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Siemens Equity Valuation

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Master in Finance

Supervisor:

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ISCTE Business School,

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BUSINESS
SCHOOL

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Abstracto

Esta dissertação apresenta uma estivativa do valor justo das ações da Siemens através de uma análise profunda da empresa e da implementação do modelo de Fluxos de Caixa Descontados (FCD) e da avaliação por múltiplos.

A Siemens é uma empresa tecnológica alemã que atua em três áreas principais: automação, eletrificação e digitalização. A empresa está presente em cerca de 200 países. A inovação e a sustentabilidade estão no centro da sua estratégia de longo prazo e na relação com os seus clientes.

O modelo dos Fluxos de Caixa Descontados levam a uma valorização estimada de 207,13 euros por ação, que é depois comparado com o preço de cada ação. Uma vez que a estimativa obtida é superior ao preço da ação, a recomendação, em termos de investimento, consiste em comprar as ações da empresa.

A avaliação por múltiplos resulta num valor justo estimado de 162,02 euros por ação levando à mesma recomendação que o modelo dos Fluxos de Caixa Descontados.

Finalmente, uma análise de sensibilidade é realizada de forma a perceber como alterações em variáveis como a taxa de desconto e a taxa de crescimento perpetual constante podem ter impacto no valor das ações da empresa.

Palavras-chave: Valor justo, Modelo dos Fluxos de Caixa Descontados, Avaliação por Múltiplos, Inovação, Sustentabilidade

Abstract

This dissertation presents an estimate regarding the fair value of Siemens shares through an in-depth analysis of the company and the implementation of the Discounted Cash Flow model (DCF) and the relative valuation.

Siemens is a German technological company that operates in three main fields: automation, electrification and digitalization. The company is present in almost 200 countries. Innovation and sustainability are at the core of its long-term strategy and in its relationship with its customers.

The DCF model leads to an estimated fair value of 207,13 euros, which is then compared with Siemens' public share price. Since the estimate obtained is higher than the public share price, the recommendation, in terms of investment case, is to buy the company's shares.

The relative valuation results in an estimated fair value of 162,02 euros leading to the same recommendation as the DCF model.

Finally, a sensitivity analysis is performed to understand how changes in key variables such as the discount rate and the perpetual constant growth rate, may impact the value of the company's shares.

Key words: Fair value, Discounted Cash Flow Model, Relative Valuation, Innovation, Sustainability

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1. Introduction

The main purpose of this dissertation is to estimate the fair value per share of Siemens, a leading technological conglomerate company, providing an investment recommendation to current and prospective shareholders.

The German company under analysis is listed on the Frankfurt Stock Exchange, and globally operates in four segments: Digital Industries, Smart Infrastructure, Mobility and Siemens Healthineers.

The present dissertation is structured in five main sections: Literature Review, Internal Analysis, Macroeconomic Analysis, Company Valuation and Results Analysis.

- Literature Review: presents an overview of the most important valuation approaches. In this section the main characteristics of models such as the DCF, the multiples and the APV are described.
- Internal Analysis: the company is introduced and each segment is analyzed in terms of their characteristics and historical performance.
- Macroeconomic Analysis: in this section, the global economic outlook and the prospects of the company's most important markets are presented.
- Company Valuation: the fair value of Siemens' shares is estimated through the establishment of projections regarding the key components of the DCF model. This section is highly supported by the previous chapters.
- Results Analysis: an investment recommendation is by comparing the estimate for the fair value obtained in the previous section and the public share price. A discussion of the factors that may have caused such difference is, additionally, carried out.

2. Literature Review

As Fernandez (2019) mentions, the valuation exercise is important for many purposes. It could be to support a company's sale or acquisition, whether being a listed or private company, or through a public offering or a private placement. It could be to conduct an analysis of value creation or the identification of value drivers. Finally, it could be to underpin strategic decisions and choices.

Valuation can also be used to determine if a company is under- or overvalued, to define the assumptions about growth and risk implied in the market value of the company and to achieve a company's main aim – creating and maximizing sustainable shareholder value. (Damodaran, 2012)

It is important to notice that the valuation exercise is not objective. This exercise involves some degree of subjectiveness, in the underlying assumptions and inputs used. Therefore, the result of the valuation process is, always, an estimated value.

The main objective of this chapter is to present the most important valuation methods, referenced in literature.

2.1. Valuation Approaches

2.1.1. Discounted Cash Flow Model

The DCF model is probably the most known and commonly used method in the valuation of assets. It is the basis of many of the other approaches, which will be later mentioned in this dissertation.

"The value of any asset is the present value of expected future cash flows on it" (Damodaran, 2012). If we extend this present value rule to the whole company and make the appropriate adjustments, we obtain the DCF method. It provides a value estimate by discounting future expected cash flows to the present moment, using the most appropriate discount rate.

There are two variants that emerge from this method, the Free Cash Flows to the Firm (FCFF) and the Free Cash Flows to Equity (FCFE). There are two main differences between them. First, the former variant represents the cash

flow available for both debtholders and shareholders and, therefore, the used discount rate reflects the cost of debt and the cost of equity. The second variant represents the cash flow available to shareholders, so the discount rate used is the cost of equity. The second difference is related with the computation of the Equity Value. While according to the FCFF, there is a two-staged approach to determine the EQV, when discounting the FCFE, the EQV is obtained directly.

2.1.1.1. Cost of equity

The cost of equity is the minimum required rate demanded by the shareholders. It is the rate of return equity investors would demand to compensate for their risk of investing capital on the firm.

Usually, the cost of equity is calculated using the Capital Asset Pricing Model (CAPM) independently developed in the early 1960's by William Sharpe, Jack Treynor, John Lintner and Jan Mossin, based on the pioneering work of Markowitz. According to this model, the expected return of a security is equal to the risk-free return plus a risk premium, based on the systematic risk. "So the CAPM suggests that the cost of equity will vary between different investments only to the extent that investments exhibit differing degrees of systematic risk." (Ogier, 2012)

When this calculation is specified to the cost of equity, it results in the following formula:

$$r_E = rf + \beta \times MRP \tag{2.1}$$

Where: rf – risk-free rate, β – levered beta, MRP – Market-risk Premium (equity risk premium), representing the additional return above the risk-free rate

2.1.1.2. The risk-free rate

The risk-free rate is the theoretical rate of return of a risk-free investment. According to Bernstrom (2014), this rate can be decomposed into two main components. The first component seeks for compensating the investor for expected inflation, and the second component is aimed to compensate them for lending their funds.

Therefore, and as it was seen previously, the risk-free rate represents the cost of equity "floor" (Bernstrom, 2014) added to the risk incurred when investing in a security.

In common practice, the risk-free rate is considered to be equal to the interest paid on a 10-year AAA rated government Treasury note. Although it is possible for a

government with such high rating to default on its securities, the probability of this event is considered to be very low.

2.1.1.3. Beta

"In the CAPM, the beta of an investment is the risk that the investment adds to a market portfolio" (Damodaran, 2002). The beta is measured by the standardized covariance between a security's return and the market's return.

There are essentially three factors which influence a firm's beta: the type of business, the degree of operating leverage and the degree of financial leverage (Damodaran, 2002).

Automotive firms, for example, tend to have cyclical businesses, whereas its revenues increase in periods of expansion and decrease when the business cycle enters a contraction phase. Therefore, the beta of these firms tends to be higher given the dependence on the market conditions.

The operating leverage measures the degree to which a firm can increase its operating income by increasing revenue. This measure refers to the relationship between fixed and variable costs on total costs. Since fixed costs do not depend on the quantity of output sold, the larger these costs are, the greater the amount of revenue required to cover them. Consequently, the volatility in revenues affects the volatility in operating and net income, which in turn determines the company's beta. This beta tends to get higher if the degree of operating leverage is high as well, as it increases in the operating income's volatility. In summary, as the business risk increases, the company's beta increases as well.

The degree of financial leverage refers to a firm's capital structure, the relationship between debt and equity. The higher the amount of debt, the higher the financial leverage and the operating leverage. As a firm borrows money, it must pay interest which is a fixed cost and, therefore, the degree of operating leverage increases. Furthermore, in case the firm is unable to redeem debt and enters a liquidation phase, debt holders receive their capital repayment before shareholders, which increases the risk of investing in the firm and leads to a higher beta. In conclusion, as a company's financial leverage increases, its beta also increases.

There are three types of betas: the unlevered, the levered and the debt beta. The first two indicators measure the volatility of the returns of a company's stocks against those of the broader market. However, the unlevered beta, also known as asset beta, is the theoretical beta the company would have if it was fully equity financed, i.e., without any

debt. It depends solely on the business risk. Therefore, it is affected by the type of business and the operating leverage. The levered beta takes into account both debt and equity financing. Consequently, it depends on three factors mentioned previously. The third indicator, the debt beta, will be discussed in the cost of debt chapter.

The levered beta can be calculated as follows:

$$\beta_L = \beta_U \left[1 + (1 - t) \times \frac{D}{E}\right] - \beta_D (1 - t) \times \frac{D}{E} \quad (2.2)$$

Where: β_L – levered beta, β_U – unlevered beta, $\frac{D}{E}$ – debt-to-equity ratio, β_D – debt beta, t – corporate tax rate

In turn, the unlevered beta is calculated as:

$$\beta_U = \frac{\beta_L + \beta_D \times \frac{D}{E} \times (1-t)}{1 + \frac{D}{E} \times (1-t)} \quad (2.3)$$

Where: β_U – unlevered beta, β_L – levered beta, β_D – debt beta, $\frac{D}{E}$ – debt-to-equity ratio, t – corporate tax rate

2.1.1.4. Cost of debt

The cost of debt of a firm represents the return its creditors demand on new borrowing. It depends on the firm's default risk. The higher the amount borrowed by the firm, the higher the probability of default, and, therefore, the higher the cost of debt.

The rating of a company's bonds is a way of evaluating the bond issuer's financial strength, i.e., of assessing the probability of that company to meet its debt payments on time. It is a letter-based credit scoring scheme that evaluates the creditworthiness of a bond.

There are three main rating agencies: Standard & Poors (S&P), Fitch, and Moody's. The rating grades can be divided into two main groups: investment zone grade and non-investment zone grade (usually identified as junk). Investment grade bonds are associated with higher ratings, and consequently, lower probability of default. In accordance with the S&P rating, the investment grade bonds' credit scoring varies from AAA to BBB. Under Moody's rating scheme, this range goes from Aaa to Baa. Junk bonds correspond to lower ratings which range from BB to D (S&P and Fitch) or Ba to D (Moody's), and are related with a greater likelihood of default.

The cost of debt can be determined using the CAPM model with some adjustments as follows:

$$r_D = rf + \beta_D \times MRP \quad (2.4)$$

Where: rD – cost of debt; BD – Debt Beta; MRP – market risk premium

Debt betas are difficult to estimate since corporate bonds are traded infrequently. So, an approximation that may be used is the estimates of betas of bond indices by rating category, as Schaefer and Strebulaev (2009) suggest.

The cost of debt can also be determined by simply observing interest rates in the financial markets (Hillier, 2021). In this sense, if a firm has bonds outstanding, then the cost of debt is simply given by the yield-to-maturity on those bonds. Similarly, if one knows the rating of the firm's bonds, then the cost of debt can be found by identifying the interest rate on newly issued bonds with the same rate.

2.1.1.5. Terminal Value

If a business is expected to grow at a certain growth rate forever, then it is necessary to discount the perpetual cash flows to the present moment. The terminal value is, therefore, the discounted value of a perpetuity with a first term of FCF_{N+1} and a constant growth rate. Mathematically:

$$TV = \frac{FCF_{N+1}}{r-g} \quad (2.5)$$

Where: FCF_{N+1} – base cash flow for the perpetuity, r – discount rate, g – constant growth rate

2.1.1.6. Free Cash Flows to the Firm Approach

"FCFF is the after-tax cash flow going to all investors in the firm" (Stowe, 2007). It can be computed according to the following formula:

$$FCFF = NOPLAT + Depreciation - Net\ WC\ Variation - CAPEX\ Net\ of\ Disposals \quad (2.6)$$

Where: NOPLAT – Net Operating Profit Less Adjusted Taxes, WC – Working Capital, CAPEX – Capital Expenditures

The NOPLAT is the net income a firm would have if it was fully equity financed, meaning with no debt. Therefore, it is simply the operational result net of corporate taxes, that is:

$$NOPLAT_t = EBIT_t \times (1 - t) \quad (2.7)$$

The appropriate discount rate in this case is the weighted average cost of capital, i.e., the WACC. To calculate it, one can use the traditional approach:

$$WACC\ after - tax = r_E \times \frac{Equity\ Value}{Enterprise\ Value} + r_D \times \frac{Net\ Debt\ Value}{Enterprise\ Value} \times (1 - t) \quad (2.8)$$

Where: rE – cost of equity, rD – cost of debt, t – corporate tax rate

The Equity Value (EQV) of a firm is the value of a firm's shares and loans made available by the shareholders. It reflects how much the business is worth plus what can be earned with the sale of assets that are not part of the core business and less the amount owed to creditors.

$$EQV = EV + NOA - Debt \quad (2.9)$$

Where: EV – Enterprise Value; NOA – Non-Operating Assets, calculated as $Market\ Value - (Market\ Value - Accounting\ Value) \times t$; Debt – all items excluding Working Capital items

The Enterprise Value is the value of the business and it is calculated as the present value of the perpetual stream of the FCFF. The EV is determined as follows:

$$EV = \frac{FCFF_1}{1+WACC} + \frac{FCFF_2}{(1+WACC)^2} + \cdots + \frac{FCFF_N}{(1+WACC)^N} + \frac{TV}{(1+WACC)^N} \quad (2.10)$$

2.1.1.7. Free Cash Flows to Equity Approach

"Whereas dividends are the cash flows actually paid to stockholders, free cash flows are the cash flows available for distribution to shareholders" (Pinto, 2010) and they are computed as follows:

$$FCFE = Net\ Income + Depreciation - CAPEX\ Net\ of\ Disposals \pm Net\ WC\ Variation \pm Debt\ Variation \quad (2.11)$$

As it was previously seen, to determine the present value of the FCFE, one must use the cost of equity.

In this case, the EQV is determined by directly discounting the cash flows obtained, and adding the NOA the same way as in the FCFF method:

$$EQV = \frac{FCFE_1}{(1+r_E)^1} + \frac{FCFE_2}{(1+r_E)^2} + \cdots + \frac{FCFE_N}{(1+r_E)^N} + \frac{\frac{FCFE_{N+1}}{r_E - g}}{(1+r_E)^N} + NOA \quad (2.12)$$

2.1.1.8. Dividend Discount Model

As it was said in the beginning of this dissertation, the main goal of a company is to create sustainable shareholder value. Therefore, it is important to look at the perspective of the shareholder. By investing in a company, shareholders expect to receive two types of cash flows: the dividends paid on the stock, and capital gains derived from the difference between the purchase and the selling price of it.

Shareholders bear the ultimate risk since the company is not obliged to declare dividends and there is no guarantee that the share price will increase. They are "the only direct shareholder group who do not have a contractual relationship with the company" (Bender & Ward, 2008) so, the firm must play fair with them.

According to this approach, the current fair price of a share is given by the present value of the sum of all future dividends. Assuming a zero-growth pattern, the price of the share would be:

$$P_0 = \frac{D_1}{r_E} \quad (2.13)$$

Where: P0 – current fair price, D1 – first dividend that serves as basis for the perpetuity, r_E – discount rate

In a constant growth pattern, also known as the Gordon Dividend Growth Model, being g the constant growth rate, the share price would be simply given by:

$$P_0 = \frac{D_1}{r_E - g} \quad (2.14)$$

If the constant growth pattern does not start right away, then, similarly to the DCF method, the price of the share is:

$$P_0 = \frac{D_1}{1+r_E} + \frac{D_2}{(1+r_E)^2} + \cdots + \frac{\frac{D_n}{r_E - g}}{(1+r_E)^{n-1}} \quad (2.15)$$

In the Dividend Discount Model, it is critical to correctly determine the dividend that serves as a basis for the perpetual stream of dividends, and the constant growth rate g.

According to this model, the Equity Value of a firm is given by the product of the price of each share by the number of outstanding shares as follows:

$$EQV = P_0 \times Number\ of\ oustanding\ shares \quad (2.16)$$

2.1.1.9. Adjusted Present Value Approach

The APV approach was developed and presented by Myers (1974), and according to this method, the value of a firm is determined by the sum of the all-equity-finance value (also known as unlevered value), the present value of the tax savings from debt and the present value of agency benefits, and the subtraction of the present value of financial distress costs and the present value of the agency costs of debt, as follows:

$$V^L = V^U + PV(Interest\ Tax\ Shield) - PV(Financial\ Distress\ Costs) - PV(Agency\ Costs\ of\ Debt) + PV(Agency\ Benefits\ of\ Debt) \quad (2.17)$$

Where: V^L – Firm's Levered Value (with debt), V^U – Firm's Unlevered Value (without debt)

The unlevered value of a firm is estimated by discounting the FCFE (that will be equal to the FCFF assuming an all-equity financed firm) at the unlevered cost of equity, which is computed as:

$$r_U = rf + \beta_U \times MRP \quad (2.18)$$

With: rf – risk-free rate, β_U – unlevered beta, MRP – Mkt Risk Premium

According to Modigliani and Miller's (MM) Proposition I (1958), in perfect capital markets the total value of a firm is not affected by its choice of capital structure. There are no taxes and no transaction costs, and the firm's financing decisions do not change the cash flows generated. So, the total market value of a firm's securities is equal to the market value of its assets, independently of being levered or not.

The previous proposition served as a basis for the MM Proposition II (1963). This second proposition considers the existence of taxes, and states that the cost of capital of levered equity increases directly and proportionally to the increase in the amount of debt, that is:

$$r_E = r_U + \frac{D}{E} \times (r_U - r_D) \times (1 - t) \quad (2.19)$$

Where: r_E – levered cost of equity, r_U – unlevered cost of capital, r_D – cost of debt

This happens because as the firm borrows more debt, both the equity and the debt become riskier, so their cost of capital rises.

In perfect capital markets, even though debt is cheaper than equity, this benefit is offset by the increase in the equity cost of capital, leaving the weighted average cost of capital unchanged.

In reality, markets are imperfect, and taxes do exist. If a company reports a profit, it must pay corporate taxes. Therefore, firms are incentivised to use debt to reduce the amount of taxable income. The corporate tax benefits from having debt are called Tax Shields.

If a firm is expected to maintain its capital structure, the present value of tax shields is given by:

$$PV(Tax\ Shields) = \frac{r_D \times Debt \times t}{Unlevered\ WACC} \quad (2.20)$$

Nevertheless, usually it is difficult to estimate the level of future interest payments because there can be changes in the amount of debt outstanding, in the interest rate on debt, and in the discount rate.

Usually, the discount rate is the major topic of discussion. Modigliani and Miller (1963) arrive at the value of tax shields by discounting the present value of the interest payments of a risk-free debt at the risk-free rate.

Myers (1974) and Luehrman (1997) determine the present value of the interest tax shield using the cost of debt as the discount rate, and they justify this method stating that the risk of the tax savings derived from the use of debt is identical to the risk of the debt itself.

Miller (1977) assumes that the present value of the interest tax shields is null as he considers that, in equilibrium, the value of the firm is independent of its capital structure, even in the presence of taxes.

Miles and Ezzel (1980), and Lewellen and Emery (1986) state that, for a firm who has a fixed debt-to-equity ratio, the tax savings should be discounted by the cost of debt in the first year, and by the unlevered cost of equity in the following years.

Harris and Pringle (1985) consider that the interest tax shields should be calculated using the unlevered cost of equity since they have a similar systematic risk to the firm's underlying cash flows.

Inselbag and Kaufold (1997) agree with Myers, considering that if the debt-to-equity ratio changes, the discount rate should be the cost of debt. If not, then they agree with Miles and Ezzel formula using two different discount rates.

There are different opinions regarding the discount rate, so Copeland, Koller, and Murrin (2000), conclude that the reader must equate what is the best approach depending on his context/situation as there is no correct theoretical answer.

Although firms are incentivised to use debt due to the tax deductibility of interests, healthy firms are not fully debt financed. As the amount of debt borrowed increases, so does the probability of default (financial distress) and the economic distress (bankruptcy costs).

Bankruptcy costs include direct and indirect costs. The former costs reduce the value of the firm's assets, and they usually sum up to an average of 3% or 4% of the firm's market value. The indirect costs are more difficult to estimate accurately, but they are usually much larger than the direct costs amounting up to 20%. Since the probability of default and the bankruptcy costs are hard to estimate, sometimes in practice, financial distress costs are ignored when determining the value of a firm.

In a world with imperfections, the optimal capital structure is the one in which the net tax saving from an additional euro interest is equal to the increase in expected financial distress costs. A firm should choose its capital structure by trading off the benefits of the tax shield from debt against the distress and agency costs.

Agency costs can also be a problem, and they arise when there are conflicts of interest between managers and, shareholders and/or debtholders. They are very hard to estimate, and are often ignored.

With all being said, according to the trade-off theory, the value of a firm is determined by adding the unlevered value and the present value of tax savings, and subtracting the present value of financial distress costs:

$$V^L = V^U + PV(Interest\ Tax\ Shield) - PV(Financial\ Distress\ Costs) \qquad (2.21)$$

2.1.2. Relative Valuation

According to this approach, similar assets should trade at similar prices. Therefore, the value of an asset is estimated based on the current value of comparable assets. Extending this concept to the whole company, its value can be estimated based on the value of similar companies.

There are essentially two types of multiples, equity value multiples and enterprise multiples. Some examples of the first type of multiples are the Price-to-Earnings ratio (PER), the Price-to-Book Value (PBV), and the Price-to-Revenues ratio. Regarding the enterprise multiples, there is the Enterprise Value to EBITDA (EV/EBITDA), the Enterprise Value to FCFF (EV/FCFF), and the Enterprise Value to Revenues ratio (EV/Revenues).

In this methodology, the first key step is to identify the benchmark, whether it is a single company or a peer group. When selecting a peer group, there is an additional step which consists of identifying and excluding the outliers. The outliers are values of a given multiple that for some reason are out of a reasonable range, and consequently should be excluded in order to produce the most accurate results.

Usually, on the same analysis, several multiples are used. If a peer group is selected, after removing the outliers, an average for each multiple is computed. Then, the Equity Value is calculated for each multiple using the data from the company under analysis. In the end, to obtain the Equity Value of the company, an average of the different equity values obtained for each multiple is calculated.

2.1.3. Asset-based Valuation

The equity value of a firm using the asset-based approach is given by the value of existing assets net out debt and other outstanding claims. There are two ways of estimating the value of the assets, either by estimating their selling price or by valuing them based on the expected future cash flows.

This approach has several limitations, and should be used as a supplement for other models, such as the relative valuation or the discount cash flow method.

Firstly, it is not easy to determine the fair value of certain assets (e.g., property, plant and equipment). Furthermore, the fair values may be different from the values on the balance sheet.

Another disadvantage of this valuation is the fact that there are some intangibles, such as synergies or the value of a business reputation for example, which are not shown on the books. For a company with a significant amount of intangibles, this would lead to a downward biased estimation.

For a company with a high growth potential, this approach is not also the more appropriate since it does not capture the expected future growth and the excess returns resulting from this growth.

Lastly, it would be difficult to value the assets of a company operating in several businesses. The assets would have to be valued separately, using the different income streams and discount rates.

2.1.4. Economic Value-Added Valuation

Under the EVA approach, a positive value of the EVA indicates that the firm is creating value, meaning it is exceeding the weighted average cost of capital. Otherwise, it is destroying value. Although, a punctual negative value for the EVA is considered to be normal, if this situation becomes a pattern, then the firm might be needing a restructuring or, in the limit, to close doors.

The Equity Value of a firm is computed as shown in the equation below:

$$EQV = Equity\ Book\ Value + Market\ Value\ Added + Non - Operating\ Assets \quad (2.22)$$

Where: $MVA = \sum_{t=1}^{\infty} \frac{EVA_t}{(1+WACC)^t}$, present value of the perpetual EVA

The EVA measures the surplus (or deficit) of the operating income over the cost of funds, equity and debt, that the company has at its disposal.

$$EVA_t = NOPLAT_t - IC_{t-1} \times WACC \quad (2.23)$$

Where: NOPLAT – Net Operating Profit Less Adjusted Taxes, IC – Invested Capital

Regarding the Invested Capital, it is the investment made by shareholders and debtholders in a firm. From a resource view, the Invested Capital measures the resources employed in the financing of a business, and it is computed as:

$$IC = Equity\ Book\ Value + Financial\ Debt - Non - Operating\ Assets \quad (2.24)$$

Where: Financial debt – includes all items except WC items, NOA – accounting value

From an asset point of view, the Invested Capital measures the investment necessary for conducting a business:

$$IC = Operating\ Non\ Current\ Assets + WC \quad (2.25)$$

An equivalent way of determining the annual EVA is:

$$EVA_t = (ROIC_t - WACC) \times IC_{t-1} \quad (2.26)$$

Where: ROIC – Return on Invested Capital

The ROIC is a profitability ratio that measures the profitability of a business. This return is given by:

$$ROIC_t = \frac{NOPLAT_t}{IC_{t-1}} \tag{2.27}$$

Generally, a company's ROIC must be higher than its WACC. If so, the firm is creating value, i.e., it is efficiently using its investors' funds to generate income.

3. Internal Analysis

Siemens AG is a German technological company with more than 175 years of history, founded in 1847 by Werner von Siemens. According to Bähr (2017), as a "(...) pioneer of electrical engineering, Werner Von Siemens helped to found a sector without which modern world would be inconceivable."

Through time, the company has been internationalizing and diversifying its businesses as a way to serve a greater range of customers and needs, to improve its processes' efficiency and to differentiate itself from the competitors. The desire to be a leader in the industries where it operates has always been a key objective. Accordingly, throughout the years, Siemens has been adjusting its structure, offerings and partnerships.

With its headquarters in Munich, Siemens, values collaboration, responsibility and compliance with the internal rules and laws. In a VUCA world, the company recognizes the importance of resilience, the fight against climate change and the delivery of sustainable value.

The company is present in more than 190 countries and employs over 320 000 people. Siemens operates in four main areas: manufacturing industries, infrastructure, transport and healthcare. In order to serve these areas, Siemens is divided into four business segments, three of which are considered industrial businesses – Digital Industries, Smart Infrastructure and Mobility – and Siemens Healthineers. The company also offers financing solutions through Siemens Financial Services and has three companies bundled under the Portfolio Companies business: Large Drives Applications, Siemens Logistics and Sykatec.

3.1. Shareholder Structure

Siemens has around 800,000,000 outstanding shares and around 840,000 registered shareholders.

On August 2023, the following pie chart represents Siemens shareholder structure.

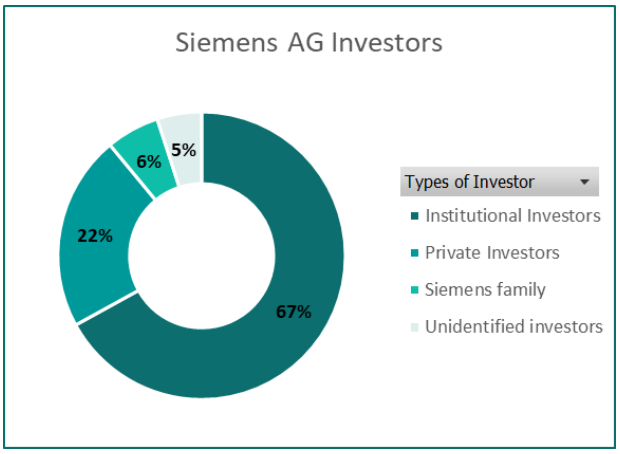

FIGURE 1. SIEMENS AG TYPES OF INVESTOR. SOURCE: SIEMENS' WEBSITE

The majority of Siemens shareholders are institutional investors (e.g. Vanguard Group), followed by private investors, Siemens family members or foundations established by the family, and finally, unidentified investors.

Regionally, as it can be observed below, most of the company's shareholders are from the U.S., Germany and the U.K. Nevertheless, the shareholder structure is quite diverse.

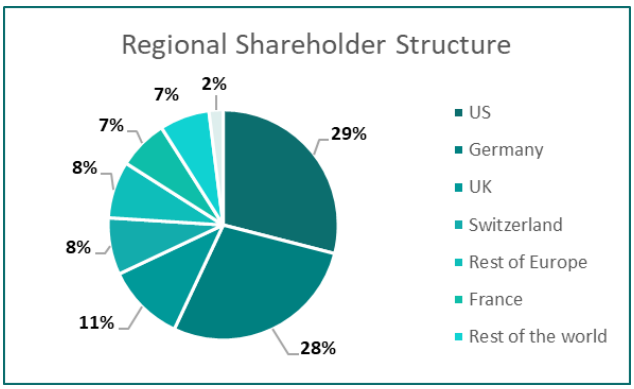

FIGURE 2. SIEMENS AG REGIONAL SHAREHOLDER STRUCTURE. SOURCE: SIEMENS' WEBSITE

In terms of rating, Siemens has been classified as Aa3 (Moody's) and AA- (&P), with a stable outlook. The last updates occurred on June 26th, 2024 and February 13th, 2024, respectively.

3.2. Stock Performance

In the graphic below is presented the price of the shares from 2019 to September 2023.

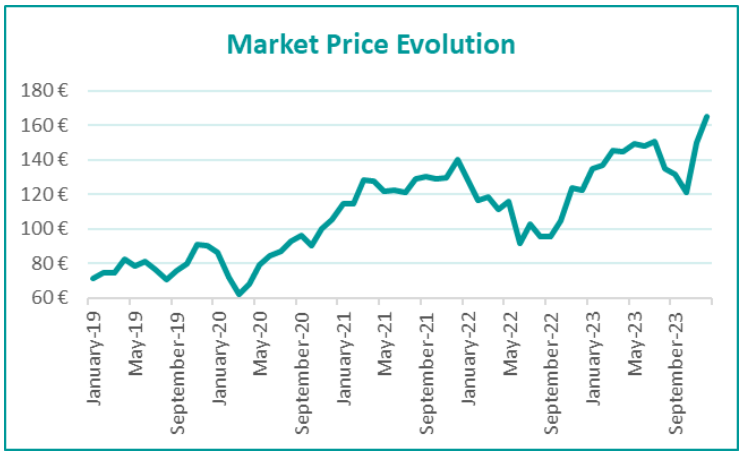

FIGURE 3. SIEMENS' SHARE PRICE BY QUARTER. SOURCE: YAHOO FINANCE

Throughout the period under analysis, it is possible to observe a growing trend of Siemens' share price. On the 29th of September, 2023 the stock price was 135,66€ representing a growth of 53% when compared to the beginning of 2019 (88,42€).

The table below shows important indicators such as the payout ratio, the dividend per share the dividend yield, and the total shareholder return.

(in millions of €)	2019	2020	2021	2022	2023
Dividends Paid	3 200	2 800	3 200	2 400	3 760
Net Income	5 648	4 200	6 697	4 392	8 529
Payout Ratio	56,66%	66,67%	47,78%	77,41%	44,08%
Dividend per Share	3,90	3,50	4,00	4,25	4,70
Share Price	88,57	107,88	141,92	101,20	135,66
Dividend yield	4,40%	3,24%	2,82%	4,20%	3,46%
Total Shareholder Return	-7,04%	25,75%	35,26%	-25,70%	38,70%

TABLE 1. SIEMENS' DIVIDEND POLICY. SOURCE: SIEMENS' WEBSITE

The payout ratio represents the percentage of earnings that is distributed by Siemens' shareholders. The lower ratios in 2021 and 2023 suggest that the company retained a significant part of its earnings to ensure the availability of funds for future growth and unexpected downturns, given the high level of uncertainty during that period.

The Total Shareholder Return measures the total valued created for shareholders represented by increases in the share price and dividends paid. TSR is one of Siemens' key performance indicators for "long-term value creation". This indicator was negatively affected in 2019 and in 2022 due to a drop in the share price.

Siemens has shown a consistent track record throughout the past years in terms of dividend payments, dividend growth rate, payout ratio and profitability, which suggests a positive outlook for the next years. Moreover, this prospect is supported by its robust strategy of innovation and resilience.

3.3. Strategic Vision

Siemens' strategy is based on three main pillars: Digitalization, Sustainability and Compliance.

The five megatrends – Digitalization, Urbanization, Environmental Change, Glocalization, and Demographic change – require a constant development and alignment of a company's strategic vision. Therefore, Siemens seeks for connecting the real and the digital worlds by taking advantage of its technological expertise to transform companies and societies.

While these megatrends can be considered as challenges, Siemens also views them as opportunities. The transformation of the world's economy, the shift in the geopolitical balance of power and the impacts on the global workforce require collaboration more than ever.

Siemens aims for transforming the everyday of its customers in order to build better societies. The company uses artificial intelligence, data analytics and the open digital business platform Xcelerator, to increase productivity and sustainability, to improve resource efficiency, as well as to foster collaboration and the share of knowledge.

3.4. Segments

3.4.1. Digital Industries (DI)

Siemens Digital Industries offers tailored products, systems, solutions, and services for customers in discrete and process industries, such as the automotive industry, the food and beverage industry, the electronics and semiconductor industry, among others. DI was formed in fiscal year 2019 resulting from a combination between the former Digital Factory Division and Process Industries and the Drives Division.

The following table presents the evolution of Digital Industries' financial performance:

(in million of €)	2019	2020	2021	2022	2023
Orders	15 944	15 896	18 427	25 283	20 620
% Orders change		-0,3%	15,9%	37,2%	-18,4%
Revenues	16 087	14 997	16 514	19 517	21 919
% Revenues change		-6,8%	10,1%	18,2%	12,3%
Profit	2 880	3 252	3 360	3 892	4 947
% Profit change		12,9%	3,3%	15,8%	27,1%
Profit Margin	17,9%	21,7%	20,3%	19,9%	22,6%

TABLE 2. DI'S FINANCIAL PERFORMANCE. SOURCE: SIEMENS ANNUAL REPORTS

DI's orders, revenues and profit were mainly driven by the automation businesses including factory automation and motion control.

3.4.2. Smart Infrastructure

Siemens Smart Infrastructure is an industrial business that focuses on building automation, low and medium-voltage power distribution, and control systems. Its portfolio of products, solutions and services seeks for connecting energy systems, buildings, and industries.

The increasing urbanization and demographic change, and the need to decarbonize and digitalize lead do the necessity of improving the quality of life through the creation of green and people-centric environments and depend on the offering of reliable and resilient power supplies. In that sense, it is crucial to ensure building efficiency, optimize energy consumption and support the electrification of transportation.

Therefore, Siemens Smart Infrastructure offers a broad portfolio with future-proof solutions and services that seek for guarantying a sustainable development by supporting the transition from fossil to renewable energy sources and the transition to smarter buildings, and by promoting a better use of resources.

The following table presents the evolution of Smart Infrastructure's financial performance:

(in million of €)	2019	2020	2021	2022	2023
Orders	15 590	14 734	16 071	20 798	22 333
% Orders change		-5,5%	9,1%	29,4%	7,4%
Revenues	14 597	14 323	15 015	17 353	19 946
% Revenues change		-1,9%	4,8%	15,6%	14,9%
Profit	1 465	1 302	1 729	2 222	3 074
% Profit change		-11,1%	32,8%	28,5%	38,3%
Profit Margin	10,0%	9,1%	11,5%	12,8%	15,4%

TABLE 3. SI'S FINANCIAL PERFORMANCE. SOURCE: SIEMENS ANNUAL REPORTS

The electrical products, the electrification and the buildings businesses were the main contributors to the evolution of orders, revenues and profit.

3.4.3. Mobility

Siemens Mobility offers customers in the railway business a broad portfolio of digital products, solutions and services aimed to optimize lifecycle costs, maximize system availability and network capacity, and optimize customer processes and experience.

As an industry pioneer, Siemens Mobility focuses on optimizing railway passenger and railway freight transportation. The growing urbanization not only intensifies the need for simpler, faster and more flexible mobility, but also requires connected, sustainable and reliable solutions. Digitalization has been an ally in this journey by simplifying the complex railway system and keeping railway traffic on track. Technology helps maximizing railway capacities and improving punctuality, availability, energy efficiency and safety.

The following table presents the evolution of Mobility's financial performance:

(in million of €)	2019	2020	2021	2022	2023
Orders	12 894	9 169	12 696	13 200	20 629
% Orders change		-28,9%	38,5%	4,0%	56,3%
Revenues	8 916	9 052	9 232	9 692	10 549
% Revenues change		1,5%	2,0%	5,0%	8,8%
Profit	983	822	850	794	882
% Profit change		-16,4%	3,4%	-6,6%	11,1%
Profit Margin	11,0%	9,1%	9,2%	8,2%	8,4%

TABLE 4. MOBILITY'S FINANCIAL PERFORMANCE. SOURCE: SIEMENS ANNUAL REPORTS

The railway infrastructure, the rolling stock and the customers service businesses were the main segments in evolution of Siemens Mobility.

3.4.4. Siemens Healthineers

Siemens Healthineers serves areas such as diagnostic and therapeutic imaging, laboratory diagnostics, molecular medicine, digital health and enterprise services.

The company's strategy based on three pillars - Engineering Excellence, Value and Partnerships – aims for improving operational efficiency and excellence, providing value-added services throughout the care pathway, and investing in the workforce's education and well-being in order to build a healing and human-centered environment.

The following table presents the evolution of Siemens Healthineers' financial performance:

(in million of €)	2019	2020	2021	2022	2023
Orders	15 853	16 163	20 320	25 556	24 499
% Orders change		2,0%	25,7%	25,8%	-4,1%
Revenues	14 517	14 460	17 997	21 715	21 681
% Revenues change		-0,4%	24,5%	20,7%	-0,2%
Profit	2 461	2 184	2 847	3 369	2 527
% Profit change		-11,3%	30,4%	18,3%	-25,0%
Profit Margin	17,0%	15,1%	15,8%	15,5%	11,7%

TABLE 5. SIEMENS HEALTHINEERS' FINANCIAL PERFORMANCE. SOURCE: SIEMENS ANNUAL REPORTS

Siemens Healthineers' diagnostics, imaging and advanced therapies businesses were the most important drivers for the evolution of the segment's orders, revenues and profit. The first business contributed to the declines in 2020 and 2023. The second and third businesses have always contributed positively to the segment's growth.

3.4.5. Siemens Financial Services

Siemens Financial Services offers tailored financing solutions such as leasing and equity investment solutions. Through a combination of technological expertise and financial know-how, this segment aims to maximize impact and accelerate customers' innovation and competitiveness.

This business segment operates in six domains: Equipment and Technology Finance; Vendor Finance; Working Capital Finance; Project Finance; Corporate Lending; and, Equity Finance. It offers smart financing solutions to enable investments in key areas including automation, digitalization, and sustainability. Hereby, recognizing the need to accelerate the shift to Industry 4.0 and the importance of a sustainable growth.

The following table presents the evolution of Siemens Financial Services' financial performance:

(in million of €)	2019	2020	2021	2022	2023
Earnings before taxes (EBT)	632	345	512	498	563
% EBT change		-45,4%	48,4%	-2,7%	13,1%
Return on Equity (after taxes)	19,1%	11,7%	15,5%	15,6%	16,3%
% ROE change		-38,7%	32,5%	0,6%	4,5%
Total Assets	29 901	28 946	30 384	33 263	32 915
% Total Assets change		-3,2%	5,0%	9,5%	-1,0%

TABLE 6. SIEMENS FINANCIAL SERVICES' FINANCIAL PERFORMANCE. SOURCE: SIEMENS ANNUAL REPORTS

The increase of expenses for credit risk provisions due to the continuing high uncertainty in markets and the negative contribution in the equity business led to a decline in EBT in fiscal years 2020 and 2022. Conversely, the significant growth in the debt business given the reduction in expenses for credit risk provisions, and the strong development in the equity business contributed to the positive evolution of Siemens SFS in 2021 and 2023, respectively.

4. Macroeconomic Analysis

4.1. Global Outlook

Macroeconomic factors have impact on every business. Companies must analyze the environment where they operate in order to understand how it is affecting and how it will affect their strategy, performance and overall business.

Siemens is highly impacted by the economic environment of the three main geographical areas in which the company divides its business: Europe, C.I.S, Africa, Middle East, being Germany the key country; Americas, with special attention to the U.S., and Asia and Australia with emphasis on China. For this reason, the energy price explosions in Europe, the severe COVID-19 lockdowns in China, and the particularly high inflation rates followed by a tightened monetary policy in the U.S., were examples of factors that had a significant impact on Siemens performance over the last years.

Other major events such as the trade war between China and the U.S, the war between Russia and Ukraine and the conflict between Israel and the Hamas are examples of recent factors that have strongly affected companies such as Siemens. These tensions weaken the development of the world economy given their impact in the increase in inflation and interest rates, or in the decrease of global trading, as examples.

Since Siemens operates worldwide, the global GDP growth rate but, more specifically, the GDP growth rate of its three main markets is extremely important. Regarding its three major markets' GDP growth in 2029: Germany is expected to grow at a 0.66% growth rate, the U.S. is expected to grow at a 2.12% growth rate, and China is expected to grow at a 3.31% growth rate. As a result, the average expected constant perpetual growth rate for Siemens is 2.03% plus the expected inflation rate.

The inflation rate is projected to decline gradually over the next years and advanced economies are expected to achieve their targets sooner than emerging market and developing economies. The outlook is positive, yet uncertain, and the inflation rate of Siemens' three main markets is expected to slow down to a rate of 2.02% by 2029.

After analyzing the global economic prospects, it is useful to dig deeper into the markets that mostly affect Siemens results as suggested in the Internal Analysis chapter.

4.2. Market Outlook

4.2.1. Industrial Automation

The automation business has significantly contributed to Digital Industries' growth. The industrial automation market has shown a growing trend throughout the years, which is expected to continue in the future at a CAGR of around 10%.

This market includes essentially three main components: hardware, software and services. Although the hardware segment is the largest, the software segment has the highest expected growth with a CAGR of 13% until 2030.

The industrial automation market serves mainly four industries: automotive, food and beverage, pharmaceutical, and electronics and semiconductor. The first industry is a leading adopter of industrial automation and has an expected CAGR of 14.9% by 2030.

4.2.2. Smart Buildings

The increased concern of society regarding the environment has demanded the development of more sustainable solutions.

The factors mentioned previously have been growth drivers for the Smart Infrastructure segment, especially in the electrical products, electrification and buildings business. The first one is expected to grow at a CAGR of 11.7% by 2032 being power generation a strong contributor. Regarding the second business, the estimated CAGR is 8.93% with a special contribution from the Asia-Pacific region.

The smart building's market, in general, is expected to grow at a strong CAGR of 21.8% by 2032.

4.2.3. Mobility

The smart mobility market's growth has been fueled by numerous factors including the need to reduce traffic congestion and gas emissions and the advance of technology. This market is expected to grow at a forecasted CAGR of 20.6% by 2032.

The global railway infrastructure market is estimated to grow at a CAGR of 4.09% by 2029 and the Asia-Pacific region is expected to lead this growth given the economic growth in countries such as India and China.

Regarding the rolling stock infrastructure market's growth, the North America region is expected to contribute the most due to the increase in the market for locomotives and rapid transit vehicles. The global rolling stock market is expected to grow at a CAGR of 2.8% by 2032 fueled by the favorable passenger and freight transportation trends.

The customer services' market is expected to grow at a significant CAGR of 19.4% by 2032, with a strong contribution from the Asia-Pacific region. The main drivers for this growth are the need for more flexible, sustainable and efficient solutions.

4.2.4. Healthcare

The laboratory diagnostics market is growing worldwide given the increase in demand for diagnostic genetic testing. The need to early detect diseases, prevent and monitor them, and to develop effective treatment plans is rising. Moreover, the technology advancements are contributing to the significant expansion of the diagnostic testing market. As a consequence, this market is expected to grow at a CAGR of 3.05% by 2033, led by the North America and the Asia-Pacific regions.

Siemens' second key market in the health segment is the diagnostic imaging, which is expected to grow at a CAGR of 6.4% by 2032. This growth is leveraged by a rise in chronic diseases whose early detection and prevention is crucial. Technology is a great ally in the expansion of the market facing the increasing product demand. The Asia-Pacific region is expected to grow at the highest rate.

Finally, the advanced therapies' market is expected to grow at a CAGR of 5.2% by 2030. The growing preference for minimally invasive therapies and surgeries, and the technological advancements are the two main growth drivers. The North America region is expected to be the major contributor for the market's expansion, especially in the U.S. However, the Asia-Pacific region is forecasted to rise at the fastest CAGR.

5. Company Valuation – Forecasts and Assumptions

5.1. Introduction

5.1.1. Methodology

The DCF Model is the most commonly method used for company valuation given its accuracy and flexibility. It is extremely detailed including all major assumptions and future expectations about the business. Moreover, even though Siemens' capital structure has had some fluctuations over the past years, the changes in the debt level have not been dramatic. For these reasons, the DCF approach will be used to perform the company's equity valuation.

5.1.2. Time Horizon

According to Siemens' vision and strategy, its main goal is to be "the world's first major industrial company to achieve a net-zero carbon footprint by 2030"[1]. Since sustainability is at the core of Siemens' strategy, it has been favoring processes, products and services that are eco-friendly but still fulfill the customers' needs. In this context, it is reasonable to assume that in 2030, the company will enter a mature state with a perpetual constant growth rate.

5.1.3. Constant growth rate

The choice of the perpetual constant growth rate is extremely important since it will affect the company's terminal value, one of the most determining components for the enterprise value estimation. Consequently, the growth rate used was the average expected GDP growth of Siemens' three main markets: U.S, Germany and China.

5.2. Valuation

5.2.1. Revenues

During the last five years, the revenues' growth rate was highly influenced by the pandemic. In fiscal year 2022, Siemens reached record levels in terms of orders, revenues and profits due to a significantly higher demand in its industrial businesses.

In order to forecast the company's future revenues, the use of average past growth rates was not recommended. Instead, it was probably more appropriate to use the comparable growth rate of 8.05% for fiscal year 2023 during the first five years of projections, which

is in line with the company's expectations. For the remaining two years, the growth rate of 6.70% derives from the sum of the expected inflation rate and the forecasted perpetual constant growth rate. Hence, the growth rate slowly converges to the perpetual growth rate. (Annex C.)

5.2.2. Cost of Sales

Since the Cost of Sales/Revenues ratio has been nearly on the same level for the past three years, the 3-year average of 58,31% was used. (Annex C.)

5.2.3. Research and development expenses

The research intensity has been similar throughout the past years. However, since Siemens desires to maintain the last year's ratio (7,95%), this ratio was used for the forecasted years. (Annex C.)

5.2.4. Selling and general administrative expenses

Siemens intends to maintain the S&GA/Revenues ratio from fiscal year 2023 of 17,93% for the next year. Furthermore, considering that the ratio was stable over the past years, it was assumed that it would remain constant during the next years. (Annex C.)

5.2.5. Other operating income/expenses

For the purpose of forecasting other operating income and expenses, the ratio over revenues was used. Since this ratio was highly unstable during the past five years, it was assumed as constant (0,74% and 0,58%, respectively) for the forecasted period. (Annex C.)

5.2.6. Investment Policy

In order to forecast depreciation and amortization expenses, and Net CAPEX, the company's investment policy was analyzed (Annex D.)

Looking at Siemens Depreciation/Last year's GPPE ratio, it is possible to observe a certain stability over the past 3 years. Consequently, the 3-year average ratio of 8,87% was used.

Siemens expects a significant increase in fiscal year 2024 in capital expenditures motivated by the construction and expansion of production facilities and office buildings. For this reason, the 3-year average PP&E Net CAPEX/Revenues of 3.98% was used, leading to an increase in capital expenditures of around 34% in fiscal year 2024.

To forecast Other intangible assets, two ratios were used: Amortization/Revenues and Other IA Net CAPEX/Revenues. The first ratio was similar over the past years, so the 3-year average of 1,69% was used. The second ratio had significant fluctuations over the past years. Considering that Siemens aims for continuing to position itself as a leader in innovation for the next years but while maintaining a tight financial policy, the average of the two last years, 1,58% was used.

5.2.8. Net Debt/Equity ratio and Cost of Debt

After analyzing the company's historical net financial debt, it is possible to observe that the slight Net Debt/Equity ratio fluctuations are mainly due to changes in the amount of long-term debt and cash. For a matter of simplicity, it was assumed that the company would maintain its capital structure stable during the forecasted years, resulting in a Net Debt/Equity ratio of around 0.69. (Annex E.)

In order to determine the company's cost of debt, the 3-year average historical implicit cost of debt of 3,36% was used. The annual implicit cost of debt was obtained by dividing the annual interest expenses by the beginning amount of financial debt. (Annex E.)

5.2.9. Working Capital

The working capital is the difference between a company's current assets and current liabilities. In this case, it was determined by subtracting Trade Payables and Other current liabilities from Trade and other receivables, Inventories and Other Current assets. (Annex F.)

Since the 3-year average Working capital/Revenues ratio has been stable, this ratio of 15,89% was used to forecast Siemens' Working capital for the next years. Thereafter, the changes in working capital were determined. (Annex F.)

5.2.10. Free cash flows projections

The following table presents the company's estimates for future free cash flows.

(in million of €)	2024	2025	2026	2027	2028	2029	2030	2031
EBITDA	13 421	14 501	15 668	16 928	18 291	19 401	20 579	21 412
Depreciation	3 836	4 247	4 690	5 170	5 687	6 209	6 762	7 035
EBIT	9 585	10 254	10 977	11 759	12 603	13 192	13 817	14 377
NOPLAT	6 719	7 188	7 695	8 243	8 835	9 248	9 686	10 078
Operational Cash Flow	10555	11435	12385	13413	14522	15456	16447	17113
WC value	13 349	14 423	15 584	16 838	18 193	19 297	20 469	21 298
WC Δ	753	1 074	1 161	1 254	1 355	1 104	1 171	829
Net CAPEX	4 668	5 044	5 450	5 889	6 362	6 749	7 158	7 320
FCFF	5133	5317	5775	6270	6805	7604	8118	8964
Terminal Value							276884	
Discount Factor	0,932075	0,868764	0,809754	0,754751	0,703485	0,655701	0,611163	
PV of FCFF	4785	4619	4676	4732	4787	4986	174182	

TABLE 7. FUTURE FREE CASH FLOWS ESTIMATES

The company's Operational Cash Flow was estimated using the forecasted NOPLAT and Depreciations. For the NOPLAT calculation, Germany's tax rate for 2024 was used.

For the Terminal value, the perpetual constant growth rate used was the average expected GDP growth rate for the company's three main markets: the U.S, Germany and China. The inflation rate for 2030 was then added to this average resulting a rate of 4,05%. (Annexes G. and H.)

The WACC was calculated using as the risk-free rate, the yield for 10-year German government bonds of 2,4175%; as the levered beta, the firm's 3-year average of 1.48; and as the average market's expected return, the DAX's annualized return of the last 5 years (8%). For the Debt/Value and Equity/Value ratios, the Net Debt/Equity ratio of the fiscal year 2023 was used, obtaining a WACC of 7,29%. (Annex H.)

5.2.11. Siemens Equity Value and Fair value per share

The Enterprise Value was determined through the sum of the present value of all future cash flows, reaching an amount of 202 767 million of euros, as Table 8. suggests.

The non-operating assets were computed using solely accounting values due to the lack of data regarding market values. For this calculation, Other current financial assets, Assets classified as held for disposal and Other financial assets were added leading to an amount of 34 450 million of euros.

The amount of debt used for the equity value estimation, presented in Table 13., was the firm's total amount of debt excluding working capital items, which are considered in the computation of the enterprise value, reaching an amount of 73 695 million of euros.

Equity Value Calculation	
Enterprise Value	202 767
Non-operating assets	34 450
Debt	73 695
Equity Value	163 522

TABLE 8. EQUITY VALUE CALCULATION

By adding the enterprise value and non-operating assets and subtracting debt, an equity value of 163 522 million was obtained. Finally, dividing it by the number of shares outstanding at the end of fiscal year 2023, led to a fair value of 207,13 euros per share.

Fair Value vs Public Share Price	
No. Shares Outstanding	789,473
Share Price (in €)	207,13
Public Share Price September 23 (in €)	135,66

TABLE 9. SIEMENS' FAIR VALUE PER SHARE

5.3. Sensitivity Analysis

The accuracy of the valuation exercise depends on the assumptions for specific input factors.

This chapter aims to analyze the impact that changes in the key valuation variables, namely, revenues' growth rate, the WACC, the perpetual constant growth rate and the corporate tax rate, have on the fair value of Siemens' shares.

Scenario Summary				
		Current Values:	Pessimistic	Optimistic
Changing Cells:				
2024 g rate	**H23**	8,05%	4,00%	10,87%
2025 g rate	**I23**	8,05%	4,00%	10,87%
2026 g rate	**J23**	8,05%	4,00%	10,87%
2027 g rate	**K23**	8,05%	4,00%	10,87%
2028 g rate	**L23**	8,05%	4,00%	10,87%
2029 g rate	**M23**	6,07%	6,70%	6,70%
2030 g rate	**N23**	6,07%	6,70%	6,70%
Result Cells:				
Fair Value	**Q4**	207,13	160,86	249,94

TABLE 10. REVENUES: PESSIMISTIC AND OPTIMISTIC SCENARIOS

Revenues are a major component in this equity valuation since a large part of the items forecasted depend on the historical ratio in terms of revenues. For this reason, the table above presents the two chosen scenarios for the period between 2024 and 2028. In the pessimistic scenario, ceteris paribus, a revenues' growth rate of 4%, the minimum rate the company expects its revenues to grow at, was chosen. In the optimistic scenario, a

10.87% growth rate, corresponding to the 3-year average revenues' growth rate, was selected considering everything else constant.

The first scenario led to a fair value of 160,86 euros per share, approximately 22% lower than the base scenario, while in the second scenario a fair value of 249,94 euros was estimated, around 21% greater than the base case. The wide range between prices shows the importance revenues assume in this valuation.

The discount rate and the perpetual constant growth rate are also crucial input factors in an equity valuation exercise. The WACC is used to discount the projected cash flows, so it can strongly affect the results obtained. The perpetual constant growth rate has an impact on the estimated terminal value, which represents the present value of all future cash flows beyond the explicit period and, therefore, accounts for a significant proportion of the enterprise value.

These two variables were analyzed simultaneously, as Table 11. shows, using changes of 0.5 percentual points for each one. On the one hand, as the WACC rises, the present value of the future cash flows decreases, which leads to lower fair value estimates. On the other hand, as the perpetual constant growth rate rises, so does the terminal value and, consequently, the estimated fair value.

		Perpetual constant growth rate				
	207,13 €	3,05%	3,55%	4,05%	4,55%	5,05%
WACC	6,29%	222,08 €	264,38 €	325,59 €	422,03 €	596,40 €
	6,79%	184,43 €	214,49 €	255,52 €	314,89 €	408,44 €
	7,29%	155,71 €	177,98 €	**207,13 €**	246,93 €	304,53 €
	7,79%	133,07 €	150,11 €	171,72 €	200,00 €	238,62 €
	8,29%	114,78 €	128,16 €	144,69 €	165,65 €	193,09 €

TABLE 11. WACC AND PERPETUAL GROWTH RATE SENSITIVITY ANALYSIS

For a minimum WACC of 6,29% and a maximum perpetual growth rate of 5,05%, a fair value of 596,40 euros is estimated. A maximum WACC of 8,29% and a minimum perpetual growth rate of 3,05% results in an estimate of 114,78 euros per share.

The corporate tax rate significantly varies from country to country depending on the tax rules applied. Hence, it can easily affect the results obtained in an equity valuation exercise, especially for a company such as Siemens, which operates globally.

For that reason, Table 12. shows an analysis of the impact that changes of 5% in the corporate tax rate have on the fair value estimate was conducted. According to this analysis, a rate 5% above the one defined in the assumptions, leads to a fair value 16

euros lower reaching 191,31 euros. If the tax rate is 5% below the estimated rate, the fair value reaches 222,28 euros, 15 euros above the estimate.

Tax rate

	207,13 €
19,90%	236,82 €
24,90%	222,28 €
29,90%	207,13 €
34,90%	191,31 €
39,90%	174,78 €

TABLE 12. CORPORATE TAX RATE SENSITIVITY ANALYSIS

Of all variables tested, the tax rate is, by far, the less relevant, as its variation has a smaller impact in the share price

6. Relative Valuation

In order to complement the DCF valuation, a relative valuation was performed using four multiples: the price-to-earnings ratio, the EV/EBITDA, the EV/Revenues and the Price-to-book value.

In this valuation, a peer group of seven companies was considered. This peer group consists of Siemens' main competitors, who operate in the same industries.

For each ratio, the outliers were excluded based on their discrepancy when compared to the remaining values. This exclusion resulted in averages of: 13,01x for the PER, 13,89x for the EV/EBITDA, 1,58x for the EV/Revenues and 3,8x for the P/B. (Annex I., Table 27)

Afterwards, the average fair value per share was estimated for each multiple. In order to exclude the outliers, the average fair value for all multiples was computed. Moreover, the standard deviation was determined. The standard deviation was then added to and subtracted from the total average resulting in a range between 115,61 euros and 226,90 euros. (Annex I., Tables 28 to 32)

After determining the range between which the fair value of Siemens' shares should be, it was possible to exclude two multiples: the EV/Revenues and the Price-to-book value.

Finally, the average fair value per share of the two remaining multiples, the price-to-earnings ratio and the EV/Revenues ratio, was computed resulting in 162,02 euros. This should be Siemens' fair value per share according to this method.

7. Results Analysis

After valuing Siemens according to two different methods, the DCF model and the relative valuation, it is important to compare the results obtained with the company's public share price at the end of fiscal year 2023.

Based on the two previously mentioned valuation methods, Siemens' shares are undervalued by 52% and by 19%, respectively.

As stated throughout this dissertation, valuing a company is a subjective exercise that depends on the accuracy of the assumptions made. It should not be seen as an exact science as it relies on the judgment of the valuator. A company's future performance is influenced by a variety of factors, including the economy, the competitors and the industry where it operates.

The first difference in the results obtained may lay on the valuation method used.

Regarding the DCF model, the first difference in the values obtained may be related with the company's revenues' growth rate. Moreover, since several of the items forecasted depend on Siemens future revenues, a different growth rate significantly affects the results. Considering every other assumption constant, the revenues' growth rate that would approximately lead to the company's public share price, would be 3% year-over-year.

Another important factor is the Net CAPEX, which highly influences the value of the future free cash flows. In 2024, it was assumed the company would invest heavily in production facilities raising its Net CAPEX by 34% and then assuming a linear growth rate following its 3-year average ratio over revenues. If a more conservative perspective was used, using the previous year ratio or the 4-year average, it would result in considerably lower amounts ranging between 2 570 million euros in 2024 and 3 940 million euros in 2030. A lower Net CAPEX would lead to higher future free cash flows and, considering every other input constant, the fair value would rise to roughly 222 euros per share.

The corporate tax rate varies from country to country. In this case, Germany's 2024 expected tax rate was used. However, one could use the historical 3-year average, which would result in a tax rate in the order of 24% and a fair value per share of approximately 225 euros.

The discount rate used in a valuation is a primary subject and usually a source of discussion. The WACC depends on the tax rate, the cost of equity, the cost of debt and

the net debt/equity ratio. These input factors depend in turn on several aspects. Changes on the risk-free rate, the levered beta, the average market's expected return and the net debt/equity ratio may result in substantially different results.

Finally, the perpetual constant growth rate is an extremely important factor as it impacts the major valuation component, the terminal value.

Most of the possible differences described above were tested in the sensitivity analysis chapter given their importance in this subject.

The relative valuation is a commonly used and simple way to value a company. However, it can lead to misuse and manipulation. The choice of the peer group may vary across valuators, it relies more on the market's judgement, and the exclusion of outliers may be subject to different rules.

In any case and based in the findings of this dissertation, one may conclude that the price of Siemens' shares is, very likely, undervalued.

8. Conclusion

This dissertation aimed to estimate the fair value of Siemens' shares, a leading company in automation and digitalization. Through a review of the main valuation methods and an in-depth analysis of the company and the external environment, the DCF and the relative valuation methods were used.

The two methods led to the same investment recommendation of buying Siemens' shares as they both resulted in an estimated fair value above the public share price. Nevertheless, since company valuation is a subjective exercise, the results obtained were analyzed to understand the possible causes for the differences found.

Company valuation is useful for reasons such as mergers and acquisitions, strategic planning, capital financing, and investing in securities. Therefore, this dissertation brought the author's practical perspective regarding this topic when applied to Siemens.

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10. Appendix

Annex A. Average beta by rating and maturity

By Rating	A and above	BBB	BB	B	CCC
Avg.Beta	< 0.05	0.10	0.17	0.26	0.31
By Maturity	(BBB and above)	1-5 Year	5-10 Year	10-15 Year	> 15 Year
		0.01	0.06	0.07	0.14

TABLE 13. AVERAGE BETA BY RATING AND MATURITY. SOURCE: S. SCHAEFER AND I. STREBULAEV, "RISK IN CAPITAL STRUCTURE ARBITRAGE", STANFORD GSB WORKING PAPER, 2009.

Annex B. Historical Financial Statements

(in millions of €, per share amounts in €)	2019	2020	2021	2022	2023
Revenue	86 849	57 139	62 265	71 977	77 769
Cost of sales	-57 428	-33 796	-36 452	-42 569	-44 508
Gross profit	29 421	23 343	25 813	29 408	33 261
Research and development expenses	-4 669	-4 569	-4 859	-5 591	-6 183
Selling and general administrative expenses	-13 345	-10 774	-11 189	-12 857	-13 941
Other operating income	442	631	236	2 171	574
Other operating expenses	-466	-403	-431	-285	-454
EBITDA	11 383	8 228	9 570	12 846	13 257
Depreciation and Amortization Expenses	-3 494	-3 157	-3 075	-3 561	-3 608
EBIT	7 889	5 071	6 495	9 285	9 649
Profit Margin	9,08%	8,87%	10,43%	12,90%	12,41%

TABLE 14. HISTORICAL INCOME STATEMENT

(in millions of €, per share amounts in €)	2019	2020	2021	2022	2023
Assets					
Cash and cash equivalents	12 391	14 041	9 545	10 465	10 084
Trade and other receivables	18 894	14 074	15 518	16 701	17 405
Other current financial assets	10 669	8 382	7 985	9 696	10 605
Contract assets	10 309	5 545	6 688	7 559	7 581
Inventories	14 806	7 795	8 836	10 626	11 548
Current income tax assets	1 103	1 523	1 795	1 432	1 363
Other current assets	1 960	1 271	1 751	1 935	1 955
Assets classified as held for disposal	238	338	223	413	990
Total current assets	**70 370**	**52 968**	**52 340**	**58 829**	**60 639**
Goodwill	30 160	20 449	29 729	33 861	32 224
Other intangible assets	9 800	4 838	10 964	12 196	10 641
Property, plant and equipment	12 183	10 250	11 023	11 733	11 938
Investments accounted for using the equity method	2 244	7 862	7 539	4 955	3 014
Other financial assets	19 843	22 771	22 964	25 903	22 855
Deferred tax assets	3 174	2 988	2 865	2 459	2 231
Other assets	2 475	1 769	2 183	1 565	1 523
Total non-current assets	**79 878**	**70 928**	**87 267**	**92 673**	**84 428**
Total assets	**150 248**	**123 897**	**139 608**	**151 502**	**145 067**

Liabilities and equity					
Short-term debt and current maturities of long-term debt	6 034	6 562	7 821	6 658	7 483
Trade payables	11 409	7 873	8 832	10 317	10 130
Other current financial liabilities	1 743	1 958	1 731	1 616	1 601
Contract liabilities	16 452	7 524	9 858	12 049	12 571
Current provisions	3 682	1 674	2 263	2 156	2 320
Current income tax liabilities	2 378	2 281	1 809	2 381	2 566
Other current liabilities	9 023	6 209	7 628	7 448	8 182
Liabilities associated with assets classified as held for disp	2	35	10	61	50
Total current liabilities	**50 723**	**34 117**	**39 952**	**42 686**	**44 901**
Long-term debt	30 414	38 005	40 879	43 978	39 113
Provisions for pensions and similar obligations	9 896	6 360	2 839	2 275	1 426
Deferred tax liabilities	1 305	664	2 337	2 381	1 655
Provisions	3 714	2 352	1 723	1 857	1 794
Other financial liabilities	986	769	679	1 867	1 453
Other liabilities	2 226	1 808	1 925	1 654	1 666
Total non-current liabilities	**48 541**	**49 957**	**50 381**	**54 011**	**47 106**
Total liabilities	**99 265**	**84 074**	**90 333**	**96 697**	**92 007**

Equity					
Issued capital	2 550	2 550	2 550	2 550	2 400
Capital reserve	6 287	6 840	7 040	7 174	7 411
Retained earnings	41 818	33 078	39 607	38 959	36 874
Other components of equity	1 134	-1 449	-19	6 159	2 282
Treasury shares, at cost	-3 663	-4 629	-4 804	-5 948	-1 177
Total equity attributable to shareholders of Siemens AG	48 125	36 390	44 373	48 895	47 791
Non-controlling interests	2 858	3 433	4 901	5 910	5 270
Total equity	**50 984**	**39 823**	**49 274**	**54 805**	**53 060**
Total liabilities and equity	**150 248**	**123 897**	**139 608**	**151 502**	**145 067**

TABLE 15. HISTORICAL BALANCE SHEET

Annex C. Forecasted Income Statement

(in millions of €)	2024	2025	2026	2027	2028	2029	2030
Revenue	84 027	90 789	98 095	105 988	114 517	121 468	128 841
Cost of sales	-48 993	-52 935	-57 195	-61 797	-66 770	-70 823	-75 122
Gross profit	35 035	37 854	40 900	44 191	47 747	50 645	53 720
Research and development expenses	-6 681	-7 218	-7 799	-8 427	-9 105	-9 657	-10 243
Selling and general administrative expenses	-15 063	-16 275	-17 585	-19 000	-20 529	-21 775	-23 096
Other operating income	620	670	724	782	845	897	951
Other operating expenses	-491	-530	-573	-619	-669	-709	-752
EBITDA	13 421	14 501	15 668	16 928	18 291	19 401	20 579
Depreciation and Amortization Expenses	-3 836	-4 247	-4 690	-5 170	-5 687	-6 209	-6 762
EBIT	9 585	10 254	10 977	11 759	12 603	13 192	13 817
Profit Margin	11,41%	11,29%	11,19%	11,09%	11,01%	10,86%	10,72%

TABLE 16. FORECASTED INCOME STATEMENT

	2024	2025	2026	2027	2028	2029	2030
Germany's expected inflation rate	2,41%	2,02%	1,97%	1,97%	1,99%	2,01%	2,01%
Chinas' expected inflation rate	0,97%	1,99%	1,95%	1,95%	1,95%	1,95%	1,95%
U.S. Expected inflation rate	2,90%	2,00%	2,10%	2,10%	2,10%	2,10%	2,10%
Average inflation rate	2,09%	2,00%	2,01%	2,01%	2,01%	2,02%	2,02%

TABLE 17. EXPECTED INFLATION RATE. SOURCE: STATISTA

(in million of €)	2024	2025	2026	2027	2028	2029	2030
Revenues (Nominal terms)	84 027	90 789	98 095	105 988	114 517	120 921	127 684
R&D expenses	-6 681	-7 218	-7 799	-8 427	-9 105	-9 614	-10 151
Research intensity	7,95%	7,95%	7,95%	7,95%	7,95%	7,95%	7,95%
Comparable nominal revenue growth	8,05%	8,05%	8,05%	8,05%	8,05%	5,59%	5,59%
Cost of Sales	-48 993	-52 935	-57 195	-61 797	-66 770	-70 504	-74 447
% Cost of Sales/Revenues	58,31%	58,31%	58,31%	58,31%	58,31%	58,31%	58,31%
Selling and general administrative expenses	-15 063	-16 275	-17 585	-19 000	-20 529	-21 677	-22 889
% S&GA expenses/Revenues	17,93%	17,93%	17,93%	17,93%	17,93%	17,93%	17,93%
Other operating income	620	670	724	782	845	893	942
% Other operating income/Revenues	0,74%	0,74%	0,74%	0,74%	0,74%	0,74%	0,74%
Other operating expenses	-491	-530	-573	-619	-669	-706	-745
% Other operating expenses/Revenues	0,58%	0,58%	0,58%	0,58%	0,58%	0,58%	0,58%

TABLE 18. INCOME STATEMENT ITEMS' ASSUMPTIONS

Annex D. Investment Policy

(in million of €)	2019	2020	2021	2022	2023
Gross PPE	29 948	23 443	24 601	26 926	27 280
Accumulated Depreciation	-17 765	-13 194	-13 578	-15 193	-15 342
Net PPE = Beg Net PPE + CAPEX - Depreciation	12 183	10 249	11 023	11 733	11 938
Depreciation	-1 427	-2 105	-2 071	-2 292	-2 279
% Depreciation/Last year's GPPE	-	7,03%	8,83%	9,32%	8,46%
PPE Net Capex	-	171	2 845	3 002	2 484
% PPE Net CAPEX/Revenues	-	0,30%	4,57%	4,17%	3,19%
Other intangible assets = Beg Other IA + CAPEX - Depreciation	9 800	4 838	10 964	12 196	10 641
Amortization	-915	-953	-1 004	-1 256	-1 321
% Amortization/Revenues	1,05%	1,67%	1,61%	1,75%	1,70%
Other IA Net CAPEX	-	-4 009	7 130	2 488	-234
% Other IA Net CAPEX/Revenues	-	-7,02%	11,45%	3,46%	-0,30%
Total Net CAPEX	-	-3 838	9 975	5 490	2 250
Total Depreciation	-	-3 058	-3 075	-3 548	-3 600

TABLE 19. HISTORICAL INVESTMENT POLICY

(in million of €)	2024	2025	2026	2027	2028	2029	2030
Gross PPE	30 623	34 234	38 136	42 353	46 908	51 740	56 865
Accumulated Depreciation	-17 762	-20 479	-23 516	-26 899	-30 657	-34 818	-39 408
Net PPE = Beg Net PPE + CAPEX - Depreciation	12 860	13 755	14 620	15 453	16 251	16 922	17 457
Depreciation	-2 420	-2 717	-3 037	-3 383	-3 757	-4 162	-4 590
% Depreciation/Last year's GPPE	8,87%	8,87%	8,87%	8,87%	8,87%	8,87%	8,87%
PPE Net Capex	3 343	3 612	3 902	4 216	4 556	4 832	5 125
% PPE Net CAPEX/Revenues	3,98%	3,98%	3,98%	3,98%	3,98%	3,98%	3,98%
Other intangible assets = Beg Other IA + CAPEX - Depreciation	10 551	10 453	10 348	10 234	10 111	9 980	9 842
Amortization	-1 416	-1 530	-1 653	-1 786	-1 930	-2 047	-2 171
% Amortization/Revenues	1,69%	1,69%	1,69%	1,69%	1,69%	1,69%	1,69%
Other IA Net CAPEX	1 326	1 433	1 548	1 672	1 807	1 917	2 033
% Other IA Net CAPEX/Revenues	1,58%	1,58%	1,58%	1,58%	1,58%	1,58%	1,58%
Total Net CAPEX	4 668	5 044	5 450	5 889	6 362	6 749	7 158
Total Depreciation	-3 836	-4 247	-4 690	-5 170	-5 687	-6 209	-6 762

TABLE 20. FORECASTED INVESTMENT POLICY

Annex E. Financial debt, Net Debt/Equity ratio and Cost of debt

(in million of €)	2019	2020	2021	2022	2023
Short-term Debt	6 034	6 562	7 821	6 658	7 483
Long-Term Debt	30 414	38 005	40 879	43 978	39 113
Total Financial Debt	36 448	44 567	48 700	50 636	46 596
Cash	12 391	14 041	9 545	10 465	10 084
Net Financial Debt	24 057	30 526	39 155	40 171	36 512
Equity	50 984	39 823	49 274	54 805	53 060
Net Debt/Equity	0,471854	0,766542	0,794638	0,732981	0,688127

TABLE 21. HISTORICAL FINANCIAL DEBT AND NET DEBT/EQUITY RATIO

(in million of €)	2019	2020	2021	2022	2023
Interest Expenses	-1 263	-1 410	-1 513	-1 612	-1 715
Implicit cost of debt	-	3,87%	3,40%	3,31%	3,39%

TABLE 22. HISTORICAL COST OF DEBT

Annex F. Working Capital

(in million of €)	2019	2020	2021	2022	2023
Trade and other receivables	18 894	14 074	15 518	16 701	17 405
Inventories	14 806	7 795	8 836	10 626	11 548
Other current assets	1 960	1 271	1 751	1 935	1 955
Trade payables	11 409	7 873	8 832	10 317	10 130
Other current liabilities	9 023	6 209	7 628	7 448	8 182
Working Capital	15 228	9 058	9 645	11 497	12 596
% Working capital/Revenues	17,53%	15,85%	15,49%	15,97%	16,20%
Changes in WC		-6 170	587	1 852	1 099

TABLE 23. HISTORICAL WORKING CAPITAL

(in million of €)	2024	2025	2026	2027	2028	2029	2030
Working Capital	13 349	14 423	15 584	16 838	18 193	19 297	20 469
% Working capital/Revenues	15,89%	15,89%	15,89%	15,89%	15,89%	15,89%	15,89%
Changes in WC	753	1 074	1 161	1 254	1 355	1 104	1 171

TABLE 24. FORECASTED WORKING CAPITAL

Annex G. GDP growth rate estimation

GDP growth rate	
Germany growth rate	0,66%
China growth rate	3,31%
US growth rate	2,12%
Average	2,03%

TABLE 25. AVERAGE GDP GROWTH RATE

Annex H. WACC calculation

Tax rate	29,9%
Growth rate (nominal terms)	4,05%
Risk-free rate	2,4175%
Levered Beta	1,48
Average market's expected return	8,00%
Market Risk Premium	5,5825%
Cost of Equity	10,6796%
Cost of Debt	3,36%
D/V	0,407627384
E/V	0,592372616
WACC after-tax	**7,29%**

TABLE 26. WACC AFTER-TAX CALCULATION

Annex I. Relative Valuation

On september 2023

Peer Group	PER	EV/EBITDA	EV/Revenues	P/B
General Electric	25,06	7,62	1,46	3,86
Alstom	-72,7	13,5	0,71	0,976
3M	9,77	-31,84	1,94	6,58
Schneider Electric	22,2	14,8	2,8	3,73
Hitachi	12,9	6,81	0,91	1,64
Philips B2B	13,11	118,04	1,34	1,43
ABB Ltd	16,86	13,37	2,29	5,14
Average	**13,01**	**13,89**	**1,58**	**3,80**
Median	13,11	13,37	1,46	3,73
Siemens 30/09/23	12,97	8,02	1,77	2,36

TABLE 27. PEER GROUP'S MULTIPLES

PER	
EQV	110 920
Oustanding shares	789,473
Fair Value (in €)	140,50

TABLE 28. FAIR VALUE USING PER

EV/EBITDA	
EV	184 140
NOA	34 450
Debt	73 695
EQV	144 895
Oustanding shares	789,473
Fair Value (in €)	183,53

TABLE 29. FAIR VALUE USING EV/EBITDA

EV/Revenues	
EV	121 838
NOA	34 450
Debt	73 695
EQV	82 593
Outstanding shares	789,473
Fair Value (in €)	104,62

TABLE 30. FAIR VALUE USING EV/REVENUES

P/B	
Outstanding shares	789,473
Equity	53 060
Fair Value (in €)	255,06

TABLE 31. FAIR VALUE USING P/B

Average Fair Value (in €)	171,26
Std deviation	55,65
Avg + Std deviation (in €)	226,90
Avg - Std deviation (in €)	115,61

Final Average Fair Value (in €)	**162,02**

TABLE 32. AVERAGE FAIR VALUE USING RELATIVE VALUATION