

A Work Project, presented as part of the requirements for the Award of a Master Degree in Finance from the
NOVA – School of Business and Economics.

Equity Research Report ASML Holding NV – The
provider of digital progress

Klaus Wenger-Oehn, 51019

A Project carried out on the Master in (Economics/Finance/Management) Program, under the supervision of:

Francisco Martins

16.12.2022

Abstract

This equity report is written to determine the value of the ASML Holding NV share and is ultimately intended to serve as a recommendation as to whether we believe the share is undervalued, overvalued or fairly valued. In doing so, we examined the semiconductor market and found both potential risks and positive prospects that will drive the market in the coming years. We primarily relied on corporate information from ASML, but also from competitors and peers in the form of financial reports and annual statements. To quantify the potential mispricing of the stock, we used Excel to build a model that forecasts future cash flows, which we discount using the discounted cashflow method and the multiples approach. The preliminary results show that the market has strong growth potential, given the current shortage of semiconductor chips and ASML's monopoly position in the EUV sector, currently the most advanced lithography solution. Nevertheless, we see a large part of this positive outlook already priced into the company's current share price, which leads us to issue a "hold" recommendation for ASML Holding NV.

This work used infrastructure and resources funded by Fundação para a Ciência e a Tecnologia (UID/ECO/00124/2013, UID/ECO/00124/2019 and Social Sciences DataLab, Project 22209), POR Lisboa (LISBOA-01-0145-FEDER-007722 and Social Sciences DataLab, Project 22209) and POR Norte (Social Sciences DataLab, Project 22209).

This report is part of the ASML research report (annexed), developed by Klaus Wenger-Oehn (51019) and Sebastian Fenz (48744) and should be read as an integral part of it.

Table of Contents

Introduction.....	5
Macroeconomic Context and Challenges	6
Nanoimprint Lithography (NIL)	6
Customer dependency	6
Competitive Landscape	7
Indirect Competitors.....	7
Direct Competitors.....	8
Valuation.....	8
Financial Health.....	8
Revenue Forecast	10
▪ EUV	10
▪ High NA EUV	11
▪ DUV.....	12
▪ Metrology and Inspection	13
▪ Net Service and Field Option Sales	13
Net Working Capital.....	13
Valuation Outcome	14
Discounted Cash Flow	14
Conclusion.....	14

Introduction

The purpose of this research is to estimate a share price of ASML Holding NV. In order to guide potential investors and provide a final recommendation regarding whether to buy, hold, or sell the stock. The reader can gain a general understanding of the market, the company, and any potential risk factors that might affect the valuation by reading the first three chapters (company overview, macroeconomic context, and competitive landscape). The final two major topics (valuation and valuation outcome) provide an explanation of our valuation model and a final recommendation backed by numerical evidence. This single part discusses the competition as well as the forecast and parts of the macroeconomic part, my partner takes into account the company presentation, the macroeconomic context as well as the valuation. Both parts are essential to create the ASML Equity Research Report.

Macroeconomic Context and Challenges

Nanoimprint Lithography (NIL)

It is undisputed that EUV is the predominant technology for manufacturing high-end semiconductors. Research and development in this area is being carried out exclusively by ASML, after the two competitors Nikon and Canon withdrew from the race at an early stage. (NIKKEI 2020) While Nikon has stopped all efforts to develop a lithography process that can compete with ASML's EUV technology, Canon is researching a new process to print wafers even more cost-effectively to form circuits. This technique is called nanoimprint lithography. By applying a nanopattern mask to the coated resin on the wafer surface, nanoimprint lithography creates patterns at the nanoscale, unlike conventional lithography, in which circuit patterns are created by exposing them to ultraviolet light. The main advantage Canon is aiming for over EUV is to reduce production costs. Since FY04, Canon has developed its nanoimprint lithography technology and acquired the U.S. company Molecular Imprints Inc (now Canon Nanotechnologies, Inc.) in FY14, which is specialized in nano structuring systems. In addition, Canon plans to invest more than \$350 million in a new plant in Tochigi, Japan, to produce its nanoimprint lithography machines, which are expected to be operational by FY25. Canon's only operational nanoimprint lithography device, the FPA-1200NZ2C, is currently used by Toshiba in Japan. Nevertheless, the technique has been known for a long time (as stated above Canon is researching this lithography technique since FY04), without any ground-breaking discovery. Since it is a contact patterning process, there are some problems, such as mask wear, problems with overlays, or high sensitivity to impurities, this causes defects in the output, which are not as well controlled today as they are with EUV. According to Canon's latest annual report, key features have now reached the level of mass production, so the company is aiming for rapid commercialization of the technology. (Cannon 2021) (Abachy)

We do not assume that nanoimprint lithography will pose a serious threat to the EUV industry in the near term but acknowledge that it could bring some cost benefits in the long term as it matures. However, when this level is eventually reached, it will likely compete with even more advanced optical lithography technologies, like High NA EUV.

Customer dependency

More than 83,7% of ASML's revenues are generated by its three key customers Intel, TSMC and Samsung. Measured by the maturity, revenue, and market position of these three companies, they are among the largest players in the semiconductor manufacturing market. Looking at the annual reports of these customers shows that they work closely with ASML and that their equipment represents the state of the art in the market. They also indicate that they plan to increase capital spending over the next few years to stave off semiconductor shortages, which would benefit ASML. (ASML 2021) (Intel 2022)

Due to ASML's monopolistic positioning in the market for EUV lithography systems, we do not see any risk of ASML losing a key customer in this field to the competition. For the DUV market, we expect ASML to be able to increase its current market share from 57.0% in FY21 to 60.0% in FY25. This is in line with the company's momentum, which has seen

its market share grow at a CAGR of 7.8% since FY18.

Competitive Landscape

To manufacture semiconductors, a silicon wafer must undergo numerous microfabrication processes, such as wafer slicing, deposition, photoresist coating, lithography, baking and development, etching, Ion implementation and the removing of photoresists. (ASML 2021) Each step along the refining process requires special machines from different suppliers. ASML's business lines, which are EUV and DUV, exclusively treat lithography systems. DUV is currently the most widely used lithography solution and the largest revenue driver for ASML in FY21. The DUV market is still relevant, but a larger share is expected to move to the EUV market in the future, which uses ultraviolet light with wavelengths as short as 13.5 nm compared to those of DUV with wavelengths between 193 nm and 248 nm. ASML is currently the only company capable of producing machines that use EUV technology, so there are no competitors in this business segment.

In this context, we distinguish between direct and indirect competitors in terms of the scope of the machines they offer. But there is also competition among indirect suppliers, as new technologies can make other processing steps redundant. According to a study by Interuniversity Center for Microelectronics (ASML 2021), EUV can help the fab to reduce the steps of some non-lithography processes like deposition, etching or cleaning steps.

Indirect Competitors



Lam Research is an American company in the wafer fab equipment market with approximately 16.300 employees and revenues of \$16,5 billion in FY21. Lam Research produces equipment used exclusively in the processes of deposition and etching. They also offer stripping and cleaning technologies, as well as mass meteorology machines. The company offers its products and services worldwide, although some shipments to China have been restricted since the Biden administration implemented the export controls. (Lam Research 2021)



Headquartered in California's Silicon Valley, Applied Materials Inc. employs about 27.000 people in 19 countries and is the only indirect competitor with higher sales than ASML, with revenues of \$23,06 billion in FY21. In connection with the semiconductor manufacturing process, the company manufactures equipment in the field of etching, ion implementation and deposition. They also offer measuring and testing equipment to ensure the flawless quality of the products produced. In addition to the wafer fabrication equipment market, Applied Materials also supplies electronic device manufacturers with equipment along the supply chain, such as for liquid crystal flat panel displays or photovoltaic solar cells. (Applied Materials 2021)



Tokyo Electron Ltd is a Japanese supplier to the wafer fab equipment market with about 15.883 employees and a revenue of \$12,6 billion in FY21. Similar to the product range of Applied Materials Inc., its main products and services are in the field of semiconductor production equipment and flat panel display (FPD) production equipment, with the FPD market accounting for just 6% of total sales and semiconductor equipment accounting for more than 90%. Due to their close cooperation, a merger between Applied Materials and

Tokyo Electron was planned in FY15 but cancelled due to antitrust concerns in the US. ASML and Tokyo Electron have also entered into joint ventures with the aim of adapting their products to the new EUV technology and maximizing technological development. Along the manufacturing process, the company produces mainly equipment in the field of coating, etching, deposition, wafer trimming and surface preparation. (Tokyo Electron 2021)

Direct Competitors

Nikon, a multinational company headquartered in Japan, is one of ASML's main competitors in the field of semiconductor lithography equipment. With a headcount of 18.437 and a revenue of \$4,8 billion in FY21/22 (annual closing takes place in March), Nikon is part of the Nikkei 225. Nikon's scope of operations can be divided into six segments: Imaging Products, Precision Equipment, Healthcare, Components, Industrial Metrology, and others. The first two segments account for the largest share of sales, 33,3% and 40,9% in FY20/21 respectively. Precision equipment can further be divided into two business units, namely FPD lithography and semiconductor lithography. ASML is in direct competition with the Semiconductor lithography business unit. Nikon currently only serves the DUV market and there are no concrete indications that a solution for EUV will be available in the foreseeable future. Based on Nikon's annual report they expect a strong demand for their DUV equipment. In particular, in the ArF immersion and Arf lithography, they believe to be able to increase units sold by over 300%. (Nikon 2021)



Like Nikon, Canon is a Japanese multinational corporation that started as a producer of cameras and lenses. Nowadays they employ over 184.034 people and generated a revenue of \$30,6 billion in FY21. The company can be divided into four segments, printing, imaging, medical, industrial and others. With a share of 55,2%, print products accounted for the largest share of net sales in FY21. On the other hand, the share of industrial and others is only 15,5%, which mainly handles semiconductor and FPD lithography systems. In the field of lithography technology, Canon offers exclusively KrF and i-line equipment. According to the annual report, Canon aims to maintain its strong position in i-line systems and increase its market share in KrF systems due to the favourable market conditions. As mentioned previously, the Japanese corporation also does not offer an EUV solution but is involved in the development of a new concept for nanoimprint lithography (NIL) that aims to minimize circuits and achieve comparable results to EUV technology at lower costs. (Canon 2021)



Table 1: Liquidity Ratios

ASML		
Liquidity Ratios	2018	2021
Current Ratio	2,75	1,46
Quick Ratio	1,63	0,96
Cash Ratio	0,82	0,57
Tokyo Electron		
Liquidity Ratios	2018	2021
Current Ratio	2,57	3,10
Quick Ratio	1,45	1,54
Cash Ratio	0,70	0,81

Source: ASML Annual Statement, TEL Annual Statement, Bloomberg

Valuation

Financial Health

To assess ASML's financial health, it is crucial to look at the company's liquidity and capital structure, as well as some balance sheet items to comprehend the financial risks involved.

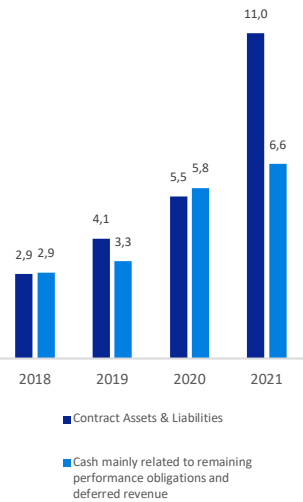
ASML's liquidity is primarily determined by cash and cash equivalents, short-term investments and available credit facilities, with the internal target to keep the sum of cash and cash equivalents and short-term investments above a minimum range of €2,0 billion

Graph 1: Contract liabilities & other current liabilities



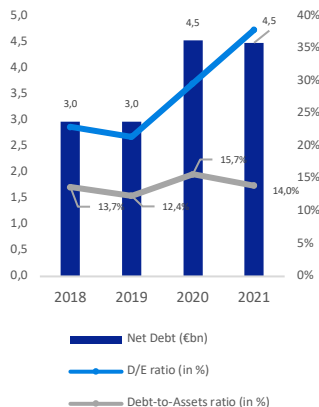
Source: ASML Annual Statement

Graph 2: Contract Assets and Liabilities



Source: ASML Annual Statement

Graph 3: Capital Structure ASML



Source: ASML Annual Statement

to €2,5 billion at all times, which is far below the actual balance of €7,5 billion in FY21. (ASML 2021) Looking at ASML's liquidity ratios, the company appears to have sufficient funds to cover its current liabilities with its current assets, as indicated by the Current Ratio. Although both the Quick Ratio and the Cash Ratio do not indicate sufficient liquidity to pay off all current liabilities in the short term, this is not necessarily concerning, as too much liquidity in the short term could also indicate inefficient use of cash and raise the question of why it is not being used.

Compared to one of its closest industry peers, Tokyo Electron, it is noticeable that ASML's liquidity ratios are significantly lower in FY21. Nevertheless, they were more balanced in FY18 and ASML's ratios seem to have shrunk between these years. When analysing the balance sheet, it is noticeable that current assets increased by 71.9% in FY18 to FY21, while current liabilities increased by 224.3%. This imbalance is due to the large increase in contractual liabilities in FY21. This item mainly includes advance payments for systems to be delivered in the future and, in addition to current liabilities, also affects current assets as cash and cash equivalents increase. However, share buyback programs, dividends and other investments in non-current assets reduce the cash pool accumulated by the advance payments, which is why the liquidity ratios are negatively affected. We can deduce two things from this, firstly we expect a further increase in revenues as contract liabilities indicate full order books. Secondly, it shows the liquidity of ASML's customers as they can tie up their capital in down payments for systems that can take up to five years to be shipped. (ASML 2021) We attribute this increase in contract liabilities to the general semiconductor shortage and strong demand for EUV technology. For the projection period we assumed the cash position that mainly relates to remaining performance obligations and deferred revenue to diverge back towards the historical balanced levels.

Looking at the financial health of the company in terms of absolute long-term debt, we see constant numbers with a jump from FY19 to FY20. Most of the debt included in net debt is ASML's outstanding Eurobonds. While the debt-to-assets ratio remained constant during the historical period, we see an increase in the debt-to-equity ratio starting in FY20. Although absolute debt remains at a similar level in FY21, the debt-to-equity ratio continues to rise as total invested capital decreases sharply, and so does the equity, due to the increase in the aforementioned contractual liabilities and the resulting high transactions with shareholders. In the medium-term future, we expect the debt-to-equity ratio to increase further due to capital investments to meet demand in the coming years, which will be financed with long-term debt. In the long term, we believe that net debt will gradually shrink as the semiconductor market will become more predictable, where equity growth is financed by strong and steady earnings based on our forecast model.

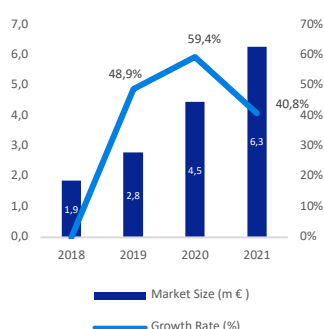
From a historical perspective, liquidity is provided by blue chip customers making down payments for machines for the coming years, which gives ASML's management an advantage in planning as it can estimate revenues more accurately. Given the proportion of the company's long-term debt combined with the "stable" credit rating of various rating agencies (Moody's 2021) (Fitch 2021), ASML does well to leverage its strong credit rating and benefit from cheap capital and the resulting tax shield. Furthermore, this has an important implication on the weighted average cost of capital, given the low amount of debt, the WACC will be close to the cost of equity.

Revenue Forecast

To build an accurate forecast model, we use a bottom-up approach by identifying the key factors that will influence the semiconductor equipment market through FY32. Within the business units, we distinguish between four business areas, EUV, High NA EUV, DUV, Metrology and Inspection, and Net Service and Field Options, each of which has its individual growth rate. For each business area, we also distinguished between the projection period, which runs from FY22 to FY29, and the steady state, which runs from FY30 to FY32, with each area taking a different approach to determining growth rates.

■ EUV

Graph 4: Historical EUV market



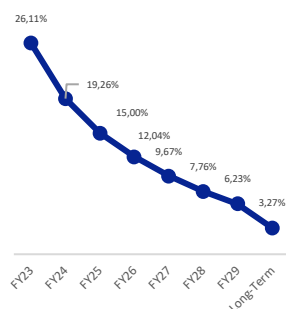
Source: ASML Annual Statement, Analyst estimates, Bloomberg

EUV as ASML's flagship technology, on which they hold a monopoly, with initially over 100 units sold in FY20, we see that there is still immense potential in the marketplace. Having reached a stage of mass production in FY22, we believe that demand is mainly correlated to the general semiconductor market and is more likely to be constrained by capacity issues than by a decline in demand in the short term.

Projection Period

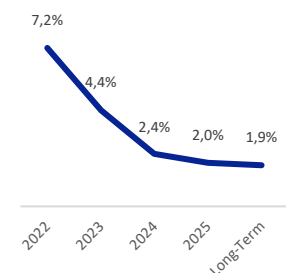
In order to retrieve the growth rates over the projection period we exclusively incorporated the lithography equipment market growth for EUV technology in dependency of ASML's respective market share. Since the other two market players, Nikon and Canon, do not offer EUV equipment, ASML has a market share of 100%, which we believe will remain so because technologies promising substitutes to EUV, such as NIL, are not yet mature enough and will probably never achieve equivalent performance. The market share for EUV is therefore negligible. Given the strong growth of ASML's EUV sector over the last three years (CAGR₁₈₋₂₁ of 149,5%), we expect this trend to slowly level off and therefore assume 15% growth for FY25, which the market is converging towards. Finally, we assume that market growth would continue to decline gradually to 5,0% in FY30 from where it reaches a steady state. These growth rates best reflect the fact that there are capacity constraints and machines tend to have a long life, which affects the number of units purchased. According to the company's information (ASML 2021), 94% of all lithography machines ever sold are still in operation, consequently, production facilities usually only need to be upgraded when a new technology enters the market. Shortages in the semiconductor market and the increasing complexity of new electronic devices are other factors that lead us to expect such strong growth over the next 8 years, until stable growth is reached. As this driver is closely related to the actual sales, we have weighted it at 100% over the whole projection period.

Graph 5: Projected EUV Growth Rates



Source: Analyst estimates

Graph 6: Projected annual inflation rate (advanced economy)



Source: IMF

Furthermore, inflation was put into consideration for ASML's future growth, as inflation in most advanced economies is currently higher than it has been for over 30 years. We believe that ASML can pass on the increased costs immediately to its end consumers, which is why we also expect increased revenues in years with higher inflation. Since an inflation rate of around 2% to 3% is generally considered desirable and normal by central banks in advanced economies (European Central Bank 2022), we assume that a rate of 3% has already been taken into account by the lithography equipment market growth. Therefore, the difference in the perspective inflation rate above 3% was added to the EUV

growth rate. This only occurred in FY22 and FY23 at 4,2% and 1,4%, respectively. Inflation data forecasts through FY27 are derived from an external source (IMF 2022), which aligns with our idea of future development.

Steady State

From FY30, the steady state should reflect the growth of the EUV business into perpetuity. Using GDP as the sole source of forecasts seemed problematic to us, as the different business areas have different maturities which should be reflected in the perpetual growth rate.

Since GDP growth in advanced economies is usually between 2% and 3% (IMF), we have taken a conservative approach to predict growth from FY30 onwards using an external dataset (Bloomberg 2022) that extends to FY27. In this approach, we project GDP growth of 1.5%, weighted at 50%, and growth of 5% weighted at 50% for the lithography equipment market. Looking at the historical growth of the sector, 5% in perpetuity seems reasonable given ASML's market maturity and monopoly on this technology. This finally results in a perpetual growth rate of 3.3% for the EUV market.

▪ High NA EUV

To keep pace with Moore's Law, the industry's benchmark for semiconductor chip development, chips must achieve twice the efficiency of their predecessor every two to three years. When it became clear in recent years how optimistic this estimate was, the industry nevertheless found ways to come close to meeting the requirements, which is why Moore's Law is still used as a benchmark. (Wired 2021) High NA EUV is the next generation of chips that will replace EUV as the leading technology in lithography systems and promises to uphold Moore's Law. As stated in ASML's latest annual report they expect it to enter high-volume manufacturing at their customers site starting in 2025. Based on our assessment and the often-optimistic promises in line with Moore's Law, we estimate that ASML will sell its first commercial High NA EUV machine in 2025. ASML has even received the first orders for the machine, although it is not yet ready for operation. As reported, a High NA EUV system will be significantly more expensive than the EUV system, more than twice as expensive, at approximately €300 million per unit. (Reuters 2022)

Projection Period

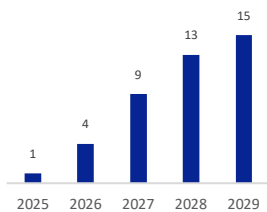
As the company has previously disclosed, Intel is the first fab that has purchased ASML's High NA EUV prototype machine EXE:5000. (ASML 2022) Taking into account the complexity of High NA EUV, capacity constraints and extremely high unit costs, we assume that ASML will sell its first system in FY25 and a total of 5 units by FY26. From there on we saw it gradually grow towards the steady state of the High NA EUV lithography equipment market of 6% in FY30. Resulting in a CAGR₂₅₋₃₀ of 71,7%.

Since we see no risk of a direct competitor developing a similar technical achievement as mentioned in the competitor chapter, we assume that ASML also has a 100% market share in the High NA EUV lithography system market.

Steady State

Since the steady state occurs just five years after the introduction of High NA EUV

Graph 7: High NA EUV Units projection



Source: Analyst estimates

systems, the technology can still be considered emerging in FY30. We have therefore decided to value growth in perpetuity at the highest but reasonable end of the range, which is 6%. Although GDP growth of 6% is not too unusual in emerging and developing countries, globally, and especially in developed countries, this is the upper limit of possible growth and primarily occurs in periods of recovery after a recession. (IMF 2022) Assuming that mature markets always converge to actual economic growth, we incorporate our expected GDP growth of 1.5% with a weighting of 50% and industry growth of 6% also with a weighting of 50%. This results in an overall growth of 3.8% in perpetuity.

■ DUV

For the revenue forecast of the DUV segment, we have taken a similar approach as for EUV and High NA EUV, but competition must be considered for this segment. Since DUV is the cheaper but inferior technology to EUV and still the most commonly method used in semiconductor production, its potential end market includes nearly every electronic industry.

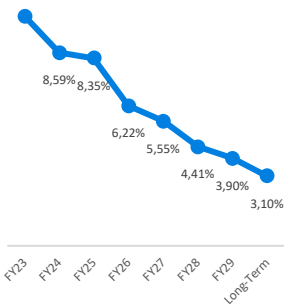
Projection Period

Unlike the EUV market, ASML has two competitors in this segment, Nikon and Canon. To obtain a market share, we looked at the past revenues of the two companies and segmented the business lines that report lithography equipment revenues. Since neither competitor offers EUV systems, no distinction had to be done and we could assume that 100% of their lithography revenues came from DUV. Adding up the sales of all three market players we received a total market for DUV equipment of €12,0 billion in FY21, with ASML's market share being 57,0%, Nikon's 12,0% and Canon's 31,0%. Since FY18 ASML was the only company that could increase their market share, with a CAGR₁₈₋₂₁ of 7,8%, while Nikon's and Canon's market share declined by a CAGR₁₈₋₂₁ of 5,4% and 8,4% respectively. In line with this trend, we expect ASML to be able to capture 60% of the market share from its competitors by FY25 and then remain constant at this level.

Main drivers that influence the further growth of DUV systems are chip shortages fuelled by the pandemic and increased complexity in the electronic industry especially from the automotive sector. (JP Morgan 2022) Considering that the shortage is not due to a lack of equipment, but to poor planning and a shortage of labour, especially in Asia, we do not expect demand in semiconductor chips to be passed on to equipment manufacturers to the same extent. Nevertheless, we saw a strong recovery in the DUV market in FY21 after two years of shrinking market size. As DUV still has advantages in terms of cost and output compared to EUV, we expect this growth to be sustained in conjunction with the growing market share until High NA EUV enters the market and possible cost effects could be realized through a price discount on older EUV equipment. (ASML 2022) From FY25 we see a mature market that gradually grows towards the steady state in FY30. Consistent with this market growth, the DUV market will be surpassed by the EUV market in FY27, while ASML's DUV sales will already be exceeded by EUV in FY22.

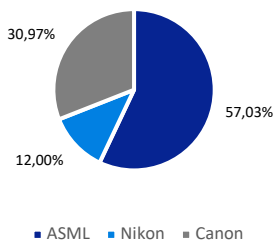
Finally, we again, considered the discrepancy between 3% and the projected inflation rate in each year with an inflation rate above this threshold, which only occurred in FY22 and FY23.

Graph 8: Projected DUV Growth Rates



Source: Analyst estimates

Graph 9: DUV Market (2021)



Source: ASML Annual Statement, Analyst estimates, Bloomberg

Steady State

Equally weighting our latest DUV growth rate of 3% in FY30 and the projected GDP growth of advanced economies, we arrive at a moderate 2.3% sustained growth of the DUV business unit. Assuming global GDP growth of around 2.5% in the absence of shocks, we expect it to be slightly below this rate as the market is already in a mature phase and new technological achievements could make DUV sales shrink.

■ Metrology and Inspection

Since sales of these systems have historically been consistent at 3% to 4% of system sales, we assume this growth to be a good proxy for the projection period. As for the steady state growth is calculated to be 2,9%, being on the upper end of a reasonable worldwide GDP growth. This reflects the fact that this unit is unlikely to disappear, as it does not depend on a single line of business and the risk is spread across all system sales of ASML.

■ Net Service and Field Option Sales

Given that the share of system sales in the past has been between 34% and 38%, we have applied the same logical reasoning as for the metrology and inspection area. As a result, we have determined the same growth rates for the projection period and the steady state.

Net Working Capital

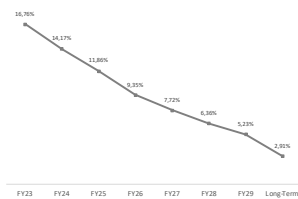
Except for cash from operations, which we have set at 2% of sales, we have presented all other items of the NWC in number of days. We compared these ratios with those of their indirect competitors, since direct competitors are not only specialized in systems for the semiconductor market, which would dilute the results. We therefore found that companies that supply equipment exclusively for semiconductor production to be a better proxy.

As a result, ASML's Cash Conversion Cycle (CCC) is between that of Applied Material and Tokyo Electron, showing that it is in line with the industry average. Also noteworthy is the difference between Days Sales Outstanding (DSO) and Days Payable Outstanding (DPO), which is consistently negative only for ASML over the entire look-back period. This reflects that ASML needs more time to pay its suppliers than to collect receivables from its customers, which has a positive impact on the cash conversion cycle.

However, if we look at the average days that ASML has its cash tied up in inventories (DIO), we see that this is higher than the industry average at 209,2 days. However, given the complexity of the machines and the volume sold annually, we consider this to be reasonable, as the lithography systems are more sophisticated than those of most indirect competitors.

Considering the high DPO combined with an industry standard CCC, ASML has a healthy working capital management but passes on a portion of its inventory cycle time to its suppliers. As there is no record of cash shortages or unpaid receivables to explain the high DPO, we acknowledge that ASML has negotiated favourable credit terms with its

Graph 10: Metrology and Inspection & Net Service Growth Rates



Source: Analyst estimates

Table 2: NWC Ratios

ASML			
	2019	2020	2021
Cash Conversion Cycle	203,30	198,08	176,75
DSO-DPO	-8,48	-24,35	-32,42
DIO	211,77	222,43	209,17
Applied Material Inc.			
	2019	2020	2021
Cash Conversion Cycle	181,28	165,39	155,75
DSO-DPO	21,58	23,81	32,38
DIO	159,70	141,59	123,37
Tokyo Electron Ltd.			
	2019	2020	2021
Cash Conversion Cycle	168,55	203,47	180,42
DSO-DPO	-0,89	1,79	3,78
DIO	169,44	201,68	176,64

Source: ASML Annual Statement, TEL Annual Statement, AMAT Annual Statement Bloomberg

suppliers, yet these are necessary to maintain a healthy CCC.

Valuation Outcome

Discounted Cash Flow

We have chosen to value ASML's equity using the DCF approach as we believe this is the most used technique and the most reliable method to derive a robust valuation. Finally, we have determined the enterprise value of ASML as of December 31, 2023, based on the DCF method. After considering non-core invested capital and the company's net debt, the equity value is €243 billion, which corresponds to a share price of €598,35 based on outstanding shares.

Conclusion

The expected share price for ASML for December 2023, as determined by the DCF valuation based on the assumptions outlined in this equity research report, is €598,92, which is 8,6% higher than the share price as of today (15.12.2022). With the key transition in semiconductor equipment technology to EUV and High NA EUV in the mid-term future, ASML is perfectly positioned as the sole supplier of EUV equipment. As the market learns more about ASML's strategy, we believe its shares should reflect their long-term customer commitment and robust forecast for future revenue growth, even though High NA EUV has little effect on projections in the near term, other from a R&D perspective. This leaves ASML with a strong outlook and a more favourable market position than its peers. The market seems to slightly undervalue the stock, consequently, our recommendation issued is a "HOLD".

ASML HOLDING NV

LITHOGRAPHY EQUIPMENT

STUDENT: KLAUS WENGER-OEHN, SEBASTIAN FENZ

COMPANY REPORT

16 DECEMBER 2022

51019, 48744@novasbe.pt

Shaping everyone's digital future

Silent winner of the digitalisation

- Our recommendation is to **HOLD** ASML considering a **Price Target of 598,35 €** included in the maximum 52-week range. This is equivalent to an investor return of 8,5%, to the current price of 551,50 €
- Industrial adoption of **new technologies** in **artificial intelligence (AI)**, **autonomous vehicles (AV)** and other related areas will drive **ASML's** future growth
- A **full order book** and **100% market share** in the extreme ultraviolet (EUV) market, which is essential to produce next-generation chips, as well as **high economic barrier to entry** will maintain **ASML's dominance** in the lithography market
- The **EUV 0.55 NA (High NA)** program, which is expected to be commercially available in **FY25**, will set new **industry benchmarks** and boost the semiconductor chip market
- Healthy liquidity ratios** and **stable credit ratings** ensure **sufficient funds** for further development and innovation
- Despite ASML's high expected growth, the potential impact of the event is **already reflected** to a large extent **in the current share price**

Company description

ASML is a Dutch company that manufactures semiconductor processing equipment. The company's products are used in the fabrication of integrated circuits (ICs). ASML is the largest supplier of lithography systems to the semiconductor industry, and is headquartered in Veldhoven, Netherlands.

Recommendation: **HOLD**

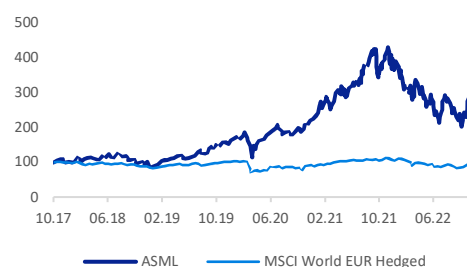
Price Target FY23: **598,35 €**

Price (as of 16-Dec-22) **551,50 €**

Bloomberg: ASML:NA

52-week range (€)	375,75 – 777,50
Market Cap (€m)	224.171
Outstanding Shares (m)	406,47

Source: ASML Annual Reports; Bloomberg



Source: Bloomberg

(Values in € millions)	2020E	2021E	2022F
Revenues	13.978	18.611	22.349
EBIT	4.244	6.830	7.867
Net Profit	3.697	6.135	6.853
Net Income per Share	8,8	15,0	16,9
Gross Margin	45,6%	50,6%	51,0%
EBIT Margin	30,4%	36,7%	35,2%
Net Debt	4.537	4.489	6.419
ROIC	34,7%	45,2%	49,3%

Source: ASML Annual Report; own estimations

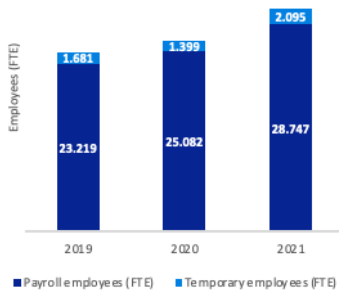
THIS REPORT WAS PREPARED EXCLUSIVELY FOR ACADEMIC PURPOSES BY [KLAUS WENGER-OEHN & SEBASTIAN FENZ], A MASTER IN FINANCE STUDENT OF THE NOVA SCHOOL OF BUSINESS AND ECONOMICS. THE REPORT WAS SUPERVISED BY A NOVA SBE FACULTY MEMBER, ACTING IN A MERE ACADEMIC CAPACITY, WHO REVIEWED THE VALUATION METHODOLOGY AND THE FINANCIAL MODEL. (PLEASE REFER TO THE DISCLOSURES AND DISCLAIMERS AT END OF THE DOCUMENT)

Table of Contents

COMPANY OVERVIEW	3
BUSINESS LINE EUV	3
BUSINESS LINE DUV	4
BUSINESS LINE APPLICATIONS	4
INSTALLED BASE SERVICE	4
GEOGRAPHICS	4
OWNERSHIP STRUCTURE	5
BOARD OF MANAGEMENT	5
ASML'S STRATEGY	5
▪ <i>Technology & Innovation</i>	5
▪ <i>Acquisitions</i>	6
▪ <i>Capacity Expansion</i>	6
STOCK PERFORMANCE	7
MACROECONOMIC CONTEXT AND CHALLENGES	8
GLOBAL TRADE WARS	9
RECESSION FEAR	9
SHORTAGES	10
CURRENCIES RISKS	11
NANOIMPRINT LITHOGRAPHY (NIL)	11
CUSTOMER DEPENDENCY	12
COMPETITIVE LANDSCAPE	12
INDIRECT COMPETITORS	13
DIRECT COMPETITORS	13
VALUATION	14
FINANCIAL HEALTH	14
REVENUE FORECAST	16
▪ <i>EUV</i>	16
▪ <i>High NA EUV</i>	18
▪ <i>DUV</i>	19
▪ <i>Metrology and Inspection</i>	20
▪ <i>Net Service and Field Option Sales</i>	20
NET WORKING CAPITAL	20
CAPITAL EXPENDITURES ("CAPEX")	21
COSTS / OPERATING MARGINS	21
RETURN ON INVESTED CAPITAL	22
WEIGHTED AVERAGE COST OF CAPITAL	22
▪ <i>Cost of Equity</i>	22
▪ <i>Cost of Debt</i>	23
VALUATION OUTCOME	23
DISCOUNTED CASH FLOW	23
RELATIVE VALUATION	23
SENSITIVITY ANALYSIS	24
.....	25
SCENARIO ANALYSIS	25
▪ <i>Worst-Case Scenario</i>	25
▪ <i>Best-Case Scenario</i>	26
CONCLUSION	26
APPENDIX	28
FINANCIAL STATEMENTS	28
DISCLOSURES AND DISCLAIMERS	34

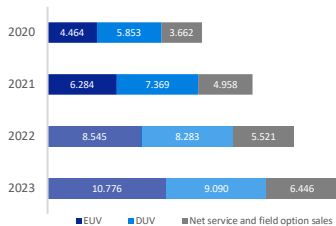
**Market leaders in
Lithography
equipment industry**

Graph 1: Workforce development



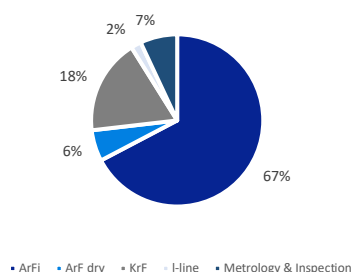
Source: ASML Annual Statement

Graph 2: Revenue split FY21 (€m)



Source: ASML Annual Statement

Graph 3: DUV Segmentation FY21



Source: ASML Annual Statement

Company Overview

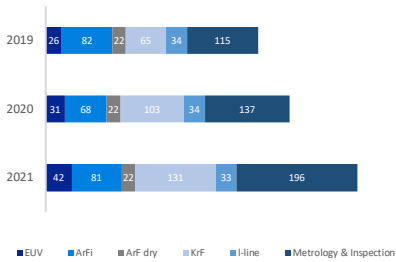
To develop lithography technologies for the expanding semiconductor market, electronics powerhouse Philips and chip-machine manufacturer Advanced Semiconductor Materials International (ASMI) founded a new firm in 1984, called ASM Lithography. During the 1980s ASMI opted to withdraw after finding it difficult to maintain high levels of investment with minimal return. ASML went public in 1996 and was listed on the Amsterdam and New York stock exchanges, gaining complete independence. The IPO provided funding to further extend their R&D and production facilities. At the IPO, Philips sold half of its shares, with the remaining shares being sold off over the ensuing years. As of 2021 ASML operates 60 locations and employs 30.842 workers. Due to the growth in the past years, ASML’s workforce has more than doubled in the past five years and is expected to grow further. (ASML 2021)

ASML’s products and services are split across four business segments, all of which highly grew over the last years:

Business Line EUV

Extreme Ultraviolet (EUV) will be one of ASML’s key products going into the future, by offering lithography resolution enhancement, revolutionary overlay performance, and cost reduction. ASML EUV lithography extends their Logic and DRAM customers’ roadmap. Their clients are utilizing EUV in the logic node and started utilizing EUV in the DRAM node in 2021. The EUV product roadmap anticipates expanding ASML’s EUV platform and launching an EUV 0.55 NA platform by 2025. Two of the key factors to ensure success and to meet the rise in demand will be ensuring high productivity levels as well as high output of machines. By 2025 EUV will make up about 70% of ASML’s business. It is expected that ASML will release a new tool every two years, which would be in line with the continuation of Moore’s Law. Moore’s Law, a forecast made more than 50 years ago, still governs the speed of innovation in the semiconductor sector. According to Gordon Moore, computing will become exponentially more powerful while also becoming more affordable. In other words, an integrated circuit will have twice as many transistors every two to three years at the same cost level. This opens two possibilities for increasing the speed and power of chips: either utilizing the same number of transistors on a chip at half the cost or using twice as many transistors at the same price level. The strength of this forecast still serves as the cornerstone of the semiconductor industry and its development. (ASML 2021)

Graph 4: No. of Units sold



Source: ASML Annual Statement

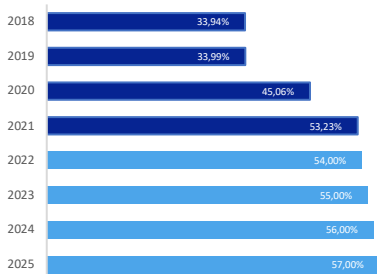
Business Line DUV

for Deep Ultraviolet (DUV) is at an all-time high and it is anticipated to stay high for the coming years due to growth in both the advanced and mature markets, which leads to a continued call for both immersion and dry systems across all wavelengths. This is paired with an increased focus on optimizing the installed base with value-added services like upgrades concerning productivity and performance. In 2021 DUV accounted for 37% of ASML’s sales. Maintaining their DUV competitiveness in innovation will help customers execute their roadmaps by pushing DUV to the limit. This includes increasing the number of installed systems and meeting client expectations by continuously enhancing operations.

Business Line Applications

ASML’s applications business is in support of the scanner business, and it provides the optical and e-beam metrology, multi-beam inspection, the control algorithm, the scanner application software, and the interface to the machine. This helps customers control and maximize their patterning performance. The primary drivers of the application business line will be the extension of the edge placement error roadmap, which is the difference between the intended and the printed features since it is the best predictor of yield. The business line focuses its strategy on nanometres, which means more accuracy and a fast time to yield by having higher productivity metrology and alignment.

Graph 5: Installed based Profitability ASML

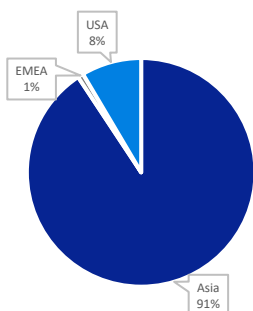


Source: ASML Annual Statement, Analyst estimates

Installed Base Service

The Installed base Service has contributed to more than 25% of total revenue in FY21 and has a margin of about 53%. It covers the servicing to provide high availability and minimal long-term downs as well as the upgrading of existing machines to provide a better system output and extend its lifetime. Within this segment, ASML offers availability improvements, software upgrades, and reactive as well as proactive diagnostics. The goal is to provide the lowest possible service cost per wafer and maximize good wafers per day. This is highly important for their customers since fabs are designed with lithography as the constraint.

Graph 6: Geographic Split FY21



Source: ASML Annual Statement

Geographics

ASML has a significant global presence with the majority of revenues driven by the Asian Market with South Korea (33,4%), Taiwan (39,4%), and the United States (8,5%). Its factory hubs are located in Wilton and San Diego (US), Linkou (Taiwan) as well as Veldhoven (the Netherlands). The Netherlands, where the Group is incorporated, contributes to 0,08% of the total revenue.

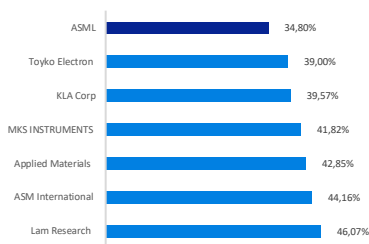
Ownership Structure

Table 1: Biggest Shareholder

	Nr. Shares	% of class
Capital Research and Management Company	63.658.826	15,81%
BlackRock Inc.	32.024.422	7,95%
Baillie Gifford & Co	18.262.995	4,54%

Source: ASML Annual Statement, Bloomberg

Graph 7: Annualized Volatility



Source: ASML Annual Statement, Bloomberg

Table 2: Board of Management

Name	Position
Peter T.F.M. Wennink	President, CEO and Chair
Martin A. van den Brink	President, CTO and Vice Chair
Roger J.M. Dassen	Executive Vice President and CFO
Christophe D. Fouquet	Executive Vice President EUV
Frédéric J.M. Schneider-I	Executive Vice President and COO

Source: ASML Annual Statement

ASML Holding N.V. is traded on Euronext Amsterdam under the ticker “ASML.AS” and on the NASDAQ under the ticker “ASML” and has a market capitalization of €224.170.574.244 as of December 15th, 2022, represented by 406.474.296 shares of which 44% are held by institutional investors. Moreover, ASML’s institutional and strategic shareholders are mainly from North America with 48%, and EMEA with 40%. Currently, Members of ASML’s current Board of Management, hold approximately 0,02% of the total shares. The high percentage of institutional and strategic investors implies a low turnover and therefore adds to less volatility in the share price. As seen in Graph 7, ASML has the lowest annualized volatility amongst its peers using 5y weekly data. This should positively encourage the Board of Management to concentrate on generating long-term growth and returns. (Bloomberg 2022)

Board of Management

Peter T.F.M. Wennink is Chief Executive Officer and Chair of the Board of Management since 2013. Wennink jointly with Martin A. van den Brink, who is the Chief Technology Officer act as Presidents and compose with 3 other members the Board of Management of ASML. On the 19th of October 2022, ASML announced an expansion of the Board of Management from five to six members. From April 2023 onwards Wayne Allan will act as Chief Strategic Sourcing & Procurement Officer. A stable board will give ASML effective leadership and direction for their future business development, enabling it to run smoothly and effectively. We place credibility on their leadership, given their successful history in the company, which will help ensure that the business follows good governance principles and complies with applicable rules and regulations, which can enhance its stability going forward.

ASML’s Strategy

ASML is constantly investing in research with a focus on developing new products and bringing new services to market. The company has a strong focus on customer satisfaction and providing value-added services and is centred on long-term relationships and close cooperation with suppliers, partners, and customers. Their future success will depend on their ability to quickly respond to further technological developments in the semiconductor equipment space.

▪ Technology & Innovation

Scaling semiconductor systems allows for exponential performance and energy improvement in support of a considerable increase in data exchange, this is

closely tied to ASML’s and their customer’s roadmap. In comparison to sophisticated multi-patterning procedures, the switch from Deep Ultraviolet (DUV) to Extreme Ultraviolet (EUV) light has revolutionized chip manufacturing and lowered costs across the board. ASML is one of the pioneers in the EUV space and by fostering trustworthy connections with clients and offering more robust, comprehensive products, ASML continues to protect this strategy and will further establish their market dominance. The success of their EUV 0,55 NA (High NA) technology will be crucial for continuing the speed of advancement and being in line with Moore’s Law. The High NA EUV platform tries to maximize compatibility with the Low NA EUV platform to lower technical introduction risk and R&D expenses. Additionally, as innovation delivery costs increase, more R&D funding is needed to accomplish the same objectives to get new products to costumers early.

▪ Acquisitions

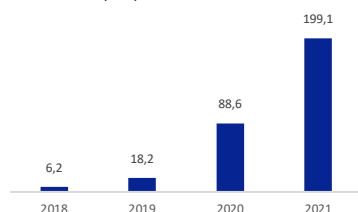
ASML's technological dominance is a result of deliberate partnerships that enable advancements for their customers that are affordable and despite having a significant international footprint, ASML has invested internationally by acquiring companies across their supply chain to enhance synergies in their offering. ASML’s strategy is anticipated to include strategic M&A activities and joint ventures, concentrating on developing technologies. Therefore, ASML made the 24.9% investment in Carl Zeiss to jointly fund R&D activities and subsequently drive the development of EUV in order to advance the creation of new lenses. This is a strategy that we expect to be continued in the future.

Table 3: M&A Activities

Year	Acquisition Details
2001	Silicon Valley Group for € 1.8bn
2007	BRION für €203m
2013	Cymer for €3.1bn
2016	Hermes Microvision (HMI) for €2.8bn
2017	Carl Zeiss SMT Holding acquisition 24.9% interest for €1bn
2020	Berliner Glas acquisition for €0.3bn

Source: ASML Annual Statement

Graph 9: Profits from Carl Zeiss Investment (€m)



Source: ASML Annual Statement

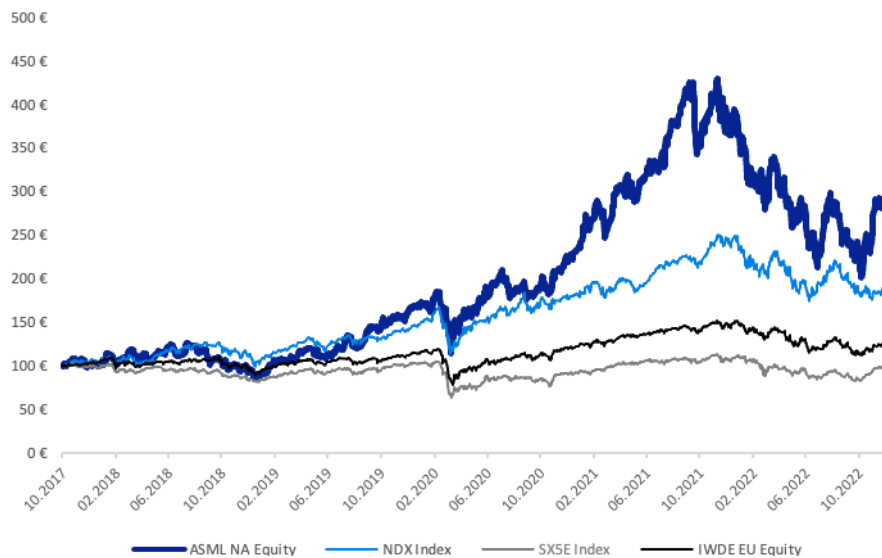
▪ Capacity Expansion

During their recent Investor Day, ASML announced their expectation that the industry and the ASML ecosystem are expected to double in size by 2030. To prepare for strong long-term growth, they are planning to invest timely and sustainably in additional capacity, with a strong emphasis on the objective of meeting all customer needs during fluctuations and incorporating flexibility to expand quickly and adapt in downturns, which is also supporting its expansion plan of 90 EUV Systems by the years 2025/2026. ASML also plans to reach an annual capacity for High NA EUV at 20 systems by 2027/2028.

Stock Performance

Currently, the stock is part of the European EURO STOXX 50 Index, representing the 50 largest publicly traded companies in the Euro area, and has the highest weight in the index. In addition, the Group is included in the NASDAQ-100 index, reflecting the 100 companies of the Nasdaq Composite with the highest market capitalization. Comparing ASML’s historic stock performance to the EURO STOXX 50 and the NASDAQ over the past five years, we find that ASML overall outperformed the market. We assume that ASML has consistently outperformed these indexes due to the electronics- and therefore the semiconductor boom that has been leading to results, that exceed investors’ expectations.

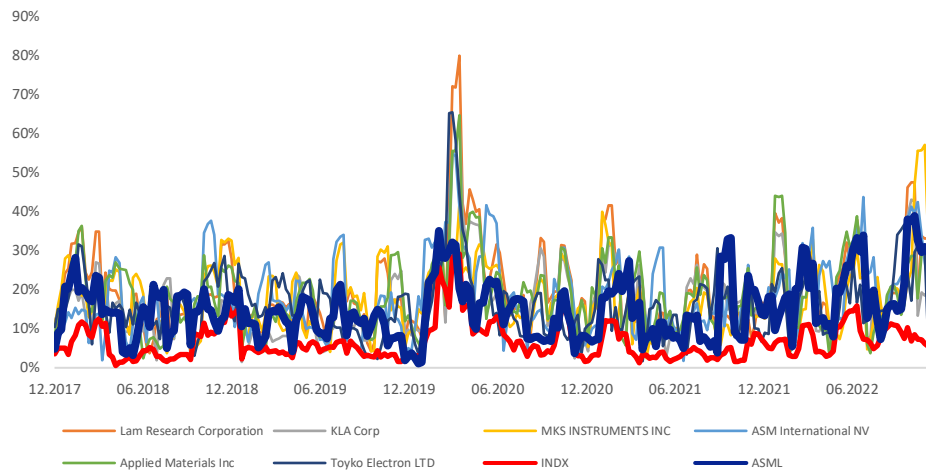
Graph 10: ASML vs. Indices



Source: Bloomberg

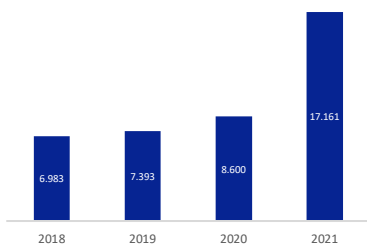
Looking at the rolling annualized volatility of ASML against its peers (Graph 11), we can see that ASML has the lowest, which indicates that the stock is less subject to sudden changes and therefore reduces the risk associated with it.

Graph 11: Rolling annualized volatility ASML vs. Peers & Index



Source: Bloomberg

Graph 12: Cumulative share buybacks (€m)



Source: ASML Annual Statement

Since November 2022, ASML’s Board of Management has authorized a new share buyback program of up to €12bn to be executed by 31. December 2025. This replaces the previous share buyback program of €9bn from 2021-2023. In 2021, ASML has repurchased 14.358.838 shares for a total of €8.560,3 million, of which 6,601,699 shares were acquired under the new program for €4.560,3 million. Also, ASML paid a total dividend of €5.50 per ordinary share in FY21. Through these share repurchasing programs ASML artificially inflates its earnings per share, rather than investing in internal growth. Given the low-interest rate environment, it makes sense to return funds to its shareholders rather than invest them in securities.

Table 4: Dividend payouts

	2018	2019	2020	2021
Dividend per share (in €)	2,10	2,40	2,75	5,50
Number of shares outstanding (in million)	425	421	418	410
Total dividends paid (in million €)	517	1.326	1.066	1.368
Net income available to shareholder (in million €)	2.526	2.581	3.697	6.135
Dividend payout ratio	0,20	0,51	0,29	0,22

Source: ASML Annual Statement

Macroeconomic Context and Challenges

Global electronics industry megatrends are anticipated to continue to drive expansion across the semiconductor market, supported by a highly profitable and

innovative ecosystem. This will lead to an increase in wafer demand at both advanced and mature nodes, but as chip characteristics continue to get smaller, the industry requires the appropriate equipment to develop chip technology in large quantities at a reasonable price. Since the semiconductor industry is closely tied to the health of the broader economy, we must look at its possible implications for ASML.

Global Trade Wars

Due to U.S. diplomatic pressure, ASML has been prohibited by the Dutch government from shipping its most advanced EUV machines to China since 2019. The sale of semiconductors to China is now subject to broad new limitations put in place by the U.S. administration earlier this year. Given that ASML is a European company with few U.S. parts utilized in its machines, it said that the impact of the new U.S. restrictions appears to be minimal. ASML still sells its older DUV technology to China, which make up 15% of its total sales in 2021. This provides ASML an advantage over its American competitors, as U.S. lithography equipment manufacturers could lose about 15-20% of their annual sales. (Lam Research Corporation 2021) (Applied Materials Inc 2021) It is important to remember that moderate escalation of US sanctions against China is likely to be good for ASML as there are high Barriers to entry, if they do not respond aggressively. ASML warned Chinese clients about having trouble finding additional parts. It is expected to remain unchanged as this is linked to technological trade policies because of efforts to increase the U.S. chip industry's independence. Since China still lacks access to EUV technology and if this were to change, we would experience higher growth rates, particularly for EUV and High NA EUV business lines.

Recession Fear

Inflation and declining consumer confidence together produce uncertainty, particularly on a macroeconomic level. In such an environment, recession risk is evidently present. This could potentially lead to customers running lower utilization rates on their existing machines, reduced CAPEX spending of customers, and requests for delays of new machines. Due to the significant down payments that consumers commit to ASML, order cancellations are unlikely. Additionally, ASML's customers want to transition to EUV as soon as possible, which will benefit ASML's standing regarding the uncertainty in the market. Therefore, we assume a minor risk in the very short-term future regarding the lithography end market, however, we think that the expected probability of it materializing in the mid- and long-term is low, thus ignoring the risk.

In addition, discussions of "technology sovereignty" may encourage the expansion of fabrication facilities in the United States and Europe in addition to Asia, as they are focusing on assuring an adequate supply of semiconductors to sustain their regional industries. This would be advantageous for the fab equipment business and ASML, as it will lift the demand for lithography equipment. Tech sovereignty will be a major upside for the coming years and beyond and is expected to amount to over \$150bn of the industry's CAPEX. Flexibility about being able to adapt quickly will be a key factor in the success going forward.

Table 5: CAPEX spending

	Programm	Capex spend
USA	Chips Act, Fabs Act	\$52bn + Investment tax credits
EU	European Chips Act	\$46bn
China	Integrated Circuit Industry Investment Fund ("Big Fund")	\$20,7bn Phase 1 + \$30,5bn Phase 2 + Tax breaks
Taiwan	Invest Taiwan Initiative	Tax credits + help securing land, water and electricity
South Korea	K-Semiconductor Belt	Tax credits + aim to attract \$450bn in private investments by 2030
Japan	Specified ICT Utilization	\$4,42bn + subsidies für setup costs

Source: „The resilience myth: Fatal flaws in the push to secure chip supply chains", Nikkei Asia, July 26, 2022

Shortages

The semiconductor industry is already facing a shortage of skilled labour, and this is expected to worsen as the demand for semiconductors increases. This will lead to a global race for talent and finding and retaining qualified talents will become more important than ever. This due to the lack of sufficient scientists, engineers, or software developers that have the expertise to create novel solutions.

Moreover, ASML's customers are also facing a shortage of raw materials, which is expected to impact production, and if resources become scarce, it will put even more pressure on the chip manufacturers. Since there is a growing demand throughout the entire product line due to the continuous digital transformation, ASML will need to address this issue across the entire supply chain and should account for potential delays in the assembly of new machines, should circumstances deteriorate. The production of an EUV machine requires about 100.000 different parts from 4.700 suppliers, of which 200 are critical. This is important to understand since it could have serious implications for ASML. However, ASML mitigates this risk, by conducting an annual risk assessment for critical suppliers to reinforce a robust supply chain.

Currencies risks

Although ASML reports all their results in Euros, most of their revenues were earned in US Dollar and a small portion in Japanese yen, Taiwanese dollar, Korean won, or Chinese Yuan. Even though they invest in hedges against currency risk with derivatives instruments, they are still subject to unexpected changes in exchange rates. Even though currency risk has previously manifested, we do not consider it significant for our valuation since currency exchange rates are incredibly difficult to forecast. We believe that in the long run unexpected changes tend to balance out.

Nanoimprint Lithography (NIL)

It is undisputed that EUV is the predominant technology for manufacturing high-end semiconductors. Research and development in this area is being carried out exclusively by ASML, after the two competitors Nikon and Canon withdrew from the race at an early stage. (NIKKEI 2020) While Nikon has stopped all efforts to develop a lithography process that can compete with ASML's EUV technology, Canon is researching a new process to print wafers even more cost-effectively to form circuits. This technique is called nanoimprint lithography. By applying a nanopattern mask to the coated resin on the wafer surface, nanoimprint lithography creates patterns at the nanoscale, unlike conventional lithography, in which circuit patterns are created by exposing them to ultraviolet light. The main advantage Canon is aiming for over EUV is to reduce production costs. Since FY04, Canon has developed its nanoimprint lithography technology and acquired the U.S. company Molecular Imprints Inc (now Canon Nanotechnologies, Inc.) in FY14, which is specialized in nano structuring systems. In addition, Canon plans to invest more than \$350 million in a new plant in Tochigi, Japan, to produce its nanoimprint lithography machines, which are expected to be operational by FY25. Canon's only operational nanoimprint lithography device, the FPA-1200NZ2C, is currently used by Toshiba in Japan. Nevertheless, the technique has been known for a long time (as stated above Canon is researching this lithography technique since FY04), without any ground-breaking discovery. Since it is a contact patterning process, there are some problems, such as mask wear, problems with overlays, or high sensitivity to impurities, this causes defects in the output, which are not as well controlled today as they are with EUV. According to Canon's latest annual report, key features have now reached the level of mass production, so the company is aiming for rapid commercialization of the technology. (Cannon 2021) (Abachy)

We do not assume that nanoimprint lithography will pose a serious threat to the EUV industry in the near term but acknowledge that it could bring some cost benefits in the long term as it matures. However, when this level is eventually reached, it will likely compete with even more advanced optical lithography technologies like High NA EUV.

Customer dependency

More than 83,7% of ASML's revenues are generated by its three key customers Intel, TSMC and Samsung. Measured by the maturity, revenue, and market position of these three companies, they are among the largest players in the semiconductor manufacturing market. Looking at the annual reports of these customers shows that they work closely with ASML and that their equipment represents the state of the art in the market. They also indicate that they plan to increase capital spending over the next few years to stave off semiconductor shortages, which would benefit ASML. (Intel 2022) (ASML2021)

Due to ASML's monopolistic positioning in the market for EUV lithography systems, we do not see any risk of ASML losing a key customer in this field to the competition. For the DUV market, we expect ASML to be able to increase its current market share from 57.0% in FY21 to 60.0% in FY25. This is in line with the company's momentum, which has seen its market share grow at a CAGR of 7.8% since FY18.

Competitive Landscape

To manufacture semiconductors, a silicon wafer must undergo numerous microfabrication processes, such as wafer slicing, deposition, photoresist coating, lithography, baking and development, etching, Ion implementation and the removing of photoresists. (ASML 2021) Each step along the refining process requires special machines from different suppliers. ASML's business lines, which are EUV and DUV, exclusively treat lithography systems. DUV is currently the most widely used lithography solution and the largest revenue driver for ASML in FY21. The DUV market is still relevant, but a larger share is expected to move to the EUV market in the future, which uses ultraviolet light with wavelengths as short as 13.5 nm compared to those of DUV with wavelengths between 193 nm and 248 nm. ASML is currently the only company capable of producing machines that use EUV technology, so there are no competitors in this business segment.

In this context, we distinguish between direct and indirect competitors in terms of the scope of the machines they offer. But there is also competition among indirect suppliers, as new technologies can make other processing steps

redundant. According to a study by Interuniversity Center for Microelectronics (ASML2021), EUV can help the fab to reduce the steps of some non-lithography processes like deposition, etching or cleaning steps.

Indirect Competitors



Lam Research is an American company in the wafer fab equipment market with approximately 16.300 employees and revenues of \$16,5 billion in FY21. Lam Research produces equipment used exclusively in the processes of deposition and etching. They also offer stripping and cleaning technologies, as well as mass meteorology machines. The company offers its products and services worldwide, although some shipments to China have been restricted since the Biden administration implemented the export controls. (Lam Research 2021)



Headquartered in California's Silicon Valley, Applied Materials Inc. employs about 27.000 people in 19 countries and is the only indirect competitor with higher sales than ASML, with revenues of \$23,06 billion in FY21. In connection with the semiconductor manufacturing process, the company manufactures equipment in the field of etching, ion implementation and deposition. They also offer measuring and testing equipment to ensure the flawless quality of the products produced. In addition to the wafer fabrication equipment market, Applied Materials also supplies electronic device manufacturers with equipment along the supply chain, such as for liquid crystal flat panel displays or photovoltaic solar cells. (Applied Materials 2021)



Tokyo Electron Ltd is a Japanese supplier to the wafer fab equipment market with about 15.883 employees and a revenue of \$12,6 billion in FY21. Similar to the product range of Applied Materials Inc., its main products and services are in the field of semiconductor production equipment and flat panel display (FPD) production equipment, with the FPD market accounting for just 6% of total sales and semiconductor equipment accounting for more than 90%. Due to their close cooperation, a merger between Applied Materials and Tokyo Electron was planned in FY15 but cancelled due to antitrust concerns in the US. ASML and Tokyo Electron have also entered into joint ventures with the aim of adapting their products to the new EUV technology and maximizing technological development. Along the manufacturing process, the company produces mainly equipment in the field of coating, etching, deposition, wafer trimming and surface preparation. (Tokyo Electron 2021)

Direct Competitors

Nikon, a multinational company headquartered in Japan, is one of ASML's main competitors in the field of semiconductor lithography equipment. With a

headcount of 18.437 and a revenue of \$4,8 billion in FY21/22 (annual closing takes place in March), Nikon is part of the Nikkei 225. Nikon's scope of operations can be divided into six segments: Imaging Products, Precision Equipment, Healthcare, Components, Industrial Metrology, and others. The first two segments account for the largest share of sales, 33,3% and 40,9% in FY20/21 respectively. Precision equipment can further be divided into two business units, namely FPD lithography and semiconductor lithography. ASML is in direct competition with the Semiconductor lithography business unit. Nikon currently only serves the DUV market and there are no concrete indications that a solution for EUV will be available in the foreseeable future. Based on Nikon's annual report they expect a strong demand for their DUV equipment. In particular, in the ArF immersion and ArF lithography, they believe to be able to increase units sold by over 300%. (Nikon 2021)

Like Nikon, Canon is a Japanese multinational corporation that started as a producer of cameras and lenses. Nowadays they employ over 184.034 people and generated a revenue of \$30,6 billion in FY21. The company can be divided into four segments, printing, imaging, medical, industrial and others. With a share of 55,2%, print products accounted for the largest share of net sales in FY21. On the other hand, the share of industrial and others is only 15,5%, which mainly handles semiconductor and FPD lithography systems. In the field of lithography technology, Canon offers exclusively KrF and i-line equipment. According to the annual report, Canon aims to maintain its strong position in i-line systems and increase its market share in KrF systems due to the favourable market conditions. As mentioned previously, the Japanese corporation also does not offer an EUV solution but is involved in the development of a new concept for nanoimprint lithography (NIL) that aims to minimize circuits and achieve comparable results to EUV technology at lower costs. (Canon 2021)

Table 6: Liquidity Ratios

ASML		
Liquidity Ratios	2018	2021
Current Ratio	2,75	1,46
Quick Ratio	1,63	0,96
Cash Ratio	0,82	0,57
Toyko Electron		
Liquidity Ratios	2018	2021
Current Ratio	2,57	3,10
Quick Ratio	1,45	1,54
Cash Ratio	0,70	0,81

Source: ASML Annual Statement, TEL Annual Statement, Bloomberg

Valuation

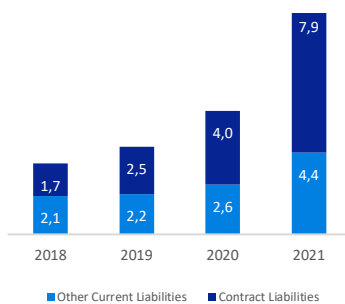
Financial Health

To assess ASML's financial health, it is crucial to look at the company's liquidity and capital structure, as well as some balance sheet items to comprehend the financial risks involved.

ASML's liquidity is primarily determined by cash and cash equivalents, short-term investments and available credit facilities, with the internal target to keep the sum of cash and cash equivalents and short-term investments above a minimum

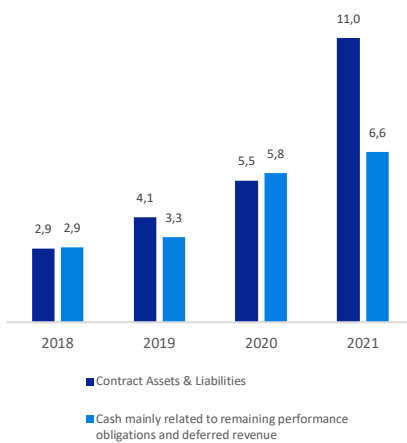
range of €2,0 billion to €2,5 billion at all times, which is far below the actual balance of €7,5 billion in FY21. (ASML 2021) Looking at ASML's liquidity ratios, the company appears to have sufficient funds to cover its current liabilities with its current assets, as indicated by the Current Ratio. Although both the Quick Ratio and the Cash Ratio do not indicate sufficient liquidity to pay off all current liabilities in the short term, this is not necessarily concerning, as too much liquidity in the short term could also indicate inefficient use of cash and raise the question of why it is not being used.

Graph 13: Contract liabilities & other current liabilities



Source: ASML Annual Statement

Graph 14: Contract Assets and Liabilities



Source: ASML Annual Statement

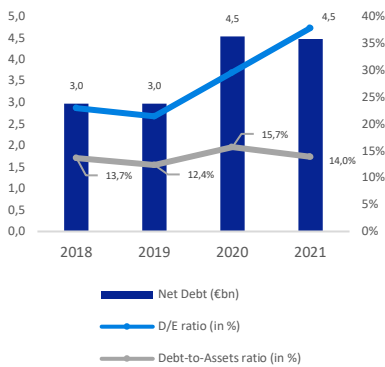
Compared to one of its closest industry peers, Tokyo Electron, it is noticeable that ASML's liquidity ratios are significantly lower in FY21. Nevertheless, they were more balanced in FY18 and ASML's ratios seem to have shrunk between these years. When analysing the balance sheet, it is noticeable that current assets increased by 71.9% in FY18 to FY21, while current liabilities increased by 224.3%. This imbalance is due to the large increase in contractual liabilities in FY21. This item mainly includes advance payments for systems to be delivered in the future and, in addition to current liabilities, also affects current assets as cash and cash equivalents increase. However, share buyback programs, dividends and other investments in non-current assets reduce the cash pool accumulated by the advance payments, which is why the liquidity ratios are negatively affected. We can deduce two things from this, firstly we expect a further increase in revenues as contract liabilities indicate full order books. Secondly, it shows the liquidity of ASML's customers as they can tie up their capital in down payments for systems that can take up to five years to be shipped. (ASML 2021) We attribute this increase in contract liabilities to the general semiconductor shortage and strong demand for EUV technology. For the projection period we assumed the cash position that mainly relates to remaining performance obligations and deferred revenue to diverge back towards the historical balanced levels.

Looking at the financial health of the company in terms of absolute long-term debt, we see constant numbers with a jump from FY19 to FY20. Most of the debt included in net debt is ASML's outstanding Eurobonds. While the debt-to-assets ratio remained constant during the historical period, we see an increase in the debt-to-equity ratio starting in FY20. Although absolute debt remains at a similar level in FY21, the debt-to-equity ratio continues to rise as total invested capital decreases sharply, and so does the equity, due to the increase in the aforementioned contractual liabilities and the resulting high transactions with shareholders. In the medium-term future, we expect the debt-to-equity ratio to increase further due to capital investments to meet demand in the coming years, which will be financed with long-term debt. In the long term, we believe that net

debt will gradually shrink as the semiconductor market will become more predictable, where equity growth is financed by strong and steady earnings based on our forecast model.

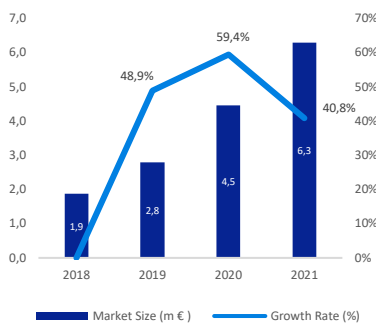
From a historical perspective, liquidity is provided by blue chip customers making down payments for machines for the coming years, which gives ASML's management an advantage in planning as it can estimate revenues more accurately. Given the proportion of the company's long-term debt combined with the "stable" credit rating of various rating agencies (Moody's 2021) (Fitch 2021), ASML does well to leverage its strong credit rating and benefit from cheap capital and the resulting tax shield. Furthermore, this has an important implication on the weighted average cost of capital, given the low amount of debt, the WACC will be close to the cost of equity.

Graph 15: Capital Structure ASML



Source: ASML Annual Statement

Graph 16: Historical EUV market



Source: ASML Annual Statement, Analyst estimates, Bloomberg

Revenue Forecast

To build an accurate forecast model, we use a bottom-up approach by identifying the key factors that will influence the semiconductor equipment market through FY32. Within the business units, we distinguish between four business areas, EUV, High NA EUV, DUV, Metrology and Inspection, and Net Service and Field Options, each of which has its individual growth rate. For each business area, we also distinguished between the projection period, which runs from FY22 to FY29, and the steady state, which runs from FY30 to FY32, with each area taking a different approach to determining growth rates.

- EUV

EUV as ASML's flagship technology, on which they hold a monopoly, with initially over 100 units sold in FY20, we see that there is still immense potential in the marketplace. Having reached a stage of mass production in FY22, we believe that demand is mainly correlated to the general semiconductor market and is more likely to be constrained by capacity issues than by a decline in demand in the short term.

Projection Period

In order to retrieve the growth rates over the projection period we exclusively incorporated the lithography equipment market growth for EUV technology in dependency of ASML's respective market share. Since the other two market players, Nikon and Canon, do not offer EUV equipment, ASML has a market share of 100%, which we believe will remain so because technologies promising substitutes to EUV, such as NIL, are not yet mature enough and will probably

never achieve equivalent performance. The market share for EUV is therefore negligible. Given the strong growth of ASML's EUV sector over the last three years (CAGR₁₈₋₂₁ of 149,5%), we expect this trend to slowly level off and therefore assume 15% growth for FY25, which the market is converging towards. Finally, we assume that market growth would continue to decline gradually to 5,0% in FY30 from where it reaches a steady state. These growth rates best reflect the fact that there are capacity constraints and machines tend to have a long life, which affects the number of units purchased. According to the company's information (ASML 2021), 94% of all lithography machines ever sold are still in operation, consequently, production facilities usually only need to be upgraded when a new technology enters the market. Shortages in the semiconductor market and the increasing complexity of new electronic devices are other factors that lead us to expect such strong growth over the next 8 years, until stable growth is reached. As this driver is closely related to the actual sales, we have weighted it at 100% over the whole projection period.

Furthermore, inflation was put into consideration for ASML's future growth, as inflation in most advanced economies is currently higher than it has been for over 30 years. We believe that ASML can pass on the increased costs immediately to its end consumers, which is why we also expect increased revenues in years with higher inflation. Since an inflation rate of around 2% to 3% is generally considered desirable and normal by central banks in advanced economies (European Central Bank 2022), we assume that a rate of 3% has already been taken into account by the lithography equipment market growth. Therefore, the difference in the perspective inflation rate above 3% was added to the EUV growth rate. This only occurred in FY22 and FY23 at 4,2% and 1,4%, respectively. Inflation data forecasts through FY27 are derived from an external source (IMF 2022), which aligns with our idea of future development.

Steady State

From FY30, the steady state should reflect the growth of the EUV business into perpetuity. Using GDP as the sole source of forecasts seemed problematic to us, as the different business areas have different maturities which should be reflected in the perpetual growth rate.

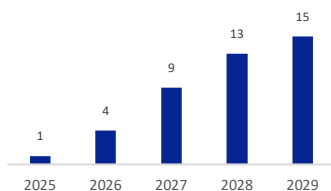
Since GDP growth in advanced economies is usually between 2% and 3% (IMF), we have taken a conservative approach to predict growth from FY30 onwards using an external dataset (Bloomberg 2022) that extends to FY27. In this approach, we project GDP growth of 1.5%, weighted at 50%, and growth of 5% weighted at 50% for the lithography equipment market. Looking at the historical growth of the sector, 5% in perpetuity seems reasonable given ASML's market

maturity and monopoly on this technology. This finally results in a perpetual growth rate of 3.3% for the EUV market.

- **High NA EUV**

To keep pace with Moore's Law, the industry's benchmark for semiconductor chip development, chips must achieve twice the efficiency of their predecessor every two to three years. When it became clear in recent years how optimistic this estimate was, the industry nevertheless found ways to come close to meeting the requirements, which is why Moore's Law is still used as a benchmark. (Wired 2021) High NA EUV is the next generation of chips that will replace EUV as the leading technology in lithography systems and promises to uphold Moore's Law. As stated in ASML's latest annual report they expect it to enter high-volume manufacturing at their customers site starting in 2025. Based on our assessment and the often-optimistic promises in line with Moore's Law, we estimate that ASML will sell its first commercial High NA EUV machine in 2025. ASML has even received the first orders for the machine, although it is not yet ready for operation. As reported, a High NA EUV system will be significantly more expensive than the EUV system, more than twice as expensive, at approximately €300 million per unit. (Reuters 2022)

Graph 19: High NA EUV Units projection



Source: Analyst estimates

Projection Period

As the company has previously disclosed, Intel is the first fab that has purchased ASML's High NA EUV prototype machine EXE:5000. (ASML 2022) Taking into account the complexity of High NA EUV, capacity constraints and extremely high unit costs, we assume that ASML will sell its first system in FY25 and a total of 5 units by FY26. From there on we saw it gradually grow towards the steady state of the High NA EUV lithography equipment market of 6% in FY30. Resulting in a CAGR₂₅₋₃₀ of 71,7%.

Since we see no risk of a direct competitor developing a similar technical achievement as mentioned in the competitor chapter, we assume that ASML also has a 100% market share in the High NA EUV lithography system market.

Steady State

Since the steady state occurs just five years after the introduction of High NA EUV systems, the technology can still be considered emerging in FY30. We have therefore decided to value growth in perpetuity at the highest but reasonable end of the range, which is 6%. Although GDP growth of 6% is not too unusual in emerging and developing countries, globally, and especially in developed countries, this is the upper limit of possible growth and primarily occurs in periods of recovery after a recession. (IMF 2022) Assuming that mature markets always

converge to actual economic growth, we incorporate our expected GDP growth of 1.5% with a weighting of 50% and industry growth of 6% also with a weighting of 50%. This results in an overall growth of 3.8% in perpetuity.

▪ DUV

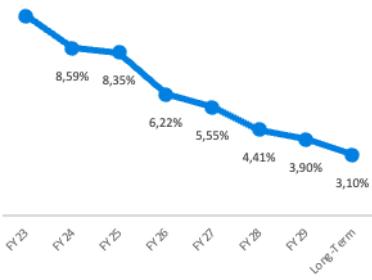
For the revenue forecast of the DUV segment, we have taken a similar approach as for EUV and High NA EUV, but competition must be considered for this segment. Since DUV is the cheaper but inferior technology to EUV and still the most commonly method used in semiconductor production, its potential end market includes nearly every electronic industry.

Projection Period

Unlike the EUV market, ASML has two competitors in this segment, Nikon and Canon. To obtain a market share, we looked at the past revenues of the two companies and segmented the business lines that report lithography equipment revenues. Since neither competitor offers EUV systems, no distinction had to be done and we could assume that 100% of their lithography revenues came from DUV. Adding up the sales of all three market players we received a total market for DUV equipment of €12,0 billion in FY21, with ASML’s market share being 57,0%, Nikon’s 12,0% and Canon’s 31,0%. Since FY18 ASML was the only company that could increase their market share, with a CAGR₁₈₋₂₁ of 7,8%, while Nikon’s and Canon’s market share declined by a CAGR₁₈₋₂₁ of 5,4% and 8,4% respectively. In line with this trend, we expect ASML to be able to capture 60% of the market share from its competitors by FY25 and then remain constant at this level.

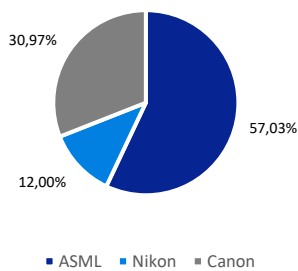
Main drivers that influence the further growth of DUV systems are chip shortages fuelled by the pandemic and increased complexity in the electronic industry especially from the automotive sector. (JP Morgan 2022) Considering that the shortage is not due to a lack of equipment, but to poor planning and a shortage of labour, especially in Asia, we do not expect demand in semiconductor chips to be passed on to equipment manufacturers to the same extent. Nevertheless, we saw a strong recovery in the DUV market in FY21 after two years of shrinking market size. As DUV still has advantages in terms of cost and output compared to EUV, we expect this growth to be sustained in conjunction with the growing market share until High NA EUV enters the market and possible cost effects could be realized through a price discount on older EUV equipment. (ASML 2022) From FY25 we see a mature market that gradually grows towards the steady state in FY30. Consistent with this market growth, the DUV market will be surpassed by the EUV market in FY27, while ASML’s DUV sales will already be exceeded by EUV in FY22.

Graph 20: Projected DUV Growth Rates



Source: Analyst estimates

Graph 21: DUV Market (2021)



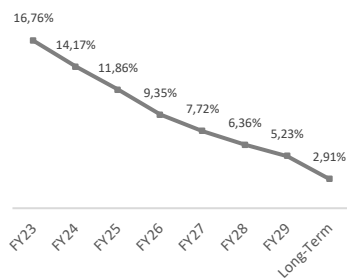
Source: ASML Annual Statement, Analyst estimates, Bloomberg

Finally, we again, considered the discrepancy between 3% and the projected inflation rate in each year with an inflation rate above this threshold, which only occurred in FY22 and FY23.

Steady State

Equally weighting our latest DUV growth rate of 3% in FY30 and the projected GDP growth of advanced economies, we arrive at a moderate 2.3% sustained growth of the DUV business unit. Assuming global GDP growth of around 2.5% in the absence of shocks, we expect it to be slightly below this rate as the market is already in a mature phase and new technological achievements could make DUV sales shrink.

Graph 22: Metrology and Inspection & Net Service Growth Rates



Source: Analyst estimates

■ Metrology and Inspection

Since sales of these systems have historically been consistent at 3% to 4% of system sales, we assume this growth to be a good proxy for the projection period. As for the steady state growth is calculated to be 2.9%, being on the upper end of a reasonable worldwide GDP growth. This reflects the fact that this unit is unlikely to disappear, as it does not depend on a single line of business and the risk is spread across all system sales of ASML.

■ Net Service and Field Option Sales

Given that the share of system sales in the past has been between 34% and 38%, we have applied the same logical reasoning as for the metrology and inspection area. As a result, we have determined the same growth rates for the projection period and the steady state.

Net Working Capital

Except for cash from operations, which we have set at 2% of sales, we have presented all other items of the NWC in number of days. We compared these ratios with those of their indirect competitors, since direct competitors are not only specialized in systems for the semiconductor market, which would dilute the results. We therefore found that companies that supply equipment exclusively for semiconductor production to be a better proxy.

As a result, ASML's Cash Conversion Cycle (CCC) is between that of Applied Material and Tokyo Electron, showing that it is in line with the industry average. Also noteworthy is the difference between Days Sales Outstanding (DSO) and Days Payable Outstanding (DPO), which is consistently negative only for ASML over the entire look-back period. This reflects that ASML needs more time to pay its suppliers than to collect receivables from its customers, which has a positive impact on the cash conversion cycle.

Table 7: NWC Ratios

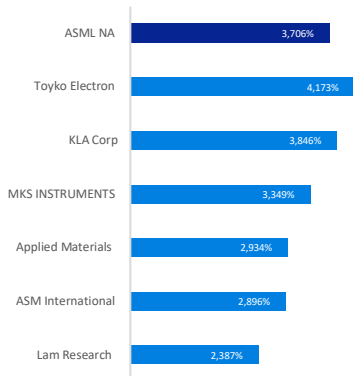
ASML			
	2019	2020	2021
Cash Conversion Cycle	203,30	198,08	176,75
DSO-DPO	-8,48	-24,35	-32,42
DIO	211,77	222,43	209,17
Applied Material Inc.			
	2019	2020	2021
Cash Conversion Cycle	181,28	165,39	155,75
DSO-DPO	21,58	23,81	32,38
DIO	159,70	141,59	123,37
Tokyo Electron Ltd.			
	2019	2020	2021
Cash Conversion Cycle	168,55	203,47	180,42
DSO-DPO	-0,89	1,79	3,78
DIO	169,44	201,68	176,64

Source: ASML Annual Statement, TEL Annual Statement, AMAT Annual Statement Bloomberg

However, if we look at the average days that ASML has its cash tied up in inventories (DIO), we see that this is higher than the industry average at 209,2 days. However, given the complexity of the machines and the volume sold annually, we consider this to be reasonable, as the lithography systems are more sophisticated than those of most indirect competitors.

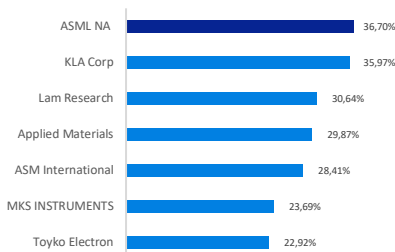
Considering the high DPO combined with an industry standard CCC, ASML has a healthy working capital management but passes on a portion of its inventory cycle time to its suppliers. As there is no record of cash shortages or unpaid receivables to explain the high DPO, we acknowledge that ASML has negotiated favourable credit terms with its suppliers, yet these are necessary to maintain a healthy CCC.

Graph 23: CAPEX/ Revenue FY21



Source: ASML Annual Statement, Analyst estimates, Bloomberg

Graph 24: EBIT margin FY21



Source: ASML Annual Statement, Bloomberg

Table 8: ASML's cost structure (€m)

	2020A	2021E	2022F
COGS System Sales	4.863	6.187	7.572
<i>in % of Revenue</i>	34,79%	33,24%	33,88%
COGS Service & Field Option	2.012	2.319	2.540
<i>in % of Revenue</i>	14,39%	12,46%	11,52%
(R&D)	1.448	1.746	2.463
<i>in % of Revenue</i>	10,36%	9,38%	11,02%
(SG&A)	509	683	824
<i>in % of Revenue</i>	3,64%	3,67%	3,69%

Source: ASML Annual Statement, Analyst estimates

Capital Expenditures (“CAPEX”)

The nature of the semiconductor industry is highly capital intensive, this is also the case for ASML and to develop next-generation technologies to further secure growth opportunities, significant cash investments in capital expenditures are required. Nearly all ASML's capital expenses are covered by their liquid assets.

From 2018 to 2021 property, plant, and equipment (PP&E) increased by approximately €1,4bn resulting in a PP&E position of about €3,0bn. ASML intends to further develop their EUV technology, especially as they are trying to launch their next generation of EUV technology called EUV 0.55 NA (High NA). To achieve that they recently completed their new EUV 0.55 NA factory and logistics facility. We believe that from 2022 onwards, their PP&E growth will be in line with their EUV growth.

To further promote growth and advancement, as mentioned in the strategy section, ASML will continue to invest in leading companies with unique technologies to advance their technological leadership and enable cost-effective innovations for their customers. This is incorporated into the development of intangible assets and will eventually lead to increased sales. Therefore, it makes sense to keep making investments in intangible assets, which will help to improve future cash flows. We decided on the rationale, that intangible assets represent a percentage of sales, and this relationship will be maintained in the future.

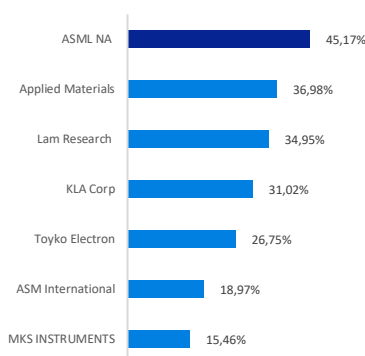
Costs / Operating Margins

We believe that despite the higher cost inflation, ASML will be able to renegotiate its selling prices to further drive its gross margin goal of 54-56% by 2025, since ASML's customers are dependent on the new EUV technology as well as upgrades of their existing machines. However, we think that a lower range of 53-

55% will be more suitable considering the economic uncertainty regarding resources and due to the cost transfer to customers. Going forward we believe ASML will be able to keep up its margins associated with efficiency gains and automation within its production facilities. In the long run, increased value addition would result in larger gross profit margins, particularly for High NA EUV and EUV.

ASML can achieve an EBIT margin of 36,70%, which is the highest EBIT margin among its peers. This is due to increased EUV profitability as a result of providing greater value to their customers and increased profitability in their installed base business as a result of ramping up production and adding additional efficiency upgrades. ASML also benefits from a large economy of scale as well as their market standing, especially within their EUV business line.

Graph 25: Return on Invested Capital FY21



Source: ASML Annual Statement, Analyst estimates, Bloomberg

Return on Invested Capital

The ROIC is stabilizing at 54,4% throughout the remaining three years of the forecasting period, which is in accordance with the idea of reaching at a stable state. In comparison to the semiconductor equipment peers, the ROIC is higher the average of 37,24%. (Damodaran 2022) This is due to the unique market standing and company composition. Looking at the development of the ROIC, ASML will keep creating additional value to its shareholder in the future.

Weighted Average Cost of Capital

Assuming an actual tax rate of 15,2%, the after-tax cost of debt and the cost of equity we computed a WACC of 7,92%.

▪ Cost of Equity

We therefore utilize the MSCI World Euro denoted as a market proxy, reflecting the global scope of ASML's revenues and their global investor base, as well as the fact that ASML publishes in Euro. To avoid the effects of daily volatilities we have seen in the past years, we use the monthly returns of the past 5 years. To compute the levered beta, we regress ASML's stock return with the market proxy. In addition, we also look at unlevered betas from comparable companies, to see if they are line in with the beta from ASML and to further improve the beta estimation. Therefore, we regress them with their respective currency-denoted market portfolio. However, due to the absence of true peers, no adjustments are made. As mentioned before, ASML is less volatile than its semiconductor peers, which implicates a strategically positioned business in the growing semiconductor sector with a solid long-term strategy.

Table 9: WACC Metrics

WACC Metrics	
Debt	
Probability of Default	0,20%
Loss given Default	51,00%
Yield to Maturity	3,12%
Credit Rating	A3
	3,02%
	2,56%
Equity	
Risk Free Rate	2,65%
Market Risk Premium	5,53%
Unlevered Beta	1,30
Cost of Equity	8,15%

Source: ASML Annual Statement, Analyst estimates

To arrive at the cost of equity we use the CAPM model. For the risk-free rate, the last rate of the Netherlands 10-Year Government Bond (TMBMKNL-10Y) is used, since ASML is incorporated in the Netherlands. We applied this logic for the market risk premium as well and therefore assume the market risk premium for the Netherlands, derived from Damodaran's report. (Damodaran 2022)

- Cost of Debt

In order to calculate ASML's expected cost of debt, we consider one of their 10y bonds with a yield to maturity of 3,09% and an S&P A- rating. Based on Moody's default study, where we assume a loss given of senior unsecured bonds of 51% and a probability of default of 0,20%. We believe based on the financial situation, ASML's cash and equivalents strategy, and its strong share buyback program, that Moody's estimates are appropriate. This leads us to a cost of debt after tax of 2,56%.

Table 10: BETA ASML vs. Peers

	5y Monthly BETA
Lam Research	1,47
KLA Corp	1,43
MKS INSTRUMENTS	1,64
ASM International	1,59
Applied Materials	1,65
Toyko Electron	1,43
ASML	1,30

Source: ASML Annual Statement, Analyst estimates

Valuation Outcome

Discounted Cash Flow

We have chosen to value ASML's equity using the DCF approach as we believe this is the most used technique and the most reliable method to derive a robust valuation. Finally, we have determined the enterprise value of ASML as of December 31, 2023, based on the DCF method. After considering non-core invested capital and the company's net debt, the equity value is €243 billion, which corresponds to a share price of €598,35 based on outstanding shares.

Relative Valuation

ASML specializes in the development and manufacturing of lithography systems for the semiconductor market, however, there are no comparable companies that accurately represent ASML's business model. To still find suitable peers, we analysed peer large- cap semiconductor equipment companies, capturing the growth potential of the semiconductor market. Firstly, we identified companies within this industry, facing similar risks associated with macroeconomics and positioned in a similar market segment. Conglomerates with comparable fab equipment endeavours were also taken into consideration, which included market dynamics into the valuation. When deciding and analysing what multiples to use, we found the price-to-earnings ratio (P/E) and enterprise value to EBIDTA (EV/EBIT) to be the most appropriate. Although ASML is one of the only companies that is based in Europe, comparing it with Lam Research Corporation,

Table 11: Multiples ASML vs. Peers

Semiconductor Peers	EV/EBIT	Price/Sales
Lam Research	19,89x	4,92x
KLA Corp	20,46x	8,81x
MKS INSTRUMENTS	14,34x	2,02x
ASM International	37,46x	7,43x
Applied Materials	18,34x	4,43x
Toyko Electron	20,67x	4,34x
Median	20,17x	4,68x
DUV Peers	EV/EBIT	Price/Sales
Canon Inc	10,79x	1,10x
Nikon Crop	-	0,96x
Median	10,79x	1,03x

Source: ASML Annual Statement, Analyst estimates

KLA Corp, MKS Instruments, Applied Materials Inc, and ASM International NV as well as Canon Inc. and Nikon Corp. does capture ASML's global scale the best.

When looking at the EV/EBIT ratio we reached a range from 14,34x to 37,46x, which corresponds to a share price range of €245,81 - €634,39, according to the P/Sales ratio, ASML would have a share price range of €92,45 - €403,61 This concludes when using the Median share prices of €214,17 for P/Sales and €343,89 for EV/EBIT, which are values below ASML's share price. This confirms that ASML does have a big premium over its peers. Reasons for that could be that ASML does have a unique standing and position in the lithography market. None of its peers are close to ASML's market share. Other reasons could be the quality of the firm on a global scale so that international investors are willing to pay premiums as well as the unique standing as a driver for high- quality technology stocks in Europe. This presents the complexity of ASML's market, since just looking at comparables may not completely illustrate the company's value and may lead us to undervalue ASML.

Table 26: Sensitivity Analysis

Growth Rate	WACC		
	7,76%	7,96%	8,16%
2,79%	246.342	236.712	227.791
2,99%	253.485	243.216	233.731
3,19%	261.241	250.254	240.139

Growth Rate	WACC		
	7,76%	7,96%	8,16%
2,79%	608,0 €	583,6 €	561,1 €
2,99%	626,2 €	600,2 €	576,2 €
3,19%	646,0 €	618,1 €	592,5 €

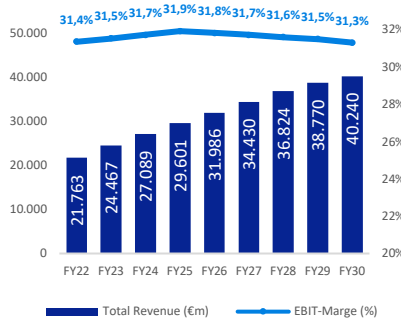
Source: Analyst estimates

Sensitivity Analysis

Considering the deviation of WACC and the terminal growth rate a sensitivity analysis was carried out to reflect the range of ASML's expected enterprise value and share price. The Weighted Average Cost of Capital ranges from 7,76% to 8,16% with 0,2% steps. For the growth rate the same step size was applied, ranging from 2,79% to 3,19%. The enterprise value of the company ranges from €228 billion in the worst scenario to €261 billion in the best scenario. Applied to the share price the sensitivity analysis yields a range from as low as €560,4 to as high as €642,7.

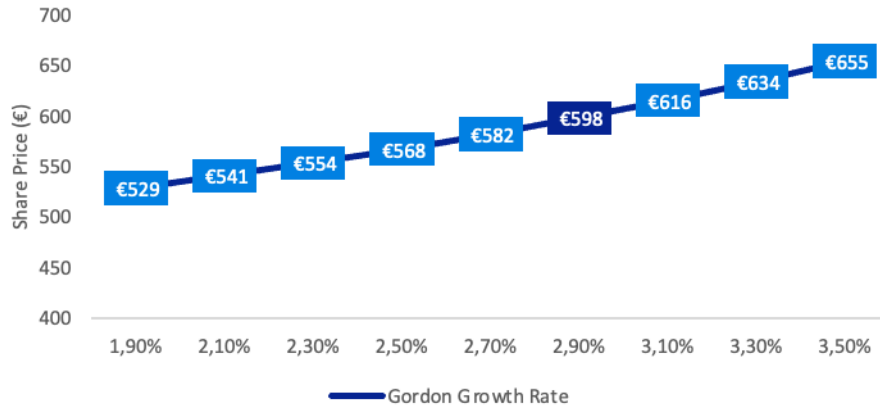
The terminal value we use to determine the company's value also greatly depends on the last cash flow and long-term growth rate we used to do so. Therefore, we analysed different growth rates while keeping the WACC constant.

Graph 28: Revenue (€m) & EBIT margin (%) – Worst-Case



Source: Analyst estimates

Graph 27: Sensitivity Analysis Growth Rate



Source: Analysts estimates

Scenario Analysis

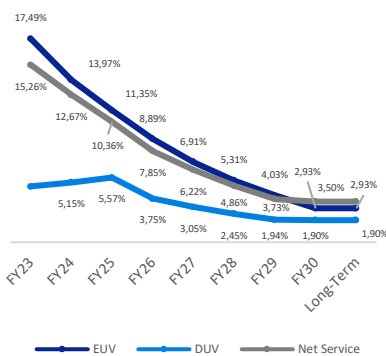
To factor in the risks ASML might face, we present a scenario analysis with a best- and worst-case scenario, depending on sales growth figures for the different business lines and possible risks. Comparing these two different cases demonstrates how important supply chain stability, technological developments, and protection against their risk factors are to ASML's market dominance and share price development.

- Worst-Case Scenario

The worst-case scenario considers an economic downturn in the short- and mid-term future. Combined with rising economic uncertainty and a decline in investments, this would have a detrimental effect on both the expansion of the world economy as well as international trade. This would increase the likelihood that resources required to continue the development of the new technologies may not be available from ASML's suppliers. Especially, the development of High NA EUV requires a significant R&D investment from ASML as well as from their suppliers. As a result, ASML's R&D costs would rise, and they may experience a significant fall in their margins and therefore slower revenue growth. Hence, the R&D will rise to 14% of revenue (compared to 11,02% in the base-case). This would also require ASML to postpone the introduction of High NA EUV and their product roadmap. Also, the adoption of EUV by consumers may be slower than anticipated if EUV and High NA EUV systems perform worse than anticipated.

This scenario implies that in addition to the aforementioned variations, ASML's operational efficiency would slightly decrease, necessitating an increase in

Graph 29: Growth Rates - Worst-Case

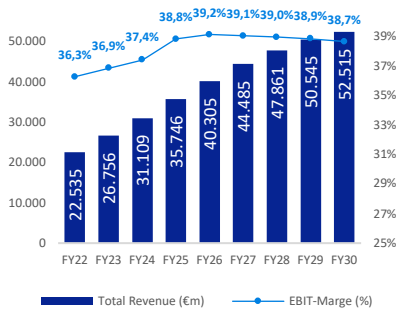


Source: Analyst estimates

CAPEX spending in order to meet the projected sales targets. We expect ASML's revenue to grow at a CAGR₂₂₋₂₇ of 9,61% (compared to 13,51% in the base-case) and an EBIT margin of 31,13% by the end of our forecasting period (compared to 37,65% in the base-case).

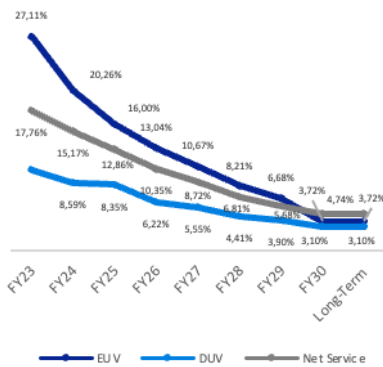
Assuming the same structure as in the base-case we derive a share price of €387,47, which is a 35,2% decline over our base-case. Even though ASML is a "high-quality" stock, there is a chance that its value could decline significantly. This is because it has considerably increased during the last decade.

Graph 30: Revenue (€m) & EBIT margin (%)
– Best-Case



Source: Analyst estimates

Graph 31: Growth Rates - Best-Case



Source: Analyst estimates

Best-Case Scenario

In the best-case scenario, we consider an earlier and stronger economic rebound than anticipated and therefore a more favourable environment for the semiconductor industry. The past shows us that long-cycle equipment companies like ASML are unlikely to see cutbacks in sales projections as a result of a typical sector downturn. As the recovery was more rapid, we anticipate slightly higher growth rates going forward. This also implies a higher likelihood that ASML and their customer are willing to invest the amount needed in R&D to develop the new anticipated technologies. Additionally, ASML could accelerate the rollout of High NA EUV and their product roadmap and by creating more capacity the adaption of EUV and High NA EUV by customers will be quicker.

As a result of earlier EUV adaption, ASML would be able to improve on their margins, due to better margins on EUV technology and thus be able to achieve their anticipated gross profit margins of 54-56% by 2025. To accommodate the higher demand, we also assume an improved asset efficiency, thus having property, plant, and equipment as 16% of revenue (compared to 16,87% in the base-case). We expect ASML's revenue to grow at a CAGR₂₂₋₂₇ of 14,57% (compared to 13,51% in the base-case) and an EBIT margin of 38,73% by the end of our forecasting period (compared to 37,64% in the base-case).

Assuming the same structure as in the base-case we derive a share price of €638,45, which is a 6,6% increase over our base-case.

Conclusion

The expected share price for ASML for December 2023, as determined by the DCF valuation based on the assumptions outlined in this equity research report, is €598,35, which is 8,6% higher than the share price as of today (15.12.2022). With the key transition in semiconductor equipment technology to EUV and High NA EUV in the mid-term future, ASML is perfectly positioned as the sole supplier of EUV equipment. As the market learns more about ASML's strategy, we believe

its shares should reflect their long-term customer commitment and robust forecast for future revenue growth, even though High NA EUV has little effect on projections in the near term, other from a R&D perspective. This leaves ASML with a strong outlook and a more favourable market position than its peers. The market seems to slightly undervalue the stock, consequently, our recommendation issued is a “HOLD”.

Appendix

Financial Statements

Income Statement (Reformulated)

Year ended December 31 (€ in millions)	2018A	2019A	2020A	2021E	2022F	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F	2031F	2032F
Net Systems Sales EUV	1.880.1	2.799.7	4.463.8	6.284.0	8.545.0	10.775.9	12.851.4	14.779.2	16.558.7	18.159.3	19.568.3	20.787.2	21.466.4	22.167.8	22.892.1
Net Systems Sales High-NA EUV	-	-	-	-	-	-	-	300.0	1,200.0	2,553.8	3,637.3	4,217.6	4,376.5	4,541.4	4,712.5
Net Systems Sales Affi	4.806.9	4.707.7	3.917.0	4.959.6	5.571.0	6.084.6	6.546.7	7.028.0	7.395.1	7.731.4	8.037.4	8.314.4	8.502.9	8.695.7	8.892.9
Net Systems Sales Aff dry	274.3	401.2	427.0	431.9	485.1	529.9	570.1	612.0	644.0	673.3	699.9	724.0	740.5	757.3	774.4
Net Systems Sales KRF	860.1	679.7	1,012.3	1,321.3	1,484.2	1,621.0	1,744.1	1,872.4	1,970.2	2,059.7	2,141.3	2,215.1	2,265.3	2,316.7	2,369.2
Net Systems Sales Hi-me	98.6	133.5	146.4	142.3	159.8	174.6	187.8	201.6	212.2	221.8	230.6	238.6	244.0	249.5	255.2
Net Systems Sales Metrology & Inspection	339.1	274.4	350.1	513.7	582.5	680.1	776.5	868.5	949.8	1,023.1	1,088.2	1,145.0	1,178.4	1,212.8	1,248.2
Net service and field option sales	2.684.9	2.823.8	3.661.9	4.958.2	5.521.2	6.446.3	7.359.8	8.232.3	9.002.1	9.697.3	10.313.9	10.853.0	11.169.2	11.495.1	11.831.0
Revenue	10.944.0	11.820.0	13.978.5	18.611.0	22.348.8	26.312.4	30.036.4	33.894.1	37.932.1	42.119.8	45.717.0	48.494.9	49.943.2	51.436.2	52.975.5
Cost of system sales	(3,852.4)	(4,382.7)	(4,862.5)	(6,186.5)	(7,572.4)	(8,840.4)	(9,977.7)	(10,906.2)	(12,150.6)	(13,617.4)	(14,869.3)	(15,809.6)	(16,285.1)	(16,775.3)	(17,280.7)
Cost of service and field option sales	(1,773.7)	(1,864.0)	(2,012.0)	(2,319.1)	(2,539.7)	(2,900.8)	(3,238.3)	(3,539.9)	(3,870.9)	(4,169.8)	(4,435.0)	(4,666.8)	(4,802.8)	(4,942.9)	(5,087.3)
Depreciation & Amortization Cost of sales(a)	(599.6)	(673.2)	(735.4)	(888.0)	(937.8)	(995.9)	(1,147.0)	(1,282.1)	(1,453.5)	(1,648.6)	(1,827.2)	(1,978.4)	(2,120.4)	(2,240.2)	(2,304.2)
Gross Profit	4,718.3	4,900.1	6,368.6	9,417.4	11,298.8	13,575.3	15,873.4	18,165.8	20,457.1	22,683.9	24,865.5	26,940.1	28,734.9	27,577.9	28,409.3
(R&D)	(1,239.8)	(1,538.2)	(1,448.0)	(1,745.7)	(2,402.9)	(2,899.7)	(3,310.3)	(3,735.2)	(4,190.2)	(4,641.7)	(5,098.1)	(5,344.2)	(5,503.8)	(5,668.4)	(5,838.0)
(SG&A)	(475.3)	(498.0)	(509.3)	(683.3)	(824.4)	(975.1)	(1,118.2)	(1,263.6)	(1,426.1)	(1,589.7)	(1,733.6)	(1,846.9)	(1,919.2)	(1,976.5)	(2,035.7)
Depreciation & Amortization	(119.9)	(147.2)	(167.5)	(158.2)	(244.3)	(288.0)	(329.2)	(371.9)	(416.7)	(463.2)	(503.3)	(534.5)	(551.8)	(568.3)	(585.3)
Core Result before Taxes (EBIT)	2,883.3	2,716.7	4,243.8	6,830.2	7,867.2	9,412.5	10,916.0	12,791.1	14,435.1	15,989.3	17,310.8	18,314.8	18,760.1	19,364.7	19,944.3
Statutory Taxes	(720.8)	(679.2)	(1,061.0)	(1,707.6)	(1,966.8)	(2,353.1)	(2,729.0)	(3,197.8)	(3,608.8)	(3,997.3)	(4,327.7)	(4,578.6)	(4,690.0)	(4,841.2)	(4,986.1)
Tax Adjustments Core	277.2	474.0	472.4	696.8	786.7	941.2	1,091.6	1,279.1	1,443.5	1,598.9	1,731.1	1,831.4	1,876.0	1,936.5	1,994.4
Core Result (NOPLAT)	2,439.7	2,511.5	3,655.3	5,819.5	6,687.1	8,006.6	9,278.6	10,872.4	12,269.9	13,590.9	14,714.2	15,567.3	15,946.1	16,460.0	16,952.6
Non-Core Business															
Other income	0.0	0.0	0.0	213.7	85.5	100.7	115.0	129.7	145.2	161.2	175.0	185.6	191.2	196.9	202.8
Finance income	13.5	11.6	8.4	10.0	18.7	22.1	25.2	28.4	31.8	35.3	38.3	40.7	41.9	43.1	44.4
Non-Core Result before Taxes	13.5	11.6	8.4	223.7	104.3	122.8	140.1	158.1	177.0	196.5	213.3	226.3	233.0	240.0	247.2
Statutory Taxes	(3.4)	(2.9)	(2.1)	(5.9)	(26.1)	(30.7)	(35.0)	(39.5)	(44.2)	(49.1)	(53.3)	(56.6)	(58.3)	(60.0)	(61.8)
Tax Adjustments Non-Core	100.8	70.1	(20.9)	(10.8)	10.4	12.3	14.0	15.8	17.7	19.7	21.3	22.6	23.9	24.8	24.7
Profit from Investments in associates	8.2	18.2	55.6	55.6	138.4	138.4	138.4	209.9	234.4	260.8	288.1	300.0	309.2	318.5	328.0
Non-Core Result	117.1	97.0	74.0	356.1	227.0	267.3	305.1	344.3	385.3	427.8	464.4	492.6	507.3	522.5	538.1
Financing															
Finance costs	(41.8)	(36.6)	(43.3)	(54.6)	(68.0)	(80.1)	(91.4)	(103.1)	(115.4)	(128.2)	(139.1)	(147.6)	(152.0)	(156.5)	(161.2)
Financing Result before Tax	(41.8)	(36.6)	(43.3)	(54.6)	(68.0)	(80.1)	(91.4)	(103.1)	(115.4)	(128.2)	(139.1)	(147.6)	(152.0)	(156.5)	(161.2)
Statutory Taxes	10.5	9.2	10.8	13.7	6.8	8.0	9.1	10.3	11.5	12.8	13.9	14.8	15.2	15.7	16.1
Financing Result	(31.4)	(27.5)	(32.5)	(41.0)	(61.2)	(72.1)	(82.3)	(92.8)	(103.9)	(115.3)	(125.2)	(132.8)	(136.8)	(140.9)	(145.1)
Comprehensive Result	2,525.45	2,581.08	3,696.78	6,134.58	6,852.93	8,195.85	9,501.43	11,123.91	12,551.29	13,903.40	15,053.36	15,927.07	16,316.68	16,841.61	17,345.70

Balance Sheet (Reformulated)

Year ended December 31 (€ in millions)	2018A	2019A	2020A	2021E	2022F	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F	2031F	2032F
Core Business															
Operating Cash	218.9	236.4	279.6	372.2	447.0	526.2	600.7	677.9	758.6	842.4	914.3	969.9	998.9	1,028.7	1,059.5
Accounts receivable, net	1,498.2	1,786.8	1,310.3	3,028.0	2,728.7	3,212.7	3,667.4	4,138.4	4,631.4	5,147.7	5,581.9	5,921.1	6,097.9	6,289.2	6,488.2
Inventories, net	3,439.5	3,899.2	4,589.4	5,179.2	5,941.5	6,898.7	7,765.2	8,487.9	9,413.5	10,451.0	11,342.3	12,031.0	12,760.6	13,442.5	14,142.5
Accounts payable	(964.0)	(1,062.2)	(1,378.1)	(2,115.1)	(4,060.3)	(6,780.5)	(9,457.0)	(12,137.0)	(14,891.3)	(17,652.3)	(19,408.1)	(20,801.6)	(21,972.7)	(23,045.0)	(24,024.4)
NWC	4,192.6	4,770.2	4,781.2	6,463.9	5,066.8	5,837.1	6,576.2	7,146.3	7,912.1	8,783.8	9,532.7	10,111.5	10,413.4	10,726.6	11,048.5
Intangible assets, net	2,592.7	2,519.4	2,633.7	2,852.9	3,334.3	4,514.3	5,153.2	5,815.1	6,507.9	7,226.3	7,843.5	8,330.1	8,588.6	8,824.7	9,068.8
Property, plant and equipment, net	1,595.9	1,999.3	2,470.3	2,982.7	3,770.5	4,438.9	5,097.5	5,718.3	6,399.6	7,116.1	7,712.8	8,181.6	8,425.9	8,677.8	8,937.5
Right-of-use assets	137.6	323.9	344.9	164.8	448.5	528.1	602.8	680.2	761.3	845.3	917.5	973.3	1,002.3	1,032.3	1,063.2
Current tax position (consolidated)	(108.2)	113.1	(42.7)	(259.9)	(166.1)	(114.0)	(102.0)	(146.9)	(184.4)	(182.0)	(196.2)	(210.2)	(216.5)	(222.9)	(229.6)
Deferred and other tax (liabilities) (consolidated) Core	(84.8)	156.6	317.0	679.9	538.8	635.5	725.5	816.6	916.2	1,017.3	1,104.2	1,177.3	1,206.3	1,243.3	1,279.5
Core Invested Capital	8,315.4	9,882.5	10,524.4	12,884.3	11,953.1	15,802.2	17,995.0	20,312.6	22,332.5	24,786.3	26,812.7	28,547.2	29,400.0	30,279.8	31,185.0
Non-Core Business															
Contract Assets & Liabilities	(2,837.3)	(4,055.0)	(6,474.9)	(10,096.3)	(7,418.4)	(8,734.1)	(9,970.2)	(11,250.1)	(12,591.1)	(13,981.3)	(15,175.2)	(16,097.3)	(16,578.0)	(17,073.6)	(17,584.6)
Cash mainly related to remaining performance obligations and deferred revenue	2,902.2	3,295.9	5,789.8	6,579.6	6,095.5	7,176.5	8,192.2	9,244.4	10,347.7	11,487.9	12,680.0	13,276.7	13,621.7	14,028.9	14,448.7
Short-term investments	913.3	1,185.8	1,302.2	688.5	859.8	1,112.7	1,406.5	1,727.1	2,096.7	2,496.9	2,900.4	3,278.5	3,792.1	4,002.2	4,210.0
Other assets (consolidated)	1,375.9	1,376.5	1,427.6	1,653.3	2,289.3	2,655.4	3,076.8	3,472.0	3,885.6	4,314.8	4,683.1	4,967.7	5,116.0	5,260.0	5,426.6
Finance receivables (consolidated)	886.2	985.6	2,111.0	1,588.6	2,233.0	2,629.0	3,001.1	3,386.5	3,790.0	4,208.4	4,567.8	4,845.4	4,990.1	5,139.3	5,293.1
Investments in associates	915.8	833.0	820.6	892.5	1,316.9	1,553.6	1,773.5	2,001.3	2,239.7	2,485.9	2,699.3	2,863.4	2,948.9	3,037.0	3,127.9
Goodwill	4,562.7	4,562.7	4,600.6	4,577.1	4,577.1	4,577.1	4,577.1	4,577.1	4,577.1	4,577.1	4,577.1	4,577.1	4,577.1	4,577.1	4,577.1
Accrued and other liabilities (consolidated)	(1,065.8)	(1,777.0)	(1,383.5)	(1,683.8)	(2,216.1)	(2,609.2)	(2,978.5)	(3,361.0)	(3,761.4)	(4,176.7)	(4,533.4)	(4,808.8)	(4,952.4)	(5,100.5)	(5,253.1)
Deferred and other tax (liabilities) (consolidated) Non-Core	(51.3)	63.1	90.1	220.9	376.2	207.5	336.4	267.2	299.1	332.1	365.2	382.4	393.8	405.5	417.7
Non-Core Invested Capital	7,580.7	6,970.6													

Free Cash Flow

Cash Flow	2019A	2020A	2021E	2022F	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F	2031F	2032F
NPAT	2,511.5	3,655.3	5,819.5	6,687.1	8,000.6	9,278.6	10,872.4	12,269.9	13,590.9	14,714.2	15,673.3	15,946.1	16,460.0	16,925.6
Depreciation & Amortization	147.2	167.5	158.2	244.3	288.0	329.2	371.9	416.7	463.2	503.3	534.5	551.8	568.3	585.3
Gross Cash Flow	2,658.7	3,822.8	5,977.7	6,931.5	8,288.6	9,607.7	11,244.3	12,686.5	14,054.1	15,217.5	16,107.8	16,497.9	17,028.2	17,510.9
Delta change in Core Invested Capital	(2,694.2)	(809.4)	(2,128.7)	(932.3)	(2,595.2)	(2,468.0)	(2,408.5)	(2,177.5)	(2,036.9)	(2,439.8)	(2,369.3)	(2,409.2)	(2,447.3)	(2,491.4)
Operating FCF	964.4	3,013.4	3,459.5	6,014.4	5,693.5	7,143.7	8,835.8	9,569.0	11,127.1	12,597.7	13,922.5	15,093.6	15,581.1	16,046.5
Non Core Result	97.0	74.0	356.5	227.0	267.3	305.1	344.3	383.3	422.8	464.4	492.6	507.3	522.5	538.1
Delta change in Non Core Invested Capital	610.1	(2,342.9)	5,865.2	(4,467.5)	(701.7)	(696.9)	(749.5)	(811.6)	(870.6)	(802.5)	(696.2)	(674.3)	(575.7)	(290.5)
Non Operating FCF	707.1	(2,268.9)	6,221.2	(4,240.5)	(434.4)	(391.8)	(405.2)	(428.2)	(442.8)	(338.2)	(193.6)	(167.0)	146.8	247.6
Financing Result	(27.5)	(22.5)	(41.0)	(61.2)	(72.1)	(82.3)	(92.8)	(103.9)	(115.3)	(125.2)	(132.8)	(136.8)	(140.9)	(145.1)
Delta net Debt	2.5	1,560.8	(48.1)	1,930.2	980.6	(837.3)	(1,022.5)	(398.7)	(371.4)	(51.3)	(717.9)	(535.4)	(142.6)	(206.7)
Financing CF	(24.9)	1,528.3	(89.0)	1,869.0	908.5	(919.6)	(1,115.3)	(502.6)	(486.7)	(876.5)	(850.7)	(672.2)	(283.5)	(351.8)
Total Free Cash Flow	1,646.6	2,272.8	9,591.7	3,646.8	6,167.6	5,832.4	7,315.3	9,040.2	10,197.6	11,383.0	12,888.1	14,254.5	15,444.4	15,942.4
Comprehensive Result	(2,581.1)	(2,696.8)	(6,124.6)	(6,852.9)	(9,195.8)	(9,501.4)	(11,123.9)	(12,551.3)	(13,903.4)	(15,053.4)	(15,927.1)	(16,316.7)	(16,841.6)	(17,245.7)
Delta Equity	934.5	1,424.0	(3,457.1)	3,206.1	2,026.2	3,669.0	3,808.6	3,511.1	3,705.8	3,670.4	3,039.0	2,062.2	1,397.2	1,403.3
CF from Financing	(1,646.6)	(2,272.8)	(9,591.7)	(3,646.8)	(6,167.6)	(5,832.4)	(7,315.3)	(9,040.2)	(10,197.6)	(11,383.0)	(12,888.1)	(14,254.5)	(15,444.4)	(15,942.4)

ROIC & Growth Rate

ROIC %	2019A	2019A	2020A	2021E	2022F	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F	2031F	2032F
Core ROIC	29.27%	29.41%	38.22%	45.17%	49.24%	50.64%	51.92%	54.23%	54.94%	54.83%	54.97%	54.93%	54.24%	54.36%	54.82%
Core ROIC	73.93%	73.93%	337.17%	36.77%	186.42%	55.39%	74.66%	68.61%	57.41%	45.59%	40.31%	33.17%	60.38%	56.66%	56.66%
Core Growth Rate	2.95%	45.54%	59.21%	14.91%	19.64%	15.97%	17.18%	12.85%	10.77%	8.26%	5.80%	2.43%	3.22%	2.99%	

Discounted Cash Flow

	2022F	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F	2031F	2032F
Year Factor	(1,0)	0,0	1,0	2,0	3,0	4,0	5,0	6,0	7,0	8,0	9,0
Core FCF	6,018	5,693	7,144	8,836	9,969	11,127	12,598	13,932	15,094	15,581	16,047
Discount Factor	1,00	0,93	0,86	0,79	0,74	0,68	0,63	0,58	0,54	0,50	0,46
Present Value	5,693	6,616	7,579	7,920	8,387	8,387	8,585	8,793	8,823	8,435	8,046
% of Total											
Terminal value period											
Terminal value											325,719
PV of terminal value											163,319
Total PV Core FCF	241,998										
Non Core Invested Capital	6,018										
Enterprise Value	250,615										
EV 4x Equity Bridge	17,400										
Less: Debt	(7,400)										
Net Debt	(7,400)										
Equity Value	243,216										
o/s Shares (in millions)	406										
Share Price (in €)	598,35										

Sources

- Annual Report Intel.* (2022). <https://www.intc.com>. <https://www.intc.com/filings-reports/annual-reports/content/0000050863-22-000007/0000050863-22-000007.pdf>
- Applied materials, Annual Report 2021. (2021). In www.appliedmaterials.com. Applied materials. <https://ir.appliedmaterials.com/static-files/df09dbcf-2e31-49ec-b992-715aeaa7e503>
- ASML, annual report 2021* (2022). Available at: <https://www.asml.com/en/investors/annual-report/2021>.
- Aswath Damodaran (2022) 'Country Default Spreads and Risk Premiums'. Available at: https://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/ctryprem.html.
- Canon provides nanoimprint lithography manufacturing equipment to Toshiba Memory's Yokkaichi Operations plant* (no date). Available at: <https://global.canon/en/news/2017/20170720.html>.
- Canon to Challenge ASML with Nanoimprint Technology* (no date). Available at: <https://abachy.com/news/canon-challenge-asml-nanoimprint-technology>.
- Canon, annual report* (2021) <https://global.canon/en/ir/annual/2021/canon-annual-report-2021.pdf>.
- European Central Bank (2022) *Measuring inflation - HICP*. Available at: https://www.ecb.europa.eu/stats/macroeconomic_and_sectoral/hicp/html/index.en.html.
- Fitch Affirms ASML at "A-"; Stable Outlook. (2021).
In <https://www.fitchratings.com>. <https://www.fitchratings.com/research/corporate-finance/fitch-affirms-asml-at-a-stable-outlook-24-06-2021>
- Furukawa, Y. (2022) *Canon plans ¥50 billion plant in Tochigi to produce more chipmaking equipment*. Available at: <https://www.japantimes.co.jp/news/2022/10/05/business/corporate-business/canon-plans-%C2%A550-billion-plant-tochigi-produce-chipmaking-equipment/>.
- J.P. Morgan Chase. (2022, August 11). *How to begin building a credit history*. <https://www.jpmorgan.com/insights/research/supply-chain-chip-shortage>
- Knight, W. (2021, August 30). *The \$150 Million Machine Keeping Moore's Law Alive*. WIRED. <https://www.wired.com/story/asml-extreme-ultraviolet-lithography-chips-moores-law/>

- Lam Research Corporation, 2021 Annual Report. (2021). In *www.annualreports.com/Company/lam-research-corporation*. Lam Research Corporation. https://www.annualreports.com/HostedData/AnnualReports/PDF/NASDAQ_LRCX_2021.pdf
- LaPedus, M. (2019) *Lithography Options For Next-Gen Devices*. Available at: <https://semiengineering.com/lots-of-lithography-options-for-next-gen-devices/>.
- Margin/ ROIC by Sector (US)*. (2022, January). <https://pages.stern.nyu.edu>. https://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/mgnroc.html
- Moody's assigns A2 rating to ASML's new green bond offering. (2022). In <https://www.moody.com/>. https://www.moody.com/research/Moodys-assigns-A2-rating-to-ASMLs-new-green-bond-offering--PR_465595
- Nanoimprint Lithography* (no date). Available at: <https://global.canon/en/technology/frontier07.html>.
- Nikon, annual report* (2021) https://www.nikon.com/about/ir/management/nikon-report/pdf/nr2021/21nikonreport_e.pdf.
- Pignataro, P. (2013) *Financial Modeling and Valuation: A Practical Guide to Investment Banking and Private Equity*. 1st edn. Wiley.
- Real GDP growth*. (2022). <https://www.imf.org/>. https://www.imf.org/external/datamapper/NGDP_RPCH@WEO/OEMDC/ADVEC/WEOWORLD
- Semiconductor Forecast Database, Worldwide, 2Q21 Update* (2021). Available at: <https://www.gartner.com/en/documents/4003111>.
- Sterling, T. (2022, January 19). *Intel orders ASML system for well over \$340 mln in quest for chipmaking edge*. Reuters. <https://www.reuters.com/technology/intel-orders-asml-machine-still-drawing-board-chipmakers-look-an-edge-2022-01-19/>

The resilience myth: Fatal flaws in the push to secure chip supply chains. (2022, July 26). Nikkei Asia. <https://asia.nikkei.com/Spotlight/The-Big-Story/The-resilience-myth-Fatal-flaws-in-the-push-to-secure-chip-supply-chains>

Vitrey, F. (2020) *The rise of nanoimprint lithography in semiconductor manufacturing.* Available at: <https://www.i-micronews.com/the-rise-of-nanoimprint-lithography-in-semiconductor-manufacturing/?cn-reloaded=1>.

Disclosures and Disclaimers

Report Recommendations

Buy	Expected total return (including expected capital gains and expected dividend yield) of more than 10% over a 12-month period.
Hold	Expected total return (including expected capital gains and expected dividend yield) between 0% and 10% over a 12-month period.
Sell	Expected negative total return (including expected capital gains and expected dividend yield) over a 12-month period.

This report was prepared by *[insert student's name]*, a Master in Finance student of Nova School of Business and Economics ("Nova SBE"), within the context of the Field Lab – Equity Research.

This report is issued and published exclusively for academic purposes, namely for academic evaluation and master graduation purposes, within the context of said Field Lab – Equity Research. It is not to be construed as an offer or a solicitation of an offer to buy or sell any security or financial instrument.

This report was supervised by a Nova SBE faculty member, acting merely in an academic capacity, who revised the valuation methodology and the financial model.

Given the exclusive academic purpose of the reports produced by Nova SBE students, it is Nova SBE understanding that Nova SBE, the author, the present report and its publishing, are excluded from the persons and activities requiring previous registration from local regulatory authorities. As such, Nova SBE, its faculty and the author of this report have not sought or obtained registration with or certification as financial analyst by any local regulator, in any jurisdiction. In Portugal, neither the author of this report nor his/her academic supervisor is registered with or qualified under COMISSÃO DO MERCADO DE VALORES MOBILIÁRIOS ("CMVM", the Portuguese Securities Market Authority) as a financial analyst. No approval for publication or distribution of this report was required and/or obtained from any local authority, given the exclusive academic nature of the report.

The additional disclaimers also apply:

USA: Pursuant to Section 202 (a) (11) of the Investment Advisers Act of 1940, neither Nova SBE nor the author of this report are to be qualified as an investment adviser and, thus, registration with the Securities and Exchange Commission ("SEC", United States of America's securities market authority) is not necessary. Neither the author nor Nova SBE receive any compensation of any kind for the preparation of the reports.

Germany: Pursuant to §34c of the WpHG (*Wertpapierhandelsgesetz*, i.e., the German Securities Trading Act), this entity is not required to register with or otherwise notify the *Bundesanstalt für Finanzdienstleistungsaufsicht* (“BaFin”, the German Federal Financial Supervisory Authority). It should be noted that Nova SBE is a fully-owned state university and there is no relation between the student’s equity reports and any fund raising programme.

UK: Pursuant to section 22 of the Financial Services and Markets Act 2000 (the “FSMA”), for an activity to be a regulated activity, it must be carried on “by way of business”. All regulated activities are subject to prior authorization by the Financial Conduct Authority (“FCA”). However, this report serves an exclusively academic purpose and, as such, was not prepared by way of business. The author - a Master’s student - is the **sole and exclusive responsible** for the information, estimates and forecasts contained herein, and for the opinions expressed, which exclusively reflect his/her own judgment at the date of the report. Nova SBE and its faculty have no single and formal position in relation to the most appropriate valuation method, estimates or projections used in the report and may not be held liable by the author’s choice of the latter.

The information contained in this report was compiled by students from public sources believed to be reliable, but Nova SBE, its faculty, or the students make no representation that it is accurate or complete, and accept no liability whatsoever for any direct or indirect loss resulting from the use of this report or of its content.

Students are free to choose the target companies of the reports. Therefore, Nova SBE may start covering and/or suspend the coverage of any listed company, at any time, without prior notice. The students or Nova SBE are not responsible for updating this report, and the opinions and recommendations expressed herein may change without further notice.

The target company or security of this report may be simultaneously covered by more than one student. Because each student is free to choose the valuation method, and make his/her own assumptions and estimates, the resulting projections, price target and recommendations may differ widely, even when referring to the same security. Moreover, changing market conditions and/or changing subjective opinions may lead to significantly different valuation results. Other students’ opinions, estimates and recommendations, as well as the advisor and other faculty members’ opinions may be inconsistent with the views expressed in this report. Any recipient of this report should understand that statements regarding future prospects and performance are, by nature, subjective, and may be fallible.

This report does not necessarily mention and/or analyze all possible risks arising from the investment in the target company and/or security, namely the possible exchange rate risk resulting from the security being denominated in a currency either than the investor’s currency, among many other risks.

The purpose of publishing this report is merely academic and it is not intended for distribution among private investors. The information and opinions expressed in this report are not intended to be available to any person other than Portuguese natural or legal persons or persons domiciled in Portugal. While preparing this report, students did not have in consideration the specific investment objectives, financial situation or

particular needs of any specific person. Investors should seek financial advice regarding the appropriateness of investing in any security, namely in the security covered by this report.

The author hereby certifies that the views expressed in this report accurately reflect his/her personal opinion about the target company and its securities. He/ She has not received or been promised any direct or indirect compensation for expressing the opinions or recommendation included in this report.

[If applicable, it shall be added: *“While preparing the report, the author may have performed an internship (remunerated or not) in [insert the Company’s name]. This Company may have or have had an interest in the covered company or security”* and/ or *“A draft of the reports have been shown to the covered company’s officials (Investors Relations Officer or other), mainly for the purpose of correcting inaccuracies, and later modified, prior to its publication.”*]

The content of each report has been shown or made public to restricted parties prior to its publication in Nova SBE’s website or in Bloomberg Professional, for academic purposes such as its distribution among faculty members for students’ academic evaluation.

Nova SBE is a state-owned university, mainly financed by state subsidies, students tuition fees and companies, through donations, or indirectly by hiring educational programs, among other possibilities. Thus, Nova SBE may have received compensation from the target company during the last 12 months, related to its fundraising programs, or indirectly through the sale of educational, consulting or research services. Nevertheless, no compensation eventually received by Nova SBE is in any way related to or dependent on the opinions expressed in this report. The Nova School of Business and Economics does not deal for or otherwise offer any investment or intermediation services to market counterparties, private or intermediate customers.

This report may not be reproduced, distributed or published, in whole or in part, without the explicit previous consent of its author, unless when used by Nova SBE for academic purposes only. At any time, Nova SBE may decide to suspend this report reproduction or distribution without further notice. Neither this document nor any copy of it may be taken, transmitted or distributed, directly or indirectly, in any country either than Portugal or to any resident outside this country. The dissemination of this document other than in Portugal or to Portuguese citizens is therefore prohibited and unlawful.