

Strategic Analysis and Valuation of Apple

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Master Thesis Copenhagen Business School MSc Applied Economics and Finance (AEF)

Date of Submission: 15th of September Number of Normal Pages: 80 Characters (with spaces): 184,639 Number of Standard CBS Pages: 125

Table of Contents

1.	Abst	ract .		1
	1.1.	Prob	lem Delimitation	1
2.	Com	ipany	Background	2
	2.1.	Appl	e's Rise	2
	2.2.	Appl	e's Share Price Development	3
	2.3.	Curr	ent Products	3
	2.3.2	1.	Electronics	3
	2.	3.1.1	. iPhone	3
	2.	3.1.2	. Mac	4
	2.	3.1.3	. iPad	5
	2.	3.1.4	. Wearables, Home and Accessories (WHA)	5
	2.3.2	2.	Services	5
	2.4.	Corp	orate Governance	6
	2.4.2	1.	Ownership	6
	2.	4.1.1	. Institutional Investors	6
	2.	4.1.2	. Individual Insider Shareholder	7
	2.4.2	2.	Compensation	7
	2.4.3	3.	Board of Directors	8
	2.	4.3.1	. Board Independence	9
	2.	4.3.2	. Board Size	9
	2.	4.3.3	. Board Composition	9
	2.	4.3.4	. Board Expertise 1	0
	2.	4.3.5	. Further Measures of Corporate Governance Policies	0
3.	Indu	stries	51	1
	3.1.	Sma	rtphone Industry1	1
	3.1.2	1.	Android vs iOS 1	2
	3.1.2	2.	Chip Shortage 1	2
	3.2.	Pers	onal Computer (PC) Industry1	3
	3.2.2	1.	Windows vs MacOS 1	3
	3.2.2	2.	Switch from Intel to Apple's own Chips 1	4
	3.3.	Tabl	et Industry1	15
	3.3.2	1.	Chip Shortage 1	15
	3.4.	WHA	A Industry 1	15
	3.4.2	1.	Headphones / Earphones 1	6
	3.4.2	2.	Smartwatches1	6

4.	Stra	ategy .		17
4	.1.	Appl	e's Ecosystem	17
4	.2.	PEST	EL Analysis	18
	4.2.	1.	Advantages vs Disadvantages	19
	4.2.	2.	Political and Legal Issues	19
	4	.2.2.1	Sub Conclusion – Political and Legal Issues	22
	4.2.	3.	Economic Issues	24
	4	.2.3.1	Sub Conclusion – Economic Issue	28
	4.2.	4.	Social Issues	29
	4	.2.4.1	Sub Conclusion – Social Issues	31
	4.2.	5.	Technological Issues	33
	4	.2.5.1	Sub Conclusion – Technological Issues	33
	4.2.	6.	Environmental Issues	34
	4	.2.6.1	Sub Conclusion – Environmental Issues	36
	4.2.	7.	Sub Conclusion – PESTEL Analysis	37
4	.3.	Port	er's Five Forces	38
	4.3.	1.	Advantages vs Disadvantages	38
	4.3.	2.	Industry Competitors	39
	4	.3.2.1	Sub Conclusion – Industry Competitors	42
	4.3.	3.	Threat of New Entry	42
	4	.3.3.1	Sub Conclusion – Threat of Entry	44
	4.3.	4.	Bargaining Power of Buyers	44
	4	.3.4.1	Sub Conclusion – Bargaining Power of Buyers	46
	4.3.	5.	Bargaining Power of Suppliers	46
	4	.3.5.1	Sub Conclusion – Bargaining Power of Suppliers	47
	4.3.	6.	Threat of Substitutes	47
	4	.3.6.1	Sub Conclusion – Threat of Substitutes	48
	4.3.	7.	Sub Conclusion – Porter's Five Forces	48
4	.4.	Port	er's Value Chain	49
	4.4.	1.	Primary Activities	49
	4.4.	2.	Support Activities	51
	4.4.	3.	Sub Conclusion – Porter's Value Chain	52
5.	Fina	ancials	·	53
5	.1.	Reor	ganisation of Financial Statements	53
	5.1.	1.	Balance Sheet	53
	5.1.	2.	Income Statement	53

5.2.	Fina	ancial Statement Analysis	54
6. Va	aluatio	n Method	58
6.1.	Rela	ative Valuation	60
6.2.	Abs	olute Valuation	61
7. Fo	orecast	ing	62
7.1.	Net	Sales	62
7.2.	COO	GS and Operating Expenses	63
7.3.	Тах	-Rate	64
7.4.	EBI	TDA, EBIT and NOPLAT	64
7.5.	FCF	Forecast	64
7.6.	Gro	wth-Case Scenario	65
8. W	/ACC		66
8.1.	Сар	ital Structure	66
8.2.	Rec	uired Return of Equity	66
8.3.	Rec	uired Return of Debt	68
8.4.	Calo	culation of WACC	68
9. Va	aluatio	n	69
9.1.	DCF	F – FCF Type 1	69
9.	1.1.	Base Case Scenario	69
9.	1.2.	Growth Case Scenario	70
9.	1.3.	Probabilistic Valuation	71
9.2.	DCF	F – FCF Type 2	71
9.	.2.1.	Base Case Scenario	71
9.	.2.2.	Growth Case Scenario	72
9.3.	Eco	nomic Value Added	73
9.	.3.1.	Base Case Scenario	73
9.	.3.2.	Growth Case Scenario	74
9.4.	Con	nbined Valuation	75
10.	Discus	sion	76
11.	Conclu	usion	80
12.	Biblio	graphy	I
13.	Apper	ndix	XXIII
13.1	lı	ncome Statement	XXIII
13.2	. В	alance Sheet	xxiv
13.3	8. R	eorganised Income Statement	XXV
13.4	I. R	eorganised Balance Sheet	xxvi

13.5.	Financial Statement Analysis	XXVII
13.6.	Relative Valuation	XXVIII
13.7.	WACC	XXIX
13.8.	Reverse DCF / Reverse EVA	
13.8.1	Base Case	
13.8.2	Growth Case	XXXI
13.9.	Sensitivity Analysis	XXXII
13.9.1	Base Case	XXXII
13.9.2	Growth Case	XXXV
13.9.3	Combined Valuation	XXXVIII

Table of Figures

Figure 2: Apple net sales 2021 per product11Figure 3: Apple net sales 2021 per region11Figure 4: Market share based on shipment by smartphone manufacturers11Figure 5: Market share in the tablet industry by sales13Figure 6: Market share in the tablet industry by shipments16Figure 7: Market share in the wearables industry by shipments16Figure 8: Linear regression GDP of the world against Apple Net Income24Figure 9: GDP development25Figure 10: Population pyramid of China25Figure 11: Interest rate27Figure 12: Inflation rate27Figure 13: Interest rate28Figure 14: Share of adults that use social media as a source of news30Figure 15: Porter's Five Forces38Figure 16: Global smartphone sales (in million units)40Figure 19: Average price of smartphones compared to smartphone sales44Figure 21: Shipment Sworldwide (in million units)41Figure 22: Porter's Value Chain43Figure 22: Porter's Value Chain49Figure 23: Apple's Distribution Channels50Figure 23: Apple's Samsurg's, and Xiaomi's R&D Spending Development (in billions)51Figure 25: Big Tech ROIC development54Figure 27: Big Tech ROIC development55Figure 27: Big Tech ROIC development56Figure 27: Big Tech ROIC development56Figure 28: Big Tech ROIC development56Figure 29: Big Tech ROIC development56Figure 30: DIfferent Valuation Models58 </th <th>Figure 1: Apple's stock price development and important releases (\$155.35 on 11.09.2022)</th> <th> 3</th>	Figure 1: Apple's stock price development and important releases (\$155.35 on 11.09.2022)	3
Figure 3: Apple net sales 2021 per region.11Figure 4: Market share based on shipment by smartphone manufacturers.11Figure 5: Market share based on shipment by PC manufacturers.13Figure 6: Market share in the tablet industry by sales.15Figure 7: Market share in the wearables industry by shipments.16Figure 8: Linear regression GDP of the world against Apple Net Income.24Figure 10: Population pyramid of China.25Figure 11: Population pyramid of Germany.26Figure 12: Inflation rate.27Figure 13: Interest rate.27Figure 14: Share of adults that use social media as a source of news.30Figure 15: Porter's Five Forces38Figure 16: Global smartphone sales (in million units).40Figure 12: Apple Smartphone sales (in million units).41Figure 12: Apple Smartphone Sales and Price Development.45Figure 22: Porter's Value Chain.43Figure 22: Porter's Value Chain.45Figure 23: Apple's Distribution Channels.50Figure 24: Apple's Samsung's, and Xiaomi's R&D Spending Development (in billions).51Figure 25: Big Tech ROC development.56Figure 26: Big Tech ROC development.56Figure 23: Which DCF Model to use?60Figure 34: Regression Daily Returns of Apple and S&P500.67Figure 35: Average DCF Gort Type 170Figure 31: Relative Valuation Models58Figure 31: Relative Valuation Models58Figure 33: Reverse DCF Base Case CFC Type 170	Figure 2: Apple net sales 2021 per product	11
Figure 4: Market share based on shipment by Smartphone manufacturers11Figure 5: Market share in the tablet industry by sales15Figure 6: Market share in the wearables industry by shipments16Figure 9: GDP development25Figure 10: Population pyramid of China25Figure 11: Population pyramid of Germany26Figure 12: Inflation rate27Figure 13: Interest rate28Figure 15: Porter's Five Forces30Figure 15: Potrer's Five Forces38Figure 16: Global smartphone sales (in million units)40Figure 21: Apple Smartphone sales (in million units)41Figure 21: Apple Smartphone sales and Price Development43Figure 22: Porter's Value Chain43Figure 23: Apple's Samsung's and Price Development45Figure 24: Apple's Samsung's, and Xiaomi's R&D Spending of Kiaomi50Figure 25: Big Tech ROE development54Figure 26: Big Tech ROE development54Figure 27: Big Tech ROE development55Figure 28: Big Tech ROE development56Figure 29: Big Tech ROE development56Figure 21: Relative Valuation M	Figure 3: Apple net sales 2021 per region	11
Figure 5: Market share based on shipment by PC manufacturers.13Figure 6: Market share in the tablet industry by sales.15Figure 7: Market share in the wearables industry by shipments.16Figure 8: Linear regression GDP of the world against Apple Net Income24Figure 9: GDP development25Figure 10: Population pyramid of China.25Figure 11: Population pyramid of Germany.26Figure 12: Inflation rate27Figure 13: Interest rate.27Figure 14: Share of adults that use social media as a source of news.30Figure 15: Porter's Five Forces38Figure 16: Global smartphone sales (in million units).40Figure 17: PC shipments worldwide (in million units).41Figure 20: Samsung Smartphone Sales and Price Development.45Figure 21: Apple Smartphone Sales and Price Development.45Figure 22: Apple's Distribution Channels50Figure 23: Apple's Distribution Channels50Figure 24: Apple's Sistribution Channels50Figure 25: Big Tech ROE development54Figure 27: Big Tech net profit margin development56Figure 28: Big Tech ROE development56Figure 29: Olifferent Valuation Models58Figure 31: Retaive Aluation of Apple60Figure 32: Which DCF Model to use?61Figure 33: Net Sales Case DCF FCT Type 170Figure 34: Regression Daily Returns of Apple and S&P500.67Figure 35: Reverse DCF Base Case CFT Type 170Figure 36: Base Case DCF FCT Type 1 <td>Figure 4: Market share based on shipment by smartphone manufacturers</td> <td> 11</td>	Figure 4: Market share based on shipment by smartphone manufacturers	11
Figure 6: Market share in the tablet industry by sales15Figure 7: Market share in the wearables industry by shipments16Figure 8: Linear regression GDP of the world against Apple Net Income24Figure 9: GDP development25Figure 10: Population pyramid of China25Figure 11: Population pyramid of Germany26Figure 12: Inflation rate27Figure 13: Interest rate28Figure 14: Share of adults that use social media as a source of news30Figure 15: Porter's Five Forces38Figure 16: Chobal smartphone sales (in million units)40Figure 17: PC shipments worldwide (in million units)40Figure 18: R&D spending of Niaomi43Figure 21: Apple Smartphone sales and Price Development45Figure 22: Porter's Value Chain49Figure 23: Apple's Distribution Channels50Figure 25: Big Tech ROIC development54Figure 25: Big Tech ROIC development54Figure 25: Big Tech ROIC development56Figure 25: Big Tech ROIC development56Figure 29: Big Tech age rypin development56Figure 29: Big Tech ages profit margin development56Figure 30: Different Valuation Models58Figure 31: Relative Valuation Models58Figure 32: Apple's Distribution FY203163Figure 33: Net Sales Distribution FY203163Figure 34: Regression Daily Returns of Apple and S&P50067Figure 34: Regression Daily Returns of Apple and S&P50067Figure 34: Regression D	Figure 5: Market share based on shipment by PC manufacturers	13
Figure 7: Market share in the wearables industry by shipments.16Figure 8: Linear regression GDP of the world against Apple Net Income.24Figure 9: GDP development25Figure 10: Population pyramid of China.25Figure 11: Population pyramid of Germany26Figure 12: Inflation rate.27Figure 13: Inflation rate.27Figure 13: Interest rate28Figure 15: Porter's Five Forces38Figure 15: Porter's Five Forces38Figure 16: Global smartphone sales (in million units).40Figure 17: PC shipments worldwide (in million units).41Figure 19: Average price of smartphones compared to smartphone sales.44Figure 21: Apple Smartphone Sales and Price Development.45Figure 22: Porter's Value Chain49Figure 23: Apple's Distribution Channels50Figure 24: Apple's Distribution Channels50Figure 25: Big Tech ROIC development54Figure 27: Big Tech ROIC development56Figure 28: Big Tech ROIC development56Figure 29: Big Tech ROIC development56Figure 30: Different Valuation of Apple60Figure 31: Relative Valuation of Apple67Figure 32: Average MRP per year in the US67Figure 33: Net Sales Distribution FY203163Figure 34: Regression Daily Returns of Apple and S&P50067Figure 35: Average MRP per year in the US67Figure 34: Regression Daily Returns of Apple and S&P50067Figure 34: Regression Daily Returns of Apple and	Figure 6: Market share in the tablet industry by sales	15
Figure 8: Linear regression GDP of the world against Apple Net Income24Figure 9: GDP development25Figure 10: Population pyramid of China.25Figure 11: Population pyramid of Germany26Figure 12: Inflation rate27Figure 13: Interest rate28Figure 14: Share of adults that use social media as a source of news30Figure 15: Porter's Five Forces38Figure 16: Global smartphone sales (in million units)40Figure 17: PC shipments worldwide (in million units)41Figure 18: R&D spending of Xiaomi43Figure 21: Apple Smartphone sales and Price Development45Figure 22: Porter's Value Chain49Figure 23: Apple's Distribution Channels50Figure 24: Apple's Namtphone Sales and Price Development50Figure 25: Big Tech ROE development54Figure 25: Big Tech ROE development54Figure 25: Big Tech ROE development55Figure 25: Big Tech ROE development56Figure 29: Big Tech asset turnover ratio development56Figure 29: Big Tech asset turnover ratio development56Figure 31: Net Sales Distribution FV203163Figure 32: Which DCF Model to use?61Figure 33: Net Sales Distribution FY203163Figure 34: Regression Daily Returns of Apple and S&P50067Figure 35: Base Case DCF FCF Type 170Figure 34: Regression Daily Returns of Apple and S&P50067Figure 34: Reverse DCF Base Case FCF Type 170Figure 34: Reverse DCF Base Cas	Figure 7: Market share in the wearables industry by shipments	16
Figure 9: GDP development25Figure 10: Population pyramid of China.25Figure 11: Population pyramid of Germany26Figure 12: Inflation rate27Figure 13: Interest rate.27Figure 14: Share of adults that use social media as a source of news30Figure 15: Porter's Five Forces38Figure 16: Global smartphone sales (in million units).40Figure 17: PC shipments worldwide (in million units).41Figure 19: Average price of smartphones compared to smartphone sales44Figure 21: Apple Smartphone Sales and Price Development45Figure 22: Porter's Value Chain49Figure 23: Apple's Distribution Channels50Figure 24: Apple's, Samsung's, and Xiaomi's R&D Spending Development (in billions)51Figure 25: Big Tech ROE development54Figure 26: Big Tech ROE development55Figure 27: Big Tech ROE development56Figure 28: Big Tech ROE development56Figure 29: Big Tech ROE development56Figure 29: Big Tech ROE development56Figure 31: Relative Valuation Models58Figure 32: Which DCF Model to use?61Figure 33: Net Sales Distribution FY203163Figure 34: Regression Daily Returns of Apple and S&P50067Figure 35: Average MRP per year in the US67Figure 34: Reverse DCF FCF Type 170Figure 34: Reverse DCF FCF Type 272Figure 34: Reverse DCF FCF Type 272Figure 34: Reverse DCF FCF Type 272Figur	Figure 8: Linear regression GDP of the world against Apple Net Income	24
Figure 10: Population pyramid of China.25Figure 11: Population pyramid of Germany.26Figure 12: Inflation rate.27Figure 13: Interest rate.28Figure 14: Share of adults that use social media as a source of news.30Figure 15: Porter's Five Forces38Figure 15: Chipments worldwide (in million units).40Figure 17: Co shipments worldwide (in million units).41Figure 17: Co shipments worldwide (in million units).41Figure 17: Co shipments worldwide (in million units).41Figure 20: Samsung Smartphone Sales and Price Development.45Figure 21: Apple Smartphone Sales and Price Development.45Figure 22: Porter's Value Chain49Figure 23: Apple's Distribution Channels50Figure 24: Apple's, Samsung's, and Xiaomi's R&D Spending Development (in billions).51Figure 25: Big Tech ROE development54Figure 26: Big Tech ROE development56Figure 27: Big Tech net profit margin development56Figure 28: Big Tech ROE development56Figure 31: Relative Valuation Models58Figure 32: Which DCF Model to use?61Figure 33: Net Sales Distribution FY203163Figure 34: Regression Daily Returns of Apple and S&P50067Figure 34: Regression Daily Returns of Apple and S&P50067Figure 34: Regression Daily Returns of Apple and S&P50067Figure 34: Reverse DCF Ease ECF Type 170Figure 34: Reverse DCF Growth-Case FCF Type 170Figure 34: Reverse DCF Grow	Figure 9: GDP development	25
Figure 11: Population pyramid of Germany26Figure 12: Inflation rate27Figure 13: Interest rate.28Figure 14: Share of adults that use social media as a source of news30Figure 15: Porter's Five Forces38Figure 16: Global smartphone sales (in million units)40Figure 17: PC shipments worldwide (in million units)41Figure 18: R&D spending of Xiaomi43Figure 20: Samsung Smartphone Sales and Price Development45Figure 21: Apple Smartphone Sales and Price Development45Figure 22: Porter's Value Chain49Figure 23: Apple's Distribution Channels50Figure 24: Apple's Samsung's, and Xiaomi's R&D Spending Development (in billions)51Figure 25: Big Tech ROE development54Figure 26: Big Tech ROE development55Figure 27: Big Tech net profit margin development56Figure 28: Big Tech ROE development56Figure 29: Big Tech asset turnover ratio development56Figure 31: Relative Valuation Models58Figure 32: Which DCF Model to use?61Figure 33: Net Sales Distribution FY203163Figure 34: Regression Daily Returns of Apple and S&P50067Figure 34: Reverse DCF Base Case FCF Type 170Figure 34: Reverse DCF Growth-Case FCF Type 170Figure 34: Reverse DCF Growth-Case FCF Type 171Figure 44: Growth Case DCF FCT Type 272Figure 44: Growth Case EVA Naluation73Figure 44: Growth Case EVA Naluation73Figure 44: Gro	Figure 10: Population pyramid of China	25
Figure 12: Inflation rate.27Figure 13: Interest rate.28Figure 13: Interest rate.28Figure 14: Share of adults that use social media as a source of news30Figure 15: Forcers38Figure 16: Global smartphone sales (in million units).40Figure 17: PC shipments worldwide (in million units).41Figure 18: R&D spending of Xiaomi.43Figure 20: Samsung Smartphone Sales and Price Development.45Figure 21: Apple Smartphone Sales and Price Development.45Figure 22: Porter's Value Chain49Figure 23: Apple's Distribution Channels50Figure 24: Apple's, Samsung's, and Xiaomi's R&D Spending Development (in billions).51Figure 25: Big Tech ROIC development54Figure 27: Big Tech net profit margin development55Figure 28: Big Tech net profit margin development56Figure 30: Different Valuation Models58Figure 31: Relative Valuation of Apple60Figure 32: Which DCF Model to use?61Figure 33: Net Sales Distribution FY203163Figure 34: Regression Daily Returns of Apple and S&P50067Figure 37: Reverse DCF Base Case FCF Type 170Figure 37: Reverse DCF Growth-Case FCF Type 170Figure 41: Growth Case DCF FCF Type 272Figure 42: Base Case DCF FCF Type 272Figure 42: Base Case DCF FCF Type 272Figure 42: Base Case DCF FCF Type 272Figure 43: Growth Case DCF FCF Type 272Figure 44: Growth Case DCF FCF Type 2	Figure 11: Population pyramid of Germany	26
Figure 13: Interest rate.28Figure 13: Interest rate.28Figure 14: Share of adults that use social media as a source of news.30Figure 15: Porter's Five Forces38Figure 15: Cobal smartphone sales (in million units).40Figure 17: PC shipments worldwide (in million units).41Figure 18: R&D spending of Xiaomi.43Figure 19: Average price of smartphones compared to smartphone sales44Figure 20: Samsung Smartphone Sales and Price Development.45Figure 22: Porter's Value Chain49Figure 23: Apple's Distribution Channels50Figure 24: Apple's, Samsung's, and Xiaomi's R&D Spending Development (in billions)51Figure 25: Big Tech ROIC development54Figure 26: Big Tech ROIC development54Figure 27: Big Tech net profit margin development56Figure 29: Big Tech asset turnover ratio development56Figure 30: Different Valuation Models58Figure 31: Relative Valuation of Apple60Figure 33: Net Sales Distribution FY203163Figure 34: Regression Daily Returns of Apple and S&P50067Figure 35: Average MRP per year in the US67Figure 37: Reverse DCF Growth-Case FCF Type 170Figure 43: Growth Case DCF FCF Type 272Figure 44: Growth Case DCF FCF Type 272Figure 42: Base Case DCF FCF Type 272Figure 44: Growth Case EVA74Figure 45: Sensitivity Analysis Part 177	Figure 12: Inflation rate	27
Figure 14: Share of adults that use social media as a source of news30Figure 15: Porter's Five Forces38Figure 16: Global smartphone sales (in million units)40Figure 17: PC shipments worldwide (in million units)41Figure 18: R&D spending of Xiaomi43Figure 19: Average price of smartphones compared to smartphone sales44Figure 20: Samsung Smartphone Sales and Price Development45Figure 21: Apple Smartphone Sales and Price Development45Figure 22: Porter's Value Chain49Figure 23: Apple's Distribution Channels50Figure 24: Apple's, Samsung's, and Xiaomi's R&D Spending Development (in billions)51Figure 24: Big Tech ROIC development54Figure 27: Big Tech net profit margin development55Figure 28: Big Tech net profit margin development56Figure 29: Big Tech net profit margin development56Figure 31: Relative Valuation Models58Figure 32: Which DCF Model to use?61Figure 33: Net Sales Distribution FY203163Figure 34: Regression Daily Returns of Apple and S&P50067Figure 35: Reverse DCF GCT Type 170Figure 39: Reverse DCF Base Case FCF Type 170Figure 39: Reverse DCF Growth-Case FCF Type 171Figure 41: Growth Case ECA Type 272Figure 42: Base Case DCF FCF Type 272Figure 43: Reverse DCF Growth-Case FCF Type 171Figure 43: Reverse EVA Malacion73Figure 43: Reverse EVA Malacion73Figure 43: Reverse EVA Malacion </td <td>Figure 13: Interest rate</td> <td> 28</td>	Figure 13: Interest rate	28
Figure 15: Porter's Five Forces38Figure 16: Global smartphone sales (in million units)40Figure 17: PC shipments worldwide (in million units)41Figure 18: R&D spending of Xiaomi.43Figure 19: Average price of smartphones compared to smartphone sales44Figure 20: Samsung Smartphone Sales and Price Development.45Figure 21: Apple Smartphone Sales and Price Development.45Figure 22: Porter's Value Chain49Figure 23: Apple's Distribution Channels50Figure 24: Apple's, Samsung's, and Xiaomi's R&D Spending Development (in billions)51Figure 25: Big Tech ROE development54Figure 26: Big Tech ROE development54Figure 27: Big Tech net profit margin development55Figure 28: Big Tech ROE development56Figure 29: Big Tech asset turnover ratio development56Figure 30: Different Valuation Models58Figure 31: Relative Valuation of Apple60Figure 32: Which DCF Model to use?61Figure 33: Net Sales Distribution FY203163Figure 34: Regression Daily Returns of Apple and S&P50067Figure 34: Reverse DCF Base Case FCF Type 170Figure 39: Reverse DCF Growth-Case FCF Type 170Figure 40: Base Case DCF FCF Type 272Figure 41: Growth Case FCF Type 272Figure 42: Base Case DCF FCF Type 272Figure 42: Rase EVA Valuation73Figure 43: Reverse EVA Malae-Case74Figure 44: Growth Case EVA74Figure 45: Sensitivity A	Figure 14: Share of adults that use social media as a source of news	30
Figure 16: Global smartphone sales (in million units)40Figure 17: PC shipments worldwide (in million units)41Figure 18: R&D spending of Xiaomi43Figure 19: Average price of smartphones compared to smartphone sales44Figure 21: Apple Smartphone Sales and Price Development45Figure 22: Porter's Value Chain49Figure 23: Apple's Distribution Channels50Figure 24: Apple's, Samsung's, and Xiaomi's R&D Spending Development (in billions)51Figure 25: Big Tech ROE development54Figure 26: Big Tech ROIC development54Figure 27: Big Tech net profit margin development56Figure 29: Big Tech asset turnover ratio development56Figure 30: Different Valuation Models58Figure 31: Relative Valuation of Apple60Figure 32: Which DCF Model to use?61Figure 33: Net Sales Distribution FY203163Figure 34: Regression Daily Returns of Apple and S&P50067Figure 35: Average MRP per year in the US67Figure 36: Base Case DCF FCF Type 170Figure 37: Reverse DCF Growth-Case FCF Type 170Figure 38: Growth Case DCF FCF Type 272Figure 42: Base Case DCF FCF Type 272Figure 42: Base Case EVA valuation73Figure 42: Base Case EVA.74Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case EVA.74Figure 45: Sensitivity Analysis Part 177	Figure 15: Porter's Five Forces	38
Figure 17: PC shipments worldwide (in million units)41Figure 18: R&D spending of Xiaomi.43Figure 19: Average price of smartphones compared to smartphone sales44Figure 20: Samsung Smartphone Sales and Price Development.45Figure 21: Apple Smartphone Sales and Price Development.45Figure 22: Porter's Value Chain49Figure 23: Apple's Distribution Channels50Figure 25: Big Tech ROE development54Figure 25: Big Tech ROE development54Figure 26: Big Tech ROIC development54Figure 27: Big Tech net profit margin development55Figure 28: Big Tech asset turnover ratio development56Figure 30: Different Valuation Models58Figure 31: Relative Valuation of Apple60Figure 32: Which DCF Model to use?61Figure 33: Net Sales Distribution FY203163Figure 35: Average MRP per year in the US67Figure 36: Base Case DCF FCF Type 170Figure 37: Reverse DCF Base Case FCF Type 170Figure 38: Growth Case DCF FCF Type 272Figure 40: Base Case DCF FCF Type 272Figure 42: Base Case DCF FCF Type 272Figure 42: Base Case EVA Valuation73Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case EVA.74Figure 45: Sensitivity Analysis Part 177	Figure 16: Global smartphone sales (in million units)	40
Figure 18: R&D spending of Xiaomi43Figure 19: Average price of smartphones compared to smartphone sales44Figure 20: Samsung Smartphone Sales and Price Development45Figure 21: Apple Smartphone Sales and Price Development45Figure 22: Porter's Value Chain49Figure 23: Apple's Distribution Channels50Figure 24: Apple's, Samsung's, and Xiaomi's R&D Spending Development (in billions)51Figure 25: Big Tech ROE development54Figure 26: Big Tech ROIC development54Figure 27: Big Tech net profit margin development55Figure 28: Big Tech gross profit margin development56Figure 29: Big Tech asset turnover ratio development56Figure 30: Different Valuation Models58Figure 32: Which DCF Model to use?61Figure 33: Net Sales Distribution FY203163Figure 34: Regression Daily Returns of Apple and S&P50067Figure 33: Reverse DCF BCF Type 170Figure 34: Regression Daily Returns of Apple and S&P50071Figure 35: Average MRP per year in the US72Figure 36: Gase Case DCF FCF Type 170Figure 37: Reverse DCF Base Case FCF Type 170Figure 38: Growth Case DCF FCF Type 272Figure 41: Growth Case DCF FCF Type 272Figure 42: Base Case EVA Valuation73Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case EVA74Figure 45: Sensitivity Analysis Part 177	Figure 17: PC shipments worldwide (in million units)	41
Figure 19: Average price of smartphones compared to smartphone sales44Figure 20: Samsung Smartphone Sales and Price Development.45Figure 21: Apple Smartphone Sales and Price Development.45Figure 22: Porter's Value Chain49Figure 23: Apple's Distribution Channels50Figure 24: Apple's, Samsung's, and Xiaomi's R&D Spending Development (in billions)51Figure 25: Big Tech ROE development54Figure 26: Big Tech net profit margin development54Figure 29: Big Tech asset turnover ratio development56Figure 29: Big Tech asset turnover ratio development56Figure 31: Relative Valuation Models58Figure 32: Which DCF Model to use?61Figure 33: Net Sales Distribution FY203163Figure 34: Regression Daily Returns of Apple and S&P50067Figure 35: Average MRP per year in the US67Figure 36: Base Case DCF FCF Type 170Figure 39: Reverse DCF Base Case FCF Type 170Figure 41: Growth Case DCF FCF Type 272Figure 42: Base Case EVA Valuation73Figure 42: Base Case EVA Valuation73Figure 43: Reverse EVA Base-Case74Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case EVA74Figure 45: Sensitivity Analysis Part 177	Figure 18: R&D spending of Xiaomi	43
Figure 20: Samsung Smartphone Sales and Price Development.45Figure 21: Apple Smartphone Sales and Price Development.45Figure 22: Porter's Value Chain49Figure 23: Apple's Distribution Channels50Figure 24: Apple's, Samsung's, and Xiaomi's R&D Spending Development (in billions)51Figure 25: Big Tech ROE development54Figure 26: Big Tech ROE development54Figure 27: Big Tech net profit margin development55Figure 28: Big Tech asset turnover ratio development56Figure 30: Different Valuation Models58Figure 31: Relative Valuation of Apple60Figure 32: Which DCF Model to use?61Figure 33: Net Sales Distribution FY203163Figure 34: Regression Daily Returns of Apple and S&P500.67Figure 35: Average MRP per year in the US67Figure 36: Base Case DCF FCF Type 170Figure 39: Reverse DCF Base Case FCF Type 170Figure 41: Growth Case DCF FCF Type 272Figure 42: Base Case DCF FCF Type 272Figure 41: Growth Case EVA Valuation73Figure 42: Base Case EVA Valuation73Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case EVA74Figure 45: Sensitivity Analysis Part 170Figure 45: Sensitivity Analysis Part 170	Figure 19: Average price of smartphones compared to smartphone sales	44
Figure 21: Apple Smartphone Sales and Price Development.45Figure 22: Porter's Value Chain49Figure 23: Apple's Distribution Channels50Figure 24: Apple's, Samsung's, and Xiaomi's R&D Spending Development (in billions)51Figure 25: Big Tech ROE development54Figure 26: Big Tech ROIC development54Figure 27: Big Tech net profit margin development55Figure 28: Big Tech asset turnover ratio development56Figure 29: Big Tech asset turnover ratio development56Figure 30: Different Valuation Models58Figure 31: Relative Valuation of Apple60Figure 32: Which DCF Model to use?61Figure 33: Net Sales Distribution FY203163Figure 34: Regression Daily Returns of Apple and S&P50067Figure 35: Average MRP per year in the US67Figure 36: Base Case DCF FCF Type 170Figure 37: Reverse DCF Base Case FCF Type 170Figure 38: Growth Case DCF FCF Type 272Figure 40: Base Case DCF FCF Type 272Figure 41: Growth Case DCF FCF Type 272Figure 42: Base Case EVA Valuation73Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case EVA74Figure 45: Sensitivity Analysis Part 170Figure 45: Sensitivity Analysis Part 170	Figure 20: Samsung Smartphone Sales and Price Development	45
Figure 22: Porter's Value Chain49Figure 23: Apple's Distribution Channels50Figure 23: Apple's Distribution Channels50Figure 24: Apple's, Samsung's, and Xiaomi's R&D Spending Development (in billions)51Figure 25: Big Tech ROE development54Figure 26: Big Tech ROIC development55Figure 27: Big Tech net profit margin development55Figure 28: Big Tech asset turnover ratio development56Figure 29: Big Tech asset turnover ratio development56Figure 30: Different Valuation Models58Figure 31: Relative Valuation of Apple60Figure 32: Which DCF Model to use?61Figure 33: Net Sales Distribution FY203163Figure 35: Average MRP per year in the US67Figure 36: Base Case DCF FCF Type 170Figure 37: Reverse DCF Base Case FCF Type 170Figure 38: Growth Case DCF FCF Type 170Figure 40: Base Case DCF FCF Type 272Figure 41: Growth Case DCF FCF Type 272Figure 42: Base Case EVA Valuation73Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case FVA74Figure 45: Sensitivity Analysis Part 170	Figure 21: Apple Smartphone Sales and Price Development	45
Figure 23: Apple's Distribution Channels50Figure 24: Apple's, Samsung's, and Xiaomi's R&D Spending Development (in billions)51Figure 25: Big Tech ROE development54Figure 26: Big Tech ROIC development54Figure 27: Big Tech net profit margin development55Figure 28: Big Tech gross profit margin development56Figure 29: Big Tech asset turnover ratio development56Figure 30: Different Valuation Models58Figure 31: Relative Valuation of Apple60Figure 32: Which DCF Model to use?61Figure 33: Net Sales Distribution FY203163Figure 35: Average MRP per year in the US67Figure 36: Base Case DCF FCF Type 170Figure 37: Reverse DCF Base Case FCF Type 170Figure 38: Growth Case DCF FCF Type 170Figure 40: Base Case DCF FCF Type 272Figure 41: Growth Case DCF FCF Type 272Figure 42: Base Case EVA Valuation73Figure 42: Base Case EVA Valuation73Figure 42: Base Case EVA Asae-Case74Figure 44: Growth Case EVA74Figure 45: Sensitivity Analysis Part 177	Figure 22: Porter's Value Chain	49
Figure 24: Apple's, Samsung's, and Xiaomi's R&D Spending Development (in billions)51Figure 25: Big Tech ROE development54Figure 26: Big Tech ROIC development54Figure 27: Big Tech net profit margin development55Figure 28: Big Tech gross profit margin development56Figure 29: Big Tech asset turnover ratio development56Figure 30: Different Valuation Models58Figure 31: Relative Valuation of Apple60Figure 32: Which DCF Model to use?61Figure 33: Net Sales Distribution FY203163Figure 34: Regression Daily Returns of Apple and S&P50067Figure 35: Average MRP per year in the US67Figure 36: Base Case DCF FCF Type 170Figure 37: Reverse DCF Base Case FCF Type 170Figure 38: Growth Case DCF FCF Type 170Figure 41: Growth Case DCF FCF Type 272Figure 41: Growth Case DCF FCF Type 272Figure 42: Base Case EVA Valuation73Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case EVA74Figure 45: Sensitivity Analysis Part 177	Figure 23: Apple's Distribution Channels	50
Figure 25: Big Tech ROE development54Figure 26: Big Tech ROIC development54Figure 27: Big Tech net profit margin development55Figure 28: Big Tech gross profit margin development56Figure 29: Big Tech asset turnover ratio development56Figure 30: Different Valuation Models58Figure 31: Relative Valuation of Apple60Figure 32: Which DCF Model to use?61Figure 33: Net Sales Distribution FY203163Figure 34: Regression Daily Returns of Apple and S&P50067Figure 35: Average MRP per year in the US67Figure 36: Base Case DCF FCF Type 170Figure 37: Reverse DCF Base Case FCF Type 170Figure 39: Reverse DCF Growth-Case FCF Type 171Figure 40: Base Case DCF FCF Type 272Figure 41: Growth Case DCF FCF Type 272Figure 42: Base Case EVA Valuation73Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case EVA.74Figure 45: Sensitivity Analysis Part 177	Figure 24: Apple's, Samsung's, and Xiaomi's R&D Spending Development (in billions)	51
Figure 26: Big Tech ROIC development54Figure 27: Big Tech net profit margin development55Figure 28: Big Tech gross profit margin development56Figure 29: Big Tech asset turnover ratio development56Figure 30: Different Valuation Models58Figure 31: Relative Valuation of Apple60Figure 32: Which DCF Model to use?61Figure 33: Net Sales Distribution FY203163Figure 34: Regression Daily Returns of Apple and S&P50067Figure 35: Average MRP per year in the US67Figure 36: Base Case DCF FCF Type 170Figure 37: Reverse DCF Base Case FCF Type 170Figure 39: Reverse DCF Growth-Case FCF Type 170Figure 40: Base Case DCF FCF Type 272Figure 41: Growth Case DCF FCF Type 272Figure 42: Base Case EVA Valuation73Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case FCA74Figure 45: Sensitivity Analysis Part 170	Figure 25: Big Tech ROE development	54
Figure 27: Big Tech net profit margin development55Figure 28: Big Tech gross profit margin development56Figure 29: Big Tech asset turnover ratio development56Figure 30: Different Valuation Models58Figure 31: Relative Valuation of Apple60Figure 32: Which DCF Model to use?61Figure 33: Net Sales Distribution FY203163Figure 34: Regression Daily Returns of Apple and S&P50067Figure 35: Average MRP per year in the US67Figure 36: Base Case DCF FCF Type 169Figure 37: Reverse DCF Base Case FCF Type 170Figure 38: Growth Case DCF FCF Type 170Figure 40: Base Case DCF FCF Type 272Figure 41: Growth Case DCF FCF Type 272Figure 42: Base Case EVA Valuation73Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case EVA74Figure 45: Sensitivity Analysis Part 170	Figure 26: Big Tech ROIC development	54
Figure 28: Big Tech gross profit margin development56Figure 29: Big Tech asset turnover ratio development56Figure 30: Different Valuation Models58Figure 31: Relative Valuation of Apple60Figure 32: Which DCF Model to use?61Figure 33: Net Sales Distribution FY203163Figure 34: Regression Daily Returns of Apple and S&P50067Figure 35: Average MRP per year in the US67Figure 36: Base Case DCF FCF Type 169Figure 37: Reverse DCF Base Case FCF Type 170Figure 38: Growth Case DCF FCF Type 170Figure 40: Base Case DCF FCF Type 272Figure 41: Growth Case DCF FCF Type 272Figure 42: Base Case EVA Valuation73Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case EVA74Figure 45: Sensitivity Analysis Part 170	Figure 27: Big Tech net profit margin development	55
Figure 29: Big Tech asset turnover ratio development56Figure 30: Different Valuation Models58Figure 31: Relative Valuation of Apple60Figure 32: Which DCF Model to use?61Figure 33: Net Sales Distribution FY203163Figure 34: Regression Daily Returns of Apple and S&P50067Figure 35: Average MRP per year in the US67Figure 36: Base Case DCF FCF Type 169Figure 37: Reverse DCF Base Case FCF Type 170Figure 39: Reverse DCF Growth-Case FCF Type 170Figure 40: Base Case DCF FCF Type 272Figure 41: Growth Case DCF FCF Type 272Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case EVA74Figure 45: Sensitivity Analysis Part 177	Figure 28: Big Tech gross profit margin development	56
Figure 30: Different Valuation Models58Figure 31: Relative Valuation of Apple60Figure 32: Which DCF Model to use?61Figure 33: Net Sales Distribution FY203163Figure 34: Regression Daily Returns of Apple and S&P50067Figure 35: Average MRP per year in the US67Figure 36: Base Case DCF FCF Type 169Figure 37: Reverse DCF Base Case FCF Type 170Figure 38: Growth Case DCF FCF Type 170Figure 39: Reverse DCF Growth-Case FCF Type 171Figure 40: Base Case DCF FCF Type 272Figure 41: Growth Case DCF FCF Type 272Figure 42: Base Case EVA Valuation73Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case EVA74Figure 45: Sensitivity Analysis Part 170	Figure 29: Big Tech asset turnover ratio development	56
Figure 31: Relative Valuation of Apple60Figure 32: Which DCF Model to use?61Figure 33: Net Sales Distribution FY203163Figure 34: Regression Daily Returns of Apple and S&P50067Figure 35: Average MRP per year in the US67Figure 36: Base Case DCF FCF Type 169Figure 37: Reverse DCF Base Case FCF Type 170Figure 38: Growth Case DCF FCF Type 170Figure 40: Base Case DCF FCF Type 272Figure 41: Growth Case DCF FCF Type 272Figure 42: Base Case EVA Valuation73Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case EVA74Figure 45: Sensitivity Analysis Part 177	Figure 30: Different Valuation Models	58
Figure 32: Which DCF Model to use?61Figure 33: Net Sales Distribution FY203163Figure 34: Regression Daily Returns of Apple and S&P50067Figure 35: Average MRP per year in the US67Figure 36: Base Case DCF FCF Type 169Figure 37: Reverse DCF Base Case FCF Type 170Figure 38: Growth Case DCF FCF Type 170Figure 39: Reverse DCF Growth-Case FCF Type 171Figure 40: Base Case DCF FCF Type 272Figure 41: Growth Case DCF FCF Type 272Figure 42: Base Case EVA Valuation73Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case EVA74Figure 45: Sensitivity Analysis Part 170	Figure 31: Relative Valuation of Apple	60
Figure 33: Net Sales Distribution FY203163Figure 34: Regression Daily Returns of Apple and S&P50067Figure 35: Average MRP per year in the US67Figure 36: Base Case DCF FCF Type 169Figure 37: Reverse DCF Base Case FCF Type 170Figure 38: Growth Case DCF FCF Type 170Figure 39: Reverse DCF Growth-Case FCF Type 171Figure 40: Base Case DCF FCF Type 272Figure 41: Growth Case DCF FCF Type 272Figure 42: Base Case EVA Valuation73Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case EVA74Figure 45: Sensitivity Analysis Part 177	Figure 32: Which DCF Model to use?	61
Figure 34: Regression Daily Returns of Apple and S&P500.67Figure 35: Average MRP per year in the US67Figure 36: Base Case DCF FCF Type 169Figure 37: Reverse DCF Base Case FCF Type 170Figure 38: Growth Case DCF FCF Type 170Figure 39: Reverse DCF Growth-Case FCF Type 171Figure 40: Base Case DCF FCF Type 272Figure 41: Growth Case DCF FCF Type 272Figure 42: Base Case EVA Valuation73Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case EVA74Figure 45: Sensitivity Analysis Part 177	Figure 33: Net Sales Distribution FY2031	63
Figure 35: Average MRP per year in the US67Figure 36: Base Case DCF FCF Type 169Figure 37: Reverse DCF Base Case FCF Type 170Figure 38: Growth Case DCF FCF Type 170Figure 39: Reverse DCF Growth-Case FCF Type 171Figure 40: Base Case DCF FCF Type 272Figure 41: Growth Case DCF FCF Type 272Figure 42: Base Case EVA Valuation73Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case EVA74Figure 45: Sensitivity Analysis Part 177	Figure 34: Regression Daily Returns of Apple and S&P500	67
Figure 36: Base Case DCF FCF Type 169Figure 37: Reverse DCF Base Case FCF Type 170Figure 38: Growth Case DCF FCF Type 170Figure 39: Reverse DCF Growth-Case FCF Type 171Figure 40: Base Case DCF FCF Type 272Figure 41: Growth Case DCF FCF Type 272Figure 42: Base Case EVA Valuation73Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case EVA74Figure 45: Sensitivity Analysis Part 177	Figure 35: Average MRP per year in the US	67
Figure 37: Reverse DCF Base Case FCF Type 170Figure 38: Growth Case DCF FCF Type 170Figure 39: Reverse DCF Growth-Case FCF Type 171Figure 40: Base Case DCF FCF Type 272Figure 41: Growth Case DCF FCF Type 272Figure 42: Base Case EVA Valuation73Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case EVA74Figure 45: Sensitivity Analysis Part 177	Figure 36: Base Case DCF FCF Type 1	69
Figure 38: Growth Case DCF FCF Type 170Figure 39: Reverse DCF Growth-Case FCF Type 171Figure 40: Base Case DCF FCF Type 272Figure 41: Growth Case DCF FCF Type 272Figure 42: Base Case EVA Valuation73Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case EVA74Figure 45: Sensitivity Analysis Part 177	Figure 37: Reverse DCF Base Case FCF Type 1	70
Figure 39: Reverse DCF Growth-Case FCF Type 171Figure 40: Base Case DCF FCF Type 272Figure 41: Growth Case DCF FCF Type 272Figure 42: Base Case EVA Valuation73Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case EVA74Figure 45: Sensitivity Analysis Part 177	Figure 38: Growth Case DCF FCF Type 1	70
Figure 40: Base Case DCF FCF Type 272Figure 41: Growth Case DCF FCF Type 272Figure 42: Base Case EVA Valuation73Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case EVA74Figure 45: Sensitivity Analysis Part 177	Figure 39: Reverse DCF Growth-Case FCF Type 1	71
Figure 41: Growth Case DCF FCF Type 272Figure 42: Base Case EVA Valuation73Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case EVA74Figure 45: Sensitivity Analysis Part 177	Figure 40: Base Case DCF FCF Type 2	72
Figure 42: Base Case EVA Valuation73Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case EVA74Figure 45: Sensitivity Analysis Part 177	Figure 41: Growth Case DCF FCF Type 2	72
Figure 43: Reverse EVA Base-Case74Figure 44: Growth Case EVA74Figure 45: Sensitivity Analysis Part 177	Figure 42: Base Case EVA Valuation	73
Figure 44: Growth Case EVA	Figure 43: Reverse EVA Base-Case	74
Figure 45: Sensitivity Analysis Part 1	Figure 44: Growth Case EVA	74
	Figure 45: Sensitivity Analysis Part 1	77
Figure 46: Sensitivity Analysis Part 277	Figure 46: Sensitivity Analysis Part 2	77

Figure 47: Sensitivity Analysis Part 3	78
Figure 48: Sensitivity Analysis Part 4	79

1. Abstract

This master's thesis aims to calculate the value of Apple Inc. by using relative and absolute valuation. In addition, the strategic valuation will serve as a foundation for the absolute valuation by using its conclusions to forecast Apple's future cash flows.

It was found that Apple has a very strong position across various industries as a result of its strong position in the smartphone industry. Through Apple's unique ecosystem, astonishing product differentiation and lock-in effects, Apple has a high potential to cross-sell its products and hence strengthen its position in all industries through strengthening its position in one. Therefore, Apple's dominancy in the smartphone market benefits Apple tremendously in other areas as well. The services segment, in particular, has a lot of potential to grow since Apple offers a lot of services that can be used on a daily basis. In addition, because of the wide popularity of Apple products, these services are the default option on many devices used by a lot of people.

Nevertheless, there are some issues that could seriously hurt the dominancy that Apple holds over consumers. One such issue is the governmental and legal influence that Apple is put under. Evidently, there is an idea that Big Tech is hurting consumers and therefore its power needs to be restricted. As a result, there is some legislation which has the potential to hurt Apple since it aims to break up its ecosystem.

In regard to these points, it is found that Apple is most likely overvalued, assuming that the fundamental analysis leads to the 'correct' value of Apple and an average derived by different approaches in valuing Apple will lead to the best approximation. This type of analysis leads to a stock price of Apple of \$147.01 which just falls short of the current stock price of \$155.35 (11.09.2022). However, assuming that a probabilistic valuation is the 'true' way to go about valuing a company, and assuming whenever new information surfaces investors simply readjust their beliefs about Apple's future performance then the valuation applied in this thesis could be correct as well.

1.1. Problem Delimitation

To formulate the above-mentioned points the specific question this thesis aims to answer is:

"Is the theoretical/fundamental value of Apple different from its market value?"

This question will be answered, in particular, through answering the following sub-questions:

- What is the strategy of Apple and is it a sustainable strategy?
- How does Apple create value in its products and how do they profit from them?
- Why might the calculated price of Apple be different from its market price?

2. Company Background

Apple is a company that mainly focuses on selling electronic devices and offers other related services that try to enhance the experience of their electronic devices. Apple is most known for its iPhone, which revolutionised the mobile industry by bringing the concept of the smartphone into the limelight and pushed Nokia, as the then market leader, off its dominating position. Other products that Apple is known for are the iPad, the Mac and AirPods. As stated above, Apple also offers digital services to enhance their product experience which include, amongst others, iCloud, Apple Music, and Apple TV+ (Apple, 2021).

2.1. Apple's Rise

Apple was founded in a garage in 1976. Their first product was the "Apple I" which was built by hand and was sold 176 times over the course of 10 months. However, it was later discontinued in 1977 as Apple created its successor which was named "Apple II". "Apple II" had strong numbers and was one of the main drivers for Apple's revenue until the mid-1980s, but Apple failed to capitalise on that, resulting in Steve Jobs, the co-founder and later the CEO of Apple, leaving the company. Before Steve Jobs left the company, "The Macintosh" was created. This was the first product aimed at the massmarket, yet still did not prove to be the turnaround for the company. Steve Jobs leaving the company was mainly due to the disappointing revenue and an internal power struggle which indicates that Apple had a poor corporate governance structure, at least at that time. John Sculley was appointed as the new CEO of Apple and initially grew the company rapidly. Under Sculley various new products were created which were continued to be sold at a premium. Soon, Windows caught up due to faster Intel processors while Apple's products seemed to be staying the same in quality. Two further CEOs were appointed who struggled to cope with Windows's dominating position, subsequently leading to Steve Jobs being reappointed as the CEO in 1997. Steve Jobs served as the acting CEO until he got terminally ill and died in 2011, after which Tim Cook took the helm at Apple as CEO. In 1998, the "iMac G3" was developed which proved to be the turning-point of the company and helped the company out of financial misery. Later, with the creation of the iPod and iPhone, Jobs revolutionised the market again and changed the market of mp3-players and mobiles. Particularly the mobile market, which was very competitive at that time, was disrupted as the iPhone redefined the mobile into a smartphone. Although there are still a few providers that offer phones that are not "smart", that market is essentially now a niche that has little demand. Currently, Apple is breaking record after record by being the first US company that reached a \$1tn market capitalisation and then in 2020 again to be the first US company to reach a \$2tn market capitalisation (Britannica, 2022; Gibbs, 2018; Beattie, 2021).

2.2. Apple's Share Price Development



Figure 1: Apple's stock price development and important releases (\$155.35 on 11.09.2022)

Source: (Yahoo Finance, 2022) & Apple's annual reports, compiled by author

2.3. Current Products

In the following segment, this thesis will dive into the main products from Apple. As stated above, there are two types of products that Apple mainly offers; the first one being hardware and the second one being services.

2.3.1. Electronics

2.3.1.1. iPhone

Apple currently sells the iPhone SE (budget iPhone), iPhone 11, iPhone 12, iPhone 12 mini, iPhone 13, iPhone 13 mini, iPhone 13 Pro, iPhone 13 Pro Max. All the new iPhones offer the latest 5G technology (Apple, 2022). Just a few days ago Apple also announced the brand-new iPhone 14 series which will be introduced in the market soon (Apple, 2022).

iPhone 13 mini and iPhone 13

iPhone 13 mini is the smallest iPhone from the current line-up. It has a 5,4" display with a smaller battery than the iPhone 13 due to its smaller size. It also has two cameras; one of which is a wide-angle camera and the other one an ultra-wide. Thus, the only main differences of the iPhone 13 are that it is bigger and has a bigger battery than the iPhone 13 mini (Apple, 2022).

iPhone 13 Pro and iPhone 13 Pro Max

The main noticeable aspects that the Pro line-up differs in from the normal iPhone 13 line-up are the camera system, design, and the battery. The camera system in the Pro line-up has another lens that

can zoom closer to objects which is also referred to as a "macro lens". Furthermore, the camera-system also offers a "LiDAR" sensor that can scan the area to further enhance the camera system. In addition, both Pro models have a better battery performance than the base iPhone 13 model. In particular, the iPhone 13 Pro Max has a very high battery performance (Apple, 2022).

2.3.1.2. Мас

In addition to iPhones, there are numerous varieties of Macs currently offered by Apple. There is the laptop line-up including the MacBook Air and the MacBook Pro. The desktop computer line-up includes the Mac mini, Mac Studio, the iMac, and the Mac Pro. In addition, Apple also offers monitors for their Macs (Apple, 2022). Furthermore, in the past Apple offered their Macs with an Intel processor but decided in 2020 to develop their own processor units which are proven to be more efficient with the same power and a good tool to increase profit margins (Zhang, 2021; Forbes, 2020).

MacBook Air

The MacBook Air is supposed be the thinnest and lightest MacBook. It currently runs with the M2 chip that Apple developed themselves. It just got redesigned with the newest M2 chip and the new screen-design with a notch (Apple, 2022; Apple, 2020).

MacBook Pro

In 2021, Apple released a new redesigned set of MacBook Pros in two different sizes. They also further improved the M1 chips that they offer by creating the M1 Pro and the M1 Max. Apple then put the updated chips into the new redesigned MacBook Pros that they offer in parallel to the cheaper old MacBook Pro that still runs on the normal M1 chip (Apple, 2021).

iMac

Apple also released the new redesigned iMac with the M1 chip inside it in 2021. Its design and its thinness are different from all other Macs, due to the fact that it is a PC with all of its components integrated into one body including its monitor (Apple, 2021; Apple, 2022).

Mac mini and Mac Studio

Mac mini and Mac Studio are based on the same concept of a small desktop that encompasses all its components excluding the monitor inside it. Just recently, Apple released the Mac Studio which is aimed at professionals that require heavy processing power, accessible through their M1 Ultra chip.

Mac Pro

The Mac Pro is the most powerful desktop that Apple is shipping. As of now, there is no information as to when the Mac Pro is going to get updated although the presentation in March hinted that the Mac Pro is going to be updated soon (Apple, 2022; Apple, 2022).

2.3.1.3. iPad

There are four different varieties of iPads that Apple currently sells; the most powerful iPad Pro, the newly unveiled iPad Air, the iPad mini and the somewhat old iPad that maintains the old design. Apple also sells widely popular accessories to further improve the iPad experience, such as the Apple pencil and the Magic Keyboard. (Apple, 2022).

iPad Pro and Air

In April 2021, Apple released the iPad Pro with the then new M1 chips. Subsequently, in 2022, Apple also revised the iPad Air with an M1 chip and released it with the main difference being that the iPad Air has one camera lens whereas the iPad Pro has a dual camera setup with a LiDAR sensor attached to it as well. They both work with the widely popular second-generation Apple Pencil (Apple, 2022).

iPad mini

As the name suggests, the iPad mini is considerably smaller than the other iPads. It also does not include the M1 chips like the iPad Pro and Air but rather uses the same chipset as the latest iPhones, namely the A15 chip. Lastly, it has the same camera setup as the iPad Air (Apple, 2022).

2.3.1.4. Wearables, Home and Accessories (WHA)

This product segment includes, among others, the AirPods, Apple Watch, and Apple TV. This section will briefly outline the most significant ones (Apple, 2021).

AirPods

Apple currently sells four types of AirPods. The most expensive over-ear AirPods Max, AirPods Pro which are the only AirPods that include a noise cancelling feature, and the second and third generation AirPods that are essentially the most basic wireless earbuds (Apple, 2022).

Apple Watch

Apple Watch is a line of smart watches powered by the company's watchOS operating system. The newest Apple Watches belonging to the Series 8 launch were announced in September 2022, and became available in October 2021 (Apple, 2022).

2.3.2. Services

Apple has many services that it offers to boost its hardware experience. These services include the music platform Apple Music, a cloud service called iCloud, and a payment service called Apple Pay. Those services use different pricing models. For instance, Apple Music and iCloud use a subscription model, whereas Apple Pay gets a cut of the transaction. Furthermore, Apple also runs an App Store where customers can download various apps. In return, Apple gets a share of the price of the App and gets a share from in-app-purchases. There are also other services such as Apple Care that offers

customers a fee-based service, which essentially includes an extension and upgrade of the warranty (Apple, 2021).

2.4. Corporate Governance

Corporate Governance is a system designed to resolve problems among scattered investors and is responsible for the settlement of conflicts of interests among numerous corporate claimholders (Becht, Bolton, & Röell, 2003). The following section will look at various aspects of Corporate Governance within Apple and discuss its effect.

2.4.1. Ownership

Currently Apple has 16.32bn shares outstanding from which 58.54% is held by institutional investors. With a stock price of \$155.35, the current market cap of the company amounts to \$2.6tn (Nasdaq, 2022).

2.4.1.1. Institutional Investors

Institutional Investors are fund managers who already own a lot of different assets. They prefer investing into diversified and liquid stocks. It has been shown that they put less effort into company-specific knowledge and mainly rely on internal and external Corporate Governance. Engagement with an institutional investor can either be of passive or activist nature (Federo, Ponomareva, Aguilera, Saz-Carranza, & Losada, 2020).

Table 1: Top 3 Institutional Investors (as of 31.12.2021)

Owner Name	Shares held	Stake (%)
Vanguard Group INC	1,261,261,357	7.69%
Blackrock INC	1,019,810,291	6.22%
Berkshire Hathaway INC	887,135,554	5.41%

Source: (Nasdaq, 2022; Apple, 2021), compiled by author

The top three institutional investors are the only investors with a bigger than 5% stake in the company, turning them into blockholders. Vanguard and Blackrock are primarily active in creating ETFs and take positions in companies depending on what ETFs they offer and whether those ETFs are tracking indices. Berkshire Hathaway, led by Warren Buffet, is a holding company that has a huge, diversified portfolio (Reiff, 2021).

It has been evidenced that blockholders can lead companies to steer away from management's myopia. Furthermore, it has been displayed that institutional investors can increase return of equity and improve corporate governance structures. In conclusion, the presence of blockholders and the big portion of institutional investors will likely have a positive effect on Apple's return of equity (Davis, 2002).

2.4.1.2. Individual Insider Shareholder

Name	Shares Held	Stake (%)	Value (\$159.59/share)
Arthur Levinson	4,592,140	0.028%	\$ 732,859,622.60
Tim Cook	837,374	0.005%	\$ 133,636,516.66
Jeff Williams	489,260	0.003%	\$ 78,081,003.40
Total	5,918,774	0.036%	\$ 944,577,142.66

Table 2: Top 3 Individual Insider Shareholders (as of 02.06.2021)

Source: (Reiff, 2021), compiled by author

The top individual shareholders are described in the table above. All three are associated with Apple and hold Apple shares with a value of around \$1bn. Although their respective stakes in the company are relatively small the total value of stocks that they are holding is a significant amount. Arthur Levinson is the chair of the board and a co-lead director; Tim Cook is the current CEO and Jeff Williams is the present COO. By exposing key figures in Apple to considerable downturn risk if the company is not led properly interests are aligned to ensure that management and the board directs the company in the "right" direction (Reiff, 2021).

2.4.2. Compensation

Table 3: Compensation policies for executives

Compensation Policy	Apple's Explanation
Prohibition on hedging, pledging, and short sales	We prohibit short sales, transactions in derivatives, hedging, and pledging of Apple securities by our named executive officers.
Stock ownership guidelines	We have robust stock ownership guidelines for our named executive officers, including a 10 times annual base salary requirement for our CEO.
Compensation clawback policy	Our compensation clawback policy allows us to recover annual cash incentives, equity awards, or other amounts that may be paid in respect of awards in the event of certain events, including acts of misconduct by our named executive officers.
No repricing	We do not allow repricing of stock options without shareholder approval.
No change of control payments	We do not provide change of control payments or gross-ups of related excise taxes.
Vesting requirements for dividend equivalents	Dividend equivalents will not be paid unless the vesting and performance conditions for the RSUs, to which the rights attach, are met.
At-will employment	We employ our named executive officers at-will; our named executive officers do not have employment contracts.
No pension or other supplemental benefits	We do not provide pensions or supplemental executive health or insurance benefits.
No significant perquisites	We do not provide significant perquisites to our named executive officers. For security and efficiency purposes, Mr. Cook is provided personal security services and is required by the Board to use private aircraft for all business and personal travel.
Annual compensation risk assessment	The Compensation Committee oversees an annual risk assessment of our compensation program.

Independent compensation consultant

The Compensation Committee has directly retained an independent compensation consultant that performs no services for Apple other than services for the Compensation Committee.

Source: Apple's Proxy Statement 2022 (Apple, 2022), compiled by author

Apple implemented a variety of policies to ensure a compensation plan that aligns the interests of shareholders and management. They even went as far as to hire an independent consultation company that can help align incentives and therefore improve corporate governance. Furthermore, Apple prohibits hedging and other trades that could diversify or mitigate the risk of a downward trend on key executives to further assure that interests are aligned. In addition, Apple makes sure that executives get a fixed part of a salary as well which is consistent with findings that a certain amount of fixed pay is necessary to retain employees and thus good corporate governance (Crongvist & Fahlenbrach, 2013). Cronqvist & Fahlenbrach also found out that compensation plans should move away from qualitative measures for bonuses to quantitative financial goals which is consistent with how Apple (2022) designed its compensation plan. However, in contradiction to Cronqvist's and Fahlenbrach's finding, Apple (2022) uses performance vesting conditional on relative industry performance which is not consistent with the findings of the paper. There are some time-based vesting options which is explained by the need of multitasking to make executives not only focus on goals that are financially incentivised (Cronqvist & Fahlenbrach, 2013; Apple, 2022). There are no significant perks other than security and private aircrafts which, according to Cronqvist and Fahlenbrach, could be explained by the concept that perks can lead to higher productivity, i.e., by enabling executives to fly to meetings and work during flights with no disturbance. In summary, the compensation-plan that Apple implemented seems like a good fit and covers most attributes that a good compensation-plan is required to. Hence, it appears that Apple is likely successful in aligning incentives through compensation.

2.4.3. Board of Directors

In the following section, this thesis is going to dive into the board composition and its influence on firm. This will be done through an examination of board independence, board size, board composition, board expertise, before a discussion of whether good practices of choosing the board is followed (Sonnenfeld, 2002; McDonald & Westphal, 2006). Furthermore, there have been no board nor committee meetings that any directors missed, implying that those are taken seriously (Apple, 2022).

Name	Since	Minority?	Committee	Further notes
Art Levinson	2000	No	Compensation Committee	 Chair of the Board Holds highest number of shares as an individual investor
Tim Cook	2011	LGBTQ+	No Committee	 CEO of Apple Holds second highest number of shares as an individual

Table 4: Board of Directors

James Bell	2015	Black	Audit Committee	-	Financial and accounting expertise Former CFO and Corporate President of the
Al Gore	2003	No	Compensation Committee / Nominating Committee	- - -	Former Vice President of the US Elected to the US Senate twice Elected to the US House of Representatives four times
Alex Gorsky	2021	No	Nominating Committee	-	Executive Chair at Johnson & Johnson Extensive experience in technology and health
Andrea Jung	2008	Female/Asian	Chair of Compensation Committee / Nominating Committee	-	Served as president and CEO of a non- profit organization
Monica Lozano	2021	Female/Latino	Audit Committee	-	Served as president and CEO of a charitable foundation
Ron Sugar	2010	No	Chair of Audit Committee	-	Director at other big companies (i.e., Uber)
Sue Wagner	2014	Female	Chair of Nominating Committee / Audit Committee	-	Co-founder of BlackRock Served as CEO and Head of Corporate Strategy at BlackRock

Source: Apple's Proxy Statement 2022 (Apple, 2022), compiled by author

2.4.3.1. Board Independence

Defines a ratio of how many directors are not affiliated (as executives) with the company. As the board's main task is to monitor and discipline, a high degree of independence is important (Rosenstein & Wyatt, 1990). Throughout the board, there is only one board member that is an executive of Apple who is the acting CEO: Tim Cook. As such, this results in a high ratio of board independence (Apple, 2022). Furthermore, the nominating committee is responsible for supporting the board in selecting and identifying candidates that are nominated to the board. Two of the board members of the nominating committee (Al Gore and Andrea Jung) are serving board members from before Tim Cook got appointed as the CEO. In addition, through strict division of the nominating committee and the CEO it seems that the influence of the CEO is somewhat limited. Consequentially, board independence should have a positive impact on the overall corporate governance of Apple.

2.4.3.2. Board Size

Another matter that lies under the responsibility of the nominating committee is the board size (Apple, 2022). According to best practices a small board size is considered as good although varying board sizes can be found both in well and poorly performing companies (Sonnenfeld, 2002). Hence, due to the low turnover rate, Apple having a relatively stable and small board size would be considered as good practice.

2.4.3.3. Board Composition

Evidence presented in literature suggests that the presence of minorities on boards could have a positive impact on firm performance (McDonald & Westphal, 2006). 33% of Apple's board is female, suggesting that Apple cares about diversity, which is further elaborated in the Proxy statement by stressing that the nominating committee is actively seeking out candidates with a diverse background

size (Apple, 2022). As explained above, the CEO has limited power on the board due to various reasons which shifts the power back to the owners. Apple also seems to intentionally pay a big portion of the salary of the directors in Apple stocks to further align incentives which is also proven by the large amount of Apple stocks Art Levinson possesses, making him, as shown above, the individual shareholder with the most amount of Apple stocks (Apple, 2022).

2.4.3.4. Board Expertise

Apple carefully picked their directors by focussing on highly trained individuals that have served high positions in other companies and hence bring loads of experiences into Apple. In particular, Al Gore likely possesses a huge political network through his experiences in high positions in the government, including being the vice president of the US. As a result, Apple has a board that has high technical expertise with far reaching social networks (Apple, 2022). In conclusion, Apple was also successful in the aspect of board expertise which improves Apple's corporate governance even more.

2.4.3.5. Further Measures of Corporate Governance Policies

Table 5: Further CG measures of Apple,

Policy	Apple's explanation
One share equals one vote	We have a single class of shares with equal voting rights.
Annual director elections	All directors are elected annually for a one-year term.
Majority voting	We have a majority voting standard for uncontested elections of directors.
Separation of Chair and CEO roles	Our CEO is focused on managing Apple and our independent Chair drives accountability at the Board level.
Continuing education and training	Our Board regularly receives training and updates on ethics, compliance, and governance.
Board and committee self- evaluation	Our Board and committees conduct annual performance self-evaluations led by our independent Chair, including one-on-one interviews.

Source: Apple's Proxy Statement 2022 (Apple, 2022), compiled by author

3. Industries

This chapter will dive into Apple's industry and give an overview as to how Apple performs in this environment.



Figure 2: Apple net sales 2021 per product Source: Apple Annual Statement 2021 (Apple, 2021) Figure 3: Apple net sales 2021 per region Source: Apple Annual Statement 2021 (Apple, 2021)

As evidenced by Figure 3, Apple's main revenue derives from the smartphone market. Thus, this thesis will mainly focus on the smartphone market. Furthermore, this thesis will primarily examine Apple's three biggest regions by sales, namely; the Americas, Europe, and Greater China (Figure 2).



3.1. Smartphone Industry

The smartphone industry shipped around 1.4bn smartphones, generating around \$450bn of revenue in 2021 alone (Counterpoint, 2022; Gartner, 2022).

Figure 4 exhibits that Apple had an average of around 15% market share throughout the quarters. Although Apple only has

Figure 4: Market share based on shipment by smartphone manufacturers Source: (Statista, 2022)

an average of around 15%, it generally generates between 50% to 80% of all the profits in the smartphone industry (Counterpoint, 2021). Thus, Apple can consistently outperform its peers on profit per device sold. However, Apple could have some issues in the next years. The number of smartphones sold is not growing continuously anymore and overall-growth is declining (Statista, 2022). This is due to most customers holding onto their phones for longer than two years and only switching phones once it is not working as well, or breaks, or has been lost (Ottoni, 2019).

3.1.1. Android vs iOS

Over the last decade Android and iOS have dominated the mobile operating system market which led to Android and iOS having a combined market share of around 99% for the last two years (statcounter GlobalStats, 2022). As such, when consumers want to buy a smartphone or upgrade their existing one, they generally must decide which operating system to go for. It has been shown by a survey that 94% of people that upgraded to an Android did so from an Android device whereas only 6% upgraded from an iPhone (Ottoni, 2019). However, 78% of people that upgraded to an iPhone upgraded from another iPhone while a far bigger 22% upgraded to an iPhone from an Android device (Ottoni, 2019).

Furthermore, Apple tends to keep more control of its operating software so that choosing an iPhone also means limited customization, apps, and file transfers (Diffen, 2022). However, due to its limited capabilities iPhones are perceived as more secure. Consistent with this idea, a comparative analysis between iOS and Android confirmed that Android is more vulnerable to malware attacks and security breaches (Garg & Baliyan, 2021).

In 2021, Android phones made up around 85.3% of all smartphones sales (Gartner, 2022). It was also shown that 42% of consumers spend \$150 – \$399 on smartphone (Ottoni, 2019). Since Apple is very selective on how many iPhones to sell compared to other brands, they only have one budget phone (iPhone SE). Consequentially, many customers that might be willing to go for Apple could opt against doing so due to the lack of variety in combination with not wanting to spend that much on a smartphone.

3.1.2. Chip Shortage

In the beginning of the COVID-pandemic, many businesses had to temporarily close their facilities due to lockdown and a lack of demand in the motor vehicle industry, resulting in the collapse of semiconductors sales (Attinasi, et al., 2021). However, this lack of demand in the motor vehicle industry was more than compensated by the rise in demand for electronic equipment and computers due to the need for more remote working solutions which then led to shortages in supply (Attinasi, et al., 2021). Although the smartphone industry did not suffer too much initially as they were stockpiling on important components, it is highly probable that slowly, they will be impacted as well (Browne, 2021). In 2021, Tim Cook warned that shortages in semiconductor supplies could very well impact iPhone and iPad sales (Browne, 2021). Furthermore, this problem will remain in the short-term as chip makers explained that it will probably not be taken care of at least until November 2022 (Baraniuk, 2021).

As aforementioned, chip makers suggested that the shortages in semiconductors could be resolved in/after November 2022. However, due to the recent events in Ukraine this timeline could be under

threat as Ukrainian companies face an uncertain future, while having a major role in the global supply of neon gas, which is detrimental for the process of producing semiconductors chips (Meaker, 2022). To produce neon, Ukrainian companies would use by-products of the Russian steel industry which would capture gasses in the process of creating steel and sell them to Ukrainian companies that would purify those (Meaker, 2022). After the recent invasion of Russia into Ukraine, it is uncertain how the conflict will turn out and how the economic cooperation of Russia and Ukraine is going to be structured. In addition, Russia produces around 40% of the global supply of Palladium; a key resource in developing semiconductor chips (Khanna, 2022).



3.2. Personal Computer (PC) Industry

estimated 314m PCs in 2021 alone, representing an increase of around 10.5% from 2020 and a nearly 20% increase from before the pandemic started in 2019 (Statista, 2022). In 2021, laptops and desktop PCs generated a combined revenue of around \$222bn (Statista, 2022). Figure 5 shows that Apple has a market share, calculated based on units

The PC industry is another strong

that

shipped

an

industry

Figure 5: Market share based on shipment by PC manufacturers Source: (Statista, 2022)

sold, of around 7% in the last seven years. Unfortunately, the most recent data that was available about the profit share is from 2013 and described that at that time Apple had a market share by sales of around 5% but pocketed 45% of the operating profit in the PC industry (Dediu, 2013). Similarly, Deutsche Bank estimated in 2010 that Apple has only 7% of the revenue share but is taking 35% of the operating profit of the PC industry (Deutsche Bank, 2010). As explained above, with the recent shift from Intel's processor units to Apple's own and the resulting higher quality and lower cost, it is probable to assume that the profit share of Apple did not decrease, but rather increased.

3.2.1. Windows vs MacOS

For the last three years, Windows users have accounted for around 85% of all users whereas consumers who opted for MacOS make up around 10%, making Windows the operating system that is primarily used around the world (NetMarketShare, 2022). Generally, MacOS is recommended if consumers have Apple devices already and want to experience a streamlined experience whereby

everything syncs up perfectly. This also includes that files edited on another Apple device can be easily accessed and edited on the Mac (Andronico, 2020). Windows, on the contrary, is the more flexible version, offering many different price ranges for different sorts of products with various functionalities such as touchscreens and 2-in-1 devices that can be converted into a tablet when required (Andronico, 2020).

Which operating system to choose will also depend on what you want to use your PC for. When it comes to creating creative products, such as producing music or editing photos and videos, people generally opt for MacOS as it has many unique features that consumers prefer (Andronico, 2020). However, if someone is looking for a gaming PC then Windows has the upper hand as Macs are generally not able to run highly demanding games, while Windows offers a variety of gaming PCs that are specialised to run games (Andronico, 2020).

Additionally, budget is a further aspect that restricts usage of MacOS since Macs typically start from a higher price-point than Windows laptops (Andronico, 2020). Consumers that require a PC for basic tasks such as browsing the web or check emails can buy one from as cheap as \$199, whereas Apple's cheapest Mac is priced at \$999 (Andronico, 2020).

3.2.2. Switch from Intel to Apple's own Chips

Currently, Apple is in a remodelling phase where it is updating its current line-up with its own chips rather than Intel's processors (Leswing, 2020). Apple's M chips are not just a processing unit such as Intel's processors but rather, they integrates many different units in one chip for faster and more efficient performance (Clover, 2022). The new chips are designed by Apple but use a technology of the company ARM which, rather than selling products, sells licensing agreements for the usage of their technology (ARM, 2022; Clover, 2022). As Apple is in control of designing the chips and the ARM-technology, their chips have higher efficiency. As a result, Macs with Apple designed chips have a significantly longer battery life and/or use significantly less power, leading to less energy waste overall (Leswing, 2020). Furthermore, by controlling the whole process Apple can set its own schedule as Intel was not always reliable in delivering their parts in time (Haselton, 2020). In addition, Apple does not own its own factories where chips are developed since it just designs the chips and sends the specification to specialised manufacturers. Contrarily, Intel is falling behind in which technologies they are able to use in their factories compared to other suppliers (Leswing, 2020). Lastly, switching from Intel's processors to Apple's own is going to have huge effects on the costs of Apple which were estimated to be reduced by \$2.5bn a year (Loeffler, 2020)



3.3. Tablet Industry

Figure 6: Market share in the tablet industry by sales Source: (statcounter GlobalStat, 2022), compiled by author

In 2020, around 150 million tablets were shipped, generating a revenue of around \$57bn (Statista, 2022; Statista, 2022). Figure 6 evidences that Apple captures most of the Tablet industry by consistently getting a market share above 50%, followed by its biggest smartphone rival, Samsung, which is expected to capture around 28% of the tablet industry in 2022. As evidenced, Apple generates a high profit off its products which probably leads to Apple capturing most of the profits in the tablet industry (Apple, 2021). Like the smartphone

industry, revenue is not rising exponentially but rather, revenue in the tablet industry is expected to decline a bit in the next few years (Statista, 2022).

3.3.1. Chip Shortage

As mentioned above, the chip shortage is a high risk and can have huge effects on electronics production. In particular, the iPad has problems due to the chip shortage as Apple is prioritising their iPhone line-up, consequentially reducing the production of iPads by 50% (Ting-Fang & Li, 2021). The article cites the reason for the iPhone's preferred treatment as low seasonality of the iPad and the higher possibility of switching to an Android phone than switching to an Android tablet (Ting-Fang & Li, 2021).

3.4. WHA Industry

Wearables are electronic devices to wear which are powered by microprocessors and can be connected to the internet (Hayes, 2021). Revenue generated by wearables has been increasing significantly over the last few years and is projected to reach \$73.27bn in 2022 alone, representing a 100% revenue increase throughout the last four years (Laricchia, 2022). For the last two and a half years, Apple has had about a third of the market share of all wearables (Figure 7) which stayed relatively stable, despite the fact that revenue was rising steeply in the industry. Furthermore, in the wearable industry, smartwatches have been rising in popularity and hearables have had a stable demand for the last two years, resulting in a combined market share of around 60% of all wearables in the third quarter of 2021 (Laricchia, 2022).

3.4.1. Headphones /

Earphones

After Apple announced the first AirPods in 2016 the demand for earbuds has risen significantly, creating a new market (Cohen, 2022). Consumers who were used to having wired earphones had the possibility of buying a product that was significantly more expensive and had a limited battery life but had no problems of tangling themselves



Figure 7: Market share in the wearables industry by shipments Source: (Laricchia, 2022), compiled by author

up and were generally less troublesome to wear (Cohen, 2022; Cai, 2021). Soon, AirPods became a status symbol and people started wearing them as accessories (Cai, 2021).

A survey recently conducted in the US showed that around 34% of all respondents use Apple headphones and 15% use Beats (subsidiary of Apple) headphones as their personal headphones, likely resulting in a dominant position of Apple in the headphone industry (Apple, 2014; Kunst, 2022). In the earbuds market, Apple currently has a market share of around 26.5%, which is significantly lower than the market share of 38% that Apple had a year before (Canalys, 2021). However, this does not necessarily mean that Apple lost out on a significant portion of the market, but rather that Apple outperformed the year prior (Canalys, 2021).

3.4.2. Smartwatches

Soon after Apple released the Apple Watch, it became a status symbol and a fashion accessory whereas nowadays, the Apple Watch is used for much more. Most notably, it has established itself as an essential tool for health and fitness (Tibken, 2020). Apple has implemented a lot of health functions such as measuring one's menstrual cycle, along with sharing heart data with companies and research institutes to improve heart health etc. (Tibken, 2020).

In 2021 alone, 127.5m smartwatches were sold, resulting in a 24% growth. Apple holds the biggest market share by shipping out around 30% of all smartwatches (Laricchia, 2022; Sharma, 2022). Apple's dominant position is not only exclusive to the smartwatch industry but is also noticeable in the overall watch market by outselling the whole Swiss watch industry (Mawston, 2020).

4. Strategy

In the last chapters the thesis established Apple's background and dived into the industries that Apple is active in. The thesis also looked into Apple's dominant position in those industries and talked about current issues affecting those industries. In this part of the thesis, we will address how Apple managed to get to this market leader position and talk about what other strategies Apple could pursue to hold this position and/or strengthen it.

To establish a complete picture of Apple's strategy, the thesis will analyse external and internal factors of Apple. These findings will late be used in the forecast to justify the assumed development of Apple's cash flows.

4.1. Apple's Ecosystem

Apple has its own unique ecosystem that constitutes a core part of Apple's overall strategy. Apple offers a lot of product-ranges as described prior. It is a well-known fact that Apple products work very well in combination with other Apple devices compared to devices produced by Apple's competition. For example, AirPods work better with iPhones and Macs compared to devices running Android or Windows (Clover, 2022; Thorp-Lancaster, 2022). The same can be said about Apple's interconnectivity by iCloud which is able to seamlessly connect all Apple devices by synching files, calendars, passwords, mails and many more things (Eckel, 2021). According to this article this is a huge upgrade from Windows alternatives on Mac since iCloud automatically synchs all files in the background and enables users to easily access anything through any of their other Apple devices. Eckel (2021) explains that iCloud is also accessible on Windows and Android but lacks the seamlessness and easiness provided by Apple products. Hence, Apple's interconnectivity and seamless connection to other Apple devices provide huge added value if a consumer with at least one Apple device is looking to buy another product from an industry that Apple is competing in. It also leads to a worse experience in other Apple devices if a consumer switches one Apple product out for one of its competition's. This leads to lockin effects that keep customers in the Apple ecosystem, as buying competitors' products would degrade the performance of Apple products that consumers already own.

Another example for such lock-in effects is evidenced by the smartphone industry. By opting for iOS, one gets access to a lot of features exclusively found in iPhones, such as iMessage and FaceTime, whereas similar features found in Android devices can generally be downloaded on an iPhone (Diffen, 2022). In the US, iMessage belongs to the most-used social media platforms (Kemp, 2022). Kemp (2022) shows that over 40% of all American between the ages of 16 to 64 use iMessage. The wide usage of iMessage worsens the conflict of Android and iOS users as Android users cannot take part in a seamless iMessage experience (Higgins, 2022). Higgins (2022) explained that during another court

case against Apple, emails surfaced that showed that Apple could offer iMessage to Android but opted against it. He clarifies that the email showed that it was strategic decision keeping iMessage off Android to keep lock-in effects intact.

In addition, since buying other Apple products improves the performance of Apple devices that a consumer already owns, Apple has a great potential to cross-sell their other products and services. For example, a consumer that already possesses an iPhone would likely use earbuds that are most convenient to use and have the best performance in combination with the device that they want to use it. Therefore, a consumer would probably prefer to buy AirPods. Further, the same logic can be applied to Apple services. When owning an iPhone one might as well use Apple Pay which provides the easiest way of payment, or if one has a Mac and an iPhone then users would likely opt for iCloud which is very easy and provides a convenient way of using cloud services on Apple products. That is one reason why Apple Services take such a big share of Apple's overall Net Sales.

By using the iPhone, which is the most popular smartphone in the world, as an introductory product to Apple's ecosystem, Apple has a huge advantage in other industries by locking-in consumers and incentivising cross-selling (Aadeetya, 2022). That is one main reason why the next analyses will largely focus on the smartphone industry. Therefore, Apple's dominant position in one industry likely leads to dominant positions in other industries. This could also explain Apple's recent venture into budget phones by introducing the iPhone SE 2020 which would still enable consumers to generate extra revenue by Apple Services (Apple, 2020).

4.2. PESTEL Analysis

It is crucial to understand the external effects on Apple from a macro perspective. The PESTEL-analysis that focuses on societal influences on companies is widely used to identify issues that could arise or are already affecting Apple. PESTEL is an acronym for the factors that are analysed. The PESTEL-analysis focuses on political, economic, social, technological, legal, and environmental aspects of the industry. In the scope of this thesis, political and legal issues will be discussed in a single chapter as much of the focus on political issues concerns how to improve legal frameworks to deal with the rising power of companies such as Apple (Dans, 2021). Furthermore, generally the PESTEL-analysis is not to dive into company specific information but since often i.e., political and legal issues can be tailor-made to apply to certain companies, the PESTEL-analysis will also go into Apple-specific issues (Satariano, 2022).

Since Apple is a multinational company and factors of the PESTEL-analysis may vary depending on the specific country, the PESTEL-analysis conducted in the thesis will mainly focus on the three regions that generate the biggest number of net sales, namely the Americas, Greater China and Europe which make up 85% of all net sales of Apple (Apple, 2021).

Nevertheless, the PESTEL-analysis may not be without any drawbacks. Hence, we need to first decide whether the advantages of a PESTEL-analysis are higher than its disadvantages.

4.2.1. Advantages vs Disadvantages

Table 6: Advantages and disadvantages of a PESTEL-analysis

Advantages			Disadvantages
The tool is simple and easy to understand and use.			The tool allows users to over-simplify the data that is used. It is easily possible to miss important data.
The tool helps u environment better.	inderstand the	business	The tool needs to be updated regularly to be effective.
The tool encourages the development of strategic thinking.			The tool is most effective when users come from different perspectives and departments.
The tool helps reduce the effect of future business threats.			The tool requires users to have access to data sources which could be time consuming and expensive.
Can help an organisation to anticipate future difficulties and take action to avoid or minimise their effect.			Much of the data used by the tool is on an assumption basis.
The tool enables projects to spot new opportunities and exploit them effectively			The business environment is changing drastically. Thus, it is becoming increasingly difficult for projects to anticipate developments.
Source: (Rasto	qi &	Trivedi,	2016), compiled by author

The main disadvantages of the PESTEL-analysis focus on the need of access to correct information which needs to be updated consistently and can allow for mistakes by leaving out information and making wrong assumptions. Apple is a multinational company which is considered one of the biggest companies of the world while also being compared to the likes of Amazon, Meta, Google, and Microsoft which are frequently referred to as Big Tech (Satariano, 2022; Schaake, 2022). Therefore, having access to reliable information that gets updated frequently is not a concern since articles published about Big Tech are in abundance. In addition, the advantages of having a tool that helps to understand the environment of Apple, detects new opportunities and is simple to use and understand is a needed asset in properly understanding Apple.

4.2.2. Political and Legal Issues

In this segment the thesis will dive into legal and political issues that affect the industry that Apple is active in or may even be tailor-made to target Apple directly. These factors consist of the political part, meaning it includes among others trade tariffs, political conflicts, taxation, and fiscal policies and the legal part that considers taxation, quotas, employment, resources, exports, and imports etc. (Rastogi & Trivedi, 2016)

Digital Markets Act (DMA)

Just recently, the EU has decided on a new law specifically targeting Big Tech (Amazon, Apple, Google, Meta, and Microsoft) that aims to increase competition by mediating lock-in effects implemented by those companies, which are also referred to as gatekeeper platforms (Satariano, 2022). The article

elaborates that the law might redesign among others app stores, messaging services and online advertising which could lead to huge implications. Satariano (2022) explains messaging services such as WhatsApp could be forced to offer users of other platforms the ability to communicate on WhatsApp. The article further goes on to explain that the DMA could enforce Apple to accept other means of payments than Apple Pay for Apps downloaded through the App Store and Apple is to let other alternatives to their App Store coexist on iPhones and iPads.

The DMA solves some of the concerns that have been rising against tech companies such as the lawsuit against Apple involving the gaming company Epic Games who filed an antitrust case after being removed from the App Store for violating Apple's agreements (Au-Yeung, 2021). The article explains that Epic Games found a way to avoid the 30% fee that Apple set by implementing their own payment system. Au-Yeung (2021) describes that after Epic Games got banned from the Apple Store, they filed an antitrust case and the court decided that Apple must let other App developers implement their own payment systems which could lead to less revenue for that service (Au-Yeung, 2021).

Policies against COVID

As governments take measures to prevent the spread of COVID, which can go as far as implementing lockdowns, companies risk the closing of facilities. Although the US and many countries in Europe have softened their measures allowing for more normality, in China, COVID cases are rising again (Kharpal, 2022; Markowitz, 2022; DW, 2022). Kharpal (2022) explains that this could lead to less consumer spending in China which could then impact various industries. Furthermore, as China is home to many suppliers it could force important suppliers to temporarily halt production by introducing strict measures of lockdown (Apple, 2020). Although COVID measures are easing in the US and Europe, since COVID-numbers generally spike in the winter and reduce in the summer (Wheeling, 2021), there is a risk that policies to prevent COVID could be implemented again which could then impact demand and productivity of companies.

China – US Trade War

Currently the US and China have both implemented tariffs on the goods of each other worth hundreds of billions of dollars (BBC, 2020). Tariffs would lead American companies that sell in China to have higher costs. Furthermore, companies that import goods to China would have to pay a higher price to get their products. In conclusion, companies that sell in China and have important supplier in China could have more costs while importing and selling in Chinese markets.

Russia – Ukraine War

As aforementioned, the Russian invasion into Ukraine has increased prices and thus worsened the existing chip shortage. Furthermore, Russia is one of the biggest suppliers of metals which means that

essential metals such as aluminium, copper, palladium etc., could increase in price (BBC, 2022). The article also describes that Russia exports the most amount of natural gas and the second most amount of crude oil in the world. This would in fact mean that energy prices could increase significantly, raising the price of production and the price of shipping. Because of these price increases, inflation could rise even higher, thus forcing governments to increase interest rates (BBC, 2022). Hence, raising debt would be much more costly. Since gold, which is widely used in electronics, is considered by many a "safe haven" during conflicts, may also increase in price (Inman, Davies, & Kollewe, 2022; King, 2022).

China – Taiwan Conflict

After Russia's invasion into Ukraine there have been questions regarding how the China – Taiwan conflict is going to progress and there has been a heightened sense of concern about whether China is going to take action and use the opportunity to invade Taiwan (Cheung & Chang, 2022). Since Taiwan and China house a significant number of important suppliers (Apple, 2020) for tech companies, a breakdown of China and Taiwan relations could lead to an uncertain future regarding those suppliers. In the case that China invades Taiwan and if, in the course of annexing the country it destroys significant parts of the island, it is very well possible that those suppliers could lose important resources needed to fulfil the demand of the tech industry.

Taxes

Apple has been accused by the EU of using Ireland as means to reduce their tax burden and had been ordered to pay \$15.7bn in taxes to the EU (Amaro, 2020). Ultimately the court decided that Apple did not have to pay the \$15.7bn to the EU but the EU claimed that this was decided due to legal errors that the court made and responded that it has not given up on making Apple pay the amount (Chee, 2021).

Furthermore, Apple's setup in Ireland is thought to be controversial as it is used to avoid taxes not only in the EU but also in the US (Bowers, 2017). The article explains that certain subsidiaries of Apple have set up in a way that they are not subject to paying taxes in any country. Apple holds around \$252bn of cash to avoid paying taxes in the US as US companies must pay a fixed rate of taxes. Even if the foreign country's tax rate is lower, US companies have to then pay the difference to the US (Pozen, 2011; Bowers, 2017).

Other Lawsuits or Regulatory Pressure

There are also other controversial issues in Apple that bring the risk of lawsuits or could potentially damage its revenue. I.e., the proposal from the EU to switch the charging ports of all smartphones to USB-C to implement a universal standard (Warren, 2021), the controversial deal of Apple and Google that sets Google as the default search engine in their products in return for billions of dollars (Potuck,

2020), and the pre-installed music-streaming service Apple Music that has an unfair advantage against its competitors by not paying any fees to the App Store whilst competitors such as Spotify are required to pay (Morrison, 2021). A simple Google search shows that there are a lot of other issues that Apple could face in the future.

4.2.2.1. Sub Conclusion – Political and Legal Issues

As demonstrated above in the industry section, Apple's main revenue derives from the iPhone. Hence, Apple's likely strategy is using the iPhone as a means of introducing customers to their ecosystem which works seamlessly with their own products but struggles with products that do not belong to Apple. This has huge implications on Apple's cross-selling abilities and lock-in effects. As evidenced, the recommendation to buy a Mac is derived from the number of Apple devices someone possesses. Also, by offering exclusive features on iPhones that are not offered on Android devices, consumers get nudged in the direction of Apple. As was shown in the industry chapter, iMessage, which is widely used in the US, is one of such services that is exclusively offered in Apple products and can leave consumers feeling excluded from social circles. This leads to consumers being forced by social pressure to give in and buy Apple products. The DMA would solve that issue by forcing Apple to open their messaging service to other platforms as well, similar to how it will force WhatsApp to do so. This would decrease social pressure and could decrease iPhone sales.

Furthermore, by enabling other payment options and forcing Apple to provide alternatives to their own App Store, Apple could lose out on a lot of revenue they get from their App Store. However, less than 5% of Apple's revenue comes from the App Store so it should not impact the company heavily (Au-Yeung, 2021). In addition, it might be in the interest of consumers to have a tightly controlled App Store which would also improve security by screening Apps before giving them the right to join. Therefore, Apple could potentially argue a case whereby they should be allowed to have more control over their App Store.

COVID measures are another risk that is difficult to manage. As demonstrated above, due to various reasons the supply chain is heavily on risk to function according to plan. Stricter COVID measures could increase the strain that is put on Apple's supply chain and lead to more bottle necks.

The ongoing China – US trade war could have far-reaching consequences for Apple. Apple could avoid some consequences of the trade war, but their suppliers have been pressured before (Peterson, 2020). An escalation of the conflict would see Apple having significantly higher costs as a significant number of Apple's suppliers are from China (Apple, 2020). Furthermore, as shown above, the Greater China region is the third most important region by Net Sales. Import tariffs could raise the cost for Apple when selling their products in China. In summary, an escalation of the trade war could lead to higher

costs of Apple during the manufacturing process and higher costs whilst selling their products to their third most important region.

As illustrated, the Russia – Ukraine war is leading to lower supply of important resources and thus increasing prices. There is a big risk that the limited supply of certain resources will further strain the supply chain which, as demonstrated, is already under enormous pressure. Not only is there a risk of lower production but also higher costs that could have an impact on Apple's profits.

The China – Taiwan conflict has an even higher risk of impacting Apple on a large scale. As shown, many suppliers of Apple are based in China and Taiwan. Notably, Foxconn, one of Apple's biggest and oldest suppliers, along with TSMC which is specialised in producing Apple's chips, are some of the most important suppliers which are both based in Taiwan (Young, Stapleton, & Schmitt, 2022; Warwick, 2021). Although Foxconn is based in Taiwan, due to its huge number of supplier locations in China, Foxconn is also referred to as the biggest Chinese supplier (Young, Stapleton, & Schmitt, 2022). Therefore, the risk of a Chinese invasion into Taiwan might be mitigated as Foxconn has a lot of supplier locations elsewhere. Having said that, TSMC's primary locations, where it manufactures its chips, are in Taiwan even though there are plans to open plants in the US as well (Apple, 2020; Nikkei Asia, 2022). Nevertheless, it is uncertain how Apple's Chinese and Taiwanese suppliers, especially TSMC and Foxconn, would operate in case of a Chinese invasion and what effect it would have on Apple.

Apple's company structure counts as controversial. Apple uses its unique structure with its subsidiaries to significantly reduce its tax burden. There is risk that the EU follows through with its demands and, after losing the first case, still pursue forcing Apple to pay \$15.7bn. The US, which is losing out on a significant amount of taxes, could also increase pressure on Apple or try to legally build the case to make Apple pay its share to the US government and force it to restructure. This could increase costs for Apple and make them less profitable in the future.

There have been a lot of lawsuits and regulatory pressure against Apple. Still, in some cases even if they get implemented Apple could avoid having any negative effects or maybe even use it to their advantage. I.e., the above-mentioned case that the EU is forcing Apple to abandon their lightning port and switch to USB-C. Apple is widely seen as a company that takes away features that they deem unnecessary and provides (sometimes more expensive) alternatives (Rossignol, 2016; Wong, 2016). For example, when unveiling the iPhone 7 Apple announced that it would get rid of the widely used headphone jack and offered the much more expensive AirPods as an alternative (Wong, 2016). Similarly, Apple could get rid of the charging port and only give the option to users to charge their phones with Apple's MagSafe that uses wireless charging (Apple, 2022). In addition, to cope with their controversial deal with Google, that was mentioned above, Apple could just give users the option of

23

deciding to use another search engine but leave Google as the default option and design it in a way that most consumers would still choose Google. To summarise, there are a lot of legal and political issues that could impact Apple's profits but there appear to be various methods that Apple can use to counter at least a few of them.

4.2.3. Economic Issues

In this segment the thesis will discuss how economic issues can impact Apple. The thesis will give among others an overview of current economic outlook by observing the GDP, interest rates and inflation rates (Rastogi & Trivedi, 2016). The thesis will mainly focus on economic issues around the world and will particularly dive into China, Europe and the US because as stated above those regions have the biggest share of Net Sales. In the sub-conclusion it will be discussed how those issues will likely influence Apple.

Gross Domestic Product (GDP)



appropriate measure. To deduce if GDP development gives us an accurate overview of Apple's cash flow, the thesis will regress the GDP of the world in trillions against Apple's net income in billions. The result of the analysis is depicted in Figure 8. We see that most of the variation in Net Income of Apple can be explained by the variation of the World's GDP. Therefore, it is reasonable to assume that GDP has an explanatory value to varying cash flows of Apple.

Firstly, we need to analyse whether GDP is an

Source: (The World Bank, 2022) & Apple's annual reports, compiled by author

Another reason as to why the GDP should be used as an indicator is its ability to describe overall available income. As shown above, smartphones are widely used and as a result of different price ranges by different companies', smartphones are generally available to all, independent of one's wealth. Since smartphones are not required to survive, they will be seen as normal goods, in the scope of this thesis, meaning with growing income there is a growing demand.

Figure 8: Linear regression GDP of the world against Apple Net Income

As shown in Figure 9 there has been significant increase in income all around the world. Most notably, *China* has increased their GDP significantly. With a population of 1.41bn people China managed to lift 800 million people out of poverty (The World Bank, 2022; The World Bank, 2022). Nevertheless, as seen in Figure 9, China's growth has been slowing down. One reason why growth will not continue as before could be due to China's population pyramid depicted



in Figure 10. Figure 10 states that most of *Source: (The World Bank, 2022), compiled by author*

China's population are in their working years (between 25 and 64) while very few belong to the oldest cohort that generally live off their pension. Soon those who are in their working years will reach the age of retirement which means that they will not be productive anymore. Secondly, there are less and less babies being born in China, reaching a new low of 1.3 which is far lower than the required replace rate of 2.1 to keep the number of the population constant (Conerly, 2022). In the long term this could have devastating effects on China's growth since the now producing cohort will belong to the retired cohort which will need to be taken care of by the next generation. Furthermore, although China has grown rapidly and lifted a huge number of people out of extreme poverty, it still belongs to one of the countries with the highest income inequality (Calcea, 2022). To ensure that everyone has enough income to buy smartphones, even if merely for social reasons, China needs to tackle its income inequality.



According to Figure 9, the United States has not been growing like China but has been an established

Figure 10: Population pyramid of China Source: (PopulationPyramid, 2022), compiled by author

economic force before 2006 anyways and managed to even grow a bit more on top (Mount Holyoke College, 2007). With a population of around 324 million, the US is a market with a huge reach (Data Commons, 2022). Furthermore, the US counts as the strongest economy in the world by GDP, making it a very important asset in the world economy and especially important for business since it is the country with the highest household spending (Research FDI, 2021; OECD, 2022). Similar to China, the US has a big problem with income inequality but still has a far higher average income of \$64,350 per year compared to China's \$10,550 per year (Calcea, 2022; WorldData, 2022). The US had a decrease of GDP by 3.4% in 2020 during the pandemic (OECD, 2021). The OECD (2021) further forecasted that the US would grow its GDP by 5.6% in 2021 and it will continue increasing in 2022 and 2023 by 3.7% and 2.4%. The report also states that the unemployment rate before the pandemic in 2019 was 3.7% which spiked to 8.1% in 2020 but now has been shown to have decreased to around 3.6% in 2022 (Statista, 2022). The OECD (2021) also stated that the US can improve the condition of its population and expand its economic development by investing more into infrastructure which should be chosen carefully.



Figure 11: Population pyramid of Germany Source: (Population Pyramid, 2022), compiled by author

The *European Union* was growing with a higher rate than the US before the financial crisis in 2008. After 2008, the growth has not been as high as the US' and hence the EU grew the weakest out of this group but still managed to get the edge in terms of absolute GDP compared to China with a margin that is getting smaller per year (The World Bank, 2022). With a population of 447.7 million it is still a market with a huge

demand and a household spending that is barely higher than China's (OECD, 2022; European Union, 2022). It still has to be acknowledged that, if past growth of the last 15 years is an indicator of how the EU is going to grow for the next years, it does not seem that the EU is going to grow as fast as the US or China. The EU will likely be overtaken in many metrics such as GDP and household spending by China in the next few years. The biggest economy of the EU is Germany with a population of around 83m (Data Commons, 2022; eurostat, 2021). Germany, especially, will have problems growing in the not-so-distant future because of its aging population as seen in Figure 11. The general age requirement in Germany for people to retire and get their pension is between 65-67 years old (European Commission, 2022). As per Figure 11 we can see that a big part of Germany's workforce is going to retire in the next 5-20 years. Because of the German pay-as-you-go pension system it could be very difficult for the government to sustain the current process since it does not pay its pension amounts on behalf of employees in a fund but rather uses these payments to pay the current retirees (Asinta, 2022). With the risk of a reversed population pyramid the German government could either invest itself to the pension system by investing less into other projects or could raise pension fees of the current workforce which could have a negative effect on GDP.

Inflation Rate and Interest Rates

Largely due to the COVID-pandemic and the current Ukraine – Russia war, prices have been rising extraordinarily (Amin, 2022; Maas, 2020). Central banks that are targeting a certain amount of inflation will adjust their interest rate to fight deflationary of inflationary developments, linking those two rates together (Jahan, 2022). If high inflation were to happen especially in one country alone it could lead to a lot of risks. A case study of Turkey is insightful into why a high inflation rate is not desired. Turkey recently hit an inflation rate of 54%, reaching a 20-year high (Turak, 2022). The article explains that the inflation has particularly hit the population since wages have not been increasing accordingly and hence their real wages have decreased significantly. Turak (2022) also explains that the trade deficit has been hugely affected as imports are more expensive due to the Turkish Lira losing on value, leading businesses to suffer as well. The article goes on to explain that President Erdogan refused to increase interest rates to counter inflation movements and rather decreased interest rates which made the situation worse. Apple had to temporarily stop its Turkish website from making sales since prices needed to be adjusted to ensure a fixed profit margin (Krishnasai, 2021).

A high interest rate increases the cost of debt and raises the incentive to save. A low interest rate leads to a lower cost of debt and increases incentives to invest. Therefore, for businesses it is more profitable to have lower interest rates because it lowers their cost of financing. Therefore, typically governments lower interest rates to fight recessions since lower interest rates raise businesses' incentives for implementing new projects and reduce their burden of debt (DeNicola, 2020). Consistent to this hypothesis the US decreased their interest rates to nearly zero to counter the pandemic (White, 2021).

As we can see in Figure 12, nearly all countries or groups had an inflationary reaction to the COVID pandemic. Unfortunately, the data does not cover the current Ukraine – Russia war that is likely pressuring inflation, so the forecasts of the IMF are likely not totally accurate. Only China had a deflationary movement to the COVID-pandemic which was likely a temporary effect





as demand plummeted and led to decreasing prices. The US, the EU, Germany and on average the rest of the world had an inflationary reaction. In particular, the US had a big problem with inflation initially as it rose more than 3%. From the forecast it can be seen that China, Germany, the US, and the EU likely follow a target inflation of 2% that they will reach in the next few years.

Figure 13 depicts the interest rate development of China, the EU and the US. It can be seen that China still has a relatively high interest rate whereas the EU and the US have interest rates close to zero.



Figure 13: Interest rate Source: (FRED, 2022; ECB, 2022; countryecononmy, 2022), compiled by author

Secondly, we can see that especially the US reacts quite heavily to recessions since they decreased the interest rate after the financial crisis in 2008 near to zero. The EU compared to the US was quite hesitant at first and decreased the interest rate to near zero later on. China seems to follow a trend to keep lowering interest rates. Furthermore, the US raised its rate later on to a maximum of 2.42% but

in order to tackle the economic impact of the pandemic they lowered it to close to zero again. The US seems to be on an upwards trend again as they increased their interest rates to 0.50% again. Most recent data of European inflation shows that it is increasing significantly, especially energy prices (Eurostat, 2022). To tackle a soaring inflation, it is very plausible to assume that the EU will soon increase interest rates as well. Since China had a higher interest rate to begin with, they are expected to lower interest rates to fight the economic impact of the pandemic (Bloomberg, 2022).

4.2.3.1. Sub Conclusion – Economic Issue

We first established that there is a connection between GDP and net income of Apple. Then we looked at the GDPs of above specified regions. China, especially, has been growing immensely over the last decade. Apple has taken opportunity of that growth and now China is the third most important country for Apple derived by Net Sales. However, the growth of China has been slowing down and for Apple to improve their share in China it needs China to tackle inequality and needs to raise the average income so that more people are able to afford Apple products. Secondly, China needs to find a solution to their demographics problem to ensure that growth can be sustained otherwise they will have problems in the future since a lot of retirees will need to be taken care of by the government or individual households. The EU grew significantly less compared to the other regions. The thesis has a detailed look at Germany since it is the biggest economy in the EU. Germany is probably going to have problems in the near future since a big portion of their population is going to retire and need to be taken care of by the German pension system which is basically an effort to redistribute wealth from the workforce to retirees. This could have serious implications for the growth of Germany as the GDP would be impacted by a scheme that does not seem that sustainable. The EU needs to solve the problem of lowpar growth for Apple to profit. The US has not been growing as strongly as China but it did have a more comparable growth to the world which is great considering that the US is already the leading economy of the world.

An outlook of simultaneously lower interest rates and inflation rates would be the best outcome for businesses. Because of the pandemic inflation was quite volatile so it was hard for businesses to know what to expect in the short-term future. After some time passed from the beginning of the pandemic, inflation started to stabilize and it was predicted that in the next two to five years the EU, the US and China would roughly reach their target inflation rate of two percent. Due to the recent Ukraine – Russia conflict, prices have been soaring again and the world is confronted with an uncertain development of prices. To tackle that, the US and the EU are likely going to increase their interest rate whereas China still seems to be on a downward trend. Apple could face higher inflation and higher interest rates. One has to wait and see how the monetary policy is going to impact inflation and economy. Therefore, it can only be concluded that the inflationary development is quite uncertain, and businesses will have a new challenge to monitor its development and try to forecast it accurately.

4.2.4. Social Issues

In this segment the thesis will talk about how the markets Apple is active in influences the community in a social way. Thus, the thesis will dive into the advantages and disadvantages of Apple products and industries and their implications on human lives.

Advantages

Electronics such as laptops and smartphones give their users access to information and communication technology (ICT). A study done in Uruguay revealed that access to ICT in the form of laptops significantly increased labour income of households, specifically those households with a below median income (Marandino & Wunnava, 2017). It has also been shown that using smartphones specifically might increase income (Ma, Grafton, & Renwick, 2018). Ma, Grafton & Renwick (2018) demonstrated in rural China that the usage of smartphones increased household income, farm income and off-farm income significantly.

ICTs have also connected many people around the globe and made it easy to be informed. With the touch of a button information is accessible across borders. Friends and families are able to connect with loved ones through a distance. People can use social media to spread their views on the world
and actively shape the opinions of other people. Medical treatment can profit off of more digitalization that is enabled by ICTs (DigitalHealthEurope, 2022).

Notably, the pandemic has demonstrated the great asset of ICTs all over the world. With strict lockdowns ICTs enabled people to work from home and students to continue with their studies without the need of being physically present. The effects of "Work From Home" (WFH) during the pandemic and its future implications have been studied in a paper that measures its effect in Indonesia (Rachmawati, Choirunnisa, Ghiffari, Syarafina, & Pambagyo, 2021). The paper describes that WFH was proven to be effective enough and is recommended for big cities since it reduces movement costs and congestion and improves efficiency as there is no time wasted in travelling to work while also limiting space needed for office buildings.

Other advantages are from a convenience point of view. Many features such as listening to music or recording videos were mainly done through different devices in the past. Smartphones and features such as Mobile Banking make life more convenient. Especially in countries that lack social infrastructure this convenience can turn into a necessity. Such is the case of many countries in Africa who did not have sufficient banks before the wide-spread of smartphones but now through cryptocurrencies and smartphones many people have access to financial services such as making transactions (Etim, 2014). There are a lot of features that smartphones bring with them and as such discussing all features is beyond the scope of this thesis.

Disadvantages

One problem that could arise due to an overreliance on WFH is social isolation, as demonstrated by a study conducted in 2001 (M., Raghuram, & Garud, 2001). This was later confirmed in studies done during the pandemic that measured the impact of WFH in combination to lockdowns (Galanti, Guidetti, Mazzei, Zappalà, & Toscano, 2021).



Figure 14: Share of adults that use social media as a source of news Source: (Newman, et al., 2021), compiled by author

There have been a lot of studies which demonstrate that smartphone addiction can lead to mental health issues and/or social problems (Lee, Cho, Kim, & Noh, 2014; Darcin, et al., 2016; Ihm, 2018). It has been demonstrated that the more children get addicted to smartphones, the less they take part in social engagements (Ihm, 2018). It has also been shown that there is reciprocal relationship, meaning that social phobia can lead to smartphone addiction (Darcin, et al., 2016). It was further revealed that smartphone addiction leads to disturbance in studying (Lee, Cho, Kim, & Noh, 2014). There are a lot more studies that tackle the issue of smartphone addiction on society but going in depth about these issues goes beyond the scope of this thesis.

As mentioned, with the touch of a button people are now able to get access to information. As seen in Figure 14, a huge number of people consume their news through social media although social media has significant dangers of misleading the public by being used as a medium for fake news (Xiao, Borah, & Su, 2021). The paper found that since the start of the COVID pandemic there has been a lot of misinformation that spread through social media and using social media contributed significantly to having conspiracy beliefs. This could have a huge effect on the well-being of society since people could have beliefs about i.e., the COVID vaccine which could be harmful towards society. Since ICTs are an access point for social media, this may lie within the responsibility of those companies.

Security risks could also be a threat to society. In 2014, there was a major iCloud leak which disclosed a lot of private media of celebrities on the internet (Peterson, Yahr, & Warrick, 2014). This breach showcases a big concern of privacy in the industry. Since the breach was uploaded on the internet and involved a lot of celebrities it was widely discussed, yet security breaches still happen from time to time. Just recently, a company called NSO group that is specialised in hacking found out how to break into iPhones in 2021 (Bing & Satter, 2022). The article explains that this technology was later used in Uganda to spy on US diplomats. Since governments are able to buy those technologies spying and discovering disclosed information of foreign powers can get easier and utilised to the users' advantage. Furthermore, if governments want to spy on their population and are able to use this kind of technology on a large scale it could be very harmful for its population.

4.2.4.1. Sub Conclusion – Social Issues

Apple is primarily active in the ICT sector which can be shown by Figure 3, which demonstrates that iPhones, Macs and iPads makes around two-thirds of Apple's Net Sales. Therefore, the industry that Apple is active in can have a positive effect on income as established by those studies. However, Apple's cheapest iPhone, namely the iPhone SE, is currently sold for \$429 (Apple, 2022). Since the increase in income that was found was mainly shown in rural areas or low-income households it can be implied that Apple as a company does not influence those households directly. Nevertheless, Apple is a huge player in the smartphone market and a big player in the laptop market and thus increases

competition and hence forces at least some players to decrease prices. In conclusion, Apple has an indirect effect on those income increases by increasing competition.

This same principle can be applied to other advantages as well. Although Apple is not directly responsible for the rise of cryptocurrency or access to smartphones being used as banks it still indirectly increases competition and hence makes smartphones more accessible. It is also fair to point out that Apple is not the only provider for ICTs and thus is not solely responsible for making WFH more accessible but still the point stands that Apple's products can be used in such a way and do have an impact on WFH and therefore can be attributed to the positive social impact WFH has on the community.

However, WFH has some negative implications as well and since Apple products do shift the trend of WFH it arguably is Apple's responsibility to deal with such implications. In this example, it appears as though the benefits outweigh the disadvantages of WFH and first and foremost it might be the responsibility of the hiring company to make sure that WFH does not lead to social isolation.

Similarly, ICTs are not the ones spreading fake news, but their devices are used to consume media and hence consume, to some degree, fake news. Software providers are generally made responsible for that kind of issue (Allcott & Gentzkow, 2017). There might be also some responsibility that ICT providers could engage in. Apple may have the ability to create an internal fact checking tool that looks at webpages. Even if there was limited ability for Apple to counter that problem the issue still remains that their technology can get misused in a way that could be harmful for society.

One point where Apple can be held totally responsible is smartphone addiction. It has been proven that smartphone addiction can be a big problem and it needs to be tackled. In particular, children need to be protected from loneliness and lack of social engagement. Apple has developed the feature 'Screen Time' that shows how much their iPads and iPhones are used and what apps are used for how many minutes (Miles, 2022). This can be seen as a nudge from Apple to make their consumers aware how much they use their phones and whether there are some apps that they want to use less in order to reduce time spent on their phones. Miles (2022) explains that Screen Time also includes the option of putting time limits on certain apps that once crossed can be extended for one more minute, 15 minutes or indefinitely. Again, we can see that Apple is nudging the users in the direction of upholding the principle set by the users themselves by offering the option of one more minute or 15 more minutes in order to make users reconsider their choice to use the app indefinitely.

One other point that is of high importance but remains unsolved to some degree is the issue of security. As written above, there was a big iCloud breach which enabled hackers to steal sensitive information and data from a lot of celebrities in 2014. Another example is the recent security breach where a company found security flaws within an iPhone and sold that technology. The unreported cases might be a lot higher than officially known since there is no way of finding out. The nature of those cases goes as follows that somebody finds out a flaw and uses it or reports it which then gets quickly fixed. To fix major security breaches Apple can allocate a huge part of their budget to security but there is no way of knowing whether it will be enough to protect them from further big flaws.

4.2.5. Technological Issues

In this segment we will discuss technological trends that might affect the industry. Since Apple plays a big part in its industry, we are going to focus on Apple products.

As Apple is active in the technology industry most of its product are used for business or private usage. Apple produces products and updates them on a regular basis, meaning that Apple brings out a product and generally develops predecessors that improve on the product. As shown above, Apple recently developed the Mac Studio that uses the relatively newly designed M1 Ultra chip which is shown to have superb performance (Warwick, 2022). The name alone implies that it is aimed at professionals that require heavy video processing. Warwick (2022) explains that the test done on the Mac Studio showed that it processed the rendering of a video significantly faster than their last highest quality Mac, namely the Mac Pro. Another example could be the iPhone 13 Pro which has the feature called Cinematic mode that enables consumers to get closer to a more professional video shot while not requiring a professional camera (Apple, 2022). Therefore, we can establish that Apple allocates a lot of its resources into R&D to bring out higher quality predecessors every year.

Secondly, Apple innovates a lot of products that did not have a big market before. The concepts of the iPhone, iPad, AirPods, Apple Watch etc., were not as well known before Apple entered into the market (Mullaney, 2016). The last main innovation from Apple were the AirPods. In 2019, it was estimated that if there was a company that is solely and exclusively producing AirPods and selling them it would be worth \$175bn (Haslam, 2019).

4.2.5.1. Sub Conclusion – Technological Issues

We can clearly derive from Apple's many industry-changing moves that Apple has been taking opportunities to get ahead of competition. The AirPods especially proved to be very profitable and led to many other companies imitating this technology which led to the rise of the Earbuds industry (Mordor Intelligence, 2022). The same process is comparable to the overall wearables trend which resulted in a huge market. However, the past achievements of Apple are not a clear indication as to whether Apple is going to be able to do the same in the future.

Finally, since the ICT market is structured in a way that it requires updates in the not-so-distant future, Apple has to constantly innovate. The market requires smartphones and laptop providers to implement the newest possible features. Thus, the market is already used to technological advances and roughly knows what to expect from competitors.

4.2.6. Environmental Issues

In this segment the thesis will dive into environmental issues arising from markets Apple is active in. We will divide the following analysis into two parts. First, there are direct impacts of the products that arise from the supply chain and the usage of smartphones. Secondly, there are some aspects that have an impact on the environment through indirect ways that reflect company decisions and their followed reaction by customers. The smartphone industry causes a lot more carbon emission than the tablet or PC industry (Thorne, 2021). Hence, the following analysis will focus on smartphones and explain how they are influencing environmental issues. Since Apple is the biggest player by profit in the smartphone industry we will mainly focus on Apple's policies and use them as an approximation for the rest of the industry.

Direct impact

Table 7: Carbon footprint of iPhones

iPhone model	CO2 emissions	Production	Transport	Usage	Recycling
Apple iPhone 12 Pro Max	86kg	82%	2%	15%	<1%
Apple iPhone 12 Pro	82kg	86%	2%	11%	<1%
Apple iPhone 12	70kg	83%	2%	14%	<1%
Apple iPhone 12 Mini	64kg	85%	2%	12%	<1%
Apple iPhone SE (2nd gen)	57kg	84%	3%	12%	<1%

Source: (Thorne, 2021), compiled by author

Table 7 describes the CO2 emissions of smartphones. It can be seen that the production process of iPhones has the biggest impact on CO2 emissions whereas transportation makes up only 2%. Surprisingly, usage makes up around 11% to 15% of the carbon footprint of iPhones. Thorne (2021) states that compared to laptops and PCs, smartphones have a far higher carbon footprint, amounting to 125 megatons of CO2e per year.

Indirect impact

There are also other factors to consider that influence sustainability and environment in an indirect way. One of such factors is called 'Right to Repair' (Šajn, 2022). More than half of all phone upgrades are due to issues that concern the performance of the phone or that the phone gets damaged or lost (Ottoni, 2019). It has been reported that 45% of people hoard up to five unused devices at home which could otherwise get recycled (Hudson, 2021). As seen in Table 7 most of the CO2 emissions are generated in the production process. Hence, it is environmentally recommended to prolong the life cycle of smartphones and to repair it rather than hoard it at home. The right to repair movement in the EU has mainly three goals to make repairs easier (Šajn, 2022). It describes that it wants to achieve

a proper right to repair during the guarantee period of two years, a right to repair after the legal guarantee has expired and a right for customers to repair their products themselves.

The right to repair during the legal guarantee is quite straightforward and does not require any further explanation but the right to repair after the legal guarantee has expired is a significant improvement to the current situation (Šajn, 2022). It is well known that Apple has a monopoly in genuine Apple spare parts by having agreements with producers that they are only going to sell to them and to Apple certified repair shops (Clover, 2021; Van der Velden, 2020). It has been reported that in order to become a certified Apple repair shop one has to pay a fee in return and even then, Apple forces their independent certified repair shops to source out loads of repairs to themselves and thus makes them lose out on revenue although it is incumbent on those repairs shops to get officially trained by Apple and follow guidelines and handbooks closely (Koebler, 2017). All of those issues keep entry barriers up and lead to problems such that consumers have to choose between buying a new product or paying a lot for spare parts and the repair. One other reason why consumers are disincentivised to repair their phone is that products are made in a way that that they cannot be repaired (Šajn, 2022). In example, as mentioned above, the M1 chip is far more integrated than prior Intel processors since it combines other parts such as GPU or RAM into the processing unit. This leads to a more complicated process of repairing phones albeit making it more efficient. Furthermore, batteries are generally glued into the phone to ensure a slick and light design, meaning they are not removeable as they used to be (Bose, 2022).

Lastly, the EU wants to improve the conditions for when consumers want to repair their phones themselves (Šajn, 2022). Šajn (2022) explains that currently the EU does not force producers to provide consumers with handbooks and manuals to follow for repairs nor is it required to offer spare parts. In case companies decide to make phones more repairable, consumers themselves could easily fix their current phones and thus prolong the smartphone cycle and use it longer and thereby boosting sustainability and reducing carbon emissions.

Therefore, the *EU legislation* wants to implement new rules such that spare parts are made available, the repair process is made easier and more cost-efficient, and phones with removable batteries are offered (Šajn, 2022). Šajn (2022) also explains that the EU wants to steer companies away from these unsustainable practices by implementing a sustainability tax that can be enforced by member states.

A recent strategy decision led by Apple, which is also now implemented by other companies such as Samsung, was also controversially discussed in the last few months which removed the power adapter out of the iPhone package in an effort to decrease packing size and hence carbon emission (Sachdeva, 2021). Since Apple included a Lighting to USB-C cable in that packaging and increased the wattage from 5W to 20W, many customers had to buy a new charger anyway. As such, Apple had an increased demand for chargers which they then delivered in a separate box (Clover, 2020). Thus, this change was arguably done out of economic incentives rather than ecological. Furthermore, it has been reported that by removing the charger, Apple made/saved an additional \$6.5bn (Friedman, 2022).

4.2.6.1. Sub Conclusion – Environmental Issues

The supply chain of smartphones alone is putting 125 megatons of CO2e per year in the environment. But that is not the whole part of the picture since there are a lot of indirect issues affecting the environment that can arise by the company's conduct. Apple has been very reluctant concerning the right to repair issue which would decrease the environmental impact of the supply chain by reducing demand in new phones. They have a monopoly on spare parts and make it difficult for repair shops to get access to genuine parts since they want them to get officially certified and pay a fee. Secondly, even then repair shops have to outsource a lot of repairs to Apple, decreasing their revenues. In addition if consumers wanted to repair their phones themselves, they did not have access to any spare parts or manuals describing what needs to be done which Apple changed just recently (Apple, 2021). According to this press release Apple announced that they are going to make limited types of spare parts available for consumers if they want to repair it themselves. Although the most common parts that need replacement, namely battery, display and camera, are made available but a lot of other parts are still not accessible to consumers. Unfortunately, the issue of non-certified repair shops not having access to genuine spare parts was not addressed in that press release and still needs to be solved since a huge part of consumers will likely want their phones to be professionally repaired rather than doing it themselves.

Furthermore, making electronics more repairable has not been addressed by Apple. However, with rising integration of parts and more complex designs a more repairable phone could have a lower performance than before. Thus, a trade-off needs to be made that if, for instance, it should be required that batteries should be replaceable, how much of a performance loss is desired.

Lastly, the analysis also showed that some business decisions that are marketed as environmentfriendly could just be an excuse for more profit. The omission of the charger in iPhone packages and the simultaneous increase of power wattage combined with the switch from USB-A to USB-C likely forced a lot of people to buy their chargers separately. This might have very well led to more carbon emission as two separate deliveries and boxes were required in order to have the full experience of the iPhone.

4.2.7. Sub Conclusion – PESTEL Analysis

Table 8: Conclusion PESTEL-Analysis

Issue	Summary	Impact
Political and Legal	There are a lot of pressing issues that Apple has to deal with currently. There are current political problems such as the Ukraine - Russia war and the China - Taiwan conflict but also regulatory changes such as the DMA that could have significant effects on Apple. It is reasonable to assume that eventually conflicts will calm down or businesses will find other solutions in getting their supplies but legal restraint such as the DMA that specifically target companies likely Apple are expected to leave an impact. In addition, it is plausible to assume that governments are going to implement additional rules and push Apple into more competition. However, it is yet to be seen how Apple copes with that.	Ŷ
Economic	It has been shown in the analysis that the world's overall growth in the last 15 years has been quite high. Especially China had an immense growth and the US's growth was high as well. However, the EU has not been growing as expected and had its ups and downs. Nevertheless, China's growth will probably not continue as it has been in the last decade and the EU has its own issues to deal with. Even so there are no major issues currently that cannot be dealt with so that those countries will continue growing. Inflation rate will in the long-term probably normalise and interest-rate will rise again, making it more costly to finance projects.	÷
Social	Socially ICTs have been a huge advantage to raise income and connect people all around the world. In addition, they have many features that make life easier and helps getting access to important information. However, there are still drawbacks. The easy access to information makes it difficult for people to differentiate between information and misinformation. In addition, engaging in online activities or using too electronic devices too much may lead to mental health issues. Lastly, there are concerns about the ability of proper security of ICTs. Loopholes that the company did not think about could get misused to violate privacy.	÷
Technological	The technology industry has to obviously keep innovating. Apple has demonstrated that it is able to keep innovating and hence still profits off a first mover advantage in newly constructed markets.	R
Environmental	Especially the smartphone market has a very high carbon footprint which mainly arises from the production process. Companies that sell hardware are incentivised to make customers buy more of their hardware and therefore disincentivise easy solutions that could prolong the product cycle. Hence, Apple has been following some business decision that are harmful for the environment but profitable for Apple. Furthermore, some of their conduct has been marketed in a way that seemed environment friendly at first but by looking closely their marketing seemed a bit misleading. Their conduct had probably profit as their main motivation compared to whether it is going to cause higher carbon emissions or not.	÷

Source: Authors own creation

4.3. Porter's Five Forces



4.3.1. Advantages vs Disadvantages

Table 9: Advantages vs Disadvantages of Porter's Five Forces

The and most widely spread known management tool is Porter's Five Forces (Dälken, 2014). Figure 16 describes the individual analyses that make up Porter's Five Forces which rather focuses on a set of factors that influence competition than only examining existing industry competition. In the following, we will analyse those factors and see how Apple is being influenced by them. For reasons of space, the following analysis is mainly going to focus on the smartphone industry since it is the biggest factor to Apple's success (i.e. Net Sales).

Advantages	Disadvantages
Ability to derive profitability and attractiveness of industry	No justification by Porter why especially those five forces were picked rather than others
By simplifying the complex forces at work that shape competition it provides the tool to evaluate and examine complex concepts in a structured way	Static model which ignores changing circumstances and reactions of competition by only concentrating on 'snap shots' of the industry
Ability to acquire strengths and weaknesses of a company to build a plan that aims to improve position within the industry	Missing focus on digitalisation, deregulation and globalisation
Established an increased focus on external factors compared to SWOT analysis	Increasing power of the internet and therefore fast shaped industries
Ability to understand the basis of the underlying profitability that is shaped by a huge part through competition and its forces	

Source: (Dälken, 2014), compiled by author

First, we need to understand the advantages and disadvantages of using Porter's Five Forces in order to understand whether such a tool should still be used approximately 40 years after it has been created. Table 8 compares those advantages and disadvantages of Porter's Five Forces. Porter did not justify why those five forces were used rather than other forces. Thus, arguably there could be other forces that could prove to be detrimental in explaining external factors which are simply ignored by the model. Additionally, changing circumstances that would be expected in a fast shaped industry which is driven by digitalisation and globalisation could make the conclusions of Porter's Five Forces obsolete in a short time. Hence, updating the model from time to time would be essential. Nevertheless, Porter's Five Forces have a lot of advantages as well. Porter's Five Forces enables us to simplify the complex structure that impacts attractiveness and profitability of an industry. It is also a useful tool to derive the strengths and weaknesses of industries and use them in a SWOT analysis to derive useful strategies. Lastly, it explains the underlying factors that shape profitability and therefore provides a better understanding about the causes of the specific profit margins. Although there are some drawbacks to using Porter's Five Forces, we still deem it to be appropriate in combination with a PESTEL-analysis. However, continuously updating the model is essential if used in a monitoring context and/or for a longer term.

4.3.2. Industry Competitors

This segment will discuss current competition in the smartphone and PC industry. Firstly, it needs to be established how competition in those industries is shaped. The thesis is mainly going to focus on the following factors to analyse industry competition: seller concentration, product differentiation, excess capacity and exit barriers (Grant, 2016).

Smartphone Industry

Grant (2016) describes that depending on *seller concentration* price, competition may soften. He explains that a dominant leader may exercise significant power over the price. Furthermore, it could be the case that an even distribution of market share amongst a few players might lead to collusion or "parallelism" which means that one company could increase prices and others could follow and hence cooperate to a higher price level. As described by Figure 4, Apple averages a market share of around 15% in the smartphone industry. Nevertheless, it captures on average between 50% - 80% of all profits (Walia, 2021). That indicates that Apple has a dominant position in the smartphone industry which leads to an uneven spread of power. Consistent with this theory (low seller concentration), it has been shown that Apple exercises dominant power in the industry. I.e., when Apple unveiled the price of the iPhone X, which was set at over \$1,000, it was the first big smartphone company that offered a mass-production phone with a price of over \$1,000 (Oremus, 2018). The article states that this has been normalised since then as other companies followed suit. Therefore, we can see that Apple exercises a lot of power on what the norm is in the industry and has the power to increase the price level.

Another factor is *product differentiation*, which Grant (2016) discovers to affect existing competition. Grant (2016) states that if products are very homogenous consumers are likely to switch between different providers depending on prices. That could lead to price wars so that companies would undercut each other, leading to a lower price level. Apple is the only company in the smartphone industry that uses the operating system iOS which in combination with smartphones that use Android, capture around 99% of the overall market share (statcounter GlobalStats, 2022). Since iOS is the only alternative to Android, consumers have to choose Apple if they are not satisfied with Android. Furthermore, the seamless connection of Apple products makes it more appealing for customers to stick with Apple since Apple products such as AirPods do not work as well with Android phones as they do with iPhones (Clover, 2022). Other features such as the above mentioned iMessage that do not feature on Android phones incentivise consumers to pick iPhones and also develop switching costs that lead to lock-in effects once customers own a sufficient number of Apple devices. In addition, it causes Apple to differentiate itself from the competition by offering something unique that is not offered by competitors. It has been shown that Apple (i.e., iPhone) has a very loyal customer base as a result of effective brand image and product differentiation (Pieter, Arijanto, Setyawati, & Setyanto, 2020). This indicates that although the industry has big players, competition seems to be not as strong as can be shown by Apple's big profit share. Nevertheless, Android phones are also differentiating themselves by coming up with new designs, features and their own unique interface (Kalyani, 2018). The paper argues that hardware improvements that were prevalent in the past to differentiate between competitors cannot be used for product differentiation anymore since they can be copied quite easily in a very short time frame. Nonetheless, according to Kalyani (2018) software can be used to successfully differentiate since it is hard to copy. For example, cameras in smartphones are not relying on only their hardware anymore but rather how photos are processed and refined by the software as demonstrated by the most recent Google Pixel and its sophisticated camera system (DXOMARK, 2021).

One of the biggest concerns that could turn competition fiercer is the stagnating demand as described by Figure 16. One important reason for the stagnating demand could be that over 80% of the global population use a smartphone already (O'Dea, 2022). Thus, companies need to compete more aggressively in order to grow. Additionally, as companies were probably not expecting a sudden dip in demand, they likely built-up *excess capacity* which further contributes to the problem. Apple's iPhone-



Figure 16: Global smartphone sales (in million units) Source: (O'Dea, 2022), compiled by author

events made that very clear because in the past Apple used to compare the performance of their devices to their predecessors rather than the overall industry which was probably due to marketing reasons in order to pretend that nothing comes close to iPhones. For example, when unveiling the iPhone 6 Apple described how the iPhone 6 compares to the iPhone 5S, whereas from the iPhone X onwards Apple decided to switch that rhetoric by describing its performance in relation to the overall smartphone industry (Apple, 2014; Apple, 2017). That indicates that Apple is acting more aggressively to maintain their competitive advantage which will likely lead to a more aggressive competition as a whole. Nevertheless, *exit barriers* seems to be not high since big players such as LG, HTC and BlackBerry left the market (Jolly, 2021). That could somewhat alleviate the problem of excess capacity and falling demand of the smartphone industry.

PC Industry

As stated above, the PC market is also dominated by two operating systems which are Apple's MacOS and Microsoft's Windows. Windows and Apple have a combined market share of around 95%. As described by Figure 5, the top five producers had a market share of around 80% in 2021. Therefore, *seller concentration* is very high which could lead to implicit collusion and therefore raise prices.

Again, Apple with its unique operating system, that is especially widely used by creative workers such as graphic designers, differentiates itself quite easily from the competition (Blue Sky Graphics, 2021). Furthermore, Apple can also differentiate themselves through what hardware they use since they design their own processing units, using the ARM technology that was explained prior. In addition, depending on how many Apple devices consumers hold it can affect their preferred PC choice since Apple's eco-system's benefits that were mentioned above still apply. Lenovo as the market leader by shipments has their line of ThinkPad laptops that make Lenovo more appealing to businesses as they are widely used in companies and hence are commonly associated with business (Newsweek, 2020). Therefore, Lenovo can easily target the B2B segment by brand recognition and brand image. HP, which is the second biggest company by market size, is mainly using different product ranges that target everything from the lower price range up to the upper price range with its simplistic design and brand

image (Cool Blue, 2021). Dell, the third biggest PC provider, uses similar techniques as HP since they too are an experienced company with a strong brand when it comes to PCs (Britannica, 2020).

As described by Figure 17, demand of PCs had a slight dip after 2010 but recovered greatly in the last three years which is likely the result of the COVID-pandemic and its change of working conditions. *Excess capacity* in that regard would be positive and alleviate competition since companies were likely not expecting such a huge shift to WFH. Similarly, *exit barriers* are likely not

Figure 17: PC shipments worldwide (in million units) Source: (Alsop, 2022), compiled by author



that high as huge businesses such as Samsung and Toshiba left the market since competition was too strong (Singh, 2020; Spring, 2014).

4.3.2.1. Sub Conclusion – Industry Competitors

After analysing the competition structure of two industries that Apple deals in, there are two particularly significant observations to make. Firstly, Apple has its own eco-system that is designed in a way that their devices work in combination with other Apple devices perfectly, whereas with other devices there are some drawbacks. Thus, Apple could theoretically lower their prices to get more customers and cross-sell more hardware or services. However, because of their customer's high brand loyalty they do not have a need to do so. This leads to a network effect that incentivises opting for Apple's products even more if a consumer owns any of Apple's products already. In conclusion, if Apple has a dominant position in an already strong and existing market it will alleviate Apple's competition not only in that market but also in other markets. Secondly, because Apple uses their own operating system and other providers mainly use Android, Apple has a huge advantage when it comes to product differentiation. Since the operating system is the main tool that you interact with it completely redesigns the experience that Apple consumers have compared to Android alternatives. Therefore, there is an intrinsic difference between Apple and its competition which likely leaves an impact of a luxury brand image as Apple devices are inherently different.

Especially in the smartphone industry we observe a dominant position of Apple. It has been evidenced above how Apple increased the price of their smartphones and other companies followed suit. There are a lot of other examples for such evidence as well. I.e., Apple scrapping the headphone jack, Apple leaving out the charger in the packaging of the iPhone etc. (Hollister, 2021; Cuthbertson, 2019). The article states that in both cases Apple was mocked by Samsung for taking such a controversial step, but later Samsung and other companies followed suit. This proves that although Apple takes controversial decisions, they have the strength to push through without having to deal with any major repercussions. On the contrary, they can even expect the market to follow and hence establish a new standard. That is even further highlighted by the fact that they have a 50% - 80% profit share while shipping only 15% of all smartphones as highlighted above.

4.3.3. Threat of New Entry

Again, to evaluate threat of new entry we can refer to Grant (2016) and his factors that contribute to the effectiveness of possible entrants. We will discuss capital requirements, economies of scale, and product differentiation (Grant, 2016).

In order to get an understanding about how much capital is required to enter the market we need to define what kind of entrance would be most reasonable to expect. Examples of a luxury phone are the

iPhone 13 Pro and the Samsung Galaxy S21+ which cost upwards of \$500 to manufacture (TechInsights, 2021). If we ignore any other costs and just look at the manufacturing process and assume an entrant needs to capture just 1% of the industry in order to have a successful and viable entry it would need to produce around 14m smartphones (Figure 16). The cost of solely the manufacturing process would be around \$7bn. Therefore, it is safe to assume if a company was to enter it would first try itself in the budget smartphone segment and then try to build a phone for the luxury segment. Exactly that type of strategy is followed by Xiaomi (Li, 2022). Li (2022) explains that Xiaomi is investing around \$15.7bn in R&D to enter the luxury smartphone segment. Therefore, we can safely assume that entering the high-end market is very difficult given the *capital requirements*. Xiaomi released its first smartphone in 2011 and as seen by its average smartphone selling price, which is 75% cheaper than the average iPhone price, it clearly outlines the strategy that they are pursuing (Canalys, 2021). Nevertheless, it was very expensive for Xiaomi to get to the point where it is today as seen by the R&D spending of Xiaomi in Figure 18. In conclusion, we can definitely say that a vast amount of capital is highly important to be a significant threat to the incumbent companies and therefore acts as a barrier to prevent entry.

Economies of scale could be another factor stopping companies from entering the industry. Since Apple is the leader in the smartphone industry it is valuable to see how they structure their supply chain. According to reports, Apple buys raw materials from different suppliers and ships them to factories where they get used for manufacturing (Lu, 2020). This likely results in a huge discount from the suppliers as Apple buys them in bulk. Furthermore, Apple has been continuously praised for its efficient supply chain system which could likely not have been set up in this way had it been for a smaller company (Griswold, 2022). Additionally, companies as big as Apple can profit off their international connectivity in order to find the best companies in relation to price and quality. Hence, Apple's huge

Figure 18: R&D spending of Xiaomi Source: Xiaomi annual reports 2017 – 2021, (macrotrends, 2022), compiled by author



size gives them an advantage to negotiate better conditions which we will talk about in the later segment.

Furthermore, Apple is not only selling hardware but as shown above is also offering services. By using an iPhone you have access to Apple Pay (MacRumors, 2022). The article states that Apple gets 0.15% of every transaction processed using Apple Pay. In addition, if one owns more than one Apple device and wants it to be connected so that one has access to all files on each device, Apple's iCloud system would be the most efficient way to do it for a relatively low cost (Cross, 2022). In conclusion, Apple's 'ecosystem' has a lot of different income sources and thus a strong foothold in many different industries in combination with a generally healthy profit margin (as seen in the Financial Statement Analysis). Therefore, Apple has far more possibilities to broaden its operation than a potential entrant with its very limited capital would likely have.

As argued in the segment of existing competition, product differentiation is a huge deal in the smartphone market. Thus, we would expect enormous marketing budgets from existing competitors. As always, looking at the most dominant players can give us an approximation about how much spending in marketing is required. Apple spent around \$64.8m on search ads in 2020 alone, ranking it in 12th place among companies that spent the most on search ads (Peterson M., 2021). Furthermore, Apple stopped publishing their marketing budget in 2015 after they raised it by 50% to \$1.8bn (Basulto, 2018). Samsung spent \$4.2bn on advertising expenditure whereas Xiaomi spent \$3.25bn in 2021 (Xiaomi, 2022; Xe Currency Converter, 2022; Samsung, 2022; Xe Currency Converter, 2022). In fact, it was shown that Samsung and Apple have a very high loyalty rate which is likely due to their marketing (Miller, 2021). Miller (2021) shows that Samsung's loyalty rate is around 70% whereas Apple's customer loyalty exceeds 90%. In conclusion, we can safely deduce that for an entrant to establish itself in this market it would require deep pockets to additionally accommodate marketing expenditures to successfully differentiate itself from the competition which is another barrier preventing entry.

4.3.3.1. Sub Conclusion – Threat of Entry

Capital requirements are a huge entry barrier. As was shown, companies such as Xiaomi who are relatively new in the smartphone industry spend huge sums of money in R&D. Secondly, the *Figure 19: Average price of smartphones compared to* smartphone industry requires an enormous marketing

budget to successfully differentiate from the competition. In addition, building up brand image, brand recognition and loyalty among customers needs to be accounted for as well. Furthermore, it is safe to assume that the bigger the company the less it must pay suppliers and can therefore decrease costs. Due to its sheer size, Apple can negotiate a great deal which will be analysed in depth later.

4.3.4. Bargaining Power of Buyers

Grant (2016) explains that bargaining power of buyers aims to explain the ability of buyers to drive down the smartphone sales







Figure 20: Samsung Smartphone Sales and Price Development Source: (Brown, 2022; O'Dea, 2022), compiled by author

price and their sensitivity to price changes. Thus, in this section we will dive into how much leverage buyers have against the industry and especially Apple.

We can see in Figure 19 that on a cumulative level average prices of smartphones have been increasing. Unfortunately, because of the COVIDpandemic it is not possible to conclusively say whether the increase in average prices has been affecting the sales of smartphones. Therefore, it is necessary that we take a closer look at the two biggest players in the industry.

First, we will examine Samsung and its price and sales development. We used the most premium Samsung Galaxy S prices as an approximation for Samsung's price development and plotted it together with Samsung's total smartphone sales in Figure 20. We can see that prices increased over the last decade significantly and although Samsung's sales have been falling for five to six years, their price increase was considerably more than the sales decrease.

Secondly, we are going to look at Apple's price changes for the most premium iPhones and how their sales have been affected by it. In Figure 21, we can see Apple 's price and sales development which looks very similar to Samsung's graphs. The only significant difference is that Apple seems to have recovered from the COVID-pandemic already and has even stronger sales than before COVID, coupled with an even higher price-level. Therefore, the demand of the smartphone industry seems to be very

insensitive to price changes which indicates a low bargaining power.

Lastly, because of Apple's eco-system and its network effects if an individual customer has enough Apple hardware and wants to upgrade one of his devices, he will possibly be forced to buy another Apple product since otherwise the experience of their other Apple devices will decrease significantly. This reason is very likely one main cause of the high brand loyalty of Apple (Miller, 2021). This leads to Apple's strong foothold



Figure 21: Apple Smartphone Sales and Price Development Source: (O'Dea, 2022; Stone, 2022), compiled by author

in the Wearables, PC, Tablet industries which is likely due to Apple's strong position in the smartphone industry.

4.3.4.1. Sub Conclusion – Bargaining Power of Buyers

By examining the conduct of consumers of the two biggest smartphone companies we analysed the price sensitivity of consumers in light of increasing prices of smartphones. Although prices of both Samsung and Apple significantly increased, it hardly influenced their sales on a cumulative level. This observation and the fact that Apple has a high profit margin strongly indicates that Apple's customers have no significant bargaining power.

Secondly, Apple's unique lock-in effect that keeps customers in their eco-system is likely the main cause of their customer loyalty. As shown, Apple's customer loyalty exceeds 90% which is probably due to its products being highly compatible in combination whereas being used jointly with other devices offers a significantly worse experience. Thus, customers that already own a specific number of Apple devices are forced to stick with Apple.

4.3.5. Bargaining Power of Suppliers

Since smartphone manufacturers like Apple and Samsung are multinational companies, suppliers should not have that much bargaining power as Apple and Samsung have access to a world-wide network of suppliers. Secondly, customers of the size of Apple or Samsung can increase the operation of suppliers significantly and thus increase their profits considerably. In theory, there should be no bargaining power of suppliers if supply is not restricted by some conditions.

In fact, we see that i.e., the biggest supplier of Apple 'Foxconn' has a single-digit profit margin and most likely generates profit by its *huge quantity* of orders (Miller, 2020). However, Miller (2020) states that Apple has a huge demand so that it is somewhat restricted by the capabilities of suppliers to reliably manufacture such a vast number of products. Therefore, there is at least some leverage that Foxconn has against Apple. That could be one reason why Foxconn has been violating Apple's rules in the past and there was not a lot that Apple could do (Miller, 2020). Apple has been trying to diversify its manufacturing process to other companies such as Wistron who also had their fair share of difficulties and scandals which led Apple to put them on probation for one year (Ahmad, 2020). Nevertheless, the fact that companies such as Foxconn are operating on single-digit profit margins seems to be an indication that Apple has the situation under control.

Another factor that could increase bargaining power of suppliers are *skills or patents* of a company that are not replicable by its competition. As stated above, one supplier of Apple that is hugely important is TSMC. TSMC is ahead of its competition (i.e., Intel) when it comes to producing semiconductor-chips since Intel is not capable of producing chips with the same kind of technology

(Patterson, 2022). Patterson (2022) explains that this problem led Intel to also outsource their production of semiconductor chips to TSMC. Currently TSMC is hugely reliant on Apple as 25% of their revenue is generated by Apple (Chien-chung & Huang, 2022). However, with other companies such as Intel and AMD also outsourcing their production to TSMC, this could change in the long-term. Thus, it remains to be seen how Apple would handle a situation in which their influence on TSMC decreases.

4.3.5.1. Sub Conclusion – Bargaining Power of Suppliers

There are mainly two factors that likely affect bargaining power of suppliers, namely the huge supply of devices required by Apple and restrictions of a required skillset of certain suppliers that is not found in the competition.

Firstly, although there seems to be an unlimited supply for a big international company such as Apple to manufacture their products, there is the constraint of being able to manage such a huge demand. Hence, there is bargaining power of suppliers but since their profit margins are rather thin compared to Apple's incredibly high margins those concerns do not seem to be too serious for Apple.

Secondly, in TSMC Apple found a supplier that has a higher quality than its competitors. However, with rising demand for TSMC's services, Apple could be confronted by a higher bargaining power of suppliers if TSMC continues to grow. That is currently being kept under track by the close partnership of TSMC and Apple since they both rely on each other. Therefore, Apple should continue keeping TSMC dependent on themselves since otherwise in the long-term, if no company with similar services should arise, bargaining power of TSMC will be hugely different.

In conclusion, currently the bargaining power of suppliers seems quite low and Apple, due to its sheer size and required standard of quality, is confronted with a limited number of potential suppliers. Nevertheless, in the long-term with a rising importance of skilful suppliers such as TSMC, Apple needs to develop a plan on how to best cope with such a relationship.

4.3.6. Threat of Substitutes

"Our objective has never been to be first. It's to be the best." - (Cook, 2014)

Apple generally has been on the forefront of innovation which can be proven by its many revolutionary products that changed whole industries (i.e., AirPods, iPhone, Apple Watch etc.) (Bose S. , 2022). Therefore, one would not expect that there could be any ground-breaking substitutes that could shift market power in a significant way. However, there is one niche product that has been drawing a lot of attention, namely the foldable smartphone (Bhalla, 2021). Whereas companies such as Samsung, Huawei, Motorola have created their own foldable smartphone, Apple has not produced any product that uses this type of technology (Bhalla, 2021). According to market research company Strategy

Analytics, this market will rise significantly in the next few years (Strategy Analytics, 2020). Strategy Analytics (2020) projected that the market will finally hit 100m shipments in 2025.

4.3.6.1. Sub Conclusion – Threat of Substitutes

Whenever there are significant trends in the smartphone industry Apple generally adopts them very late. For example, this can be seen by Apple's reluctancy to offer in-display fingerprint reader or higher than 12MP cameras while competitors are already offering those features on a wide variety of phones (Bayley & Halliday, 2020; Adorno, 2022). Although Apple takes its time to offer new features, whenever they do, they ensure that it works perfectly across their ecosystem and there are hardly any flaws (Reda, 2021). In addition, according to latest reports Apple has been researching this technology as seen by Apple's latest patents filed (Michaels, 2022). Therefore, in light of Tim Cook's above quote, Apple is not interested in being the first to offer any particular feature. Rather, it is interested in offering the best feature, independently of how long it takes. Thus, even if Apple does not have any foldable smartphone yet it could be argued that Apple takes its development quite seriously and might have some plans if foldables rise in popularity.

As stated, there is one possible substitute that is currently still a niche product and still not sold on a wide scale. Even if foldable smartphones become the new standard and replace the current smartphone industry it could still be argued that Apple can offer a significant alternative since Apple has continuously shown that even if it is not the first to implement a feature it can still adopt a standard late and maintain its place as the market leader. Thus, foldable phones are not a significant threat as long as Apple is monitoring the issue closely and has some plans that are yet to be unveiled.

4.3.7. Sub Conclusion – Porter's Five Forces

Issue	Summary	Impact
Industry Competitors	 In Apple's most important market, namely the smartphone industry, demand seems to stagnate which could be likely due to the fact that a significant portion of the global population holds a smartphone already. In addition, people holding on to their current phone for a longer time, meaning less frequently. Therefore, with a shrinking demand competition could increase significantly in the coming years Secondly, Significant lock-in effects of Apple alleviate competition which leads to significant cross-selling and nudges the consumer to stick with Apple and upgrade to Apple products only. Lastly, Apple's unique hardware and software gives them an edge in product differentiation since competitors mainly use the same operating system coupled with similar hardware. This is further proven by the fact that Apple ships around 15% of all smartphones but capture 50% – 80% of all profits in the smartphone industry. 	Ч

Threat of New Entry	The huge amount of capital required to successfully differentiate from competition, manufacture capable smartphones and build up brand image and a loyal customer base make up a huge entry barrier that deter entry. Secondly, patents and R&D contribute to the costliness of successful entry making it less probable for a company to enter.	٦
Bargaining Power of Buyers	Although prices keep increasing the reaction of customers is not proportional, implying a low-price sensitivity. On the contrary, the huge rate of customer loyalty that exceeds 90% proves that bargaining power of buyers seems to be low.	7
Bargaining Power of Suppliers	The huge difference in profit margins is an indication that suppliers do not have a high bargaining power. However, rising importance of suppliers like TSMC could change the uneven relationship in the future should TSMC become more independent in the future.	\rightarrow
Threat of Substitutes	The only significant substitutes to mention are foldables smartphones which are currently still a niche product. In the future this could change. However, it could still be argued that Apple could catch up quite fast which would if managed correctly leave no significant impact.	Z

Source: Author's own creation

4.4. Porter's Value Chain



Figure 22: Porter's Value Chain Source: (Grant, 2016)

that Porter's Value Chain aims to identify the impact of primary activities, which deal with transformation processes of inputs and customer interface, and support activities. He describes that this analysis aims to provide a detailed function of each segment and should define how those different departments add value to the product. In the following analysis we will examine how exactly those departments work and establish how they might add value to the product.

4.4.1. Primary Activities

Starting with *Inbound Logistics*, which aims to describe how materials required for the product are bought and transported. As explained above, Apple buys raw materials in bulk which then get shipped to their manufacturing bases. Since Apple requires a lot of material which they can buy anywhere they have a high bargaining power. In fact, when Tim Cook got appointed as the CEO of Apple, he significantly decreased suppliers of components from 100 to 24 (Oliver, 2012). The article explains that this measure was taken in order to increase competition amongst suppliers. Furthermore, through its

With the PESTEL-Analysis and Porter's Five Forces we have concluded the external analysis that is used to describe issues of the industry. Now we are going to look at Apple's internal factors that assess Apple's internal capabilities and examine whether Apple is able to efficiently function. Grant (2016) explains



high bargaining power, Apple is likely also able to demand a certain quality of parts for a relatively cheap price. Similarly to the auto industry, Apple uses the "just-in-time manufacturing" (JIT) that aims to minimise inventory time of inputs (Lopatto, 2020). Lopatto (2020) explains that once Tim Cook took over the COO position, he changed Apple's inventory system to JIT.

Figure 23: Apple's Distribution Channels Source: (Cuofano, 2022)

According to the article, because of supply shortages caused by the COVID-pandemic, JIT at Apple resulted in a decrease of smartphone manufacturing by 12%. In addition, due to the Russia – Ukraine war and semiconductor shortages following the JIT process could again result in shortages and delays through the supply chain. However, in the long-term, once all those issues vanish the efficient JIT system could likely bear its fruits again.

After the inbound logistics process, we have to analyse *Operations*. As explained above, Apple currently assembles and manufactures its products primarily in China. However, Apple is diversifying by also sourcing and manufacturing in other countries such as India and Vietnam (MacLellan, 2022). Diversifying its production process is quite important since China has its fair share of problems as explained in the PESTEL-Analysis. Again, because of Apple's high bargaining power the companies which manufacture and assemble the parts that make up Apple's products have likely to guarantee a high standard of quality while being low-cost.

After Apple's products have been assembled and are ready to be shipped the department of *Outbound Logistics* must define how to get the product to the consumer. Apple has a lot of different distribution channels. As seen in Figure 23, Apple's revenue is derived by 36% from its direct channels and by 64% from its indirect distribution channels. Apple's direct channels are its Apple Store and its website whereas its indirect channels mainly consist of cellular networks, wholesalers, retailers, and resellers. We can expect Apple's direct channel to have a far higher profit margin than its indirect channels because of the problem of double marginalization which describes how an extra mark-up in the distribution channel changes increases the costs (or price) (Staahl Gabrielsen, Johansen, & Shaffer, 2018). Therefore, Apple has a huge direct reach and a vast network of indirect sellers that get their products across to their customers. As explained above, Apple's *Marketing* budget has reached such a height that it is no longer disclosed. Furthermore, Apple ranks 12th in companies that spend the most in search ads (Peterson M. , 2021). In addition, it has a customer loyalty exceeding 90%, making it the smartphone company with the highest customer loyalty (Miller, 2021). This indicates that Apple's marketing strategy is highly successful and communicates Apple's brand image as intended to a vast number of customers. Apple also has been ramping up its *Sales* to other businesses (Bort, 2019). Bort (2019) explains that i.e., software usage for SAP for iOS has grown by 40%, indicating that more people are using business apps on iPhones. Therefore, Apple cannot only sell more hardware to other businesses but also more services. The article explains that while Apple has been strong in the consumer market for a long time, it's also growing a lot in the B2B segment. Furthermore, as explained above, Apple captures around 15% of all smartphone sales but generates around 50% – 80% of all profits, proving that the sales department is highly capable and skilled.

After Apple sold its products, it still needs to provide additional *Services*. Apple provides every customer with a one-year warranty that is extendable for a surcharge if required (Apple , 2022; Apple, 2022). The high quality of Apple's customer services is also demonstrated by different rankings that place it among the top in that area (O'Dea, 2021; Smith, 2020). In conclusion, Apple is highly capable of providing greatly valuable services.



4.4.2. Support Activities

Figure 24: Apple's, Samsung's, and Xiaomi's R&D Spending Development (in billions) Source: Apple's, Samsung's, and Xiaomi's annual reports, compiled by author As described by Figure 24, Apple's *R&D* is around \$22bn, placing it as the highest of its immediate competitors. This high investment into R&D is likely justified by Apple's venture into designing chips, new products which is done by the *Technology Department* (i.e., AirPods, Apple Watch) and seems to be hugely paying off by creating a lot more lock-in effects in their eco-system.

In addition, it was shown that Apple is greatly valued as a potential employer, being ranked as the third most sought-after employer for Ivy League graduates (Bernard, 2018). Therefore, Apple's *Human Resource* department has access to the most skilled and qualified workers. Furthermore, Apple offers a lot of benefits and

perks to their employees (Caboodle, 2019). The article explains that Apple provides commuting and health benefits and additionally has various other perks such as discounts on its stock and products.

Hence, Apple has a big pool of highly capable applicants and has put programs in place to increase the wellbeing of its employees.

As explained prior, Apple's *Procurement* department has a lot of bargaining power when buying materials as Apple buys them in bulk. By buying a vast number of materials from a few suppliers Apple keeps competition up and assures that it gets a great deal. This is also demonstrated by the difference in profit margins of Apple and its suppliers.

4.4.3. Sub Conclusion – Porter's Value Chain

According to the Porter's Value Chain Apple is a well organised company. The supply chain of Apple is considered to be one of the most efficient and structured supply chains in the world. Furthermore, Apple's sales department is doing an outstanding job as demonstrated by their big share in the smartphone industry. Their marketing department enables amongst other things a high profit margin and incredible customer loyalty. Lastly, Apple is putting a lot of money into R&D which is established by its revolutionary market shifts by introducing new products such as AirPods and Apple Watch. In conclusion, the internal analysis gives us the impression of a greatly functioning company that has access to a lot of talent. Thus, according to the Porter's Value Chain Apple is a very well-structured company.

5. Financials

5.1. Reorganisation of Financial Statements

In order to value Apple, we need to assess the statements and modify them so that they only include data that is relevant for Apple's core business. The reorganised financial statements will be used to do the financial statement analysis and will be relevant for valuing the company. Therefore, in the following we will reorganise the balance sheet and the income statement. The whole process of reorganisation is included in the enclosed Excel sheet.

5.1.1. Balance Sheet

Excess cash is cash that is not used for operation. Generally, it is determined as anything more than 2% of net sales (Koller, Goedhart, & Wessels, 2010). As explained by Koller et al (2010), *marketable securities* also need to be deducted to determine Invested Capital. Therefore, in Apple's case, Invested Capital is derived as follows (Koller, Goedhart, & Wessels, 2010):

Table 11: Invested Capital and FCF of Apple												
Assets (in millions)	2021	2020	2019	2018	2017							
Total Funding	351,002.00	323,888.00	338,516.00	365,725.00	375,319.00							
Marketable Securities	155,576.00	153,814.00	157,054.00	211,187.00	248,606.00							
Excess Cash	27,623.66	32,525.70	43,640.52	20,601.10	15,704.32							
Invested Capital	167,802.34	137,548.30	137,821.48	133,936.90	111,008.68							
Net Investment	48,318	30,254	-273	3,885	22,928							
FCF	49,913	27,924	54,296	52,264	22,743							

Source: Apple annual reports, compiled by author

In addition, Apple differentiates between financing and operating lease liabilities in their last two annual reports. However, they did not report financing lease liabilities in prior annual reports. It is hence assumed that operating and financing lease liabilities have a similar ratio across years. Therefore, the ratio of financing and lease liabilities for 2021 and 2020 have been calculated and their average used to calculate financing lease liabilities of 2019 – 2017.

5.1.2. Income Statement

Apple's financial statements make it clear that their operating income has been adjusted for nonrecurring revenue and expenses already. Therefore, we can take the operating income as given and proceed with it.

5.2. Financial Statement Analysis

By analysing the financial statements of Apple and comparing them to competitors we can get a clear picture of Apple's performance relative to their industry competitors. The results will later be used for the valuation as well. Although Big Tech is not always directly competing with Apple, we deem them to be appropriate to be compared to Apple since they all are big and powerful corporations and are often compared to one another and exercise significant power over society.

Return Analysis



Figure 25: Big Tech ROE development Source: (Macro Trends, 2022; Macro Trends, 2022; Macro Trends, 2022; Macro Trends, 2022), Apple annual statements, compiled by author

Apple reached an ROE of around 150% whereas Microsoft, which has the next highest ROE out of Big Tech, just stays short of 50%. The rest of the group is trailing around 30%. This chart tells us that there has been an incredible difference in ROE of Apple compared to Big Tech, meaning Apple overperformed significantly compared to its peer group.

Figure 26 describes the development of *return on invested capital (ROIC)* of Apple and Big Tech. ROIC has been calculated as follows (Koller, Goedhart, & Wessels, 2010):

Return on equity (ROE) is an important metric to measure the return on equity that has been invested into assets (Damodaran, 2010). ROE has been calculated as follows (Damodaran, 2010):

$$ROE = \frac{Net \, Income}{Book \, Value \, of \, Equity}$$

In Figure 25, we can see return of the company belonging to Big Tech. Since those companies belong to the most influential and biggest companies it would be interesting to see how Apple's ROE compares to theirs. We can observe that Apple's ROE is incredibly high even when compared to such a powerful and big

group.

Figure 26: Big Tech ROIC development Source: (ROIC, 2022; ROIC, 2022; ROIC, 2022; ROIC, 2022), Apple annual statements, compiled by author



$ROIC = \frac{NOPLAT}{Invested Capital}$

ROIC is considered a superior measure when compared to ROE (Koller, Goedhart, & Wessels, 2010). Koller et al (2010) explain that ROE gives a somewhat skewed account of performance since it gets influenced by the capital structure of the specific company under assessment. Therefore, ROIC is more appropriate to apply when it is used to compare companies with each other. Nevertheless, the conclusion remains the same. Apple still overachieves even if its ROIC is compared to Big Tech. As seen in Figure 26, Apple's ROIC is near 60%, whereas Meta, Alphabet and Microsoft have an ROIC of around 25%. Amazon has a very low ROIC of over 10% when compared to Big Tech. Thus, again we find that Apple overperforms if compared to Big Tech.

Profitability Analysis

Again, in Figure 27 we can see the development of *net profit margin* of Big Tech. Net profit margin has been calculated as follows (Damodaran, 2012):

$Net \ profit \ margin = rac{Net \ income}{Net \ sales}$

This measure is not dominated by Apple like it was the case with ROIC and ROE. We can see that Apple is somewhere in the middle and currently has the second-lowest net profit margin. Microsoft just barely took the lead against Meta in 2021 with a net profit margin of over 35%, closely followed by



Figure 27: Big Tech net profit margin development Source: (ROIC, 2022; ROIC, 2022; ROIC, 2022; ROIC, 2022), Apple annual statements, compiled by author

Meta with a net profit margin of just under 35%. Alphabet just falls short of a net profit margin of 30% followed by Apple with one around 25%. At the bottom we see Amazon with a net profit margin of under 10%. Even when compared to such an elite group, Apple performs fairly well with a net profit margin of around 25%. Another important metric is gross profit margin which is calculated as follows (Brigham & Houston, 2007):

$$Gross \ profit \ margin = \frac{(Net \ sales - COGS)}{Net \ sales}$$

Compared to Big Tech we see a similar picture of Apple as was the case when assessing how high net profit margin is. According to Figure 28, Apple just barely made the jump over Amazon, implying that their relatively low net profit margin is likely due to high cost of goods and sales (COGS). Meta has the highest gross profit margin of around 80% which is roughly double that of Apple. Meta is followed by Microsoft, which has a gross profit margin of around 70% and Alphabet with a gross profit margin just over 55%. Therefore, when compared to big powerful companies such as Big Tech, Apple's gross profit margin belongs to the lower end and implies that the industry that Apple participates in is probably associated with higher costs.

Asset Turnover Ratio

The asset turnover ratio (ATR) is supposed to describe how effectively companies are using their assets to generate sales (Brigham & Houston, 2007). The





formula to derive the turnover ratio is as follows (Brigham & Houston, 2007):



Figure 29: Big Tech asset turnover ratio development Source: (Morningstar, 2022; Morningstar, 2022; Morningstar, 2022; Morningstar, 2022), Apple annual statements, compiled by author



Figure 29 describes the ATR from Big Tech. Apple is overperforming according to that metric and according to the past five years getting more and more efficient. On the contrary, Amazon, which currently has the highest ATR, seems to be on a downward trend. Alphabet and Microsoft have a similar ATR which is significantly lower than Apple's and Amazon's. Lastly, Microsoft has the lowest ATR which just barely tops 0.5.

Although total ATR is widely used as a metric to judge how efficiently assets are used it does not take into account that companies might have NOA. Therefore, to judge the efficiency of a company more precisely, it would be better to use operating assets instead of total assets. A company that has a lot of NOA likely has an artificially low ATR. In Figure 29, we also included 'Apple adjusted' to see how the turnover ratio would change if only operating assets were used. The result is that there is a huge increase in the ATR since Apple has a lot of cash just sitting around or invested into assets that are not linked to their main business. This gives a more precise account of their efficiency since only those assets are used that generate income.

Liquidity Indicators

Table 12: Liquidity Indicators

Liquidity indicators:	2021	2020	2019	2018	2017
Financial levarage	0.11	-0.07	-0.38	-0.64	-0.80
Interest rate	2.96%	-18.16%	-4.08%	-3.54%	-2.70%
Spread	56%	60%	40%	43%	41%
Current operating ratio	1.27	1.19	1.30	1.14	1.14
Working capital ratio	5%	3%	6%	3%	3%
Liquidity reserve ratio	96%	103%	120%	142%	168%
Source: Compiled by author					

Apple's financial leverage has been negative four times out of the last five years. The formula applied for *Financial Leverage* is: $\frac{NIBL}{E}$ (Petersen & Plenborg, 2012). It has been negative due to Apple possessing a huge amount of cash which outweighs their debt and hence turns NIBL negative. However, it has been rising in recent years. Financial leverage rose from -0.8 in 2017 to 0.11 in 2021. Nevertheless, financial leverage is still quite low, indicating the vastness of Apple's cash and cash equivalents. Secondly, Apple's *Current Operating Ratio (CRO)* has been consistently above 1, implying that Apple can cover its short-term operating liabilities by its short-term operating assets. Thus, Apple is well-equipped to cover its short-term liabilities and similarly, due to its vast amount of cash, its longterm liabilities as well. Apple's *Working Capital Ratio*, which is defined as $\frac{Working Capital}{Net Sales}$, is really low, indicating that Apple is highly efficient (Petersen & Plenborg, 2012). Lastly, the *Liquidity Reserve Ratio (LRR)* has been calculated using the following formula: $\frac{Financing Liabilities}{Financing Liabilities}$ (Petersen & Plenborg, 2012). This ratio is another indicator aiming to explain how financing liabilities are covered by financing assets. Apple had an LRR of over 100% for four out of the five years that are being evaluated, indicating a high liquidity. In the last year, Apple had an LRR under 100% which could be an outlier and hence does not indicate any long-term issues with liquidity.

6. Valuation Method





Before we delve into the valuation process it is necessary to determine what kind of valuation we will use. Therefore, we need to look at all kinds of different methods and determine which one is most suited for Apple. This analysis will be done according to standards set by Damodaran (2012). Damodaran urges to assess the following factors before taking a decision on which

type of Valuation to use: *Marketability of Assets, Cash-Flow-Generating Capacity, Uniqueness,* and *Time Horizon.*

Marketability of Assets

Damodaran explains that if a company deals with assets that are easily marketable then a *Liquidation* and/or *Replacement Cost* approach would be best. For example, he cites a real estate company that is easily valued by the value of their assets. However, he also explains that if a company has businesses that are inseparable and has value that is intangible, such a method cannot be used. Since Apple has a high brand value and lock-in effects that are not quantifiable in a liquidation or replacement valuation, such a method is not recommended. Therefore, we can rule out *Asset-Based Valuations*.

Cash-Flow-Generating Capacity

Secondly, Damodaran (2012) states that the capacity of companies to generate cash-flow is also a significant indicator as to what valuation method to use. He states that there are three types of assets:

- 1. Assets with current and future cash flows (i.e., most publicly traded companies)
- 2. Assets who will only generate cash flows under certain conditions in the future (i.e., drug patents or promising technology)
- 3. Assets that will never generate cash flows

He explains that companies with the first type of assets can be valued with a *Discounted Cash Flow Model* or a *Relative Valuation*. Companies with assets that belong to the second type can be valued by *Contingent Claim Models (Option Pricing Models)*. Lastly companies with the third type can be valued using a *Relative Valuation*. Apple, like most publicly traded companies, generates current cash flows and will most likely continue doing so in the future. Therefore, according to the capacity of Apple to generate cash flows, a Discounted Cash Flow Model should be applied.

Uniqueness

Uniqueness is cited as another factor necessary to be evaluated by Damodaran (2012). He states that to value companies which are competing in markets that offer similar products, a *Relative Valuation Model* should be used. If a company sells something unique then a *Discounted Cash Flow Model* or *Option Pricing Model* should be applied.

Apple is active in mass-markets with a lot of competitors. Therefore, it sells products that could be considered as similar to others. However as argued above, Apple's unique product features are not found in other products and hence create a unique experience. Thus, Apple sells products that could be compared to others but also creates a unique experience that is not found in other competitors. In conclusion, according to uniqueness a *Relative Valuation Model* or *Discounted Cash Flow Model* or *Option Pricing Model* could be applied.

Time Horizon

Damodaran (2012) describes that time horizon plays another role into what type of valuation model to use. He explains that if a company has a very short time frame which it is going to operate in, an *Asset-Based Valuation* should be used. If a company is assumed to operate forever, then a *Discounted Cash Flow Model* should be applied. Any company in between those two extremes can be valued using *Option Pricing Models* or *Relative Valuation*.

As explained, Apple is one of the biggest companies in the world with a market capitalization of over \$2tn. Thus, it is reasonable to assume that Apple is going to operate for at least a very long time. Therefore, again, a *Discounted Cash Flow Model* would be suited best.

Conclusion

Most of the factors discussed indicate that the proper way to value Apple would be by using a *Discounted Cash Flow Model*. Some of the factors imply that a *Relative Valuation Model* or *Option Pricing Model* would also be useful in getting a rough value of Apple. However, Damodaran (2012) also states that *Option Pricing Model* should not be used too often. He says that the Option Pricing Model is best suited for small companies where a big part of its profit is contingent on something. He explicitly cites Merck as an example by clarifying that although Merck's success is contingent on R&D and how their patents will perform in the future, Merck's value derives from its portfolio and its cash flows. Therefore, in the case of Merck and hence Apple, they both should be valued with a Discounted Cash

Flow Model. In addition, as it is possible that the Relative Valuation Model has its benefits as well, we will additionally aim to derive Apple's value by Relative Valuation.

6.1. Relative Valuation

Relative Valuation attempts to estimate prices depending on how other assets are priced among peergroups or within a sector (Damodaran, 2012). In addition, as there are a lot of multiples to choose from, we have restricted the valuation to the most common used multiples (Damodaran, 2012). Therefore, by using multiples we can estimate Apple's value according to its peer-group or similar companies. We deemed Big Tech, Samsung, and Xiaomi as Apple's peer group. The reason for that is that Big Tech are quite similar in power, capacity, and competition and in addition, Samsung and Xiaomi are the biggest competitors of Apple in the smartphone industry which is the most important regarding the share of Net Sales.

Company	P/E	P/B	EV/Sales	EV/EBITDA
Samsung	1.15	1.30	0.98	2.99
Xiaomi	0.77	1.80	0.69	7.42
Alphabet	5.59	5.81	5.05	13.37
Meta	3.71	3.45	3.30	7.59
Microsoft	9.96	11.65	9.63	18.81
Amazon	2.34	8.25	2.41	19.13
Apple	26.92	40.40	6.97	21.20

Table 13: Multiples of Apple and its peer-group

Source: (Yahoo Finance, 2022; Yahoo Finance, 2022), Annual financial statements of 2021 from Samsung, Xiaomi, Alphabet, Meta, Microsoft, Amazon and Apple

Table 13 shows the multiples from Apple and its peer-group. With that information and the reorganised balance sheet that we already have from Apple, we can calculate the market capitalisation



Figure 31: Relative Valuation of Apple Source: Compiled by author

and EV of Apple. This will be calculated by taking the average of the calculated values. The calculation in detail is enclosed in the appendix.

Figure 30 describes the results of the relative valuation whereas the dotted line represents the actual market capitalisation and EV of Apple. Both calculations indicate that Apple is overvalued significantly if the peer-group is similar enough.

Since Apple is very strong in marketing and strategy customer retention and brand loyalty might not be significantly accounted for. In addition, Apple's unique lock-in effect could also be reason for this significant deviation. In fact, there might be a lot of shortcomings of this approach which is why we need to proceed with an absolute valuation model to give a more complex and accurate description of Apple's business.

6.2. Absolute Valuation



As discussed, the thesis is mainly going to focus on the Discounted Cash Flow (DCF) model. Now we simply must choose the most appropriate DCF model. Figure 32 describes what DCF model to choose. Firstly, Apple is a publicly traded company which means that a lot of data is available that can be used to estimate cash flows. Therefore, a Dividend Discount Model (DDM) is not

Figure 32: Which DCF Model to use? Source: (Damodaran, 2012)

recommended. Secondly, according to the last five years Apple's leverage was constantly changing which takes away the opportunity of using FCFE to get to a fairly accurate estimate. Thirdly, since current earnings are positive and normal, they can be used as a base to estimate firm value. Lastly, although Apple is currently growing at a higher rate than the market (will be discussed later in depth) it is reasonable to assume that its competitive edge will eventually fade, especially since political pressure to increase competition is very high (see PESTEL-Analysis). In conclusion, we will be using a two-stage DCF-Model that uses FCF derived by current earnings as a base. We will be using the above calculated FCF and Invested Capital in the following. There is another model, namely the Economic Value Added (EVA) method, which, although not included in Figure 32, could prove quite useful in our analysis. Therefore, Apple's stock price will also be calculated by the EVA method. However, the main focus will still be the DCF method and hence the thesis will not go into depths due to reasons of space.

7. Forecasting

In order to apply the valuation model, we need to forecast how certain metrics will develop. Therefore, considering the strategic analysis we need to forecast those measures that are required to calculate FCF. In order to calculate FCF we need to forecast: Net Sales, Gross-Margin, Operating Expenses, D&A, Tax-Rate and Invested Capital. To get a precise valuation the thesis will predict the cash flows for the next 10 years and assume a constant growth-rate after.

7.1. Net Sales

To accurately predict the growth-rate of sales we are going to look at the growth-rates of sales for the last five years, while keeping in mind the conclusions we already drew in the strategy-section. After analysing Apple, we came up with the following forecast:

Year	2017	2018	2019	2020	2021	2022F	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F	2031F
iPhone	141,319	166,699	142,381	137,781	191,973	230,368	264,923	291,415	320,557	342,995	370,435	388,957	400,626	408,638	416,811
year-on-year growth%	-	18%	-15%	-3%	39%	20%	15%	10%	10%	7%	8%	5%	3%	2%	2%
Mac	25,850	25,484	25,740	28,622	35,190	40,469	44,515	48,967	51,415	53,472	55,611	57,279	58,425	59,593	60,785
year-on-year growth%	-	-1%	1%	11%	23%	15%	10%	10%	5%	4%	4%	3%	2%	2%	2%
iPad	19,222	18,805	21,280	23,724	31,862	38,234	43,970	48,367	50,785	53,324	54,924	56,572	57,703	58,857	60,034
year-on-year growth%	-	-2%	13%	11%	34%	20%	15%	10%	5%	5%	3%	3%	2%	2%	2%
WHA	12,863	17,417	24,482	30,620	38,367	49,877	62,346	74,816	86,038	94,642	99,374	104,343	109,560	113,942	116,221
year-on-year growth%	-	35%	41%	25%	25%	30%	25%	20%	15%	10%	5%	5%	5%	4%	2%
Services	29,980	37,190	46,291	53,768	68,425	88,953	120,086	156,112	195,140	234,167	269,293	296,222	311,033	320,364	326,771
year-on-year growth%	-	24%	24%	16%	27%	30%	35%	30%	25%	20%	15%	10%	5%	3%	2%
Total net sales	229,234	265,595	260,174	274,515	365,817	447,900	535,840	619,676	703,934	778,601	849,636	903,372	937,346	961,394	980,622
year-on-year growth%	-	16%	-2%	6%	33%	22%	20%	16%	14%	11%	9%	6%	4%	3%	2%
Courses: Conselled by a date															

Table 14: Apple's Net Sales Forecast

urce: Compiled by autho

As argued, the *iPhone* is being confronted by tough competition and additionally a market that is quite saturated. In addition, with ecological and political pressure from society and government to make phones more durable and repairable while considering that people are holding on to their phones far longer than prior indicates that iPhone-sales are not going to grow quickly in the future and reach their peak soon. Secondly, political pressure (i.e. DMA) on Apple is quite high so as to break its dominancy. As explained, the DMA aims to break Apple's ecosystem which keeps customers locked in. This is a huge threat to Apple's competitive advantage.

The Mac is currently enjoying high growth which is likely due to the shift in the way we work. Furthermore, due to Apple's new chips, Macs have been improved incredibly and could thus enjoy short-term high growth until other companies (i.e., Intel) catch up. The *iPad* had a mixed performance over the last few years which it finished off with a very strong last year by growing 34%, which could also be explained by the sudden shift to WFH. iPad sales in the near future will be hugely affected by the semiconductor-shortage since Apple will probably focus more on timely iPhone deliveries than they did before. The WHA segment was growing significantly before the pandemic which is likely due to it being a relatively new industry compared to others. Therefore, we expect the WHA market to grow significantly in the short-term until it slowly reaches its peak.

Lastly, a very bullish progress for the *Services* industry of Apple is expected. The reason why we expect the services market to grow that significantly is because it is in theory limitless. With higher product life cycles and restructuring due to ecological issues the growth of Apple's hardware is somewhat capped. However, due to Apple's unique lock-in effects, even if their sales decline they will keep on generating revenue from their services. For example, in a cash-less society everyone who uses iPhones will mainly pay through Apple Pay while Apple will continue receiving some share of each transaction. Similarly, Apple's cloud service will keep generating revenue if their products are used. In an extreme case, if Apple's hardware segment hardly makes any money anymore since products became quite durable, Apple's services will still generate loads of cash for a relatively small cost. The only problem is that everything is interdependent. If for some reason iPhone popularity decreases, this will hurt every segment, including the services market. Therefore, Apple's current service-business model is totally dependent on their hardware success. Hence, as explained in the PESTEL-Analysis specific policies aiming to break up Apple's grip over the world also have a disastrous effect on this segment.



Figure 33: Net Sales Distribution FY2031 Source: Compiled by author

This forecast would mean that eventually net sales would be distributed as described by Figure 33. Due to its sheer popularity, the iPhone would stay the biggest source of net sales. Services will eventually be the second highest contributor to net sales since Apple has been focusing on that segment for the last few years. Macs, iPads and WHAs would still generate loads of income but would rather be used strategically to cross-sell services and other Apple products. However, Figure 33 is hugely dependent on the fact that Apple will be somewhat able to cope with

especially the political and legal threats aiming to break up Apple's dominancy.

7.2. COGS and Operating Expenses

Table 15: COGS and Operating Expenses Forecast															
Year	2017	2018	2019	2020	2021	2022F	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F	2031F
COGS	-141,048	-163,756	-161,782	-169,559	-212,981	-273,538	-327,244	-378,443	-429,901	-475,501	-518,883	-551,700	-572,448	-587,135	-598,878
COGS / Net Sales	62%	62%	62%	62%	58%	61%	61%	61%	61%	61%	61%	61%	61%	61%	61%
R&D	-11,581	-14,236	-16,217	-18,752	-21,914	-26,396	-31,579	-36,519	-41,485	-45,885	-50,072	-53,239	-55,241	-56,658	-57,791
R&D / Net Sales	5%	5%	6%	7%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%
SG&A	-15,261	-16,705	-18,245	-19,916	-21,973	-29,760	-35,602	-41,173	-46,771	-51,732	-56,452	-60,022	-62,279	-63,877	-65,155
SG&A / Net Sales	7%	6%	7%	7%	6%	7%	7%	7%	7%	7%	7%	7%	7%	7%	7%
D&A	-10,157	-10,903	-12,547	-11,056	-11,284	-18,338	-21,938	-25,370	-28,820	-31,877	-34,785	-36,985	-38,376	-39,361	-40,148
D&A / Net Sales	4%	4%	5%	4%	3%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
R&D / Net Sales SG&A SG&A / Net Sales D&A D&A / Net Sales	5% -15,261 7% -10,157 4%	5% -16,705 6% -10,903 4%	6% -18,245 7% -12,547 5%	7% -19,916 7% -11,056 4%	6% -21,973 6% -11,284 3%	6% -29,760 7% -18,338 4%	6% -35,602 7% -21,938 4%	6% -41,173 7% -25,370 4%	6% -46,771 7% -28,820 4%	6% -51,732 7% -31,877 4%	6% -56,452 7% -34,785 4%	6% -60,022 7% -36,985 4%	6% -62,279 7% -38,376 4%	6% -63,877 7% -39,361 4%	-65,19 -65,19 7 -40,14

Source: Compiled by author

Table 15 describes the forecast for operating expenses and COGS. As previously stated, the suppliers of Apple are operating on thin margins, meaning that there is not a lot of room to be even more efficient. However, there is one big threat to Apple's COGS which is TSMC. As explained, currently TSMC is largely dependent on Apple since a big part of their revenue is generated by Apple. As more

and more companies are trying to establish a relationship with TSMC, its bargaining power is rising. Nevertheless, Apple has the current situation under control and are likely aware of the risk. They have shown (i.e., with Intel) that they can deal with suppliers who seem to have a lot of bargaining power and can slowly faze them out. Therefore, it is likely that COGS are going to stay as efficient as the last five years propose and hence it is appropriate to use an average calculated by the last five years to forecast Apple's future COGS. A similar reasoning can be applied to other operating expenses since there is no reasoning as to how Apple can become more efficient nor any threat as to why Apple should become more inefficient with time. Thus, operating expenses have been kept at their average as well.

7.3. Tax-Rate

Table 16: Forecast of Apple's Effective Tax-Rate

Year 2018 2019 2020 2022F 2023F 2024F 2025E 2026F 2027F 2028F 2029F Tax-Rate 24.60% 18.30% 15.90% 14.40% 13.30% 17.30% 17.30% 17.30% 17.30% 17.30% 17.30% 17.30% 17.30% 17.30% 17.30% 17.30% Source: Compiled by author

Table 16 describes Apple's historical and forecasted effective tax-rates. Apple has been able to keep its tax-rate artificially low as explained prior. It is reasonable to assume that eventually Apple will not be able to keep tax-rates low and governments will come up with additional regulation to make companies pay their intended share of taxes. Since Apple's tax-rate has been declining, the thesis assumes that an average of their tax-rates best represents their future tax-rates.

7.4. EBITDA, EBIT and NOPLAT

Table 17: Forecast of EBITDA, EBIT and NOPLAT

Year	2017	2018	2019	2020	2021	2022F	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F	2031F
EBITDA	71,501	81,801	76,477	77,344	120,233	118,206	141,415	163,540	185,777	205,482	224,229	238,411	247,377	253,724	258,798
EBIT	61,344	70,898	63,930	66,288	108,949	99,869	119,477	138,170	156,957	173,606	189,444	201,426	209,001	214,363	218,650
NOPLAT	45,671	56,149	54,023	58,178	98,231	98,425	117,750	136,172	154,688	171,096	186,706	198,514	205,980	211,264	215,489
NOPLAT / Net Sales	20%	21%	21%	21%	27%	22%	22%	22%	22%	22%	22%	22%	22%	22%	22%

Source: Compiled by author

The above forecasted measures give us the EBIT and EBITDA described in Table 17. By using the NOPLAT / Net Sales metric the future NOPLAT was forecasted by using the average and assuming that relation to stay constant which was done due to reasons cited above.

7.5. FCF Forecast

To finally forecast the FCF we need to decide on a formula on how to calculate it. The thesis will come up with two different ways on calculate the FCF (Koller, Goedhart, & Wessels, 2010; Damodaran, 2012):

$$FCF Type 1 = EBIT * (1 - \tau_c) + Depreciation - Capital Expenditure - \Delta Working Capital$$
$$FCF Type 2 = NOPLAT - Net Investment$$

Both of these formulas give us different FCFs that lead to different results. Therefore, both results are going to be compared to the current market price.

Table 18: FCF Forecast

Year	2017	2018	2019	2020	2021	2022F	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F	2031F
PPE	33,783	41,304	37,378	36,766	39,440	61,658	73,764	85,304	96,903	107,182	116,961	124,358	129,035	132,345	134,992
PPE / Net Sales	15%	16%	14%	13%	11%	14%	14%	14%	14%	14%	14%	14%	14%	14%	14%
CapEx	-	7,521	-3,926	-612	2,674	22,218	12,106	11,541	11,599	10,279	9,779	7,397	4,677	3,310	2,647
NWC	7258.68	8495.9	15707.5	9321.3	17138.34	18,349	21,951	25,386	28,838	31,896	34,806	37,008	38,400	39,385	40,172
NWC / Net Sales	3%	3%	6%	3%	5%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
Change in NWC	-	1,237	7,212	-6,386	7,817	1,210	3,603	3,434	3,452	3,059	2,910	2,201	1,392	985	788
Invested Capital	111,009	133,937	137,821	137,548	167,802	221,983	265,567	307,117	348,876	385,881	421,087	447,719	464,557	476,475	486,005
Invested Capital / Net Sales	48%	50%	53%	50%	46%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Net Investment	22,928	3,885	-273	30,254	54,181	43,584	41,550	41,759	37,005	35,206	26,632	16,838	11,919	9,530	9,720
FCF Type 1	-	60,068	63,027	74,797	95,252	77,501	105,037	124,661	143,573	162,111	178,767	193,966	205,151	212,343	217,537
FCF Type 2	22,743	52,264	54,296	27,924	44,050	54,841	76,200	94,413	117,683	135,890	160,074	181,676	194,061	201,735	205,769

Source: Compiled by author

Again, due to the same reasoning above, namely that Apple is likely operating at its peak efficiency, there is no sound reasoning to argue that it is going to change one of its metrics significantly. Thus, it is assumed that Apple's Invested Capital, Capex, NWC will likely stay around their average of the last five years. These assumptions lead us to the FCFs described in Table 18.

7.6. Growth-Case Scenario

Table 19: Growth-Case Sales Forecast

Year	2017	2018	2019	2020	2021	2022F	2023F	2024F	2025F	2026F	2027F	2028F	2029F	2030F	2031F
Total net sales	229,234	265,595	260,174	274,515	365,817	447,900	535,840	619,676	765,902	919,082	1,102,898	1,268,333	1,395,167	1,464,925	1,538,171
year-on-year growth%	-	16%	-2%	6%	33%	22%	20%	16%	24%	20%	20%	15%	10%	5%	5%
Source: Compiled by author															

There is a second case to consider. As evidenced, Apple has shown time and time again that it can create a new product or revolutionise a whole new market by creating a new product. Their latest ground-breaking product has to be the AirPods which, if spun-off into its own company, could be valued at \$175bn (Haslam, 2019). Such a product could rejuvenate Apple's Net Sales and therefore significantly increase its value. Hence, Apple's stock price needs to be calculated using this growth-case scenario as well while keeping other assumptions constant. After having calculated both cases, one could calculate the market-probabilities for the base and growth-case provided the assumptions are correct.
8. WACC

To value the forecasted cash-flow to their present value, we first need to derive Apple's cost of capital. Thus, Apple's *Capital Structure, Required Return of Equity and Required Return of Debt* need to be calculated. The following formula to calculate WACC will be applied (Petersen & Plenborg, 2012):

$$WACC = \frac{E}{E + NIBL} * r_e + \frac{NIBL}{E + NIBL} * r_d * (1 - \tau_c)$$

8.1. Capital Structure

There are a few variations of the WACC-formula and thus some differences in how capital structure should be calculated. Furthermore, to calculate a precise capital structure it is generally recommended to use market values of equity and debt (Petersen & Plenborg, 2012). However, if market values are not available, book values can be used as an approximation (Koller, Goedhart, & Wessels, 2010). Since calculating the market value of debt for Apple is quite complex and requires a lot of assumptions, it will be assumed that book value will lead to a proper approximation of capital structure for the scope of this thesis. These assumptions lead to the following weights: $w_e = 90.41\%$, $w_d = 9.59\%$

This may seem at first a bit odd since the weight of equity is quite high but according to Petersen & Plenborg (2012), industries specialised in electronics such as computers or software have a $w_e = \frac{E}{E+NIBL} > 90\%$ on average. Therefore, according to industry standards Apple should have an even higher w_e .

8.2. Required Return of Equity

The formula to calculate the required return of equity is as follows (Petersen & Plenborg, 2012):

$$r_e = r_f + \beta * (E(r_m) - r_f)$$

Risk-Free Rate

The first required measure to calculate the required return of equity is the risk-free rate. Usually, the risk-free rate is calculated by the current and past interest rates on a 10-year government bond (Koller, Goedhart, & Wessels, 2010). However, as interest rates have been low for a few years to fight recessions and the economic impact of the pandemic, they are expected to rise. Additionally with rising inflation central banks are forced to raise the interest rate to keep inflation stable. Thus, using the average interest rate of a 10-year US government bond would not make sense to calculate the required return of equity used for future cashflows since it would artificially keep the interest rate low. Hence, the current interest rate would be a more appropriate proxy. In addition, to cover the likely scenario of rising interest-rates the current rate will be mocked up slightly. The present interest-rate on a 10-

year US government bond is around 3% which will be adjusted slightly to 3.50% as explained prior (Trade Economics, 2022).

 $R_i = \alpha + \beta_i * R_m + \varepsilon_i$

Beta



Figure 34: Regression Daily Returns of Apple and S&P500 Source: (Yahoo Finance, 2022), compiled by author

To adequately measure the raw beta of Apple its returns need to be regressed against a welldiversified index representing the market portfolio as shown in the equation above (Koller, Goedhart, & Wessels, 2010). According to Koller, Goedhart & Wessels (2010), there is only a small difference between well-diversified indexes such as MSCI World and S&P500 which can be ignored. Thus, in this analysis S&P500 has been used to calculate Apple's raw beta. In addition, daily returns over the last five years have been used in the regression as recommended (Koller, Goedhart, & Wessels, 2010). The results are

described in Figure 34 and give us the following beta: $\beta_{RAW} \approx 1.22$. However, based on historical data betas eventually converge to 1 and can be therefore adjusted according to the Bloomberg method (BYU Library, 2022). The adjustment is constructed as follows and hence gives us the following beta:

$$\beta_{Adjusted} = \frac{2}{3} * \beta_{RAW} + \frac{1}{3} = 1.14$$

Market Risk Premium (MRP)

Now we only need to get the MRP to finally calculate the required return of equity. Figure 35 describes the average MRP per year for the last decade. By taking the average of the MRP over the last years we get to an MRP of around 5.53%. In this case, the last ten years were used as a basis to calculate the MRP. Nevertheless, as shown in Figure 35, MRP barely fluctuated which hardly changes the required return of equity.



Figure 35: Average MRP per year in the US Source: (Statista, 2022), compiled by author

Calculation of the Required Rate of Equity

After calculating all required measures, they can be finally slotted into the above-mentioned formula which returns a required rate of equity of: 3.50% + 1.22 * 5.53% = 9.83%

8.3. Required Return of Debt

As we do not have all of the required details of Apple's debt to calculate what interest rate lenders would require, alternative approaches need to be found. Damodaran proposes a sound alternative solution that says that the required return of debt can be calculated by an adjustment which is derived by the riskiness of the company (Damodaran, 2010). This would lead to such a formula: $r_d = r_f + Default Spread$. Damodaran (2010) defines the riskiness of a company by referring to ratings and defined a table that assigns individual default spreads to those ratings. A part of that table can be seen in the following:

Table 20: Default Spread for Specific Risk Ratings

Rating	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1
Default spread	0.50%	0.80%	1.10%	1.20%	1.35%	1.45%	1.50%	1.70%

Source: Compiled by author

Apple has been regarded as one of the lowest risk companies of the world and hence has been given the best credit-rating (i.e., Aaa) (Reuters, 2021). Therefore, by using Damodaran's table and the above calculated risk-free rate, Apple gets a required return of debt of *4.00%*.

8.4. Calculation of WACC

With all the measures calculated we can finally calculate the WACC which is as follows:

$$WACC = 90.41\% * 9.83\% + 9.59\% * 4.00\% * (1 - 17.30\%) = 9.20\%$$

However, the WACC calculated in this thesis is somewhat limited to its assumptions. For example, the tax-rate of Apple could not be 17.30% for the next few years and needs to be adjusted for every year or the fact that the capital structure was calculated by using book values rather than market value. Such possibly wrong assumptions could skew the results of the calculation of the whole valuation model.

9. Valuation

With the forecasting done and the WACC calculated we can finally calculate the value of Apple. The thesis valued Apple by using the DCF method while using two different formulas to calculate FCF. In addition, the value of Apple has also been calculated using the EVA method under the base and growth scenario. Lastly, Apple has been valued using multiples which have been examined in chapter five already. Thus, ignoring the relative valuation, the thesis will have in total six values which will be investigated in the following.

9.1. DCF – FCF Type 1

9.1.1. Base Case Scenario

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
FCF Type 1	77,501	105,037	124,661	143,573	162,111	178,767	193,966	205,151	212,343	217,537
Discounted FCF Type 1	70,969	88,079	95,725	100,956	104,385	105,409	104,732	101,437	96,144	90,195
Growth rate for Perpetuity	2.00%									
WACC	9.20%		Com	position o	of EV					
Forecasted Value	958,032		Forecaste	d Value	43%					
Terminal Value	1,277,217		Terminal	Value	57%					
Enterprise Value	2,235,249									
Excess Cash	183,200			Multiples						
Debt	189,893		Price to E	arnings	23.54					
Value of Equity	2,228,556		Price to B	ook	35.32					
Outstanding Stocks	16,406		EV/EBITD	A	18.59					
Price per Stock	\$ 135.83		EV/Sales		6.11					

Figure 36: Base Case DCF FCF Type 1

Source: Compiled by author

The base case scenario that assumes the first formula of the FCF to be precise calculates a stock-price of \$135.83 which falls around 14% short of the current market price of \$155.35. Assuming that this valuation is the most precise it would mean that Apple is severely overvalued, and the market price is disconnected from its intrinsic value. Due to a lower EV and Price, the multiples are closer to the average of Apple's peer group but would still get to a higher value.

Reverse DCF

Since there is a big price difference between the market-value and the calculated value we can calculate a market-implied growth-rate which assumes that the forecast is true, but the perpetuity growth-rate is differently valued by the market (McClure, 2022). Therefore, we can take the price as true and reverse engineer the valuation model that uses exactly that perpetuity growth rate which is needed to get to the market price of Apple.

Figure 37: Reverse DCF Base Case FCF Type 1

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
FCF Type 1	77,501	105,037	124,661	143,573	162,111	178,767	193,966	205,151	212,343	217,537
Discounted FCF Type 1	70,969	88 <i>,</i> 079	95,725	100,956	104,385	105,409	104,732	101,437	96,144	90,195
Growth rate for Perpetuity	3.37%									
WACC	9.20%		Com	position c	of EV					
Forecasted Value	958,032		Forecaste	d Value	37%					
Terminal Value	1,597,395		Terminal	Value	63%					
Enterprise Value	2,555,427									
Excess Cash	183,200			Multiples						
Debt	189,893		Price to E	arnings	26.92					
Value of Equity	2,548,734		Price to B	ook	40.40					
Outstanding Stocks	16,406		EV/EBITD	A	21.25					
Price per Stock	\$ 155.35		EV/Sales		6.99					

Source: Compiled by author

As evidenced by Figure 37, provided that the forecast for the next 10 years is correct and the WACC is also precise, the market is implying for Apple to have a perpetuity growth-rate of 3.37% which is roughly 1.5 times the growth rate that is generally used. Thus, provided the forecast is accurate the market expects an incredible growth of 3.37% for eternity which does seem a bit too high.

9.1.2. Growth Case Scenario

Figure 38: Growth Case DCF FCF Type 1

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
FCF Type 1	77,501	105,037	124,661	146,467	179,742	215,691	256,253	291,729	317,643	333,525
Discounted FCF Type 1	70,969	88,079	95,725	102,991	115,738	127,181	138,364	144,245	143,822	138,286
Growth rate for Perpetuity	2.00%									
WACC	9.20%		Com	position o	of EV					
Forecasted Value	1,165,401		Forecaste	d Value	37%					
Terminal Value	1,958,213		Terminal	Value	63%					
Enterprise Value	3,123,615									
Excess Cash	183,200			Multiples						
Debt	189,893		Price to E	arnings	32.92					
Value of Equity	3,116,921		Price to B	ook	49.40					
Outstanding Stocks	16,406		EV/EBITD	A	25.98					
Price per Stock	\$ 189.98		EV/Sales		8.54					

Source: Compiled by author

However, the assumption that Apple will not innovate anymore or will not be capable of revolutionising a new or existing markets seems a bit shaky since, as seen in the first chapter, Apple has proved time and time again that they are highly capable of producing revolutionary products and be highly innovative. For example, with especially the introduction of the Apple Watch, AirPods, iPhone and iPad, Apple transformed markets and grew significantly. Therefore, such a possibility should be included in our valuations again. Provided Apple will be able to replicate such practices they would be valued at \$189.98. Therefore, the current market-price of \$155.35 would be too low and hence Apple would be undervalued.

Reverse DCF

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
FCF Type 1	77,501	105,037	124,661	146,467	179,742	215,691	256,253	291,729	317,643	333 <i>,</i> 525
Discounted FCF Type 1	70,969	88,079	95,725	102,991	115,738	127,181	138,364	144,245	143,822	138,286
Growth rate for Perpetuity	-0.68%									
WACC	9.20%		Com	position c	of EV					
Forecasted Value	1,165,401		Forecaste	d Value	46%					
Terminal Value	1,390,015		Terminal	Value	54%					
Enterprise Value	2,555,416									
Excess Cash	183,200			Multiples						
Debt	189,893		Price to E	arnings	26.92					
Value of Equity	2,548,723		Price to B	ook	40.40					
Outstanding Stocks	16,406		EV/EBITD	A	21.25					
Price per Stock	\$ 155.35		EV/Sales		6.99					

Figure 39: Reverse DCF Growth-Case FCF Type 1

Source: Compiled by author

Again, the market-implied growth-rate of the perpetuity can be calculated by solving the price for the current market-price by adjusting the growth-rate of the perpetuity. In such a case where the price implied an undervaluation, the growth-rate will be severely decreased. Figure 39 evidences that if the assumptions of the growth-case are accurate, the market implies a perpetuity growth-rate of -0.68%. This seems too low for a company such as Apple and either implies that the market is disconnected to the fundamental value or investors use probabilistic scenarios as explained in the following.

9.1.3. Probabilistic Valuation

If it is assumed that the forecasts in both cases are correct and are the only two options, it is possible to calculate the market-implied probability for either case by using the current stock-price of Apple.

	 Base Case	(Growth Case	М	arket Price
Price	\$ 135.83	\$	189.98	\$	155.35
Probability	64%		36%		-
Source: Compiled by author					

Table 21: Probabilistic Valuation DCF of FCF Type 1

Table 20 demonstrates that if the above laid out assumptions are correct, the market currently assumes a probability of 64% that the base case is going to materialise and hence a probability of 36% that the growth case will happen.

9.2. DCF – FCF Type 2

9.2.1. Base Case Scenario

Assuming that the second formula to calculate the value of Apple is more accurate, we would get the results described in Figure 40. Thus, in the base case scenario, Apple would be valued at \$110.98 which is lower than the value derived by using FCF Type 1. Thus, it still hugely differentiates from the current market-price, implying that Apple is overvalued.

Figure 40: Base Case DCF FCF Type 2

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
FCF Type 2	54,841	76,200	94,413	117,683	135,890	160,074	181,676	194,061	201,735	205,769
Discounted FCF Type 2	50,220	63,898	72,498	82,751	87,501	94,387	98,096	95,953	91,341	85,316
Growth rate for Perpetuity	2.00%									
WACC	9.20%		Com	position c	of EV					
Forecasted Value	821,960		Forecaste	d Value	40%					
Terminal Value	1,208,125		Terminal	Value	60%					
Enterprise Value	2,030,085									
Excess Cash	183,200			Multiples						
Debt	189,893		Price to Ea	arnings	21.37					
Value of Equity	2,023,392		Price to B	ook	32.07					
Outstanding Stocks	16,406		EV/EBITD	A	16.88					
Price per Stock	\$ 123.33		EV/Sales		5.55					

Source: Compiled by author

The Reverse DCF (see Appendix) of this case would imply a market-implied growth-rate for the perpetuity of 4.08%. Which again, would be a very bold assumption considering that the common growth-rate is around 2%.

9.2.2. Growth Case Scenario

Figure 41: Growth Case DCF FCF Type 2

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
FCF Type 2	54,841	76,200	63,701	92 <i>,</i> 388	110,865	160,368	215,854	272,012	285,612	299,893
Discounted FCF Type 2	50,220	63,898	48,915	64,964	71,387	94,560	116,551	134,496	129,319	124,342
Growth rate for Perpetuity	2.00%									
WACC	9.20%		Compo	sition of I	EV					
Forecasted Value	898,651		Forecasted Val	lue	34%					
Terminal Value	1,760,750		Terminal Value	9	66%					
Enterprise Value	2,659,401									
Excess Cash	183,200		Μι	ultiples						
Debt	189,893		Price to Earnin	gs	28.02					
Value of Equity	2,652,708		Price to Book		42.05					
Outstanding Stocks	16,406		EV/EBITDA		22.12					
Price per Stock	\$ 161.69		EV/Sales		7.27					

Source: Compiled by author

Assuming the growth case scenario is the most likely scenario to happen, the calculated stock price of Apple should be around \$161.69. That calculated price implies that if taken this example alone it is quite a strong indication that the market is slightly undervaluing Apple since the calculated price and the market price have only a difference of around \$6. Therefore, according to the Reverse DCF we would get a growth-rate of just under 1.58%. In conclusion, from the DCF models the best estimate of the current market-value is derived by using the FCF-Type 2 and assuming the growth case scenario to be correct. Later, all results of the absolute valuation will be compared, and an average will be calculated to compare it to the actual market-price. A probabilistic valuation is not needed as the growth case scenario quite accurately reflects the current market price.

9.3. Economic Value Added

Since all of the forecasts have been made it is also possible to calculate Apple's value using the EVA method. Similar to the DCF model a two-stage EVA model will be applied. To calculate the EV the following formula will be used (Petersen & Plenborg, 2012):

$$EV_0 = Inv \, cap_0 + \sum_{t=1}^n \frac{(ROIC_t - WACC) * inv. \, cap_{t-1}}{(1 + WACC)^t} + \frac{(ROIC_{n+1} - WACC) * inv. \, cap_n}{WACC - g} * \frac{1}{(1 + WACC)^n}$$

As shown by the formula the EVA aims to derive the EV of a company by using present invested capital and adding further invested capital multiplied by excess return. The EVA is said to have some advantages over the DCF by being more consistent and a better measure to evaluate investments (Pruzhansky, 2013).

9.3.1. Base Case Scenario

Figure 42: Base Case EVA Valuation

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
EVA	53,990	65,403	71,651	75 <i>,</i> 878	78,931	79 <i>,</i> 946	79 <i>,</i> 887	77,782	73,905	69 <i>,</i> 413
Growth rate for Perpetuity	2.00%									
WACC	9.20%		(Compositi	on of EV					
Inv. Capital (t=0)	167,802		Invested (Cap. (t=0)		9%				
Forecasted Value	726,785		Forecaste	d Value		39%				
Terminal Value	982,929		Terminal Y	Value		52%				
Enterprise Value	1,877,517									
Excess Cash	183,200			Multi	ples					
Debt	189,893		Price to Ea	arnings		19.76				
Value of Equity	1,870,823		Price to Bo	ook		29.65				
Outstanding Stocks	16,406		EV/EBITD	Ą		15.62				
Price per Stock	\$ 114.03		EV/Sales			5.13				

Source: Compiled by author

The base case scenario of the EVA method calculates a price of \$114.03 which is the lowest price that has been calculated among the absolute valuation methods. Among the base case scenarios, the EVA method calculates the lowest terminal value relative to the calculated EV. Since EVA provides the lowest EV out of all valuations, it also is the closest to the relative valuation.

Reverse EVA

As EVA is not as commonly known as the DCF, there are in general less papers and articles to be found about it. Therefore, research on Reverse EVA is basically non-existent. Nevertheless, since the Reverse DCF aims to calculate the growth-rate of the perpetuity and EVA uses such a growth-rate as well, it can also be applied to the EVA. Again, if the forecast of the EVA is correct, it is possible to calculate the market-implied growth-rate of the perpetuity.

Figure 43: Reverse EVA Base-Case

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	203
EVA	53,990	65 <i>,</i> 403	71,651	75,878	78,931	79,946	79,887	77,782	73 <i>,</i> 905	69,41
Growth rate for Perpetuity	4.94%									
WACC	9.20%			Compositi	on of EV					
Inv. Capital (t=0)	167,802		Invested (Cap. (t=0)		7%				
Forecasted Value	726,785		Forecaste	d Value		28%				
Terminal Value	1,660,840		Terminal '	Value		65%				
Enterprise Value	2,555,427									
Excess Cash	183,200			Multi	ples					
Debt	189,893		Price to Ea	arnings		26.92				
Value of Equity	2,548,734		Price to Be	ook		40.40				
Outstanding Stocks	16,406		EV/EBITD	A		21.25				
Price per Stock	\$ 155.35		EV/Sales			6.99				

Source: Compiled by author

Assuming that the EVA forecast (see Appendix) is correct, the market would believe that Apple will be growing by 4.94% until eternity which seems absurdly high, even for Apple. Consequently, around 65% of Apple's EV would be due to its terminal value. Considering the fact that Apple is company that is likely fully matured and has high profitability margins, that huge weight of its terminal value seems to be non-sensical. Thus, either the market is disconnected from Apple's fundamental value, or this particular application of the EVA is not suited.

9.3.2. Growth Case Scenario

Figure 44: Growth Case EVA

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
EVA	53 <i>,</i> 990	65,403	71,651	75,878	85,879	94,370	103,700	109,205	110,002	105,768
Growth rate for Perpetuity	2.00%									
WACC	9.20%			Compositi	on of EV					
Inv. Capital (t=0)	167,802		Invested (Cap. (t=0)		6%				
Forecasted Value	875,847		Forecaste	d Value		34%				
Terminal Value	1,541,790		Terminal	Value		60%				
Enterprise Value	2,585,439									
Excess Cash	183,200			Multi	ples					
Debt	189,893		Price to Ea	arnings		27.24				
Value of Equity	2,578,746		Price to Be	ook		40.87				
Outstanding Stocks	16,406		EV/EBITD	Ą		21.50				
Price per Stock	\$ 157.18		EV/Sales			7.07				

Source: Compiled by author

The growth case scenario provides a very close estimate of the current market price. The market price only falls short of around two dollars of the calculated growth case EVA price. This variation could be fully explained by noise surrounding the correct price. However, if taken that the fundamental value is closely connected to the market value investors would assume that the base case scenario is not likely at all. From a probabilistic point of view, this seems a bit far-fetched since that valuation hinges on the condition that Apple is going to revolutionise a market or introduce a ground-breaking new product that can rejuvenate its sales. In addition, again, a probabilistic valuation is not necessary since the growth case scenario gets really close to the market price.

9.4. Combined Valuation

Valuation Method	Price	Accurate?
FCF Type 1 Base Case	\$ 135.83	
FCF Type 2 Base Case	\$ 123.33	
EVA Base Case	\$ 114.03	
FCF Type 1 Growth Case	\$ 189.98	
FCF Type 2 Growth Case	\$ 161.69	
EVA Growth Case	\$ 157.18	
Average	\$ 147.01	
Difference	\$ -8.34	
Difference %	-5%	

If assumed that every valuation that has been discussed prior has its drawback and is equally valid it would make sense to look at an average price derived from all the calculated prices and draw a conclusion based on that price as to whether Apple's market price is correctly priced. Based on such an approach the valuations would provide a price of \$147.01

Source: Compiled by author

Table 22: All Calculated Stock Prices of Apple

which still very slightly underestimates the current market-price by around 5%. Secondly, the assumption that every valuation should be equally weighted and thus is equally valid cannot be conclusively answered. Thus, such a valuation should always be taken with caution.

Probabilistic Valuation

Assuming the market price is correctly priced according to the fundamentals of Apple and all of the applied models are valid, it would be the case

Scenario	Ave	rage Price	Probability
Base Case	\$	124.40	31.55%
Growth Case	\$	169.62	68.45%
Current Market Price	\$	155.35	-

Source: Compiled by author

that the market would expect a growth case Table 23: Probabilistic Valuation of the Combined Valuation

scenario with a probability of 68.45% and hence a probability for the base case scenario of 31.55%. This is consistent with Apple's history of innovating and revolutionising markets and hence it at least seems reasonable to a certain degree that such a probability is expected by the market. However, the recent Apple stock price has a range of \$129.04 - \$182.94 for the last 52 weeks. Therefore, if this valuation had been done a few months prior such a probabilistic valuation would not even be applicable since the average price of the growth case scenario still falls short of the stock price a few months ago.

10. Discussion

"Valuation is a craft, not an art or a science" (Damodaran, 2015)

As touched upon slightly in the previous chapters it is important to be critical of the valuation methods that have been applied in this thesis. Even the renounced professor Aswath Damodaran who has written a lot of valuation books clearly rejects the idea of valuation being a science. Damodaran (2015) argues that valuation does not fulfil the required precision in order to be counted as a science. He elaborates that valuation is a craft like cooking and requires hands-on experience to improve. He further clarifies that valuation cannot be learned by simply listening or reading. Therefore, even if the thesis used a lot of references and books since the framework of valuation is shaky in itself, meaning lacks precision, the calculated price can still be wrong.

There are a lot of different models or formulas that people could apply to value an asset. It is not always clear what formula or model is best suited to calculate the "correct" value of a company. To counter such a possibility, the thesis is considering a few options whilst also keeping in mind that every applied model could be wrong.

In addition, some of the assumptions required to value a company properly could be off. For example, although a valuation requires a strategic evaluation of the company, different people looking could come to different conclusions while looking at the same facts. Thus, there is no tool to check which assumption is more suited for the company but rather a range of different opinions.

Furthermore, there is no definitive proof that the company under assessment has a stock-price that is in any way connected to its fundamentals. For example, Tesla's stock has a current market-price of \$16.73 while also having a price-range of \$620.57 - \$1,243.49 (Yahoo Finance, 2022). Is it reasonable to assume that changes in new information justify a price-range that spans over \$600? Critics have been saying for a long time that Tesla is not a technology company but a capital-intensive automotive company and should hence not be valued in a similar fashion such as Big Tech (Fiorillo, 2022). One could argue that, in that regard, the market is acting irrationally or using measures that should possibly not be applied to an automotive company.

Sensitivity Analysis

All of these issues are potential reasons as to why valuations can be somewhat imprecise. This is an important reason as to why they should be analysed in regard to how its price behaves when incremental changes in its underlying assumptions occur.

				Return on Equity	,	
	WACC	9.43%	9.63%	9.83%	10.03%	10.23%
Return on debt	3.60%	8.81%	8.99%	9.17%	9.35%	9.53%
	3.80%	8.83%	9.01%	9.19%	9.37%	9.55%
	4.00%	8.84%	9.02%	9.20%	9.38%	9.56%
	4.20%	8.86%	9.04%	9.22%	9.40%	9.58%
	4.40%	8.87%	9.05%	9.23%	9.42%	9.60%

Figure 45: Sensitivity Analysis Part 1

Source: Compiled by author

The calculated WACC consists of the required return on equity and required return on debt. Thus, a change in the WACC which results in incremental changes of those factors should be put against its calculated price to see what a price range could be explained by small, expected mistakes. Figure 45 shows the relationship of these changes and how the calculated WACC moves when required return on debt and required return on equity are slightly adjusted. The dark-green cell in the middle results of the applied assumptions that make up required return on debt and required return on equity. The lighter but still relatively dark-green cells surrounding the calculated WACC represent the most likely values that could be more accurate if a small mistake has been made when estimating it. The figure recalculates the WACC by changing the calculated required return on equity (9.83%) by 0.20 percentage points. Likewise, the required return on debt has also been changed by a stepwise adjustment of 0.20 percentage points to measure its impact on the WACC applied in this thesis. By holding the required return on debt constant and adjusting solely the required return on equity Figure 45 evidences that the WACC changes from 8.84% to 9.56%. When holding the required return of equity constant and adjusting required return of debt we get a range between 9.17% and 9.23%. That implies that the required return of equity is the part of the WACC that has a bigger impact on its value and therefore a bigger driver of errors. Therefore, it is required to see how the WACC behaves if the assumptions or measures used to calculate the required return on equity are changed.

		Market Risk Premium							
	WACC	5.03%	5.28%	5.53%	5.78%	6.03%			
	0.84	7.32%	7.51%	7.70%	7.89%	8.08%			
	0.99	8.00%	8.23%	8.45%	8.68%	8.90%			
Beta	1.14	8.69%	8.94%	9.20%	9.46%	9.72%			
	1.29	9.37%	9.66%	9.95%	10.25%	10.54%			
	1.44	10.05%	10.38%	10.70%	11.03%	11.36%			

Figure 46: Sensitivity Analysis Part 2

Source: Compiled by author

Figure 46 uses the same kind of analysis method applied in Figure 45. However, since changes in the required return of equity proved a bigger impact in changes in the WACC, it will be tested how the WACC changes when the market risk premium and beta are changed. The WACC has been analysed by changing the calculated beta by 0.15 and adjustments of the market risk premium by 0.25 percentage

points. When holding beta constant and adjusting the market risk premium the WACC moves between 8.69% and 9.72%. Likewise holding the market risk premium constant and changing the beta provides a range of values between 7.70% and 10.70%. The total analysis calculates a range of values between 7.32% and 11.36%. These values are hugely different from the calculated WACC applied in the previous valuation models. Hence, such changes and their implications need to be measured to know what the likely error margin is. Again, the values surrounding the calculated WACC will be put under further analysis since they represent the most likely 'true' value of the WACC.

Figure 47: Sensitivity Analysis Part 3

		Growth rate for Perpetuity							
	EV	1.70%	1.85%	2.00%	2.15%	2.30%			
	8.23%	\$2,788,073.15	\$2,831,486.29	\$2,876,990.48	\$2,924,740.54	\$2,974,906.93			
	8.45%	\$2,677,335.42	\$2,717,032.15	\$2,758,574.33	\$2,802,093.72	\$2,847,734.91			
	8.68%	\$2,573,976.04	\$2,610,358.46	\$2,648,375.33	\$2,688,139.33	\$2,729,773.71			
	8.94%	\$2,460,019.33	\$2,492,920.06	\$2,527,242.10	\$2,563,079.58	\$2,600,535.15			
WACC	9.20%	\$2,357,461.89	\$2,387,383.39	\$2,418,551.09	\$2,451,044.50	\$2,484,950.02			
	9.46%	\$2,262,014.66	\$2,289,294.38	\$2,317,670.88	\$2,347,211.66	\$2,377,989.89			
	9.66%	\$2,193,077.43	\$2,218,527.40	\$2,244,974.05	\$2,272,477.09	\$2,301,101.11			
	9.95%	\$2,097,894.32	\$2,120,925.61	\$2,144,825.67	\$2,169,644.61	\$2,195,436.46			
	10.25%	\$2,009,529.79	\$2,030,427.20	\$2,052,084.92	\$2,074,545.22	\$2,097,853.54			

Source: Compiled by author

Figure 47 shows how the EV of Apple changes when using the WACCs previously calculated in Figure 46, assuming that the best model to describe Apple's value is the Combined Valuation. That particular model was chosen since every model has its drawbacks and an equally weighted valuation might arguably somewhat mediate them. Figure 47 describes the change of Apple's EV if the growth-rate is adjusted stepwise by 0.15 percentage points. If the growth-rate is held constant, Apple's EV moves between \$2.05tn and \$2.88tn. That is a range which spans over around \$830bn. Therefore, the WACC which has been applied to value Apple has huge implications regarding how the stock-price of Apple will turn out. In contrast, if the calculated WACC is held constant and the growth-rate is adjusted, Apple's EV has a range between \$2.36tn and \$2.48tn, implying a change in EV of up to \$120bn. Therefore, if the WACC is even slightly skewed in the above applied valuations it could lead to an EV anywhere between \$2.01tn and \$2.98tn which is a huge error margin of around \$970bn. As a next step it should be assessed how those changes in EV impact the calculated price of Apple's stock-price.

Figure 48: Sensitivity Analysis Part 4

			GIOWI	.1116	ate for Perp	etu	lly	
	Р	1.70%	1.85%		2.00%		2.15%	2.30%
	8.23%	\$ 169.53	\$ 172.18	\$	174.95	\$	177.86	\$ 180.92
	8.45%	\$ 162.78	\$ 165.20	\$	167.73	\$	170.38	\$ 173.17
	8.68%	\$ 156.48	\$ 158.70	\$	161.02	\$	163.44	\$ 165.98
	8.94%	\$ 149.53	\$ 151.54	\$	153.63	\$	155.82	\$ 158.10
WACC	9.20%	\$ 143.28	\$ 145.11	\$	147.01	\$	148.99	\$ 151.05
	9.46%	\$ 137.47	\$ 139.13	\$	140.86	\$	142.66	\$ 144.53
	9.66%	\$ 133.26	\$ 134.82	\$	136.43	\$	138.10	\$ 139.85
	9.95%	\$ 127.46	\$ 128.87	\$	130.32	\$	131.84	\$ 133.41
	10.25%	\$ 122.08	\$ 123.35	\$	124.67	\$	126.04	\$ 127.46

Growth rate for Perpetuity

Source: Compiled by author

Such changes in the growth-rate and WACC mean that Apple's stock-price is somewhere between \$122.08 and \$180.92. If the WACC and the growth-rate are just slightly misjudged, then the price lies somewhere between \$134.82 and \$163.44. Thus, the price bracket that enables a small margin of error includes the current market price, implying that a small error could have led the thesis to the wrong conclusion that Apple is overvalued.

11. Conclusion

As shown by the sensitivity analysis, the calculated price is highly volatile depending on incremental changes in the assumptions that have been laid out. Therefore, the sensitivity analysis further proves the shaky ground on which the result of the valuation is founded on. As stated by Damodaran: "(...) valuation is not an art nor a science (...)". Hence, there is no right or wrong answer about valuing a company. It is possible to use the correct models or use sound reasoning, but the uncertainty remains since there is not one rational solution but rather a lot of various conclusions that can be rationally drawn from the same facts. Similarly, it is also possible to have the perfect valuation model, but the market is acting irrationally.

Judging by the best guess from this thesis which is the result provided by the final combined valuation, namely \$147.01, the thesis recommends that Apple stocks should be *shorted*. However, there seems to be a high market-implied probability that Apple rejuvenates its sales and additionally still the threat that the market does not correct itself although fundamentals suggest otherwise. Furthermore, the thesis implied an equal weight to each valuation model and sales development scenario, which likely does not represent the 'true' probabilities that are applied by investors. Hence, it is highly possible that the market is using similar models with differentiating probabilities since the models applied in this thesis *can* lead to the market value as shown by the probabilistic valuation.

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13. Appendix

13.1. Income Statement

Actual

Effective tax-rate	13.30%	14.40%	15.90%	18.30%	24.60%		
Income statement (in USD millions)	2021	2020	2019	2018	2017	Notes	
Net sales:							2
Products	297,392	220,747	213,883	225,847	196,534		
Services	68,425	53,768	46,291	39,748	32,700		
Total net sales	365,817	274,515	260,174	265,595	229,234		
Cost of sales:							
Products	-192,266	-151,286	-144,996	-148,164	-126,337		
Services	-20,715	-18,273	-16,786	-15,592	-14,711		
Total cost of sales	-212,981	-169,559	-161,782	-163,756	-141,048		
Gross margin	152,836	104,956	98,392	101,839	88,186		
Operating expenses and D&A:							
R&D	-21,914	-18,752	-16,217	-14,236	-11,581		
SG&A	-21,973	-19,916	-18,245	-16,705	-15,261		
Depreciation & Amorisation:							
D&A	-11,284	-11,056	-12,547	-10,903	-10,157		
EBITDA	120,233	77,344	76,477	81,801	71,501		
Operating income	108,949	66,288	63,930	70,898	61,344		11
Other income:							7
Interest income	2843	3,763	4,961	5,686	5,201		
Interest expenses	-2,645	-2,873	-3 <i>,</i> 576	-3,240	-2,323		
Other income, net	60	-87	422	-441	-133		
Total other income	258	803	1,807	2,005	2,745		
EBT	109,207	67,091	65,737	72,903	64,089		
Income taxes	-14,527	-9,680	-10,481	-13,372	-15,738		
Net income	94,680	57,411	55,256	59,531	48,351		

13.2. Balance Sheet

Balance sheet (in USD millions)	2021	2020	2019	2018	2017 Note	s
Assets						
Current assets:						
Cash and cash equivalents	34.940	38.016	48.844	25.913	20.289	3
Marketable securities	27,699	52,927	51,713	40,388	53,892	3
Accounts receivable, net	26,278	16,120	22,926	23,186	17,874	
Inventories	6,580	4,061	4,106	3,956	4,855	
Vendor non-trade receivables	25,228	21,325	22,878	25,809	17,799	
Other current assets	14,111	11,264	12,352	12,087	13,936	
Total current assets	134,836	143,713	162,819	131,339	128,645	
Non-current assets:						
Marketable securities	127,877	100,887	105,341	170,799	194,714	3
Property, plant and equipment, net	39,440	36,766	37,378	41,304	33,783	6
Other non-current assets	48,849	42,522	32,978	22,283	18,177	
Total non-current assets	216,166	180,175	175,697	234,386	246,674	
Total accosts	251 002	272 000	220 516	265 775	275 210	
	331,002	525,000	556,510	303,723	373,319	
Liabilities and equity						
Current liabilities:						
Accounts payable	54,763	42,296	46,236	55,888	44,242	
Other current liabilities	47,493	42,684	37,720	33,327	30,551	
Deferred revenue	7,612	6,643	5,522	5,966	7,548	
Commercial paper	6,000	4,996	5,980	11,964	11,977	
Term debt	9,613	8,773	10,260	8,784	6,496	7
Total current liabilities	125,481	105,392	105,718	115,929	100,814	
Non-current liabilities:						
Term debt	109,106	98,667	91,807	93,735	97,207	7
Long-term taxes payable	24,689	28,170	29,545	33,589	257	
Deferred tax liabilities	0	0	0	426	31,504	
Other non-current liabilities	28,636	26,320	20,958	14,899	11,490	
Total non-current liabilities	162,431	153,157	142,310	142,649	140,458	
Shareholder's equity:						8
Common stock and additional naid-in canital	57 365	50 779	45 174	40 201	35 867	0
Retained earnings	5 562	14 966	45,298	70,201	98 330	
Accumulated other comprehensive income/(loss)	163	-406	-584	-3 454	-150	
Total shareholders' equity	22 UOU	65 330	90 / 89	107 1/17	134 047	
	03,030	03,335	50,400	107,147	137,07/	
Total lightlition and charabaldara' aquitu	251 002	272 000	220 516	265 725	275 210	
rotar nabilities and shareholders equity	351,002	⊃∠ ⊃,ŏŏŏ	330,510	303,723	3/3,319	

13.3. Reorganised Income Statement

Reorganised

Effective tax-rate	13.30%	14.40%	15.90%	18.30%	24.60%	
Income statement (in USD millions)	2021	2020	2019	2018	2017	Notes
Net sales:						2
iPhone	191,973	137,781	142,381	166,699	141,319	
Mac	35,190	28,622	25,740	25,484	25 <i>,</i> 850	
iPad	31,862	23,724	21,280	18,805	19,222	
Wearables, Home and Accessories	38,367	30,620	24,482	17,417	12,863	
Services	68,425	53,768	46,291	37,190	29,980	
Total net sales	365,817	274,515	260,174	265,595	229,234	
Cost of sales:						
Products	-192,266	-151,286	-144,996	-148,164	-126,337	
Services	-20,715	-18,273	-16,786	-15,592	-14,711	
Total cost of sales	-212,981	-169,559	-161,782	-163,756	-141,048	
Gross margin	152,836	104,956	98,392	101,839	88,186	
Operating expenses and D&A:						
R&D	-21,914	-18,752	-16,217	-14,236	-11,581	
SG&A	-21,973	-19,916	-18,245	-16,705	-15,261	
Depreciation & Amorisation:						
D&A	-11,284	-11,056	-12,547	-10,903	-10,157	
EBITDA	120,233	77,344	76,477	81,801	71,501	
Operating income	108,949	66,288	63,930	70,898	61,344	11
Computed expected tax	-22,933	-14,089	-13,805	-17,890	-22,431	
State taxes, net of federal effect	-1,151	-423	-423	-271	-185	
Impacts of the U.S. Tax Cuts and Jobs Act of 2017	0	582	0	-1,515	0	
Earnings of foreign subsidiaries	4,715	2,534	2,625	5,606	6,135	
Foreign-derived intangible income deduction	1,372	169	149	0	0	
Domestic production activities deduction	0	0	0	195	209	
Research and development credit, net	1,033	728	548	560	678	
Excess tax benefits from equity awards	2,137	930	639	0	0	
Other	300	-111	-214	-57	-144	
Income taxes	-14,527	-9,680	-10,481	-13,372	-15,738	
Core income tax	-10,718	-8,110	-9,907	-14,749	-15,673	7
NOPLAT	98,231	58,178	54,023	56,149	45,671	
Interest income	2843	3,763	4,961	5,686	5,201	
Interest expenses	-2,645	-2,873	-3,576	-3,240	-2,323	
Other income, net	60	-87	422	-441	-133	
Total other income	258	803	1,807	2,005	2,745	
EBT	109,207	67,091	65,737	72,903	64,089	
Net income	94,680	57,411	55 <u>,25</u> 6	59,53 <u>1</u>	48,351	

13.4. Reorganised Balance Sheet

Balance sheet (in USD millions)	2021	2020	2019	2018	2017	Notes
Operating activities:						
Property, plant and equipment, net	39,440	36,766	37,378	41,304	33,783	6
Other non-current assets	48,849	42,522	32,978	22,283	18,177	
Long-term operating assets	88,289	79,288	70,356	63,587	51,960	
Long-term taxes payable	24,689	28,170	29,545	33,589	257	
Deferred tax liabilities	0	0	0	426	31,504	
Operating lease liabilities	10,955	9,181	10,838	9,672	9,545	
Long-term operating liabilities	35,644	28,170	40,383	43,687	41,306	
Fixed capital	52,645	51,118	29,973	19,900	10,654	
Operating cash	7,316	5,490	5,203	5,312	4,585	3
Accounts receivable, net	26,278	16,120	22,926	23,186	17,874	
Inventories	6,580	4,061	4,106	3,956	4,855	
Vendor non-trade receivables	25,228	21,325	22,878	25,809	17,799	
Other current assets	14,111	11,264	12,352	12,087	13,936	
Short-term operating assets	79,513	58,260	67,465	70,350	59,049	
Accounts navable	54 763	42 296	46 236	55 888	44 242	
Deferred revenue	7 612	6 643	5 522	5 966	7 548	
Short term liabilities	62 375	48 939	51 758	61 854	51 790	
	02,373	40,555	51,750	01,034	51,750	
Net working capital	17,138	9,321	15,707	8,496	7,259	
Net operating assets	69,783	60,439	45,680	28,396	17,913	
Eingneing activities:						
	27 62 4	22 526	42 644	20 604	45 704	2
Cash	27,624	32,526	43,641	20,601	15,704	5
Marketable securities	27,699	52,927	51,713	40,388	53,892	5
Non-current marketable securities	127,877	100,887	105,341	170,799	194,/14	3
Financial assets	167 802	130,340	200,095	231,788	204,310	
	107,802	157,546	140,039	145,009	120,554	
Term debt	9.613	8.773	10.260	8,784	6.496	7
Commercial paper	6.000	4.996	5.980	11.964	11.977	-
Lease liability	848	661	810	, 723	, 713	
Term debt	109,106	98,667	91,807	93,735	97,207	7
Other current liabilities	47,493	42,023	36,910	32,604	29,838	
Other non-current liabilities	16,833	26,320	20,958	14,899	11,490	
Financial liabilities	189,893	181,440	166,725	162,709	157,721	
Net interest bearing liabilities	6,693	-4,900	-33,970	-69,079	-106,589	
Common stock and additional paid-in capital	57.365	50.779	45.174	40.201	35.867	
Retained earnings	5.562	14,966	45,898	70,400	98,330	
Accumulated other comprehensive income/(loss)	163	-406	-584	-3.454	-150	
Total shareholders' equity	63,090	65,339	90,488	107,147	134,047	
Total financing	69,783	60,439	56,518	38,068	27,458	

13.5. Financial Statement Analysis

Return analysis:	2021	2020	2019	2018	2017
Return on equity (ROE)	150%	88%	61%	56%	36%
Return on invested capital (ROIC)	59%	42%	39%	42%	41%
Source: Compiled by author					

Profitability-analysis:	2021	2020	2019	2018	2017
Net profit margin	26%	21%	21%	22%	21%
Gross profit margin	42%	38%	38%	38%	38%
Operating profit margin	30%	24%	25%	27%	27%
NOPLAT margin	27%	21%	21%	21%	20%
Source: Compiled by author					

Source: Compiled by author

Asset-turnover:	2021	2020	2019	2018	2017
Asset-turnover rate	2.18	2.00	1.89	1.98	2.07
Inverse asset-turnover rate	0.46	0.50	0.53	0.50	0.48
Source: Compiled by author					

Liquidity indicators:	2021	2020	2019	2018	2017
Financial levarage	0.11	-0.07	-0.38	-0.64	-0.80
Interest rate	2.96%	-18.16%	-4.08%	-3.54%	-2.70%
Spread	56%	60%	40%	43%	41%
Current operating ratio	1.27	1.19	1.30	1.14	1.14
Working capital ratio	5%	3%	6%	3%	3%
Liquidity reserve ratio	96%	103%	120%	142%	168%

Source: Compiled by author

Assets (in millions)	2021	2020	2019	2018	2017
Total Funding	351,002.00	323,888.00	349,354.00	375,397.00	384,864.00
Marketable securities	155,576.00	153,814.00	157,054.00	211,187.00	248,606.00
Excess cash	27,623.66	32,525.70	43,640.52	20,601.10	15,704.32
Invested Capital	167,802.34	137,548.30	148,659.48	143,608.90	120,553.68
Net Investment	30,254.04	- 11,111.18	5,050.58	23,055.22	-
FCF	128,485.04	47,066.82	59,073.58	79,204.22	-

Relative Valuation		Peer Group				Apple		
Company	P/E	P/B	EV/Sales	EV/EBITDA Company	Market capitalisation	Market capitalisation	EV	EV
Samsung	1.15	1.30	0.98	2.99 Samsung	108,882,000,000.00	123,084,000,000.00	358,500,660,000.00	359,496,670,000.00
Xiaomi	0.77	1.80	0.69	7.42 Xiaomi	72,903,600,000.00	170,424,000,000.00	252,413,730,000.00	892,128,860,000.00
Alphabet	5.59	5.81	5.05	13.37 Alphabet	529,261,200,000.00	550,090,800,000.00	1,847,375,850,000.00	1,607,515,210,000.00
Meta	3.71	3.45	3.30	7.59 Meta	351,262,800,000.00	326,646,000,000.00	1,207,196,100,000.00	912,568,470,000.00
Microsoft	9.96	11.65	9.63	18.81 Microsoft	943,012,800,000.00	1,103,022,000,000.00	3,522,817,710,000.00	2,261,582,730,000.00
Amazon	2.34	8.25	2.41	19.13 Amazon	221,551,200,000.00	781,110,000,000.00	881,618,970,000.00	2,300,057,290,000.00
Apple	26.92	40.40	6.97	21.20 Average	371,145,600,000.00	509,062,800,000.00	1,344,987,170,000.00	1,388,891,538,333.33
Apple data:								
Ь	155.35							
Shares Outstanding	16,406,397,000							
Market Capitalization	2,548,733,773,950							
Market Capitalization (in USD millions)	2,548,734							
В	4							
EPS	5.77							
EV	2,548,733,878,662							

13.6. Relative Valuation

13.7. WACC

Beta	1.22
Adjusted Beta	1.14
Risk-free Rate	3.50%
Market Risk Premium	5.53%
Req. Return of Equity	9.83%
Default Spread	0.50%
Req. Return of Debt	4.00%
NIBL	6,693
Equity	63,090
Weight of NIBL	9.59%
Weight of Equity	90.41%
Tax-Rate	17.30%
WACC	9.20%

13.8. Reverse DCF / Reverse EVA

13.8.1. Base Case

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
FCF Type 1	77,501	105,037	124,661	143,573	162,111	178,767	193,966	205,151	212,343	217,537
Discounted FCF Type 1	70,969	88,079	95,725	100,956	104,385	105,409	104,732	101,437	96,144	90,195
Growth rate for Perpetuity	3.37%									
WACC	9.20%		Com	position o	of EV					
Forecasted Value	958,032		Forecaste	ed Value	37%					
Terminal Value	1,597,395		Terminal	Value	63%					
Enterprise Value	2,555,427									
Excess Cash	183,200			Multiples						
Debt	189,893		Price to E	arnings	26.92					
Value of Equity	2,548,734		Price to B	ook	40.40					
Outstanding Stocks	16,406		EV/EBITD	A	21.25					
Price per Stock	\$ 155.35		EV/Sales		6.99					

Source: Compiled by author

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
FCF Type 2	54,841	76,200	94,413	117,683	135,890	160,074	181,676	194,061	201,735	205,769
Discounted FCF Type 2	50,220	63,898	72,498	82,751	87,501	94,387	98,096	95,953	91,341	85,316
Growth rate for Perpetuity	4.08%									
WACC	9.20%		Com	position o	of EV					
Forecasted Value	821,960		Forecaste	d Value	32%					
Terminal Value	1,733,467		Terminal	Value	68%					
Enterprise Value	2,555,427									
Excess Cash	183,200			Multiples						
Debt	189,893		Price to Ea	arnings	26.92					
Value of Equity	2,548,734		Price to B	ook	40.40					
Outstanding Stocks	16,406		EV/EBITD	A	21.25					
Price per Stock	\$ 155.35		EV/Sales		6.99					

Source: Compiled by author

Year	2022	2023	2024	2025	2026	2027	2028		2029	2029 2030
EVA	53,990	65,403	71,651	75,878	78,931	79,946	79,887	7	7,782	7,782 73,905
Growth rate for Perpetuity	4.94%									
WACC	9.20%		(Compositi	on of EV					
Inv. Capital (t=0)	167,802		Invested (Cap. (t=0)		7%				
Forecasted Value	726,785		Forecaste	d Value		28%				
Terminal Value	1,660,840		Terminal	Value		65%				
Enterprise Value	2,555,427									
Excess Cash	183,200			Multi	ples					
Debt	189,893		Price to Ea	arnings		26.92				
Value of Equity	2,548,734		Price to Bo	ook		40.40				
Outstanding Stocks	16,406		EV/EBITD	A		21.25				
Price per Stock	\$ 155.35		EV/Sales			6.99				

13.8.2. Growth Case

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
FCF Type 1	77,501	105,037	124,661	146,467	179,742	215,691	256,253	291,729	317,643	333,525
Discounted FCF Type 1	70,969	88,079	95,725	102,991	115,738	127,181	138,364	144,245	143,822	138,286
Growth rate for Perpetuity	-0.68%									
WACC	9.20%		Com	position c	of EV					
Forecasted Value	1,165,401		Forecaste	d Value	46%					
Terminal Value	1,390,015		Terminal	Value	54%					
Enterprise Value	2,555,416									
Excess Cash	183,200			Multiples						
Debt	189,893		Price to E	arnings	26.92					
Value of Equity	2,548,723		Price to B	ook	40.40					
Outstanding Stocks	16,406		EV/EBITD	A	21.25					
Price per Stock	\$ 155.35		EV/Sales		6.99					

Source: Compiled by author

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
FCF Type 2	54,841	76,200	63,701	92,388	110,865	160,368	215,854	272,012	285,612	299,893
Discounted FCF Type 2	50,220	63,898	48,915	64,964	71,387	94,560	116,551	134,496	129,319	124,342
Growth rate for Perpetuity	1.58%									

Growth rate for Perpetuity	1.58%	
WACC	9.20%	Composition of EV
Forecasted Value	898,651	Forecasted Value 35%
Terminal Value	1,656,776	Terminal Value 65%
Enterprise Value	2,555,427	
Excess Cash	183,200	Multiples
Debt	189,893	Price to Earnings 26.92
Value of Equity	2,548,734	Price to Book 40.40
Outstanding Stocks	16,406	EV/EBITDA 21.25
Price per Stock	\$ 155.35	EV/Sales 6.99

Source: Compiled by author

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
EVA	53,990	65,403	71,651	75,878	85,879	94,370	103,700	109,205	110,002	105,768
Growth rate for Perpetuity	1.86%									
WACC	9.20%		(Compositi	on of EV					
Inv. Capital (t=0)	167,802		Invested (Cap. (t=0)		7%				
Forecasted Value	875,847		Forecaste	d Value		34%				
Terminal Value	1,511,778		Terminal	Value		59%				
Enterprise Value	2,555,427									
Excess Cash	183,200			Multi	ples					
Debt	189,893		Price to Ea	arnings		26.92				
Value of Equity	2,548,734		Price to Bo	ook		40.40				
Outstanding Stocks	16,406		EV/EBITD	4		21.25				
Price per Stock	\$ 155.35		EV/Sales			6.99				

13.9. Sensitivity Analysis

13.9.1. Base Case

FCF Type 1

			Grow	th rate for Perpe	tuity	
	EV	1.70%	1.85%	2.00%	2.15%	2.30%
	8.23%	2,544,899.52	2,583,361.73	2,623,676.52	2,665,981.06	2,710,426.37
	8.45%	2,451,394.89	2,486,647.07	2,523,538.09	2,562,184.94	2,602,716.04
	8.68%	2,364,010.98	2,396,395.64	2,430,235.16	2,465,629.82	2,502,689.35
	8.94%	2,267,533.65	2,296,900.42	2,327,535.84	2,359,523.93	2,392,956.30
WACC	9.20%	2,180,575.40	2,207,354.70	2,235,249.33	2,264,330.43	2,294,675.37
	9.46%	2,099,522.99	2,124,003.38	2,149,468.00	2,175,977.43	2,203,597.32
	9.66%	2,040,902.54	2,063,787.88	2,087,569.46	2,112,300.97	2,138,040.49
	9.95%	1,959,844.42	1,980,617.37	2,002,173.92	2,024,559.24	2,047,822.06
	10.25%	1,884,458.14	1,903,363.27	1,922,956.22	1,943,275.23	1,964,361.42

Source: Compiled by author

EV

WACC

Growth rate for Perpetuity 1.70% 1.85% 2.00% 2.15% 2.30% \$ 159.51 \$ 8.23% 154.71 \$ 157.05 \$ 162.09 \$ 164.80 8.45% \$ 149.01 \$ 151.16 \$ 153.41 \$ 155.76 \$ 158.23 8.68% \$ 145.66 \$ 149.88 \$ 152.14 143.68 \$ 147.72 \$ 137.80 \$ 8.94% \$ 139.59 \$ 141.46 \$ 143.41 \$ 145.45 9.20% \$ 132.50 \$ 134.13 \$ 135.83 \$ 137.61 \$ 139.46 9.46% \$ 127.56 \$ 129.05 \$ 132.22 \$ 133.91 130.61 \$ \$ 129.91 9.66% 123.99 125.38 \$ 126.83 \$ 128.34 \$ \$ 9.95% \$ 119.05 \$

121.63 \$

116.80 \$

122.99 \$

118.04 \$

124.41

119.32

120.31 \$

115.61 \$

Source: Compiled by author

\$

114.45 \$

10.25%

FCF Type 2

Growth rate for Perpetuity

WACC

8.23% 2,320,685.57 2,357,067.14 2,395,201.09 2,435,217.13 2,477,258.1 8.45% 2,232,778.11 2,266,123.30 2,301,018.68 2,337,574.90 2,375,913.4
8.45% 2,232,778.11 2,266,123.30 2,301,018.68 2,337,574.90 2,375,913.4
8.68% 2,150,654.95 2,181,287.74 2,213,296.69 2,246,776.66 2,281,831.4
8.94% 2,060,022.68 2,087,800.84 2,116,779.02 2,147,036.69 2,178,660.5
9.20% 1,978,369.14 2,003,699.80 2,030,085.45 2,057,593.39 2,086,296.8
9.46% 1,902,295.22 1,925,451.32 1,949,538.42 1,974,613.81 2,000,739.5
9.66% 1,847,297.64 1,868,944.99 1,891,440.08 1,914,833.73 1,939,180.8
9.95% 1,771,282.48 1,790,931.71 1,811,322.14 1,832,496.51 1,854,500.9
10.25% 1,700,624.07 1,718,506.52 1,737,039.57 1,756,259.42 1,776,204.9

Source: Compiled by author

			Grow	/th r	rate for Perpetu	ity	
	EV	1.70%	1.85%		2.00%	2.15%	2.30%
	8.23%	\$ 141.04	\$ 143.26	\$	145.58 \$	148.02	\$ 150.59
	8.45%	\$ 135.68	\$ 137.72	\$	139.84 \$	142.07	\$ 144.41
WACC	8.68%	\$ 130.68	\$ 132.55	\$	134.50 \$	136.54	\$ 138.67
	8.94%	\$ 125.15	\$ 126.85	\$	128.61 \$	130.46	\$ 132.39
	9.20%	\$ 120.18	\$ 121.72	\$	123.33 \$	125.01	\$ 126.76
	9.46%	\$ 115.54	\$ 116.95	\$	118.42 \$	119.95	\$ 121.54
	9.66%	\$ 112.19	\$ 113.51	\$	114.88 \$	116.30	\$ 117.79
	9.95%	\$ 107.55	\$ 108.75	\$	110.00 \$	111.29	\$ 112.63
	10.25%	\$ 103.25	\$ 104.34	\$	105.47 \$	106.64	\$ 107.85

Economic Value Added

WACC

EV	1.70%	1.85%	2.00%	2.15%	2.30%
8.23%	2,173,060.29	2,201,730.72	2,231,782.11	2,263,316.68	2,296,447.02
8.45%	2,086,984.09	2,113,044.04	2,140,315.48	2,168,884.91	2,198,847.26
8.68%	2,006,623.17	2,030,364.18	2,055,171.74	2,081,119.36	2,108,287.49
8.94%	1,917,998.72	1,939,314.15	1,961,550.42	1,984,768.50	2,009,034.89
9.20%	1,838,215.89	1,857,465.50	1,877,516.83	1,898,421.04	1,920,233.72
9.46%	1,763,942.46	1,781,368.73	1,799,495.63	1,818,366.28	1,838,027.40
9.66%	1,710,283.97	1,726,452.65	1,743,254.52	1,760,727.53	1,778,912.71
9.95%	1,636,175.57	1,650,689.29	1,665,750.49	1,681,390.75	1,697,644.11
10.25%	1,567,352.54	1,580,414.11	1,593,950.89	1,607,989.31	1,622,557.78

Growth rate for Perpetuity

Source: Compiled by author

		Growth rate for Perpetuity												
	EV		1.70%		1.85%	2.00%	2.00%			2.30%				
	8.23%	\$	132.04	\$	133.79	\$	135.62	\$	137.55	\$	139.56			
	8.45%	\$	126.80	\$	128.39	\$	130.05	\$	131.79	\$	133.62			
	8.68%	\$	121.90	\$	123.35	\$	124.86	\$	126.44	\$	128.10			
	8.94%	\$	116.50	\$	117.80	\$	119.15	\$	120.57	\$	122.05			
WACC	9.20%	\$	111.63	\$	112.81	\$	114.03	\$	115.30	\$	116.63			
	9.46%	\$	107.11	\$	108.17	\$	109.27	\$	110.42	\$	111.62			
	9.66%	\$	103.84	\$	104.82	\$	105.85	\$	106.91	\$	108.02			
	9.95%	\$	99.32	\$	100.20	\$	101.12	\$	102.08	\$	103.07			
	10.25%	\$	95.13	\$	95.92	\$	96.75	\$	97.60	\$	98.49			

13.9.2. Growth Case

FCF Type 1

			Grow	th rate for Perpe	etuity	
	EV	1.70%	1.85%	2.00%	2.15%	2.30%
	8.23%	3,587,381.11	3,646,350.89	3,708,161.03	3,773,021.82	3,841,164.81
	8.45%	3,446,606.80	3,500,655.00	3,557,215.85	3,616,468.72	3,678,610.49
	8.68%	3,315,184.74	3,364,836.50	3,416,718.82	3,470,985.47	3,527,804.68
	8.94%	3,170,254.66	3,215,279.43	3,262,249.27	3,311,293.01	3,362,551.10
WACC	9.20%	3,039,789.41	3,080,847.09	3,123,614.78	3,168,201.57	3,214,726.05
	9.46%	2,918,338.73	2,955,871.76	2,994,913.80	3,035,557.72	3,077,904.19
	9.66%	2,830,600.64	2,865,688.16	2,902,149.77	2,940,067.82	2,979,531.33
	9.95%	2,709,429.35	2,741,278.18	2,774,328.41	2,808,649.30	2,844,315.57
	10.25%	2,596,905.26	2,625,890.37	2,655,930.04	2,687,082.89	2,719,411.98

Source: Compiled by author

Growth rate for Perpetuity Ρ 1.70% 1.85% 2.00% 2.15% 2.30% 8.23% \$ 233.72 218.25 \$ 221.84 \$ 225.61 \$ 229.56 \$ 8.45% 209.67 \$ 212.96 \$ 216.41 \$ 220.02 \$ 223.81 \$ 8.68% \$ 201.66 \$ 204.68 \$ 207.85 \$ 211.15 \$ 214.62 8.94% \$ 192.82 \$ 195.57 \$ 198.43 \$ 201.42 \$ 204.55 WACC 187.38 \$ 9.20% \$ 184.87 \$ 189.98 \$ 192.70 \$ 195.54 9.46% \$ 177.47 \$ 179.76 \$ 182.14 \$ 184.61 \$ 187.20 9.66% \$ 172.12 \$ 176.48 \$ 178.79 \$ 181.20 174.26 \$ 9.95% 172.96 \$ 164.74 \$ 166.68 \$ 168.69 \$ 170.78 \$ 10.25% \$ 157.88 \$ 159.64 \$ 161.48 \$ 163.37 \$ 165.35

FCF Type 2

Growth rate for Perpetuity

WACC

EV	1.70%	1.85%	2.00%	2.15%	2.30%
8.23% 3	3,071,235.39	3,124,258.74	3,179,836.04	3,238,156.35	3,299,427.89
8.45% 2	2,945,870.02	2,994,468.08	3,045,325.41	3,098,603.30	3,154,478.78
8.68% 2	2,828,900.43	2,873,545.37	2,920,195.95	2,968,990.43	3,020,080.07
8.94% 2	2,699,990.83	2,740,475.37	2,782,708.84	2,826,807.07	2,872,896.36
9.20% 2	2,584,028.45	2,620,945.94	2,659,400.99	2,699,491.71	2,741,324.73
9.46% 2	2,476,154.67	2,509,902.91	2,545,008.01	2,581,553.46	2,619,629.76
9.66% 2	2,398,274.38	2,429,823.72	2,462,608.59	2,496,703.03	2,532,187.10
9.95% 2	2,290,791.70	2,319,428.94	2,349,146.43	2,380,006.45	2,412,076.18
10.25% 2	2,191,063.52	2,217,125.80	2,244,136.31	2,272,147.75	2,301,216.82

Source: Compiled by author

		Growth rate for Perpetuity									
	Р		1.70%		1.85%		2.00%		2.15%		2.30%
	8.23%	\$	186.79	\$	190.02	\$	193.41	\$	196.96	\$	200.70
	8.45%	\$	179.15	\$	182.11	\$	185.21	\$	188.46	\$	191.86
	8.68%	\$	172.02	\$	174.74	\$	177.58	\$	180.56	\$	183.67
	8.94%	\$	164.16	\$	166.63	\$	169.20	\$	171.89	\$	174.70
WACC	9.20%	\$	157.09	\$	159.34	\$	161.69	\$	164.13	\$	166.68
	9.46%	\$	150.52	\$	152.58	\$	154.71	\$	156.94	\$	159.26
	9.66%	\$	145.77	\$	147.69	\$	149.69	\$	151.77	\$	153.93
	9.95%	\$	139.22	\$	140.97	\$	142.78	\$	144.66	\$	146.61
	10.25%	\$	133.14	\$	134.73	\$	136.38	\$	138.08	\$	139.86

Economic Value Added

WACC

EV	1.70%	1.85%	2.00%	2.15%	2.30%
8.23%	3,031,177.03	3,076,148.51	3,123,286.11	3,172,750.18	3,224,717.33
8.45%	2,900,378.63	2,941,255.39	2,984,032.47	3,028,845.53	3,075,843.47
8.68%	2,778,481.97	2,815,721.33	2,854,633.64	2,895,334.22	2,937,949.24
8.94%	2,644,315.44	2,677,750.13	2,712,629.19	2,749,048.30	2,787,111.75
9.20%	2,523,793.03	2,553,987.33	2,585,439.18	2,618,228.83	2,652,443.46
9.46%	2,411,833.89	2,439,168.17	2,467,601.42	2,497,201.29	2,528,041.06
9.66%	2,331,105.39	2,356,467.04	2,382,821.89	2,410,229.48	2,438,754.14
9.95%	2,219,842.40	2,242,608.14	2,266,232.65	2,290,765.43	2,316,259.90
10.25%	2,116,775.20	2,137,263.14	2,158,496.49	2,180,516.69	2,203,368.30

Growth rate for Perpetuity

Source: Compiled by author

		Growth rate for Perpetuity									
	EV		1.70%		1.85%		2.00%		2.15%		2.30%
	8.23%	\$	184.35	\$	187.09	\$	189.96	\$	192.98	\$	196.14
	8.45%	\$	176.38	\$	178.87	\$	181.47	\$	184.21	\$	187.07
	8.68%	\$	168.95	\$	171.22	\$	173.59	\$	176.07	\$	178.67
	8.94%	\$	160.77	\$	162.81	\$	164.93	\$	167.15	\$	169.47
С	9.20%	\$	153.42	\$	155.26	\$	157.18	\$	159.18	\$	161.26
	9.46%	\$	146.60	\$	148.26	\$	150.00	\$	151.80	\$	153.68
	9.66%	\$	141.68	\$	143.22	\$	144.83	\$	146.50	\$	148.24
	9.95%	\$	134.90	\$	136.28	\$	137.72	\$	139.22	\$	140.77
	10.25%	\$	128.61	\$	129.86	\$	131.16	\$	132.50	\$	133.89

WAC

13.9.3. Combined Valuation

Probabilistic Valuation

		Growth rate for Perpetuity									
	EV	1.70%	1.85%	2.00%	2.15%	2.30%					
	8.23%	\$2,951,120.45	\$2,997,820.82	\$3,046,770.58	\$3,098,136.26	\$3,152,101.23					
WACC	8.45%	\$2,832,421.47	\$2,875,123.47	\$2,919,810.64	\$2,966,624.69	\$3,015,721.19					
	8.68%	\$2,721,656.16	\$2,760,792.44	\$2,801,686.87	\$2,844,460.67	\$2,889,246.44					
	8.94%	\$2,599,564.63	\$2,634,955.13	\$2,671,874.49	\$2,710,423.99	\$2,750,714.01					
	9.20%	\$2,489,715.96	\$2,521,901.30	\$2,555,427.11	\$2,590,378.94	\$2,626,849.72					
	9.46%	\$2,387,510.80	\$2,416,854.04	\$2,447,377.02	\$2,479,152.36	\$2,512,258.73					
	9.66%	\$2,313,710.69	\$2,341,085.46	\$2,369,532.28	\$2,399,115.39	\$2,429,904.26					
	9.95%	\$2,211,840.29	\$2,236,613.03	\$2,262,320.23	\$2,289,015.79	\$2,316,757.81					
	10.25%	\$2,117,297.92	\$2,139,775.05	\$2,163,069.96	\$2,187,228.12	\$2,212,298.41					

Source: Compiled by author

		Growth rate for Perpetuity										
	Р		1.70%		1.85%		2.00%		2.15%		2.30%	
	8.23%	\$	179.47	\$	182.31	\$	185.30	\$	188.43	\$	191.72	
	8.45%	\$	172.23	\$	174.84	\$	177.56	\$	180.41	\$	183.41	
	8.68%	\$	165.48	\$	167.87	\$	170.36	\$	172.97	\$	175.70	
	8.94%	\$	158.04	\$	160.20	\$	162.45	\$	164.80	\$	167.25	
WACC	9.20%	\$	151.34	\$	153.31	\$	155.35	\$	157.48	\$	159.70	
	9.46%	\$	145.12	\$	146.90	\$	148.76	\$	150.70	\$	152.72	
	9.66%	\$	140.62	\$	142.29	\$	144.02	\$	145.82	\$	147.70	
	9.95%	\$	134.41	\$	135.92	\$	137.48	\$	139.11	\$	140.80	
	10.25%	\$	128.65	\$	130.02	\$	131.44	\$	132.91	\$	134.44	