



# ASML Holding NV

## Equity Valuation

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Dissertation written under the supervision of Professor José Tudela  
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## **Abstract**

**Title:** Equity Valuation | ASML Holding NV

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The semiconductor sector, which has undergone stressful periods due to high demand resulting in a chip shortage, could view the upcoming phases as growth opportunities resulting from advancements in various sectors.

This thesis examines the performance of ASML Holding NV, a Netherlands-based semiconductor industry member founded in the 1980s that is presently the primary provider of lithography systems in the industry.

A DCF valuation has been developed, supplemented by a relative valuation framework that considers the specific industry context. The valuation is underpinned by assumptions that account for the company's production capabilities and the expectation that its technological progress will align with the industry's requirements and the wider macroeconomic situation. The results are then compared to an equity research prepared by investment bank analysts. Finally, according to the model, the company has been valued at €677, resulting in a HOLD recommendation.

**Keywords:** Equity Valuation, ASML Holding NV, Semiconductor, DCF, WACC, Relative Valuation, Multiples, Scenario Analysis

## **Abstrato**

**Título:** Equity Valuation | ASML Holding NV

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O setor dos semicondutores, que passou por períodos de tensão devido à elevada procura que resultou numa escassez de chips poderá encarar as próximas fases como oportunidades de crescimento resultantes de avanços em vários setores.

Esta tese examina o desempenho da ASML Holding NV, um membro da indústria de semicondutores sediado nos Países baixos e fundado na década de 1980, que é atualmente o principal fornecedor de sistemas de litografia na indústria.

Foi desenvolvida uma avaliação DCF, complementada por uma Avaliação Relativa que considera o contexto específico do setor. A avaliação é sustentada por pressupostos que têm a capacidade de produção da empresa e a expectativa de que o seu progresso tecnológico se alinhe com os requisitos da indústria e com a situação macroeconómica em geral. Os resultados são depois comparados com um reporte realizado por analistas financeiros de um banco de investimentos. Finalmente, de acordo com o modelo, a empresa foi avaliada em 677 euros, resultando numa recomendação de HOLD.

**Palavras-Chave:** Avaliação Patrimonial, ASML Holding NV, Semicondutores, DCF, WACC, Avaliação Relativa, Múltiplos, Análise de Cenários

## **Acknowledgements**

All journeys come to an end, and this one could not be any different: with the completion of this dissertation, not only the master's degree comes to an end, but also this cycle of studies before a new phase of my life begins.

Projects are made up of people and I would like to start by thanking Professor José Tudela Martins for his guidance and knowledge during the process, as well as the various professors who contributed in some way during the program to increasing my interest in certain topics in the world of Finance.

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May it be an end with a beginning.

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## 1 Introduction

An unprecedented economic cycle has emerged, characterized by historic inflation in some countries and resulting in interest rates that are difficult to support. The situation is compounded by economic and geopolitical tensions, which have made certain industries more vulnerable while encouraging the growth of others.

Notably, the semiconductor industry has thrived during the pandemic, as limited access to certain services has underscored the urgent need for devices equipped with chips. The significant surge in demand has led to shortages in the industry that were impossible to fulfil. ASML, the firm being evaluated, serves as primary supplier to the semiconductor industry.

Consideration will be given to the challenge coping with an unfinished crisis of shortages and meeting customer needs in the coming years, thereby positioning ASML in the marketplace and comprehending what the Dutch corporation can offer.

To ensure coherent evaluation, this dissertation initiates with a literature review that includes a presentation of relevant bibliographic sources to be used in subsequent chapters. Chapters 3 and 4 provide insight into the company and its industry, with an analysis of the macroeconomic landscape in which it operates.

This is followed in chapter 5 and 6 by a discussion of the reasons why the company is expected to perform in a particular way, considering the assumptions used in the valuation models presented to arrive at a final share price, which is compared with a report prepared by an investment bank. The final chapter concludes by reflecting on the analyzed results.

## 2 Literature Review

“Valuation can be considered the heart of finance” (Damodaran, 2006), recognizing value to something, can be subjective from a personal perspective, to prove that represents a certain value, there needs to be a way to demonstrate it. (Koller et al., 2010) describes value as the defining dimension of measurement in a market economy, the positioning and expectations that arise from this evaluation determine the business prospects.

(Damodaran, 2012) presents three main approaches that leads to a valuation, Discounted Cash Flow Valuation, which reflects the value of an asset based on the present value of its future cash flows, Relative Valuation when the value of an asset is determined by comparing it with similar assets, using specific criteria, and Contingent Claim Valuation, the valuation of assets with similar share option characteristics is achieved using option pricing models, this latter approach is not within the scope of this study, as it deviates considerably from the business model of the company under analysis and lacks any significant demonstration.

### 2.1 Discounted Cash Flow Valuation

In a discounted cash flow model, the value of the future cash flows is discounted to its present value at a discount rate that explains the risk of these cashflows, (Damodaran, 2006), the mentioned future cash flows are determined from their current earnings and the implicit growth rate expected from those earnings (Damodaran, 2008a).

The Discounted Cash Flow (DCF) approach conceives two distinct perspectives addressing the valuation of the Firm (FCFF) and Equity (FCFE) as topics that require different methods, both approaches discount future cash flows, the discrepancies arise from the cash flow being considered and the discount rate employed (Damodaran, 2012).

#### 2.1.1 Free Cash Flow to Equity

**Formula 1:** Free Cash Flow to Equity

$$FCFE = \text{Net Income} - (\text{Capital Expenditures} - D\&A) - \Delta NWC - (\text{New Debt Issued} - \text{Debt Repayments})$$

Where:

*D&A* – Depreciation and Amortization

*ΔNWC* – Change in Net Working Capital

The FCFE represents the cash balance that a company retains after deducting investments in long-term assets (these are the differences between capital expenditures and depreciation &

amortization), short-term assets (changes in non-cash Working Capital) and Net Borrowings (which are the subtraction of debt repayments from new debt issued) (Damodaran, 2006).

### 2.1.2 Free Cash Flow to Firm

**Formula 2:** Free Cash Flow to Firm

$$FCFF = EBIT(1-t) - Capital Expenditures + D\&A - \Delta NWC$$

Where:

*D&A* – Depreciation and Amortization

*ΔNWC* – Change in Net Working Capital

In contrast to the FCFE, FCFF represents a cash flow following tax deductions and reinvestment requirements but before any debt payments, aligned with the investor's viewpoint rather than that of the shareholders (Damodaran, 2006).

### 2.1.3 Discount Rate

To determine the ultimate value of both Equity and Firm, it is crucial to discount certain cash flows to present value using discount rates. Specifically, using cost of equity (*ke*) to calculate FCFE, and the weighted average cost of capital (WACC) to assess the FCFF.

## 2.2 Cost of Equity

**Formula 3:** Cost of Equity

$$ke = Rf + \beta(\text{Market Risk Premium})$$

Where:

*Rf* – Risk free rate

*β* – Beta

The cost of equity, as per the CAPM model, is composed of three elements, risk-free rate of return, the market risk premium, and beta. The capital asset pricing model (CAPM) is based on Markowitz's modern portfolio theory and was created by (Treynor, 1962), (Sharpe, 1964) e (Lintner, 1965), this model permits the specific risk of a company to be adjusted using beta (Koller et al., 2010).

### 2.2.1 Risk Free Rate

The risk-free concept entails, according to (Damodaran, 2008b), two conditions, the need for there to be no risk of default, the only example being government securities since these entities have the potential to control currency creation, the second condition is the absence of any

reinvestment risk to ensure there is an actual return that is equal to the expected return of the investment.

### 2.2.2 Beta

**Formula 4:** Beta

$$\beta = \frac{Cov(R_i, R_m)}{Var(R_m)}$$

Where:

*Cov(R<sub>i</sub>, R<sub>m</sub>) – Covariance between the Return of the Security(i) and the Return of the Market*

*Var(R<sub>m</sub>) – Variance of the Market Returns*

The betas employed to assess risk in particular models gauge the risk added to a diversified portfolio (specific risk) whilst also measuring relative asset risk, rather than total risk. To obtain these betas, it is necessary to estimate regressions of an asset's returns against the returns of an index that represents the market portfolio over a specific period, (Damodaran, 2012).

### 2.2.3 Market Risk Premium

**Formula 5:** Market Risk Premium

$$E(R_m - R_f)$$

Where:

*R<sub>m</sub> – Market Returns*

The market risk premium is considered by (Zenner et al., 2008) to be “*the most important number in finance*”, reflecting the premium that investors expect to receive relative to risk-free asset for the investment in a diversified market portfolio. Mirrors the performance of the economy and provides the basis for macroeconomic measures such as interest rates, inflation, and economic growth through the expected returns of different asset classes.

## 2.3 WACC

**Formula 6:** Weighted Average Cost of Average

$$WACC = \frac{D}{E + D} \times kd(1 - t) + \frac{E}{E + D} \times ke$$

Where:

$$\frac{D}{E + D} - \text{weight of a company's debt of the EV}$$

$$\frac{E}{E + D} - \text{weight of a company's equity of the EV}$$

$kd$  – cost of debt

$t$  – tax rate

As previously explained, the WACC is a discount rate that applies to a DCF model. It consists of three components: cost of equity ( $ke$ ), after-tax cost of debt and the capital structure of the company being analyzed. The weighted average cost of capital is not a cost or a required return, but rather a combination of both, (Fernández, 2011).

### 2.3.1 After tax cost of debt

**Formula 7:** After tax cost of debt

$$\text{After tax cost of debt} = kd(1 - t)$$

The cost of debt denotes the cost of obtaining debt capital. When evaluating investment grade companies, the means used to determine this expense is through the yield to maturity linked to the long-term debt released by the company. The YTM is considered a proxy for expected returns, as stated by (Koller et al., 2010) “*the yield is actually a promised rate of return on a company’s debt*”, this only holds true for a debt rated BBB or higher, Otherwise, the recommended approach is to use the adjusted present value (APV), which will be addressed below. The resulting value of both presented methods to determine the after-tax cost of debt must be multiplied by 1 subtracting the marginal tax rate ( $t$ ).

### 2.4 Terminal Value

**Formula 8:** Terminal Value

$$TV = \frac{FCFF_{t+1}}{WACC - g} \text{ or } TV = \frac{FCFE_{t+1}}{ke - g}$$

Where:

$FCFF_{t+1}$  – Free Cash Flow to Firm period  $t+1$

$FCFE_{t+1}$  – Free Cash Flow to Equity period  $t+1$

$g$  – growth rate

For the purpose of a definitive valuation of a company, a terminal value is calculated, which reflects the present value of all cash flows. The method for calculation utilizes a constant growth model, where the central concept is that a company's progression advances at a constant perpetual growth rate ( $g$ ), (Schill, 2014). The expected behavior of the free cash flow's value in year  $t+1$  is anticipated to mimic year  $T$  and reach a steady state, which will be verified in perpetuity.

#### 2.4.1 Growth Rates

To establish a suitable growth rate for a company or market and plan its future, it is essential to examine its past performance and contextual factors. (Schill, 2014), defines the growth rate as the anticipated growth rate of a particular business or asset in perpetuity. (Koller et al., 2010) sees the most accurate projection for the growth rate as the result of adding the long-term consumption growth rate within the industry to the inflation rate. (Damodaran, 2012) assumes that the growth rate cannot exceed the growth of the economy in which the company operates. This assumption leads to the division of growth rate estimates into three categories. The first is more consensual, based on company's past – historical growth rates, the second derived from analysts who follow the company, and assumes a growth rate defined by them, and the third category is an estimate from a firm's fundamentals, *“A firm's growth ultimately is determined by how much is reinvested into new assets and the quality of these investments”*.

#### 2.5 Relative Valuation

A DCF analysis enables valuation of assets using their cash flows, while multiples are an alternative that attempts to arrive at a valuation using assets of similar value that are valued in the market, (Damodaran, 2012). This can be considered a means of comparison, aiding in the identification of disparities between the company undergoing evaluation and its peer group for comparison, (Fernández, 2002).

##### 2.5.1 Peer Group

Selecting the appropriate peer group is crucial in determining multiples valuation and should be considered as a primary step. Various factors differentiate companies that can be selected, (Koller et al., 2010) suggests that categorizing companies according to their industry (Standard Industrial Classification codes) is a distinguishing method, aligned with production methods, production channels and R&D shall result in comparable growth and ROIC figures.

## 2.5.2 Multiples

Multiples can be classified into three categories: multiples specific to the company's capitalization, multiples based on the company's value, and multiples based on growth, (Fernández, 2002) Furthermore, to enhance the accuracy of valuation it is recommended by (Goedhart et al., 2005) to use forward-looking multiples rather than relying solely on historical multiples. This is supported by a study conducted by Jing Liu, Doron Nissim and Jacob Thomas which found that the percentage of error in one-year forecasts using historical multiples was 23%, compared to 18% when using forward looking multiples. The selection of appropriate multiples is a crucial aspect of valuation analysis, the two selected to carry out the valuation of ASML Holdings NV were:

### 2.5.2.1 P/E

The price/earnings ratio, which belongs to the group of multiples based on capitalization, is the most widely used ratio by the technology and semiconductor industry, which includes ASML, (Fernández, 2002).

### 2.5.2.2 EV/EBITDA

EV ratios are deemed more precise compared to the P/E ratio as the latter can be influenced by the company's capital structure and other non-operational assets, (Koller et al., 2010) Using both EV multiples and P/E ratios in conjunction creates a more sustainable valuation. The EV multiple offers a more comprehensive approach as it considers the total value of the company, whilst the P/E concentrates on the share price.

## 2.6 Other Valuations

Additional models that allow us to value a company are the adjusted present value model and the dividend discount model.

### 2.6.1 Adjusted Present Value (APV)

**Formula 9:** Adjusted Present Value

$$\text{Current Firm Value} = \text{Unlevered Firm} - \text{Expected Bankruptcy Costs} + \text{PV of Tax Benefits}$$

The APV model examines the benefits and costs of borrowing by analyzing the impact of different debts on tax revenue and the likelihood of bankruptcy. (Damodaran, 2012), defines this approach as starting by assessing the company's financial position without any debt and then analyze the changes in the aforementioned parameters. As opposed to the WACC, the APV

makes it possible not only to realize the intrinsic value of an asset, but also to understand where that value comes from, (Luehrman, 1997).

## 2.6.2 Dividend Discount Model

This is widely accepted as the most elementary approach to equity valuation: a stock's value equals the present value of its expected dividends. (Damodaran, 2012) presents this model as being divided into two, the first of which is known as the Gordon Growth Model, assuming that the company is in a state of stability and its dividend payouts will grow at a consistent rate for an extended period. And the second technique is the Two-Stage Dividend Discount Model. This model breaks down the growth period into two phases, the first being a period of instability and the second a steady state in which the growth rate is stable and expected to remain so in the long run.

### **Formula 10:** Gordon Growth Model

$$\text{Value of a company's Stock} = \frac{DPS_1}{ke - g}$$

Where:

$DPS_t$  – Expected Dividends per share in year  $t$

$ke$  – Cost of equity

$g$  – Expected growth rate

### **Formula 11:** Two-Stage Dividend Discount Model

$$\text{Value of the stock} = \sum_{t=1}^{t=n} \frac{DPS_t}{(1 + k_{e,hg})^t} + \frac{P_n}{(1 + k_{e,hg})^n}$$

$$\text{where } P_n = \frac{DPS_{n+1}}{k_{e,st} - g_n}$$

Where:

$ke$  – cost of equity ( $hg$ : high growth period;  $st$ : stable growth period)

$P_n$  – Price at the end of year  $n$

$g$  – extraordinary growth rate for the first  $n$  years

$g_n$  – growth rate forever after year  $n$

## 2.7 Valuation Model Selection

Various models for company valuation are available, but to ensure precision and suitability for the target's characteristics, one was chosen, namely the Discounted Cash Flow model. The selection of this specific model is based on its precision and depth, a combination of its ability to produce forecasts for an extended period and the underlying assumptions, that will result in an approximated present value. Even within this framework, there are two options to consider, but the preferred option is FCFF because FCFE does not reflect the changes in capital that may occur as precisely and the assumptions required to calculate it are fewer, so the final figure may be less accurate.

The APV model was not factored into the calculation of ASML's final value as no exceptional alterations in the capital structure are foreseen, and this represents the key benefit of the model. Similarly, the DDM model is unsuitable for the Dutch company's model due to the distortion of forecasts caused by rounds of share buybacks, despite their standard policy of regular dividend payments.

To complement and frame the position defined by the company in the industry in which it operates, a peer group of six members is divided into three groups and from this a Relative Valuation is conceived, with a future perspective of the firm, through forward multiples.

## 3 Company Overview

### 3.1 History

More than 30 years have elapsed since the giant Philips and the chip manufacturer Advanced Semiconductor Materials International (ASMI) established ASM Lithography. The company, based in Eindhoven at the time, was conceived with the aim of disrupting the semiconductor industry and developing lithography systems. Acquisitions and partnerships have been diverse throughout its history, always adapting these acquisitions to needs to fulfil certain requirements, Carl Zeiss was its inaugural partner, in this case, as a lens manufacturer.

In a capital-intensive industry like this, progress depends on investment, and after ASMI withdrew in 1986 and Philips period of cost-cutting, it was not until 1995, with the IPO, that the necessary investment was channeled into growth and the expansion of R&D production facilities.

As an autonomous enterprise, listed on the stock exchange of both Amsterdam and New York, the remarkable progress of growth follows the departure of Philips as a shareholder. The company as fortified its image as a dominant industry contender with five acquisitions to date, operating in over 60 countries, employing more than 39 000 personnel. As a significant feature and a positive branding factor, the company exclusively produces the most advanced lithography system on the market, Extreme Ultraviolet (EUV).

### 3.2 Business Segments

ASML's core strengths lie in its exclusive offerings and the presentation of distinguishing solutions. The company offers a diverse range of products and services through its Holistic Lithography product and service portfolio and provides patterning solutions that cater to various industry wavelengths, from the cutting-edge EUV (13.5 nm) to the widely used DUV (193 nm, 248 nm or 365 nm). The product is approached from two perspectives: production and maintenance which supports the Lithography platforms to assist customers in maximizing their patterning performance.

#### 3.2.1 EUV

The highly developed chip production platform utilizes light wavelength of 13.5 nm and numerical aperture of 0.33, significantly reducing the wavelength used when compared to DUV by almost 15 times. The expenses incurred are substantial, involving investments of billions of euros in R&D and the acquisition of Cymer, a light source manufacturer, to make the process more efficient.

As of today, ASML is the world's only manufacturer of these Lithography systems, which contributed to the production of 111 million wafers in 2022. These systems represented 33% of total revenues in 2022 and will soon become the primary product line, with the development of EUV 0.55 NA, which will enable higher resolution patterning for even smaller transistor features, this product is expected to enter the market in 2025, with customer orders already received.

### 3.2.2 DUV

As the platform with the largest market and highest number of producers, it plays a crucial role in its development. The four models present by ASML are i-line (365 nm), KrF (248 nm), ArF (193 nm) and ArFi, which, like the previous platform, offer wide range of semiconductor nodes and technologies, while supporting cost and energy efficient scaling for the industry.

The level of innovation its expressed, with a new variant of the KrF model present in 2022, thus maintaining the expectation that DUV will retain its weight as a percentage of sales in the coming periods, despite the 36% presented in 2022 compared to 50% in 2019, justified by the EUV growth, is expected to remain above 35%, meeting the need of customers who do not require a wavelength of less than 193 nm.

### 3.2.3 Metrology and Inspection Systems

With the objective of achieving optimal performance, products have been created to oversee the comprehensive chip manufacturing process, the goal is to attain both speed and precision that will enable the process to be cyclical. The two metrology solutions, YieldStar and HIM e-beam, make it feasible to regulate pattern quality on wafers manufactured in high volume and analyze chip defects on a case-by-case basis. Accounting for 3% of sales in 2022, this aligns with company's strategy to maintain this proportion given the projected growth in revenue, which will satisfy customer demands.

### 3.2.4 Managing Installed Base Systems

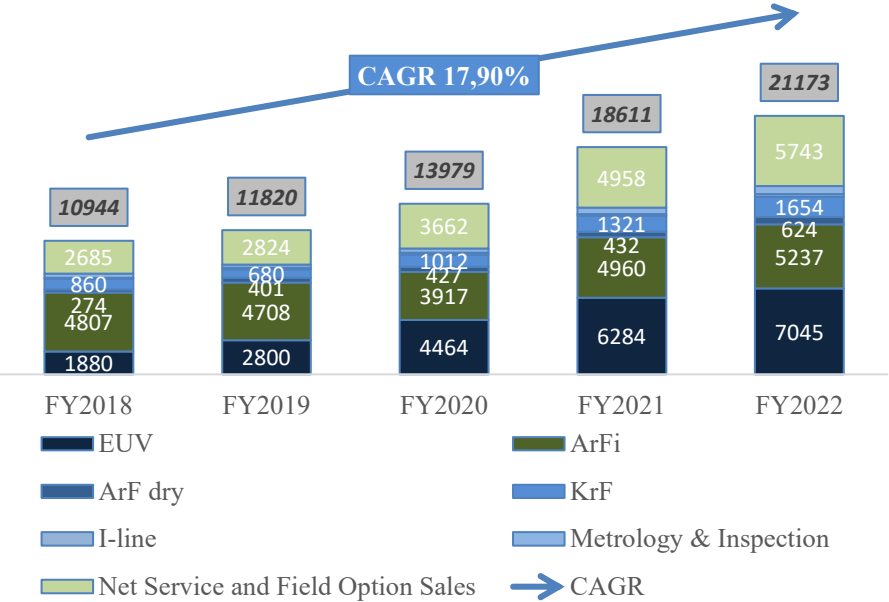
The business model is accomplished by enabling the deployment of the systems obtainable in its portfolio. With over 9000 customer support staff members, their responsibility is to guarantee the smooth operating and high-level functioning of the systems in each client's factory. In turn, this results in reduced production costs of every wafer and more significant output.

### 3.3 Historical Performance

#### 3.3.1 Revenues

ASML has shown remarkable performance in recent periods, while many industries have suffered due to the COVID-19 pandemic. The semiconductor market, on the other hand, took advantage of it, with its revenues registering a CAGR of 17,9% since 2018 and a staggering 23,1% during pandemic period (2020-2022). The company’s revenues are now at an all-time high of approximately 21,2 billion euros, driven by the innovative EUV system with a CAGR of 39,1% which accounted for 36% of sales last year.

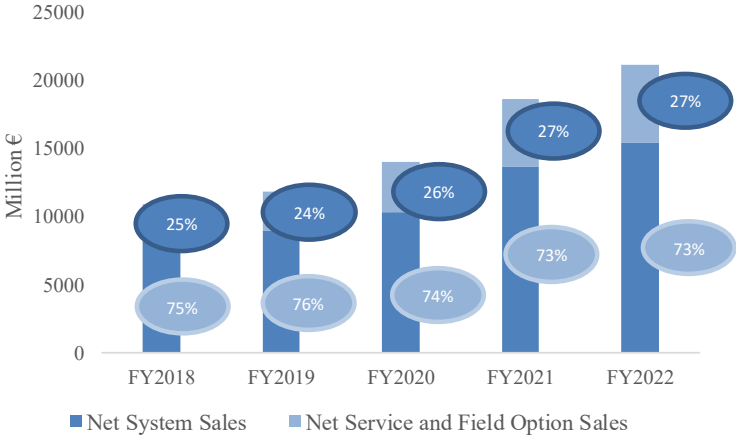
**Figure 1:** ASML Revenues by Business segment



**Source:** ASML annual report 2022

With a wider sales breakdown, revenues are divided into two main categories: Net system sales, consisting of Lithography systems, and Net Service Field option sales, representing installed based systems. The latter group accounts for 27% of sales and has greatly profited from the 2022 global shipping shortage, with a CAGR of 20,9%.

**Figure 2:** Net System Sales vs Net Service Field option sales (with % of sales)

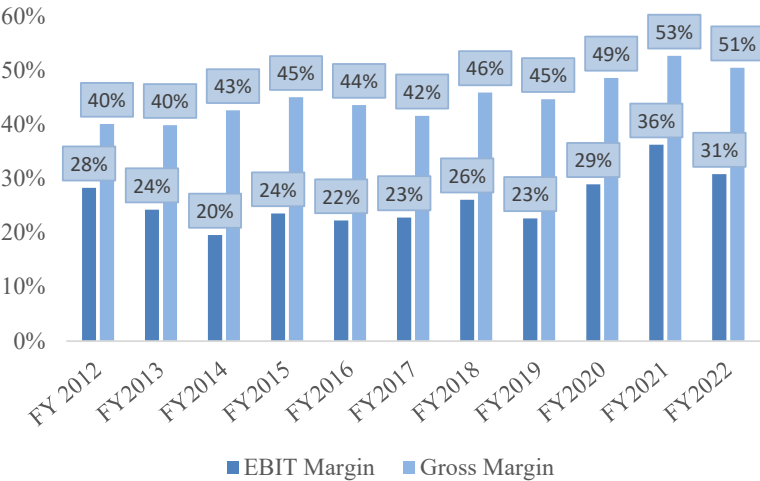


**Source:** ASML Annual report 2022

**3.3.2 EBIT margin and Gross margin**

From a profitability perspective and supported by revenue data, the EBIT Margin has been increasing since 2014. The evolution from 26% in 2018 to 36% in 2021 is countered by a fall to 31% in 2022, which is justified by the increase in demand for chips, which has led to rapid deliveries and consequently, a delay in revenue recognition. To the same extent, the gross margin, which had increased from 46% to 53% during the same period, decreased to 51% in 2022, possibly due to the higher rise in COGS in comparison to the growth in revenues, 19% versus 14%.

**Figure 3:** EBIT margin Gross margin

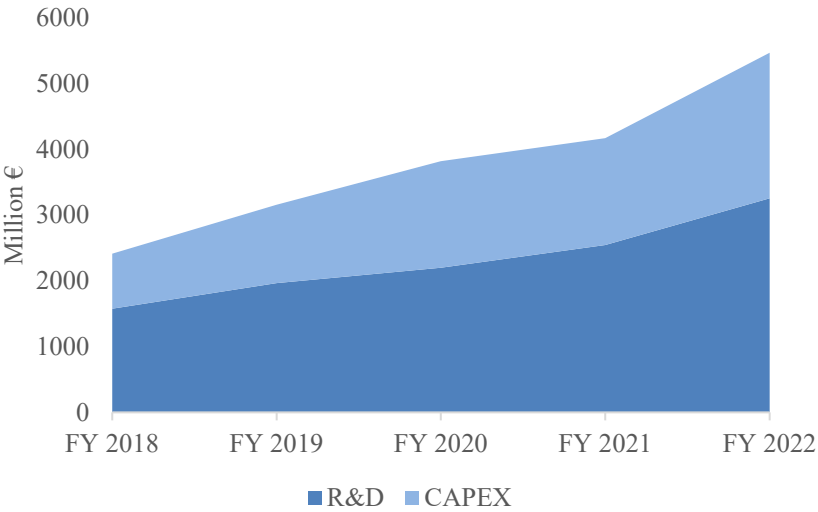


**Source:** ASML Annual report 2022

### 3.3.3 Capex and R&D

The investment needed to sustain technological innovation at the level showcased by the Dutch force is manifested in the amount of 3,3 billion euros invested in R&D, indicating a rise of roughly 28% for the year of 2022. This spending is focused on EUV, DUV and application programs that support the holistic lithography solutions that ultimately led to the development of EUV high-volume manufacturing. Similarly, CAPEX levels are equally high at €2,2 billion in 2022, with a significant increase of 36% after remaining stable in 2021.

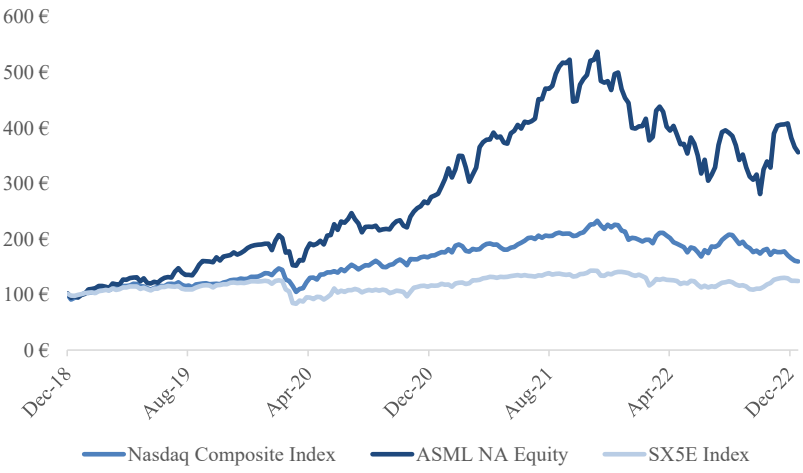
**Figure 4.** Capex vs R&D



**Source:** ASML annual report 2022

### 3.3.4 Share Price Performance

**Figure 5.** Share Price performance vs Index



**Source:** Refinitiv Eikon

It is a member of the NASDAQ-100 technology index and EURO STOXX 50 European index, where it is currently the second largest by market capitalization. Based on information in Figure 5, it can be seen that ASML’s performance outperformed both indices between 2018 and 2022, with a similar movement until the first quarter of 2020, which then turned into a significant difference, with the European index growing by 23%, the American by 60% and lithography systems producer by 250%.

An excellent performance has been consistently delivered by rewarding shareholders through a quarterly dividend redistribution policy, announced in 2022 as €5.8 per ordinary share, which represents a 5.5% increase from 2021. In addition to the dividend policy, the company also has a robust share buy-back program which, after buying-back more 8.5 million shares from its shareholders in 2022 for a value of approximately €4.6 billion, has announced a new project for December 2025 with the aim of buying back a further 12 billion euros of shares, demonstrating the strategy of reward and trust imposed by its Board of Directors.

**Table 1:** ASML Ownership Structure

<i>Ownership structure</i>	<b>Shares</b>	<b>% of Class</b>
<i>Capital Research and Management Company</i>	40 615 837	10,29%
<i>BlackRock Inc</i>	32 539 755	8,25%
<i>T. Rowe Price Group, Inc.</i>	13 527 385	3,43%
<i>Members of ASML'S current Board of Managemnt</i>	89 892	0,02%

**Source:** ASML Annual report 2022

**3.4 Future Strategy**

Following excellent results and a leading position in the industry, what awaits should be similar to the bright times of the past. ASML has prioritized growth in its core lithography business, with the first EUV 0.55 NA machine scheduled for production in 2025 and a high scenario of reaching 30 machines by 2030. Despite the focus on the EUV NA 0.55, the strategy also includes maintaining competitiveness in the DUV market, where it has its biggest competitors, while securing high volume manufacturing capability and increasing the value of EUV technology through the EUV 0.33 NA. In the most positive scenario, the company points to a range of €30 billion to €40 billion in revenues and a gross margin of 54% to 56% in 2025. Unilateralism has never been one of ASML’s dogmas and, as evidenced by the acquisitions it as made to reduce costs and improve supply chain efficiency, synergistic opportunities are a top priority for a holistic transition and better customer service.

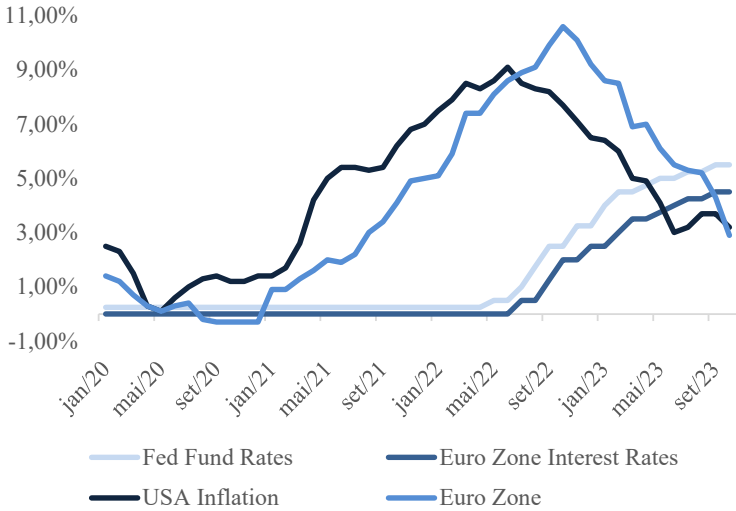
## 4 Macroeconomic Environment & Industry Analysis

### 4.1 Macroeconomic Situation

The demanding environment of competition and pressure that ASML currently operates in entails various uncontrollable risks and responsibilities including the macroeconomic climate. Following the challenging ordeal of the pandemic, an inflationary crisis has arisen, causing the European Central Bank’s 2% target to become an unattainable goal.

In October 2022, inflation in the Eurozone surged to 10,6%, while in the United States, it reached its 30-year peak at 9,10% in June of the same year. As a result, interest rates sharply increased in both regions in response to these figures. In the US, the Fed Fund Rates were already at 3,25% at the end of 2022 and showed no signs of decreasing until inflation was restored. In the same sense, but with more caution, the ECB set interest rates at 2,5% at the end of 2022.

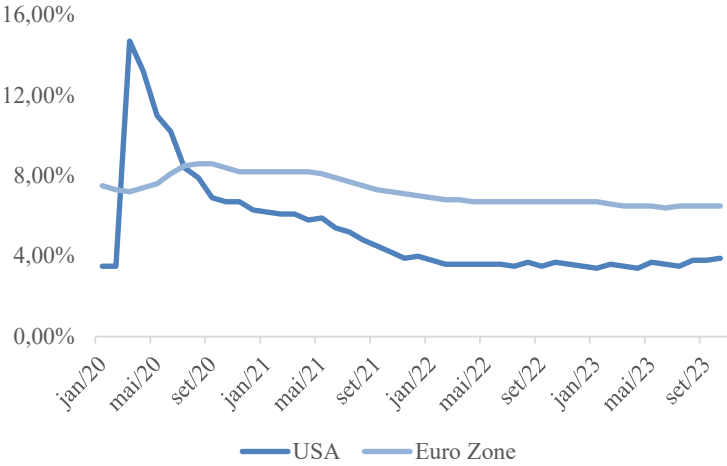
**Figure 6:** Inflation and Interest Rates



**Source:** Bloomberg

As a consequence of inflation and as a measure to combat levels of consumption, the number of unemployed people has increased. This as result in a shortage of qualified staff, which is a pressing need within the industry. Unemployment rates have reached record levels in the United States, reflected in the consumption of second-hand goods. European unemployment again follows the trend, but in a more subtle way, with a greater speed of return to pre pandemic levels due to worker protection measures and barriers to layoffs versus the United States.

**Figure 7:** Unemployment Rate US vs Euro Zone

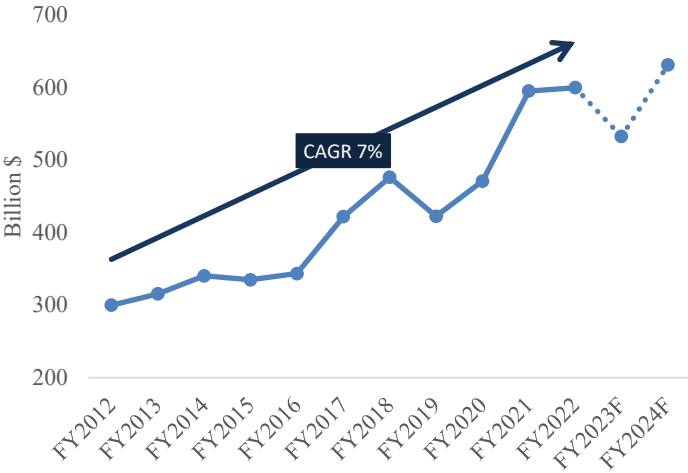


**Source:** Bloomberg

**4.2 Industry Performance**

The semiconductor industry is renowned for its technological innovation in various sectors, including automobiles, computing, data storage and wireless. With market capitalization of \$1067 billion, it generated revenues of \$600 billion in 2022. Notably it has demonstrated significant growth with a CAGR of 7% since 2012. According to McKinsey (Burkacky et al., 2022) the industry’s growth outlook is projected to range between 6% to 8% annually until 2030, if inflation stabilizes at 2%. ASML’s position in an industry such as this is regarded as a prominent one, being the top market capitalization holder with an 80% market share in the lithography systems sector.

**Figure 8:** Industry Revenues

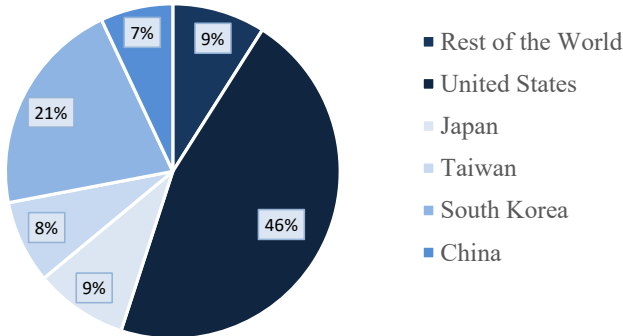


**Source:** Statista

The remarkable growth that characterizes the industry must be sustained to uphold the significant levels of CAPEX and R&D that have already been put forth. Exhaustive investment strategies have been devised, but they fell short in 2021. The micro-chip sector experienced a shortage that was exacerbated by chip manufacturers' lack of prompt response despite high demand.

At the end of 2019, it is estimated that the industry manufacturer assets were operating at 95%, leaving hardly any room for maneuver for such a high increase in demand. The costumers of ASML, have emphasized the need for time-efficient lithography systems, therefore justifying the company's intent focus on improving its supply chain. Furthermore, as this is one of the industries with the highest demand for skilled labor, there has been a correlation between the increase in demand for semiconductors and the shortage of technicians, leading to a rivalrous atmosphere amongst tech companies to obtain and retain talented professionals.

**Figure 9:** Industry Revenue per Geographic area (2021)



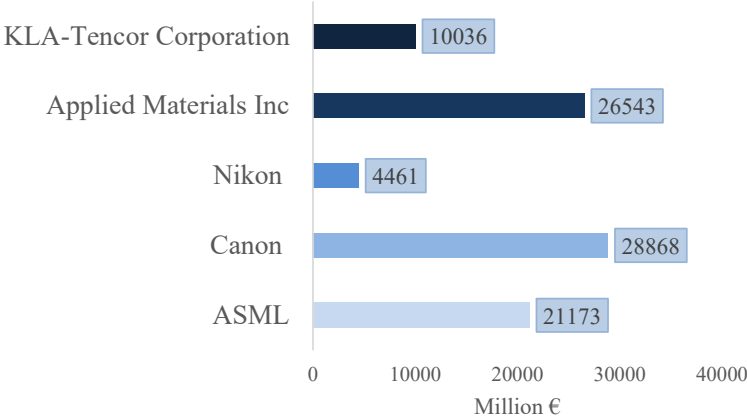
**Source:** Statista

4.2.1 Competition

The industry is highly competitive, demanding more from players, due to the large number of opportunities. Canon and Nikon have emerged as key adversaries in the DUV systems market, their comparable resources and product lines pose a potential threat to the company's business line and future sales. Despite the exclusivity of EUV technology and its benefits in terms of managing market risks, there exists significant competitors who can push back against it. Applied Materials Inc. and KLA-Tencor Corporation are among the providers of applications that support complex patterning solutions, and as this represents a quarter of the business that

supports the company’s results, they are considered competitors and possible market share dividers.

**Figure 10:** Revenues in comparison with potential peers (in millions)

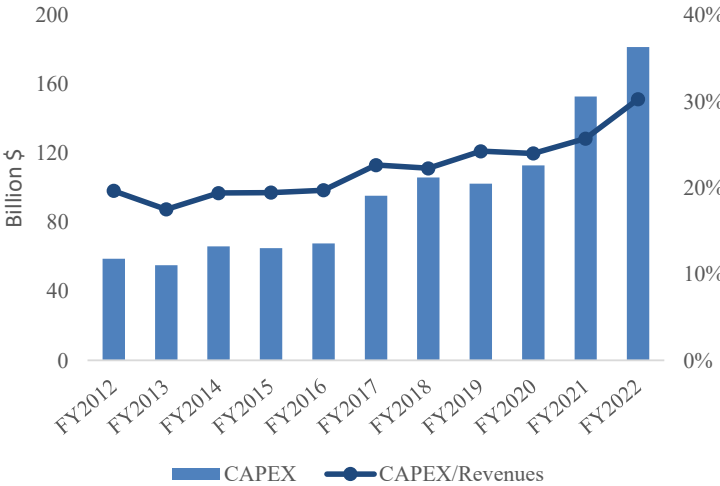


**Source:** Refinitiv Eikon

4.2.2 Cycle Risk

As a provider to the semiconductor industry, ASML is heavily reliant on business cycles. The emergence of new entrants into the market, particularly the Chinese, heightens the potential for cyclicity moving forward. The sales of lithography systems are greatly impacted by the CAPEX that semiconductor manufacturers are willing to make. Between 2016 and 2022, the percentage of capital expenditure as a proportion of sales rose from 20% to 30%.

**Figure 11:** Industry CAPEX Historical Performance



**Source:** Refinitiv Eikon

This increase illustrates the evolution that the industry has undergone and highlights the potential consequences of not following this trend. To mitigate this risk and prepare for a possible downturn, cost management must aim to achieve breakeven level given the expansion in employees, infrastructure, and manufacturing necessary for maintenance and new product development. A recession could prove challenging for a company this size.

#### 4.2.3 Political Risk

In 2019, under the influence of the United States, the Dutch government prohibited ASML from providing any of the EUV system models in its portfolio to China. Restrictions in the US semiconductor market towards the Asian giant are focused on the American efforts to become independent in the chip market and are expected to further restrict at the beginning of 2023. ASML having produced some of its components on US territory, however, continues to export DUV systems to Chinese soil, which amounted to 14% in 2022, down from 15% in 2021.

The Asian market constitutes the foremost customer of the lithographic firm, where Taiwan alone contributes to almost 38% of sales and South Korea accounts for 29%, both in the year 2022. The mentioned territories are contending with certain political uncertainty or prospects of conflicts, and the strained relationship existing between Taiwan and China can pose detrimental effects on the company.

Following the limitations imposed by the United States, Taiwan gained a significant position, although Japan experienced the most notable growth as percentage of sales, with a 3% increase in the past year. The annual report mentions one of the concerns in the Korean scenario, which is the relationship between South Korea and North Korea. Similar to the situation in Taiwan, a conflict's onset could adversely affect future performance.

#### 4.2.4 Currency

By reporting results in euros and having the majority of revenues in locations with a different currency, the result is subject to fluctuations in these currencies. The US Dollar/Euro Exchange rate is the primary factor, but the Asian countries that use the Japanese yen, South Korean won, Taiwanese dollar, and Chinese yuan also play a role.

## 5 Valuation Assumptions

For the final valuation of ASML, the Discounted Cash Flow model will be used. While a final price will be computed using the Relative Valuation approach, this will be solely for contrasting with the industry and categorizing the company in relation to its counterparts. To support the final value obtained in the DCF valuation, assumptions were made in the calculation of FCFF main components such as Revenues, EBIT (COGS, R&D, D&A), capital expenditures and net working capital.

The forecast period used was 8 years from 2023 to 2030, based on the premise that steady state will be reached between 2026 and 2027, with CAPEX levels stabilizing and the introduction of High EUV already incorporated into the production line. This timeline was influenced by the forecasts outlined in the 2022 annual report, which set goals for 2025 and 2030 and underlying the assumptions presented in this publication.

### 5.1 Revenues

The revenue estimation method employed involved segmenting by technology. Due to ASML's significant reliance on its production line, this approach to forecasting is practical. This forecast will be calculated by multiplying the anticipated number of units sold by the respective revenue per unit. The latter element will adjust in accordance with the predicted inflation rate for each year assessed.

After analyzing inflation levels presented through a weighted average of the countries that contribute the most to the company's revenues, and assigning a weight of 10% to the country where the headquarters is located (considered the most influential for this matter), it has been determined that a level of inflation is reached where price growth is expected to be 3% until 2026 and 2% until the end of the analysis period, thus entering a steady state.

**Table 2:** Units Forecast

<i>Units</i>	<b>FY 2022</b>	<b>FY 2023e</b>	<b>FY 2024e</b>	<b>FY 2025e</b>	<b>FY 2026e</b>	<b>FY 2027e</b>	<b>FY 2028e</b>	<b>FY 2029e</b>	<b>FY 2030e</b>	<b>CAGR</b>
High - EUV	-	-	-	1	4	9	14	20	25	90%
EUV	40	56	70	80	85	90	95	98	100	9%
ArFi	81	128	115	119	122	126	130	134	138	1%
ArF dry	28	26	23	24	25	26	26	27	28	1%
KrF	151	172	181	190	195	201	205	209	213	3%
I-line	45	53	58	61	64	65	67	69	70	4%
Metrology & Inspection	216	187	201	216	232	249	268	288	310	8%
Total Units	561	621	648	690	727	766	805	845	884	5%

**Source:** Own Computations

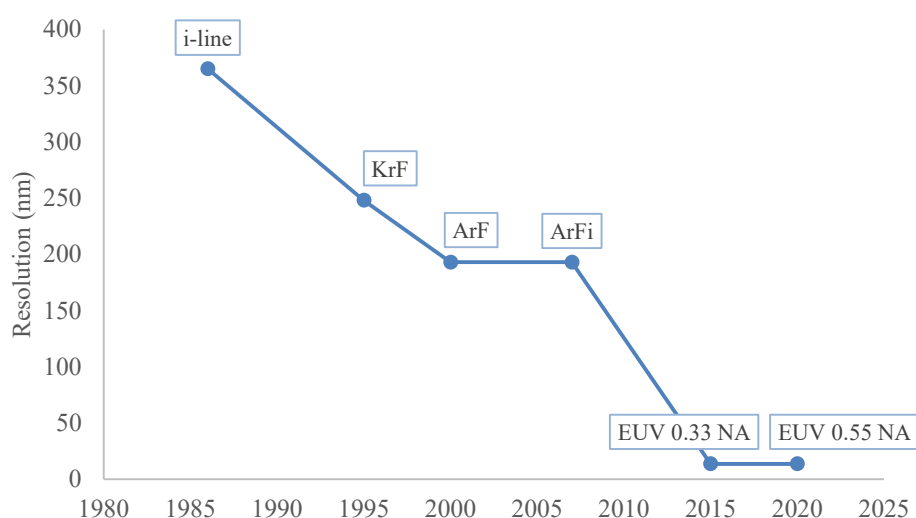
**Table 3:** Revenues per Unit Forecast

Revenues per unit	FY 2023e	FY 2024e	FY 2025e	FY 2026e	FY 2027e	FY 2028e	FY 2029e	FY 2030e
High - EUV	-	-	300,00	309,00	315,18	321,48	327,91	334,47
EUV	175,00	180,25	185,66	191,23	195,05	198,95	202,93	206,99
ArFi	67,80	69,83	71,93	74,08	75,57	77,08	78,62	80,19
ArF dry	22,55	23,22	23,92	24,64	25,13	25,63	26,14	26,67
KrF	11,58	11,93	12,28	12,65	12,91	13,16	13,43	13,70
I-line	5,06	5,21	5,37	5,53	5,64	5,75	5,86	5,98
Metrology & Inspection	3,35	3,45	3,56	3,67	3,74	3,81	3,89	3,97

**Source:** Own Computations

According to Moore’s Law, every two years the number of transistors in a computer chip doubles, and these transistors are positively correlated with processing power. As the number of transistors increases, the price per transistor decreases. The advancements made by ASML in the last 35 years indicate that the future holds immense potential for developing lithographic systems with smaller nanometers and enhanced numerical aperture, a law on which the revenue assumptions were also founded.

**Figure 12:** Moore’s Law ASML evolution



**Source:** ASML Annual report

### 5.1.1 EUV

Is identified as unique and a distinctive product within the lithographic portfolio, as the sole manufacturer of this product, market growth is uncertain. The EUV 0.33 NA, which propelled ASML to the forefront of the market and sold 40 units in 2022, is predicted to have 80 deliveries in 2025, defying the company’s expectations of 90 unites between 2025 and 2026, as investment

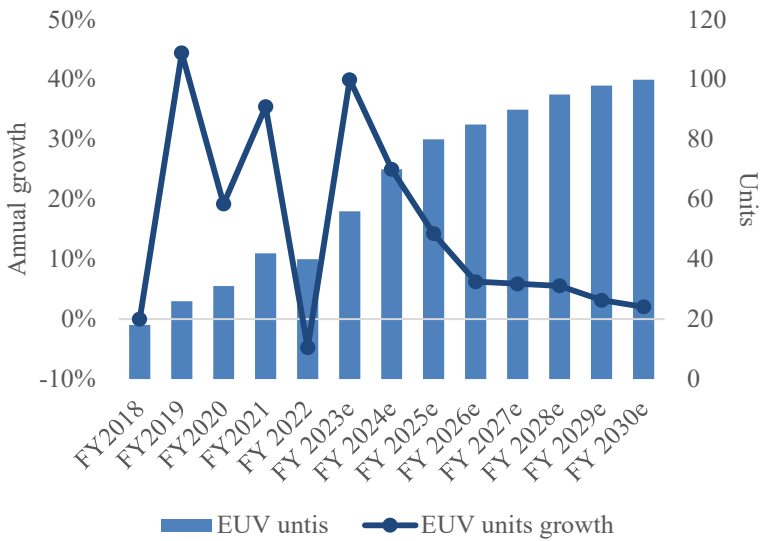
is directed towards the new EUV model while also maintaining competitiveness in the DUV market. A CAGR of 20% is anticipated until 2025 and 9% for the entire forecast.

Its progression stabilizes at no more than 6% per year once it attains a steady state, and its contribution to revenues is projected to increase to 42% in 2025 but will lessen to a more cautious 35% in 2030.

Occupying a crucial position in the company’s future, the High EUV with an NA of 0.55 is set to roll out its first unit in 2025. The annual report’s forecast of 20 units by the end of 2027 may be optimistic, but a more prudent estimate, with a production cost that is twice as high as that of EUV 0.33 NA, and a revenue per unit close to €300 million, suggest that 20 units could be achieved by 2029.

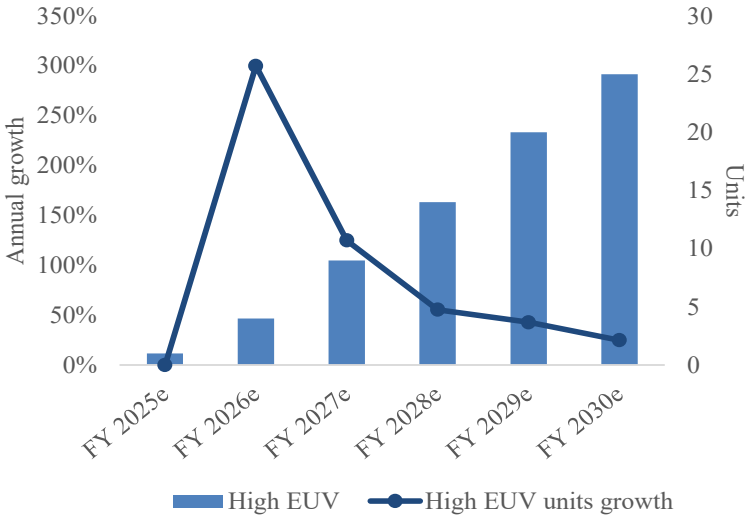
Strengthening the estimate is the fact that although there are existing orders and the possibility to use lower-end models to design them, an increase in demand for qualified personnel is expected. It is not anticipated that recovery in this area will happen immediately, especially since there is a period of uncertainty regarding the American restrictions. As these models cannot be exported to China, investment and reinforcement will have to be greater to protect the company itself, hence the more pessimistic of the EUV 0.33. Despite this, EUV 0.55 are expected to generate revenues of more than €5 billion from 2019 onwards. While their growth may not be organic during the initial years due to being in a steady state later than the other products, they are projected to contribute almost 15% of the total revenues by 2030.

**Figure 13:** EUV Forecast



**Source:** Own computations

**Figure 14:** High EUV Forecast



**Source:** Own computations

5.1.2 DUV

A category that offers a wide range of options to fulfil the diverse needs of various target customers, whilst remaining highly competitive with other players in the industry who provide similar products. In light of this, ASML ensures it stays ahead of the competitors, even though the product has already been around for a long time.

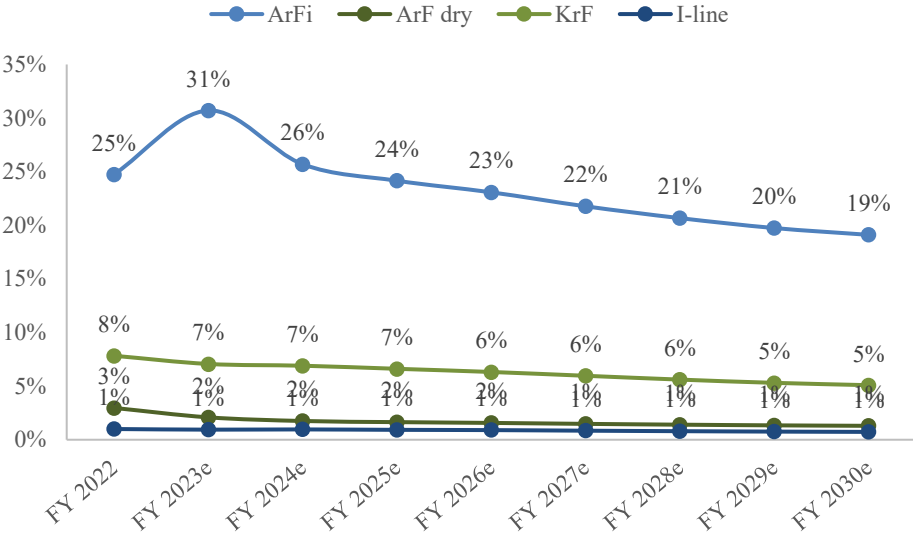
DUV models are not currently among the restricted exports to China, but it is predicted that limitations may arise in early 2024 due to forecasts and the investment made by the United States. The KrF was the model with the highest sales figures in 2022, with a new version that is more efficient, the production capacity has increased to 330 wafers per hour, compared to the previous 260. This development was made possible through the integration of the NXT platform, resulting in a higher scan speed and can be reduced overhead time.

To reach the number of production units required by the end of 2023, the figure presented for the first half of the year has been used, assuming that the second half will be similar, with annual growth of 14% rising to 15% in 2024 and 2025, and 3% and 2% in the future but taking some market share away from ArFi and ArF dry.

The ArFi and ArF dry models, although similar, differ in their market performance. The most recent of the two models to enter the market, the ArFi, is expected to grow to 128 units produced in 2023, which will be a banner year after a strong first half. The ArF dry is the most cost-effective option among the portfolio, it remains, however the only DUV whose sales are

expected to decline until 2025, when they will start grow again by 3% per year. I-line, although having the longest wavelength, could be considered less innovative, but it holds a special place among long-term costumers for whom the company pays special attention. These costumers have consistently maintained a sales level independent of other higher range products due to competitive pricing. Therefore, the product will maintain 1% revenues share through the forecast. The DUV range sustained over 30% of the final sales until the release of the High EUV model, at which point its market share began do decline.

**Figure 15:** DUV Forecast

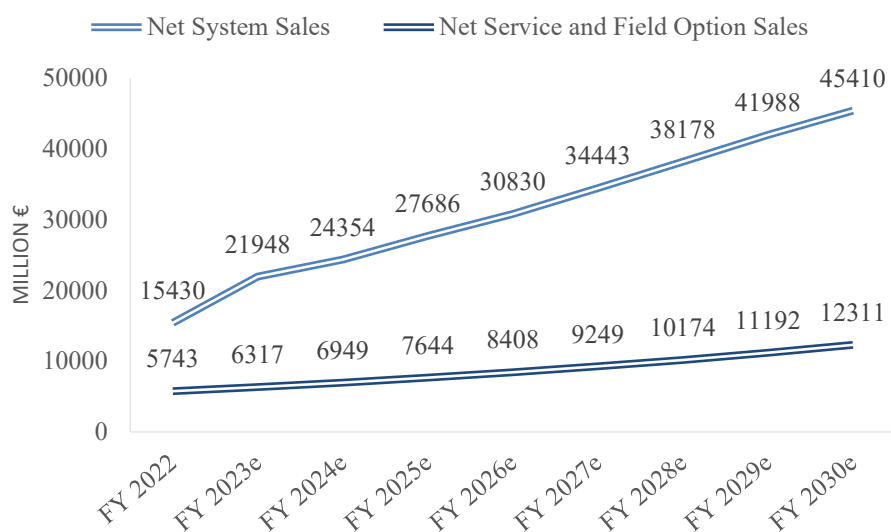


**Source:** Own Calculations

The two large groups, specifically Net System Sales and Net Service and Field Options, are projected to grow similarly over the long term at close to 10%. The first of these is made up of the EUV, DUV and Metrology & Inspections models, the latter of which has not yet been presented and is expected to grow in line with the others given that is very much based on maintenance and development and sustained by the need for the new machines, its estimate for 2023 is double that of the first half of the same year, with a total of 187 units.

Net Service and Field Option, on the other hand, being very dependent on the number of units sold in Net System Sales, was assigned a growth rate of 10% per year, which would be the rate at which revenues would grow from Net System Sales alone. This would lead to revenues of €57 billion, in line with ASML’s forecast of between 44 and 66 billion in revenues by 2030.

**Figure 16:** Net System Sales vs Net Service and Field Option Sales Forecast



**Source:** Own Computations

## 5.2 EBIT

EBIT a primary component of FCFF, underwent a segmented estimation process, where each of its components grows at a specific rate.

### 5.2.1 COGS

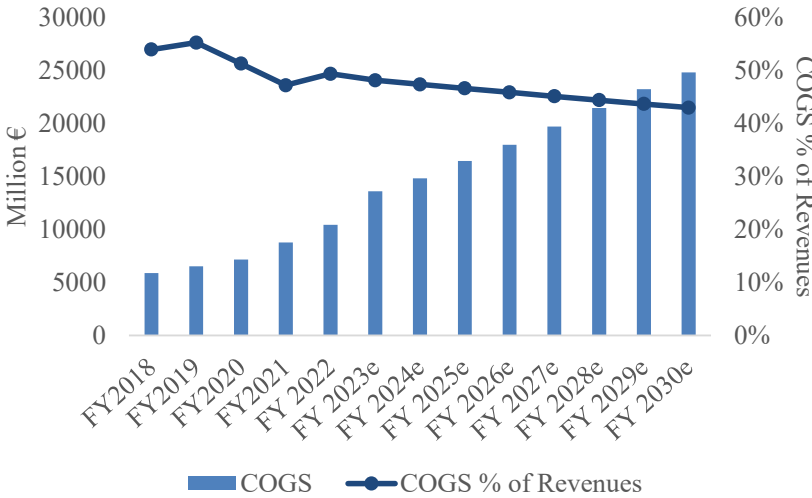
The cost of goods sold was bifurcated into two groups: the cost of system sales covering the system sales group, which accounts for approximately 75% of total revenues. The forecast was calculated based on the growth in net system sales for the projection years shown above but discounted by 2% to consider the number of machines that can be reused, by the second owner program that the company has, and the upgrade from EUV 0.33 to 0.55 without the need to start production from scratch.

The revenue forecast already includes cost inflation, achieved by an increase in revenue per unit. The cost of service and field option sales adheres to the same principles and increases at the same rate as net service and field option sales. The growth rate is, in this case, reduced by 1% to focus on efficiency and optimization of the support provided.

Historically, the COGS has represented approximately 50% of the total revenues. In 2022 this figure decreased to 47%, the lowest it has been in the past 6 years. It is expected to recover in 2023, however, due to the focus on the cost efficiency mentioned earlier, the COGS-to-revenues ratio is projected to decrease further in the following years, reaching 43% in the steady state.

Therefore, Total COGS will reach 24 billion by 2030, with CAGR of 9%.

**Figure 17:** COGS Forecast

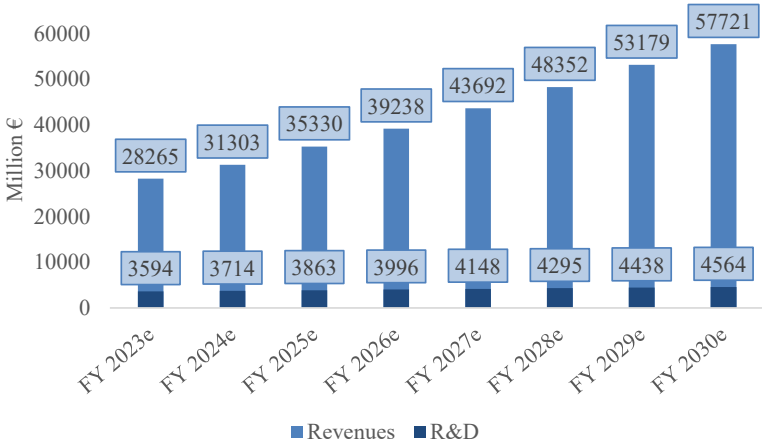


**Source:** Own Computations

5.2.2 R&D

The R&D investment, according to the company’s estimates, would amount to €4 billion by 2025, but like the number of units produced, this figure seems very optimistic, and even the results of the first half of 2023, in which only 1588 million was invested, make the desired outlook more distant.

**Figure 18:** R&D Forecast



**Source:** Own Computations

Since 2016, the research and development sector of AML has experienced comparable growth to that of revenue, which has consequently resulted in the adjustment of the company's projected investment figure of approximately €4 billion by a year to 2026. The said adjustment assumes that growth will remain proportional to that of previous years leading up to the mentioned date. This translates to a 10% growth of R&D in 2023, followed by a consistent growth between 3 and 4% in the subsequent years.

### 5.2.3 SG&A and D&A

Over the past few years, selling general and administrative expenses (SG&A) have consistently accounted from 4% of sales, even in times of greater volatility. Therefore, it is assumed that this percentage will remain unchanged over the next eight years. Depreciation and amortization, which is not included in the calculation of EBIT, has weighting in FCFF. Depreciation accounted for an average of 14% of Fixed Assets during 2021 and 2022, being projected to remain at this value for the entire forecast. Fixed Assets were projected based on their percentage in relation to sales, remaining at 30% until 2025 and 31% in steady state.

**Table 4:** D&A and SG&A Forecast

<i>In millions</i>	FY 2023e	FY 2024e	FY 2025e	FY 2026e	FY 2027e	FY 2028e	FY 2029e	FY 2030e
Amortization	131	125	119	113	109	106	103	100
% of Fixed Assets	4%	1%	1%	1%	1%	1%	1%	1%
Depreciation	1187	1315	1471	1715	1905	2117	2313	2511
% of Fixed Assets	14%	14%	14%	14%	14%	14%	14%	14%
D&A	1318	1440	1591	1828	2014	2223	2415	2611

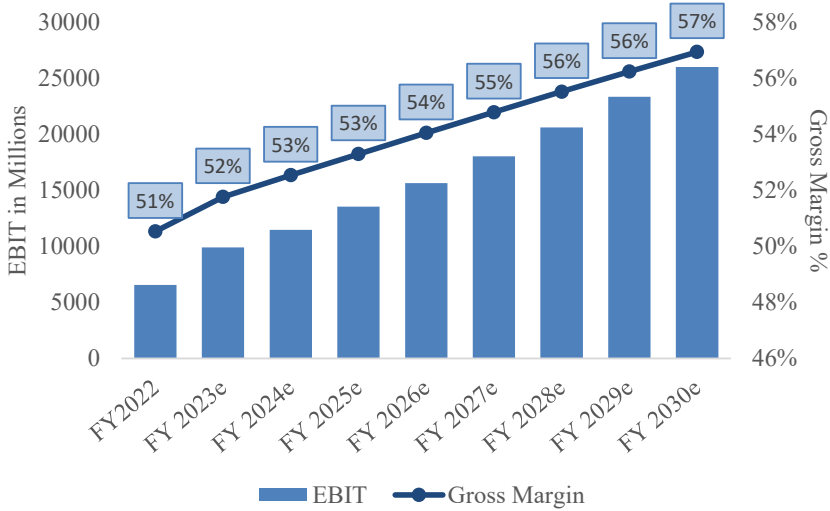
<i>In millions</i>	FY 2023e	FY 2024e	FY 2025e	FY 2026e	FY 2027e	FY 2028e	FY 2029e	FY 2030e
SG&A	1131	1252	1413	1570	1748	1934	2127	2309
% of sales	5%	4%	5%	4%	4%	4%	4%	4%

**Source:** Own Computations

As for the amortization, the figure present in the annual report extend until 2028 and are not estimations. The document indicates that there is a gap of €243 million, of which €200 million is expected to be amortized by 2030. For depreciation and amortization, the life expectancy of their systems of 1-7 years has been used, which is the life expectancy assigned by the company.

In 2030, EBIT is expected to reach 25 billion with a CAGR of 15%. Gross margin will range between 54-56% in 2026 and is projected to be at 57% in the long term.

**Figure 19: EBIT & Gross margin Forecast**



**Source:** Own Computations

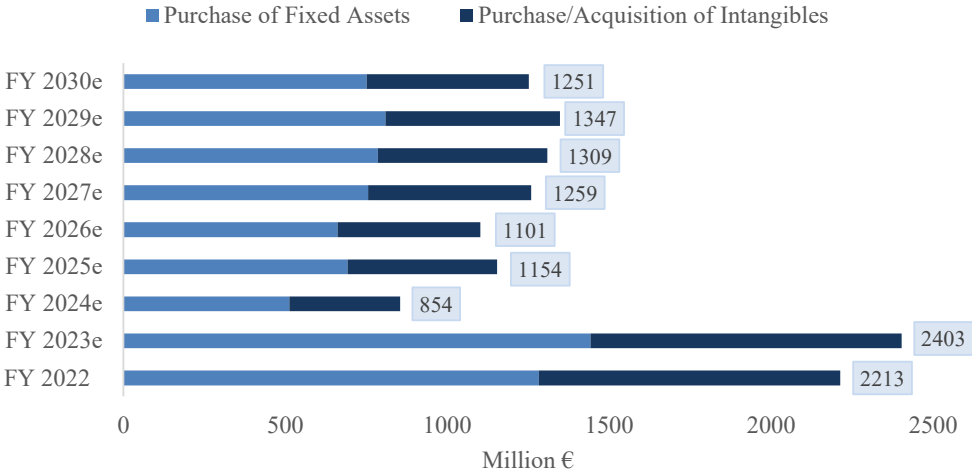
**5.3 Capex**

It is crucial to align CAPEX levels with the revenue growth plan, distinguishing between the purchase of fixed assets and purchase/acquisition of intangibles. ASML set the figure of €2.4 billion for the end of 2023, using it to compute the weight of CAPEX in the initial year of the projection. Based on the company’s defined value, future CAPEX will be adjusted according to the revenue evolution, which is already predicting an increased demand for investment to meet projected figures. In 2023, CAPEX represented 8.5% of sales, this was calculated with a 60% ratio attributed to fixed asset purchases and 40% to purchase/acquisition, which has been the historical ratio between these two parameters.

The 2023 investment figure is significant because, despite two years of investment, it remained sturdy due to the strengthening of the EUV line and the consistency of DUV. Whereas in 2024 there is a sharp drop of almost 65% in investment, which is expected to return to pre-pandemic levels and will be affected by possible restrictions.

With the launch of the initial High EUV unit, 2025 is expected to witness a return in investment figures to the tune of 1 billion, with a significant influence from the purchase of fixed assets. The subsequent periods of stability and greater maintenance can be assumed to be driven by the cost efficiency in Research and Development, despite the increase in High EUV production that brings along costs, a minimally constant level of CAPEX which never escalates beyond 14% is expected.

**Figure 20: Capex Forecast**



**Source:** Own Computations

**5.4 NWC**

All the components of the net working capital, excluding operating cash set at 2% of revenues, and Tax Payables (not included in accounts payable) set at €315 million, were defined based on the number of days. ASML’s cash conversion cycle (CCC) for 2022 was at 252, placing it above company average and only topped by 2014 and 2015. The high value is justified by the increase in the three factors that make up the CCC.

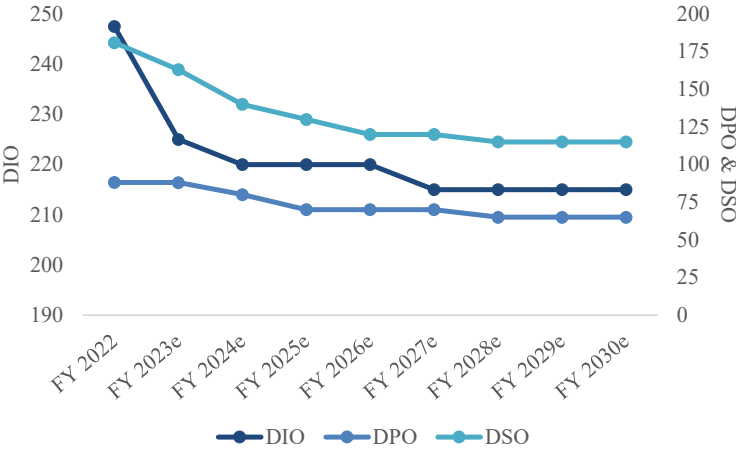
Days payable outstanding (DPO), measures the average number of days a company takes to pay its suppliers. Days inventory outstanding (DIO) is the average number of days it takes a company to sell its inventory. Lastly, days sales outstanding (DSO) measures the number of days it takes a company to receive payments after making a sale.

The company presented a DPO of 88 days in 2022, marking the highest recording for the period under review. It is feasible that this figure has been reached after periods of increased instability, during which customers themselves also delayed payments. In the future, it is planned to return to values close to the average of 63 days, stabilizing the growth of accounts payable at a CAGR of 4%.

On the other side of the spectrum, DSO is also at a record level, and if 2022 in an unusual year and that the economic situation in both Europe and the United States improves, with a possible reduction in inflation and a future reduction in interest rates, the money available from costumers is expected to be higher and the number of days is to stabilize at pre pandemic and pre crisis. Over 8 years, their days have decreased from 92 to 50, with a CAGR of 5%.

Regarding inventories, the shortage that occurred in 2021 has had a significant impact on them, 2022 shows a longer than normal delay in being able to clear inventories. The need for prevention measures has result in a period of increased accumulation, which makes 2022 an atypical year. The next years point towards a decrease and regularization of product shortages, bringing them close to 220 days in DIO.

**Figure 21:** Cash Conversion Cycle



**Source:** Own Computations

Based on the given analysis, the NWC will grow steadily and in parallel with the growth of inventories, its CAGR will be 8% and its % of sales will decrease from 48% in 2022 to 33% at the end of the forecast period. The Cash Conversion Cycle follows a downward trend, returning to values close to 200, as seen in previous years.

**Table 5:** Changes in NWC Forecast

<i>Forecast NWC</i>	<b>FY 2022</b>	<b>FY 2023e</b>	<b>FY 2024e</b>	<b>FY 2025e</b>	<b>FY 2026e</b>	<b>FY 2027e</b>	<b>FY 2028e</b>	<b>FY 2029e</b>	<b>FY 2030e</b>
Account Payables	2564	3332	3301	3208	3506	3841	3883	4202	4487
DPO	88	88	80	70	70	70	65	65	65
Account Receivables	5456	5889	5217	5888	5450	6068	6716	7386	8017
DSO	93	75	60	60	50	50	50	50	50
Inventories	7200	8520	9079	10083	11018	11797	12844	13898	14843
DIO	247	225	220	220	220	215	215	215	215
Operating Cash	423	565	626	707	785	874	967	1064	1154
Tax Payables	315	315	315	315	315	315	315	315	315
<b>NWC</b>	<b>10200</b>	<b>11327</b>	<b>11305</b>	<b>13155</b>	<b>13432</b>	<b>14583</b>	<b>16329</b>	<b>17831</b>	<b>19212</b>
<b>Δ NWC</b>	<b>3874</b>	<b>1126</b>	<b>-21</b>	<b>1849</b>	<b>277</b>	<b>1151</b>	<b>1746</b>	<b>1502</b>	<b>1381</b>
NWC % of Sales	48%	40%	36%	37%	34%	33%	34%	34%	33%
<b>CCC</b>	<b>252</b>	<b>212</b>	<b>200</b>	<b>210</b>	<b>200</b>	<b>195</b>	<b>200</b>	<b>200</b>	<b>200</b>

**Source:** Own Computations

## 6 Valuation

After presenting the underlying assumptions, this chapter will detail the calculation of parameters comprising the DCF model, forming the basis for the final share price. To further validate the model, sensitivity and scenario analyses have been performed on various factors that may affect the final value.

### 6.1 DCF

#### 6.1.1 WACC

The discount rate used in this model is the weighted average cost of capital (WACC) and its forecast elements are as follows.

##### 6.1.1.1 Cost of equity

The cost of equity was calculated through application of the popular CAPM model including three elements: risk free rate, market risk premium and beta.

###### 6.1.1.1.1 Risk-Free Rate

The risk-free rate is chosen as a rate without any default-risk, and the yields of the 10-year German Bunds, representing European rates with the lowest credit risk in the same currency as the company's results, were used.

As per Bloomberg data for 1 December 2022, the value was 2.35%.

###### 6.1.1.1.2 Market Risk Premium

The market risk premium was calculated by taking a weighted average of the equity risk premium from different countries sourced from Damodaran database. The weights used were based on the percentage of revenues generated by each country to which ASML sold to in 2022. A value of 5% was assigned to the Netherlands, where ASML deducts its taxes and on which it depends fiscally. This resulted in a final market risk premium of 5.75%.

###### 6.1.1.1.3 Beta

Beta was determined using a regression that compares ASML's monthly excess returns with those of a benchmark index, in this case the NASDAQ-100, on which ASML is listed and is seen as the most representative market for its industry. The analysis covered the period from 2013 to 2023, which produced a beta value of 1.18.

This brings the cost of equity to 9.14%.

**Table 6:** Cost of Equity Computation

	<i>ERP</i>	<i>Weights</i>		<i>Cost of Equity</i>	
Taiwan	5,91%	40,11%	2,37%	ERP	5,75%
Netherlands	5,00%	5,00%	0,25%	Beta	1,18
USA	5,00%	9,50%	0,48%	Rf	2,35%
South Korea	5,75%	30,61%	1,76%	<u>Rm-Rf</u>	<u>5,75%</u>
China	6,07%	14,78%	0,90%	Ke	9,14%
		<i>ERP WA</i>	5,75%		

**Source:** Own Calculations

#### 6.1.1.2 Cost of debt

ASML'S cost of debt is calculated by applying a weighted average of the YTM of ASML's outstanding long-term debt with a maximum maturity of 10 years. The resulting cost of debt is 3.67%, but the value used for WACC purposes is the after-tax cost of debt. Where the cost of debt is multiplied by 1 minus the effective tax rate of 14% reaching a value of 3.16%.

**Table 7:** Cost of Debt Computation

	<i>Amount Outstanding</i>	<i>Periods to Maturity</i>	<i>Coupon</i>	<i>Present Value</i>	<i>Face Value</i>
YTM ASML 1.375	€ 1 000 000 000,00	3	1,38%	93,97	100
YTM ASML 1.625	€ 750 000 000,00	4	1,63%	93,33	100
YTM ASML 0.625	€ 750 000 000,00	6	0,06%	84,76	100
YTM ASML 0.250	€ 750 000 000,00	7	0,25%	80,55	100
YTM ASML 2.250	€ 500 000 000,00	9	2,25%	89,79	100

	<i>Yield to Maturity</i>	<i>Market Value</i>	<i>Weights</i>	<i>Pre Tax Kd</i>
YTM ASML 1.375	3,70%	€ 939 700 000,00	28,23%	1,05%
YTM ASML 1.625	3,60%	€ 699 975 000,00	21,03%	0,76%
YTM ASML 0.625	3,68%	€ 635 692 500,00	19,10%	0,70%
YTM ASML 0.250	3,72%	€ 604 132 500,00	18,15%	0,67%
YTM ASML 2.250	3,65%	€ 448 930 000,00	13,49%	0,49%
Total		€ 3 328 430 000,00	100,00%	3,67%
			Kd After Tax	3,16%

**Source:** Own Computations

#### 6.1.1.3 Capital Structure

The WACC comprises of the proportionate weight of the market value of equity and the market value of debt employed in the company's cost of capital structure.

To obtain the market value of equity is the value that comes from the multiplication of the share price of 1 December 2023 (€637.50) by the number of outstanding shares (395 million) provided in the annual report, resulting in a market capitalization of €251 813 million.

The market value of debt is determined by adding the short-term debt and long-term debt. The traded debt is assumed to be the long-term debt, while the debt held on the balance sheet that is not traded equates to the short-term debt. The weighted average cost of capital amounts to 9.03%, considering an effective tax rate of 14%.

**Table 8:** WACC Computations

Rf	2,35%	Short Term Debt	794,00
Beta	1,18	Long Term Debt	3328,43
Market Premium	5,75%	V	255934,93
Ke	9,14%	MV Equity	251812,50
Kd	3,16%	MV Debt	4122,43
		Tax Rate	14,00%
		<b>WACC</b>	<b>9,03%</b>

**Source:** Own Computations

6.1.1.4 Growth Rate

The DCF model’s estimation of the growth rate stemmed from two factors: GDP growth and industry growth.

By assigning weights to the countries with the most significant impact on the company’s sales, average GDP growth was calculated. In this set of weighted averages, the Netherlands held weight of 30%, given that it recorded the highest GDP growth in the previous years and, as the country where the company is based, it wields a greater impact on these growth rates and is therefore more dependent on them.

The distribution of weights across the parameters was as follows, Industry growth has a weight of 40%, with the company’s growth being higher than industry, which had been presented as 2.58% in 2022, and GDP growth was allocated 60% given the investment and robustness of the economy from the main countries which ASML depends on.

The growth rate then remained at 2.87%, adhering to limitations that Dutch GDP growth could not be exceeded, and it should also stay below average inflation, which was calculated by assigning the same weights used to compute GDP growth, arriving at a value of 5.8%.

**Table 9:** Growth rate

<b>GDP Growth</b>	<b>FY2020</b>	<b>FY2021</b>	<b>FY2022</b>	<b>WA</b>	<b>Weights GDP &amp; Inflation</b>	
GDP Taiwan	3,39%	6,53%	2,45%	0,72%	Taiwan	29,56%
GDP Netherlands	-3,80%	4,90%	4,33%	1,30%	Netherlands	30,00%
GDP USA	-2,20%	5,80%	1,90%	0,13%	USA	7,00%
GDP South Korea	-0,70%	4,30%	2,56%	0,58%	South Korea	22,56%
GDP China	2,20%	8,10%	3,00%	0,33%	China	10,89%
				3,06%		

<b>Inflation</b>	<b>FY2020</b>	<b>FY2021</b>	<b>FY2022</b>	<b>WA</b>	<b>FY2022</b>	
Inflation Taiwan	-0,24%	1,97%	2,95%	0,87%	Industry growth	2,58%
Inflation Netherlands	1,30%	2,70%	10,00%	3,00%	<i>Bloomberg 2022</i>	
Inflation USA	1,20%	4,70%	8,00%	0,56%		
Inflation South Korea	0,50%	2,50%	5,10%	1,15%		
Inflation China	2,40%	1,00%	2,00%	0,22%	<b>Growth Rate</b>	2,87%
				5,80%		

**Source:** Own Computations

### 6.1.2 FCFE & Share Price

ASML's free cash flow to firm was calculated by accounting for assumptions regarding D&A, NWC and CAPEX. This allowed for the determination of value from 2023 to 2030.

The FCFE experienced consistent growth but faced a decline in 2025 due to a substantial variation in NWC and a rise in CAPEX exceeding 200 million in the same period. In the long run, CAPEX and depreciations converge to a similar value, and the changes in NWC becomes positive, ultimately leading to over €20 billion FCFE with a remarkable CAGR of 19%.

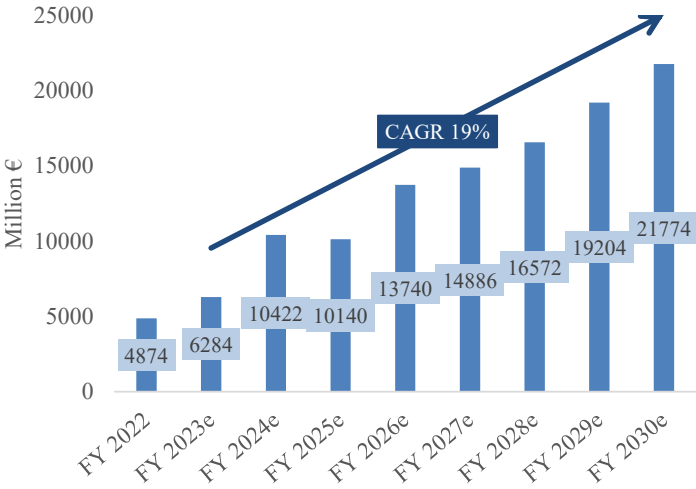
**Table 10:** FCFE Computations

<b>In millions</b>	<b>FY 2022</b>	<b>FY 2023e</b>	<b>FY 2024e</b>	<b>FY 2025e</b>	<b>FY 2026e</b>	<b>FY 2027e</b>	<b>FY 2028e</b>	<b>FY 2029e</b>	<b>FY 2030e</b>
EBIT	6537	9908	11481	13555	15643	18044	20617	23342	25994
EBIT*(1-t)	5621	8495	9814	11552	13290	15281	17403	19638	21795
D&A	876	1318	1440	1591	1828	2014	2223	2415	2611
Δ NWC	3874	1126	-21	1849	277	1151	1746	1502	1381
CapExp	2213	2403	854	1154	1101	1259	1309	1347	1251
Free Cash Flows to Firm	4836	6284	10422	10140	13740	14886	16572	19204	21774

**Source:** Own Computations

Using the WACC, the FCFE values are updated to their present value. The sum of these values and the Terminal Value equals the Enterprise Value. To arrive at the TV, the updated value of the FCFE for 2030 is used through the WACC and growth rate presented above.

**Figure 22: FCFE Forecast**



**Source:** Own Computations

Once the Enterprise value is attained, the market value of debt and minority interest presented by the company, which is nil in the in the case of minority interest, are deducted to obtain the equity value.

With an equity value of 267 491 million and a total of 395 million shares outstanding, dividing one value by the other results in a final share price of €677.

**Table 11: Share Price Computations**

	<i>Million €</i>
Total PV of FCFE	73290
Terminal Value	198324
Enterprise Value	271613
Total Debt	4122
<hr/>	
WACC	9,03%
g	2,87%
<hr/>	
Equity Value	267491
Shares Outstanding 2022	395
Shares' price 2023 Dec	€ 677

**Source:** Own Computations

### 6.1.3 Sensitivity Analysis

The objective of the sensitivity analysis is to assess how changes in the WACC, and the growth rate affect the share price and enterprise value. The inputs were tested with variations of +/- 0.25 percentage points in both analyses.

**Table 12:** Sensitivity Analysis – Share Price

		<i>WACC</i>				
		8,53%	8,78%	9,03%	9,28%	9,53%
	677					
	2,37%	695	665	637	612	588
	2,62%	718	686	657	629	604
	2,87%	743	709	677	648	622
	3,12%	771	734	700	669	640
<i>g</i>	3,37%	801	761	724	691	660

**Source:** Own Computations

**Table 13:** Sensitivity Analysis – Enterprise Value

		<i>WACC</i>				
		8,53%	8,78%	9,03%	9,28%	9,53%
	€271 613					
	2,37%	€279 241	€267 396	€255 899	€246 313	€236 892
	2,62%	€288 426	€275 748	€263 480	€253 283	€243 286
	2,87%	€298 346	€284 736	€271 613	€260 738	€250 107
	3,12%	€309 349	€294 668	€280 567	€268 922	€257 573
<i>g</i>	3,37%	€321 333	€305 442	€290 242	€277 735	€265 587

**Source:** Own Computations

These fluctuations cause the price range to oscillate between €801 (best-case scenario) and €588 (worst-case scenario), which is the result of a previous change in the EV, in this case between €321 333 million (best-case scenario) and €236 892 million (worst-case scenario).

### 6.1.4 Scenario Analysis

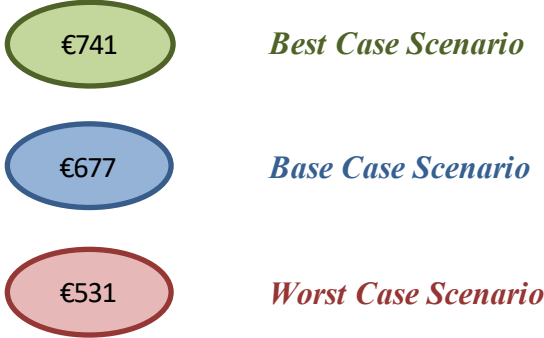
To assess potential future scenarios for the company, various factors were considered. The company's reliance on the new EUV production line is evident, and meeting planned deadlines is contingent on the macroeconomic situation.

If this situation doesn't materialize and the inflationary crisis persists, with inflation in the 3%-4% range, ASML's production level could slow down. If this proves to be a worst-case scenario, along with the increased restrictions imposed by the United States on China, an additional cost will be levied on exporting DUV models. Consequently, the production of High EUV and Low

EUV models will be delayed by a year and launch of the novel product will only take place in 2026. The price hike led to a 4% annual increase in both R&D costs and COGS, causing a gross margin to decrease to 46% in 2023. Under circumstance, the share price is anticipated to decrease by 22% to €531.

In the ideal situation, economic conditions improve and as a result, inflation follows a downward trend. Consequently, High EUV production is expected to commence in 2023. A relief in inflation levels of 1% is anticipated, as a higher percentage in unrealistic, with the COGS decreasing by the same amount. The tax rate remains at the same level as assumed in the DCF model despite the worst-case scenario predicting a 16% tax rate. In addition to these enhancements, it is imperative that the restrictions enforced on China remain static, allowing the organization to construct a business framework based on its current knowledge. This will culminate in revenues approaching the peak value of €60 billion, which has been set by the company as the uppermost figure to be achieved by 2030. Moreover, the gross margin is expected to be around 59%. By these conditions, the share price will exceed the one predicted in the DCF model by 9%, with €741.

**Figure 23:** Scenario Analysis – Share Price Variation



**Source:** Own Computations

### 6.2 Relative Valuation

To conduct a relative valuation, it is imperative to establish the peer group to which the company belongs. This allows for the application of relevant multiples to deduce the company’s share price based on the valuation.

6.2.1 PEER Group

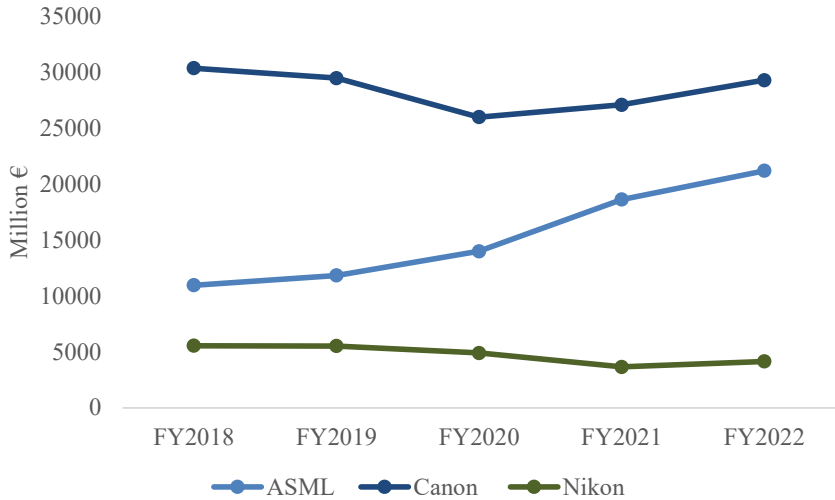
To formalize this group using Refinitiv, the industry in which ASML is included was selected, in this case semiconductors, resulting in a sample of 286 companies, none of which is half the size of the Dutch company in terms of market capitalization. This implies that the company’s competitors will have to be segmented into distinct areas, making it challenging for them to be truly similar companies as a whole.

Building on the annual report’s definitions and adding a group of peers, sets of peers were identified to analyze the different areas in which certain companies compete as rivals.

The only criteria required for companies to be considered peers is that they share some sort of product or belong to the same industry, in addition to being listed on the stock exchange and having debt. The identified groups consist of:

- (1) DUV – where Canon and Nikon, both Japanese firms, are the major competitors who could impede ASML’s DUV production. Canon’s production line comprises the KrF and i-line systems and has generated sales of over 28 billion euros. Nikon’s production base includes ArFi and ArF systems. In both instances, the metrics differ from those reported by ASML, with D/E ratios of 20.43% (Canon) and 29.7% (Nikon), as well as significantly lower ROEs of 8.15% and 7.52% respectively, in contrast to ASML’s 59.35%. Its notable that this is a group rather than a similar business management.

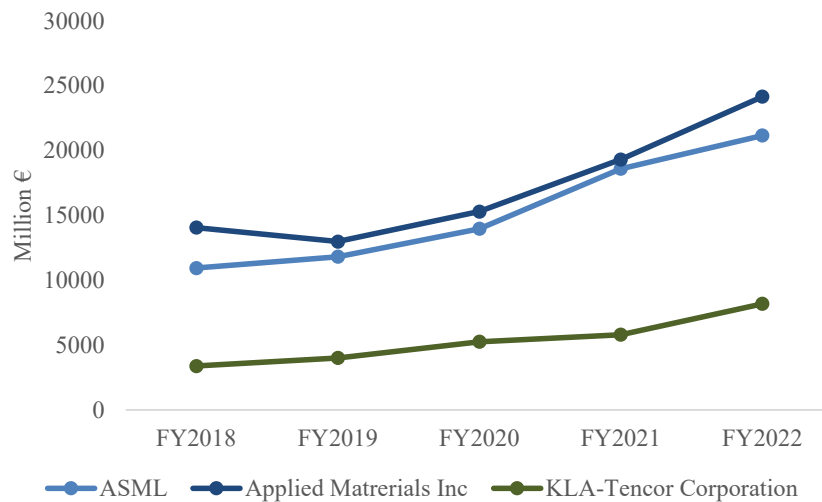
**Figure 24:** Canon & Nikon Revenues



**Source:** Refinitv Eikon

(2) Application offering – Applied Materials Inc and KLA Tencor Corporation are part of this category due to their customer support services, aimed at optimizing processes and achieving cost efficiency within the supply chain. Their products are comparable to those offered in the service and field option sales, and even partly in metrology and inspection. In terms of revenue, only Applied Materials and Canon surpass ASML, in this case with €26.543 billion in 2022, while also sharing similar ROE and DY rates, currently standing at 53.33% and 1.05%, respectively. KLA’s dividend yield is comparable to that of the Dutch company at 1.25%, while its return on equity stands out as the industry’s highest at 139.02%.

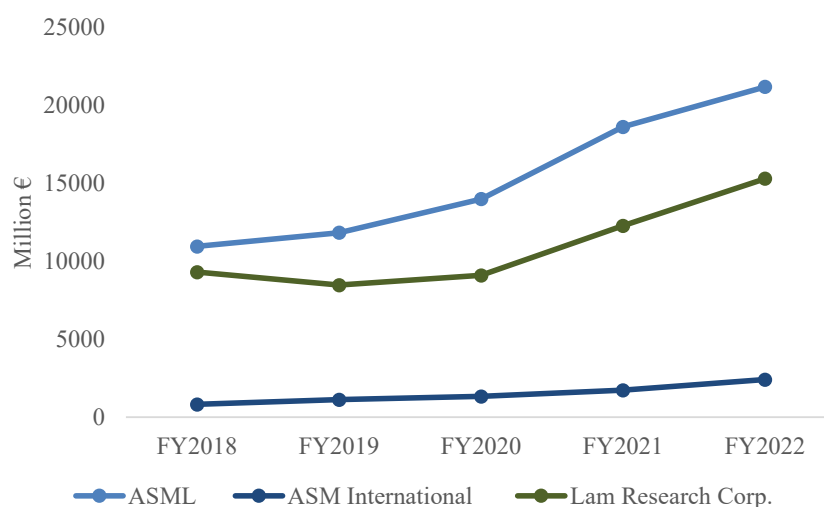
**Figure 25:** Applied Materials Inc & KLA Tencor Corporation Revenues



**Source:** Refinitiv Eikon

(3) Indirect Competitors – this last grouping is external to the players identified by the company. It was chosen because their position in the industry is as close as possible, and their size is also similar to that of the lithographic company. ASM International, one of ASML’s original firms, is in the Netherlands and has a D/E ratio of 0.18%, making it the closest to ASML’s 1.84%, and a DY of 1.06%. On the other hand, Lam Research Corporation situated in the United States, has the highest share price (€384.65) among the selected group and a DY of 1.53%, and suffered from export restrictions to China imposed by its country.

**Figure 26:** ASML International & Lam Research Corp. Revenues



**Source:** Refinitv Eikon

**Table 14:** ASML & Peers Financials

	<i>Market Cap (M)</i>	<i>DY</i>	<i>D/E</i>	<i>ROE</i>	<i>EBITDA Margin</i>	<i>Gross Margin</i>
ASML	€251 812,50	1,27%	1,84%	59,35%	39,10%	50,54%
Canon	€24 287,81	4,20%	20,43%	8,15%	14,40%	45,30%
Nikon	€3 018,56	2,75%	29,70%	7,52%	13,70%	46,00%
Applied Materials Inc	€116 538,01	1,05%	7,29%	53,39%	31,00%	46,70%
KLA-Tencor Corporation	€69 019,84	1,25%	11,62%	139,02%	43,30%	61,60%
ASML International	€23 444,96	1,06%	0,18%	15,59%	31,30%	47,40%
Lam Research Corp.	€88 456,75	1,53%	9,40%	74,85%	32,30%	45,10%
	01/12/2023	31/12/2022	31/12/2022	31/12/2022	31/12/2022	31/12/2022

**Source:** Refinitv Eikon (30/12/2022)

## 6.2.2 Multiples

The multiples chosen for this valuation were forward looking multiples, supported by the literature review for their greater accuracy. The selected multiples include the P/E, widely used in the technology and semiconductor industries, and the EV/EBITDA. The use of such multiples together assists in reducing the influence of the capital structure present in the P/E ratio, providing a comprehensive view of the company's total value as provided by the EV multiples.

The multiples presented by ASML, differ significantly from those of its peers, with a P/E of 31.28x and an EV/EBITDA of 25.67x. Across all groups, the share price indicated by P/E exceeded that indicated by EV/EBITDA.

Even the indirect competitors group, which one would expect to have values closer to the company's reality, presented a share price considerably lower than ASML's market value at

the end of 2022, and by being forward multiples is expected to be higher. On the opposite side of the spectrum and exhibiting the lowest values, lies the DUV group whose median P/E (13.78x) and EV/EBITDA (7.18x) were the weakest among the three groups. The share price when divided by groups ranged between €413.74 (Indirect Competitors) and €166.67 (DUV), it was assumed an average of the prices from the two multiples used.

**Table 15:** Multiples Share Price segmented by group of peers

<b><i>DUV</i></b>	<b><i>P/E</i></b>	<b><i>EV/EBITDA</i></b>	<b><i>Indirect Competitors</i></b>	<b><i>P/E</i></b>	<b><i>EV/EBITDA</i></b>
Median	13,78x	7,18x	Median	28,56x	22,47x
Implied Share Price	€223,05	€110,28	Implied Share	€462,37	€365,11
Final Share Price	€166,67		Final Share Price	€413,74	
<b><i>Application offering</i></b>	<b><i>P/E</i></b>	<b><i>EV/EBITDA</i></b>			
Median	20,68x	16,47x			
Implied Share	€334,78	€265,06			
Final Share Price	€299,92				

**Source:** Refinitiv Eikon and Own computations

For the three groups as a whole, the peers ranged from a high of €418.19 to a low of €150.19. It is evident that the peers may be comparable in specific business areas or capital structure, but they are not similar to ASML in entirety, resulting in a much lower price than anticipated. This is justified by the company's position as a major player in the industry. Thus, this valuation will not be considered as an influence for a final price recommendation.

**Table 16:** Multiples Shares Price

<b><i>Total</i></b>	<b><i>Low</i></b>		<b><i>High</i></b>			
	<b><i>P/E</i></b>	<b><i>EV/EBITDA</i></b>	<b><i>P/E</i></b>	<b><i>EV/EBITDA</i></b>	<b><i>P/E</i></b>	<b><i>EV/EBITDA</i></b>
Median	12,97x	5,97x	20,68x	16,47x	33,13x	25,74x
Implied Share	€210,02	€90,21	€334,78	€265,06	€416,79	€419,59
Final Share Price	€150,11		€299,92		€418,19	

**Source:** Refinitiv Eikon and Own computations

### 6.3 Comparison with IB Report

This chapter analyses the evaluation of specific parameters and assumptions made by comparing the presented model against the one prepared by an investment bank for the valuation of ASML Holding NV.

**Table 17:** Thesis Share Price vs IB Share Price

	<b>Thesis</b>		<b>IB</b>
Rf	2,35%	Rf	2,9%
Beta	1,18	Beta	1,05
Market Premium	5,75%	Market Premium	5,80%
Ke	9,14%	Ke	9,00%
Kd	3,16%	Kd	-
Tax Rate	14%	Tax Rate	16%
g	2,87%	g	3,00%
WACC	9,03%	WACC	9,00%
Equity Value	267491	Equity Value	267149
Share Price	€ 677	Share Price	€ 659

**Source:** Own computations and IB Report

Société Générale was selected as the bank for this comparison, and the report used was published on July 21, 2023, already using the ASML report for the first half of the same year throughout its forecast. The report shows two share prices, one for July 19, 2023, and the other for a 12-month span, which will be comparable to the one used in the thesis, given the time at which will be finalized and the period for which the forecast was made.

Starting with the presented final prices, there is a mere discrepancy of €18 between the thesis and the report, however, the disparities are substantial. The foremost critical element in the WACC computation is the investment bank's omission of Kd, as it only accounts for Net Debt, valuing it at zero, unlike the thesis which combines both short- and long-term debt to assume the market value of debt, resulting in Kd of 3.16%.

The beta indicates a slight variation (1.18 vs 1.05), and the assumed risk-free rate differs as the thesis employed the German 10-year Bunds while SG analysts chose Dutch bonds. The WACC and terminal growth rate are comparable, with the number stated in the thesis being more conservative, featuring a lower growth rate of 2.87% in contrast to the report's 3%, despite this, the forecast period chosen by SG is 10 years instead of 8 years already mentioned in the previous chapters.

Based on the assumptions and adopting a more positive outlook presented in the report, it is anticipated that the initial High EUV units will be launched in 2024, with the production of two of the most advanced systems, and it is less aggressive on Low EUV production, predicting a faster evolution in this sector than the company itself.

With this, analysts also anticipate a fixed CAPEX level of €1.5 billion instead of adjusting it to demand levels of product development. Additionally, they expect R&D costs to increase by 8% annually in a steady state, compared to the 4% used in the thesis. The higher investments notwithstanding, there is a trade-off between the thesis and the report in the models, which assume higher growth in the near future, leading to similar sales growth up to 2030 with a CAGR of 11% (thesis) and 9% (report). These assumptions justify the equity value difference of around €4 billion.

Applying the model developed in this thesis and based on the assumptions outlined in chapter 5, by solely assigning the WACC and growth rate defined by the SG, the share price of ASML would increase to €693.

**Table 18:** IB under Thesis assumptions

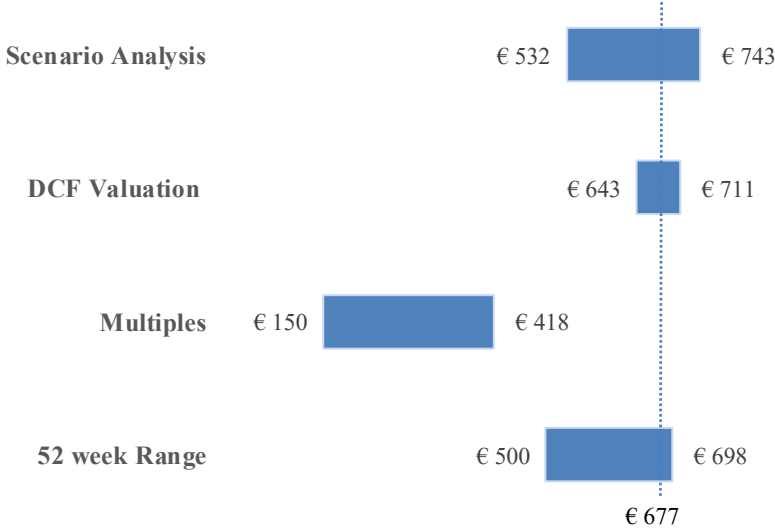
<i><b>IB under Thesis assumptions</b></i>	
Total PV of FCFF	73383
Terminal Value	204476
Enterprise Value	277859
Total Debt	4122
<hr/>	
WACC	9%
g	3%
<hr/>	
Equity Value	273737
Shares Outstanding 2022	395
Shares' price 2023	€ 693

**Source:** Own computations and IB Report

#### 6.4 Price Recommendation

The final share price is 677€, using the DCF valuation and comparing the values from the multiple valuation and the 52-week range. The football field graph illustrates how this price closely approximates the highest deviation from the past year. Despite semiconductor company's potential and eminence, the susceptibility to economic and political circumstances prompt a HOLD recommendation. The current valuation of the company (€659 on the 11<sup>th</sup> of December 2023) is very close to the value shown, the prediction is that a negative scenario could have a greater impact on the company than a positive one, despite the rise of around 30% in the past year, when compared to the price of 504€ on the 30<sup>th</sup> of December 2022.

**Figure 27:** Football Field



**Source:** Own Computations

## 7 Conclusion

The economic outlook is promising, and a turnaround is expected that could benefit an industry such as semiconductors, which suffered from a shortage of chips and skilled workers in 2020 and 2021. The potential influence of a fluctuating market, particularly from USA and China, may impact the company across various business areas in the near future, and could be the main risk in this environment.

The market is predicted to experience steady growth, with significant prospects for ASML's expansion. The business model is designed to integrate the substantial CAPEX and R&D that this industry demands to ensure the intended innovation thrives, all while supporting the EUV and DUV lines and developing the new High EUV line.

The chosen model for conducting a comprehensive evaluation of the company was the DCF, which involved making numerous assumptions covering an eight-year period. Through performing a multiples valuation, the company's standing as a leader in its industry was reaffirmed. It was also highlighted that comparisons with peers can only be drawn in specific areas, and the firms similar to ASML size are indirect competitors.

The analysis culminates in a final price of 677€ and a recommendation to HOLD, supported by the growth and level of innovation allied to perseverance, in accordance with the investment bank's report of a €659 and HOLD.

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## 9 Appendices

*Appendix 1:* Historical Revenues per Technology (2018-2022)

*Appendix 2:* Historical Revenues per Technology (Units) (2018-2022)

*Appendix 3:* Net System Sales vs Net Service Field Option Sales (2018-2022)

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*Appendix 17:* Cash Conversion Cycle Historical Performance (2014-2022)

**Appendix 1: Historical Revenues per Technology (2018-2022)**

<i>In millions</i>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
EUV	1880	2800	4464	6284	7045
gYoY%		49%	59%	41%	12%
ArFi	4807	4708	3917	4960	5237
gYoY%		-2%	-17%	27%	6%
ArF dry	274	401	427	432	624
gYoY%		46%	6%	1%	44%
KrF	860	680	1012	1321	1654
gYoY%		-21%	49%	31%	25%
I-line	99	134	146	142	212
gYoY%		35%	10%	-3%	49%
Metrology & Inspection	339	274	350	514	660
gYoY%		-19%	28%	47%	28%

**Appendix 2: Historical Revenues per Technology (Units) (2018-2022)**

<i>Units</i>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
EUV	18	26	31	42	40
gYoY%		44%	19%	35%	-5%
ArFi	86	82	68	81	81
gYoY%		-5%	-17%	19%	0%
ArF dry	16	22	22	22	28
gYoY%		38%	0%	0%	27%
KrF	78	65	103	131	151
gYoY%		-17%	58%	27%	15%
I-line	26	34	34	33	45
gYoY%		31%	0%	-3%	36%
Metrology & Inspection	114	115	137	196	216
gYoY%		1%	19%	43%	10%

**Appendix 3: Net System Sales vs Net Service Field Option Sales (2018-2022)**

<i>In millions</i>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
Net System Sales	8259	8996	10317	13653	15430
gYoY%	-	9%	15%	32%	13%
Net Service and Field Option Sales	2685	2824	3662	4958	5743
gYoY%	-	5%	30%	35%	16%
Total Sales	10944	11820	13979	18611	21173

#### Appendix 4: Historical Revenues by Geographical Region (2018-2022)

<i>In millions</i>	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022
Japan	568	463	543	459	1009
gYoY%		-18%	17%	-15%	120%
South Korea	3725	2202	4152	6223	6046
gYoY%		-41%	89%	50%	-3%
Singapore	223	120	85	126	476
gYoY%		-46%	-29%	49%	277%
Taiwan	1990	5357	4731	7328	8096
gYoY%		169%	-12%	55%	10%
China	1843	1378	2324	2741	2916
gYoY%		-25%	69%	18%	6%
Rest of Asia	2	3	2	2	7
gYoY%		37%	-38%	13%	300%
Netherlands	1	3	2	14	9
gYoY%		117%	-38%	788%	-35%
EMEA	632	315	483	135	625
gYoY%		-50%	54%	-72%	364%
United States	1962	1980	1657	1583	1991
gYoY%		1%	-16%	-4%	26%

#### Appendix 5: Historical Performance (2013-2022)

<i>Historical Growth</i>	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022
Dividends	216	268	302	446	517	597	1326	1066	1368	2560
gYoY%	14,29%	24,07%	12,69%	47,68%	15,92%	15,47%	122,11%	-19,61%	28,33%	87,13%
EBIT	1275	1148	1481	1532	2047	2858	2681	4052	6751	6537
gYoY%	-4,92%	-9,96%	29,01%	3,44%	33,62%	39,62%	-6,19%	51,14%	66,61%	-3,17%
Net Income	1194	1418	1619	1643	2173	2526	2581	3697	6135	6396
gYoY%	-8,29%	18,76%	14,17%	1,48%	32,26%	16,24%	2,18%	43,24%	65,95%	4,25%
CAPEX	-538	-706	-743	-724	-723	-838	-1192	-1621	-1626	-2212
gYoY%	13,74%	31,23%	5,24%	-2,56%	-0,14%	15,91%	42,24%	35,99%	0,31%	36,04%
Depreciation	321	353	243	291	707	734	828	918	863	876
gYoY%	12,24%	9,97%	-31,16%	19,75%	142,96%	3,82%	12,81%	10,87%	-5,99%	1,51%
R&D	557	1074	1068	1106	1260	1576	1969	2201	2547	3254
gYoY%	86,91%	92,82%	-0,56%	3,56%	13,92%	25,08%	24,94%	11,78%	15,72%	27,76%
EBIT Margin	24,31%	19,60%	23,56%	22,28%	22,84%	26,11%	22,68%	28,99%	36,27%	30,87%
Gross Margin	39,89%	42,64%	45,06%	43,61%	41,63%	45,95%	44,67%	48,63%	52,71%	50,54%

#### Appendix 6: Industry Historical Performance (2012-2022)

<i>In billion \$</i>	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022
Revenues	300	315	340	335	344	422	476	422	471	595	600
Capex	59	55	66	65	68	96	106	103	113	153	182
Capex/Revenues	20%	18%	19%	19%	20%	23%	22%	24%	24%	26%	30%

### Appendix 7: Revenues Forecast Inflation (2020-2025)

<i>Inflation</i>	<b>FY2020</b>	<b>FY2021</b>	<b>FY2022</b>	<b>FY 2023e</b>	<b>FY 2024e</b>	<b>FY 2025e</b>	<b>Weights</b>
Inflation Taiwan	-0,24%	1,97%	2,95%	2,4%	1,6%	2,7%	38%
Inflation Netherlands	1,30%	2,70%	10%	4,6%	1,1%	0,8%	10%
Inflation USA	1,20%	4,70%	8%	4,6%	2,4%	2,5%	9%
Inflation South Korea	0,50%	2,50%	5,10%	3,7%	2,2%	2,5%	29%
Inflation China	2,40%	1,00%	2%	0,5%	2,1%	2,2%	14%
			<b>Total</b>	<b>2,9%</b>	<b>1,9%</b>	<b>2,4%</b>	

### Appendix 8: Revenues Forecast (2022-2030)

<i>In millions</i>	<b>FY 2022</b>	<b>FY 2023e</b>	<b>FY 2024e</b>	<b>FY 2025e</b>	<b>FY 2026e</b>	<b>FY 2027e</b>	<b>FY 2028e</b>	<b>FY 2029e</b>	<b>FY 2030e</b>	<b>CAGR</b>
High - EUV	-	-	-	300	1236	2837	4501	6558	8362	95%
%	-	-	-	-	312%	130%	59%	46%	28%	-
EUV	7045	9800	12618	14853	16254	17555	18901	19887	20699	11%
%	12%	39%	29%	18%	9%	8%	8%	5%	4%	-
ArFi	5237	8678	8045	8534	9054	9512	9994	10499	11031	3%
%	6%	66%	-7%	6%	6%	5%	5%	5%	5%	-
ArF dry	624	586	543	577	612	643	675	709	745	3%
%	44%	-6%	-7%	6%	6%	5%	5%	5%	5%	-
KrF	1654	1992	2154	2329	2471	2596	2701	2810	2924	6%
%	25%	20%	8%	8%	6%	5%	4%	4%	4%	-
I-line	212	266	301	325	352	368	385	402	420	7%
%	49%	26%	13%	8%	8%	5%	5%	5%	5%	-
Metrology & Inspection	660	626	694	768	850	932	1022	1121	1229	10%
%	28%	-5%	11%	11%	11%	10%	10%	10%	10%	-
Service and Field option sales	5743	6317	6949	7644	8408	9249	10174	11192	12311	10%
%	16%	10%	10%	10%	10%	10%	10%	10%	10%	-
Total Revenues	21173	28265	31303	35330	39238	43692	48352	53179	57721	11%

### Appendix 9: COGS Historical Performance (2018-2022)

<i>In millions</i>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>	
Cost of System Sales		4141	4676	5169	6483	7582
Cost of Service and Field Option Sales		1774	1864	2012	2319	2891
Total COGS		5915	6540	7181	8802	10473
COGS/Revenues		54%	55%	51%	47%	49%

### Appendix 10: EBIT Forecast (2023-2030)

<i>In millions</i>	FY 2023e	FY 2024e	FY 2025e	FY 2026e	FY 2027e	FY 2028e	FY 2029e	FY 2030e	CAGR
Revenues	28265	31303	35330	39238	43692	48352	53179	57721	11%
gYoY%	33%	11%	13%	11%	11%	11%	10%	9%	
COGS	13633	14856	16499	18029	19752	21506	23272	24854	9%
gYoY%	30%	9%	11%	9%	10%	9%	8%	7%	
Gross Profit	14632	16447	18831	21209	23940	26846	29907	32867	12%
Gross Margin	52%	53%	53%	54%	55%	56%	56%	57%	
R&D	3594	3714	3863	3996	4148	4295	4438	4564	3%
gYoY%	10%	3%	4%	3%	4%	4%	3%	3%	
SG&A	1131	1252	1413	1570	1748	1934	2127	2309	11%
gYoY%	31%	11%	13%	11%	11%	11%	10%	9%	
EBIT	9908	11481	13555	15643	18044	20617	23342	25994	15%

### Appendix 11: COGS Forecast (2022-2030)

<i>In millions Forecast</i>	FY 2022	FY 2023e	FY 2024e	FY 2025e	FY 2026e	FY 2027e	FY 2028e	FY 2029e	FY 2030e
Cost of System Sales	7582	10482	11421	12755	13948	15304	16658	17987	19093
Cost of Service and Field Option Sales	2891	3151	3435	3744	4081	4448	4848	5285	5760
Total COGS	10473	13633	14856	16499	18029	19752	21506	23272	24854
COGS/Revenues	49%	48%	47%	47%	46%	45%	44%	44%	43%

### Appendix 12: Capital Expenditure Forecast (2023-2030)

<i>In million €</i>	FY 2023e	FY 2024e	FY 2025e	FY 2026e	FY 2027e	FY 2028e	FY 2029e	FY 2030e
Purchase of Fixed Assets	-1442	-512	-692	-661	-755	-785	-808	-751
% of Revenues	-5%	-2%	-2%	-2%	-2%	-2%	-2%	-1%
Purchase/Acquisition of Intangibles	-961	-342	-461	-441	-503	-524	-539	-500
% of Revenues	-3%	-1%	-1%	-1%	-1%	-1%	-1%	-1%
Total CAPEX / Revenues %	9%	3%	3%	3%	3%	3%	3%	2%
CAPEX	-2403	-854	-1154	-1101	-1259	-1309	-1347	-1251
gYoY%	9%	-64%	35%	-5%	14%	4%	3%	-7%

### Appendix 13: Peers Revenues (2018-2022)

<i>Revenues million €</i>	FY2018	FY2019	FY2020	FY2021	FY2022
Canon	30339	29461	25968	27070	29268
Nikon	5540	5524	4893	3653	4137
Applied Materials Inc	14070	12995	15305	19330	24178
KLA-Tencor Corporation	3385	4007	5253	5803	8183
ASM International	818	1125	1328	1730	2411
Lam Research Corp.	9294	8463	9088	12271	15284

### **Appendix 14: Historical Depreciation and Fixed Assets (2014-2022)**

<i>Historical</i>	<b>FY 2014</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>FY 2017</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
PPE	1448	1621	1687	1546	1727	2323	2815	3148	4137
PPE/Revenues	-	-	-	-	16%	20%	20%	17%	20%
Other Long Term	588	591	649	826	1172	1336	1692	2268	2929
Other Long Term/Revenues	-	-	-	-	11%	11%	12%	12%	14%
Fixed Assets	2036	2212	2336	2372	2899	3659	4507	5416	7066
growth Fixed Assets	-	9%	6%	2%	22%	26%	23%	20%	30%
Fixed Assets/Revenues	-	-	-	-	26%	31%	32%	29%	33%
Dep/Fixed Assets	17%	11%	12%	30%	25%	23%	20%	16%	12%

### **Appendix 15: Depreciation Forecast (2022-2030)**

<i>Forecast</i>	<b>FY 2022</b>	<b>FY 2023e</b>	<b>FY 2024e</b>	<b>FY 2025e</b>	<b>FY 2026e</b>	<b>FY 2027e</b>	<b>FY 2028e</b>	<b>FY 2029e</b>	<b>FY 2030e</b>
PPE	4137	5088	5635	6305	7351	8164	9074	9912	10763
Other Long Term	2929	3392	3756	4204	4901	5443	6049	6608	7175
Fixed Assets	7066	8480	9391	10509	12252	13607	15123	16519	17939
% of sales	33%	30%	30%	30%	31%	31%	31%	31%	31%
Dep	876	1187	1315	1471	1715	1905	2117	2313	2511

### **Appendix 16: Net Working Capital Historical Performance (2014-2022)**

<i>NWC</i>	<b>FY 2014</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>FY 2017</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
Account Payables	496	419	593	837	964	1062	1378	2116	2564
Operating Cash	117	126	138	179	219	236	280	372	423
Account Receivables	1053	804	766	2011	1594	2018	1430	3193	5456
Inventories	2550	2574	2732	2956	3440	3809	4569	5179	7200
Tax Payable	36	4	202	152	188	66	110	302	315
<b>NWC</b>	<b>3188</b>	<b>3081</b>	<b>2841</b>	<b>4157</b>	<b>4101</b>	<b>4935</b>	<b>4791</b>	<b>6326</b>	<b>10200</b>
<b>Δ NWC</b>	<b>-</b>	<b>-107</b>	<b>-240</b>	<b>1317</b>	<b>-56</b>	<b>835</b>	<b>-145</b>	<b>1536</b>	<b>3874</b>

### **Appendix 17: Cash Conversion Cycle Historical Performance (2014-2022)**

<i>Cash Conversion Cycle</i>	<b>FY 2014</b>	<b>FY 2015</b>	<b>FY 2016</b>	<b>FY 2017</b>	<b>FY 2018</b>	<b>FY 2019</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>
DPO	53	44	55	58	59	58	69	87	88
DSO	65	46	40	81	52	61	37	62	93
DIO	273	268	254	203	209	210	229	212	247
CCC	285	271	239	227	203	213	197	187	252

## 10 Glossary & Abbreviations

APV – Adjusted Present Value

CAGR – Cumulative Annual Growth Rate

CAPEX – Capital Expenditure

CCC – Cash Conversion Cycle

COGS – Cost of Goods Sold

D&A – Depreciation and Amortization

DCF – Discounted Cash Flow

DDM – Dividend Discount Model

DIO – Days Inventory Outstanding

DPO – Days Payable Outstanding

DSO – Days Sales Outstanding

DUV – Deep Ultraviolet

DY – Dividend Yield

EBIT – Earnings Before Interest and Taxes

ECB – European Central Bank

EUV – Extreme Ultraviolet

EV – Enterprise Value

FCFE – Free Cash Flow to Equity

FCFF – Free Cash Flow to Firm

GDP – Gross Domestic Product

IB – Investment Bank

IPO – Initial Public Offer

NA – Numerical Aperture

NWC – Change in Net Working Capital

R&D – Research and Development

ROE – Return on Equity

ROIC – Return on Invested Capital

SG – Société Générale

SG&A – Selling General and Administrative

TV – Terminal Value

USA – United States of America

WACC – Weighted Average Cost of Capital

YTM – Yield to Maturity