise of the lab grown diamond*. BBC. https://www.bbc.com/future/article/20200207-the-sparkling-rise-of-the-lab-grown-diamond

Cont, R. (2001). Empirical properties of asset returns: stylized facts and statistical issues. *Quantitative Finance*, *1*(2), 223–236. https://doi.org/10.1080/713665670

Crawford, M. (2021). *Lab-grown diamonds are transforming the face of luxury*. https://www.highsnobiety.com/p/lab-grown-diamonds/

Da Rin, M., & Hellmann, T. (2020). *Fundamentals of Entrepreneurial Finance* (1st ed.). Oxford University Press.

Da, Z., Guo, R.-J., Jagannathan, R., Chirinko, B., Dittmar, B., Grundy, B., Murphy, D., Schaumburg, E., Schwert, B., Sharpe, W., Sher, M., Warachka, M., Yan, H., Yang, W., Yu, J., & Guo, J. (2009). *CAPM for Estimating the Cost of Equity Capital: Interpreting the Empirical Evidence* (No. 14889). http://www.nber.org/papers/w14889

Damodaran, A. (2007). *Probabilistic approaches: scenario analysis, decision trees and simulations*. https://pages.stern.nyu.edu/~adamodar/pdfiles/papers/probabilistic.pdf

Damodaran, A. (2013). *Living with Noise: Valuation in the Face of Uncertainty*. NYU Stern. https://ssrn.com/abstract=2684015

Damodaran, A. (2018). *Facing Up To Uncertainty: Using Probabilistic Approaches In Valuation*. https://ssrn.com/abstract=3237778https://ssrn.com/abstract=3237778

Damodaran, A. (2020). *Levered and Unlevered Betas by Industry 2020*. NYU Stern. https://pages.stern.nyu.edu/~adamodar/New_Home_Page/datacurrent.html

Damodaran, A. (2022). *Ratings, Spreads and Interest Coverage Ratios 2015-2022*. NYU Stern. https://pages.stern.nyu.edu/~adamodar/New_Home_Page/dataarchived.html#capstru

Damodaran, A. (2023). *Implied Equity Risk Premiums - United States 1960-2022*. NYU Stern. https://pages.stern.nyu.edu/~adamodar/New_Home_Page/datacurrent.html

D'arpizio, C., & Levato, F. (2020). *Bain-Altagamma 2020 Worldwide Luxury Market Monitor*. Bain & Comapny.

De Kerviler, G., & Rodriguez, C. M. (2019). Luxury brand experiences and relationship quality for Millennials: The role of self-expansion. *Journal of Business Research*, *102*, 250–262. https://doi.org/10.1016/j.jbusres.2019.01.046

DeBeers Group. (2021). *Diamond Insight Report*.

Demirakos, E. G., Strong, N. C., & Walker, M. (2004). What Valuation Models Do Analysts Use? *Accounting Horizons*, *18*(4), 221–240. https://doi.org/10.2308/acch.2004.18.4.221

Dizikes, P. (2010). *Explained: Knightian uncertainty*. MIT News. https://news.mit.edu/2010/explained-knightian-0602

Dobbs, M. E. (2014). Guidelines for applying Porter's five forces framework: A set of industry analysis templates. *Competitiveness Review*, *24*(1), 32–45. https://doi.org/10.1108/CR-06-2013-0059

Dorfleitner, G., Rößle, F., & Lesser, K. (2019). The financial performance of the most valuable brands: A global empirical investigation. *Heliyon*. https://doi.org/10.1016/j.heliyon.2019

Eccles, R. G., Lanes, K. L., & Wilson, T. C. (1999). Are You Paying Too Much for That Acquisition? *Harvard Business Review*, *77*(4), 136–186.

Elsner, S., & Krumholz, H. C. (2013). Corporate valuation using imprecise cost of capital. *Journal of Business Economics*, *83*(9), 985–1014. https://doi.org/10.1007/s11573-013-0687-z

Erlingsson, E. J., Alfarano, S., Raberto, M., & Stefánsson, H. (2012). On the distributional properties of size, profit and growth of Icelandic firms. *Journal of Economic Interaction and Coordination*. https://doi.org/10.1007/s11403-012-0103-8

Farrell, J., & Klemperer, P. (2007). Coordination and Lock-In: Competition with Switching Costs and Network Effects. In *Handbook of Industrial Organization* (Vol. 3, pp. 1967–2072).

Faulkner, T. W. (1996). Applying "Options Thinking" To R&D Valuation. *Research Technology Management*, *39*(3), 50–56. https://doi.org/10.1080/08956308.1996.11671064

French, N., & Gabrielli, L. (2004). The Uncertainty of Valuation. *Journal of Property Investment & Finance*, *22*(6), 484–500. https://doi.org/10.1108/14635780410569470

French, N., & Gabrielli, L. (2005). Discounted Cash Flow: Accounting for Uncertainty. *Journal of Property Investment & Finance*, *23*(1), 75–89. https://doi.org/10.1108/14635780510575102

Gomelsky, V. (2022). *Houses like Bulgari, Cartier and Prada are expanding their factories and adding new product lines*. The New York Times. https://www.nytimes.com/2022/11/21/fashion/jewelry-growth-bulgari-cartier-tiffany.html

Gschwandtner, A. (2010). Evolution of Profit Persistence in the US: Evidence from Three Periods. *The Manchester School*, *80*(2), 172–209. https://doi.org/10.1111/j.1467-9957.2011.02277.x

He, L. (2020). *A US-China trade war is the last thing the world economy needs now*. CNN Business. https://www.cnn.com/2020/05/19/economy/us-china-trade-war-resume-coronavirus-intl-hnk/index.html

Hertz, D. B. (1979). Risk analysis in capital investment. *Harvard Business Review*, *57*(5), 169–181.

Ho, H. C., Awan, M. A., & Khan, H. U. (2016). Luxury Brands and Corporate Social Responsibility: A perspective on consumers' preferences. *Journal of International Management Studies*, *16*(1), 77–81.

Hoesli, M., Jani, E., & Bender, A. (2005). *Monte Carlo Simulations for Real Estate Valuation* (No. 148). https://doi.org/10.1108/14635780610655076

Hughes, M. Ü., Bendoni, W. K., & Pehlivan, E. (2016). Storygiving as a co-creation tool for luxury brands in the age of the internet: a love story by Tiffany and thousands of lovers. *Journal of Product and Brand Management*, *25*(4), 357–364. https://doi.org/10.1108/JPBM-09-2015-0970

Hwang, Y., Ko, E., & Megehee, C. M. (2014). When higher prices increase sales: How chronic and manipulated desires for conspicuousness and rarity moderate price's impact on choice of luxury brands. *Journal of Business Research*, *67*(9), 1912–1920. https://doi.org/10.1016/j.jbusres.2013.11.021

Iglesias, O., Ind, N., & Schultz, M. (2020). History matters: The role of history in corporate brand strategy. *Business Horizons*, *63*(1), 51–60. https://doi.org/10.1016/j.bushor.2019.09.005

Ijaouane, V., & Kapferer, J.-N. (2012). Developing Luxury Brands Within Luxury Groups – Synergies Without Dilution? *Marketing Review St. Gallen*, 24–29. https://doi.org/10.1007/s11621-012-0107-8

IMAA. (2023). *M&A Statistics: Transactions and Activity by year*. Institute for Mergers, Acquisitions & Alliances. https://imaa-institute.org/mergers-and-acquisitions-statistics/

IMF. (2020). *World Economic Outlook. A Long and Difficult Ascent*. International Monetary Fund. https://www.imf.org/en/Publications/WEO/Issues/2020/09/30/world-economic-outlook-october-2020

Jacquier, E., Kane, A., & Marcus, A. J. (2005). Optimal estimation of the risk premium for the long run and asset allocation: A case of compounded estimation risk. *Journal of Financial Econometrics*, *3*(1), 37–55. https://doi.org/10.1093/jjfinec/nbi001

Jain, S. P., & Maheswaran, D. (2000). Motivated Reasoning: A Depth-of Processing Perspective. *Journal of Consumer Research*, *26*, 358–371. https://doi.org/10.1086/209568

Jensen, E. (2020). *What Does it Mean for Fashion to Be Aspirational in 2020?* Hypebeast. https://hypebeast.com/2020/7/luxury-fashion-diversity-officers-black-lives-matter-gucci-prada-burberry-chanel

Johnes, G., & Johnes, J. (2013). The persistence of efficiency. *Expert Systems with Applications*, *40*(14), 5661–5672. https://doi.org/10.1016/j.eswa.2013.05.014

Karaevli, A., & Özcan, S. (2022). Why Some CFOs Make Better M&A Deals. *MIT Sloan Management Review*, *63*(4), 78–84.

Kelliher, C. F., & Mahoney, L. S. (2000). Using Monte Carlo Simulation to Improve Long-Term Investment Decisions. *The Appraisal Journal*, *68*(1), 44–56.

Knight, F. (1921). *Risk, Uncertainty, and Profit* (1st ed.). Houghton Mifflin Company.

Kode, G. V. M., Ford, J. C., & Sutherland, M. M. (2003). A conceptual model for evaluation of synergies in mergers and acquisitions: A critical review of the literature. *South African Journal of Business Management*, *34*(1). https://doi.org/10.4102/sajbm.v34i1.675

Koller, T., Goedhart, M., & Wessels, D. (2020). *Valuation* (7th ed.). John Wiley & Sons, Inc.

Kroll Cost of Capital Resource Center. (2020). *Kroll Recommended U.S. Equity Risk Premium and Corresponding Risk-free Rates; January 2008–Present*. https://www.kroll.com/-/media/cost-of-capital/kroll-us-erp-rf-table-2022.pdf

Lei, D., & Hitt, M. A. (1995). Strategic Restructuring and Outsourcing: The Effect of Mergers and Acquisitions and LBOs on Building Firm Skills and Capabilities. *Journal of Management, 21*(5), 835–859. https://doi.org/10.1177/014920639502100502

Leland, H. E., Ekern, S., Ferson, W., Grinblatt, M., Kahn, R., Rubinstein, M., Sheikh, A., & Stefek, D. (1999). Beyond Mean-Variance: Risk and Performance Measurement in a Nonsymmetrical World. *Financial Analysts Journal*, *55*(1), 27–36. https://doi.org/10.2469/faj.v55.n1.2239

Linde, O., & Epstein, A. (2019). *The Global Diamond Industry 2019*. Bain & Company.

Liu, X., Burns, A. C., & Hou, Y. (2013). Comparing online and in-store shopping behavior towards luxury goods. *International Journal of Retail and Distribution Management*, *41*(11), 885–900. https://doi.org/10.1108/IJRDM-01-2013-0018

Loizou, P., & French, N. (2012). Risk and uncertainty in development: A critical evaluation of using the Monte Carlo simulation method as a decision tool in real estate development projects. *Journal of Property Investment and Finance*, *30*(2), 198–210. https://doi.org/10.1108/14635781211206922

Loukianova, A., Nikulin, E., & Vedernikov, A. (2017). Valuing synergies in strategic mergers and acquisitions using the real options approach. *Investment Management and Financial Innovations*, *14*(1), 236–247. https://doi.org/10.21511/imfi.14(1-1).2017.10

Luehrman, T. A. (1997). What's it Worth? *Harvard Business Review*, *75*(3), 132–142.

Martynova, M., Oosting, S., & Renneboog, L. (2006). The long-term operating performance of European mergers and acquisitions. In *International Mergers and Acquisitions Activity Since 1990* (pp. 79–116). Elsevier. https://doi.org/10.1016/B978-075068289-3.50006-X

Martynova, M., & Renneboog, L. (2008). A century of corporate takeovers: What have we learned and where do we stand? *Journal of Banking and Finance*, *32*(10), 2148–2177. https://doi.org/10.1016/j.jbankfin.2007.12.038

Meucci, A., & Loregian, A. (2016). Neither "Normal" nor "Lognormal": Modeling Interest Rates Across all Regimes. *Financial Analysts Journal*, *72*(3). https://doi.org/10.2469/faj.v72.n3.7

Milnes, H. (2018). *How Tiffany is reaching out to Chinese millennials on Tmall*. https://www.glossy.co/fashion/how-tiffany-is-reaching-out-to-chinese-millennials-on-tmall/

Muret, D. (2019). *Bulgari overhauls its distribution*. Fashion Network. https://ww.fashionnetwork.com/news/Bulgari-overhauls-its-distribution,1166596.html

OECD. (2018). *The LONG VIEW: SCENARIOS FOR THE WORLD ECONOMY TO 2060* (No. 22; OECD Economic Policy Paper).

Officer, M. S. (2004). Collars and renegotiation in mergers and acquisitions. In *Journal of Finance* (Vol. 59, Issue 6, pp. 2719–2743). Blackwell Publishing Ltd. https://doi.org/10.1111/j.1540-6261.2004.00714.x

Pellegrino, G. (2018). Barriers to innovation in young and mature firms. *Journal of Evolutionary Economics*, *28*(1), 181–206. https://doi.org/10.1007/s00191-017-0538-0

Plenborg, T., & Kinserdal, F. (2021). *Financial Statement Analysis: Valuation, Credit Analysis, Performance Evaluation* (2nd ed.). Fagbokforlaget.

Popper, N. (2012). *Turning Diamonds Into a Commodity to Be Traded*. The New York Times. https://www.nytimes.com/2012/04/14/business/turning-diamonds-into-a-must-have-commodity.html

Porter, M. E. (2008). The Five Competitive Forces That Shape Strategy. *Harvard Business Review*, *86*(1), 78–93.

Raychaudhuri, S. (2008). Introduction to Monte Carlo Simulation. *2008 Winter Simulation Conference*, 91–100. https://doi.org/10.1109/WSC.2008.4736059

Remer, S., Hwee Ang, S., & Baden-Fuller, C. (2001). Dealing with uncertainties in the biotechnology industry: The use of real options reasoning. *Journal of Commercial Biotechnology*, *8*(2), 95–105. https://doi.org/10.5912/jcb419

Rhodes-Kropf, M., & Viswanathan, S. (2004). Market Valuation and Merger Waves. *The Journal of Finance*, *59*(6), 2685–2718. https://doi.org/10.1111/j.1540-6261.2004.00713.x

Rugman, A. (2001). The End of Global Strategy. *European Management Journal*, *19*(4), 333–343. https://doi.org/10.1016/S0263-2373(01)00035-4

Salehzadeh, R., & Pool, J. K. (2017). Brand Attitude and Perceived Value and Purchase Intention toward Global Luxury Brands. *Journal of International Consumer Marketing*, *29*(2), 74–82. https://doi.org/10.1080/08961530.2016.1236311

Salvidio & Partners. (2018). *Industry Betas. Levered and Unlevered*.

Schlossberg, M. (2016). *Tiffany Sales Are Down*. Business Insider. https://www.businessinsider.com/tiffany-sales-are-down-2016-1?r=US&IR=T

Singh, M., & Davidson, W. N. (2003). Agency costs, ownership structure and corporate governance mechanisms. *Journal of Banking and Finance*, *27*(5), 793–816. https://doi.org/10.1016/S0378-4266(01)00260-6

S&P Global Ratings. (2019). *China's GDP growth to average 4.6% through 2030 in "inescapable" slowdown*. S&P Global. https://www.spglobal.com/marketintelligence/en/news-insights/trending/gofxsdup_3v7m-h94c0i6g2

Stanley, M. H. R., Amaral, L. A. N., Buldyrev, S. V., Havlin, S., Leschhorn, H., Maass, P., Salinger, M. A., & Stanley, H. E. (1996). Scaling behaviour in the growth of companies. *Nature*, *379*, 804–806. https://doi.org/https://doi.org/10.1038/379804a0

Steiger, F. (2008). *The Validity of Company Valuation Using Discounted Cash Flow Methods*.

Stimolo, S. (2019). *Tiffany diamonds on blockchain? A traceability project has been announced*. Cryptonomist. https://en.cryptonomist.ch/2019/01/15/tiffany-diamonds-on-blockchain/

Stoll, J. D. (2018, September 1). *Tiffany's $250 Million Bet on a 78-Year-Old Store*. Wall Street Journal. https://www.wsj.com/articles/tiffanys-250-million-bet-on-a-78-year-old-store-1535774938

Tiffany & Co. (2014). *Annual Report 2013*.

Tiffany & Co. (2015). *Annual Report 2014*.

Tiffany & Co. (2016). *Annual Report 2015*.

Tiffany & Co. (2017). *Annual Report 2016*.

Tiffany & Co. (2018). *Annual Report 2017*.

Tiffany & Co. (2019). *Annual Report 2018*.

Tiffany & Co. (2020a). *Annual Report 2019*.

Tiffany & Co. (2020b). *Form 10-Q for Q3 2020*. www.sec.gov.

Truong, Y., & McColl, R. (2011). Intrinsic motivations, self-esteem, and luxury goods consumption. *Journal of Retailing and Consumer Services*, *18*(6), 555–561. https://doi.org/10.1016/j.jretconser.2011.08.004

Whaley, R. E. (2009). Understanding the VIX. *Journal of Portfolio Management; Spring*, *35*(3), 98–105. https://doi.org/10.3905/jpm.2009.35.3.098

White, S., & Aloisi, S. (2020, September 10). *LVMH to counter sue Tiffany in fight over troubled takeover*. Reuters. https://www.reuters.com/article/us-tiffany-m-a-lvmh-idUKKBN2611XS

Wilcox, K., Kim, H. M., College, B., Cuny, /, Kim, M., & Sen, S. (2009). Why Do Consumers Buy Counterfeit Luxury Brands? *Journal of Marketing Research*, *46*(2), 247–259. https://doi.org/10.1509/jmkr.46.2.247

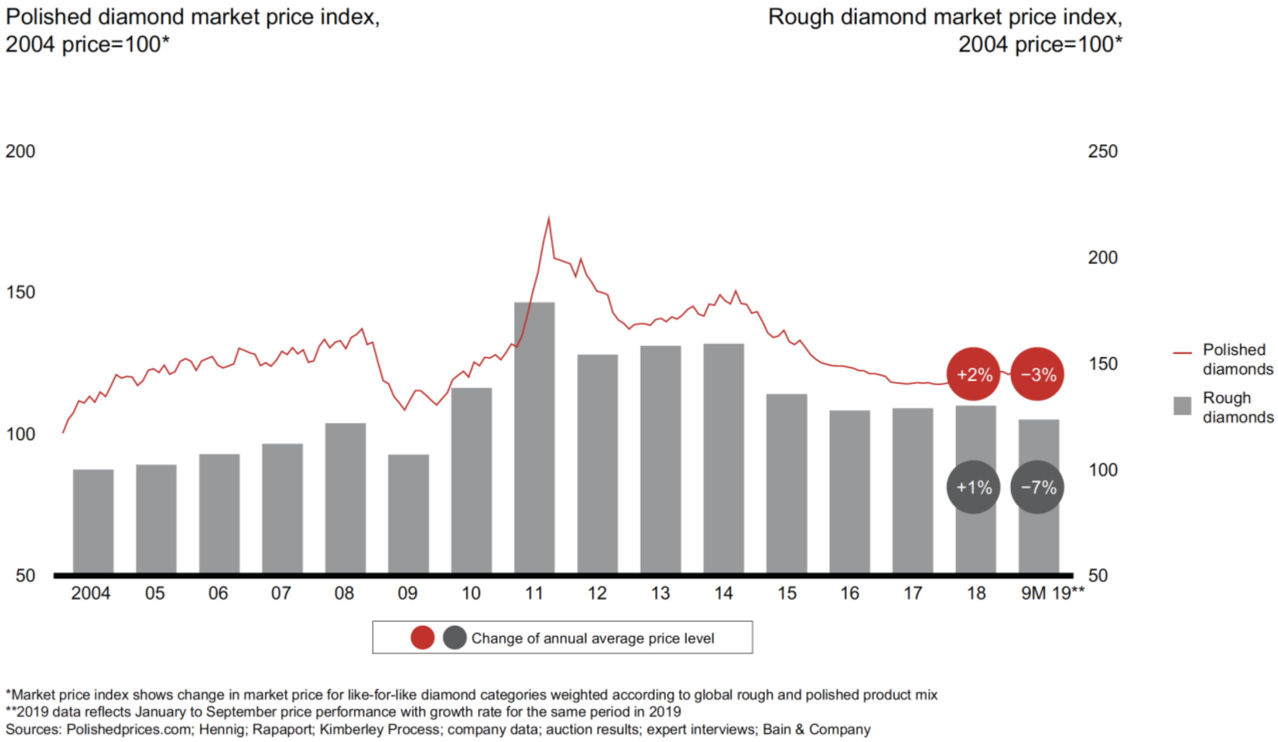
Williams, M. A., Baek, G., Li, Y., Park, L. Y., & Zhao, W. (2017). Global evidence on the distribution of GDP growth rates. *Physica A: Statistical Mechanics and Its Applications*, *468*, 750–758. https://doi.org/10.1016/j.physa.2016.11.124

Wong, A. C. S., & Chan, W.-S. (2005). Mixture Gaussian Time Series Modeling of Long-Term Market Returns. *North American Actuarial Journal*, *9*(4), 83–94. https://doi.org/10.1080/10920277.2005.10596227

Wuestefeld, T., Hennigs, N., Schmidt, S., & Wiedmann, K.-P. (2012). The impact of brand heritage on customer perceived value. *Der Markt*, *51*(2–3), 51–61. https://doi.org/10.1007/s12642-012-0074-2

Appendix

Appendix 1: Rough and polished prices and trading volume from the "The Global Diamond Industry 2019" report (Linde & Epstein, 2019, p.4)



Appendix 2: Tiffany & Co.'s original income statement

mUSD	2013	2014	2015	2016	2017	2018	2019	Sept 30 2020 YTD
Net sales	**4,031**	**4,250**	**4,105**	**4,002**	**4,170**	**4,442**	**4,424**	**2,311**
Americas	1,927	2,034	1,947	1,842	1,871	1,960	1,924	826
Asia-Pacific	945	1,025	1,003	999	1,095	1,239	1,258	854
Japan	579	554	541	604	596	643	650	353
Europe	470	513	506	458	489	504	498	249
Other	111	124	108	99	119	95	94	28
Cost of sales	(1,691)	(1,713)	(1,614)	(1,512)	(1,559)	(1,631)	(1,662)	(897)
Gross profit	**2,340**	**2,537**	**2,491**	**2,490**	**2,611**	**2,811**	**2,762**	**1,414**
Selling, general and administrative expenses	(1,556)	(1,646)	(1,731)	(1,769)	(1,801)	(2,021)	(2,029)	(1,295)
Arbitration award expense	(480)	-	-	-	-	-	-	-
EBIT	**304**	**891**	**760**	**721**	**809**	**790**	**733**	**119**
Interest expenses and financial costs	(63)	(63)	(49)	(46)	(42)	(40)	(39)	(32)
Other (income) expenses, net	13	3	(1)	1	(7)	(7)	(4)	21
Loss on exstinguishment of debt	-	(94)	-	-	-	-	-	-
Total financing (income) expenses	(49)	(154)	(50)	(45)	(49)	(47)	(42)	(11)
EBT	**255**	**738**	**710**	**677**	**761**	**744**	**690**	**108**
Income taxes	(74)	(253)	(246)	(231)	(390)	(157)	(149)	(22)
Net earnings	**181.4**	**484.2**	**463.9**	**446.1**	**370.1**	**586.4**	**541.1**	**86.3**

Appendix 3: Tiffany & Co.'s original balance sheet

mUSD	2013	2014	2015	2016	2017	2018	2019	Sept 30 2020 YTD
ASSETS								
Cash and cash equivalents	346	730	844	928	971	793	875	1,146
Short-term investments	21	2	43	58	321	63	23	-
Accounts receivable, net	189	195	206	227	231	245	240	200
Inventories, net	2,327	2,362	2,225	2,158	2,254	2,428	2,464	2,485
Prepaid expenses and other current assets	245	220	190	203	207	231	274	319
Total current assets	**3,128**	**3,509**	**3,508**	**3,574**	**3,983**	**3,760**	**3,876**	**4,150**
Operating lease right-of-use assets	-	-	-	-	-	-	1,103	1,108
PPE, net	855	900	936	932	991	1,027	1,099	1,112
Deferred income taxes	379	426	383	302	188	216	225	229
Other assets, net	391	346	295	290	306	331	358	337
Total non-current assets	**1,625**	**1,672**	**1,613**	**1,524**	**1,485**	**1,574**	**2,785**	**2,785**
Total assets	**4,753**	**5,181**	**5,122**	**5,098**	**5,468**	**5,333**	**6,660**	**6,935**
LIABILITIES AND STOCKHOLDERS EQUITY								
Short-term borrowings	252	234	222	229	121	113	148	543
Current portion of long-term debt	-	-	84	-	-	-	-	-
Accounts payable and accrued liabilities	342	318	329	313	437	513	542	440
Current portion of operating lease liabilities	-	-	-	-	-	-	203	225
Income taxes payable	32	40	27	22	89	21	16	23
Merchandise credits and deferred revenue	70	66	68	69	77	70	62	69
Total current liabilities	**697**	**658**	**730**	**633**	**725**	**718**	**970**	**1,300**
Long-term debt	751	883	790	878	883	883	884	888
Pension/postretirement benefit obligations	268	524	428	319	287	312	375	381
Deferred gains on sale-leasebacks	82	65	55	46	41	31	-	-
Long-term portion of operating lease liabilities	-	-	-	-	-	-	1,008	996
Other long-term liabilities	221	201	189	194	284	257	87	91
Total non-current liabilities	**1,322**	**1,672**	**1,462**	**1,436**	**1,495**	**1,484**	**2,354**	**2,357**
Preferred stock	-	-	-	-	-	-	-	-
Common stock	1	1	1	1	1	1	1	1
Additional paid-in capital	1,095	1,174	1,176	1,190	1,256	1,275	1,387	1,409
Retained earnings	1,682	1,951	2,013	2,078	2,114	2,046	2,208	2,079
Accumulated other comprehensive loss, net of tax	(59)	(290)	(278)	(256)	(138)	(205)	(273)	(221)
Non-controlling interests	14	16	18	15	15	14	13	12
Total stockholders' equity	**2,734**	**2,851**	**2,930**	**3,028**	**3,248**	**3,131**	**3,335**	**3,279**
Total liabilities	**4,753**	**5,181**	**5,122**	**5,098**	**5,468**	**5,333**	**6,660**	**6,935**

Appendix 4: Tiffany & Co.'s analytical income statement (with effective tax rates)

mUSD	2013	2014	2015	2016	2017	2018	2019	Sept 30 2020 YTD
Net sales	**4,031**	**4,250**	**4,105**	**4,002**	**4,170**	**4,442**	**4,424**	**2,311**
Americas	1,927	2,034	1,947	1,842	1,871	1,960	1,924	826
Asia-Pacific	945	1,025	1,003	999	1,095	1,239	1,258	854
Japan	579	554	541	604	596	643	650	353
Europe	470	513	506	458	489	504	498	249
Other	111	124	108	99	119	95	94	28
Cost of sales	(1,691)	(1,713)	(1,614)	(1,512)	(1,559)	(1,631)	(1,662)	(897)
Gross profit	**2,340**	**2,537**	**2,491**	**2,490**	**2,611**	**2,811**	**2,762**	**1,414**
Selling, general and administrative expenses	(1,385)	(1,461)	(1,537)	(1,544)	(1,593)	(1,800)	(1,748)	(1,048)
EBITDA	**956**	**1,076**	**954**	**947**	**1,018**	**1,011**	**1,014**	**366**
Depreciation and amortization	(181)	(194)	(203)	(209)	(207)	(229)	(260)	(204)
Amortization of gain on sale-leaseback	10	9	8	9	8	8	-	-
Depreciation and amortization, net	(171)	(185)	(194)	(200)	(199)	(221)	(260)	(204)
EBIT before non-recurring items	**784**	**891**	**760**	**747**	**819**	**790**	**754**	**162**
Income taxes on operating income	(226)	(306)	(263)	(254)	(263)	(167)	(163)	(33)
NOPAT before non-recurring operating items	**558**	**585**	**497**	**492**	**556**	**623**	**591**	**129**
Non-recurring operating items, pre-tax	(480)	-	-	(25)	(10)	-	(21)	(43)
Expenses related to M&A	-	-	-	-	-	-	(21)	(43)
Arbitration award expense	(480)	-	-	-	-	-	-	-
Asset impairment charges	-	-	-	(25)	(10)	-	-	-
Tax shield (expense) from non-recurring operating items	138	-	-	9	3	-	5	9
Non-recurring operating (income) expenses, post-tax	(342)	-	-	(17)	(7)	-	(17)	(34)
NOPAT after non-recurring operating items	**217**	**585**	**497**	**476**	**549**	**623**	**574**	**95**
Interest and other fianncial expenses, pre-tax	(49)	(154)	(50)	(45)	(49)	(47)	(42)	(11)
Interest expenses and financial costs	(63)	(63)	(49)	(46)	(42)	(40)	(39)	(32)
Other financial income (expenses), net	13	3	(1)	1	(7)	(7)	(4)	21
Loss on exstinguishment of debt	-	(94)	-	-	-	-	-	-
Tax shield (expense) from financial items	14	53	17	15	16	10	9	2
Interest and other financial expenses, post-tax	(35)	(101)	(33)	(29)	(33)	(37)	(33)	(9)
Non-recurring tax item: Charges related to US Tax Act	-	-	-	-	(146)	-	-	-
Net income	**181**	**484**	**464**	**446**	**370**	**586**	**541**	**86**
Effective tax rate (derived)	*28.8%*	*34.3%*	*34.7%*	*34.1%*	*51.3%*	*21.1%*	*21.6%*	*20.2%*
Effective tax rate (normalized for one-off charges)	***28.8%***	***34.3%***	***34.7%***	***34.1%***	***32.1%***	***21.1%***	***21.6%***	***20.2%***

Appendix 5: Tiffany & Co. analytical balance sheet (1/2)

mUSD	2013	2014	2015	2016	2017	2018	2019	Sept 30 2020 YTD
OPERATING								
Operating assets								
Accounts receivable, net	189	195	206	227	231	245	240	200
Inventories, net	2,327	2,362	2,225	2,158	2,254	2,428	2,464	2,485
Prepaid expenses and other current assets	245	220	190	203	207	231	274	319
Total current operating assets	**2,760**	**2,777**	**2,622**	**2,588**	**2,692**	**2,904**	**2,978**	**3,004**
PPE, net	855	900	936	932	991	1,027	1,099	1,112
Operating lease right-of-use assets	-	-	-	-	-	-	1,103	1,108
Other assets, net	391	346	295	290	306	331	358	337
Total non-current operating assets	**1,246**	**1,246**	**1,230**	**1,222**	**1,297**	**1,358**	**2,559**	**2,557**
Total operating assets	***4,006***	***4,023***	***3,852***	***3,810***	***3,989***	***4,262***	***5,538***	***5,561***
Operating liabilities								
Accounts payable and accrued liabilities	342	318	329	313	437	513	542	440
Current portion of operating lease liabilities	-	-	-	-	-	-	203	225
Merchandise credits and deferred revenue	70	66	68	69	77	70	62	69
Total current operating liabilities	**412**	**384**	**397**	**382**	**515**	**583**	**806**	**734**
Long-term portion of operating lease liabilities	-	-	-	-	-	-	1,008	996
Deferred gains on sale-leasebacks	82	65	55	46	41	31	-	-
Total non-current operating liabilities	**82**	**65**	**55**	**46**	**41**	**31**	**1,008**	**996**
Total operating liabilities	***494***	***449***	***452***	***428***	***555***	***614***	***1,815***	***1,730***
Invested capital (net operating assets)	**3,512**	**3,575**	**3,400**	**3,382**	**3,433**	**3,648**	**3,723**	**3,831**

Appendix 5: Tiffany & Co.'s analytical balance sheet (2/2)

FINANCING								
Total stockholders' equity	*2,734*	*2,851*	*2,930*	*3,028*	*3,248*	*3,131*	*3,335*	*3,279*
Financing liabilities								
Short-term borrowings	252	234	222	229	121	113	148	543
Current portion of long-term debt	-	-	84	-	-	-	-	-
Income taxes payable	32	40	27	22	89	21	16	23
Total current financing liabilities	**284**	**274**	**333**	**251**	**210**	**135**	**164**	**566**
Long-term debt	751	883	790	878	883	883	884	888
Pension/postretirement benefit obligations	268	524	428	319	287	312	375	381
Other long-term liabilities	221	201	189	194	284	257	87	91
Total non-current financing liabilities	**1,240**	**1,607**	**1,407**	**1,391**	**1,455**	**1,453**	**1,346**	**1,360**
Total financing liabilities	*1,524*	*1,881*	*1,740*	*1,641*	*1,665*	*1,588*	*1,510*	*1,926*
Financing assets								
Cash and cash equivalents	346	730	844	928	971	793	875	1,146
Short-term investments	21	2	43	58	321	63	23	-
Total current financing assets	**367**	**732**	**887**	**986**	**1,291**	**855**	**897**	**1,146**
Deferred income taxes	379	426	383	302	188	216	225	229
Total non-current financing assets	**379**	**426**	**383**	**302**	**188**	**216**	**225**	**229**
Total financing assets	*747*	*1,158*	*1,269*	*1,288*	*1,479*	*1,071*	*1,123*	*1,374*
Net interest-bearing liabilities (NIBL)	**778**	**724**	**471**	**354**	**185**	**517**	**388**	**552**
Invested capital (financing)	**3,512**	**3,575**	**3,400**	**3,382**	**3,433**	**3,648**	**3,723**	**3,831**

Appendix 6: Historical sales growth: reported vs. constant exchange rate basis

	2013	2014	2015	2016	2017	2018	2019
Net sales growth (reported)	6%	5%	-3%	-3%	4%	7%	0%
Net sales growth (constant exchange rate basis)	10%	7%	2%	-3%	4%	6%	1%

Appendix 7: Tiffany & Co.'s ROIC, NOPAT margin, and ATO ratio

	2013	2014	2015	2016	2017	2018	2019	Sept 30 2020 YTD
ROIC	15.9%	16.4%	14.6%	14.6%	16.2%	17.1%	15.9%	3.4%
NOPAT margin	13.8%	13.8%	12.1%	12.3%	13.3%	14.0%	13.4%	5.6%
ATO ratio	1.15	1.19	1.21	1.18	1.21	1.22	1.19	0.60

Appendix 8: ROIC of Tiffany & Co. and LVMH

	2013	2014	2015	2016	2017	2018	2019	Sept 30 2020 YTD
Tiffany & Co.	15.9%	16.4%	14.6%	14.6%	16.2%	17.1%	15.9%	3.4%
LVMH	14.4%	13.4%	12.8%	13.0%	13.8%	16.4%	16.9%	7.4%

Appendix 9: Cash Conversion Cycle of Tiffany & Co. and LVMH, in days

Days	2013	2014	2015	2016	2017	2018	2019	Sept 30 2020 YTD
Tiffany & Co.								
DIO	502.3	503.4	503.3	521.0	527.6	543.3	541.4	1011.6
DSO	17.1	16.8	18.4	20.7	20.2	20.2	19.8	31.6
DPO	73.9	67.8	74.4	75.5	102.4	114.9	119.0	179.0
CCC	445.5	452.4	447.2	466.2	445.4	448.6	442.2	864.2
LVMH								
DIO	310.1	320.2	293.6	295.2	268.8	291.6	276.3	415.4
DSO	27.3	27.1	25.8	26.1	23.4	25.1	23.5	31.9
DPO	120.4	121.9	115.1	117.1	112.1	124.1	117.1	162.7
CCC	217.0	225.4	204.2	204.2	180.2	192.6	182.6	284.6

Appendix 10: Tiffany & Co.'s forecasted income statement

mUSD	E 2020	FC 2021	FC 2022	FC 2023	FC 2024	FC 2025	FC 2026	FC 2027	FC 2028	FC 2029
Net sales	**3,604**	**3,962**	**4,427**	**4,600**	**4,779**	**4,963**	**5,199**	**5,449**	**5,735**	**6,062**
Americas	1,347	1,468	1,615	1,648	1,681	1,714	1,766	1,819	1,873	1,948
Asia-Pacific	1,289	1,457	1,676	1,793	1,918	2,053	2,217	2,393	2,608	2,843
Japan	513	549	599	611	621	630	644	657	671	685
Europe	405	437	481	490	500	505	510	515	515	515
Other	46	51	57	58	59	61	63	65	68	71
Cost of sales	(1,406)	(1,545)	(1,705)	(1,748)	(1,816)	(1,861)	(1,950)	(2,016)	(2,093)	(2,243)
Gross profit	**2,199**	**2,417**	**2,723**	**2,852**	**2,963**	**3,102**	**3,249**	**3,433**	**3,642**	**3,819**
Selling, general and administrative expenses	(1,622)	(1,664)	(1,815)	(1,840)	(1,912)	(1,985)	(2,028)	(2,125)	(2,237)	(2,364)
EBITDA	**577**	**753**	**908**	**1,012**	**1,051**	**1,117**	**1,222**	**1,308**	**1,405**	**1,455**
Depreciation and amortization	(179)	(182)	(204)	(198)	(205)	(213)	(207)	(217)	(220)	(214)
Amortization of gain on sale-leaseback	-	-	-	-	-	-	-	-	-	-
Depreciation and amortization, net	(179)	(182)	(204)	(198)	(205)	(213)	(207)	(217)	(220)	(214)
EBIT before non-recurring items	**397**	**570**	**704**	**814**	**846**	**903**	**1,014**	**1,090**	**1,185**	**1,241**
Income taxes on operating income	(85)	(122)	(150)	(174)	(181)	(193)	(217)	(233)	(253)	(265)
NOPAT before non-recurring operating items	**313**	**449**	**553**	**640**	**665**	**710**	**798**	**857**	**932**	**976**

Appendix 11: Projections for industry growth and sales growth drivers

	E 2020	FC 2021	FC 2022	FC 2023	FC 2024	FC 2025	FC 2026	FC 2027	FC 2028	FC 2029
Overall industry growth										
Global luxury industry, mUSD	217,000	260,000	290,000	320,000	350,000	380,000	414,200	451,478	492,111	536,401
YoY %	*-23%*	*20%*	*12%*	*10%*	*9%*	*9%*	*9%*	*9%*	*9%*	*9%*
Growth of Gen Y, Gen Z, and Gen Alpha										
Share in global luxury industry	57%	59%	60%	65%	66%	67%	68%	69%	70%	71%
Market size, mUSD	123,690	153,400	174,000	208,000	231,000	254,600	281,656	311,520	344,478	380,845
YoY %	*0%*	*24%*	*13%*	*20%*	*11%*	*10%*	*11%*	*11%*	*11%*	*11%*
Growth of Chinese market										
Share in global luxury industry	20%	22%	23%	24%	25%	27%	28%	29%	30%	30%
Market size, mUSD	43,400	57,200	66,700	76,800	87,500	102,600	115,976	130,929	147,633	160,920
YoY %	*40%*	*32%*	*17%*	*15%*	*14%*	*17%*	*13%*	*13%*	*13%*	*9%*

Appendix 12: Tiffany & Co.'s forecasted cost items

	E 2020	FC 2021	FC 2022	FC 2023	FC 2024	FC 2025	FC 2026	FC 2027	FC 2028	FC 2029
in % of net sales										
Cost of sales	39%	39%	39%	38%	38%	38%	38%	37%	37%	37%
Selling, general and administrative expenses (reclassified)	45%	42%	41%	40%	40%	40%	39%	39%	39%	39%
in % of non-current operating assets										
Depreciation and amortization, net	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%

Appendix 13: Tiffany & Co.'s forecasted operating balance sheet items

mUSD	E 2020	FC 2021	FC 2022	FC 2023	FC 2024	FC 2025	FC 2026	FC 2027	FC 2028	FC 2029
OPERATING										
Operating assets										
Accounts receivable, net	214	226	266	276	287	298	271	284	299	316
Inventories, net	2,386	2,577	2,828	2,910	2,994	3,050	3,134	3,222	3,327	3,450
Prepaid expenses and other current assets	319	263	256	245	254	261	273	282	293	314
Total current operating assets	**2,919**	**3,066**	**3,350**	**3,431**	**3,535**	**3,608**	**3,678**	**3,788**	**3,919**	**4,080**
PPE, net	1,168	1,189	1,328	1,288	1,338	1,390	1,352	1,417	1,434	1,394
Operating lease right-of-use assets	1,141	1,189	1,328	1,288	1,338	1,241	1,300	1,362	1,147	1,212
Other assets, net	363	475	354	322	335	397	416	490	516	546
Total non-current operating assets	**2,673**	**2,853**	**3,011**	**2,898**	**3,011**	**3,027**	**3,067**	**3,269**	**3,097**	**3,152**
Total operating assets	***5,591***	***5,919***	***6,360***	***6,328***	***6,546***	***6,636***	***6,745***	***7,057***	***7,016***	***7,232***
Operating liabilities										
Accounts payable and accrued liabilities	484	510	563	594	636	670	721	746	795	852
Current portion of operating lease liabilities	216	198	221	230	239	248	208	218	229	242
Merchandise credits and deferred revenue	68	65	73	76	79	82	85	90	94	100
Total current operating liabilities	**769**	**773**	**857**	**900**	**953**	**1,000**	**1,015**	**1,053**	**1,119**	**1,195**
Long-term portion of operating lease liabilities	1,036	991	1,107	1,104	1,147	1,142	1,196	1,253	1,147	1,212
Total non-current operating liabilities	**1,036**	**991**	**1,107**	**1,104**	**1,147**	**1,142**	**1,196**	**1,253**	**1,147**	**1,212**
Total operating liabilities	***1,805***	***1,764***	***1,964***	***2,004***	***2,100***	***2,141***	***2,211***	***2,307***	***2,266***	***2,407***
Invested capital (net operating assets)	***3,786***	***4,155***	***4,397***	***4,325***	***4,446***	***4,494***	***4,535***	***4,751***	***4,749***	***4,825***

Appendix 14: Tiffany & Co's forecasted NOPAT margin and ATO ratio development

mUSD	E 2020	FC 2021	FC 2022	FC 2023	FC 2024	FC 2025	FC 2026	FC 2027	FC 2028	FC 2029
NOPAT margin	8.7%	11.3%	12.5%	13.9%	13.9%	14.3%	15.3%	15.7%	16.2%	16.1%
ATO ratio	0.95	0.95	1.01	1.06	1.07	1.10	1.15	1.15	1.21	1.26

Appendix 15: Stata Output for Tiffany & Co.'s raw beta regression

```
      Source |       SS           df       MS      Number of obs   =       262
-------------+----------------------------------   F(1, 260)       =     29.67
       Model |  .052493702         1  .052493702   Prob > F        =    0.0000
    Residual |   .45993533       260  .001768982   R-squared       =    0.1024
-------------+----------------------------------   Adj R-squared   =    0.0990
       Total |  .512429033       261   .00196333   Root MSE        =    .04206

------------------------------------------------------------------------------
    TIF_wret | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
     SP_wret |   .6446297   .1183364     5.45   0.000     .4116099    .8776495
       _cons |   .0006926   .0026063     0.27   0.791    -.0044395    .0058247
------------------------------------------------------------------------------
```

Appendix 16: DCF calculation – Tiffany & Co.'s standalone value

Assumptions for terminal period (starting 2030)	
Sales growth	3.0%
NOPAT margin	16.1%
ATO ratio	1.23

mUSD	E Q4 2020	FC 2021	FC 2022	FC 2023	FC 2024	FC 2025	FC 2026	FC 2027	FC 2028	FC 2029	Terminal 2030
NOPAT	183	449	553	640	665	710	798	857	932	976	1,005
- Δ Net Operating Assets	(44)	369	242	(72)	121	48	40	216	(1)	76	251
FCFF	**227**	**80**	**312**	**712**	**544**	**662**	**757**	**641**	**933**	**900**	**754**
WACC	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%
Discount factor	0.98	0.92	0.86	0.80	0.75	0.70	0.66	0.62	0.58	0.54	
PV(FCFF)	224	74	268	573	409	466	499	395	537	484	

PV(FCFF) Forecast period	3,928	mUSD
PV(FCFF) Terminal period	10,343	mUSD
Estimated EV	**14,271**	**mUSD**
NIBL	552	mUSD
Estimated equity value	**13,719**	**mUSD**
Shares outstanding	121.4	m
Implied share price	**113.0**	**USD**
Trading share price (09/09/2020)	114.0	USD
Overpricing (underpricing) by market	0.9%	

Appendix 17: Assumptions on synergetic effects on Tiffany & Co. from merger with LVMH

Assumptions on added value through merger

mUSD	E Q4 2020	FC 2021	FC 2022	FC 2023	FC 2024	FC 2025	FC 2026	FC 2027	FC 2028	FC 2029	Terminal 2030
Additional sales growth (in pp)		1.5	2.0	3.0	3.0	2.0	2.0	1.0	1.0	1.0	0.5
New YoY sales growth (%)		11.4%	13.7%	6.9%	6.9%	5.9%	6.8%	5.8%	6.3%	6.7%	3.5%
New net sales		**4,016**	**4,568**	**4,883**	**5,220**	**5,525**	**5,898**	**6,241**	**6,631**	**7,076**	**7,323**
Additional NOPAT margin increase (in pp)		2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5
New NOPAT margin (%)		13.3%	14.5%	15.9%	14.9%	15.3%	16.3%	16.7%	17.2%	17.1%	16.6%
New NOPAT		**535**	**662**	**777**	**779**	**846**	**964**	**1,044**	**1,144**	**1,210**	**1,215**

Appendix 18: DCF calculation – Tiffany & Co.'s value as part of LVMH (incl. synergies)

Assumptions for terminal period (starting 2030)	
Sales growth	3.5%
NOPAT margin	16.6%
ATO ratio	1.23

mUSD	E Q4 2020	FC 2021	FC 2022	FC 2023	FC 2024	FC 2025	FC 2026	FC 2027	FC 2028	FC 2029	Terminal 2030
NOPAT	183	535	662	777	779	846	964	1,044	1,144	1,210	1,215
- Δ Net Operating Assets	(44)	425	325	54	265	147	141	296	50	141	322
FCFF	**227**	**110**	**337**	**723**	**514**	**699**	**823**	**748**	**1,093**	**1,069**	**893**
WACC	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%
Discount factor	0.98	0.92	0.86	0.80	0.75	0.70	0.66	0.62	0.58	0.54	
PV(FCFF)	224	101	290	582	386	492	542	460	629	576	

PV(FCFF) Forecast period	4,281	mUSD
PV(FCFF) Terminal period	14,048	mUSD
Estimated EV	**18,329**	**mUSD**
Implied PV(Synergies)	**4,059**	**mUSD**
NIBL	552	mUSD
Estimated equity value	**17,777**	**mUSD**
Shares outstanding	121.4	m
Share price	**146.4**	**USD**
Acquisition price per share	131.5	USD
Trading share price (02/11/2020)	131.0	USD
PV(Synergies) per share	33.4	USD
Paid premium/share (based on standalone trading price)	17.5	USD
Paid premium/share (based on estim. standalone price)	18.5	USD
Implied underpricing/share (based on estim. price w/ synergies)	-14.9	USD
Implied underpricing in % (based on estim. price w/ synergies)	**-10.2%**	