

Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Economic Theories



Master's Thesis

Approaches to common stock valuation

Mgr. Vladyslav Desiatnichenko

© 2021 CZU Prague

CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

DIPLOMA THESIS ASSIGNMENT

Vladyslav Desiatnichenko

Economics and Management

Economics and Management

Thesis title

Valuation of a chosen firm

Objectives of thesis

Practical application of the selected stock valuation methods (PE ratio, DDM) to estimate the value of the selected company's stocks, comparison of differences in the results of the models used.

Methodology

Literary research will be processed by the method of comparison and compilation of knowledge from literature and other cited sources. Emphasis will be placed on comparing the views of several authors on the issue of selecting an appropriate stock valuation model. The practical part of the thesis first introduces the analyzed joint stock company, where the available corporate documents and other sources will briefly summarize the history of the company, an overview of its activities and financial results of business. The stock analysis will focus at first on the comparative price of the stock on the stock exchange where the company is traded. Then the input parameters of the used valuation models will be estimated, then the intrinsic value of the company's share will be estimated using two selected valuation models (PE ratio, DDM – Dividend discount model) presented in the theoretical part. The estimated intrinsic value of the share will be compared with the average price of the company's shares on the stock exchange. In addition, selected approaches to stock valuation will be compared and conclusions about the results of their application will be drawn with the help of synthesis.

The proposed extent of the thesis

60-80

Keywords

stock, stock valuation, fundamental analysis, stock value, share, stock price, valuation models

Recommended information sources

- DAMODARAN, A. The Dark Side of Valuation: Firms with no Earnings, no History and no Comparables: Can Amazon.com be valued? 2000. URL:
<http://people.stern.nyu.edu/adamodar/pdfiles/papers/HighGrow.pdf>
- GOTTWALD, R. The Use of Indicators in Modified Historical Model to Estimate the Intrinsic Value of a Stock. *Journal of Competitiveness*, 2012, 4(2), pp. 97-110. doi: 10.7441/joc.2012.02.07
- GOTTWALD, R. The Use of the P/E Ratio to Stock Valuation. *GRANT Journal*. Hradec Králové: Magnanimitas Assn., 2012, 31, pp. 21-24. ISSN 1805-0638. URL:
<https://www.grantjournal.com/issue/0102/PDF/0102gottwald.pdf>
- IMAM, Sh., BARKER, R., CLUBB, C. The Use of Valuation Models by UK Investment Analysts. *European Accounting Review*. Taylor & Francis Online, 2008, 17(3), pp. 503-535.
doi:10.1080/09638180802016650
- SANTY MAYDA, B., FENNY, S., RYANI, Y. The Strategy of Investment Decision Making Based on Fundamental Analysis. *International Journal of Scientific and Research Publications*. IJSR, 2018, 8(12), pp. 401-409. doi: 10.29322/IJSRP.8.12.2018.p8454
- VISHWANATH, G., THOMAS, R., DIAS, Sh. Comparative Performance Analysis Of P/E And Peg Ratio In Selected Stocks. *IOSR Journal of Economics and Finance*. IOSR, 2018, 9(3), pp. 78-88. doi: 10.9790/5933-0903037888
-

Expected date of thesis defence

2021/22 WS – FEM

The Diploma Thesis Supervisor

Ing. Pavel Srbek, Ph.D.

Supervising department

Department of Economic Theories

Electronic approval: 11. 12. 2020

doc. PhDr. Ing. Lucie Severová, Ph.D.

Head of department

Electronic approval: 22. 1. 2021

Ing. Martin Pelikán, Ph.D.

Dean

Prague on 27. 11. 2021

Declaration

I declare that I have worked on my master's thesis titled "Approaches to common stock valuation" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the master's thesis, I declare that the thesis does not break any copyrights.

In Prague on date of submission _____

Acknowledgement

I would like to thank Ing. Pavel Srbek, Ph.D, the supervisor of my diploma thesis, for his advices and support during my work on this thesis.

Approaches to common stock valuation

Abstract

Main aim of the diploma thesis is: practical application of the selected stock valuation methods (PE ratio, DDM) to estimate the value of the selected company's stocks, comparison of differences in the results of the models used. Stocks of the major global company Apple Inc. (AAPL) are selected as a subject of the analysis in this thesis. In conditions of self-isolation due coronavirus infection, the population has noticeably increased the demand for Apple products – Macs and iPads. At the same time, smartphones and wearable devices (headphones, smartwatches) did not sell as well in that time. The question is how recent changes have affected the value of the company's shares. A fundamental analysis of the company is made and selected models of stock valuation are applied. Conclusions are made that are important for investors' decisions. The DDM model showed that Apple shares were overvalued, while the PE ratio and the modified PE ratio showed that the shares were undervalued. Due to the greater complexity of obtaining input data for the DDM calculation, a greater risk of skewing the results, caused by the selected period or mathematical method of calculation, is allowed. The PE ratio results are more reliable and, in addition, are in line with analyst estimates.

Keywords: Apple, DDM, investing, models of stock valuation, PE ratio, stock, stock valuation, value of the stocks.

Přístupy k běžnému ocenění akcií

Abstrakt

Hlavním cílem diplomové práce je praktická aplikace vybraných metod oceňování akcií (PE ratio, DDM) k odhadu hodnoty akcií vybrané společnosti, porovnání rozdílů ve výsledcích použitých modelů. V této práci jsou jako předmět analýzy vybrány akcie významné globální společnosti Apple Inc. (AAPL). V podmínkách izolace způsobené koronavirovou infekcí populace ztlačila poptávku po produktech Apple – počítačích Mac a iPad. Současně se smartphony a nositelná zařízení (sluchátka, chytré hodinky) v té době příliš neprodávaly. Otázkou je, jak nedávné změny ovlivnily hodnotu akcií společnosti. V práci je provedena fundamentální analýza společnosti a jsou aplikovány vybrané modely oceňování její akcií. Jsou udělány závěry, důležité pro rozhodnutí investor. DDM model ukázal, že akcie Apple jsou nadhodnoceny, zatímco PE ratio a modifikované PE ratio ukázalo, že akcie jsou podhodnoceny. Vzhledem k větší náročnosti získání vstupních dat pro výpočet DDM je připouštěno větší riziko zkreslení výsledků, vyvolaných zvoleným obdobím nebo matematickou metodou výpočtu. Výsledky PE ratio jsou spolehlivější a navíc jsou v souladu s odhady analytiků.

Klíčová slova: Apple, DDM, investování, modely oceňování akcií, PE ratio, akcie, oceňování akcií, hodnota akcií.

Table of content

1 Introduction	11
2 Objectives and Methodology	13
2.1 Objectives.....	13
2.2 Methodology	14
3 Literature Review.....	21
3.1.1 Capital markets	21
3.1.2 Investments and investment instruments	23
3.1.3 „Magic“ triangle of investing.....	24
3.2 Types of the company’s stocks	25
3.3 Approaches to the stock valuation.....	26
3.3.1 Technical analysis	26
3.3.2 Psychological analysis	27
3.3.3 Fundamental analysis.....	28
3.3.4 Dividend discount models.....	34
3.3.5 Approaches based on the PE ratio.....	38
3.4 Comparison of common stock valuation methods.....	40
4 Practical Part.....	45
4.1 Characteristic of the Apple Inc.....	45
4.1.1 A brief history of the company	46
4.1.2 Products sold by the company	47
4.2 Financial analysis of the company	51
4.2.1 Balance sheet analysis.....	51
4.2.2 Income statement analysis	59
4.2.3 Analysis of ratios	64
4.3 Practical application of the selected stock valuation methods	67
4.3.1 Construction of the Dividend discount model (DDM)	67
4.3.2 Construction of the PE ratio model.....	71
5 Results and Recommendation	73
6 Conclusion.....	77
7 References	79
8 Appendix	90

List of pictures

Figure 1	„Magic“ triangle of investing	24
Figure 2	Main steps of the fundamental analysis („top-down“ approach)	29
Figure 3	The structure of net sales (by the product category), Apple Inc., 2020.....	50
Figure 4	The structure of net sales (by the geographical segment), Apple Inc., 2020.....	51
Figure 5	Total assets of the Apple Inc., 2016-2020 (mln. USD).....	52
Figure 6	The assets of the Apple Inc. in 2020 (share on the total assets, %)	53
Figure 7	Current and non-current assets of the Apple Inc., 2015-2020 (mln. USD).....	54
Figure 8	Shareholders' equity, current and non-current liabilities of the Apple Inc., 2015-2020 (mln. USD)	56
Figure 9	The shareholders' equity and liabilities of the Apple Inc. in 2020 (share on the total, %).....	57
Figure 10	Net income of the Apple Inc. (mln. USD), 2016-2020	60
Figure 11	Revenues of the Apple Inc. (mln. USD), 2016-2020	61
Figure 12	Revenues of the Apple Inc. (share of the total revenues, %), 2016-2020	62
Figure 13	Costs of the Apple Inc. (mln. USD), 2016-2020.....	63
Figure 14	Structure of costs of the Apple Inc. (share of total revenues, %), 2016-2020 ..	63
Figure 15	Liquidity ratios of the Apple Inc., 2016-2020.....	66

List of tables

Table 1	Basic characteristic of the company (Apple Inc.) and the stock (AAPL).....	45
Table 2	Net sales of the main product categories, Apple Inc., 2018-2020	49
Table 3	Net sales by reportable segment, Apple Inc., 2018-2020	50
Table 4	Assets of the Apple Inc., 2016-2020 (mln. USD).....	52
Table 5	Vertical analysis of the assets of the Apple Inc., 2016-2020.....	53
Table 6	Horizontal analysis of the assets of the Apple Inc. (changes in %), 2016-2020...55	
Table 7	Shareholders' ekvity and liabilities of the Apple Inc., 2016-2020 (mln. USD) ...55	
Table 8	Vertical analysis of the shareholders' equity and liabilities of the Apple Inc., 2016-2020.....	57
Table 9	Horizontal analysis of the shareholders' equity and liabilities of the Apple Inc. (changes in %), 2016-2020	58
Table 10	Income statement of the Apple Inc. (mln. USD), 2016-2020	59
Table 11	Revenues of the Apple Inc. (year-on-year changes, %), 2016-2020	62
Table 12	Costs of the Apple Inc. (year-on-year changes, %), 2016-2020	64
Table 13	Profitability ratios of the Apple Inc., 2016-2020	64
Table 14	Debt ratio and debt to equity ratio of the Apple Inc., 2016-2020	65
Table 15	Liquidity ratios of the Apple Inc., 2016-2020	65
Table 16	Activity ratios of the Apple Inc., 2016-2020	67
Table 17	Development of Apple dividend payments, 2015-2020	69
Table 18	Index S&P 500 (2015-2020).....	70
Table 19	Results of the stock evaluation (Apple Inc.).....	74

1 Introduction

The concept of company management, focused on increasing the value of the business and, accordingly, on increasing the well-being of the company's owners, is now universally recognized. One of the key issues in the concept of value management is the problem of measuring value and, accordingly, choosing an adequate valuation model by the company.

There are different approaches for the valuation of shares, for example dividend discount models (DDMs), profit models, free cash flow models in their various versions and modifications. According to Imam, Barker & Clubb (2008), discounted cash flow (DCF) models and P/E ratios are perceived by the analysts as important methods in this area. Ivanovski, Narasanov & Ivanovska (2018) stated, that DDM generally misprices stocks, while DCF model provides values close to average market prices. In contrast, Stow, McLeavey and Pinto (2007) reject the DDM critics and say it is still suitable for stock valuations. The results of the paper (Cahrumathi & Sudhakar, 2014) show, that P/E model and P/B model are more informative with high predictive power providing better and more accurate estimations of equity market values for stocks, while CAPM model and DDM are not reliable for the valuation. All of these and other studies test models in different conditions – at different times and in different markets. It is therefore relevant to test different models on the example of the shares of a global company that is traded on the US market. In particular, conflicting views are evident in the assessment of the suitability of the DDM model (Ivanovski, Narasanov & Ivanovska, 2018; Stow, McLeavey and Pinto, 2007), while the P/E model is generally perceived as too primitive and simple, but its growing popularity among analysts is still observed (Imam, Barker & Clubb, 2008).

The model that a company chooses as a financial management tool within the value management concept must meet a number of criteria. Moreover, the model that best meets the criteria can be recognized as an adequate financial management tool.

There are many modern methods, used to evaluate the stock. Dividend Discount Model (DDM) is the most basic model. Another method – Discounted Cash Flow Model (DCF) does not look at dividends as DDM, but uses discounted future cash flows to value the business. Another popular method – P/E ratio focuses on the earnings, which is one of

the key factors of an investment's value. Understanding methods of the stocks' valuation, its advantages and disadvantages, is important for investors, management, entrepreneurs.

In modern times, stock trading is becoming available to everyone. Investing is no longer a matter for large corporations or “millionaires“. All you need is less capital, internet access, analytical skills and an appetite for risk. Novice investors on the stock exchanges are often attracted by well-known stocks – they lazily expect market leaders to bring them the biggest profits. They often spend unnecessarily on the purchase of shares of giants such as Microsoft, Apple, Google, etc. Due to psychological factors, the shares of well-known large companies are often incorrectly valued. The important ability for the investor is therefore an ability to professionally assess the market and the value of the stock.

2 Objectives and Methodology

A stock of a well-known company will be selected for this thesis and selected models of stocks valuation will be applied. The reason for choosing a large company is the availability of financial information, analysts' estimates, with which one can compare one's own conclusions. Last but not least, the choice was influenced by the presumption that the shares of well-known companies are poorly valued due to the specific perception of its position, but bad market decisions threaten investors and companies.

2.1 Objectives

Main aims of the diploma thesis are:

- practical application of the selected stock valuation methods (PE ratio, DDM) to estimate the value of the selected company's stocks,
- comparison of differences in the results of the models used.

The amount of appreciation, or even impairment, of invested funds can vary diametrically depending on the chosen company, the time period of the investment, the development of the economic cycle, the political situation and other influencing factors. It is therefore a rational approach to take certain steps before each investment to minimize possible downside risks and to maximize the chances of making a profit. This step can be an analysis that will provide the potential investor with the information to make a perhaps more beneficial decision. One of such analyzes, covering from the global context, the specifics of the relevant industry and the selected company, is the stock fundamental analysis.

Stocks of the major global company Apple Inc. (AAPL), which produces and sells electronics, personal and tablet computers, phones, software and online services, are selected as a subject of the analysis in this thesis. In conditions of self-isolation due coronavirus infection, the population has noticeably increased the demand for Apple products – Macs and iPads. At the same time, smartphones and wearable devices (headphones, smartwatches) did not sell as well in that time. The question is how recent changes have affected the value of the company's shares.

In order to achieve the selected aim of the thesis is obligatory to answer the following research questions:

- What trends affect the market in which the selected company operates?
- What are the input values for estimating the intrinsic value of a company's stock using two selected valuation models?
- Does the calculated intrinsic value of the stock differ from the average stock price of the company on the stock exchange?
- What recommendations should be suggested for investors?

The hypothesis of the thesis is set out as follows: the evaluation of shares of large well-known companies (such as Apple Inc.) requires a comprehensive analysis and consideration of many different factors that may affect the value of the stock.

2.2 Methodology

The first part of the thesis deals with the literary research processed by the method of comparison and compilation of knowledge from literature and other cited sources. Emphasis is placed on comparing the views of several authors on the issue of selecting an appropriate stock valuation model.

The practical part contains the application and comparison of the selected methods of the valuation methods (DDM model and P/E ratios), that allow to evaluate selected stock – AAPL of the Apple Inc. The main sources for the practical part processing are available corporate documents and financial statements of the Apple Inc., then analytical online sources such as Macrotrends.net and Yahoo.finance.com.

The practical part of the thesis begins with the description and analysis of the Apple company, based on the briefly summarization the history of the company an overview of its products and financial results of business.

The analysis of the product portfolio includes analysis of net sales of the main product categories in 2018-2020 and geographical structure of net sales (by regions). The percentual share of the selected segments in total net sales is calculated. This analysis makes it possible to find out which products and markets contribute the most to the company's revenue generation. The growth of key segments and markets points to the positive dynamics

of sales, which can be positively evaluated from the point of view of investors, because it can affect the growth of the company's shares.

Methods of the financial analysis

Then the financial analysis of the Apple Inc. is conducted. The analysis of balance sheets and income statements of the company in 2016-2020 is made, used the methods of the horizontal and vertical financial analysis.

Horizontal analysis (or trend analysis) means the comparison of the information from the financial statements over some certain time periods. Selected items of the financial statements can be compared as average values or percentage values (Sakevych & Kobyletskii, 2015).

Absolute changes of the items are calculated as follows (Chibili, 2019):

$$\text{Absolute changes (mil. USD)} = \text{Item}_t - \text{Item}_{t-1} \quad (1)$$

Where Item_t is a value of the selected item of the financial statement in a given year (in mil. USD), item_{t-1} – is a value of the same item (in mil. USD) but in the previous year.

Percentage changes of the items are calculated as follows (Chibili, 2019):

$$\text{Percentage changes (\%)} = \frac{\text{Item}_t - \text{Item}_{t-1}}{\text{Item}_{t-1}} \times 100 \% \quad (2)$$

The result expresses the year-on-year change in the item as a percentage.

Vertical analysis allows to compare the selected item to the base item. Commonly, the vertical analysis is used to analyse the financial statement of a single period (unlike the horizontal analysis, which is reviewing information over different periods of time (Sakevych & Kobyletskii, 2015). The total assets are usually set as the base item in the balance sheet analysis and the total revenues are set as the base in the income statement analysis (Chibili, 2019). The calculation can be expressed using formulas (3) and (4):

$$\text{Share on the total assets (\%)} = \frac{\text{Item of the balance sheet}_t}{\text{Total assets}_t} \times 100 \% \quad (3)$$

$$\text{Share on the total revenues (\%)} = \frac{\text{Item of the income statement}_t}{\text{Total revenues}_t} \times 100 \% \quad (4)$$

Methods of the ratio analysis

Analysis of ratios in the next common step in the company's financial analysis. These ratios are calculated:

- profitability ratios (ROA, ROE, ROS),
- debt ratio and debt to equity ratio,
- liquidity ratios (cash ratio, quick ratio, current ratio),
- activity ratios (turnover periods, turnover ratio, cash conversion cycle).

Profitability ratios have a significant influence on stock price (Manoppo, 2015) and they also enter stock evaluation models. The formulas for the calculation are as follows (Černohorský & Teplý, 2011):

$$ROA = \frac{EBIT}{\text{Total assets}} \quad (5)$$

$$ROE = \frac{EAT}{\text{Total equity}} \quad (6)$$

$$ROS = \frac{EBIT}{\text{Total sales}} \quad (7)$$

ROA is used to measure the amount earned on each dollar of assets invested. ROE expresses how much net profit per dollar fall on invested capital. Value of ROE gives a picture of whether the invested capital is used with sufficient intensity. In order for the company to be attractive to investors (ie suitable for the allocation of other resources), the amount of this indicator should exceed the interest rate on government securities in the long run. ROS shows the percentage margin on sales (Shim, 2013).

Different “types” of profit are used in the formulas: EBIT (earning before interest and taxes) and EAT (earning after taxes). The use of EAT (net income) in the formula to calculate ROE is appropriate, because it actually expresses the rate of profit that remain in the company as a source of financing (Černohorský, Teplý, 2011). EBIT is used in formulas for ROA and ROS, as the indicator, that measures the gross productive strength of the

company's assets before deducting taxes and interest expenses (Sedláček, 2011). Similarly (Wagner, 2009) recommends using EBIT indicators that are not affected by the funding structure because ROA is a measure of the overall effectiveness of the activity.

Debt ratio measures the amount of debt as a proportion of total assets, debt to equity ratio shows how much debt a company has compared to the shareholders' capital (Dili, 2017):

$$\text{Debt ratio} = \frac{\text{Total liabilities}}{\text{Total assets}} \quad (8)$$

$$\text{Debt to equity ratio} = \frac{\text{Total liabilities}}{\text{Shareholder's equity}} \quad (9)$$

Liquidity is an economic term used in several senses, however, in general it can be said as an indicator of how quickly an investment can be turned into cash. The higher the liquidity, the faster the investment can be monetized (Rezková, 2011). Liquidity ratios are three types: cash ratio, quick ratio and current ratio (Sakevych & Kobyletskii, 2015):

$$\text{Cash ratio} = \frac{\text{short term financial assets}}{\text{short term liabilities} + \text{short term loans}} \quad (10)$$

$$\text{Quick ratio} = \frac{\text{financial assets} + \text{short term receivables}}{\text{short term liabilities} + \text{short term loans}} \quad (11)$$

$$\text{Current ratio} = \frac{\text{current assets}}{\text{short term liabilities} + \text{short term loans}} \quad (12)$$

A good current ratio is between 1,2 to 2. If a company's quick and cash ratio is more than 1, the company is able to cover all short-term debt and still have some cash remaining. Too high values of liquidity can also indicate, that the company is not enough effectively and doesn't use profitable investment tools (FreshBooks, 2021). The comparison with similar companies or the corresponding market is also good to indicate recommended values of these ratios (Sakevych & Kobyletskii, 2015).

Activity ratios express how active the company is in using assets or resources to cover these assets. Two basic calculations are used: turnover ratio (number of turnovers; how many times the asset is renewed during the observed period) and turnover period (how many days does the renewal of the assets take) (Voborová, 2013). The calculation of ratios is based on achieved sales and selected item of the balance sheet:

$$\text{Turnover period} = \frac{\text{Selected item of the balance sheet}}{\text{annual sales}/360} \quad (13)$$

$$\text{Turnover ratio} = \frac{\text{Annual sales}}{\text{selected item of the balance sheet}} \quad (14)$$

Using the indicators of the turnover period, the cash conversion cycle (or net operating cycle) can be calculated. Cash conversion cycle expresses the time between the payment of the purchased material and the receipt of the collection from the sale of products. It consists of the following items: inventory turnover period (the time from the purchase of material to the sale of products), receivables turnover period (the time from product invoicing to the date of collection), liabilities turnover period (the time between the purchase of materials and labor and payment for them). The formula is (Ranganatham, 2006):

$$\text{Cash conversion cycle} = \text{Inventories turnover period} + \text{Receivables turnover period} - \text{Liabilities turnover period} \quad (15)$$

The lower cash conversion cycle shows the less money (working capital) the company needs.

Ratio analysis, vertical and horizontal analysis, as the part of fundamental analysis, give a relative measure of the operating performance and financial condition of the company, and summarize various factors that will go into the investment decision-making process (Shim, 2013).

The analysis of the external environment is also a part of the fundamental analysis (Shim, 2013). It can provide information of the external factors, that can affect the financial condition of the company, the value of its stocks and, as a result, investment decisions. Due to the topic of work, more attention is paid to the application of stock valuation methods, while marginal attention is paid to the external environment. The smaller significance of the external analysis in the context of the work can also be explained by the fact that the chosen company – Apple Inc. is a global company, that is the undisputed leader in a competitive market and is so powerful, that it can affect the external environment on its own. However, some elements of the analysis of the external environment are applied in the work. When performing the analysis of the company, secondary sources are used, which partly outline

the trends in the external environment – within the technological environment, the behavior of competitors and consumers.

Stock analysis focused at first on the comparative price of the stock on the stock exchange where the company is traded. Then the input parameters of the used valuation models are estimated, then the intrinsic value of the company's share is estimated using two selected valuation models (PE ratio, DDM – Dividend discount model). The estimated intrinsic value of the share is compared with the average price of the company's shares on the stock exchange.

Evaluation models work with specific inputs that the analyst must estimate or determine from the available information about the company, or take them from other analysts and researchers. It is advisable to pay maximum attention to the determination of these specific inputs when carrying out the analysis. The subjective aspect, which may be a legitimate part of determining individual inputs, may cause variations in values that will ultimately result in diametrically different estimates of the intrinsic values of shares.

Inputs of the models especially include:

Required rate of return (K_e) according to the CAPM model:

$$K_e = R_f + \beta(R_m - R_f) \quad (16)$$

R_f – risk-free rate of return on government treasury bills,
 R_m – expected yield rate from the market stock portfolio,
 β – beta coefficient, which determines the systematic risk.

Historical rate of dividend growth (g):

$$g = \sqrt[t]{\frac{D_M}{D_S}} - 1 \quad (17)$$

D_M is the younger dividend,

D_S is the oldest dividend,

t is the time difference between the younger and the older dividend.

After finding all the necessary input values, the intrinsic value of the company's shares will be estimated using the dividend discount model, specifically the Gordon model according to the formula:

$$V_0 = \frac{D_M(1+g)}{K_E-g} \quad (18)$$

The second of the models used is the profit model, specifically the model based on PE ratio:

$$PE \text{ ratio} = \frac{P_0}{E_1} = \frac{\frac{E_1 \times p}{K_E-g}}{E_1} = \frac{p}{K_E-g} \quad (19)$$

P_0 - current market price per share,

E_1 – expected earning per share.

Another type of PE ratio is Sharpe PE ratio:

$$\frac{V_0}{E_0} = \frac{p \times (1+g)}{K_E-g} \quad (20)$$

The comparison of the Sharpe PE ratio with the current PE ratio shows, if the share is overvalued (Sharpe PE < Current PE) or undervalued (Sharpe PE > Current PE).

P/BV ratio is calculated as rate of the current market price to the current book value of equity per share. Sharpe P/BV ratio is:

$$P_0/BV_0 = \frac{ROE \times p \times (1+g)}{K_e-g} \quad (21)$$

If the value of the Sharpe P/BV ratio is greater than current P/BV ratio, the share is undervalued. If the Sharpe P/BV ratio is less than current P/BV ratio, the share is overvalued.

The synthesis of the results of the analyses makes it possible to draw a conclusion about the value of the shares of Apple Inc. and make recommendations to other analysts and investors. There is also a comparison of the selected approaches to stock valuation and the conclusions about the results of stock valuation methods application.

3 Literature Review

The explanation of capital, stock exchanges and markets is very important for understanding the mechanism of operation of the whole system. Without understanding, it will be very difficult to achieve success in the markets. It is important to understand the concept of the capital market, the concept of investment and investment instruments. It is also appropriate to focus on stocks – as one of the basic investment tools. It is necessary to describe types of stocks and then move on to the key topic – stock valuation methods. Attention in this work is devoted to fundamental analysis and selected methods of stock valuation – PE ratio and dividend discount models.

The financial system, its development and efficiency support investments and growth. Authors have different views on the link between growth of financial sector and economic sector. For example, Schumpeter claims, that the services of financial intermediaries are the key drivers for innovation and growth. On the other side Robinson says, that financial development is a result of the economic growth, caused by a higher demand for financial services. (Draženović & Kusanović, 2016).

The capital market is the basis of any advanced market economy. It is possible to talk about the capital market for a long time, because there are a lot of books written about it.

3.1.1 Capital markets

The development of capital markets began deep in the Middle Ages, when stock exchanges began to emerge from pre-existing markets on which many different types of goods were traded. Later, securities trading was profiled separately. Over time, the capital market has become an area of human activity that greatly affects the lives of all people in the world.

The capital markets of individual states are interconnected. They are used in the modern world to distribute man trillions of dollars. There are 15 thousands companies in the European Union and in the U.S., that have access to capital markets by issuing shares or bonds. There are also many other companies (25 million companies in the EU, 5,7 million in the U.S.), that finance their activities by other means (Boldeanu & Tache, 2016).

Capital market can be described as a system of economic relations and institutions mediating the concentration, allocation and reallocation of free funds through securities or investment tools, that are derived from various types of financial and non-financial assets (Musílek, 2011).

The absence of capital markets or their malfunction causes a number of negative effects on the economy as a whole. This was proved in particular by the study of transformation processes, where capital markets were just beginning to be created. In addition, for example, a research by Kogut & Spicer (2002), made on the example of Russian and Czech transformation, shows that the absence of financial markets has created illegal or non-transparent shift of assets to selected users. This means that the absence of capital markets causes a number of other undesirable phenomena in the economy and society.

The research by Abina & Lemea (2019), which examines capital market and performance of Nigeria, shows, that capital market is a strong driver of economic growth for both public and private entities. A sound institutional framework for the regulation of the actors and also the confidence of investors are important factors of the capital market development (Adedigba Praise, 2019).

Capital market is composed of primary and secondary markets. The primary market is about the first offering of shares from issuer to investor. The secondary market allows to buy and sell securities at any time. (Fabiola, Ponno & Nusantara, 2020). Both markets are important. King (2018) claims, that the role of secondary market is important, because it encourages investments into primary markets.

The most important segments of the capital market are organized stock exchange markets. At the stock exchange, sellers and buyers meet. Each stock exchange specializes in some asset, which is given to history. The first stock exchanges were established in the 16th century and the same principles exist for them to this day. There are many types of stock exchanges, there are mainly distinguished money (stock), commodity and currency exchanges (Štýbr, 2011). Stock exchanges are the most important for this thesis.

The stock exchange is a market on which the prices of securities or commodities are determined according to supply and demand. The main task of the stock exchange is to bring together investors who want to value their money and companies that want to raise new capital. Stock exchange thus fulfills an important function for the entire national economy. (Prague Stock Exchange, 2020).

The largest and the oldest organizer of the securities market in the Czech Republic is the Prague Stock Exchange. The activities of the stock exchange and the overall events on the capital market in Czech Republic are supervised by the Czech National Bank (CNB) (Prague Stock Exchange, 2020).

3.1.2 Investments and investment instruments

There are different approaches to the description of the concept of investment resources and their structure. Most of the economics consider, that any type of value (material, financial, intangible, intellectual, informational, organizational, labour, innovative etc.) or their combination can be used for the investment proposes (Lytvynenko & Bakumenko, 2018). The investment purpose can be explained in this context as gaining the higher future value, even if not certain, in the result of deliberately sacrificing some well-known today's value (Rejnuš, 2016).

If there is a shift from this concept of investment to greater detail, it can be claimed, that investment instrument is an asset, that brings the investor some right to future income. It can be income in the form of dividends, coupon payments, interest, foreign exchange gains etc. (Veselá, 2019). This future income can be defines as the yield, but it does not come completely automatically – it is a reward to investors for taking the risk associated with the implementation of the investment. That risk can be defined as the uncertainty of the investor that he will not be able to achieve the expected return (Rejnuš, 2016).

The Act No. 256/2004 Sb., on Capital Market Business (section 3), defines investment instruments traded on the capital market as a complete list:

- transferable securities – securities, that are tradable on the capital market (shares, bonds, depositary receipts etc.),
- units in collective investment undertakings - securities, that representing a share in investment funds,
- money-market instruments – treasury bills, certificates of deposit and commercial papers,
- derivatives: options, futures, swaps, forwards and other instruments.

It is important, that investment securities traded on the capital market do not contain such instruments as current banking account (it cannot be lent using a securities lending

agreement). Investment instruments that are not securities are also not recorded in the central securities register, as they are private law obligations that have been established by an agreement between the parties (Kyncl, 2010).

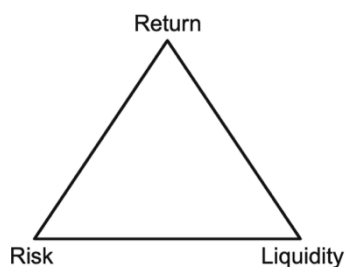
Investment instruments are traded on the capital markets, which distribute capital from persons who have excess funds to persons who, on the contrary, lack funds. Investment instruments influence the position of private individuals and often have a serious impact on the development of the international political situation (Kyncl, 2010).

3.1.3 „Magic“ triangle of investing

Investor demand for investment instruments is influenced by general and specific factors. Specific factors vary from investor to investor. General factors that all investors take into account are wealth, return, risk and liquidity.

The goal of most investors is to maximize return in relation to risk and liquidity. Return is the motive for investing and a reward for the implementation of the investment process (Dvořák et al., 2015). Most theorists in finance agree with this view. Return and risk are especially important investment criteria (Duspiva & Kruml, 2014), but the investor is looking for the ideal combination of return, risk and liquidity, according to his own preferences – it can be imagined as a point on the area of a given triangle (figure 1).

Figure 1 „Magic“ triangle of investing



Source: Menšík, 2020, p. 158

The triangle (see figure 1) is based on the three axioms of financial management: „(1) It is better to have a higher return (profit, cash flow) than a lower return. (2) It is better to have a lower risk than higher risk. (3) It is better to have higher liquidity than lower.“ (Menšík, 2020, p. 157). Also the triangle shows its own laws: it is possible to achieve only two of the three vertices. So, investment can have (Menšík, 2020):

- low risk and high liquidity, but low return,

- high liquidity and high return, but high risk,
- high return and low risk, but low liquidity.

These possibilities are considered by the investor.

Stocks are one of the popular investment tools between which the investor can choose on the capital markets. In case of operation with stocks the three vertices of the “magic” triangle mean (Wang, 2017):

- liquidity of stock is the ability to cash – it is higher, if the stock can be easily bought or sold on the market, with little or no impact on its price,
- return is the gain (or loss) during a selected period, it consists on the income and the capital gains relative on the investment. Return is divided into three types: holding period return, historic rate of return and expected rate of return,
- risk is a chance of gaining less returns than expected. Risks are connected with economic situation, given country and its specifics, also with individual security etc.

3.2 Types of the company’s stocks

In the world financial market, it is possible to meet a number of different types of stocks, which differ significantly in their characteristics, property rights, freedoms to issue them, etc. Detailed classification of corporate stocks is provided e.g. by Rejnuš (2014).

The basic view distinguishes between two types of stocks: common stocks (also called ordinary stocks) and preferred stocks (also called preference stocks).

Preferred stocks are stocks that combine the standard features of common stock and some of the features of a bond. This is due to the fact that the significance of their issuance lies in the increase of the capital of joint-stock companies, without changing the current ratio of voting rights and without the funds thus obtained having to be returned in the future. Therefore, these are mostly non-voting shares, which provide some other benefits to their holders. (Rejnuš, 2014).

Holders of preferred stocks get a fixed dividend from the company's earnings. Preferred shareholders also get paid before common shareholders. Common stocks have also lower priority in event of liquidation than preferred stocks (Money Control Glossary, 2020).

Although preferred stocks have fixed dividends, they can be constructed differently. In this connection, they distinguish the following types (Rejnuš, 2014):

- preferred stocks with fix dividend rate (fixed-rate) – it is usually a certain percentage of the nominal value of the share,
- preferred stocks with variable dividend rate (variable-rate) – the rate is derived from some key market reference interest rate,
- participating preferred stocks – provide, in addition to priority dividends, also opportunities to participate in the profits of the joint-stock company (so-called additional dividends),
- cumulative preferred stocks – grant the right to an additional payment of the detained divisions, even before the commencement of the payment of dividends arising from ordinary shares. It is a right that is a standard feature of preference shares, so this type can be considered quite common.

3.3 Approaches to the stock valuation

There are different investment analyses (fundamental, technical or psychological), which allow to find needed data about stock.

3.3.1 Technical analysis

Technical analysis is the oldest analytical approach dealing with the development of securities prices or commodity prices. Munehis Honma is considered a pioneer in the field of technical analysis in this context. Theoretically, the basic principles of technical analysis were summarized and further developed by Charles H. Dow, who assumed that most stocks in the market exhibit similar behavior, and therefore the development of the market can be easily described using stock indices (Chutka & Vagner, 2020).

Dow first published the mid-market share price on July 3, 1884. That first average rate included only 11 stocks of various companies. In this form, the index existed for 13 years and, subsequently, was divided into two parts: the index of railway (Dow-Jones Rail Average) and industrial companies (Dow-Jones Industrial Average). In 1929, the index of utilities was added to this list (Tolkach, 2014).

The history of technical analysis goes back to 1884, the year when the Dow index first appeared. Technical analysis assumes that the market price is influenced only by supply and demand, which already contain the views of trading sides on macroeconomic, political and other events, with which, for example, fundamental analysis works. Technical analysis also assumes a recurring history, which is perceived in the form of patterns in graphs, which catch especially exchange rate movements and trading volumes, and other less or more technically complicated indicators, such as moving averages, oscillators and others (Veselá, 2019).

3.3.2 Psychological analysis

The basic premise on which the psychological analysis is based is that the stock markets are strongly influenced by the psychology of the stock market audience, which, by acting on market participants, affects the level of stock prices (Rejnuš, 2014).

Psychological analysis includes a number of different theoretical concepts that deal with the influence of mass psychology on stock quotes. These are, for example, Keynes's speculative equilibrium hypothesis, Kostolany's stock market psychology, the theory of speculative bubbles, Drasnarov's conception of psychological analysis, etc.

One of the psychological factors that is taken into account in this analysis is the irrational behaviour of investors. Loktionova (2013) states, that rational share pricing mechanisms are universal, clear-cut ways of deriving a stock price judgment from available data. According to Loktionova (2013), the irrational part in the evaluation of securities is an intuitive judgment based on personal preferences, fears, goals, views. The degree of irrationality in investor behaviour increases, for example, as the flow of significant information or conflicting data accelerates. The situation is also complicated by the presence of speculative investors on the market. At any given time, the value of a share is a reflection of the rational and irrational expectations of market participants.

A remarkable research that has shown the importance of behavioural and psychological factors in stock evaluation is the Damodaran's article, in which the market value of the American company Tesla, fashionable among investors and overvalued seven times, was determined – see Damodaran & Cornell (2014), Damodaran (2013).

3.3.3 Fundamental analysis

Fundamental analysis is the most complex method (Gottwald, 2012). It is based on the analysis of internal and external production and financial indicators of the enterprise (Zaripov & Ezhova, 2020). The objects of fundamental analysis of the company are the issuer itself, the industry in which the issuer operates, the political and economic state of the issuing country (Kupriyanova & Sokolinskaya, 2018). Based on the results, fundamental analysis can examine the reasons for the change in stock prices and predict the future development.

There are two main methods of fundamental analysis: benchmarking and net present value analysis. The main task of the comparative analysis is to determine the overvalued or undervalued shares of the enterprise. With the help of comparative analysis, companies and their shares are compared with each other to identify preferences for investing in a particular company (Zaripov & Ezhova, 2020).

In the theory of fundamental analysis, there are two classical schemes for its implementation: the scheme “top-down” and “bottom-up”, first considered in the well-known work “Analysis of securities” by B. Gramm and D. Dodd.

The bottom-up approach presupposes the reverse sequence of the fundamental analysis procedure: an investor chooses from the whole variety of companies in the world one in which he wants to invest money, and then assesses the conditions characteristic of the industry and macroeconomic environment (Adrianova, 2020).

In the case of international investment, the most convenient is the “top-down” scheme, since it allows at all stages of the analysis to consistently limit options unacceptable for the investor.

The top-down approach is described by Adrianova (2020) in several steps. At the first stage, the study of the macroeconomic market situation. An investment market is selected depending on the investor's incline to risk (e.g. emerging markets are a priori inherent in greater risk). This is followed by an analysis of macroeconomic statistics of the economies (depending on the choice made by the investor in the first step of the analysis) to determine a specific country in which investor can place his temporarily free resources by comparing the level of risk assumed with the possible return on investment. The subsequent stages are the choice of the industry, and then the target company, for the implementation of

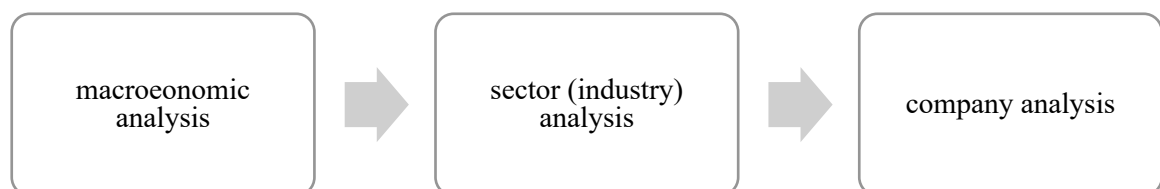
which information and analytical materials, industry statistics are studied, a financial analysis of enterprises belonging to this industry is carried out, based on the retrospective data reflected in the reporting of organizations, as well as their further investment and strategic plans.

Vishal & Deepti (2018) follows the next steps in the top-down approach:

- macroeconomic analysis,
- industry analysis,
- company level analysis, including quantitative financial analysis.

Main steps of the fundamental analysis are shown by the figure 2.

Figure 2 Main steps of the fundamental analysis („top-down“ approach)



Source: made by the author

When conducting macroeconomic analysis, such indicators are traditionally considered as: GDP growth rate, inflation rate, interest rate, taxes, demography, political and legal risks.

GDP growth rates

It is customary to begin the analysis of the macroeconomic situation in the country with an analysis of the dynamics of the GDP growth rates. This indicator is inextricably linked with aggregate demand, therefore, a decrease in GDP growth rates directly indicates a decrease in aggregate demand presented by households, investors, government and foreign countries. When assessing the intrinsic stock value of companies in the consumer sector, the growth rate of GDP per capita is also analysed. The dynamics of GDP per capita allows to draw a conclusion about the future dynamics of consumer activity (Altman, 2012).

Inflation rate

By examining both the dynamics of GDP and the rate of inflation, the better image of the current macroeconomic is made. Low (reasonable) inflation usually indicates the normal functioning of the economy. Consumers, knowing about the expected rise in prices, are interested in purchasing goods now, without postponing for the future, and this, in turn, contributes to an increase in business activity. However, unpredictable, excessively high or low inflation indicates the emerging problems in the economy. To stabilize inflationary (deflationary) pressure on the national economy, Central banks most often use special monetary politics (Jurečka et al., 2017).

Interest rate

The interest rate set by the Central Bank is one of the main instruments of monetary policy. By raising the key interest rate, the monetary authorities increase the cost of funding for commercial banks, which leads to a subsequent rise in the cost of credit resources for corporations and the population. As Holman (2012) claims, restrictive monetary policy reduces investment and consumer demand, and decreasing demand leads to lower inflation.

Taxes

Depending on the type of fiscal policy, the state may increase taxes (with a restrictive policy aimed at limiting cyclical economic upturns). It will ultimately lead, on the one hand, to a decrease in corporate profits, but on the other hand, it will allow companies to save on the cost of debt resources thanks to a tax corrector: interest payments on debt service are deducted from the taxable base for income tax. On the contrary, by adhering to a stimulating fiscal policy, the state reduces the tax burden on corporations, allowing them to reduce not only the tax burden, but also the effect of the tax corrector. Thus, the analyst in each specific case must separately consider the tax effect on both the discount rate and the post-tax cash flow (Adrianova, 2020).

Demography

While analysing the companies in the B2C segment (business-to-consumer), it is advisable to consider the current birth and death rate in the country, the structure of the population etc. Also, other demographic factors are taken into account that can have a significant impact on the level of demand of the analysed companies and, as a consequence,

on their financial results due to the fact that the end consumers in this segment are people, not corporations or states.

Political risks

Political instability is immediately projected onto all economic processes, and consequently, on the strategic development programs of corporations. For example, the introduction of sanctions prohibiting the Russian import of certain commodities from the EU countries in 2014-2015 or sugar quotas in EU until 2017 have provoked changes in the investor's behaviour. The political situation should therefore be taken into account in the fundamental analysis.

Legal risks

Investor should to understand the legal environment in which the company operates, as it often has a tremendous impact on both the financial and operational results of the company: sometimes new rules, laws and standards can completely change the usual business model of an entire industry.

Thus, macroeconomic factors, described above, are necessary for investor – this analysis helps not only to determine the expected rate of return on invested capital, but also to comprehensively assess the assumed risk.

The next stage of the “top-down” approach is sector (industry) analysis.

Sector (industry) analysis

The sector analysis assesses the specifics of the response of individual sectors to the overall development of the economy. These are, for example, the development of the level of profit, differences in the regulation of the industry and the prospects for their further development. In terms of economic sensitivity, a distinction is made between cyclical, neutral and countercyclical industries (Polouček et al., 2009).

It is appropriate to assess the degree of regulation of the sector by the state (barriers to entry into the sector, etc.) and the structure of the sector. The structure of the industry is affected by five dynamic competitive factors, which M. Porter included in his model (Kislingerová, 2001):

- potential new competitors,
- suppliers,

- substitution,
- existing competitors in the sector.

The important part of the sector analysis is the competitive analysis (Adrianova, 2020, p. 40). The number of competing companies, conditions of entry/exit, type of structure (monopoly, oligopoly, perfect competition etc.), export opportunities, average generated profit can be described in this area (Gottwald, 2012).

Company analysis

The analysis can be qualitative or quantitative. The qualitative research can be carried out as SWOT analysis or PEST (PESTLE, STEP, PESTE) analysis. (SWOT analysis relates to both internal and external environment of the company, PEST analysis – only to macroeconomic analysis). The quantitative analysis examines the development of selected indicators, e.g. ratio indicators and the horizontal or vertical analysis (Gottwald, 2012).

Kudrin (2016) recommends the following approach to the company analysis:

- assessment of the financial condition of the issuer (basic indicators of the financial analysis),
- debt Assessment (the ratio of payments on all loans and borrowings to the income),
- assessment of the issuer's ability to pay dividends.

Dividends are one of the most important indicators for an investor, so the analysis of the company's dividend history can be made). The potential of a stock (in terms of dividend payments) can be determined using various indices.

Fundamental analysis states, that undervaluated and overvaluated stocks are on the capital markets, because of this, “*stock price can be different from its intrinsic value, in the practice.*” (Gottwald, 2012, p. 21).

The intrinsic value is a main concept of any stock analysis, but throughout its long history, the development of the concept of intrinsic value has been accompanied by a number of discussions and controversial views – eg. Zimmerman (2001) and Davison (2012) point this out. According to Gladiš (2005), investment opportunities lie precisely in the difference between the price and the intrinsic value of a stock. He also states, that smart investor tries

to buy a dollar for 50 cents. So the intrinsic value is a concept, that cannot be forgotten in context of stock valuation methods and investor decisions.

Graham (2009), one of the original founders of the term intrinsic value, describes it as a justifiable value based on assets, profits, dividends, or company prospects. It also draws attention to the difference between internal and book value, which does not include plans, goals, management skills and other variables, which, however, certainly affect the success of the company and the stock price.

The valuation process takes place continuously on the stock market. Dvořák et al. (2015) describe this process as follows: the market price is an exogenous quantity. Investors determine the intrinsic value of a stock based on new information. The intrinsic value is compared with the current market rate. If the price is higher than the intrinsic value, the share is overstated and sales orders increase on the market, which causes the market price of the shares to decrease and bring it closer to the intrinsic (actual) value. The situation may be the opposite: the market price of a stock is lower than its intrinsic value, then the stock is undervalued in the market, which encourages investors to buy such undervalued stock, purchase orders increase and the market price of the stock rises to its real (intrinsic) value. These relationships are used to make recommendations for investors, that can be expressed as follows:

$P_0 < V_0$ market price P_0 is lower than the intrinsic value of the stock V_0 ,
recommendation: buy the share.

$P_0 > V_0$ market price P_0 is higher than the intrinsic value of the stock V_0 ,
recommendation: sell the share.

The intrinsic value of a share may be the same as the market price, which means that the share is correctly valued.

Among the most used models to estimate the intrinsic stock value are (Gottwald, 2012):

- the profit model (e.g. PE ration),
- the dividend discount model (DDM),
- the combination of the profit model and the dividend,
- historical model,

- discount model,
- the free cash flow to equity model (FCFE),
- the balance model.

Certain models are used to calculate the intrinsic values of stocks and then to compare these values with the current market prices of stocks. Based on this results, the investment decision, related to recommending buying or selling the stock, is made.

Documented and online resources, also opinions of industry experts are usually used in the fundamental analysis. It helps to make a judgment about the potential of the selected company and industry for potential investment (Vishal & Deepti, 2018).

3.3.4 Dividend discount models

The dividend model for stock valuing is based on the assumption that the stock value is given by the present value of future income flowing to the owner of the stock. The shareholder's future income consists of dividends paid in individual years and the sale price of the stock at the end of the holding period.

“The dividend discount model is based on an assumption that the intrinsic value of a stock equals the present value of future dividends generated by this stock. In general, the dividend growth may be, over time, zero, constant or variable, or the company may not pay out any dividends.” (Gottwald, 2012, p. 99).

The specific model therefore assumes the end of the investment in the form of a sale and according to this assumption is called the dividend discount model with a finite holding period. The present value of income from stocks is given by the following relationship in this model (Režnáková, 2007):

$$V_0 = \frac{D_1}{(1+K_e)} + \frac{D_2}{(1+K_e)^2} + \dots + \frac{D_n + P_n}{(1+K_e)^n} \quad (22)$$

V_0 – intrinsic value of the share,

D_n – expected dividend in n-year,

P_n – expected price in n-year,

K_e – required rate of return,

n – the length of the holding period of the share.

If the investor does not consider the sale of the share in the foreseeable future (n acquires high values or directly approaches infinity), then the current expected value of the sale price of the share is close to zero (Musílek, 2011). A dividend discount model with an infinite holding period of the share is used in this case:

$$V_0 = \frac{D_1}{(1+K_e)} + \frac{D_2}{(1+K_e)^2} + \dots + \frac{D_n}{(1+K_e)^n} \quad (23)$$

V_0 – intrinsic value of the share,

D_n – expected dividend in n -year,

K_e – required rate of return,

n – the length of the holding period of the share.

According to this, Veselá (2019) states following dividend discount models (DDM):

- DDMs with zero growth,
- one-stage DDMs,
- two-step jump DDMs,
- three-stage linear DDM,
- H-model.

Models work with dividends that are constant, rising or falling constantly, or even combine multiple growth rates. According to this, the theory knows models with zero growth, constant growth or single-stage or multi-stage models. The first type – DDMs with zero growth is suitable for preferred stocks, other types – for the common stocks with increasing dividends (Veselá, 2019).

The Gordon's dividend discount model, used in this thesis, is presented as follows:

$$V_0 = \frac{D_1}{K_E - g} = \frac{D_M(1+g)}{K_E - g} \quad (24)$$

V_0 – intrinsic value of the share,

D_1 – expected dividend in the next year,

D_0 – dividend in the current year,

K_e – required rate of return,

g – the rate of dividend growth.

Musílek (2011) states two, Veselá (2011, p. 346) states five assumptions on which the Gordon's model is based. The most detailed list of the assumptions by Veselá (2011) is as follows:

- dividends must increase or decrease at the same rate throughout the period considered,
- the required rate of return, which reflects the level of risk and liquidity, must be also constant,
- the required rate of return must be greater than the rate of dividend growth,
- the model, created by the sum of an infinite geometric series of ever-increasing dividends, is strictly based on the assumption of an infinite period of stocks holding,
- necessary input is information about the current or expected dividend.

Dividend discount models continue to work with many input values. The quality of the results is depends on the reliability of the calculation of these input values.

The first key value is required rate of return (K_e). Required rate of return (K_e) according to the CAPM model is calculated as follows:

$$K_e = R_f + \beta(R_m - R_f) \quad (25)$$

R_f – risk-free rate of return on government treasury bills,

R_m – expected yield rate from the market stock portfolio,

β – beta coefficient, which determines the systematic risk.

Risk-free means that the debt will be settled on time and in the right amount; there are no risks arising from changing exchange rates and interest rates; there is no risk of uncertainty as to how profitable a creditor may reinvest interest income (Mařík, 2011). Absolute risk-freeness is a model rather than a realistic situation. In practice, therefore, when calculating the risk-free rate (R_f), there is often a search for assets that are characterized by at least minimal risk. These are usually considered to be securities issued by the state, these are mainly short-term treasury bills and long-term government bonds.

Beta coefficient (β) represents the sensitivity of a particular stock to changes in the yield of the market portfolio (Musílek, 2011).

Expected yield rate from the market stock portfolio (R_m) is the market rate produced by the market index. The historical data of the local capital market or markets of developed countries, most often the US market, and usually used (Mařík, 2018).

The last indicator, used in the Gordon's model is the rate of dividend growth (g). The following three approaches can be used to find it (Veselá, 2003):

- historical rate of dividend growth,
- dividend growth rate estimated by analysts,
- dividend growth rate based on corporate financial indicators.

The first approach, as the name suggests, determines the rate of growth based on historical data. The calculation of the historical rate of dividend growth (g) based on this formula (Veselá, 2003):

$$g = \sqrt[t]{\frac{D_M}{D_S}} - 1 \quad (26)$$

D_M is the younger dividend,

D_S is the oldest dividend,

t is the time difference between the younger and the older dividend.

The second way of calculation is based on the information of other analysts. In addition to the calculations, analysts can also use subjective feelings, experience and are able to include so-called soft data in estimates, which often achieves more accurate estimates than mathematical models, especially in the short term.

The last mentioned way of the calculation is dividend growth rate based on corporate financial indicators. It is about the maintenance growth model, which uses especially the value of ROE (return on equity) (Damodaran, 2015):

$$g = b \times ROE = (1 - p) \times ROE \quad (27)$$

b is the retention ratio,

p is the payout ratio,

ROE is the return on equity.

3.3.5 Approaches based on the PE ratio

PE ratio (price-to-earning) is one of the most used approaches to the stock valuation. Many authors, including Watsham (1993), Halsey (2001), Gottwald (2012) and others, focus on the application of this model. It is the ratio of the company's capitalization and its net profit for the year (usually the previous reporting period or the last 4 quarters). In fact, it is about the ratio of the market price per share to earnings per share (EPS):

$$PE\ ratio = Price\ (Market\ Capitalization) / EPS \quad (28)$$

Market price of the stock is taken according to the broker or if you are interested in a certain day, then the share price is taken from the specified day.

Earnings per share (EPS) represents the ratio of the company's earnings to each share of the company in the market. In other words, earnings per share represent a portion of the company's net profit that would be paid out per share if all earnings were paid to shareholders. EPS is usually used to determine the so-called financial strength of a company (VSbrok, 2020).

So, EPS is calculated as follows: the total profit is divided by the total number of shares in the company outstanding.

“A high PE usually indicates that the market will pay more to obtain the company's earnings because it believes in the firm's ability to increase its earnings. Similarly a low PE ratio indicates the market has less confidence that the company's earnings will increase. High PE stocks were volatile compared to low PE stocks concluding that low PE stocks are more stable.” (Vishwanath, Thomas & Dias, 2018, p. 78-79). Simply declared, the PE ratio shows how much the market, being in conditions with the “today's” price, is willing to pay per share based on past or future earnings.

Gottwald (2012) states, that the PE ratio can be used in different modifications, as soon as other models of the fundamental analysis.

There is another type of stocks valuation method – PEG ratio: the price earning with growth incorporated (Vishwanath, Thomas & Dias, 2018):

$$PEG\ ratio = PE\ ratio / annual\ EPS\ growth \quad (29)$$

Since PEG ratio links to the growth rate (in %), calculated final PEG value from 0 to 1 still provides good return, but negative PEG value means negative companies returns or reduced future growth and high investment risk.

Vishwanath, Thomas & Dias (2018) showed in their study that with the availability of PE and PEG ratios values, it is more appropriate to focus on PEG results than on PE results. “When compared to High PE and Low PE, High PE is good for investment and compared to the PE and PEG, PEG are good for the investment.” (Vishwanath, Thomas & Dias, 2018, p. 87).

Another modification of PE ratio is Sharpe P/E ratio.

$$\frac{V_0}{E_0} = \frac{p*(1+g)}{k-g} \quad (30)$$

p is payout ratio,

g is dividend growth rate,

k is required rate of return.

Comparison of the Sharpe P/E ratio and the current P/E ratio indicates the fact, that a given share is overvalued, undervalued or is or is correctly valued.

P/BV ratio (price to book value) is the market price per share divided by the book value per share. The book value per share is a firm's equity (total assets minus liabilities), divided by the total number of shares.

$$P/BV \text{ ratio} = \frac{P_0}{\text{Equity per share}} \quad (31)$$

Sharpe P/BV ratio (P_0/BV_0) is calculated as follows:

$$P_0/BV_0 = \frac{ROE*p*(1+g)}{k-g} \quad (32)$$

Sharpe P/BV ratio (P_0/BV_0) can be compared with a normal P/BV ratio:

$P_0/BV_0 >$ normal P/BV ratio: the share is undervalued,

$P_0/BV_0 <$ normal P/BV ratio: the share is overvalued,

$P_0/BV_0 =$ normal P/BV ratio: the share is correctly valued.

3.4 Comparison of common stock valuation methods

Estimating the intrinsic value of a stock is a process that is based on a relatively small number of relatively simple principles, but their application in practice is usually complicated. At the same time, the value of a stock are influenced by many subjective opinions and preferred approaches to evaluation. For example, technical analytics almost completely ignore the psychological or fundamental aspects, other analytics can purely focused on value indicators.

The basic assumptions of technical and fundamental analysis are different, which causes a different way of their proceeding. Fundamental analysts assumes, that the market will not reveal the intrinsic value of the stock at any given time, some stocks may be overvalued or undervalued. On the other hand, technical analysts believe, that all relevant information has been reflected in the share price, the movement of the share price tends to repeat itself in the future.

The main difference between fundamental analysis and technical analysis is the way they are used to predict the value of securities. Fundamental analysis studies the overall performance of the economy, industry and society in order to determine the intrinsic value of stocks and compare it with market values, thus identifying investment opportunities (Wafi, Hassan, Mabrouk, 2015). However, technical market analysis studies focus only on stock price movements. It does not take into account economic factors or the intrinsic value of the stock. The chart, which is created by supply and demand, is important. It is therefore possible to gain knowledge from this chart and enter or exit the market in the most appropriate way and at the best time (Jakpar et al., 2018).

According to the research conducted by Cohen, Kudryvtsev and Shlomit (2011), most professional portfolio investors, as well as amateur investors, use fundamental analysis more often than technical analysis, when making investment decisions, because fundamental analysis has proven useful in generating a positive return on investment. However, the result of this research contrasts with the studies of Neely (2010), Moosa and Li (2014) and Wafi (2015). Based on their findings, they stated that technical analysis is more effective than fundamental analysis. This may be due to the fact, that different sectors and countries show different results.

Venkatesh and Ganesh (2011) found that different approaches were used in different sectors. Fundamental analysis has been used by investors in conventional industries such as banking, pharmaceuticals etc., while technical analysis has been used in modern sectors such as entertainment, real estate, telecommunications etc.

Oberlechner (2001) suggested that technical analysis is more advantageous in the short term, while fundamental analysis is more appropriate over a long period of time. This showed, that the time period will affect the outcome of the study.

Jakpar et al. (2018) points out that the reliability of studies, demonstrating the higher usefulness and accuracy of one of the analyzes (fundamental or technical, or both), is severely limited. Studies use only a limited number of indicators and examine only selected methods of these approaches.

According to Suresh (2013), fundamental and technical analysis are both important for investment decisions, although both use a different method of predicting stock returns. Petrusheva and Jordanoski (2016) further concluded that fundamental analysis and technical analysis have their advantages and disadvantages, and therefore the combination of both analyzes will lead to optimal stock results. This view is shared by other analysts (eg Bettman & Sault, 2009), who state that the two approaches – technical and fundamental analysis - must complement each other in order to achieve above-average and reliable results.

It is further appropriate to summarize the specific distinguishable features of each of these analyses.

Technical analysis

Technical analysis, based on the Dow's principles can equally well be used for the current commodity and stock markets, although, the Dow's indexes were used for the analysis of industrial and railway indices. Technical analysis and Dow's ideas still find application in the modern world, but it meet with several problems and limitations.

The first problem is related to the fact that its investors are missing out on profits, waiting for a clear signal of a trend change. Another problem with Dow theory is that over time, the economic indicators and market indices originally used by the Dow have changed. Consequently, the connection between them has weakened. The third problem is that the Dow theory postulates do not tell the investor exactly which stocks to buy and which to sell (Tolkach, 2014, p. 165).

The technical analysis focuses mainly on the short horizon and assumes that the market price is influenced only by supply and demand, which already contain the views of trading parties on macroeconomic, political and other events, with which, for example, fundamental analysis works.

Technical analysis, based on the Dow's theory, can help form the basis of the analysis, but it is necessary to increase the accuracy and perverseness of the analysis, for example, using other indexes and methods.

Fundamental analysis

Fundamental analysis allows the comparative assessment. This assessment is considered to be "quick and rough", it is able to give an instant picture of reality, to show how much a stock is undervalued / overvalued compared to competitors. Although it is less accurate compared to complex models of discounting cash flows (Kholodenko, 2018).

The problem with comparative analysis can occur, if there are no comparable firms (e.g. firms of similar size in the same business with enough history data). When the examined firm is unique or the other firms in the sector are quite different in the basic characteristics, the comparison is limited (Damodaran, 2000, p. 10).

PE ratio

The main limitation in the use of the PE ratio is that it can be used only if the company has positive earnings. If the company "loses" money, ie it has to borrow for the operation, then earnings per share cannot be calculated. A negative EPS is not specified, in this case the company has no EPS.

PE ratio is simple understandable and famous model, because earnings per share are often a key measure of the company's top management. PE is often used to evaluate the market as a whole. Despite its prevalence, this indicator has many disadvantages.

The PE ratio is affected by many factors: the dividend policy, the company management quality, industry type and its popularity among investor, used accounting model in the company etc. (Gottwald, 2012). Research by Chisholm (2009) shows, that the results of the PE ratio calculation can be distorted due the using accounting method of pricing, calculation of the average PE for stocks of companies from different industries.

PE ratio is not applicable to corporations with negative net income (unprofitable corporations). Here it is necessary either to use forward multipliers (taking into account expected future income), or smoothing PE taking into account the cycle (Kholodenko, 2018).

PE ratio does not take into account the difference in taxation and debt burden of the compared companies. An important point in emerging markets is the organizational structure of an enterprise, a list of key owners, which means risks for minority shareholders. The two enterprises may look different in terms of PE ratio precisely because of the differences in these aspects of the business. The fact that the PE ratio of the compared companies differ greatly is not a reason to talk about underestimation / overestimation of one of them (Kholodenko, 2018).

It is important to note, that the PE ratio is determined by the relation between current and future profitability of the firm. If current profitability is considered as low in comparison to future profitability, the PE ratio will be high. And if the current profitability is high in comparison to future profitability, the PE ratio will be low. The results of the model can be interpreted incorrect in some cases. Such example is described as follows: *“For example, a firm with poor future prospects, but even poorer current performance, would still report a high P/E ratio. And conversely, a firm with positive expected RI might still report a low P/E ratio if current levels of profitability are higher than the levels the market projects.”* (Halsey, 2000, p. 10). RI – residual-income: *„It is theoretically equivalent to the discounted „free-cash-flow-to-equity“ model taught in finance courses as well as the original dividend discount model from which both are derived.“* (Halsey, 2000, p. 4).

Damodaran (2000, p. 8) states, the using of consensus estimates of the growth rate, that is generally available as public information, is not available or meaningful for firms with negative earnings in the present time. It is the next limitation of the stock valuation method for unprofitable firms.

When calculating PE, its misinterpretation often occurs. This is clear from the results of these studies (eg Vishwanath, Thomas & Dias, 2018), which point to the need to take into account other ratio models (eg PEG). As with any approach, it is useful to assess the situation as a whole, not relying on one single indicator.

However, there are other studies that confirm the suitability of using the PE model. This is the case, for example, of the research by Drexel Firestone, which compared the average annual returns or losses of low-PE stocks to those of high and the entire DJI index.

DJI is Dow Jones index, which contains of the stocks of the 30 American company's (Mlýnek, 2020). The monitoring began in 1937, and in each five-year period since that year, the yield on low PE shares was higher than the others monitored until 1969, when the monitoring ended. Low PE stocks were considered relatively cheap and were less popular at the time than higher stocks (Graham, 2007, p. 152).

DDM models

Proponents of DDM models justify its reliability by the fact that it starts from a simple, universally recognized concept: the fair value of a security should be equal to the discounted value of cash receipts expected from this security (Sharpe, Alexander, Bailey, 2002, p. 590). Although, the disadvantage of DDM models is their increasing complexity in calculations. Another problem is associated with stockholders' values and expectations, that have impact on the dividend politics of the company.

Brigham & Gapenski (1996, p. 447) note that dividend policy should be based largely on investor preference for dividends or capital gains. In this case, the question occurs: what is preferable for the marginal investor: to distribute the profit in the form of dividends or to re-invest this profit in the business in order to further receive income from capital gains? However, classical DDM models ignore such part of the return received by the shareholder from the shares as capital gains. This position is justified by the thesis that investors are more interested in receiving dividend payments than income from capital gains expected from retained earnings. But there is an absolutely opposite position on the irrelevance of dividends in relation to the value of shares and the price of capital. According to this position, the value of the firm is determined by its overall profitability and the degree of risk; moreover, the value of a firm largely depends on which part is paid as dividends and which part is reinvested (Volkov, 2004, p. 83). This means that the value of the results of DDM models for differing dividend policies (reinvestment in business) decreases.

Further development of the methodology and use of stock valuation should consist of an integrated approach, taking into account the operational, investment, financial activities of the corporation, and comprehensive reflection of internal and external factors.

4 Practical Part

This part gives the basic characteristics of the selected company (Apple Inc.) and its products. The evaluation of stocks of the company is performed using the methods described in the theoretical part of the work (PE ratio, DDM).

4.1 Characteristic of the Apple Inc.

Apple Inc. is American corporation, manufacturer of personal and tablet computers, audio players, phones, software. It is one of the pioneers in the field of personal computers and modern multi-tasking operating systems with a graphical interface. Headquarters – Cupertino, state California.

Table 1 contains the basic identification data of the selected stock.

Table 1 Basic characteristic of the company (Apple Inc.) and the stock (AAPL)

Name of the company	Apple Inc.
Headquarters	One Apple Park Way, Cupertino, CA 95014, U.S.
Sector	Technology
Industry	Consumer Electronics, communications equipment
Number of employyes	147 000 (full time)
Stock Exchange	The Nasdaq Stock Market LLC
ISIN	US0378331005
Ticker	AAPL
Currency	USD
Emission volume	50 400 000 000 shares of common stock
Market capitalization	2,46 trillion USD
Market stock price	152,7 USD (28th October 2021)

Source: made by Apple Inc. (2020), Yahoo Finance (2021), CompaniesMarketCap.com (2021)

The American company Apple became the first American publicly traded company, whose market capitalization exceeded 1 trillion USD. However, in August 2020, it reached another historic milestone and exceeded the market capitalization of 2 trillion USD. In order to approximate the size of this company – only 11 exchanges of the 72 largest exchanges in the world have a market capitalization larger than Apple. Examples of stock exchanges that are directly behind Apple are for example the South Korea Stock Exchange or Swiss Stock Exchange (TradinhHours.com, 2021). Compared to other technology giants, Apple is still in

first place. In October 2021 Microsoft reaches market capitalization of 2.4 trillion USD, Amazon – 1.7 trillion USD, Alphabet Google – 1.97 trillion USD (CompaniesMarketCap.com, 2021).

Many factors affect the value of the company's stocks. Most important factors are demand, supply, market sentiment, the company's bottom line, new product launches and volume of sales. An established brand, due to which the company has become a favorite of a wide range of consumers, plays a significant role in determining the value of shares.

Apple is dynamically developing and introduces new models of smartphones, computers, headphones, watches, is also engaged in such areas as neural networks, artificial intelligence and augmented virtual reality. With the development of technologies and the introduction of its new products on the market, the company attracts more and more investors. However, sometimes the position of the company can be shaken, for example, with a failed product release, a lawsuit against the company, corporate news, activities of other companies. Because of this, analysis of the different factors is relevant.

4.1.1 A brief history of the company

Apple company was founded in 1976 by Steve Jobs, Steve Wozniak and Ronald Wayne. In the 1970s and 1980s, it dealt with the production of Apple X and Macintosh personal computers. At that time, the founders still had no idea how the company would grow. Wayne, who wrote the manual for Apple I and also designed the company's first logo, left just after 14 days. He sold his 10% stake for 800 USD. Today, a tenth of the company's market value costs 246 billions dollars.

The beginning of 1980s in the history of Apple was marked by the failure of Apple III project, caused by a number of reasons. In March 1981, Wozniak got into a plane crash and left the company. Problems with sales of the Apple III led to Jobs having to lay off 40 employees. The press has already talked about the imminent end of the Apple company (Khairullin, 2011, p. 297-298).

Steve Jobs, on the advice of investors, invited John Scully, then president of Pepsi Co. (Castcom, 2021). In the same period, the legendary Macintosh PC appeared: „*It was the first personal computer to be sold without a programming language at all.*“ (Stanko, 2015, p. 97). Subsequently, the release of computers of this series became the main business of the company (Khairullin, 2011, p. 298).

Conflicts between Jobs and Scully caused that Jobs left the company and began his own business (Castcon, 2021; Václavík, 2016). His new company – the NeXT company produced computers for the scientific field. In addition, he successfully runs the Pixar company acquired from George Lucas (Castcom, 2021).

In that time Apple began to change significantly and experiment with new products. For example, the Cupertino company developed its own laser printer, digital camera, Newton pocket computer, and also worked on development of game consoles. But a lot of products from that time burned down and the company withered (CNews, 2021).

Under pressure from investors, Apple returned Jobs (Castcom, 2021) and Apple's new era began in 1997, when the company bought Jobs's NeXT and received an investment of 150 million USD from Microsoft (CNews, 2021).

"Restarted Apple" then produced one iconic product after another: the iMac G3 in 1998, Mac OS X in 2001, iPod in 2001, iTunes Music Store in 2003, Mac Pro in 2006, iPhone in 2007, MacBook Air in 2008, iPad in 2010 came (CNews, 2021).

The period of 2007-2010 was very successful for the company, because of the development of mobile devices (especially iPhone 4) and App Store launching.

The changes started in 2011 when Steve Jobs took a medical leave. He never came back from her. After a few months, he left his position to Tim Cook and succumbed to cancer in the autumn 2011 (Václavík, 2016). Nevertheless, the release of the iPhone 5 in September 2012 became the Apple's biggest iPhone launch with over 2 million pre-orders (Stanko, 2015, p. 98).

Cook changed the strategy of the company – he began to apologize and admit problems. Under his leadership, Apple began buying many other companies. He launched the devices, that Jobs didn't want: smaller tablets and bigger phones. He settled patent disputes. Cook also has the first large product of its own unrelated to the previous ones – the Apple Watch, launched in 2015 (Václavík, 2016).

4.1.2 Products sold by the company

Apple's product offering has changed significantly during the company's existence, but the history of its success are still studying. There are some opinions about the reasons of the Apple's success: *"Its mission is clear, and both staff and customers buy into it. While*

famed for innovation, the company is also not afraid to take ideas and make them better. In short, Apple stays strong to its brand identity. And that's why you instantly recognize its products too." (Maiorca, 2021). There is an opinion, that the Apple's success is based also on fulfilling and catering to the needs of customers, strategy of improvement and branding and wide variety of quality products (Business Checklist, 2019). The products of the company have to be easy to use and Apple only makes a product if it can do it better (Bajarin, 2012).

The Apple Inc. itself states that its key competitive factors include: *"price, product and service features (including security features), relative price and performance, product and service quality and reliability, design innovation, a strong third-party software and accessories ecosystem, marketing and distribution capability, service and support, and corporate reputation."* (Apple Inc., 2020, p. 2).

The range of Apple's products nowadays can be divided to the following groups:

- iPhone – the line of smartphones based on its iOS operating system,
- Mac – the line of personal computer based on its macOS operating system,
- iPad – the line of multi-purpose tablets based on its iPadOS operating system,
- Wearables, Home and Accessories: AirPods, Apple TV, Apple Watch, Beats products, HomePod, iPod touch and other Apple branded and third-party accessories.

The company also provides the following services (Apple Inc., 2020, p. 1-2):

- Advertising: various third-party licensing arrangements and its own advertising platforms,
- AppleCare: a fee-based service and technical support, the network of global Apple authorized services,
- Cloud Services: help to store and keep customers' content up-to-date and available across multiple Apple devices and Windows personal computers,
- Digital Content: various platforms, including the App Store, that allow users to search and download applications and digital content (music, video, games, podcasts, books etc.), the Apple ArcadeSM (a game subscription

service), Apple Music, Apple News+SM, Apple TV+SM, Apple Fitness+SM,

- Payment Services: Apple Card™ (a co-branded credit card) and Apple Pay (a cashless payment service).

The products are sold through the direct and indirect distribution channels. In 2020, the share of direct channels was 34 % on the total net sales of Apple Inc., the share of indirect channels, such as third-party cellular network carriers, wholesalers, retailers and resellers, was 66 % (Apple Inc., 2020, p. 2).

The structure of sales according to the main product categories is listed in the table 2. The total net sales increased 6 % or 14,3 billion USD during 2020 compared to 2019, primarily driven by sales of products in categories Wearables, home and Accessories and Services.

In 2020, iPhone sales dropped compared to 2019, mainly due to the lack of new iPhone models. Also, the reason for the fall can be considered in the change in the exchange rate. Mac sales have increased in 2020, especially thanks to the rise in MacBook Pro sales. iPod sales are also boosted by sales of ten-inch versions of the iPad, iPad air and iPad pro. Sales of AirPods and Apple Watch, sales in the App Store and Cloud services also increased.

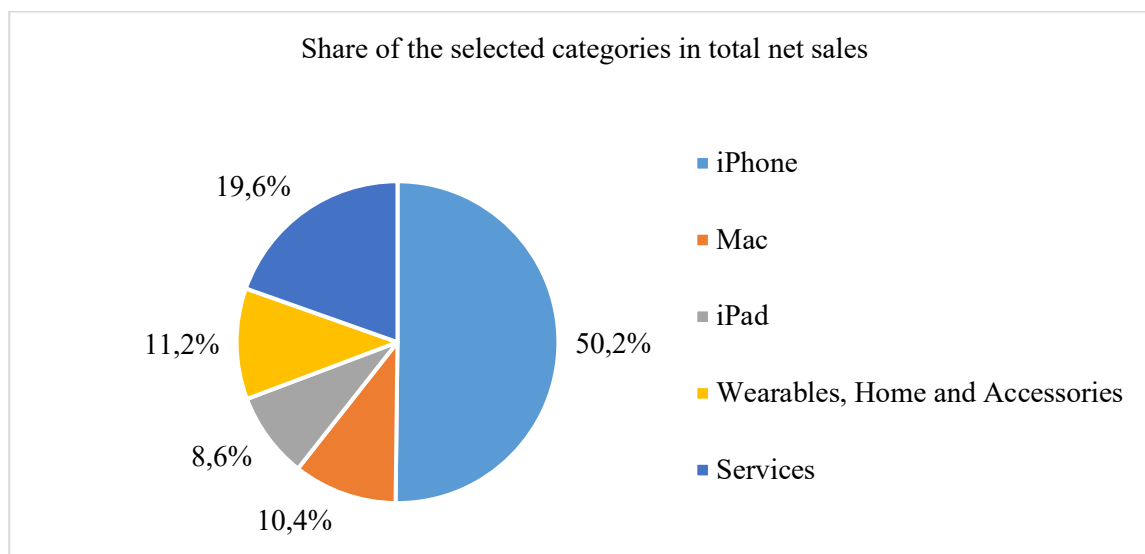
Table 2 Net sales of the main product categories, Apple Inc., 2018-2020

Product categories	2018	2019		2020	
	mln. USD	mln. USD	change 2019/2018	mln. USD	change 2020/2019
iPhone	164 888	142 381	-14 %	137 781	-3 %
Mac	25 198	25 740	2 %	28 622	11 %
iPad	18 380	21 280	16 %	23 724	11 %
Wearables, Home, Accessories	17 381	24 482	41 %	30 620	25 %
Services	39 748	46 291	16 %	53 768	16 %
Total net sales	265 595	260 174	-2 %	274 515	6 %

Source: made by author based on Apple Inc., 2020, p. 21

Despite the continuing decline in sales of iPhones, they still remain the main category in the company's sales structure. In 2020, iPhone sales accounted for 50 % of all company net sales. The structure of sales by category in 2020 is presented using Figure 3.

Figure 3 The structure of net sales (by the product category), Apple Inc., 2020



Source: made by author based on Apple Inc., 2020, p. 21

The changes in the geographical structure of sales are presented in the table 3. It is evident that the growth in sales in 2020 was mainly driven by the growth in sales in the Europe segment (growth of 14 % compared to 2019). On the contrary, sales in Greater China decreased by 8 % in 2019, which can be associated with the negative impact of the coronavirus crisis in this region. However, the decline in sales in Greater China slowed down, as in 2019 the year-on-year decline was 16 %. The main reason of the increasing trends is the weakness in foreign currencies relative to the U.S. dollar.

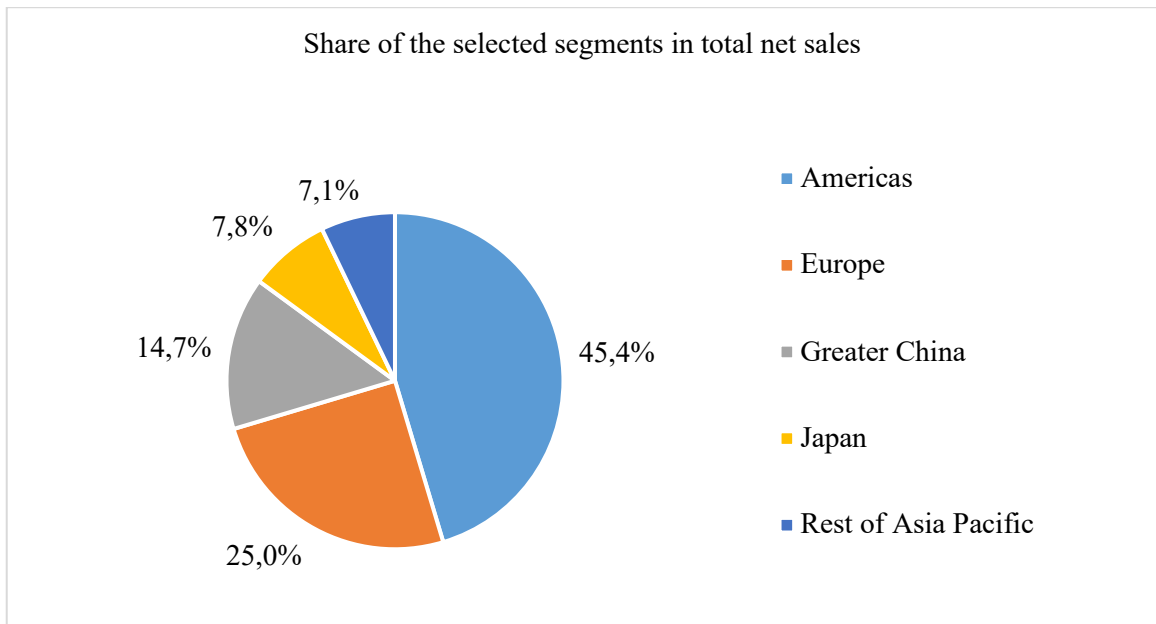
Table 3 Net sales by reportable segment, Apple Inc., 2018-2020

Segment	2018	2019		2020	
	mln. USD	mln. USD	change 2019/2018	mln. USD	change 2020/2019
Americas	112 093	116 914	4 %	124 556	7 %
Europe	62 420	60 288	-3 %	68 640	14 %
Greater China	51 942	43 678	-16 %	40 308	-8 %
Japan	21 733	21 506	-1 %	21 418	- %
Rest of Asia Pacific	17 407	17 788	2 %	19 593	10 %
Total net sales	265 595	260 174	-2 %	274 515	6 %

Source: made by author based on Apple Inc., 2020, p. 21

Figure 4 illustrates the structure of sales by region in 2020. The Americas region contributed almost half of the sales (45,4 %). A quarter of net sales (25 %) was generated by the European region.

Figure 4 The structure of net sales (by the geographical segment), Apple Inc., 2020



Source: made by author based on Apple Inc., 2020, p. 21

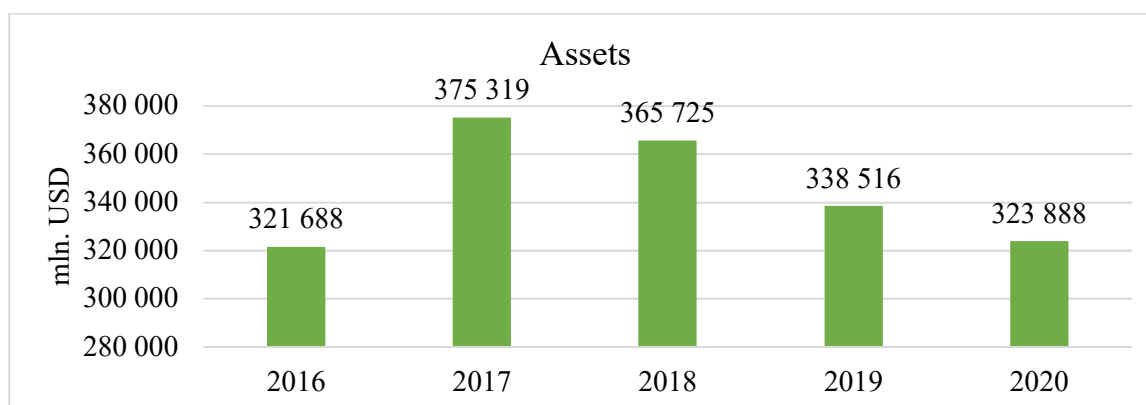
4.2 Financial analysis of the company

To make a comprehensive view of the financial health of the company, a financial analysis is processed. The main data source are balance sheets and statements of operations of the Apple Inc. from the Annual reports 2016-2020.

4.2.1 Balance sheet analysis

The company's total assets were 323 888 million USD in 2020 (dynamics of the total assets is presented by the Figure 5), of which more than half were non-current assets. The part of the balance sheets – information about the company's assets is given in the table 4. Horizontal and vertical analysis will provide a deeper look at the structure and dynamics of changes in the company's assets.

Figure 5 Total assets of the Apple Inc., 2016-2020 (mln. USD)



Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)

In the company's balance sheet, assets are divided into two main groups: current assets and non-current assets. A particularly declining trend is evident in the monitoring of non-currents assets, which amounted to 180 175 million USD in 2020 compared to 214 817 million USD in 2016. It is difficult to state, what caused the decrease in the asset of the enterprise – perhaps this was given by the decision of the management, by the depreciation of the assets etc. The analysis of the annual report of Apple Inc. did not provide an answer to this question. The decline is particularly noticeable for marketable securities, while other asset items were mostly increased.

Table 4 Assets of the Apple Inc., 2016-2020 (mln. USD)

Assets	2016	2017	2018	2019	2020
Current assets	106 871	128 645	131 339	162 819	143 713
Cash and cash equivalents	20 484	20 289	25 913	48 844	38 016
Marketable securities	46 671	53 892	40 388	51 713	52 927
Accounts receivable, net	15 756	17 874	23 186	22 926	16 120
Inventories	2 132	4 855	3 956	4 106	4 061
Vendor non/trade receivables	13 545	17 799	25 809	22 878	21 325
Other current assets	8 283	13 936	12 087	12 352	11 264
Non-current assets	214 817	246 674	234 386	175 697	180 175
Marketable securities	170 430	194 714	170 799	105 341	100 887
Property, plant and equipment, net	27 010	33 783	41 304	37 378	36 766
Other non-current assets	17 377	18 177	22 283	32 978	42 522
Total assets	321 688	375 319	365 725	338 516	323 888

Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)

The structure of assets can be assessed by calculating the share of individual asset items in the company's total assets (see Table 5). Despite the decline in marketable securities, their share still remains the most significant in asset structure (31 % in 2020).

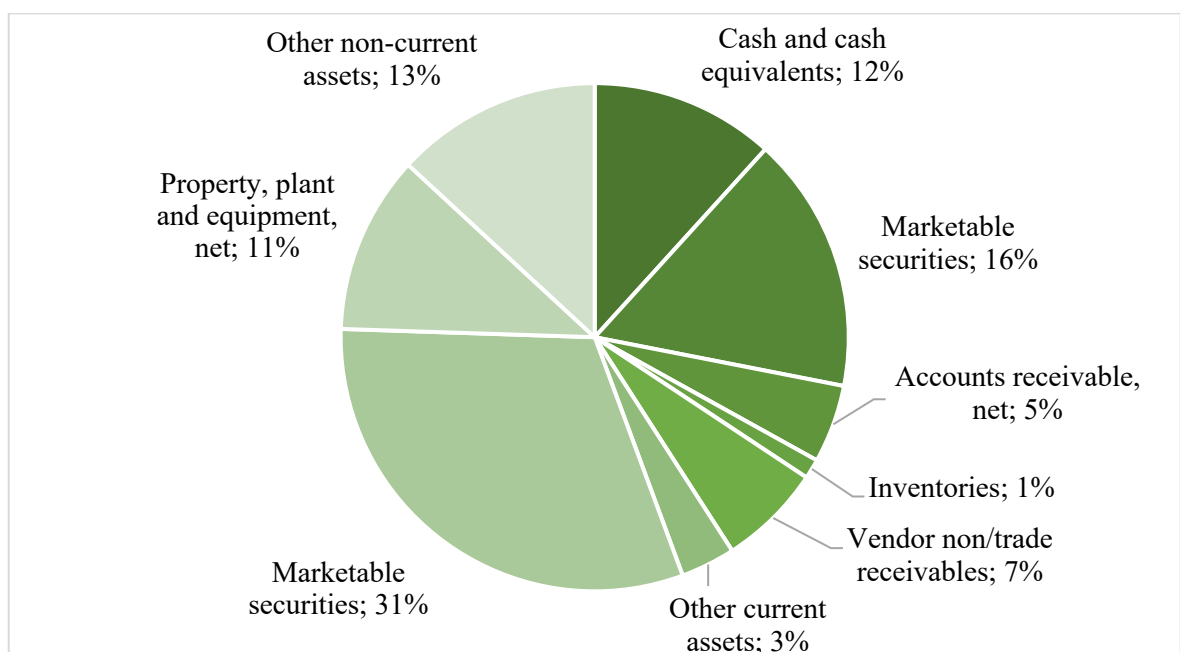
Table 5 Vertical analysis of the assets of the Apple Inc., 2016-2020

Assets	2016	2017	2018	2019	2020
Current assets	33 %	34 %	36 %	48 %	44 %
Cash and cash equivalents	6 %	5 %	7 %	14 %	12 %
Marketable securities	15 %	14 %	11 %	15 %	16 %
Accounts receivable, net	5 %	5 %	6 %	7 %	5 %
Inventories	1 %	1 %	1 %	1 %	1 %
Vendor non/trade receivables	4 %	5 %	7 %	7 %	7 %
Other current assets	3 %	4 %	3 %	4 %	3 %
Non-current assets	67 %	66 %	64 %	52 %	56 %
Marketable securities	53 %	52 %	47 %	31 %	31 %
Property, plant and equipment, net	8 %	9 %	1 %	11 %	11 %
Other non-current assets	5 %	5 %	6 %	10 %	13 %
Total assets	100 %	100 %	100 %	100 %	100 %

Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)

The structure of assets in 2020 is also shown with the help of Figure 6.

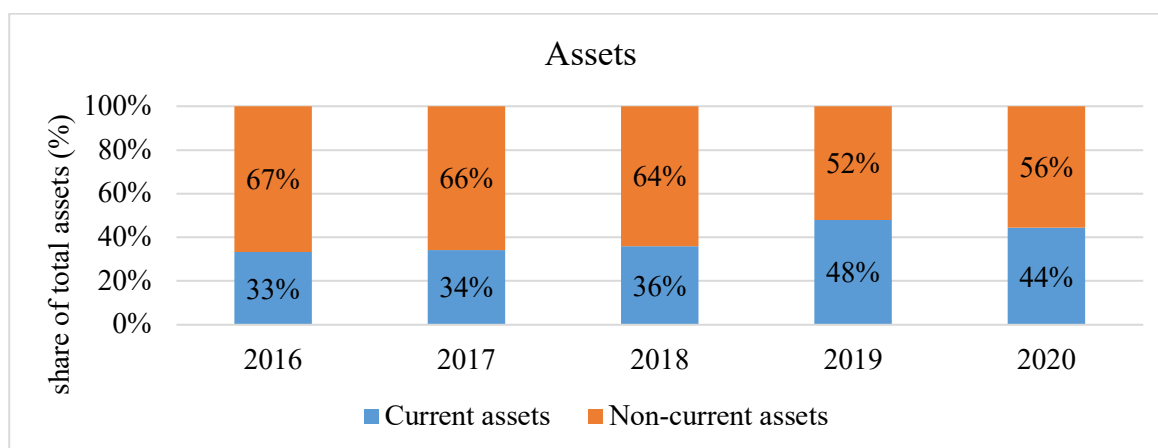
Figure 6 The assets of the Apple Inc. in 2020 (share on the total assets, %)



Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)

It is obvious that the structure of assets, in terms of their difference between current and non-current (Figure 7), is getting flatter: in 2016, for example, their ratio was 33% : 67%, in 2020 – already 44% : 56%. These changes can be evaluated positively, but it is also important to look at the structure of liabilities.

Figure 7 Current and non-current assets of the Apple Inc., 2015-2020 (mln. USD)



Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)

Another area of asset analysis is also horizontal analysis, which helps quantify the dynamics of change. Appendix A shows the calculated absolute changes in asset items. Table 6 shows the percentage year-on-year change.

The highest increase in total assets occurred in 2017 (+ 17% compared to 2016), which can be associated with the introduction of new iPhone models, increasing inventories, increasing production capacity and purchasing new equipment and other assets. In 2017, current assets increased by 20% year-on-year, non-current assets by 15%. This was the only case of a significant increase in assets during the period under review. It is also worth mentioning the significant increase in current assets (+ 24% year-on-year) in 2019, which was caused by an increase in cash and cash equivalents (+ 88%) at the expense of the sale of part of marketable securities (-38%).

The overall trend of the last years of the observed period is declining, which can be evaluated negatively by investors. However, the decline in assets is even and slow. The second part of the company's balance sheet consists of shareholders' equity and liabilities, which are further divided into current and non-current liabilities. Overview of data from the balance sheet of Apple Inc. in the period 2016-2020 is shown in Table 7.

Table 6 Horizontal analysis of the assets of the Apple Inc. (changes in %), 2016-2020

Assets	2016	2017	2018	2019	2020
Current assests	-	20 %	2 %	24 %	-12 %
Cash and cash equivalents	-	-1 %	28 %	88 %	-22 %
Marketable securities	-	15 %	-25 %	28 %	2 %
Accounts receivable, net	-	13 %	30 %	-1 %	-30 %
Inventories	-	128 %	-19 %	4 %	-1 %
Vendor non/trade receivables	-	31 %	45 %	-11 %	-7 %
Other current assets	-	68 %	-13 %	2 %	-9 %
Non-current assets	-	15 %	-5 %	-25 %	3 %
Marketable securities	-	14 %	-12 %	-38 %	-4 %
Property, plant and equipment, net	-	25 %	22 %	-10 %	-2 %
Other non-current assets	-	5 %	23 %	48 %	29 %
Total assets	-	17 %	-3 %	-7 %	-4 %

Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)

Table 7 Shareholders' ekvity and liabilities of the Apple Inc., 2016-2020 (mln. USD)

Shareholders' equity and liabilities	2016	2017	2018	2019	2020
Total liabilities	193 437	241 272	258 578	248 028	258 549
Current liabilities	79 006	100 814	116 866	105 718	105 392
accounts payable	37 294	49 049	55 888	46 236	42 296
other current liabilities	22 027	25 744	32 687	37 720	42 684
deferred revenue	8 080	7 548	7 543	5 522	6 643
commercial paper	8 105	11 977	11 964	5 980	4 996
term debt	3 500	6 496	8 784	10 260	8 773
Non-current liabilities	114 431	140 458	141 712	142 310	153 157
term debt	78 357	100 043	93 735	91 807	98 667
other non-current liabilities	36 074	40 415	47 977	50 503	54 490
Total shareholders' equity	128 249	134 047	107 147	90 488	65 339
common stock and additional paid-in capital	31 251	35 867	40 201	45 174	50 779
Retained earnings	96 364	98 330	70 400	45 898	14 996
Accumulated other comprehensive income/loss	634	-150	-3 454	-584	-406
Total liabilities and shareholders' equity	321 686	375 319	365 725	338 516	323 888

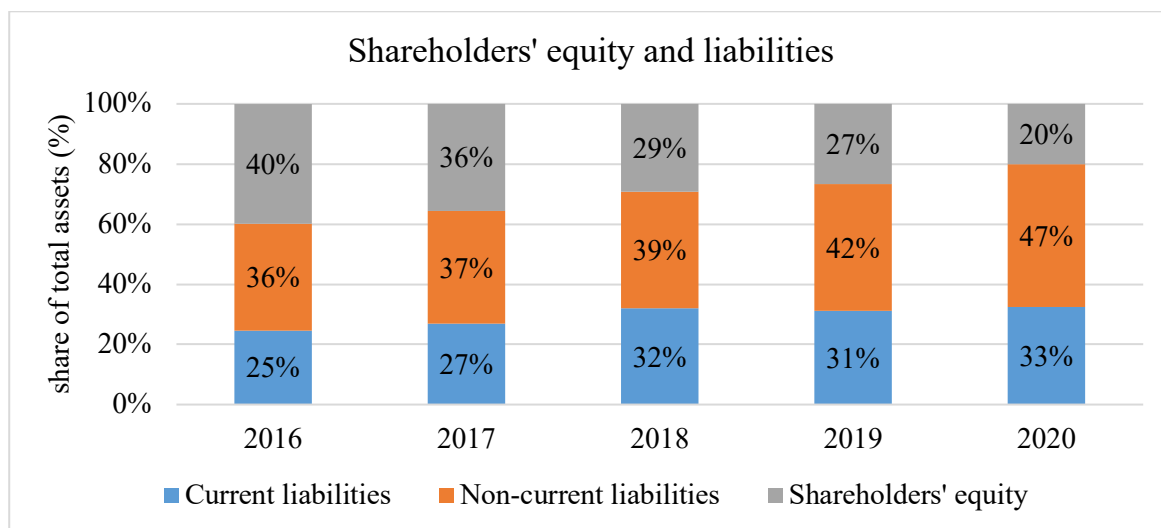
Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)

The value of total liabilities is equal to the value of total assets, their development has already been shown in the graph. Loss of total assets means a decrease in the company's total assets. It is more interesting to look at the structure of liabilities in terms of individual items.

Figure 8 illustrates the structure of the company's liabilities in individual years (it is assumed that total liabilities = total assets = 100%). The most significant change is the increase in the share of non-current liabilities (36 % in 2016 and already 47 % in 2020). The positive fact is that, the share of current liabilities is increasing (25 % in 2016, 33 % in 2020), which covers the growing share of the company's current assets.

Shareholders' equity is important for investor because it presents the company's net worth, which is significant to consider in a stock. During the period under review, a halving of shareholders' equity is evident (40 % of total assets in 2016 and 20 % in 2020). To assess whether the decline in shareholders' equity is a real threat to investors, it is necessary to take into account other factors (especially ROE), which will be done in the next chapters of this thesis.

Figure 8 Shareholders' equity, current and non-current liabilities of the Apple Inc., 2015-2020 (mln. USD)



Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)

A detailed overview of the results of the vertical analysis of liabilities is given in Table 8.

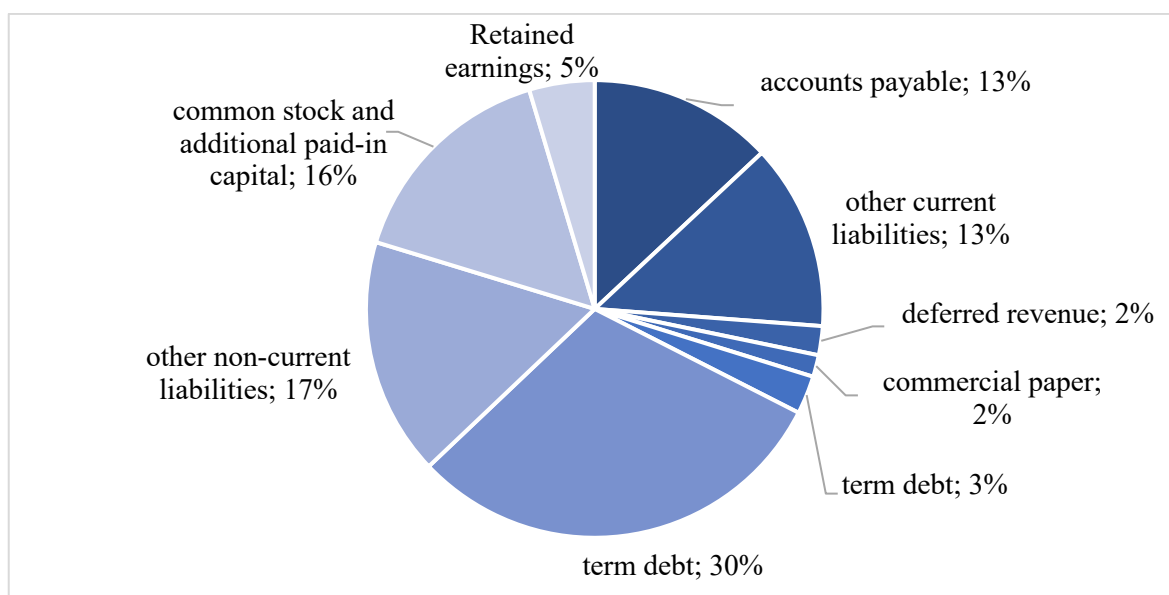
Table 8 Vertical analysis of the shareholders' equity and liabilities of the Apple Inc., 2016-2020

Shareholders' equity and liabilities	2016	2017	2018	2019	2020
Total liabilities	60 %	64 %	71 %	73 %	80 %
Current liabilities	25 %	27 %	32 %	31 %	33 %
accounts payable	12 %	13 %	15 %	14 %	13 %
other current liabilities	7 %	7 %	9 %	11 %	13 %
deferred revenue	3 %	2 %	2 %	2 %	2 %
commercial paper	3 %	3 %	3 %	2 %	2 %
term debt	1 %	2 %	2 %	3 %	3 %
Non-current liabilities	36 %	37 %	39 %	42 %	47 %
term debt	24 %	27 %	26 %	27 %	30 %
other non-current liabilities	11 %	11 %	13 %	15 %	17 %
Total shareholders' equity	40 %	36 %	29 %	27 %	20 %
common stock and additional paid-in capital	10 %	10 %	11 %	13 %	16 %
Retained earnings	30 %	26 %	19 %	14 %	5 %
Accumulated other comprehensive income/loss	0 %	0 %	-1 %	0 %	0 %
Total liabilities and shareholders' equity	100 %	100 %	100 %	100 %	100 %

Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)

Figure 9 illustrates the structure of liabilities in the last observed year – in 2020.

Figure 9 The shareholders' equity and liabilities of the Apple Inc. in 2020 (share on the total, %)



Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)

The dynamics of change are evidenced by the results of horizontal analysis. Absolute changes in asset items are shown in Appendix A. Percentage changes – see Table 10. It is important to compare the two indicators – absolute and percentage changes, because sometimes a high change in percentage does not mean a significant change in the value of liabilities. An example is the -2203% decrease in “accumulated other comprehensive income / loss” in 2018, which in fact represents less than 1% of total liabilities. Significant decrease was observed in case of retained earnings. During the period under review, the value of this item decreased from 96 354 million USD in 2016 to 14 996 million USD in 2020.

Changes of these items are connected with the adopting of the FASB ASU No. 2017-12, Derivatives and Hedging (Topic 815): Targeted Improvements to Accounting for Hedging Activities. After this step, the company recorded an increase in accumulated other comprehensive income/loss and decrease in retained earnings in the last two years (Apple Inc., 2020, p. 36).

Table 9 Horizontal analysis of the shareholders' equity and liabilities of the Apple Inc. (changes in %), 2016-2020

Shareholders' equity and liabilities	2016	2017	2018	2019	2020
Total liabilities	-	25 %	7 %	-4 %	4 %
Current liabilities	-	28 %	16 %	-10 %	0 %
accounts payable	-	32 %	14 %	-17 %	-9 %
other current liabilities	-	17 %	27 %	15 %	13 %
deferred revenue	-	-7 %	0 %	-27 %	20 %
commercial paper	-	48 %	0 %	-50 %	-16 %
term debt	-	86 %	35 %	17 %	-14 %
Non-current liabilities	-	23 %	1 %	0 %	8 %
term debt	-	28 %	-6 %	-2 %	7 %
other non-current liabilities	-	12 %	19 %	5 %	8 %
Total shareholders' equity	-	5 %	-20 %	-16 %	-28 %
common stock and additional paid-in capital	-	15 %	12 %	12 %	12 %
Retained earnings	-	2 %	-28 %	-35 %	-67 %
Accumulated other comprehensive income/loss	-	-124 %	-2203 %	83 %	30 %
Total liabilities and shareholders' equity	-	100 %	100 %	100 %	100 %

Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)

4.2.2 Income statement analysis

The income statement (table 10) shows the profit of the Apple Inc. over a period of 2016-2020. Overall, net income growth was interrupted in 2019, which became less successful for the company. In 2020, net income increased slightly to 57 411 millions USD. The development of net income is illustrated by the figure 10.

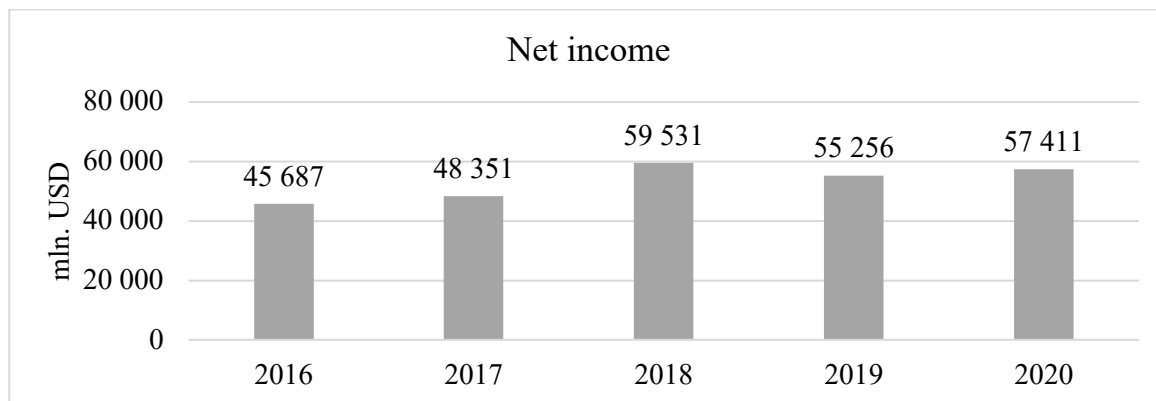
Table 10 Income statement of the Apple Inc. (mln. USD), 2016-2020

	2016	2017	2018	2019	2020
Net product sales	131 376	141 048	225 847	213 883	220 747
Net services sales	84 263	88 186	39 748	46 291	53 768
Total net sales	215 639	229 234	265 595	260 174	274 515
Total cost of sales	131 376	141 048	163 756	161 782	169 559
<i>Gross margin</i>	<i>84 263</i>	<i>88 186</i>	<i>101 839</i>	<i>98 392</i>	<i>104 956</i>
Operating expenses:					
Research and development	10 045	11 581	14 236	16 217	18 752
Selling, general and administrative	14 194	15 261	16 705	18 245	19 916
Total operating expenses	24 239	26 842	30 941	34 462	38 668
Operating income	60 024	61 344	70 898	63 930	66 288
Other income/(expense), net	1 348	2 745	2 005	1 807	803
Income before provision for income taxes	61 372	64 089	72 903	65 737	67 091
Provision for income taxes	15 685	15 738	13 372	10 481	9 680
Net income	45 687	48 351	59 531	55 256	57 411

Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)

Despite the company's growth in profits in 2018, Apple was no longer the most profitable company in the world – this title has passed to the oil company Saudi Aramco in Saudi Arabia. At the end of 2018, the Arab competitor's profit reached 111 billion USD (Shmyrova, 2019), while Apple's profit was only 59,53 billion USD (Apple Inc., 2021). English-language tech media agree that with such a gap, it will not be easy for Apple to return to the first line of the ranking, if at all possible (Shmyrova, 2019). However, in 2020, Apple Inc. returned to first place in the rating with 57,5 billion USD in profit, while Saudi Aramco was in second place with 49,27 billion USD in profit (Statista, 2021). From the point of view of the investor and the value of Apple's shares, this is a positive trend.

Figure 10 Net income of the Apple Inc. (mln. USD), 2016-2020



Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)

Based on the analysis of the Apple product portfolio in Chapter 4.1.2 it can be stated, that the decline in net income in 2019 can be linked to the decline in iPhone sales (14% year-on-year decline in 2019), which was not offset by growth in sales of wearables, home and accessories. In 2020, the company's net income increased slightly due to a slowdown in the decline in iPhone sales, an increase in Mac sales. Growth of the sales in Europe and in the rest of Asia Pacific also contributed to the increase in net sales of Apple Inc. in 2020.

The recession is due to the fact that users were waiting for the release of new models, and it was delayed due to the COVID-19 coronavirus pandemic. Apple CEO Tim Cook says interest in the iPhone 5G line and other new devices from the company has been “*overwhelmingly positive.*” (Tadvisor, 2021).

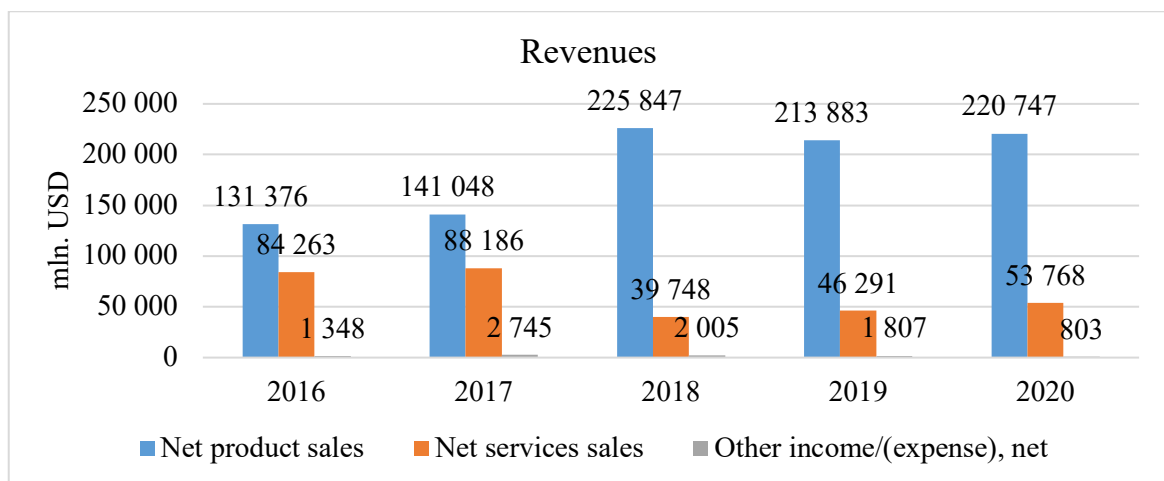
Apple is also strengthening its position in terms of smartwatch sales, according to analysts' estimates. More than one third of sales of this products in the world in 2020 came from Apple (33,9 %). Apple's significant competitor in this market is Huawei, with a 26% share of the global smartwatch market (Tadvisor, 2021).

In early October 2021, it became known that Apple earns more from video games than other companies in the world, although it has not released a single game itself. In 2020, sales of games and content in them in the App Store reached about 45 billion USD by the end of 2020, with most share of them coming from China market. The share of purchases in the United States was 26 %. In total, in 2020, Apple earned 13,5 billion USD from the sale of games, which corresponds to 5 % of the corporation's total turnover of 275 billion USD.

For comparison: iPhone sales account for about 50% of the company's revenue. Apple makes twice in this market, first with a commission from developers who pay to download games from the App Store and then from gamers who download them. In contrast, Nintendo, Microsoft, Activision, and Sony all sell games at a higher price, but end up making less money (Higgins, 2021).

The results of the vertical and horizontal income statement analysis are set out in Annex B. First of all, it is necessary to focus on the revenue side of the income statement analysis. Dynamics of the revenues is shown by the Figure 11. Sales became record-breaking in 2018 – although revenues from the sale of services decreased in 2018, the company got 225 847 mln. USD from the sales of products.

Figure 11 Revenues of the Apple Inc. (mln. USD), 2016-2020

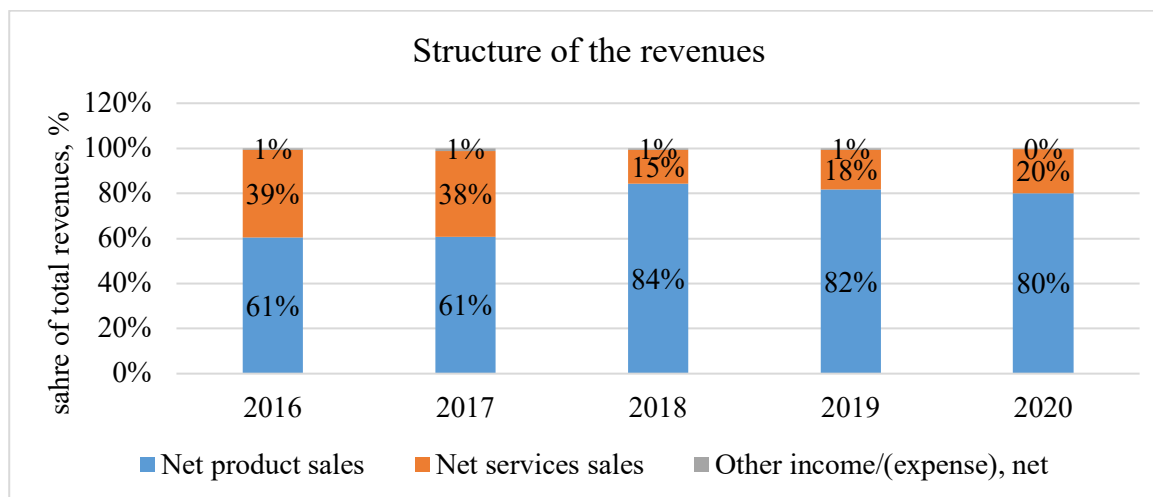


Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)

Despite the growth in revenues in 2018, the company's shares fell by 7 % after the publication of reports, and the market capitalization of the Apple Inc. fell by 70 billion USD and was below 1 trillion USD (Tadviser, 2021). At a conference dedicated to the publication of annual reports, Apple CFO Luca Maestri said that starting from the first quarter of 2019, the company will stop disclosing the number of smartphones, computers and tablets sold. This information, according to the top manager, does not always reflect the main strength of the business (Quayle, 2018). This statement was one of the reasons for the fall in Apple's quotes, as investors are clearly not happy with the company's decision to hide the sale of devices (Tadviser, 2021).

The structure of revenues is presented with the help of Figure 12. The share of sales of products is the highest – In recent years, thanks to the increase in sales of products, it has increased to about 80 %. The share of revenues from the sale of services is currently about a fifth (in 2020).

Figure 12 Revenues of the Apple Inc. (share of the total revenues, %), 2016-2020



Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)

Year-on-year changes in revenues are shown in Table 10. The largest decrease in sales of services in 2018 was 54.9%. In contrast, sales of products increased by 60.1%. In 2019-2020, sales of services began to grow. It is clear that the growth in sales of services did not help increase net income in 2019. Changes in sales of products and services are related to the introduction of new production models or the introduction of Apple.

Table 11 Revenues of the Apple Inc. (year-on-year changes, %), 2016-2020

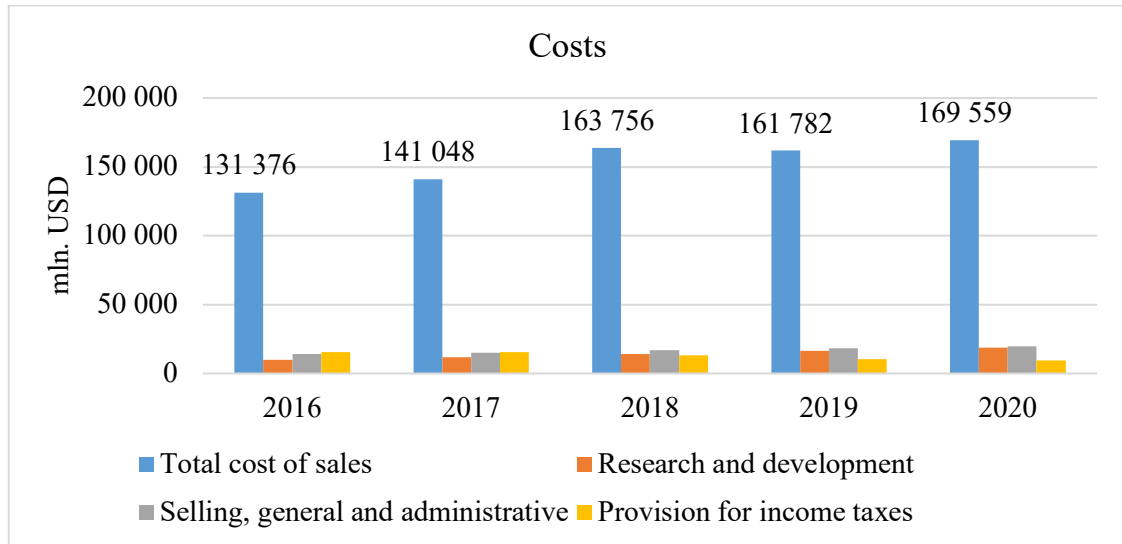
Horizontal analysis, changes in %	2016	2017	2018	2019	2020
Net product sales	-	7,4 %	60,1 %	-5,3 %	3,2 %
Net services sales	-	4,7 %	-54,9 %	16,5 %	16,2 %
Total net sales	-	6,3 %	15,9 %	-2,0 %	5,5 %
Other income/(expense), net	-	103,6 %	-27,0 %	-9,9 %	-55,6 %
Income before provision for income taxes	-	4,4 %	13,8 %	-9,8 %	2,1 %
Net income	-	5,8 %	23,1 %	-7,2 %	3,9 %

Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)

It is also useful to look at the cost structure of the company. The dynamics of costs in 2016-2020 is illustrated in Figure 13. There is a significant increase in the most important item of costs – total costs of sales. It is clear that the most significant share of costs is related

to the sale of products. In 2019, when sales of products decreased, costs also decreased. The company invests a lot in research and development, which is important in terms of its strategy. In 2020, the costs of research and development were 18 752 million USD.

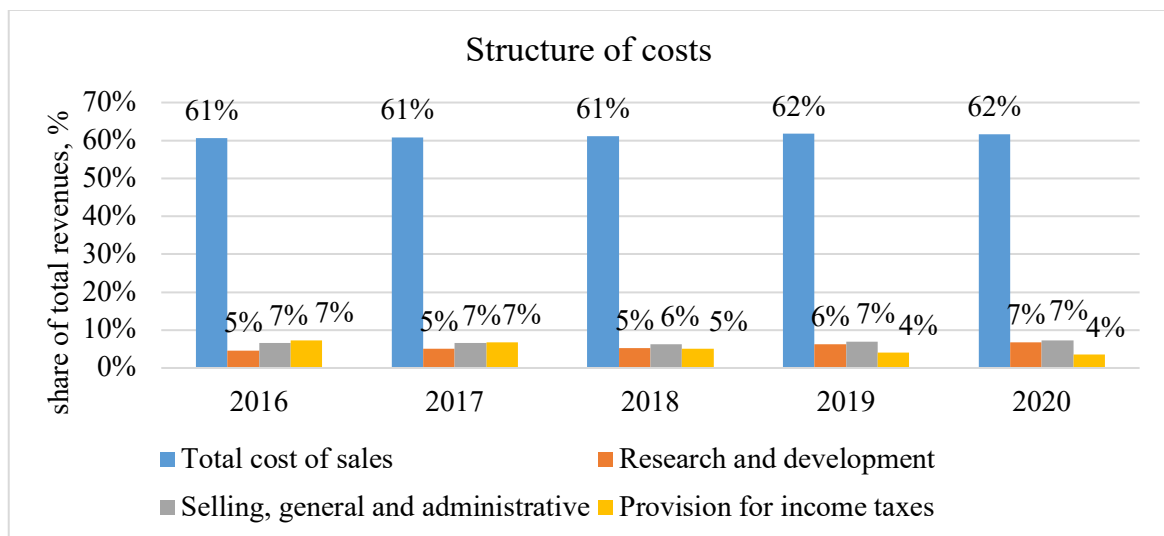
Figure 13 Costs of the Apple Inc. (mln. USD), 2016-2020



Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)

The results of the vertical analysis show that the total cost of sales accounts for 61-62% of total sales. Other cost items account for up to 7 % of total sales. The structure remained almost unchanged in the period under review.

Figure 14 Structure of costs of the Apple Inc. (share of total revenues, %), 2016-2020



Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)

Table 12 shows calculated percentage changes in cost items. The stable growth of all the most significant costs is becoming a threat due to the less stable growth of the company's sales.

Table 12 Costs of the Apple Inc. (year-on-year changes, %), 2016-2020

Horizontal analysis, changes in %	2016	2017	2018	2019	2020
Total cost of sales	-	7,4 %	16,1 %	-1,2 %	4,8 %
Research and development	-	15,3 %	22,9 %	13,9 %	15,6 %
Selling, general and administrative	-	7,5 %	9,5 %	9,2 %	9,2 %
Total operating expenses	-	10,7 %	15,3 %	11,4 %	12,2 %
Provision for income taxes	-	0,3 %	-15,0 %	-21,6 %	-7,6 %

Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)

4.2.3 Analysis of ratios

According to Manoppo (2015, p. 697), profitability ratios (ROA, ROE, ROS) have a significant influence on stock price. Profitability ratios also enter into stock evaluation models. It is therefore important to evaluate these indicators when analyzing Apple Inc. ROA, ROE and ROS calculation for Apple Inc. in the period 2016-2020 is shown in Table 13.

Table 13 Profitability ratios of the Apple Inc., 2016-2020

	2016	2017	2018	2019	2020
ROA	19,1 %	17,1 %	19,9 %	19,4 %	20,7 %
ROE	35,6 %	36,1 %	55,6 %	61,1 %	87,9 %
ROS	28,3 %	27,6 %	27,2 %	25,1 %	24,4 %

Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)

In terms of indicators of the return on assets (ROA), it is evident that during the years 2016 to 2020, the development of this indicator increased from 19,1 % to 20,7 %. This has been a positive development and achieving such an indicator is a success for the company. This indicator was definitely influenced by the decline in the company's assets found in the balance sheet analysis.

The ROE indicator measures the efficiency with which a company uses the owners' capital. It tells us how much net profit per crown of invested capital by a shareholder (owner).

In general, the ROE indicator in the technology sector is higher in the range of about 30 % - 50 % (Damodaran, 2007). In the case of Apple Inc., ROE reached 88 % in 2020, which means above-average return on equity. Higher leverage and increased asset turnover have a significant effect on the increasing value of ROE. A higher value of asset turnover means a more efficient use of assets for their business, which I consider to be a positive aspect. In contrast, increasing leverage (see Table 14) means increasing use of foreign capital.

Table 14 Debt ratio and debt to equity ratio of the Apple Inc., 2016-2020

	2016	2017	2018	2019	2020
Debt ratio	0,6	0,6	0,7	0,7	0,8
Debt to equity ratio	1,5	1,8	2,4	2,7	4,0

Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)

Overall, the development of liquidity since 2016 can be described as very positive without any major fluctuations, except for the year-on-year comparison of 2018 and 2019 (see Figure 15). Here it has had the greatest volatility since 2016. Liquidity ratios (see Table 15) rose and exceeded a recommended level of 1 (Sakevych & Kobyletskii, 2015), so overall, this indicator can be evaluated very positively. The company should keep the value in line with the management strategy.

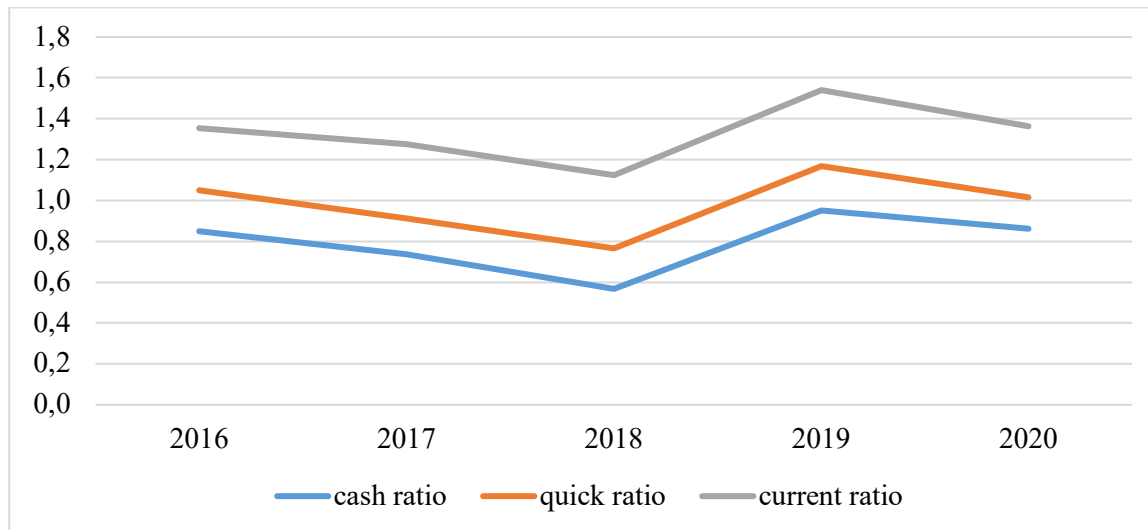
Table 15 Liquidity ratios of the Apple Inc., 2016-2020

	2016	2017	2018	2019	2020
cash ratio	0,8	0,7	0,6	1,0	0,9
quick ratio	1,0	0,9	0,8	1,2	1,0
current ratio	1,4	1,3	1,1	1,5	1,4

Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)

The shape of the liquidity curves (see Figure 15) is very similar. This may indicate that the company has manipulated some non-current asset that affects both liquidities. We can conclude from this that inventories that are not included in cash and quick ratio did not fluctuate significantly. Inventories are thus kept at a very stable level between 2016 and 2020. Such stability in stocks can be described as very positive. This situation goes hand in hand with delivery planning. Given the development of all three types of liquidity, we can conclude that these indicators are affected by cash and its changes. A slight decline can very likely be expected in the coming years, as historical developments suggest this.

Figure 15 Liquidity ratios of the Apple Inc., 2016-2020



Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)

The calculation of activity indicators is performed in Table 16. They are important, because some studies (Jakpar, 2018) proved, that there is a strong relationship between stock return and turnover of assets.

The turnover period of total assets is more than 1 year, but it is clear that the indicator is steadily declining, which is due to a decrease in assets on the one hand, and sales growth on the other. In contrast, the turnover period of inventories strongly increased in 2017, which is related to the increase in production, and since 2018 it has stabilized at the level of approximately 5,3 – 5,6 days. The stable level of this indicator is a very positive fact from the point of management's and investors' views.

It is more advantageous for the company if the creditor days ratio (Liabilities turnover period) is longer than the debtor days ratio (Receivables turnover period), because the company receives money in time to pay its liabilities. The calculations of these indicators (see Table 16) show precisely this situation, which is advantageous for the company. Because the Creditor days ratio greatly exceeds Debtor days ratio, the cash conversion cycle is negative in all monitored years. It follows that the company does not have sufficient capital requirement to meet its liabilities. This is mainly due to the fact, that the company pays its liabilities over a longer period. The company therefore uses the patience of its suppliers, to whom it can pay for a longer period of time.

Table 16 Activity ratios of the Apple Inc., 2016-2020

	2016	2017	2018	2019	2020
Turnover period					
Assets turnover period	533,7	582,4	492,0	465,2	423,5
Debtor days ratio (Receivables turnover period)	26,1	27,7	31,2	31,5	21,1
Inventories turnover period	3,5	7,5	5,3	5,6	5,3
Creditor days ratio (Liabilities turnover period)	320,9	374,4	347,9	340,8	338,1
Turnover ratio					
Asset turnover ratio	0,67	0,62	0,73	0,77	0,85
Receivables turnover ratio	13,8	13,0	11,5	11,4	17,1
Inventory turnover ratio	101,8	47,8	67,6	63,8	67,8
Payables turnover ratio	1,1	1,0	1,0	1,1	1,1
Cash conversion cycle	-291	-339	-311	-304	-312

Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)

4.3 Practical application of the selected stock valuation methods

The next step in the analysis of Apple Inc. is application of the selected stock valuation methods – DDM and P/E ratios.

4.3.1 Construction of the Dividend discount model (DDM)

As the first model to calculate the intrinsic value of Apple Inc. shares, the Gordon's dividend discount model (DDM) is calculated. This model assumes an infinite period of holding the share. A constant growth rate of dividends (g) is assumed. First, I need to find out the input data for this model.

Required rate of return (K_e)

The required rate of return (K_e) is one of the most important inputs for all models that take into account the time value of money. If the analyst chose too high value of this quantity, he would commit a high overvaluation of this stock. Otherwise, if he chose a low required rate of return, he would get a high intrinsic value and would consider, that the share is undervalued. With increasing risk and insufficient liquidity of the analyzed stock, the analyst should reach a higher required level, which would compensate for these negative aspects.

The required rate of return (K_e) is used as a discount factor in determining the present value of future dividends. According to the Capital Asset Pricing Model (CAPM) model, the required rate of return is the sum of the risk-free rate of return (R_f) and the systematic risk premium. The risk-free rate of return (R_f) is usually considered to be the interest rate on government treasury bills. Systematic risk is determined using the beta coefficient (β). The formula for calculating the required rate of return within the CAPM model is as follows:

$$K_e = R_f + \beta(R_m - R_f) \quad (7)$$

K_e – required rate of return,

R_f – risk-free rate of return on government treasury bills,

R_m – expected yield rate from the market stock portfolio,

β – beta coefficient, which determines the systematic risk.

- **Risk-free rate of return on government treasury bills (R_f)**

Models where we try to estimate future cash flows over very long periods (or infinity) use long-term government bond rates that offer a reasonable measure of the risk-free rate of return (Damordan, 2006, p. 83). Currently, the US treasury yield 10 Years is 1,571 % (Finance.Yahoo, 2021). It means, that the risk-free rate from the market stock portfolio is:

$$R_f = 1,571 \%$$

The amount of systematic risk is represented here by the beta factor. The determination of the beta factor is based on historical data on the yield rate of a particular stock and the yield rate produced by a market index. According to analysts, the beta factor of the stock (Beta 5Y Monthly) reaches 1,22 (Finance.Yahoo, 2021). If the beta reaches a value higher than 1, the company appears to be more risky, than the capital market as a whole, and vice versa.

$$\beta = 1,22$$

- **Dividend growth rate (g)**

Maintenance growth model

To calculate the dividend growth rate in 2020, I used the ROE values of 127,12 % and the payout ratio of 16,31 % given on Morningstar.com (2021). The share of retained earnings at the company level in the company's total net profit is equal to 83,69 %:

$$b = 1 - p = 1 - 0,1631 = 0,8369 = 83,69 \%$$

For the final calculation of the dividend growth rate in 2020, we substitute the values into the formula:

$$g_{2020} = 1,2712 * 0,8369 = 1,0639 = 106,39 \%$$

The value of 106,39 % can be considered almost unrealistic, therefore, we use also other methods.

Historical rate of dividend growth

Growth rate calculated from two extreme values of historical dividends:

$$g = \sqrt[t]{\frac{D_M}{D_S}} - 1 \quad (7)$$

g is a rate of dividend growth,

D_M is the younger dividend,

D_S is the oldest dividend,

t is the time difference between the younger and the older dividend.

The development of Apple's dividend payments can be seen in the table 4. The company announced on July 30, 2020 the division of its shares 1: 4. In addition to the 1 share of Apple held, investors will receive 3 more. They will have 4 shares instead of 1, but with a quarter price compared to the price before the split. Therefore, dividends for 2020 will be calculated as:

$$0,77 + 0,82 + 0,82 + 0,205 \cdot 4 = 3,23$$

Table 17 Development of Apple dividend payments, 2015-2020

Year	2015	2016	2017	2018	2019	2020
Q1	0,47	0,52	0,57	0,63	0,73	0,77
Q2	0,52	0,57	0,63	0,73	0,77	0,82
Q3	0,52	0,57	0,63	0,73	0,77	0,82
Q4	0,52	0,57	0,63	0,73	0,77	0,205*4
Dividend	2,03	2,23	2,46	2,82	3,04	3,23

Source: made by the author based on Investor.apple.com (2021)

$$g = \sqrt[5]{\frac{D_{2020}}{D_{2015}}} - 1 = \sqrt[5]{\frac{3,23}{2,03}} - 1 = 0,09734$$

$$g = 9,734 \%$$

Historical Normalized Dividend Growth Rate

Another method can be the Historical Normalized Dividend Growth Rate for the next 5-year period.

$$g_n = \sqrt[t]{\frac{\sqrt[3]{D_b}}{\sqrt[3]{D_v}}} - 1 = \sqrt[t]{\frac{\sqrt[3]{3,23 * 3,04 * 2,82}}{\sqrt[3]{2,03 * 2,23 * 2,46}}} - 1 = 0,1065 = 10,65 \%$$

D_b is the multiple of the three oldest dividends,

D_v is the multiple of the three youngest dividends,

t is the period between these periods.

$$g_n = 10,65 \%$$

For the purposes of calculating the intrinsic value of an Apple Inc. share I will use the value of 10,65 % as the growth rate of dividends, this value best reflects the reality.

- **Expected yield rate from the market stock portfolio (R_m)**

The last variable that enters into the calculation of the required rate of return is the market rate produced by the market index (R_m). Shares of Apple Inc. are traded on the US stock market, so I will consider the market rate of return to be the rate of return of the S&P 500 index, which is considered a standard measure of the performance of the US stock market. In the table 18 we can see the values and percentage changes of this index from 2015 to 2020. All values are at the end of the year (year close).

Table 18 Index S&P 500 (2015-2020)

Year	2015	2016	2017	2018	2019	2020
Value	2043,9	2238,8	2673,6	2506,9	3230,8	3756,07
Change, %	-0,73 %	9,54 %	19,42 %	-6,24 %	28,88 %	16,26 %
Arithmetic mean diameter	11,19 %					
Geometric mean diameter	10,58 %					

Source: made by Macrotrends.net (2021)

The average market rate of return for the S&P 500 index from 2015 to 2020, calculated using the geometric mean, is 10,58 %. I will use this value as a market rate of return.

$$R_m = 10,58 \%$$

Required rate of return (K_e)

Now we have all the necessary values to calculate the required rate of return using the CAPM model:

$$K_e = 1,571 \% + 1,22(10,58 \% - 1,571 \%) = 12,56198 \%$$

$$K_e = 12,56 \%$$

The required rate of return value for Apple Inc. based on the formula at 12,56 %. I will use this value to calculate the intrinsic value of the company's shares.

According to Gordon's dividend discount model, the intrinsic value of an Apple Inc. stock is:

$$V_0 = \frac{3,23 \cdot (1 + 0,1065)}{0,1256 - 0,1065} = 187,00$$

When we compare this value with today's stock price – 152,7 USD (28th October 2021), it can be concluded that the stock is Apple Inc. **undervalued**.

Gordon's model has a number of limitations resulting from the logical and mathematical requirements that it must meet. Damodaran (2011) describes them, for example. It is therefore appropriate to use other models in the analysis.

4.3.2 Construction of the PE ratio model

P/E ratio

To calculate the intrinsic value of a stock using a current P/E model, we first need to calculate the P/E ratio. As default values for this calculation, I will use an earning per share of 3,28 USD (Macrotrends.net, 2021) and a current market price of 152,7 USD as of 28th October 2021.

$$PE \text{ ratio} = 152,7 / 3,28 = 46,55$$

Apple Inc.'s current P/E ratio is 46,55.

Sharpe P/E ratio

Another type of PE ratio is Sharpe P/E ratio. To determine whether an Apple stock is overvalued, undervalued, or properly valued, it is necessary to compare the calculated value of the current P/E ratio with the value of Sharpe P/E ratio. After substituting into the formula Sharpe P/E ratio:

$$\frac{V_0}{E_0} = \frac{p*(1+g)}{k-g} = \frac{0,1631*(1+0,1065)}{0,1256-0,1065} = 9,44$$

If we compare the value of the Sharpe P/E ratio (9,44) with the indicator of the current P/E ratio (46,55), we see that the current P/E ratio significantly exceeds the Sharpe P/E ratio, which indicates the fact that is a given share of Apple Inc. significantly overvalued in the market.

P/BV ratio

To calculate P/BV ratio, I used the current market price of 152,7 USD as of 28th October 2021 and the current book value of equity per share of 3,88 USD (Finance.Yahoo, 2021):

$$\frac{P}{BV} = \frac{152,7}{3,88} = 39,36$$

Sharpe P/BV ratio (P_0/BV_0) can be used to determine whether a stock is undervalued, overvalued or properly valued by comparison with a normal P/BV ratio.

$$P_0/BV_0 = \frac{ROE * p * (1 + g)}{k - g} = \frac{1,2721 * 0,1631 * (1 + 0,1065)}{0,1256 - 0,1065} = 12,00$$

If we compare the value of the Sharpe P/BV ratio (12,00) with the indicator of the current P/BV ratio (39,36), we see that the current P/BV ratio significantly exceeds the Sharpe P/E ratio. It points to the fact, that a given share of Apple Inc. is significantly overvalued in the market.

5 Results and Recommendation

Based on the analysis, the main positive and negative factors affecting the financial situation and the shares value of Apple Inc. can be identified.

Positive factors

- Brand strength, partly justifying the high cost of Apple products. Apple's complex business system facilitates the purchase of not only basic but also non-essential products of the company. Due to this, the service segment is actively developing.
- New smartphones supporting faster 5G communications technology. This could help shape a new technology cycle for smartphone upgrades.
- According to the forecast (Yahoo.Finance.com, 2021), over the next years, total revenues, earnings and earnings per share (EPS) are expected to grow (e.g. year-on-year growth of EPS would be 5,98 % in 2023).
- Friendly policy towards shareholders – dividends and buybacks.
- Stable increase in dividends.
- Positive development and very high ROA and ROE indicators.

Risks

- The company's profit and total success depends on iPhone sales, that makes a half of total Apple's sales.
- High competition in the smartphone market, given the high cost of the iPhone. The problem is especially acute in China, where the majority of the population is still insufficiently able to pay (Kholodenko, 2021).
- With the advent of each new model of smartphones, the opportunities for revolutionary changes in the device as a whole are decreasing, which lengthens the update cycle for smartphones by users.
- High competition from Huawei in the smart watch market, which threatens Apple's position as a leader in this market.

- Management's decision to stop publishing information on the number of products sold since the beginning of 2019, because of this the transparency was reducing and the company's shares fell.
- The company uses the patience of its suppliers, to whom it can pay for a longer period of time (negative Cash conversion cycle, Liabilities turnover period is considerably higher than Receivables turnover period).

Results of the stock valuation based on DDM and PE ratio

The use of the DDM model and models based on the calculation of the P/E ratio (see Table 6), indicates that the shares of Apple Inc. are overvalued in the market.

Table 19 Results of the stock evaluation (Apple Inc.)

Model		Stock evaluation
Intrinsic value based on DDM vs. market value	187 USD > 152,7 USD	undervalued
Sharpe P/E ratio vs. common P/E ratio	9,44 < 46,55	overrated
Sharpe P/BV ratio vs. common P/BV ratio	12,00 < 39,36	overrated

Source: made by the author, based on previous calculations

Overvalued stocks are usually recommended for sale because they are then expected to decline. However, it is needed to keep in mind, that an overvaluation of a stock may be the result of a boom in emotion-based trading, or the impact of illogical decisions that are driven by instinct instead of rational judgment (Kudláček, 2021). This is a typical situation that occurs in the case of trading in shares of well-known large companies. I would recommend a psychological analysis of the market.

Based on the results of the company's analysis and based on the secondary analytical studies it is possible to expect further growth in earnings (MarketWatch, 2021), so it is possible to postpone the sale of shares for some time.

The results of using the DDM and P/E models for the evaluation of a well-known stock well illustrate the situation where it is necessary to apply a comprehensive analysis and use several different approaches and perspectives in making recommendations for investors.

Discussion about using of DDM model and its limitations

Gordon's model is a popular method for its simplicity, but due to its assumptions, it also has a number of disadvantages. It cannot be used, for example, for dynamically growing companies, companies that do not pay dividends. The assumption of a constant required rate of return is difficult to implement due to its construction. At the same time, the model is very sensitive to input data, which can lead to a wide range of final values of individual analysts.

For example, the defining of the expected yield rate from the market stock portfolio (R_m) hides methodological problems:

- what period to choose for the calculation,
- how to calculate average profitability values,
- how to take into account geographical and political affiliation.

S&P 500 index from 2015 to 2020 and calculation of the average rate using the geometric mean were used in this thesis. A change in market, period or average calculation method may change the stock's valuation results. This is a significant limitation to the use of work results.

The same limitations is observed in the calculation of the dividend growth rate (g). There were used three ways to determine this rate: maintenance growth model, historical rate of dividend growth and historical normalized dividend growth rate.

The main advantage of determining the growth rate on the basis of historical data is the simplicity of the calculation, provided that the company pays dividends and that the current and historical values of the dividends are known. On the contrary, the disadvantage is the backward view itself, which does not guarantee the same development in the future. If two dividend values are used, which for whatever reason are extreme unusual values, the growth rate will be distorted at the same time. It is possible to work with this by using averaged values, values adjusted for extremes and other changes of values or directly by changes of the calculation methodology.

During the selected period 2015-2020, no significant change in the amount of dividends of the Apple Inc. was observed, but the historical normalized dividend growth rate provided provided different value ($g_n = 10,65\%$), than historical rate of dividend growth ($g_n = 9,73\%$). Maintenance growth model provided almost unrealistic value of the dividend

growth rate ($g_n = 106,39\%$), because of the very high ROE of Apple (127,1 %). If another analyst uses a different method of calculation, it will fundamentally affect the result of the whole model. Finally, the results of the calculation based on the chosen period was 2015-2020. As with the R_m calculation, a change in the period may affect the final result of the stock valuation.

Despite its disadvantages, however, it is probably the best-known dividend discount model, which serves as the basis for other more sophisticated models.

Discussion about using of PE ratio and its limitations

Calculating PE ratio and modified PE ratio was mathematically simpler and required less input data than the DDM model. As a result, the risk of a significant influence of an input indicator on the final result of the calculation of the intrinsic value of the share has decreased.

Nevertheless, there are some limitations in the use of the results of the modified PE ratio models, that are mainly related to the same problems in the DDM calculations. It concerns to the Sharpe PE ratio, because it uses the dividend growth rate (g) and the required rate of return (k), as does the DDM model (the same indicators are g_n and K_e).

It is also important to point out, that the accuracy the PE ratio depends on the accuracy of calculating earnings per share. It is an accounting value of the company and can be a subject of manipulations. The earnings – one of the basic indicators in the PE ratio formula, depends both on the current situation of the enterprise and on the specifics of accounting.

If we take the current value of earnings, we miss the growth of future cash flows and get an estimate much lower than in reality. On the other hand, corporate earnings are almost as volatile as stocks, and it difficult to predict them. For example, the historical standard deviation of the S&P 500 was 15,2% since 1926 till 2017 (Reuters, 2017).

An even more important problem is connected with the errors, caused by the earning forecasting at turning points in market cycles (Authers, 2019). The 2008 crisis and many other stock market crises are clear examples of this. Since the analyzed period in this work affects the year 2020, known for the coronavirus crisis, errors in forecasts for the future can be expected. This can limit the results of the PE ratio in this thesis.

6 Conclusion

The thesis was devoted to the analysis and comparison of different models for the evaluation of stocks. The well-known company Apple Inc. was chosen for this thesis, on the example of which it was proved that a comprehensive approach and use of different valuation methods and approaches are necessary in the evaluation of shares and the creation of additional recommendations.

The main aims of the thesis were:

- practical application of the selected stock valuation methods (PE ratio, DDM) to estimate the value of the selected company's stocks,
- comparison of differences in the results of the models used.

The hypothesis of the thesis is set out as follows: the evaluation of shares of large well-known companies (such as Apple Inc.) requires a comprehensive analysis and consideration of many different factors that may affect the value of the stock.

The aim of the work was fulfilled through the application of DDM and P/E models and comparison of results. In the calculation process, it was found that the result of the DDM model is highly dependent on the approach chosen to determine the rate of dividend growth. In this work, the dividend growth rate was calculated using three approaches – maintenance growth model, historical rate of dividend growth and historical normalized dividend growth Rate. These three methods gave three different rates of dividend growth. Another factor that affects the result of DDM is the Expected yield rate from the market stock portfolio. It is important which market will be chosen, what method will be used to determine the market rate of return. Calculating P / E ratios was mathematically simpler, but gave the same result as the DDM model: shares of the Apple Inc. are overrated.

Furthermore, the analysis was supplemented by the results of the analysis of the company's product portfolio, which made it possible to determine which products contribute the most to the company's sales and profits. It was found that the company is heavily dependent on iPhone sales, but the company is limited in this area due to the development of competition in the market, technological and social factors. Promising product segments were identified – such as smart watches, games, service sector. The company's emphasis on these segments and the growth of research and development costs are positive factors

influencing the company's development. With the help of these analyzes, conclusions were drawn, supplementing the results of the stock evaluation itself using the DDM and P/E models.

7 References

- ABINA, A. & LEMEA, G., 2019. Capital Market and Performance of Nigeria Economy (1985-2017). *International Journal of Innovative Finance and Economics Research*. SEAH Publications, 7(2), pp. 51-66. ISSN 2360-896X.
- ADRIANOVA, L., 2020. Methodological aspects of fundamental stock analysis. *Financial markets and banks*. Moscow: Ruscience, 1, pp. 38-43. ISSN 2658-3917.
- ALTMAN, M., 2012. *Economic Growth and the High Wage Economy: Choices, Constraints and Opportunities in the Market Economy*. New York: Routledge. 316 p. ISBN 978-0-415-23262-3.
- APPLE INC., 2020. *Annual Report 2020 10-K* [online]. URL: [https://s2.q4cdn.com/470004039/files/doc_financials/2020/ar/_10-K-2020-\(As-Filed\).pdf](https://s2.q4cdn.com/470004039/files/doc_financials/2020/ar/_10-K-2020-(As-Filed).pdf). Accessed 4th October 2021
- AUTHERS, J. (2019). Points Of Return The Dangers Lurking in Stocks. *Bloomberg* [online]. URL: <https://www.bloomberg.com/news/newsletters/2019-07-08/the-stock-market-is-becoming-more-dangerous>. Accessed 10th November 2021.
- BAJARIN, T., 2012. 6 reasons Apple is so successgul. *Tech Land Time* [online]. URL: <https://techland.time.com/2012/05/07/six-reasons-why-apple-is-successful/>. Accessed 4th October 2021
- BETTMAN, J., & SAULT, S. (2009). Fundamental and technical analysis: substitutes or complements? *Accounting & Finance*. Wiley, 49(1), pp. 21-36. doi: 10.1111/j.1467-629X.2008.00277.x
- BOLDEANU, F. & TACHE, I., 2016. The Financial System of the EU and the Capital Markets Union. *European Research Studies*. OAR UM, 9(1), pp. 59-70. URL: <https://www.um.edu.mt/library/oar//handle/123456789/28718>
- BRIGHAM, E. & GAPENSKI, L., 1996. *Financial management: Theory and Practice*. 6th edition. 526 p. Dryden Press. ISBN 978-0-030187087.
- BUSINESS CHECKLIST, 2019. *5 reasons why Apple is so successful* [online]. URL: <https://businesschecklist.com/5-reasons-why-apple-is-so-successful/>. Accessed 4th October 2021

- CAHRUMATHI, B., & SUDHAKAR, S., 2014. Comparing Stock Valuation Models for Indian Bank Stocks. *International Journal of Accounting and Taxation*. Genamics, 2(2), pp. 111-127. ISSN 2372-4986
- CASTCOM, 2021. *Apple – the history of development and success of the company* [online]. URL: <https://www.castcom.ru/publications/history/apple.html>. Accessed 4th October 2021
- ČERNOHORSKÝ, J., & TEPLÝ, P. (2011). *Základy finance*. Prague: Grada. 304 p. ISBN 978-80-247-3669-3.
- CHIBILI, M. (2019). *Basic Management Accounting for the Hospitality Industry*. 2nd edition. Routledge. 380 p. ISBN 978-1-0000-3575-9.
- CHISHOLM, A., 2009. *An Introduction to International Capital Markets*. 2nd edition. West Sussex: John Wiley & Sons. 444 p. ISBN 978-0470758984.
- CHUTKA, J., & VAGNER, L. (2020). Graphic Patterns and How to Use Them to Maximize Trading Earnings. *Advances in Economics, Business and Management Research*. Atlantis Press SARL, 159, pp. 275-278. ISSN 2352-5428.
- CNEWS, 2021. Téma: Apple. *Cnews.cz* [online]. URL: <https://www.cnews.cz/tagy/apple/>. Accessed 4th October 2021
- COHEN, G., KUDRYAVTSEV, A., & SHLOMIT, H. (2011). Stock market analysis in practice: Is it Technical or Fundamental? *Journal of Applied Finance & Banking*. Scienpress Ltd., 1(3), pp. 1-9. ISSN 1792-6599.
- COMPANIESMARKETCAP.COM, 2021. Alphabet Google. *Companies Market Cap* [online]. URL: <https://companiesmarketcap.com/alphabet-google/marketcap/>. Accessed 4th October 2021
- COMPANIESMARKETCAP.COM, 2021. Amazon. *Companies Market Cap* [online]. URL: <https://companiesmarketcap.com/amazon/marketcap/>. Accessed 4th October 2021
- COMPANIESMARKETCAP.COM, 2021. Microsoft. *Companies Market Cap* [online]. URL: <https://companiesmarketcap.com/microsoft/marketcap/>. Accessed 4th October 2021

- DAMODARAN, A., 2006. *Damodaran on valuation: security analysis for investment and corporate finance*. 2nd ed. Hoboken: John Wiley. ISBN 978-0-4717-5121-2.
- DAMODARAN, A. & CORNELL, B., 2014. Tesla: Anatomy of a Run-Up Value Creation or Investor Sentiment? *SSRN*. 24 p. doi: 10.2139/ssrn.2429778
- DAMODARAN, A., 2000. *The Dark Side of Valuation: Firms with no Earnings, no History and no Comparables: Can Amazon.com be valued?* URL: <http://people.stern.nyu.edu/adamodar/pdfiles/papers/HighGrow.pdf>. Accessed 30th October 2020
- DAMODARAN, A., 2007. *Return on Capital (ROC), Return on Invested Capital (ROIC) and Return on Equity (ROE): Measurement and Implications* [online]. URL: <http://people.stern.nyu.edu/adamodar/pdfiles/papers/returnmeasures.pdf>. Accessed 4th October 2021
- DAMODARAN, A., 2013. *Valuation of the week 1: A Tesla Test* [online]. URL: <http://aswathdamodaran.blogspot.com/2013/09/valuation-of-week-1-tesla-test.html>. Accessed 30th October 2020
- DAVISON, S. (2012). *On the Intrinsic Value of Everything*. A&C Black. 150 p. ISBN 978-1-4411-6282-3.
- DILI, 2017. Difference Between Debt Ratio and Debt to Equity Ratio. *Difference Between* [online]. URL: <https://www.differencebetween.com/difference-between-debt-ratio-and-vs-debt-to-equity-ratio/>. Accessed 4th November 2021
- DRAŽENOVIĆ, B. & KUSANOVIĆ, T., 2016. Determinants of capital market in the new member EU countries. *Economic Research-Ekonomska Istraživanja*. Taylor & Francis Group, 29(1), pp. 758-769. doi: 10.1080/1331677X.2016.1197551
- DUSPIVA, P. & KRUML, L., 2014. Yields and Risk of Selected Investment Instruments of the Czech Capital Market. *Trends Economics and Management*. Brno: Brno University of Technology, Faculty of Business and Management, 8(20), pp. 9-21. ISSN 2336-6508.
- DVOŘÁK, P. et al., 2015. *Peněžní ekonomie a bankovníctví*. Prague: Management Press. 424 p. ISBN 978-80-726-1303-8.

- FABIOLA, C., PONNO, E. & NUSANTARA, D., 2020. Primary Market vs. Secondary Market. *SSRN*. New Work: SSRN. doi: 10.2139/ssrn.3523441
- FINACE YAHOO, 2021. *Apple Inc. (AAPL)* [online]. URL: <https://finance.yahoo.com/quote/AAPL?p=AAPL>. Accessed 26th October 2021
- FINANCE.YAHOO, 2021. *US Treasury Bonds Rates* [online]. URL: <https://finance.yahoo.com/bonds>. Accessed 26th October 2021
- FIORILLO, S., 2021. Apple: A Path To Doubling Its Revenue, Dividend Increases And Buybacks Could Make The 2020s Feel Like The 2010s. *Seeking Alpha* [online]. URL: <https://seekingalpha.com/article/4402159-apple-path-to-doubling-revenue-dividend-increases-and-buybacks-make-2020s-feel-like-2010s>. Accessed 4th October 2021
- GLADIŠ, D. (2015). *Akciové investice*. Prague: Grada. ISBN 978-80-247-5375-1.
- GOTTWALD, R., 2012. The Use of Indicators in Modified Historical Model to Estimate the Intrinsic Value of a Stock. *Journal of Competitiveness*. 4(2), pp. 97-110. doi: 10.7441/joc.2012.02.07
- GOTTWALD, R., 2012. The Use of the P/E Ratio to Stock Valuation. *GRANT Journal*. Hradec Králové: Magnanimitas Assn., 31, pp. 21-24. ISSN 1805-0638. URL: <https://www.grantjournal.com/issue/0102/PDF/0102gottwald.pdf>. Accessed 30th October 2020
- GOTTWALD, R., 2012) The Use of Indicators in Modified Historical Model to Estimate the Intrinsic Value of a Stock. *Journal of Competitiveness*. 4(2), pp. 97-110. doi: 10.7441/joc.2012.02.07
- GRAHAM, B., & DODD, D. (2009). *Security analysis: principles and technique*. 6th ed. New York: McGraw-Hill. ISBN 978-0-071-59253-6.
- GRAHAM, B., 2007. *Inteligentní investor*. Prague: Grada. 504 p. ISBN 978-80-247-1792-0.
- HALSEY, R., 2001. Using the Residual-Income Stock Price Valuation Model to Teach and Learn Ratio Analysis. *SSRN*. [online]. 29 p. doi: 10.2139/ssrn.256595
- HIGGINS, T., 2021. Apple Doesn't Make Videogames. But It's the Hottest Player in Gaming. *The Wall Street Journal* [online]. URL:

- <https://www.wsj.com/articles/apple-doesnt-make-videogames-but-its-the-hottest-player-in-gaming-11633147211?mod=djemalertNEWS>. Accessed 4th October 2021
- HOLMAN, R., 2012. *Úvod do ekonomie*. 2nd edition. Prague: C. H. Beck. 192 p. ISBN 978-80-717-9304-5.
- IMAM, SH., BARKER, R. & CLUBB, C., 2008. The Use of Valuation Models by UK Investment Analysts. *European Accounting Review*. Taylor & Francis (Routledge), 17(3), pp. 503-535. doi: 10.1080/09638180802016650
- INVESTOR.APPLE.COM, 2021. *Dividend history* [online]. URL: <https://investor.apple.com/dividend-history/default.aspx>. Accessed 4th October 2021
- IVANOVSKI, Z., NARASANOV, Z., & IVANOVSKA, N., 2018. Performance Evaluation of Stocks' Valuation Models at MSE. *Economic and Regional Studies / Studia Ekonomiczne i Regionalne*. De Gruyter Open Sp. z o.o., 11(2), pp. 7-23. doi: 10.2478/ers-2018-0011.
- JAKPAR, Sh. et al. (2018). Fundamental Analysis VS Technical analysis: The Comparison of Two Analysis in Malaysia Stock Market. *UNIMAS Review of Accounting and Finance*. NIMAS Journal Publication, 2(1), pp. 38-61. doi: 10.33736/uraf.1208.2018
- JUREČKA, V. et al., 2017. *Makroekonomie*. 3rd updated edition. Prague: Grada. 368 p. ISBN 978-80-271-9265-6.
- KHAIRULLIN, D., 2011. *The history of the Apple corporation* [online]. URL: <http://lib.ugsha.ru:8080/bitstream/123456789/4989/1/2011-03-297-299.pdf>. Accessed 4th October 2021
- KHOLODENKO, O., 2018. Multiplikator P/E. Preimushchestva, nedostatki, kak ego ispolzovat'. *BCS Express* [online]. URL: <https://bcs-express.ru/novosti-i-analitika/mul-tiplikator-p-e-preimushchestva-nedostatki-kak-ego-ispol-zovat>. Accessed 25th October 2020
- KHOLODENKO, O., 2021. Analiz emitenta. Apple – o dal'nejshih perspektivh bumag. *BCS-Express* [online]. URL: <https://bcs-express.ru/novosti-i-analitika/analiz-emitenta-apple-o-dal-neishikh-perspektivakh-bumag>. Accessed 4th October 2021
- KING, M., 2018. Due diligence in capital markets. *Journal of Capital Markets Studies*. Emerald, 2(1), pp. 6-8. doi: 10.1108/JCMS-07-2018-014

- KISLINGEROVÁ, E., 2001. Oceňování podniku. 2nd edition. Prague: C. H. Beck, 2001. ISBN 80-7179-529-1.
- KOGUT, B. & SPICER, A., 2002. Capital market development and mass privatization are logical contradictions: lessons from Russia and the Czech Republic. *Industrial and Corporate Change*. Oxford: Oxford University Press, 11(1), pp. 1-37. doi: 10.1093/icc/11.1.1
- KUDLÁČEK, P., 2021. Why can company shares be overvalued? How do you know them and what characterizes an overvalued market? *Finex.cz* [online]. URL: <https://finex.cz/proc-mohou-byt-akcie-spolecnosti-nadhodnocene/>. Accessed 4th October 2021
- KUDRIN, A., 2016. Formation of the investment strategy of a private investor in the stock market. *International scientific review*. Ivanovo: Olimp, 12(22), pp. 50-55. ISSN 254-0798.
- KUPRIYANOVA, L. & SOKOLINSKAYA, N., 2018. Fundamental Analysis of Securities Issuer. *The New Economy World*. Moscow: FinU, 12(1), pp. 114-123. doi: 10.26794/2220-6469-2018-12-1-114-123
- KYNCL, L., 2010. *Veřejnoprávní regulace kapitálového trhu*. (Rigorous work). Brno: Masaryk University.
- LOKTIONOVA, E., 2013. Psychological factors which influence stock market participant's behavior in the process of stock valuation. *Bulletin of the Baikal State University*. Irkutsk: Baikal State University, 2(88), pp. 19-21. ISSN 2500-2759.
- LYTVYENENKO, O. & BAKUMENKO, O., 2018. Economic essence of definition: investment potencial. *Young Scientist*. Publishing house Young Scientist, 10(62), pp. 347-350. ISSN 2313-2167.
- MACROTRENDS.NET, 2021. *S&P 500 Index - Historical Annual Data* [online]. URL: <https://www.macrotrends.net/2526/sp-500-historical->. Accessed 4th October 2021
- MAIORCA, D., 2021. What makes Apple Successful? *Makeuseof.com* [online]. URL: <https://www.makeuseof.com/what-makes-apple-successful/>. Accessed 4th October 2021

- MANOPPO, Carmela P., 2015. The influence of ROA, ROE, ROS, and EPS on stock price. *Jurnal EMBA*. EMBA, 3(4), pp. 691-697. ISSN 2303-1174.
- MARKET WATCH. (2021). Analyst estimates: Apple Inc. *Market Watch* [online]. URL: https://www.marketwatch.com/investing/stock/aapl/analystestimates?mod=mw_quote_tab. Accessed 10th November 2021.
- MENŠÍK, M., 2020. Business and Finance. *Spationomy: Spatial Exploration of Economic Data and Methods of Interdisciplinary Analytics*. Springer Open, pp. 149-172. ISBN 978-3-030-26625-7
- MLÝNEK, J., 2020. Dow Jones index – 8 zajímavostí k nejznámějšímu indexu světa. *LYNK broker online*. [online]. URL: <https://www.lynxbroker.cz/vzdelavani/dow-jones-index/>. Accessed 30th October 2020
- MONEY CONTROL GLOSSARY, 2020. *Stocks*. [online]. e-Eighteen.com Ltd. URL: https://www.moneycontrol.com/glossary/stocks/common-stock_3280.html. Accessed 30th October 2020
- MOOSA, I., & LI, L. (2014). Technical and fundamental trading in the Chinese stock market: Evidence based on time-series and panel data. *Emerging Markets Finance and Trade*. Taylor & Francis Online, 47(1), pp. 23-31. doi: 10.2753/REE1540-496X4701S103
- MORNINGSTAR, 2021. AAPL stocks analysis. *Morningstar.com* [online]. URL: <https://finance.yahoo.com/quote/AAPL/analysis?p=AAPL>. Accessed 26th October 2021
- MORNINGSTAR, 2021. AAPL stocks dividends. *Morningstar.com* [online]. URL: <https://www.morningstar.com/stocks/xnas/aapl/dividends>. Accessed 25th October 2021
- MORNINGSTAR, 2021. AAPL stocks financials. *Morningstar.com* [online]. URL: <https://www.morningstar.com/stocks/xnas/aapl/financials>. Accessed 25th October 2021
- MUSÍLEK, P. (2011). *Trhy cenných papírů*. 2nd edition. Prague: Ekopress. ISBN 978-8-86929-70-5.

- MUSÍLEK, P., 2011. *Trhy cenných papírů*. 2nd edition. Prague: Ekopress. 520 p- ISBN 978-80-86929-70-5.
- NEELY, J. et al. (2010). Out-of-sample equity premium prediction: Fundamental vs. Technical analysis. *Research collection Lee Kong Chian School of Business paper No. 3063*. <https://core.ac.uk/download/pdf/13243654.pdf>
- OBERLERCHNER, T. (2001). Importance of technical and fundamental analysis in the European foreign exchange market. *International Journal of Finance and Economics*. John Wiley & Sons Ltd., 6(1), pp. 81-93. doi: 10.1002/ijfe.145
- PETRUSHEVA, N., & JORDANOSKI, I. (2016). Comparative analysis between the fundamental and technical analysis of stocks. *Journal of Process Management – New Technologies, International*. Belgrade: University Business Academy in Novi Sad, 4(2), pp. 26-31. ISSN: 2334-7449.
- POLOUČEK, S. et al., 2009. *Peníze, abnky, finanční trhy*. Prague: C. H. Beck. 415 p. ISBN 978-80-740-0152-9.
- PRAGUE STOCK EXCHANGE, 2020. Prague Stock Exchange: About us. [online]. URL: <https://www.pse.cz/en/about-us>. Accessed 25th October 2020
- QUAYLY, K., 2018. *Apple Reports Fourth Quarter Results* [online]. URL: <https://www.apple.com/newsroom/2018/11/apple-reports-fourth-quarter-results/>. Accessed 4th October 2021
- RANGANATHAM, M. (2006). *Investment Analysis and Portfolio Management*. Pearson Education India. 540 p. ISBN 978-8-177-58229-1.
- REJNUŠ, O., 2014. *Finanční trhy*. 4th edition. Prague: Grada. 768 p. ISBN 978-80-247-3671-6.
- REJNUŠ, O., 2016. *Finanční trhy: učebnice s programem na generování cvičných textů*. Prague: Grada. ISBN 978-80-247-5871-8.
- REUTERS. (2017). Is the Stock Market More Volatile Now Than Ever Before? *Reuters* [online]. URL: <https://www.reuters.com/article/sponsored/stock-market-more-volatile>. Accessed 10th November 2021.

- REZKOVÁ, J., 2011. Ukazatele likvidity. *Živnostnik.c* [online]. URL: <https://www.zivnostnik.cz/33/ukazatele-likvidity-uniqueidmRRWSbk196FNf8-jVUh4EjlSp8qJDutNjVYfSG2XDKY/>. Accessed 10th November 2021
- REŽŇÁKOVÁ, M., 2007. *Mezinárodní kapitálové trhy – zdroj financování*. Prague: Grada. 222 p. ISBN 978-80-247-1922-1.
- SAKEVYCH, A., & KOBYLETSKII, P. (2015). *An Introduction to the Financial Statement Analysis*. BookRix. ISBN 978-3-7396-2467-9.
- SEDLÁČEK, J. (2011). *Finanční analýza podniku*. 2nd edition. Brno: Computer Press. ISBN 978-80-251-3386-6.
- SHARPE, W., ALEXANDER, G. & BAILEY, J., 2002. *Investments*. 6th edition. PHI. ISBN 978-8120321014.
- SHIM, J. (2013). *Dictionary of Accounting Terms*. Simon and Schuster. 600 p. ISBN 978-1-438-09246-1.
- SHYROVA, V., 2019. Apple is no longer the most profitable company in the world. *CNews* [online]. URL: https://www.cnews.ru/news/top/2019-04-02_apple_perestala_byt_samoj_pribylnoj_kompaniej. Accessed 4th October 2021
- STANKO, A., 2015. The history of Apple company. *VII All - Ukrainian student scientific and technical conference "natural and humanities. current issues"*, pp. 97-98. [online]. URL: http://elartu.tntu.edu.ua/bitstream/123456789/12665/2/Conf_2015v1_Stanko_A-The_history_of_Apple_company_97-98.pdf. Accessed 4th October 2021
- STATISTA, 2021. Leading companies in the world in 2020, by net income. *Statista* [online]. URL: <https://www.statista.com/statistics/269857/most-profitable-companies-worldwide/>. Accessed 14th October 2021
- STOW, J., MCLEAVEY, D., & PINTO, J., 2007. Share Repurchases and Stock Valuation Models. *The Journal of Portfolio Management*. Portfolio Management Research, 35(4). doi: 10.2139/ssrn.1051281
- ŠTÝBR, D., 2011. *Začínáme investovat a obchodovat na kapitálových trzích*. Prague: Grada. 156 p. ISBN 978-80-247-3648-8.

- SURESH, A. (2013). A study on fundamental and technical analysis. *International Journal of Marketing, Financial Services and Management Research*. Indian Research Journals, 2(5), pp. 44-59. ISSN 2277-3622.
- TADVISER, 2021. Financial indicators of Apple. *Tadviser* [online]. URL: https://www.tadviser.ru/index.php/Статья:Финансовые_показатели_Apple. Accessed 4th October 2021
- TADVISOR, 2021. Smartwatches (world market). *Tadvisor* [online]. URL: <https://1url.cz/kKDzD>. Accessed 4th October 2021
- THE PARLIAMENT OF THE CZECH REPUBLIC, 2020. *Act No. 256/2004 Sb., on Capital Market Business, as amended* [online]. Ministry of Finance of The Czech Republic. URL: <https://www.mfcr.cz/cs/legislativa/legislativni-dokumenty/2004/zakon-c-256-2004-sb-3568>. Accessed 30th October 2020
- TOLKACH, A., 2014. Dow theory as a fundamental basis for technical analysis. *Actual problems of the humanities and natural sciences*. Volgograd: Institute of strategic issues, 8(1), pp. 163-165. ISSN 2073-0071.
- TRADINGHOURS.COM, 2021. List of Stock Markets. *TrafinHours.com* [online]. URL: <https://www.tradinghours.com/markets>. Accessed 4th October 2021
- VÁCLAVÍK, L., 2016. Před 40 lety byl založen Apple. Stáli za ním Jobs, Wozniak a smolař Wayne. *CNews* [online]. URL: <https://www.cnews.cz/pred-40-lety-byl-zalozen-apple-stali-za-nim-jobs-wozniak-a-smolar-wayne/>. Accessed 4th October 2021
- VENKATESH, C., & GANESH, L. (2011). Fundamental analysis as a method of share valuation comparison with technical analysis. *International economics and finance journal*. New Delhi: Serials Publ., 6(1), pp. 27-37. ISSN 0973-5259.
- VESELÁ, J., 2003. *Analýza trhu cenných papírů: 2. díl, Fundamentální analýza*. Praha: Oeconomica. 362 p. ISBN 80-245-0506-1.
- VESELÁ, J., 2019. *Investování na kapitálových trzích*. 3rd edition. Prague: Wolters Kluwer. ISBN 978-80-7598-212-4.
- VISHAL, P. & DEEPTI, K., 2018. Fundamental research analysis of real estate sector: A case study of IRB infrastructure and developers Ltd. *MANTHAN: Journal of Commerce and Management*. 5(1), pp. 88-107. doi: 10.17492/manthan.v5i01.13047

- VISHWANATH, G., THOMAS, R., DIAS, Sh., 2018. Comparative Performance Analysis Of P/E And Peg Ratio In Selected Stocks. *IOSR Journal of Economics and Finance*. IOSR, 9(3), pp. 78-88. doi: 10.9790/5933-0903037888
- VOBOROVÁ, N. (2013). *Poměrové ukazatele activity*. [online]. URL: https://hotelovkapodebrady.cz/moment/FR_Financni_rizeni_a_financni_analyza/20_Pomerove_ukazatele_aktivity.pdf. Accessed 8th November 2021
- VOLKOV, D., 2004. *Financial management*. Saint Petersburg University Bulletin. Saint Petersburg: Saint Petersburg University, 8-4(32), pp. 79-98. ISSN 1605-7953.
- VSBROK, 2020. Jak spočítat PE poměr firmy/akcie. *Investiční gramotnost* [online]. URL: <https://www.investicnigramotnost.cz/wipjak-spocitat-pe-pomer/>. Accessed 30th October 2020
- WAFI, A., HASSAN, H., MABROUK, A. (2015). Fundamental analysis models in financial markets-Review study. *Procedia Economics and Finance*. Elsevier, 30, pp. 939-947. doi: 10.1016/S2212-5671(15)01344-1
- WAGNER, J. (2009). *Měření výkonnosti: Jak měřit, vyhodnocovat a využívat informace o podnikové výkonnosti*. Prague: Grada. ISBN 978-80-247-2924-4.
- WANG, A., 2017. *Stock Performance Evaluation of Delivery Companies in China*. Ostrava: VSB. URL: http://dspace5.vsb.cz/bitstream/handle/10084/121849/WAN0042_EKF_B6202_6202R010_2017.pdf?sequence=1&isAllowed=y. Accessed 30th October 2020
- WATSHAM, T., 1993. *International Portfolio Management: A Modern Approach*. London: Longman Group UK, 1993. 440 p. ISBN 978-0-851-21912-7.
- ZARIPOV, R. & EZHOVA, L., 2020. Assessment of investment attractiveness of shares of Russian energy companies. *Economics: Colloquium Journal*. GRCZ, 11(63), pp. 148-150. doi: 10.24411/2520-6990-2020-11753
- ZIMMERMAN, M. (2001). *The Nature of Intrinsic Value*. Rowman & Littlefield Publishers. 288 p. ISBN 978-1-4616-1012-0.

8 Appendix

Appendix A Horizontal analysis of the balance sheet, Apple Inc. (2016-2020, changes, mil. USD)91

Appendix B Vertical and horizontal analysis of the income statement, Apple Inc. (2016-2020)92

Appendix A Horizontal analysis of the balance sheet, Apple Inc. (2016-2020, changes, mil. USD)

Total assets, changes in mil. USD	2016	2017	2018	2019	2020
Current assets	-	21 774	2 694	31 480	-19 106
Cash and cash equivalents	-	-195	5 624	22 931	-10 828
Marketable securities	-	7 221	-13 504	11 325	1 214
Accounts receivable, net	-	2 118	5 312	-260	-6 806
Inventories	-	2 723	-899	150	-45
Vendor non/trade receivables	-	4 254	8 010	-2 931	-1 553
Other current assets	-	5 653	-1 849	265	-1 088
Non-current assets	-	31 857	-12 288	-58 689	4 478
Marketable securities	-	24 284	-23 915	-65 458	-4 454
Property, plant and equipment, net	-	6 773	7 521	-3 926	-612
Other non-current assets	-	800	4 106	10 695	9 544
Total assets	-	53 631	-9 594	-27 209	-14 628

Total shareholders' equity and liabilities, changes in mil. USD	2016	2017	2018	2019	2020
Total liabilities	-	47 835	17 306	-10 550	10 521
Current liabilities	-	21 808	16 052	-11 148	-326
accounts payable	-	11 755	6 839	-9 652	-3 940
other current liabilities	-	3 717	6 943	5 033	4 964
deferred revenue	-	-532	-5	-2 021	1 121
commercial paper	-	3 872	-13	-5 984	-984
term debt	-	2 996	2 288	1 476	-1 487
Non-current liabilities	-	26 027	1 254	598	10 847
term debt	-	21 686	-6 308	-1 928	6 860
other non-current liabilities	-	4 341	7 562	2 526	3 987
Total shareholders' equity	-	5 798	-26 900	-16 659	-25 149
common stock and additional paid-in capital	-	4 616	4 334	4 973	5 605
Retained earnings	-	1 966	-27 930	-24 502	-30 902
Accumulated other comprehensive income/loss	-	-784	-3 304	2 870	178
Total liabilities and shareholders' equity	-	53 633	-9 594	-27 209	-14 628

Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)

Appendix B Vertical and horizontal analysis of the income statement, Apple Inc. (2016-2020)

Vertical analysis, share of total income, %	2016	2017	2018	2019	2020
Net product sales	61 %	61 %	84 %	82 %	80 %
Net services sales	39 %	38 %	15 %	18 %	20 %
Total net sales	99 %	99 %	99 %	99 %	100 %
Total cost of sales	61 %	61 %	61 %	62 %	62 %
<i>Gross margin</i>	39 %	38 %	38 %	38 %	38 %
Operating expenses:					
Research and development	5 %	5 %	5 %	6 %	7 %
Selling, general and administrative	7 %	7 %	6 %	7 %	7 %
Total operating expenses	11 %	12 %	12 %	13 %	14 %
Operating income	28 %	26 %	26 %	24 %	24 %
Other income/(expense), net	1 %	1 %	1 %	1 %	0 %
Income before provision for income taxes	28 %	28 %	27 %	25 %	24 %
Provision for income taxes	7 %	7 %	5 %	4 %	4 %
Net income	21 %	21 %	22 %	21 %	21 %

Horizontal analysis, changes in mil. USD	2016	2017	2018	2019	2020
Net product sales	-	9 672	84 799	-11 964	6 864
Net services sales	-	3 923	-48 438	6 543	7 477
Total net sales	-	13 595	36 361	-5 421	14 341
Total cost of sales	-	9 672	22 708	-1 974	7 777
<i>Gross margin</i>	-	3 923	13 653	-3 447	6 564
Operating expenses:					
Research and development	-	1 536	2 655	1 981	2 535
Selling, general and administrative	-	1 067	1 444	1 540	1 671
Total operating expenses	-	2 603	4 099	3 521	4 206
Operating income	-	1 320	9 554	-6 968	2 358
Other income/(expense), net	-	1 397	-740	-198	-1 004
Income before provision for income taxes	-	2 717	8 814	-7 166	1 354
Provision for income taxes	-	53	-2 366	-2 891	-801
Net income	-	2 664	11 180	-4 275	2 155

Source: own processing, based on the Annual Reports of the Apple Inc. (Investor.apple.com, 2021)