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Equity Carve-Outs: Strategic motivations & decision-making: Porsche AG case.

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BUSINESS
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Resumo

Este projeto de mestrado analisa a estratégia de “equity carve-out” como uma ferramenta de alienação do capital de uma subsidiária pela empresa-mãe, mantendo no entanto grande parte desse mesmo capital. A base teórica associada a este fenómeno é apresentada pelo estudo da sua literatura, sendo depois analisada a sua aplicação prática no contexto do estudo de caso do “equity carve-out” da Porsche AG.

As posições estratégicas e tomada de decisão apresentadas para a execução do equity carve-out da Porsche AG encontram-se em linha com o proposto pela literatura.

É efetuada a avaliação do preço por ação da Porsche AG, através da metodologia “discounted cash flow” (DCF) e avaliação por múltiplos, estimado em 132.74 Euros e 82.80 Euros, respetivamente. Esta avaliação sugere a existência de um desconto relativo ao preço de oferta inicial de 82.50 Euros por ação, estando assim presente a subvalorização deste valor, como esperado pela literatura. A avaliação DCF pode ter sobrestimado esta subvalorização por não conseguir capturar o ambiente economico altamente desafiante em que esta transação teve lugar.

Procedendo à análise do desempenho em bolsa da Porsche AG e das suas empresas-mãe, Volkswagen AG e Porsche SE, os resultados estão em linha com o esperado pela teoria. No anúncio da transação observam-se rendibilidades negativas (CAAR), indiciando expectatativas por parte do mercado na existência de uma reaquisição. No primeiro ano após a oferta pública inicial as três empresas têm um desempenho superior ao seu índice de referência, indicando a criação de valor a longo termo para os investidores.

Palavras-Chave: Porsche AG, Equity carve-out, DCF, Relative Valuation, CAAR

JEL Classification: G14; G34

Abstract

This project examines equity carve-outs as a strategic method for parent corporations seeking divestment from a subsidiary while retaining substantial ownership. The application of this strategy is delivered by exploring the theoretical underpinnings of this approach through relevant literature and providing an empirical comparison point by analyzing the Porsche AG equity carve-out case.

The strategies and decision-making associated with Porsche's equity carve-out align with the literature expectations.

The execution of a discounted cash flow (DCF) and relative valuation methodologies provide this analysis with a value per share estimate, prior to the initial public offering. These methodologies value each share of Porsche AG at 132.74 Euros and 82.80 Euros, respectively, suggesting the presence of underpricing, as the offering price of 82.50 Euros per share was issued at a discount. Notably, the DCF valuation might have overestimated the level of underpricing, as it is difficult to capture the challenging environment in which the deal took place.

Furthermore, a stock market performance analysis of Porsche AG and its parent companies, Volkswagen AG and Porsche SE was conducted for two distinct periods: Announcement and the subsequent year. While the announcement period exhibits negative CAAR, suggesting the market expects a future reacquisition of Porsche AG, the subsequent 12 months demonstrates all three stocks outperforming the DAX index, a strong indicator of long-term shareholder value creation.

A more recurrent application of carve-out strategies by managers should be dependent on an appropriate update of existing literature. This would support and clarify the intricacies of equity carve-outs.

Keywords: Porsche AG, Equity carve-out, DCF, Relative Valuation, CAAR

JEL Classification: G14; G34

General Index

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Glossary

$AML – Aston Martin Lagonda Global Holdings plc ticker

$BMW – Bayerische Motoren Werke Aktiengesellschaft ticker

$MBG – Mercedes-Benz Group AG ticker

$RACE – Ferrari N.V. ticker

$TSLA – Tesla, Inc ticker

$VOLCAR – Volvo Car AB ticker

$VOW – Volkswagen AG ticker

AAR – Average abnormal returns

AG – Aktiengesellschaft (Public limited company)

AI – Artificial Intelligence

AR – Augmented reality

BEV – Battery electric vehicle

CAAR – Cumulative average abnormal returns

CAGR – Compound Annual Growth Rate

CapEx – Capital expenditures

CAPM – Capital asset pricing model

CAR – Cumulative abnormal returns

CEO – Chief operating officer

CF – Cash flow

CFO – Chief financial officer

COO - Chief operating officer

CPI – Consumer price index

CRP – Country risk premium

D = Debt

D&A – Depreciation and amortization

DAX – German Stock Index DAX 30

DCF – Discounted cash flow

E = Equity

$E(r_m)$ – Market's expected return

EBIAT – Earnings before interest and after taxes

EBIT – Earnings before interest and taxes

EBITDA – Earnings before interest taxes depreciation & amortization

ECO – Equity carve-out

EQV – Equity value

EV – Electric vehicle

EV – Enterprise value

EVA – Economic value added

FCFF – Free cash flow to the firm

g – Terminal growth rate

GDP – Gross domestic product

GmbH – Gesellschaft mit beschränkter Haftung (Limited liability company)

HNWI – High-net-worth individuals

ICE – Internal combustion engine

IPO – Initial public offering

M&A – Mergers and acquisitions

MaaS – Mobility as a service

MRP – Market risk premium

P – Share price

PBV – Price to book value

PER – Price to earnings ratio

r_D = Cost of debt

r_E – Cost of equity

r_f – Risk-free rate

R_t – Logarithmic actual return

SE – Societas Europaea (European company; Public limited-liability company)

SUV – Sports utility vehicle

t – corporate tax rate

TV – Terminal value

UHNWI – Ultra-high-net-worth individuals

VR – Virtual reality

VTS – Value Tax Shields

WACC – Weighted average cost of capital

WC – Working capital

YoY – Year on year

β - Beta

β_D – Debt beta

β_L – Levered beta

β_U – Unlevered beta

ΔWC – Changes in working capital

1. Introduction

In September 2022, coinciding with the beginning of this master's program, Porsche AG was about to enter the Frankfurt stock exchange. The transaction and the intricate corporate structure of the Volkswagen group, of which Porsche AG is a part, struck as a compelling topic to be explored under the context of a master thesis.

Through in-depth research on Porsche AG's initial public offering, it was clear that the operation could be classified as an equity carve-out, which shaped the main focus of this project. In an equity carve-out, a parent company divests a portion of a wholly owned subsidiary, by offering it to the public markets through an initial public offering.

After elaborating a primary literature review on equity carve-outs, presented in Chapter 2, a research gap was uncovered – existing studies primarily focused on 20th-century data sets. This led us to explore the potential for updating such studies using data from 2001 to 2023 equity carve-outs. Analyzing this timeframe could not only enable an update on the understanding of the topic but also lay the ground for future research, widespread of artificial intelligence, machine learning, and other revolutionary technologies in finance is anticipated for the near future.

Data collection and subsequent computations revealed limitations related to data availability. Therefore, the development of this initial research question was considered unsuitable under this master's thesis project development, as the resources necessary to ensure the feasibility of this study could not be obtained within the available timeframe.

While the previously mentioned limitations prevent us from pursuing the original research question, a new and valuable avenue arises. This project shifts its focus to providing insights into the equity carve-out process, a deal-making strategy that has been overlooked by both literature and practitioners. Theoretical background and empirical evidence are provided throughout this project by analyzing the case of Porsche AG IPO.

The following chapters of this thesis provide a structured approach to the research objective. Chapter two comprises a comprehensive literature review on equity carve-outs and relevant valuation methods. Chapters three and four lay the foundation for the valuation of Porsche AG, by presenting a market overview and a detailed company overview. Chapter five delves into key events and motivations surrounding the transaction. The sixth chapter then provides the Porsche AG valuation at the time of the IPO and compares it to the offering price. Chapter seven examines the stock market performance of the subsidiary and its parent companies. The project concludes with a discussion of the results obtained concerning the research objectives and recommendations for future research.

2. Literature Review

2.1 **Equity carve-outs**

2.1.1 Definition

With different motivations, organizations may need to divest their position from relevant subsidiaries or divisions. An equity carve-out (ECO) is treated by firm managers, analysts, and financial reporters as a form of divestiture (Vijh, 2002) where the parent proceeds to the initial public offering (IPO) of a stake of a wholly owned subsidiary (Schipper & Smith, 1986), while typically retaining a controlling interest (Slovin et al., 1995). Hogan (2005) highlights the difference between carve-outs and IPOs, which stands at the level of information available to investors and the stage of the firm life cycle. Furthermore, the author finds that ECOs benefit from a significantly lower level of underpricing, and their offer size is less critical.

Klein et al. (1991) and later Perotti and Rossetto (2007) place carve-outs as the first stage of a complete disposal of parent interest in the subsidiary or the re-acquisition (buy-back) of prior-owned shares to its portfolio, thus attributing a temporary character to such an operation.

2.1.2 Strategic motivations

Equity Carve-outs combine restructuring and financing transactions (Powers, 2003) and are motivated by financial and strategic reasons.

Usually, companies with a higher leverage ratio and exhibiting poor operating performance are more likely to engage in this strategy, as it provides the parent company with funds to pay down debt and improve its capital position (Allen & McConnell, 1998; Chen & Guo, 2005). Otsubo's (2013) research on Japanese carve-outs indicates that the parents' effort to reduce their leverage does not end with the carve-out execution but continues years after.

In contrast, Wagner (2005) proposes a financing hypothesis where parent firms finance previous investments only if they do not exhibit higher leverage or financial distress than comparable firms. In some cases, ECOs provide parent companies the chance to take on projects that might otherwise drain their earnings (Anslinger et al., 1997) or be forgone (Nanda, 1991). Carved-out subsidiaries may expect more attractive conditions to finance their future projects, as the markets have a clearer perspective on their operations and can assess profitability and growth more easily (Nanda, 1991).

Allen and McConnell (1998), using a sample of 188 equity carve-outs from 1978 to 1993, observed significant positive average excess returns of 6.63 percent in the 54 carve-outs where the proceeds were raised to reduce leverage, whereas in the 60 carve-outs for investment purposes, the observation reflects a nonsignificant negative 0.01 percent average excess return.

Vijh (2002) finds a higher appetite in the market for carve-outs when the Wall Street Journal reports the payment of debt investment as the goal for such transactions.

A third motivation for a parent company to engage in the carve-out of a subsidiary is to unlock its value, as the parent can take advantage of overvalued subsidiary equity (Powers, 2003). Simultaneously, the operation provides investors with the possibility of becoming shareholders of the subsidiary in a direct way, as opposed to indirect shareholding if only the parent company was listed (Anslinger et al., 1997). According to Desai et al. (2011), when this is the motivation for the equity carve-out, the probability of a future acquisition, Sell-off or buy-back is high, as the market can inform the parent company on the optimal allocation of its ownership of the subsidiary (Perotti & Rossetto, 2007).

Schipper and Smith (1986) mention this form of equity financing to enhance shareholders' value by reflecting a positive perception of the markets and attracting a future acquirer for the subsidiary, as it is then possible to negotiate based on the market price. Hulburt (2011) observes the expectation of a future acquisition event as the main driver for an increase in the parent firm's market value. Nanda (1991) also links this increase to a positive market perception of the parent's equity, showing that undervalued firms usually engage in carve-out operations.

Strategic growth through a carve-out operation can be achieved, as it allows the change of relationships between parent and subsidiary in corporate governance, human resources, and financing activities (Anslinger et al., 1997). Funds collected from such operations allow the financing of the subsidiary's growth initiatives (Schipper & Smith, 1986). The standalone and listed subsidiary management team will then be pressured to perform at the highest levels and comply with their duty of information towards a variety of shareholders, therefore enabling growth, according to Anslinger et al. (1997). The same author also points out an enhancement in the value proposition for skilled employees, as salaries and bonuses can now align with the ones practiced in the market and enable a talent retention policy. By incorporating market metrics into performance evaluations, managers will face a more holistic assessment, potentially leading to improved compensation and incentive structures that reward long-term value creation (Schipper & Smith, 1986; Wagner, 2005).

When the goal is to streamline the parent company's core business, Slovin et al. (1995) propose carve-outs as a mean for management to collect cash and invest it into the creation of a pure play. Vijh (2002) identifies a positive market reaction to this strategy, as there is the belief that this is a chance for the company to unlock value that is hidden inside the firm's structure.

By streamlining its core businesses, the parent company will adopt equity carve-outs to divest itself from non-core assets. Schipper and Smith (1986) find this strategy to be one that values the

subsidiary's net assets following a market-based valuation. Nanda (1991) further expands this argument to the parent level, as the market may also value all other non-subsidiary-related assets. In fact, the author argues that in equilibrium, an equity carve-out is usually a strategy engaged by firms that the market has undervalued. Perotti and Rossetto (2007) find ECOs as a tool to assess, through market-based valuation, the value of the subsidiary as an independent firm, information that may help in the decision of complete divestment or buy-back.

Vijh (2002) found more enthusiasm from the market as the carved-out subsidiary is unrelated to the parent company's operations.

The possibility of an information asymmetry hypothesis is often discussed throughout the literature on Equity Carve-outs. Powers (2003) argues that, in order to maximize value, managers perform carve-outs when it is their understanding that the subsidiary is underperforming, as it may be possible to sell the subsidiary shares for a premium when compared with their intrinsic value and benefit from a not so well-informed market. Chen and Guo (2005) find that highly diversified firms carve out their low-performant subsidiaries, arguing, however, limited evidence for the information asymmetry as a driver for a carve-out operation.

Equity Carve Outs can also be considered as a mean to achieve market advantage against competitors, as Slovin et al. (1995) observes a negative impact on the subsidiary competitors market value, due to the market's negative sentiment on the industry and how wealth may end up flowing to the parent shareholders. Hulburt et al. (2002) find this trend in the carve-out parent firm industry, with rivals experiencing negative returns during the announcement period.

2.1.3 Decision-making

Although management may have high motivation to engage in the carve-out of a subsidiary, there should be a diligent analysis of the entire process to achieve efficient and informed decision-making.

Wagner (2005) observes that, unlike what is observed in the United States., market timing appears to be non-relevant at an industry level, in the case of German Equity Carve-Outs. Perotti and Rossetto (2007) find this strategy to be held under more informative, although highly uncertain markets and developed a real options model where the optimal timing for a possible buy-back or further liquidation of the parents' position can be assessed. Approaching equity carve-outs through a real options analysis may benefit the company when the decision to pursue a carve-out of a subsidiary is made. Slovin et al. (1995) results show management's appetite to engage in this process when they expect the market to price the subsidiary value higher than their perceived value.

Schipper and Smith (1986) find that the number of common shares offered to the market always consider the parent retention of a controlling position, which typically accounts for more than 50 percent and/or by providing board directors with connections to the parent firm. According to the same authors, control maintenance is an advantage in case the parent wants to buy back the shares offered, and a stake of 20 percent should be the maximum ownership a firm would give away when it aims to obtain benefits on its tax consolidation. Along the same lines, Hulburt (2011) considers the size of the IPO as a factor for the parent gains, noting that the optimal retention level fits in between 10 to 50 percent of ownership offered to the public when the motivation of the carve-out is a change in corporate control. When a higher stake is offered to the public, parent shareholders should expect higher gains, as it may point the market in the direction of a complete divestiture. As a trade-off, Powers (2003) finds this large sale will impact future performance, as the subsidiary becomes increasingly independent from the parent and synergies get lost.

A successful announcement of the operation may allow the maximization of abnormal gains by both parent and subsidiary. Schipper and Smith (1986) find that, on average, an Equity Carve-out announcement provides abnormal gains to the parent firm, whereas in the case of another form of parent equity offerings, it would result in abnormal losses. This may be explained by the possibility of separating the financing of each firm. Vijh (2002) explains this positive market reaction with the belief that value will be added to divesting an unrelated business, allowing new financing and investments, and decreasing stock complexity. Otsubo (2013) argues that a carve-out may be taken to reduce leverage and finds that usually when there is a negative stock price reaction during the announcement, it is the reflection of a market expectation that in the future, the parent will engage in the re-acquisition of the subsidiary.

Regarding the subsidiary's board composition, Kayanga (2006) finds a negative relation between board size and firm performance for non-financial firms, whereas this relation is favorable for financial firms. Kayanga (2006) also observes a positive relation between board independence and firm performance in financial and non-financial firms, a negative relation between a dual CEO option and performance, and the more rights protection, the lower underperformance. Anslinger et al. (1997) suggest that a carved-out subsidiary allows executives to create an environment that prepares and develops in-house talent for a future tenure as parent board members. Fan (2022) reports a positive reaction from the Japanese stock market to the existence of dual directors holding the CEO position in the subsidiary, with further increased enthusiasm in the case of young directors, as they seem to be long-term reputation driven. This posture may enhance wealth opportunities for both parent and subsidiary.

Hogan (2005) analyzes the post-equity carved-out stock performance of the subsidiary. He finds that initial excess returns can be influenced by listing exchange, offer size and percentage of carved out. In contrast, the lead underwriter, number of managers and lockup agreements do not affect these returns. The author also highlights this performance due to each company's newly acquired ability to streamline their core activities, and as the parent will still be able to follow closely the subsidiary decision-making process. Vijh's (2001) research points out that over three years after the carve-out, the subsidiary stock will not underperform appropriate benchmarks, in contrast to other equity offerings.

To the announcement of a complete divestiture or re-acquisition, the market reacts positively to the decision. However, such abnormal returns are usually offset by negative abnormal returns days before the execution of one of these secondary events. (Klein et al., 1991; Otsubo, 2009). Klein et al. (1991) find the same gains to be offset by the subsidiary's underperformance before the secondary event execution.

Powers (2003) found the subsidiary's performance to peak at issue and decline to industry benchmarks during the following five years. Furthermore, a negative relationship between the stake offered to the markets and the subsequent performance is established, which implies that the operation's motivations were not to increase efficiency but to sell equity at a price above its actual intrinsic value. This decrease in efficiency tends not to support a subsidiary financing hypothesis for the carve-out (Otsubo, 2013).

Boone et al. (2003) present a negative relation between the parents' operating performance and the retained stake in the subsidiary carve-out. Atanasov et al. (2010) results further highlight this relation, with parent corporations which retain more shares on the subsidiary exhibiting negative peer-adjusted operating performance (worst at ownership levels of 25%) and seeing their value severely discounted relative to industry peers (23% median discount),

If the parent is also struggling at its own performance levels, it may identify the re-acquisition of the subsidiary as a strategy to improve such levels (Gleason et al., 2006). Expropriation of value is more common through operational transactions between both parties than via parents' transactions of subsidiary stock based on market timing (Atanasov et al., 2010).

As mentioned, the stock market considers the possibility of a complementary event after announcing a carve-out. Otsubo (2009) finds that market gains are driven by these secondary event expectations, usually in the form of M&A activity or even secondary offerings, spin-offs or re-acquisitions, the latter in case the market is highly undervalued. The shareholders receive a premium above the market price when the transactions are made with cash rather than in parent stock (Klein et al., 1991). Hulburt's (2011) study displays that 16% of the carve-out under analysis

are taken over, which matches a higher parent share price reaction to the equity carve-out announcement.

Following the re-acquisition of the subsidiary, its long-term performance relies on how it is reintegrated within the parent company structure. The market rewards both companies at the announcement of this operation, especially when the parent becomes the sole shareholder again and if the carve-out also operates in the same or related industry as the parent (Gleason et al., 2006).

Klein et al.'s (1991) research also highlights the fact that from a sample of forty pre-1983 carve-outs, only one remains public, and half of them have sell-off or buy-back as the secondary event, suggesting Equity Carve-Outs as a means of operating an asset restructuring.

2.2 Valuation Methods

Valuation is a transversal practice across finance, achieving particular relevance in portfolio management, corporate finance, mergers and acquisitions and more. It aims to establish the most appropriate, fair, and reliable value to an asset, by conveying the analysis of all related information. This ephemeral process results are highly susceptible to macroeconomic changes and the potential integration of biases and preconceptions. Even though a valuation can be considered more accurate in the case of mature companies, compared to younger ones, its outcome cannot be guaranteed. Nevertheless, the process gives many insights into the company's value-enhancing drivers, such as growth prospects, risk profile, margins and cash flows, key to understanding its prospects and boosting its potential (Damodaran, 2012), as well as identifying sources of economic value destruction (Fernandez, 2001).

Damodaran (2012) and Fernandez (2002a) find a diversity of valuation approaches. For this case study, we will delve deeper into the two more common practices in corporate finance valuation: a discounted cash flow approach through free cash flow; and an income statement-based approach through the employment of a variety of multiples (Relative Valuation). Acknowledging their relevance, the remaining methodologies highlighted by the literature are presented on table 1.

Balance Sheet	Income Statement
Book value	Multipless
Adjusted book value	- PER
Liquidation value	- Sales
Substantial value	- P/EBITDA
Cash Flow Discounting	**Value Creation**
Equity cash flow	Economic value added (EVA)
Free cash flow	Economic profit
Capital cash flow	Cash value added
Contingent Claim Valuation (Options)	
Black-Scholes	
Binomial Options	

Table 1 Valuation Methods: Adapted from Damodaran (2012) and Fernandez (2002a).

In the case of an Equity Carve-out, a valuation should be made as it will support the establishment of the offer price at which the subsidiary shares will be issued when offered to the public markets. One limitation of valuation methods is the possibility of integrating bias, as analysts may unconsciously tailor a valuation to justify a pre-established offer price for the IPO (Damodaran, 2012).

2.2.1 Discounted Cash Flows

Considered by Fernandez (2002a) as the only conceptually sound valuation methodology, it values an asset based on the present value of its future cash flows, previously discounted by an appropriate discount rate that accounts for its risk profile. For each year under analysis, this approach focuses on best estimating the operational items directly involved in cash flow generation and destruction, which are then subject to a fitting discount rate in order to integrate risk and historical volatility. When the DCF methodology is applied in the context of a private firm, the measurement of risk is highlighted by Damodaran (2012) as a primary limitation. As a potential solution, the author suggests relating the private firm riskiness with the risk profiles of comparable publicly traded companies. Another critical element in DCF-based valuations is a proper constant growth rate (g) estimation, which is crucial to computing the firm's terminal value and represents an estimation of all future cash flows after the forecast period.

The general expression stated in (1) can be used as a starting point to compute the value for a discounted cash flow valuation.

$$V = \sum_{t=1}^{n} \frac{CF_t}{(1+r)^t} + \frac{TV_n}{(1+r)^n} \qquad (1)$$

Where: V = Value; CF_t = Cash Flow estimated to be generated on period t; r = Appropriate discount rate integrating the firm's risk profile; TV_n = Terminal value at year n.

Free cash flow to the firm (FCFF) and free cash flow to equity (FCFE) are presented by Damodaran (2012) as the two main variations of the DCF approach. A key difference lies in the outcome of each model. The FCFF enables the assessment of the company's total value by considering cash flows before debt payments and after reinvestments, whereas the FCFE focuses on the standalone valuation of equity by considering cash flows after debt payments and reinvestment needs (Damodaran, 2006; Damodaran, 2012).

One of the objectives of this case study is to provide a high-quality valuation of Porsche AG through the application of the FCFF model, as the firm's characteristics are consistent with stable growth assumptions (Damodaran, 2012). Therefore, a detailed literature overview on discounted cash flow methodologies will be provided, solely focusing on FCFF.

Equity value, EQV

Through the FCFF model, a firm's equity value comprises the estimated enterprise value and nonoperating assets owned by the firm, less non-equity claims on the firm (Damodaran, 2012). Hence the expression (2):

$$EQV = EV + NonOperating\ Assets - NonEquityClaims \qquad (2)$$

Non-operating assets are assets that generate earnings unrelated to the firm's operations. These include cash and marketable securities, income from minority holdings, and idle assets (Damodaran, 2006).

Non-equity Claims represent the financial obligations towards creditors and non-owners, mainly comprising of all the firm's financial liabilities (borrowings), capitalized leases (leases treated as debt) and future pension fund and health care obligations (Damodaran, 2006).

Enterprise Value, EV

Applying the generalized discounted cash flows expression in the context of the FCFF model, the following expression (3) yields the firm enterprise value:

$$EV = \sum_{t=1}^{n} \frac{FCFF_t}{(1+WACC)^t} + \frac{TV_n}{(1+WACC)^n} \qquad (3)$$

Where: EV = Enterprise value; $FCFF_t$ = Free cash flow to the firm at period t; WACC = Weighted average cost of capital; TV_n = Terminal value at year n.

The enterprise value of a firm is calculated in two steps, which are developed in more detail in subsequent sections. The first comprises the sum of the present value of all forecasted free cash flows to the firm. The second calculates the present value of the terminal value.

Free Cash Flow to the Firm, FCFF

Also known as unlevered cash flow, the FCFF is the forecasted earnings before interest and taxes (EBIT) net of taxes and reinvestment needs for the firm's future (Damodaran, 2012). Hence:

$$FCFF = EBIT(1-t) + D\&A - CapEx - \Delta WC \qquad (4)$$

Where: FCFF = Free cash flow to the firm; EBIT = Earnings before interest and taxes; t = Corporate tax rate; D&A = Depreciation and amortization; CapEx = Capital Expenditures; ΔWC = Changes in working capital.

An advantage of this model is that it implicitly handles debt-related cash flows, such as tax shields, eliminating the need for separate estimates, particularly when leverage conditions change.

Terminal Value

As aforementioned, a second step in the discounted cash flow model estimates the perpetual stable growth of the free cash flows to the firm, assuming that operations will reach maturity after the projections period (Damodaran, 2012; Damodaran, 2006). Berk & DeMarzo (2017) and Koller et al. (2020) highlight the importance of this period, as it can account for a large portion of a firm's value. Therefore, the estimated terminal growth rate should be consistent and consider the growth experienced by the economy, inflation expectations, the firm and industry prospects, and other assumptions used in the model. The terminal value arm of the enterprise value computation follows expression (5) provided below:

$$TV_n = \frac{FCFF_n * (1+g)}{(WACC - g)} \qquad (5)$$

Where: $FCFF_n$ = Last projected FCFF of the projections period; g = Terminal growth rate; WACC = Weighted Average Cost of Capital.

Weighted average cost of capital, WACC

The discount rate in place for the FCFF approach is the weighted average cost of capital, as it reflects the cost of capital from all sources of capital (Damodaran 2006). It allows the FCFF model to incorporate the opportunity cost, provided by the cost of debt and cost of equity, an operational risk premium, and to implicitly consider value creation or destruction from debt financing in the form of debt tax shields (Luehrman, 1997). The author also highlights a limitation on WACC adoption when a firm's capital structure includes more complex debt financing instruments (e.g., high-yield debt, floating-rate debt). This leads to a less accurate reflection of the value created when the implicit value for debt financing tax shields is integrated into the model.

The formula for the WACC:

$$WACC = rE * \frac{E}{E+D} + rD * \frac{D}{E+D} * (1-t) \qquad (6)$$

Where: WACC = Weighted average cost of capital; rE = Cost of equity; rD = Cost of debt (before tax effect); E = Market value of equity; D = Market value of debt; t = Corporate tax rate.

Cost of equity, rE

The cost of equity represents the rate of return expected by equity investors to compensate for the risk incurred when investing in a firm. While many methods are available in the literature to estimate this cost, the capital asset pricing model, CAPM, maintains its relevance. Despite its main limitation of capturing one source of market risk in the market portfolio, practitioners find the model's intuitive approach valuable as it allows them to focus on refining the estimates for its inputs rather than adopting a more complex alternative risk model (Damodaran, 2012). Under the CAPM, the cost of capital should reflect the investor expected risk from an investment in the market portfolio, assuming the market portfolio is a well-diversified, efficient portfolio representing the non-diversifiable risk in the economy (Berk & DeMarzo, 2017). Thus, the cost of capital will comprise the expected return from a risk-free investment (rf), the expected return associated with the risk incurred for taking the investment, and a country risk premium.

$$rE = rf + \beta_L * (MRP + CRP) \qquad (7)$$

Where: r*E* = Cost of equity; r*f* = Risk-free rate; β_L = Levered beta; MRP = Market risk premium; CRP = Country risk premium.

Risk-free rate, rf

The CAPM risk model uses the expected return from an investment in a risk-free asset as the benchmark to select an appropriate risk-free rate. Two conditions must be met to consider an asset as free of risk. First, the asset should bear no default risk, usually the case of securities issued by governments, as these entities are always expected to honor their commitments. Second, there must be no reinvestment risk for such assets, which is the case of long-term zero-coupon government bonds (Damodaran, 2012). Regarding the maturity of such securities, ideally, they should reflect the same maturity of the cash flow to be discounted, but for simplicity, a 10-year maturity government bond is preferred in practice (Koller et al., 2020).

Market risk premium, MRP

When computing the cost of equity and cost of capital, it is fundamental to account for the expected return on an investment bearing non-diversifiable risk (Damodaran, 2008b). This risk can be subdivided into an equity risk component, representing the expected return for that specific investment, and a market risk component, reflecting the risk associated with investing in the broader market. In the CAPM model, the total risk premium is then yielded by multiplying the equity

risk premium by the investment's beta, which measures its sensitivity to market movements. By adding the risk-free rate, the cost of equity is determined.

The market risk premium is calculated as the difference between the market's expected return ($E(r_m)$) and the risk-free return (rf):

$$MRP = E(r_m) - rf \qquad (8)$$

Where: MRP = Market risk premium; E(r_m) = Market's expected return; r*f* = Risk-free rate.

Koller et al. (2020) acknowledge the lack of a universally accepted model to estimate the market risk premium. The more general approaches would be to estimate the future risk premium through the extrapolation of historical returns, and the regression of current market variables, such as the aggregate dividend-to-price ratio.

Country Risk Premium, CRP

Damodaran (2012) explores various approaches for estimating the additional risk demanded by investors when investing in a specific country. The country risk premium provides the cost of equity computations with a higher premium in the case of investments in riskier countries. Country risk premium should also be factored into the cost of equity when analyzing companies based in low-risk countries but with significant business exposure to emerging markets.

Beta, β

An investment beta, β, measures the degree to which its returns fluctuate relative to the returns of the overall market portfolio. This value is usually estimated through a regression of the investment returns against the market's returns.

In the case of unlisted entities, the application of such regressive method is impossible. Alternatively, Damodaran (1999) suggests the beta estimation to be yielded by a bottom-up approach, which will account for the firm's type of business, current financial leverage, and degree of operating leverage. The bottom-up approach involves the selection of an appropriate levered beta benchmark. Selecting a twin company levered beta, industry average or peer group average, provides the referred benchmark. Regarding a peer group average selection, formula (9) unveils the unlevered beta for each firm.

$$\beta_U = \frac{\beta_L + \beta_D * \frac{D}{E} * (1 - t)}{1 + \frac{D}{E} * (1 - t)} \qquad (9)$$

Where: β_U = Benchmark unlevered beta; β_L = Peer company levered beta; β_D = Peer company debt beta; $\frac{D}{E}$ = Debt to equity ratio of the peer company; t = Peer company tax rate.

The debt beta β_D can be obtained through formula (10):

$$\beta_D = \frac{rD - (rf + CRP)}{MRP} \qquad (10)$$

Where: β_D = Peer company debt beta; r*D*= Cost of debt; r*f* = Risk-free rate; CRP = Country risk premium; MRP = Market risk premium.

Once each peer company's unlevered betas are available, an average is calculated. Formula (11) provides the levered beta for the firm under analysis, weighting in the peer group average within the capital structure and debt beta in place, therefore concluding the bottoms up approach.

$$\beta_L = \beta_U + (\beta_U - \beta_D) * \frac{D}{E} * (1 - t) \qquad (11)$$

Where: β_U = Benchmark unlevered beta; β_L = Peer company levered beta; β_D = Peer company debt beta; $\frac{D}{E}$ = Debt to equity ratio of the peer company; t = Peer company tax rate.

Cost of debt

The cost of debt, rD, reflects the firm's ability to borrow funds on the debt market. This form of financing yields a positive impact on a firm's valuation, as it considers the benefits of interest payments on debt outstanding deductions from its taxable income (Fernández, 2010). This key detail is embedded into the WACC computation, therefore allowing the DCF valuation to contemplate such tax benefits since the FCFF term computation only reflects the cash available to both debt and equity holders before any interest and principal repayments are made.

$$rD = rf + \beta_D * MRP \qquad (12)$$

Where: β_D = Peer company debt beta; r*D*= Cost of debt; r*f* = Risk-free rate; CRP = Country risk premium; MRP = Market risk premium.

Fernandez (2010) points out that the value of tax shields (VTS) computation approach varies according to the firm's debt policy, as backed by the different approaches offered by literature. Authors Modigliani and Miller (1963), Myers (1974), Luehrman (1997), Brealey and Myers (2000) and Damodaran (2006) propose this savings to be discounted at the cost of debt (rD), resulting in a higher VTS due to the assumed reinvestment at the relatively lower cost of debt. Harris and Pringle (1985) and Ruback (1995, 2002) propose discounting at the unlevered cost of capital of the unlevered firm (rU), which leads to a lower VTS as the benefit is allocated to debt repurchase, reducing the firm's leverage and increasing its overall cost of capital. Milles and Ezzell (1985) take a hybrid approach, using rD for the first year and rU for the subsequent years, reflecting a potential gradual shift in capital structure over time.

$$VTS = rD * (1 - t) \qquad (13)$$

Where: VTS = Value of tax shields; r*D* = Cost of debt; t = Corporate tax rate.

2.2.2 Relative Valuation (Multiples Approach)

Under the assumption that market valuation is the primary approach in practice, an asset value can be built on a similar asset value. Considering standardized prices, a relative valuation approach establishes a relationship between market value and financial metrics, such as earnings, book value or revenues using market multiples (Damodaran, 2006). Fernandez (2002b) divides the multiples into three groups based on a firm's capitalization, value, and growth references.

Relative valuation is commonly implemented through a comparables approach. Data points such as current and historical market prices on comparables and target companies allow the computation of industry averages and multivariate regression models to set up valuation multiples. Analysts are then provided with a swift process to estimate a target firm's market value relative to its financial performance metrics, especially in markets featuring a sufficient number of truly comparable firms. Still, the use of a multiples approach is highly debatable in literature. A key concern is its susceptibility to selection bias, primarily at the comparables group or peer group selection stage. Analysts can significantly influence the valuation outcome due to companies' differences in size, growth prospects and risk profiles, potentially over or underestimating the target company's value (Damodaran, 2012). Fernandez (2002-12) also points out high dispersion levels when a multiples approach is in place, leading to a less precise valuation. However, the author also acknowledges the benefits of using multiples to complement other, more formal forms of valuation, as this approach provides a comparison ground between the firm's valuation and its peers. Analysts can understand whether the primary valuation might be relatively undervalued or overvalued by comparing a company's multiple to the average or median multiple of similar companies.

Table 2 displays a selection of multiples under analysis in upcoming sections, which integrate a list of the most commonly used multiples according to Fernandez (2002b).

Multiples based on market value	Price to earnings ratio	$PER = \frac{EQV}{Net\ Income}$
	Price to Book Value	$PER = \frac{EQV}{Equity\ Book\ Value}$
Multiples based on enterprise value	Enterprise value to EBITDA	$EV/EBITDA = \frac{EV}{EBITDA}$
	Enterprise value to revenues	$EV/Revenues = \frac{EV}{Revenues}$

Table 2 - Common multiples. Adapted from Fernandez (2002b).

3. Market Overview

3.1 Macroeconomic analysis

Understanding Porsche AG's carve-out from Volkswagen AG requires a clear identification of the surrounding market and economic context in which the transaction occurred.

Several world events impacted the economic and financial landscape preceding the carve-out. As the recovery from the COVID-19 pandemic began, many related disruptions persisted, including significant supply-chain vulnerabilities, changes in consumer behavior, labor market changes, and inflationary pressure.

These challenges were further exacerbated in early 2022 by the disruption of the energy markets following the Russia-Ukraine conflict and the resultant sanctions imposed by Western countries. The oil and gas prices surge affected production, operational, and supply-chain costs across industries, laying the ground for a general price increase for products and services. Below is a CPI graph with monthly CPI for Europe, the United States, China, and the World (From Jan 2018 to August 2022) and Forecasts.

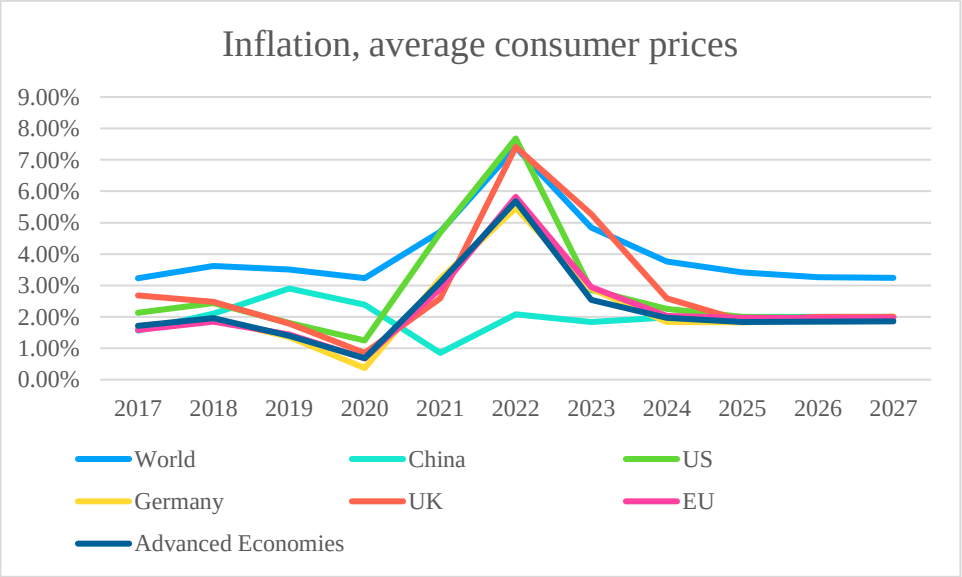

Figure 1 – Inflation International Monetary Fund, World Economic Outlook Database, April 2022.

As central banks seek to combat and stabilize rising inflation, tightening monetary policy is expected. This will impact borrowing costs for consumers and businesses and potentially lead to slower economic growth, as shown in figures 2 and 3 displayed below.

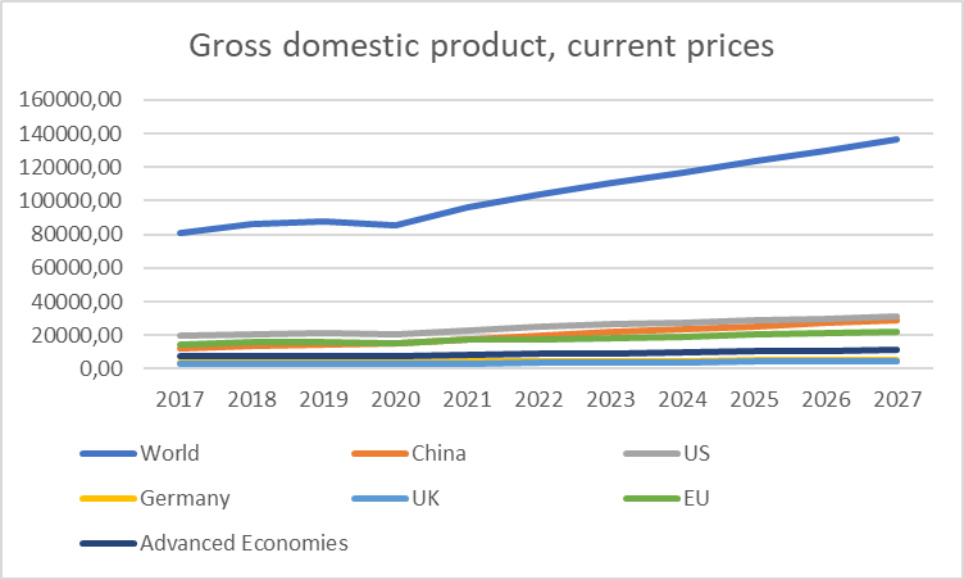

Figure 2 - GDP current prices - International Monetary Fund, World Economic Outlook Database, April 2022.

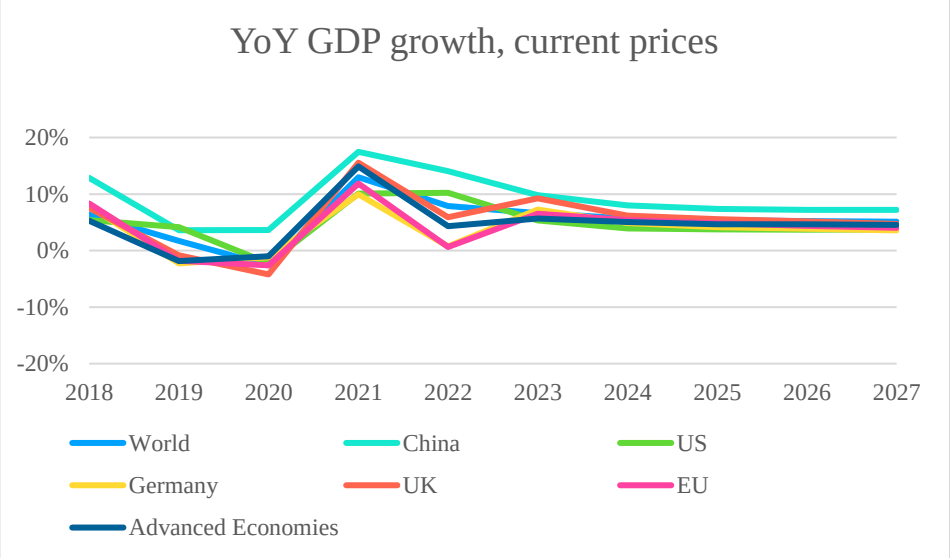

Figure 3 - YoY GDP growth - International Monetary Fund, World Economic Outlook Database, April 2022.

These factors will undoubtedly shape the future of the automotive industry, including Porsche AG and the Volkswagen Group.

3.2 Automotive industry overview

The automotive industry is undergoing a revolution across its value chain, powered by critical trends such as technology advancements, electrification, regulatory changes, and evolving consumer preferences.

Regulators look forward to the generalized adoption of more environmentally conscious mobility solutions, with the European Parliament voting for all zero-emission car sales by 2035 (Posaner, 2022). Furthermore, several countries have been investing in programs that subsidize the purchase of Electric Vehicles by consumers and corporations and the growth of battery electric vehicle (BEV) manufacturers. With lower assembling complexities, it is now possible for BEV brands to enter a market dominated by heritage manufacturers, taking advantage of a more technologically driven approach.

While electric vehicles are a significant focus in the mobility revolution, synthetic fuels offer a promising alternative. International automotive and energy companies are developing carbon-neutral synthetic fuels, as exemplified by Porsche's involvement in such projects. For consumers in emerging markets, low-income communities, or those with limited access to charging infrastructure, synthetic fuels could be a greener option than traditional gasoline. Additionally, this solution could benefit auto enthusiasts who wish to maintain and use their classic automobiles. Hydrogen engine technologies are also being developed, with some industry players already providing clients with hydrogen powered automobiles.

Established automakers now face a dilemma: focus on EV production, catch up with new and agile competitors, or carefully achieve a balance between EVs and internal combustion engine (ICE) models in their lineup. New brands and manufacturers fluoresce at a higher pace than ever, leading to a competitive and highly fragmented market as the barriers to new entrants are lowering. Fueled by the government's heavy subsidizing policies, leading Chinese manufacturers are taking the next natural step of expanding their more cost-effective products to more established markets like the US and Europe.

In the US, Tesla's disruptive sales and marketing strategies make established automotive brands rethink their strategies, especially regarding their online channels. The automotive market fragmentation may even go beyond new BEVs' pure plays. Competition is expected to intensify as tech giants like Google, Microsoft, Sony and Apple reportedly work on their own EV market entrance (Stevenson, 2021). Amazon's collaboration with Rivian Motors on electric vehicles for its logistics network exemplifies such technological convergence.

Legacy manufacturers increasingly adopt major corporate restructuring strategies to secure needed resources and infrastructure to remain competitive. A prime example is Groupe PSA and Fiat Chrysler Automobiles merging into Stellantis, one of the world's largest automakers, in 2021.

As in many other industries, technological advancements are at the forefront of the automotive sector transformation. Manufacturers actively push to develop and integrate autonomous driving technology, connectivity solutions, and digitalization.

A McKinsey survey finds that executives behind autonomous vehicle projects expect technology adoption in the form of *robotaxis* and other driverless vehicles within the next ten years. Despite start-up executives' optimism about this integration timeline, there is a broad agreement that regulations pose the main bottleneck for implementation (Heineke et al., 2021).

Nowadays, vehicles are increasingly equipped with powerful onboard computers. These advanced systems enable the development of various features, including better infotainment systems with capabilities to seamlessly integrate the vehicle into the customer's smartphone ecosystem. Remote interaction solutions such as over-the-air car updates and diagnostics, car settings control, and tracking have also seen high implementation across the sector. These consumer-centric features transform the driving experience and play an increasingly important role in differentiating each manufacturer.

Powerful tools such as Augmented Reality (AR) and Virtual Reality (VR) can also provide automakers a path to differentiation. On the one hand, AR provides a more immersive environment for designing and conceiving vehicles, prototypes, and parts, as well as product testing. On the other hand, besides the areas mentioned before, VR technologies have been adopted to enhance marketing and sales strategies, such as virtual showrooms and customer service. Equally relevant technologies, such as artificial intelligence (AI), machine learning, blockchain, and mobility as a service system (MaaS), are being explored by Automakers, who anticipate significant developments and future integration.

4. Porsche AG Overview

4.1 Profile and history

Founded by Ferdinand Porsche, Anton Piëch, and Adolf Rosenberger, Dr. Ing. h.c. F. Porsche GmbH began in Stuttgart, Germany, on April 25, 1931, focusing on technical projects for other automakers, including Volkswagen and Zündap. Seventeen years later, in 1948, and with Ferdinand's son Ferry at the helm, the company transitioned to Porsche-branded car production, launching its first model, the Porsche Type 356. Since then, Porsche emerged as a powerhouse in the industry through an iconic vehicle design and performance, strong brand and product identity, and racing legacy, including 19 overall and 110 class wins at the prestigious 24 Hours of Le Mans (Landenberger, 2016).

Critical milestones in Porsche's journey as a high-performance, luxury vehicle manufacturer include the debuts of iconic models like the timeless 911 in the early 1960s, the Boxster in 1996, the Cayenne (the brand's first SUV) launched in 2002, and the Taycan, a model pioneering the brand's electric future, in 2019. Headquartered in Stuttgart-Zuffenhausen, the brand develops its production models in Weissach at the Porsche Research and Development Center. These go into production at its facilities in Zuffenhausen, Leipzig, and Volkswagen's group factory in Bratislava. Porsche boasts a vast sales network through over 900 dealerships in more than 120 countries. In line with the Porsche Destination concept, Porsche Centers are being transformed to create more modern and customer-centric spaces (Porsche AG, 2022-7).

4.2 Business model

As a McKinsey report suggests, the car market can be divided into luxury and non-luxury automobiles. The luxury segment, divided into four tiers, consists of cars with manufacturing retail prices above 80,000 dollars, accounting for 2 to 3 percent of the market share. Non-luxury cars, priced below 80,000 dollars, comprise 97 to 98 percent of the market. (see graph below) The luxury segment, where Porsche strategically positions itself, expects higher margins paired with a favorable Compound Annual Growth Rate (CAGR) of 8 to 14 percent over the next decade. This growth is driven by previously discussed Macroeconomic and Industry trends, along with the rising ultra-high-net-worth individuals (UHNWI), with more than 30 million dollars in assets and high-net-worth individuals (HNWI), people with 1 to 30 million dollars in assets, a trend particularly evident in the Asia Pacific and middle east regions, as highlighted by Knight Frank, which forecasts from 2021 to 2026, a worldwide increase of UHNWI and HNWI, of 28.4% and 52.3% respectively (Guan et al., 2022; Knight Frank Research, 2022)

Living up to its vision as “The brand for those who follow their dreams”, Porsche proposes a distinguished product line that seamlessly blends heritage, performance, innovation, and luxury. This compelling vision aligns perfectly with the brand strategy of broadening its customer base, targeting Millennials, Gen Z individuals, and women, demographics expected to see a significant rise in high-net-worth and ultra-high-net-worth individuals (Porsche AG, 2022-7; Porsche AG, 2022-10).

Luxury car buyers expect not only superior quality, design, and performance but also a seamless integration of technology. As digital literacy becomes increasingly widespread among target demographics, integrating the most up-to-date tech features has become a buying factor in the luxury car market. This trend is evident in a McKinsey survey on the Chinese market, which highlights a growing appetite for technology-driven features such as powertrain modes, digital interactions and interfaces, connectivity, and autonomous driver-assistance systems. Taking advantage of considerably higher barriers to entry compared to the mass market, luxury segment traditional manufacturers must address these demands to ensure long-term competitiveness (Guan et al., 2022).

Recognizing a growing demand for a modern buying experience among luxury customers, Porsche delivers a seamlessly integrated digital sales solution. This approach guides customers through their purchasing journey and empowers authorized dealerships with customer-centric tools to complete the sale. Following the successful purchase of one of its models, Porsche owners gain access to the “My Porsche” ecosystem, offering tailored features and services that enhance their ownership experience (Porsche AG, 2022-7).

4.2.1 Products and services portfolio

Porsche, a leader in the luxury automotive market, is constantly enhancing its value proposition with a portfolio that meets and exceeds customer expectations. Porsche’s automotive division focuses on the segments of sports cars, sports limousines, and sport utility vehicles (SUVs), generating an average of 91% of its revenue. The financial division accounts for the remaining 9% (Porsche AG, 2022-7).

Sports cars

For almost 60 years, the iconic Porsche 911 has been produced out of Zuffenhausen facilities. In 2021, it surpassed a million units sold and achieved record deliveries. The model currently contributes to about 13 percent of the brand’s revenue. As an ICE-only model, Porsche is considering a 911 hybrid version in the medium term. This sports car targets performance-oriented customers who want luxury and exclusivity, as it is one of the brand’s most customizable products.

Introduced in 1995 and targeting a younger audience, the Porsche 718 allows a more affordable entry point to its sports car segment. Available as the Cayman (coupe) and the Boxster (cabriolet), roughly 7 percent of Porsche's revenue derives from the model sales. Porsche plans to produce a BEV version of the 718 in Zuffenhausen in the medium term. In contrast the current production of the ICE version will be moved to a Volkswagen facility in Osnabrück, Germany.

Sports limousines

In 2008, Porsche bridged the gap between performance and luxury with the Panamera, targeting customers who seek comfort and convenience without sacrificing the brand's spirit. Produced in Leipzig, Germany, the Panamera currently contributes around 10 percent of Porsche's annual revenue.

Appealing to Porsche enthusiasts who seek an electric alternative in line with the brand's DNA, the Taycan debuted in 2019, unleashing a high level of interest and capturing 60 percent of first-time Porsche buyers. Produced in Zuffenhausen, the Taycan is available in the four-door sport limousine, Cross Turismo, and Sport Turismo variants, leading the charge in Porsche's electrification plans.

Sport utility vehicles (SUV)

Porsche's debut in the SUV segment began in 2002 by introducing the Cayenne, a model targeting families and utility vehicles enthusiasts. Now in its third generation and with a Sports Coupe variant, the Cayenne combines versatility, luxury, and high performance. Produced primarily at Volkswagen's Bratislava facility and with a third party also assembling some of the units in Malaysia since May 2022, the Cayenne is one of Porsche's best-selling models, making up over 30% of the brand annual revenue.

Capitalizing on the success of the SUV segment, Porsche debuted the Macan in 2014. This more compact and practical model targets SUV customers seeking a more accessible entry point into the Porsche world. The model has lived up to expectations, consistently ranking alongside the Cayenne as Porsche's best-selling model, further solidifying the segment within the brand's portfolio. Manufactured at the Leipzig facilities, the Macan accounts for over 30% of Porsche's annual revenue and will see a BEV version added to its lineup in 2024.

Porsche Exclusive Manufaktur

While Porsche's delivery volume aligns more with the one observed in the premium segment, its exclusivity and prestige are closer to the luxury segment. Limited editions help the brand maintain its status, with each model allowing more room for increased profit generation. Porsche Classic sets the brand apart by providing customers with parts and tools for historical models.

Porsche Exclusive Manufaktur allows a higher level of customization on all the models in the current lineup, generating close to 750 million Euros in revenue. Finally, Porsche's development of Supercars and Hypercars, limited-production street-legal sports cars offering racetrack-inspired performance to select customers, solidified the brand's position in the luxury automotive industry.

Porsche Motorsport division

Throughout its almost 75-year history, Porsche has been driven by its unmatched success on racetracks worldwide. Porsche Motorsports division provides the structure for such success, developing high-performance race vehicles and powertrains for various global competitions. The division integrates Porsche's racing projects and supports other customer racing teams, earning an average of 200,000 Euros in revenue for each race car sold.

Racing has historically served as the proving ground for new technologies before its integration into road-legal vehicles. Porsche Motorsport is actively involved in sustainability-based research projects, developing high-performance electric vehicles and exploring alternative fuels under extreme racing conditions. One alternative fuel being tested by Porsche Motorsport is a synthetic fuel called e-fuel, currently under development in Chile by a Porsche-led consortium. The process combines hydrogen extracted from water through electrolysis and carbon dioxide captured from the air. A fuel compatible with internal combustion engines and a net-zero carbon footprint is created. While some emissions occur during combustion, these are significantly lower than conventional fuels. The project targets an initial annual production of around 130,000 liters, with plans to scale up to 550,000 liters.

Financial services division

Porsche Financial Services supports the automotive division by offering financial products for Porsche customers, including retail and wholesale leasing and financing, insurance, service contracts, and mobility services. The division contributed 10% of the company's revenue and generated an operating profit of 313 million Euros in the preceding year.

Other ventures and participation

Beyond its core business of manufacturing luxury cars, Porsche leverages its heritage and prestige to explore a variety of business industries through its subsidiaries.

- Porsche Consulting offers strategic consulting to various external clients. Currently tackles topics such as sustainability, artificial intelligence, and change management.
- Porsche Digital focuses on creating digital products and services, which are then implemented by Porsche's automotive division and other in-house divisions.
- MHP serves clients in IT consulting services focused on manufacturing and mobility ndustries.

- Merchandising and brand licensing, encompassing Studio F. A. Porsche, Porsche Lifestyle, and Porsche Design brands are provided by Porsche Lifestyle Group.
- Porsche Engineering provides engineering services to customers across a wide range of industries, including vehicle and technological development and other related supporting services.
- This diversification allows Porsche to expand its reach and influence beyond the automotive industry.

In addition to its subsidiary activities, Porsche actively pursues strategic investments involving participation in ventures, partnerships, and joint ventures in core and non-core related projects. Porsche Ventures, its venture capital arm, provides the structure for early-stage investments.

4.2.2 Competitive Landscape

Porsche occupies a unique place within the automotive industry. Its product portfolio straddles both the luxury and premium segment. The 911 and other limited-edition Supercars and Hypercars position Porsche in the luxury segment, characterized by lower sales volume and higher margins, competing with brands like Aston Martin, Bentley, Ferrari, Lamborghini, Maserati, and McLaren. The Cayenne, Macan, Taycan, 718, and Panamera are placed at the higher end of the premium segment, where Porsche rivals Audi, BMW, Mercedes-Benz, Tesla, and Volvo Cars (Porsche AG, 2022-10).

5. Porsche AG Equity Carve-out

5.1 Pre-carve-out

Paving the way for such a strategy, Porsche AG underwent a capital increase in August 2022, resulting in a total of 911,000,000 Porsche AG shares held at a no-par value of 1 euro. Shares were divided into 455,500,000 ordinary shares and 455,500,000 non-voting preferred shares (Porsche AG, 2022-7).

For the Initial Public Offering, only preferred shares were part of the offering to the public markets. Of the non-voting preferred shares, approximately 21.74 percent were offered as Base Shares and 3.26 percent as Over-Allotment Shares (Porsche AG, 2022-7).

Additionally, on September 18, 2022, a share purchase agreement was entered between Volkswagen AG (through Porsche GmbH) and Porsche SE. This agreement consisted of selling 25 percent of the ordinary shares plus one ordinary share to Porsche SE at the established offer price per share plus a 7.5% premium (Porsche AG, 2022-7).

5.2 Carve-out execution

On September 29, 2022, with an offer price per share of 82.50 Euros established the day before, the initial public offering of Porsche AG shares was successfully executed on the Frankfurt Stock Exchange. This operation marked Porsche AG's equity carve-out, with Volkswagen AG retaining 75.4 percent minus one ordinary share, with the remaining shareholding held by Porsche SE (12.5 percent plus one ordinary share) and institutional and private investors (12.1 percent). The offering placed Porsche's IPO as the largest to have in Europe, achieving a market capitalization of around 78 billion Euros.

Figure 4 next, provides Porsche's shareholding structure before and after the equity carve-out operation.

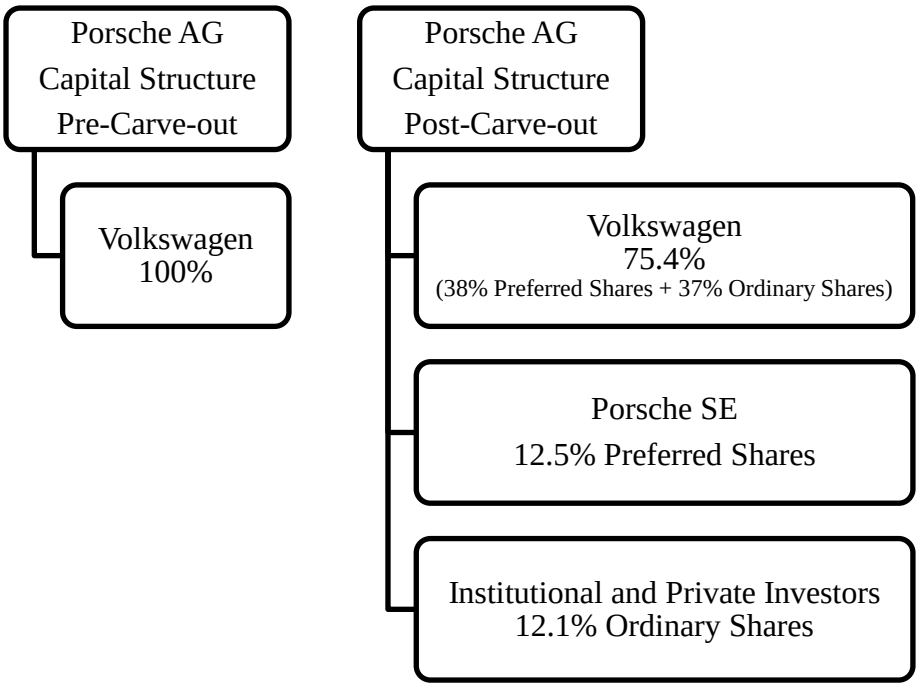

Figure 4 - Direct shareholding in Porsche AG - Adaptation from Porsche Prospectus.

5.3 Carve-out Motivations

According to the IPO prospectus dated September 19, 2022, the motivation behind the Equity Carve-out procedure was to provide Porsche AG with direct access to the capital markets while unlocking the company's intrinsic value. The selling shareholder, Volkswagen AG, the sole owner of Porsche AG's share capital, would retain the operation's net proceeds through Porsche Holding Stuttgart GmbH (Porsche GmbH).

In a speech at Volkswagen AG's extraordinary general meeting held on December 16, 2022, the firm's CFO and COO, Arno Antlitz, further elaborated on the rationale behind the Equity Carve-out decision for Porsche AG. The goal was to unlock value, providing greater independence and agility to the company while benefiting from group synergies. The net proceeds of the operation will be channeled towards strategic investments in crucial areas for Volkswagen Group, such as battery supplies and software-based services, with autonomous driving technologies being an example. These developments will then be essential for the strategic positioning of both Porsche AG and the Volkswagen group within the automotive industry's future (Antlitz, 2022).

6. Porsche AG Valuation

As discussed, Porsche AG entered the Frankfurt Stock Exchange on September 29, 2022, through an IPO with an offer price of 82.50 Euros per share, the maximum limit of the price range placed between 76.50 Euros and 82.50 Euros presented by the IPO prospectus. This initial offering price will serve as benchmark for developing a Porsche AG valuation at the time of the IPO. Valuation techniques such as discounted cash flow (DCF) and relative valuation approaches will be applied.

6.1 Discounted cash flow approach

Considering the aforementioned market overview and company profile, several fundamental assumptions lay the ground for developing an adequate valuation of Porsche AG as of September 29 (Financial statements and related tables available on Appendix A). The analysis's first step will be to value the company as of June 30, 2022, using the discounting cash flow approach. The second step is to capitalize this value at a cost of capital that incorporates any other relevant market data available on the day before publishing the IPO prospectus, September 13, 2022, to achieve a valuation as of September 29, 2022, the date of the IPO.

The IPO prospectus presents the company's financial statements for the first semester of 2021 and 2022, offering a glimpse into its recent financial performance. This data will provide a starting point for the analysis, with 2022 yearly financials estimated based on a direct comparison of both periods. (Please consult Appendix A.2 for Porsche AG simplified first semester financial statements – 2021 and 2022)

6.1.1 Assumptions Income statement items

Revenue

Revenue considers a compound annual growth rate (CAGR) of 8.45 percent for the 2022-2026 period, which is estimated by the year-on-year growth observed from the 1st semester of 2021 to the 1st semester of 2022 and further supported by the following factors:

- Historical performance: Porsche achieved an 8.97 percent CAGR for 2017-2021. Furthermore, when comparing results from the first semester of 2021 and 2022, a growth rate of 8.45 percent is observed, further supporting the possibility for consistent future growth. (Consult Appendix A.1 for further details).

- Luxury market growth: Such assumptions are solidified by McKinsey's forecasts of a CAGR of 8 to 10 percent on the relevant operational segments for Porsche, from 2021 to 2031. The consulting firm also highlights the increasing number of HNWI and UHNWI as a main growth

driver. Knight Frank estimates respectively a 9 percent and 5 percent CAGR for 2021-2026 (Guan et al., 2022; Knight Frank Research, 2022).

The terminal growth rate of 2.5 percent, detailed in a further section, is used to estimate the revenue for the year 2027 in per the DCF approach.

Earnings before interest and taxes

According to McKinsey, the luxury automotive industry saw its earnings before taxes and interest (EBIT) margins grow from 2016 to 2021. This trend should be observed in the following years, with 21 to 25 percent margins expected across the sector. Over the same period, Porsche achieved operational margin growth of 6.4 percent (CAGR), averaging 16.1 percent of sales. The brand is committed to further improving this metric through luxury pricing, BEV platform scalability, leveraging partnerships, and engaging in profit improvement programs. Results from the first semester of 2022 already reflect this commitment, with the EBIT margin growing from 16.90 to 19.42 percent despite increasing geopolitical tensions, especially with the outbreak of the Russia-Ukraine conflict in February 2022. It is assumed that a 19.42 percent EBIT margin will prevail through 2022, leading to a 6-year (2017-2022) CAGR of approximately 2.16 percent. A path towards increased profitability should be trailed as Porsche intends to continue narrowing the gap to other luxury segment players like Ferrari (2021 EBIT Margin of about 25.2 percent). Therefore, a yearly growth rate of 2.16 percent is assumed, placing Porsche's operational profitability above 20 percent by 2027.

Income tax

Income tax is projected as a percentage of EBIT. For the year 2022, an income tax of 33.99 percent of EBIT is assumed, in accordance with the consolidated income statement for the first six months of that year. From 2023 onwards, the income tax as a percentage of EBIT is forecasted to be 32.23 percent. This reflects the average income tax as a percentage of EBIT from 2018 to 2022.

Earnings before interest and after taxes (EBIAT)

The following table presents the previously mentioned income statement items of this DCF analysis and the respective earnings before interest and after taxes (EBIAT), computed by subtracting income tax from the EBIT.

Income Statement Items	2017	2018	2019	2020	2021	2022E	2023F	2024F	2025F	2026F	2027F
Revenue	**23500**	**25784**	**28518**	**28695**	**33138**	**35939**	**38978**	**42273**	**45847**	**49722**	**50965**
EBIT	**4 100**	**4 289**	**3 862**	**4 177**	**5 314**	**6 979**	**7 732**	**8 567**	**9 493**	**10 518**	**11 014**
% of Revenue	17.45%	16.63%	13.54%	14.56%	16.04%	19.42%	19.84%	20.27%	20.71%	21.15%	21.61%
Income Tax		**1 434**	**1 253**	**1 231**	**1 691**	**2 372**	**2 492**	**2 762**	**3 060**	**3 390**	**3 550**
% of EBIT		33.43%	32.44%	29.47%	31.82%	33.99%	32.23%	32.23%	32.23%	32.23%	32.23%
EBIAT						**4 606.2**	**5 239.9**	**5 805.8**	**6 432.8**	**7 127.6**	**7 463.8**

Table 3 - Income statement items - Porsche IPO Prospectus and own estimates (M€).

6.1.2 Assumptions Cash flow items

Net CapEx

Walking through Porsche cash flow items, presented in table 3 below, Net CapEx is computed by applying the Rappaport Method where fixed assets growth is linked to revenue growth, as discussed in an earlier section. Each year's fixed assets are estimated to be equal to revenue times the average Fixed assets as a percentage of revenue from the 2018 to 2021 period, which is 68.19 percent.

Changes in Working Capital

Changes in working capital are computed similarly to Net CapEx. Forecasted working capital for each year is estimated to be equal to revenue times the average working capital as a percentage of revenue from the 2018 to 2021 period, which is 11.41 percent.

Cash Flow Items	2018	2019	2020	2021	2022E	2023F	2024F	2025F	2026F	2027F
Fixed/revenues	17289	19379	20160	22368	24507	26579	28826	31263	33906	34754
Net Capex					**2 139**	**2 072**	**2 247**	**2 437**	**2 643**	**848**
% of Revenues					68.19%	68.19%	68.19%	68.19%	68.19%	68.19%
NWC	2151	3043	3933	4285	4 102	4 448	4 824	5 232	5 675	5 816
Change in NWC		**892.0**	**890.0**	**352**	**(183)**	**347**	**376**	**408**	**442**	**142**
% of Revenues					11.41%	11.41%	11.41%	11.41%	11.41%	11.41%

Table 4 - Cash flow items - Porsche IPO Prospectus and own estimates (M€).

6.1.3 Assumptions Rates

Weighted average cost of capital (WACC)

Risk-free rate, rf

In Europe, the 10-year German Eurobond is often considered the benchmark for the risk-free rate. Its high liquidity and low credit risk compared to other European countries provide a reliable reference point for the expected return on a risk-free investment, a key element in pursuing CAPM computations (Koller et al., 2020).

To calculate WACC and cost of equity rates, the following yields were observed on the 10-year German Eurobond, serving as the benchmark for the risk-free rate:

- Bund 10-YR (DE10Y) – June 30, 2022 = 1.36%

- Bund 10-YR (DE10Y) – September 13, 2022 = 1.75%

Levered Beta

Porsche AG is an unlisted firm, which prevents an estimate of its beta using historical stock regression against the market. It is then key to employ a bottom-up approach to calculate Porsche AG's levered beta for each cost of equity calculation. This process involves the selection of an appropriate levered beta benchmark, which, in this case, will be estimated through a peer group average. The peer group comprises automakers Aston Martin, BMW, Ferrari, Mercedes-Benz, Tesla, Volkswagen, Volvo.

After calculating the unlevered betas for each peer group member, as of June 30, 2022, and September 13, 2022, the peer group average will yield the two unlevered betas necessary to pursue the necessary computations.

Peer - 1y @30/06	βL	D/E	t	βu
AML	1.948	2.114	0.190	0.718
BMW	1.099	1.114	0.225	0.590
MBG	1.155	1.283	0.297	0.607
RACE	1.085	1.189	0.200	0.556
TSLA	1.735	0.281	0.083	1.380
VOLV	1.126	0.343	0.242	0.894
VOW	1.322	1.255	0.239	0.676
Average = Porsche AG βu				**0.774**

Table 5 - Peer group unlevered beta calculations - $AML, $BMW, $MBG, $RACE, $TSLA, $VOLV, $VOW 2021 Annual reports and Bloomberg Terminal (June 30, 2022).

Peer - 1y @13/09	βL	D/E	t	βu
AML	1.921	2.114	0.190	0.708
BMW	1.096	1.114	0.225	0.588
MBG	1.199	1.283	0.297	0.630
RACE	1.074	1.189	0.200	0.550
TSLA	2.191	0.281	0.083	1.742
VOLV	1.115	0.343	0.242	0.885
VOW	1.287	1.255	0.239	0.658
Average = Porsche AG βu				**0.823**

Table 6 - Peer group unlevered beta calculations - $AML, $BMW, $MBG, $RACE, $TSLA, $VOLV, $VOW 2021 Annual reports and Bloomberg Terminal (September 13, 2022).

Employing the unlevered beta benchmark on formula (11), the following levered betas for Porsche AG are yielded:

- β_L as of June 30, 2022 = 0.774
- β_L as of September 13, 2022 = 0.823

Debt Beta

When the risk-free rate is greater than the cost of debt, the company debt beta is assumed to be zero. This is the case for Porsche AG.

Market Risk Premium and Country Risk Premium

Headquartered in Stuttgart-Zuffenhausen, Germany, Porsche AG's cost of capital must consider the additional return investors require to compensate for the risks associated with investing in Porsche AG. Such risks will be accounted for by introducing Germany's market risk premium (MRP) of 6.01 percent to a country risk premium (CRP) of 0.98 percent. Both are estimated by consulting Aswath Damodaran's 2022 mid-year update data. In the case of the country risk premium, each country or region where Porsche AG operates is weighted according to 2021 deliveries figures made available through a company presentation in May 2022. A more complete estimate of the risk associated with Porsche's operations in different countries is then factored in.

Terminal growth rate, g

The terminal growth rate is 2.5 percent, which is a factor in long-term annual inflation expectations and GDP growth.

WACC		Jun 30, 2022 - 2027	Sep 13 2022
Market Risk Premium		6.01%	6.01%
Risk-free rate, rf		1.36%	1.73%
Country Risk Premium		0.98%	0.98%
Cost of Debt, rD	rd < rf => rd=rf	1.36%	1.73%
Unlevered Beta, βu		0.77	0.82
Debt Beta		-	-
D/E Ratio		0.11	0.11
E/(D+E)		90.12%	90.12%
D/(D+E)		9.88%	9.88%
Corporate taxe rate		30.00%	30.00%
Levered Beta, βL		0.83	0.89
Cost of equity, rE		7.19%	**7.92%**
WACC		**6.57%**	7.25%
Growth Rate		**2.50%**	2.50%

Table 7 - WACC calculation – Bloomberg Terminal and own estimates.

6.1.4 Valuation results

Free cash flow to the firm

It is now possible to compute each year's free cash flow to the firm by subtracting both net capital expenditures and changes in net working capital from the estimated and forecasted

earnings before interest and after taxes (EBIAT). These cash flows are then individually discounted to their present value on June 30, 2022, considering a weighted average cost of capital (WACC) of 6.57 percent as the discount rate.

Terminal Value

The model assumes that Porsche AG's operations will reach maturity after 2027, and a perpetual stable growth rate of 2.5 percent is applied to estimate the free cash flows to the firm beyond that year. Using the appropriate formula mentioned before, the terminal value is calculated and then discounted to its present value on June 30, 2022, considering the WACC as the discount rate of 6.57 percent.

DCF	2022E	2023F	2024F	2025F	2026F	2027F	TV
Free Cash Flow	2 650	2 821	3 183	3 588	4 042	6 474	162 914
Present Value FCF	2 567	2 564	2 714	2 871	3 035	4 560	114 756

Table 8 - Free Cash Flow and Terminal Value - Own estimates (M€).

Enterprise Value, EV

Based on the sum of the present value of each year's free cash flow to the firm with the present value of the terminal value, Porsche AG's enterprise value is estimated to be approximately 133,066 million Euros.

Equity value on 29/09/2022

Porsche AG's equity value on June 30, 2022, is then uncovered by adding non-operating assets (Securities, cash, cash equivalents, and time deposits) and deducting debt (non-current liabilities, current financial liabilities, and other current financial liabilities). As this valuation aims at unveiling Porsche AG equity value on the date of its IPO, September 29, 2022, the value before mentioned is then capitalized at the estimated cost of equity capital on September 13 (7.92 percent), therefore unveiling Porsche's AG equity value, at the time of the offer, of 120,929 million Euros, translating to a price of 132.74 Euros for each of the 911 million shares.

The DCF valuation suggests underpricing,

When comparing our DCF estimate and the price at which Porsche AG shares were issued (82.50 Euros per preferred share), a discount of 37.85 percent is proposed. This wide valuation gap can be attributed to the usual level of underpricing associated with equity carve-outs, as well as factors such as high uncertainty in the markets at the time due to low deal activity, rising interest rates, and high inflation expectations, that cannot be fully incorporated into the valuation. It is concluded that the stakeholders behind the IPO valued the firm according to a more conservative approach.

Porsche AG	
Enterprise value, EV	133 066
Cash	5872
Debt	20260
Equity value, EQV as of Jun 30, 2022	118 678
Equity value, EQV as of Sep 29, 2022	120 929
# shares	911
Suggested share price (Sep 29, 2022)	132.74

Table 9 - Suggested share price on September 29, 2022 = 132.74 Euros per preferred share - Porsche IPO Prospectus and own estimates (M€).

6.2 Relative Valuation

6.2.1 Multiples

To complement the discounted cash flow analysis, a proper relative valuation is produced by employing the following multiples: price-to-book ratio, price-to-earnings ratio, enterprise value to EBITDA, and enterprise value to revenues. These multiples were then obtained through the consultation of the Bloomberg Terminal, following the data available as of the end of the year of 2021 and for a selection of peer companies.

Peer group selection and results

As previously mentioned, Porsche identifies the following automakers as its competition: The luxury segment - Aston Martin, Bentley, Ferrari, Lamborghini, Maserati, and McLaren; The premium segment - Audi, BMW, Mercedes-Benz, Tesla, and Volvo Cars. These competitors will then serve as the starting point for developing an adequate peer group selection, restricted to listed firms. In addition, Volkswagen Group will be added to this selection, as it comprises competitors such as Bentley, Lamborghini, and Audi, as well as the sole shareholder of Porsche. Then, as per standard practice, outliers will be identified and, therefore, excluded under the following rules:

- Average and standard deviation are calculated for each multiple under analysis.

- On each multiple, an outlier is considered when the value is below the average minus one standard deviation and above the average plus one standard deviation.

- A peer with two or more outliers identified will be excluded from the peer group selection.

At this point, peer Tesla is excluded from the analysis, as it failed to meet the criteria for all the valuation multiples used. Peer Ferrari high values on multiples PER, PBV, and EV/Revenues could distort the valuation results, therefore being excluded. For the PER analysis, Aston Martin will not be considered, as the firm's negative net income hinders the computation of this ratio. All other peers under analysis are considered valid, as their ratios comply with the established criteria.

This procedure is then refined by considering only each equity value obtained for Porsche AG that is relatively close to the offer price of 82.50 Euros per share. As a result, EV/EBITDA and PBV multiples are excluded. Therefore, Porsche's relative valuation yields a price per share of 82.80 Euros.

Peer	PER	PBV	EV/EBITDA	EV/Revenues
AML	-	1.4	13.5	1.5
BMW	12.6	0.8	0.4	2.2
MBG	18.8	1.0	0.3	3.1
~~RACE~~	~~78.9~~	~~20.4~~	~~10.9~~	~~33.1~~
~~TSLA~~	~~954.4~~	~~30.5~~	~~21.3~~	~~155.9~~
VOLV	20.4	2.7	1.0	7.3
VOW	10.1	0.8	0.3	1.8
Average	**156.5**	**8.2**	**6.8**	**29.3**
Trimmed Average	**15.5**	**1.3**	**3.1**	**3.2**
Suggested Porsche AG share price (€)	**68.6**	**33.8**	**13.0**	**96.9**
Relative Valuation Porsche AG share price (€)				**82.8**

Table 10 – Suggested Relative Valuation of Porsche AG share price = 82.8 Euros per preferred share - Porsche IPO Prospectus and own estimates.

7. Stock Market Performance

As per the literature review, Equity Carve-out strategies may display abnormal stock returns for both the parent and subsidiary during the announcement period and long-term returns.

An analysis of the stock market performance of parent companies Porche SE and Volkswagen AG is made, as these listed firms hold indirect interests in the company before and after the Equity carve-out operation. The cumulative abnormal returns will be computed, taking as benchmark the DAX Index, a performance tracker of the forty largest companies trading on the Frankfurt Stock Exchange.

Cumulative average abnormal returns (CAAR)

The cumulative average abnormal returns formula can be decomposed below:

$$CAAR = \sum_{t=T_1}^{T_2} AAR_t \qquad (14)$$

$$AAR_t = R_t - E(R_t) \qquad (15)$$

Where: AAR_t = Average abnormal returns; R_t = Return of a stock on day t; Where: $E(R_t)$ = Expected return for stock on day t

Historical prices for the companies and benchmark under analysis, extracted from the Bloomberg Terminal, for September 2022 and one year starting on the date of Porsche AG's initial public offering, which helps compute daily returns through the logarithmic actual return formula:

$$R_t = \ln\left(\frac{P_t - D_t}{P_{t-1}}\right) \qquad (16)$$

Where: R_t = Return of a stock on day t; P_t = Share price on day t; r*f* - Expected return of the market; D_t = Dividend issued by the firm

Expected return – $E(R_t)$ – for each stock is computed through the CAPM model, with the risk-free rate observed on the 1-year Beta of the stock as of September 28, 2022, and following the formula:

$$E(R_t) = r_f + \beta\left(r_m - r_f\right) \qquad (17)$$

$$R_m = \ln\left(\frac{P_t}{P_{t-1}}\right) \qquad (18)$$

Where: $E(R_t)$ = Expected return for stock on day t; P_t = Share price on day t; r*f* - Expected return of the market; β = Beta of the stock

7.1 Carve-out announcement returns

Across the literature, the author's definition of the announcement period is varied. For example, Schipper and Smith (1986) analyze 85 days, while Vijh (2002) pursues the analysis of a shorter period of 11 days, reflecting a high degree of independence from each author regarding the definition of the period under analysis. Therefore, for the context of this study, announcement returns will be referred to as the cumulative abnormal returns measured during 22 consecutive trading days, including the day of the Equity Carve-out announcement. The period in study is the one shown on the timeline below.

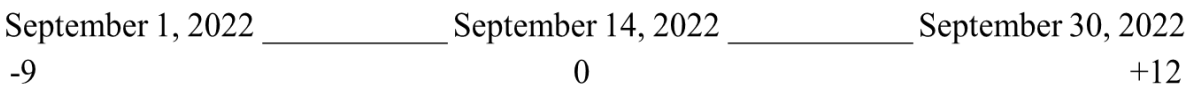

Figure 5 - Equity carve-out announcement period under analysis.

Considering historical 1-year adjusted betas as of August 31, 2022, of 1.251 and 1.285 for Volkswagen AG and Porsche SE, respectively, and a risk-free rate of 1.53 percent based on the 10-year German Eurobond yield on that same date, it is possible to examine the cumulative abnormal returns (CAR) of both parent companies of Porsche AG

Interestingly, the analysis reveals a similar cumulative abnormal return for Volkswagen AG and Porsche SE of approximately -0.03, yielding a cumulative average abnormal return (CAAR) of -0.03. According to expectations from the literature, such negative abnormal returns reflect a negative stock price reaction to the announcement of Porsche AG carve-out, therefore mirroring the market's expectation for a future reacquisition of the subsidiary.

rf = 1.53%	Volkswagen AG	Porsche SE
Ticker	VOW	PSE
Index Benchmark	DAX	DAX
β	1.251	1.285
CAAR	**-0.03**	**-0.03**
Announcement Period CAAR		**-0.03**

Table 11 – Volkswagen AG and Porsche SE Announcement cumulative average abnormal returns (CAAR) - Bloomberg Terminal. $DAX as benchmark. Sample available on Appendix B.

7.2 Carve-out execution performance

On September 29, 2022, Porsche entered the market at 82.50 Euros per share and closed that same day at 82.52 Euros, reflecting an insignificant first-day gain of 0.0242 percent (0.02 Euros). Meanwhile, both parent companies observed losses of 4.57 percent and 3.84 percent for Volkswagen AG and Porsche SE, respectively.

7.3 After Carve-out 1-year returns

Following a successful initial public offering and therefore a successful equity carve-out of Porsche AG from Volkswagen AG, this analysis aims to verify if the newly issued stock performance aligns with expectations from the literature. Vijh (1999) suggests that the subsidiary stock performance at least meets or outperforms its benchmark in the first three years. Both parent firms' performances will also be studied to understand the impact of this transaction on their market value.

This analysis examines the cumulative abnormal returns of Porsche AG, Volkswagen AG, and Porsche SE during the first year of trading for Porsche AG, which encompasses 258 trading days. Using historical 1-year adjusted betas as of September 29, 2023, of 1.015 for Porsche AG, 1.124 for Volkswagen AG, and 1.113 for Porsche SE. The risk-free rate is 2.838 percent, reflecting the 10-year German Eurobond yield on that date. A positive CAR of 0.93 for Porsche AG is revealed, which aligns with the literature expectations and shows that the stock outperformed the DAX index for the period. It is important to note that both Volkswagen AG and Porsche SE exhibit positive CAR of 8.45 and 7.73, respectively, contributing towards a CAAR for the three stocks of 5.70. These results indicate a strong possibility for long-term value creation for shareholder investing in both subsidiary and parent entities and aligns with the expectation of positive returns for the first three years.

rf = 1.53%	Porsche AG	Volkswagen AG	Porsche SE
Ticker	P911	VOW	PSE
Index Benchmark	DAX	DAX	DAX
β	1.015	1.124	1.113
CAAR	**0.93**	**8.45**	**7.73**
Post Carve-out Parent firms CAAR			**5.70**

Table 12 - Porsche AG, Volkswagen AG and Porsche SE cumulative average abnormal returns (CAAR) - Bloomberg Terminal. $DAX as benchmark.

8. Conclusion

This dissertation provides a detailed analysis of Porsche AG's equity carve-out and compares the strategic and financial motivations surrounding the transaction with prior research expectations.

Porsche AG's equity carve-out was successfully completed after its IPO on September 29, 2022, as Volkswagen AG divested a portion of its stake while retaining significant ownership. The operation provided the subsidiary with operational independence and direct access to the capital markets while still benefiting from synergies within the Volkswagen group. This unlocked Porsche AG's intrinsic value, with Volkswagen strategically investing the proceeds in developing battery technology and autonomous driving. This strategy ultimately aims to future-proof the group against the rapidly evolving automotive landscape.

Supporting the findings from the literature, the valuation methodologies carried out for Porsche AG suggest a potential underpricing commonly associated with IPOs and equity carve-outs. The significant discount between the offering price of 82.50 Euros per share and the discounted cash flow estimate of 132.74 Euros per share may be linked to high market uncertainty, low deal activity, and the challenging economic environment with rising interest rates and high inflation, factors that are difficult to fully capture in this valuation methods. Additionally, the stakeholders behind the Porsche AG IPO might have adopted a conservative approach due to these same factors. The relative valuation estimated a price per share of 82.8 Euros, a value closer to the offering price.

The analysis of stock market performance yielded mixed results. The announcement period returns, with a cumulative abnormal return of approximately -0.03 for both parent companies (Volkswagen AG and Porsche SE), may reveal the market's expectation for Porsche AG reacquisition. The long-term performance was positive, with all three entities exhibiting positive cumulative abnormal returns of 0.93, 8.45, and 7.73 for Porsche AG, Volkswagen AG, and Porsche SE, respectively, for the 1-year period after the carve-out. A cumulative average abnormal return for these three stocks of 5.70, indicating a favorable long-term impact of the equity carve-out strategy on the stock performance of both the subsidiary and parent entities, in line with the literature.

To conclude, the successful execution of Porsche AG's equity carve-out highlights the distinct tool set that this sometimes-overlooked strategy can provide to managers. A more recurrent application of carve-out strategies by managers should be dependent on an appropriate update of existing literature. This would support and clarify the intricacies of equity carve-outs.

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10. Appendix

Income Statement	2017	2018	2019	2020	2021
Revenue	23500	25 784	28 518	28 695	33 138
Cost of Sales		18 629	21 256	21 598	24 281
Gross Profit		**7 155**	**7 262**	**7 097**	**8 857**
Operating Expenses		3 679	4 246	3 873	4 622
Other Operating Income		813	846	953	1 079
EBIT	**4100**	**4 289**	**3 862**	**4 177**	**5 314**
Financial Result		(263)	(192)	(220)	(415)
EBT		**4 552**	**4 054**	**4 397**	**5 729**
Income Tax		1 434	1 253	1 231	1 691
Net Income		**3 118**	**2 801**	**3 166**	**4 038**
Net Profit Margin		12.09%	9.82%	11.03%	12.19%

Table 13 - Appendix A.1: Results 1st semester 2021 and 2022 – Porsche IPO Prospectus.

Income Statement S1	2021	2022	Change (%)
Revenue	16 525	17 922	8.45%
Cost of Sales	12 036	12 869	6.92%
EBITDA	**4 489**	**5 053**	**12.56%**
Gross Margin	27.16%	28.19%	
EBIT	**2 792**	**3 480**	**24.64%**
Operational Margin	16.90%	19.42%	
Income Tax Expense	**846**	**1 183**	**39.83%**
As % of EBIT	30.30%	33.99%	
Net Income	**2 113**	**2 505**	**18.55%**
Net Profit Margin	12.79%	13.98%	9.31%

Table 14 - Appendix A.2: Results 1st semester 2021 and 2022 – Porsche IPO Prospectus.

Balance Sheet - Assets	2018	2019	2020	2021
Intangible assets	4 929	5 085	5 437	6 190
Property, plant & equip	6 928	8 624	8 695	8 763
Leased assets	3 776	3 829	3 614	3 954
Equity-accounted investments	368	298	167	573
Other equity investments	98	146	217	313
Financial servies receivables	1 656	1 841	2 414	3 461
Other financial assets	8 398	8 350	8 870	8 596
Other receivables	125	179	164	113
Deferred tax assets	730	1 355	817	867
Non-current assets	**27 008**	**29 707**	**30 395**	**32 830**
Fixed Assets	**17 289**	**19 379**	**20 160**	**22 368**
Fixed Assets as % of Revenue	67.1%	68.0%	70.3%	67.5%
Inventories	3 889	4 013	4 108	4 517
Trade receivables	759	842	1 081	1 199
Financial services receivables	730	842	1 122	1 081
Other financial assets	2 292	2 415	2 761	5 353
Other receivables	468	490	606	579
Tax receivables	81	95	163	155
Securities	297	451	755	982
Cash, cash equivalents and time deposits	2 635	3 511	4 500	4 686
Total Current Assets	**11 151**	**12 659**	**15 096**	**18 552**
Total Assets	**38 159**	**42 366**	**45 491**	**51 382**

Table 15 - Appendix A.3: Historical balance sheet – Porsche IPO Prospectus.

Balance Sheet - Equity and Liabilities	2018	2019	2020	2021
Subscribed capital	45	45	45	45
Capital reserves	11 453	12 726	13 754	14 225
Retained earnings	4 876	4 991	6 302	9 146
Other reserves	97	(339)	118	(489)
Equity before non-controlling interests	16 471	17 423	20 219	22 927
Non-controlling interests	6	5	5	8
Equity	**16477**	**17428**	**20224**	**22935**
Provisions for pensions and similar obligations	3 792	5 438	5 932	5 525
Other provisions	778	996	939	1 184
Deferred tax liabilities	650	681	685	782
Financial liabilities	3 644	5 375	5 668	6 599
Other financial liabilities	399	657	285	633
Other liabilities	402	492	473	645
Non-current liabilities	**9665**	**13639**	**13982**	**15368**
Provisions for taxes	96	129	111	126
Other provisions	1 951	2 118	1 849	2 189
Financial liabilities	2 215	2 239	2 657	3 128
Trade payables	3 134	2 582	2 335	2 447
Other financial liabilities	3 441	3 082	2 959	3 638
Other liabilities	1 087	1 077	1 331	1 486
Tax payables	93	72	43	65
Current liabilities	**12 017**	**11 299**	**11 285**	**13 079**
Total Equity + Liabilities	**38 159**	**42 366**	**45 491**	**51 382**

Table 16 - Appendix A.4: Historical balance sheet – Porsche IPO Prospectus.

Working Capital	2018	2019	2020	2021	2022E
Accounts Receivables	1 489	1 684	2 203	2 280	
Inventory	3 889	4 013	4 108	4 517	
Accounts Payables	3 134	2 582	2 335	2 447	
State	93	72	43	65	
WC	**2 151**	**3 043**	**3 933**	**4 285**	**4 102**
Changes in WC	**-**	**892**	**890**	**352**	**(183)**
Changes in WC as % of Revenue	**8.34%**	**10.67%**	**13.71%**	**12.93%**	**11.41%**

Table 17 - Appendix A.5: Working capital - Porsche IPO Prospectus and own estimates.

Cash Flow Statement	2018	2019	2020	2021
Cash and cash equivalents at beginning of period	**2 960**	**2 635**	**3 174**	**4 344**
Profit before tax	4 552	4 054	4 397	5 729
Income taxes paid	(1 531)	(1 310)	(837)	(1 552)
Depreciation, amortization and impairment losses	2 567	3 044	3 357	3 214
Gain/loss on disposal of non-current assets	46	10	49	35
Share of profit or loss of equity-accounted investments	4	7	15	23
Other non-cash expense/income	(214)	(127)	(13)	(222)
Change in inventories	(851)	(86)	(223)	(152)
Change in receivables (excluding financial services)	(505)	(372)	(734)	(409)
Change in liabilities (excluding financial liabilities)	504	(456)	(134)	543
Change in pension provisions	371	417	493	471
Change in other provisions	81	378	(299)	539
Change in leased assets	(940)	(807)	(945)	(931)
Change in financial services receivables	(239)	(266)	(987)	(872)
Cash flows from operating activities	**3 845**	**4 486**	**4 139**	**6 416**
Investments in intangible assets (excluding capitalized deve	(2 093)	(2 044)	(1 547)	(1 442)
Additions to capitalized development costs	(1 064)	(949)	(1 225)	(1 601)
Change in equity investments	(71)	(65)	(46)	(352)
Cash received from disposal of intangible assets and prope	10	13	48	21
Change in investments in securities	(237)	(146)	(300)	(283)
Change in loans and time deposits	(111)	(427)	51	(2 308)
Cash flows from investing activities	**(3 566)**	**(3 618)**	**(3 019)**	**(5 965)**
Capital contributions	1 208	1 273	1 028	471
Profit transfer and dividends	(2 157)	(2 294)	(1 802)	(1 864)
Capital transactions with non-controlling interests	-	(19)	- -	
Proceeds from issuance of bonds	2 727	2 410	3 222	5 243
Repayment of bonds	(2 422)	(2 369)	(2 550)	(3 814)
Change in other financial liabilities	38	723	282	(444)
Repayments of lease liabilities	-	(77)	(102)	(110)
Cash flows from financing activities	**(606)**	**(353)**	**78**	**(518)**
Effect of exchange rate changes on cash and cash equival	2	23	(29)	50
Net change in cash and cash equivalents	**(325)**	**538**	**1 169**	**(17)**
Cash and cash equivalents at end of period	**2 635**	**3 174**	**4 344**	**4 327**
Securities, loans and time deposits	775	1 360	1 518	4 079
Gross liquidity	**3 410**	**4 534**	**5 862**	**8 406**

Table 18 - Appendix A.6: Historical cash flow statement – Porsche IPO Prospectus.

Asset Price			
Date	Volkswagen AG	Porsche SE	DAX
-9	182.80	69.38	12630.23
-8	184.25	72.80	13050.27
-7	182.45	69.44	12760.78
-6	193.95	69.30	12871.44
-5	193.05	68.90	12915.97
-4	188.15	67.70	12904.32
-3	184.60	66.84	13088.21
-2	198.35	69.30	13402.27
-1	193.95	67.44	13188.95
0	198.10	67.70	13028.00
1	196.60	67.00	12956.66
2	196.95	66.86	12741.26
3	205.80	69.22	12803.24
4	205.40	71.90	12670.83
5	201.90	72.00	12767.15
6	198.55	72.34	12531.63
7	191.65	70.22	12284.19
8	190.95	69.96	12227.92
9	189.30	68.58	12139.68
10	195.80	67.90	12630.23
11	173.90	60.48	13050.27
12	165.95	58.16	12760.78

Table 19 - Appendix B.1: Asset price for the announcement period - Bloomberg Terminal.

Asset Daily Return			
Date	Volkswagen AG	Porsche SE	DAX
-9	0.01	0.05	0.03
-8	-0.01	-0.05	-0.02
-7	0.06	0.00	0.01
-6	0.00	-0.01	0.00
-5	-0.03	-0.02	0.00
-4	-0.02	-0.01	0.01
-3	0.07	0.04	0.02
-2	-0.02	-0.03	-0.02
-1	0.02	0.00	-0.01
0	-0.01	-0.01	-0.01
1	0.00	0.00	-0.02
2	0.04	0.03	0.00
3	0.00	0.04	-0.01
4	-0.02	0.00	0.01
5	-0.02	0.00	-0.02
6	-0.04	-0.03	-0.02
7	0.00	0.00	0.00
8	-0.01	-0.02	-0.01
9	0.03	-0.01	0.04
10	-0.12	-0.12	0.03
11	-0.05	-0.04	-0.02

Table 20 - Appendix B.2: Asset daily return for the announcement period – Bloomberg Terminal.

Asset Expected Return		
Date	Volkswagen AG	Porsche SE
-9	0.04	0.04
-8	-0.03	-0.03
-7	0.01	0.01
-6	0.00	0.00
-5	0.00	-0.01
-4	0.01	0.01
-3	0.03	0.03
-2	-0.02	-0.02
-1	-0.02	-0.02
0	-0.01	-0.01
1	-0.02	-0.03
2	0.00	0.00
3	-0.02	-0.02
4	0.01	0.01
5	-0.03	-0.03
6	-0.03	-0.03
7	-0.01	-0.01
8	-0.01	-0.01
9	0.05	0.00
10	0.04	-0.03
11	-0.03	0.01

Table 21 - Appendix B.3: Asset Expected Return for the Announcement Period – Bloomberg Terminal.

Average abnormal returns		
Date	Volkswagen AG	Porsche SE
-9	-0.03	0.01
-8	0.02	-0.01
-7	0.05	-0.01
-6	-0.01	-0.01
-5	-0.02	-0.01
-4	-0.03	-0.03
-3	0.05	0.01
-2	0.00	0.00
-1	0.04	0.02
0	0.00	0.00
1	0.03	0.02
2	0.04	0.03
3	0.01	0.06
4	-0.02	0.00
5	0.01	0.03
6	-0.01	0.00
7	0.01	0.01
8	0.00	-0.01
9	-0.01	-0.01
10	-0.16	-0.09
11	-0.01	-0.05
CAAR	**-0.03**	**-0.03**

Table 22 – Appendix B.4: Average abnormal return and CAAR for the announcement period – Bloomberg Terminal