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VALUATION OF THE COMPANY USING THE DISCOUNTED CASH FLOW MODEL

Abstract*: the article considers the process of assessing the value of a company using the discounted cash flow model within the framework of the income approach. The author describes the theoretical foundations of the discounted cash flow model and compares the features of different approaches to this method in the modern literature. The author carries out the detailed company valuation using the discounted cash flow model on the example of the company «X5 Group». The author assessed the value of the company «X5 Group» using the discounted cash flow model. The real example of the company valuation shown in the article is useful for the company for making managerial decisions in the future.*

Keywords*: valuation of the company, income approach, discounted cash flow model, free cash flow to the firm, forecasting future cash flows, expected growth rate, discounting, present value, discount rate, terminal value.*

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ОЦЕНКА СТОИМОСТИ КОМПАНИИ МЕТОДОМ ДИСКОНТИРОВАННЫХ ДЕНЕЖНЫХ ПОТОКОВ

Аннотация*: в статье рассматривается процесс оценки стоимости компании методом дисконтированных денежных потоков в рамках доходного подхода, описываются теоретические основы метода дисконтированных денежных потоков и проводит сравнение особенностей разных подходов к данному методу в современной литературе. Автор подробно проводит оценку стоимости компании методом дисконтированных денежных потоков на примере компании «X5 Group». В работе получена оценка стоимости компании «X5 Group» методом дисконтированных денежных потоков. Показанный в статье реальный пример оценки стоимости компании может быть использован компанией в будущем для принятия управленческих решений.*

Ключевые слова*: оценка стоимости компании, доходный подход, метод дисконтированных денежных потоков, свободный денежный поток компании, прогнозирование будущих денежных потоков, ожидаемый темп роста, дисконтирование, приведенная стоимость, ставка дисконтирования, терминальная стоимость.*

In conditions of market uncertainty, the company's valuation plays a significant role in the company management. The value of a company should be assessed not only in cases of purchase, sale, mergers and acquisitions, liquidation and bankruptcy of a

business, but also for the awareness of owners and managers, since changes in the company value provide information about its financial condition and allow managers to analyze the possible dynamics of development.

In Russian Federation the valuation of the company is carried out in accordance with several regulatory legal acts. The Federal Law of the Russian Federation «On Valuation Activities in the Russian Federation» defines the objects of valuation, establishes basic rules for conducting valuation activities, and sets cases in which a mandatory valuation is required [1]. Recently issued Order No. 200 of the Ministry of Economic Development of the Russian Federation dated April 14, 2022 «On Approval of Federal Valuation Standards and on Amendments to Some Orders of the Ministry of Economic Development of the Russian Federation on Federal Valuation Standards» [2] includes several federal valuation standards, according to which the valuation process should be carried out.

Federal valuation standard No. 5 «Approaches and Methods of Valuation» includes income, comparative and cost approaches of valuation and methods within them. It also provides a general guidance about carrying each of them, including the main stages.

The discounted cash flow model, or the DCF model, which is considered in this article, is a method applied within the framework of the income approach. Federal valuation standard No. 5 defines the income approach as a set of valuation methods which are based on calculating the present value of the expected future cash flows generated from the use of the object of valuation [2]. Thus, within the framework of this approach, income is the main factor determining the value of the object. The more income the object brings, the higher its market value. A valuator, who uses the income approach, firstly analyzes the future incomes, which the object is expected to bring, and then recalculates them into a single sum of the present value [7, p. 108]. This approach is considered to be the most acceptable from the investment point of view, since the buyer does not actually acquire a set of assets that make up the enterprise, but a flow of future incomes that will allow him to pay off the initial investment and receive regular profit. The basic idea behind the deal to buy the company is that the parties are most likely to

come to an agreement on a market price that is equal to the present value of future income [3, p.36]. This is explained by the fact that it is irrational to buy a company for an amount exceeding the present value of future income from it, and correspondingly it is irrational to sell the company at a price below the present value of future income. Thus, with income approach, the company value is determined as the present value of future incomes that are expected to be received during the operation of the company and with of possible further sale of it.

The discounted cash flow model (the DCF model) is a method within the income approach, by which the company value is estimated by recalculating each future income individually to the present value using a discount rate [5, p.139]. The method includes forecasting future incomes and discounting them. The main indicator expressing future incomes, used under this method, are cash flows.

The basic formula of the discounted cash flow model can be represented in the following way (formula 1):

$$PV = CF_0 + \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \cdots + \frac{CF_n}{(1+r)^n} + PVTV \quad (1), \text{ where}$$

PV – the present value of the company;

$CF_{1,2...n}$ – the cash flows in forecasted periods;

n – the number of forecasted periods (from 1 to n);

r – the discount rate;

PVTV – the present value of the terminal value;

Terminal Value is the company value beyond the clearly defined forecast period.

Thus, at the end of the company valuation process using the discounted cash flow model, one value will be obtained – the sum of the present values of future cash flows, which is equal to the value of the company.

This is the general guidance on carrying out a company valuation by the discounted cash flow method. However, in modern literature there are different views on the features of the model construction. I created the comparative table of approaches to the DCF model, which is presented below (Table 1).

Table 1

The comparison of approaches to the discounted cash flow modelling

	Gryaznova A.G., Fedotova M.A., Eskindarov M.A., Tazikhina T.V., Ivanova E.N., Shcherbakova O.N[7, p.107 – 123] Esipov V.E., Makhovikova G.A [5, p. 139 – 156]	Pablo Fernandez [6, p.14 – 21]	Aswath Damodaran [4]
Suggested type of the cash flow used in the model	Free cash flow to equity (FCFE)	Free cash flow to the firm (FCFF)	Free cash flow to the firm (FCFF)
Suggested way of calculating the free cash flow	Adjusted Net Income + Depreciation - Increase in net working capital - Capital expenditures + Increase in long-term liabilities = Free cash flow	EBIT*(1-T) + Depreciation + Increase in fixed assets - Increase in working capital required = Free cash flow	Operating cash flow - Capital expenditures = Free cash flow
Suggested way of determining the free cash flows in the forecasting period	Conducting retrospective analysis of all elements that affect the value of free cash flow. Historical data on each element, starting with revenue, is analyzed, and then the values of each element are separately forecasted. After that, the free cash flow is calculated based on the predicted values of the elements that make it up.	Using the approach of cash budgeting, i.e. forecasting the cash that will be received and the cash that will be paid in each period. Also, it is recommended to conduct and take into account the forecast of the industry's evolution, the forecast of the company's competitive position, and competitive position of the main competitors	It is assumed that free cash flow will increase with certain growth rates. Firstly, the expected growth rate is calculated, and then the future free cash flows are determined by multiplying the value of the previous FCF by this expected growth rate.
Discount rate	Discount rate can be calculated using Capital Asset Pricing Model (CAPM) or the cumulative method, or the combination of these two methods. In cumulative method various factors are taken into account, such as: risk-free rate, the company size, profit quality and profitability, the quality of the company's management, the sources of financing, the	It is recommended to use either weighted average cost of capital (WACC) as a discount rate, or apply adjusted present value (APV). In case of the use of adjusted present value (APV) required return to equity is used as a discount rate, then it is necessary to add the value of the debt's tax	The discount rate should reflect the risk of expected cash flows. Most often weighted average cost of capital (WACC) is used as the discount rate

	factor of diversifications, and factors of other risks	schield to the obtained value of NPV	

Based on Damodaran's methodology, I would like to consider the DCF modeling with various assumptions, in particular, the discount rate will be taken as the key rate of the Bank of Russia. The DCF modelling will be carried out on the example of the company «X5 Group».

«X5 Group» was previously known as «X5 Retail Group», it was renamed in 2021. The company «X5 Group» is one of the leaders of the Russian food retail. In 1995, the first supermarket «Perekrestok» was opened, in 1999 – the first store «Pyaterochka». On May 18, 2006, the two retail chains merged, resulting in appearance of the company «X5 Group». Now the main structural divisions of the Group include shops near the house «Pyaterochka», supermarkets «Perekrestok», hard discounters «Chizhik» and hypermarkets «Karusel». «X5 Group» also has digital businesses such as express delivery from «Pyaterochka» and «Perekrestok», online hypermarket «Vprok.ru Perekrestok», delivery service of goods from online stores from the company's partners «5Post» and online service for the sale of ready-made food «Mnogo lososya». «X5 Group» also has its own financial service «X5 Bank». In 2021 the company launched its media platform «Food.ru».

According to the «Forbes» rating, «X5 Group» is the second largest private company in terms of revenue in Russia in 2021 [13]. «X5 Group» shares are listed on the London Stock Exchange (LSE) and the Moscow Stock Exchange (MCX). The company also issues exchange-traded bonds.

A leading position of the company «X5 Group» on the Russian food retail market is reflected by statistics. The company is the largest player with a market share of 13,2% by the end of 2022 [9]. The main competitor is «Magnit», which has a market share of 10,6% (Figure 1)

Figure 1. 10 leading food retailers of the Russian market in 2022, % of the market [11]

If we look at the company's revenue history, we can see stable growth. In 2022 the revenue of «X5 Group» was 2 605 232 mln rub (Figure 2). Average annual growth rate of revenue is 14,2% [9].

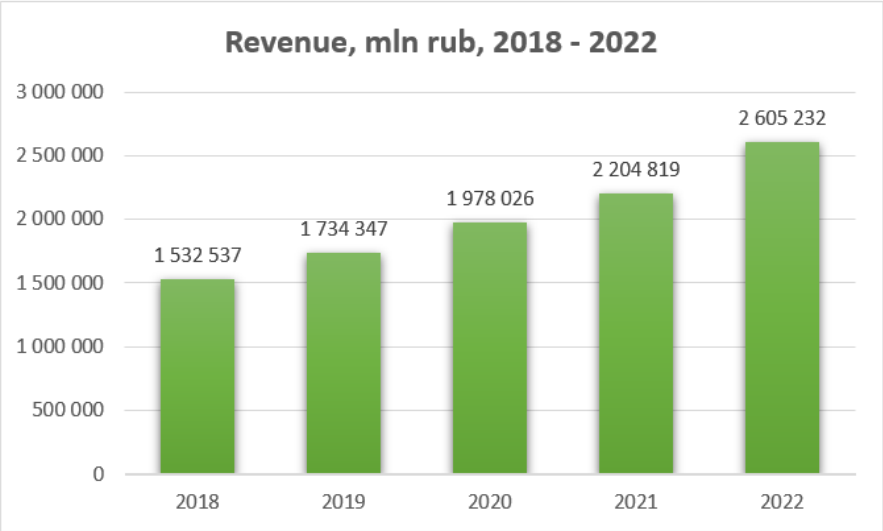

Figure 2. Revenue of the company «X5 Group», mln rub, 2018–2022 [11]

The comparison of the dynamics of revenue of the company «X5 Group» with the growth of the revenue of the market as a whole also provides important information. It can be noticed that the revenue of «X5 Group» is growing faster than the average market's revenue (Figure 3).

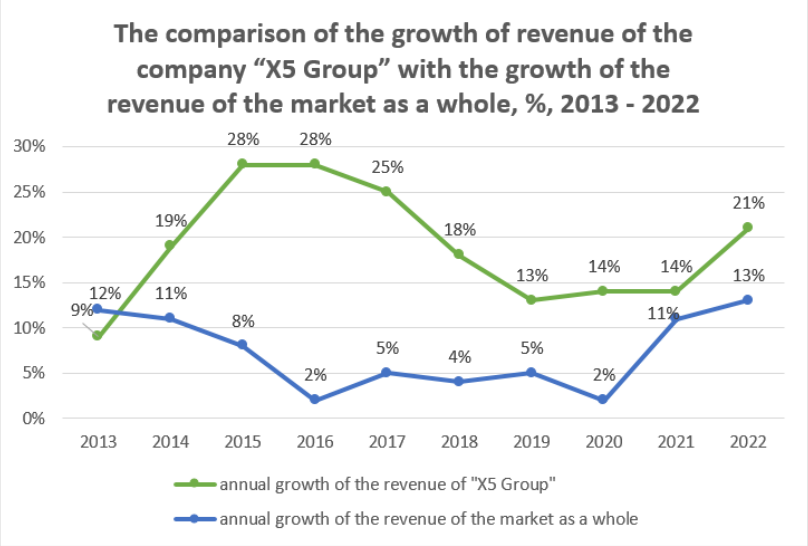

Figure 3. The comparison of the growth of revenue of the company «X5 Group» with the growth of the revenue of the market as a whole, %, 2013–2022 [11]

Net profit of the company had always positive values and, despite the decline in 2019, there was a growing trend during the period 2018–2022. In 2022 net profit of «X5 Group» was 45 188 mln rub. Average annual growth rate of revenue is 16,2% [9].

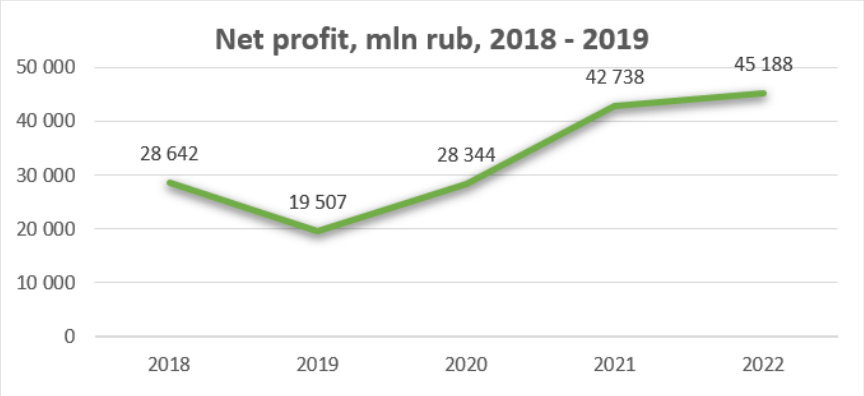

Figure 4. Net profit of the company «X5 Group», mln rub, 2018–2019 [11]

Thus, «X5 Group» is one of the leaders on the Russian food retail market with the biggest market share. The company has chains of shops near the house, supermarkets, hard discounters and hypermarkets. «X5 Group» continues to grow and develop, and has recently launched digital businesses and its own financial service. The company «X5 Group» is quite promising in terms of income generating, and has stable revenue growth. Therefore, income approach of valuation and, more precisely, the discounted cash flow model is quite suitable for assessing the value of the company «X5 Group».

So, further in the article the discounted cash flow modelling on the example of the company «X5 Group» is carried out.

The first step of the DCF modelling includes calculating the free cash flow to the firm at the moment, and forecasting it for the future periods. In order to calculate free cash flow, it is needed to subtract capital expenditures from operating cash flow (formula 2).

$FCF = OCF - Capex$ (2), where

FCF – free cash flow;

OCF – operating cash flow;

Capex – capital expenditures;

In 2022 «X5 Group» had operating cash flow in amount of 220 924 mln rub and capital expenditures amounted to 59 554 mln rub [10]. So, in 2022 free cash flow to the firm for «X5 Group» was (3):

FCF = 220 924 – 59 554= 161 370 mln rub (3).

Now it is necessary to calculate free cash flow in forecasting period, which will be 5 years, since it is the optimal one [8, p. 29]. We will assume that free cash flow will be growing with the certain constant rate, which is equal to g (4):

$g = RR * ROA$ (4), where

g – growth rate;

RR – reinvestment rate;

ROA – return on assets;

Reinvestment rate (RR) will be taken as the ratio of retained earnings growth to net profit (5):

$$RR = \frac{Retained\ earnings_{2022} - Retained\ earnings_{2021}}{Net\ profit_{2022}} \quad (5)$$

In 2022 retained earnings of the company «X5 Group» amounted to 84 125 mln rub, while in 2021 retained earnings were 38 926 mln rub. Net profit of the company in 2022 was equal to 45 188 mln rub [10]. So, RR of «X5 Group» is almost equal to 100% or, in other words, 1 (6):

$$RR = \frac{84\ 125 - 38\ 926}{45\ 188} = 100\% = 1 \quad (6)$$

Such value of reinvestment rate (RR = 1) is caused by the company's decision not to pay dividends in 2022 due to the current geopolitical and market situation [11].

ROA can be calculated using the following formula (7):

$$ROA = \frac{Net\ Profit}{Total\ Assets} \quad (7)$$

In 2022 «X5 Group» had net profit in amount of 45 188 mln rub, and total assets were equal to 1 352 015 mln rub. So, ROA of the company is 3,34% (8):

$$ROA = \frac{45\ 188}{1\ 352\ 015} = 3{,}34\% \quad (8)$$

Thus, we will assume that free cash flow will be increasing with the certain constant growth rate, which is equal to 3,34% (9):

$$g = 1 * 3{,}34\% = 3{,}34\% \quad (9)$$

It can be noticed that in the case of the company «X5 Group» the growth rate coincides with the ROA, since reinvestment rate is equal to 1 caused by the company's decision not to pay dividends.

Now it is possible to forecast the values of free cash flow of the company for the next 5 years (Table 2). Future values of free cash flows (FVFCF) are calculated by multiplying the amount of the free cash flow for the previous year by the constant growth rate (g) of 3,34% calculated above.

Table 2

Finding the values of future free cash flows for 2023 – 2027 years on the example of the company «X5 Group» [11]

	2022	2023	2024	2025	2026	2027
Free cash flow (FCF), mln rub	161 370					
Expected growth rate (g)	3,34%					
Future free cash flow (FVFCF), mln rub FVFCF=g*FCF		166 760	172 330	178 085	184 033	190 180

The next step in creating the discounted cash flow model involves bringing the forecasted future values to the present value. As the discount rate the key rate of the Bank of Russia is chosen. The discount rate should reflect the future risks. In October 2023 the Bank of Russia raised the key rate to 15% [12], therefore the new value of the key rate

already includes the inflationary risk and the country risk premium. Taking the key rate as the discount rate for the DCF model will allow to better reflect the current macroeconomic situation than weighted average cost of capital of a particular company.

So, at this step it is necessary to discount the future values of free cash flow (FVFCF) using the discount rate r (15%) to find the present value of future cash flows (PVFCF) and their sum (Sum of PVFCF). The calculations are based on the formula 1, and the results are shown in the table 3 (Table 3).

Table 3

Discounting the future values of free cash flows in order to find the present value of future cash flows on the example of the company «X5 Group» [11]

	2022	2023	2024	2025	2026	2027
Free cash flow (FCF), mln rub	161 370					
Expected growth rate (g)	3,34%					
Future free cash flow (FVFCF), mln rub FVFCF=g*FCF		166 760	172 330	178 085	184 033	190 180
Discount rate (r)	15%					
Discounted future free cash flow (PVFCF), mln rub $PVFCF = \frac{FVFCF_n}{(1+r)^n}$	161 370	145 008	130 306	117 094	105 222	94 553
Sum of PVFCF, mln rub	753 553					

So, the sum of present values of future cash flows is 753 553 mln rub. However, such value of the company is based only on five future periods (2023–2027) and does not take into account the ability of the company to generate profit in long-term future (beyond the forecast period). That is why it is necessary to calculate the terminal value, which is the value of free cash flows for all periods following the forecast period. For estimating the terminal value the Gordon stable growth model [5, p. 308] will be used, which assumes that the free cash flow of the company will grow every year at a constant rate during an infinite period. So, to calculate the terminal value in accordance with the Gordon model the following formula (10) will be used:

$TV = \frac{FCF_{next\ period}}{K}$ (10), where

TV – the terminal value;

k – the rate of capitalization;

k = r – d;

r – the discount rate;

g – the expected growth rate;

Since the forecast period is 2023–2027, the future free cash flow for 2028 will be used in the numerator of the formula. Future value of free cash flow for 2028 is calculated in the same way as future free cash flows in 2023 – 2027 and is equal to 196 532 mln rub (11):

$$FVFCF_{2028} = FVFCF_{2027} * (1 + g) = 190\,180 * (1 + 3{,}34\%) = 196\,532 \quad (11)$$

Discount rate (r = 15%) and expected growth rate (g = 3,43%) will be the same as in the previous calculations. So, the rate of capitalization is (12):

$$K = r - g = 15\% - 3{,}43\% = 11{,}66\% \quad (12)$$

Thus, the terminal value is equal to 1 685 524 mln rub (13):

$$TV = \frac{196\,532}{11{,}66\%} = 1\,685\,524 \quad (13)$$

Terminal value also should be reduced to the present value using the same formula of discounting (14):

$$PVTV = \frac{FVTV}{(1+r)^n} = \frac{1\,685\,524}{(1+15\%)^{2028-2022}} = 728\,699 \quad (14)$$

Present value of terminal value is 728 699 mln rub. At the final stage it is necessary to add the present value of terminal value to the sum of present values of future cash flows, which was calculated earlier (15):

$$PV = \sum \frac{CF_n}{(1+r)^n} + PVTV_{n+1} = 753\,553 + 728\,699 = 1\,482\,252 \quad (15)$$

Thus, as a result of using the discounted cash flow method, the sum of the present values of all future free cash flows was obtained, which amounts to 1 482 252 mln rub. So, the value of the company «X5 Group» obtained using the discounted cash flow model is equal to 1 482 252 mln rub. The full calculations including the final step, are shown in table 4 (Table 4).

Table 4

The full calculations by the discounted cash flow method on the example of the company «X5 Group» [11]

	2022	2023	2024	2025	2026	2027	2028
Free cash flow (FCF), mln rub	161 370						
Expected growth rate (g)	3,34%						
Future free cash flow (FVFCF), mln rub FVFCF=g*FCF		166 760	172 330	178 085	184 033	190 180	196 532
Discount rate (r)	15%						
Discounted future free cash flow (PVFCF), mln rub $PVFCF = \frac{FVFCF_n}{(1+r)^n}$	161 370	145 008	130 306	117 094	105 222	94 553	
Sum of PVFCF, mln rub	753 553						
Stable growth rate K= r-g	11,66%						
Terminal value (TV), mln rub							1 685 524
Discounted terminal value (PVTV), mln rub							728 699
PV, mln rub	*1 482 252*						

Thus, the value of the company «X5 Group» obtained using the discounted cash flow model based on Damodaran's methodology amounts to 1 482 252 mln rub for 2022. The discounted cash flow methodology can be used by the company in the further practice for such purposes as comparison with the companies-competitors, making decisions about mergers and acquisitions, and analyzing the possible dynamics of development.

During the study, we made some assumptions, in particular, the discount rate was identified with the level of the key rate of the Bank of Russia. According to the official website of the Bank of Russia [12], the change in the key rate is associated with the level of inflation expectations, where the policy of the Bank of Russia is aimed at re-

turning inflation to the target level of 4%. Also in the study indicators are formed provided that the accumulation rate is 1, which characterizes the maximum level of use of the company's financial potential when implementing a self-financing strategy.

References

1. Federal Law No. 135-FZ of 29.07.1998 (as amended on 13.06.2023) «On Valution Activities in the Russian Federation» from https://www.consultant.ru/

2. Федеральный закон «Об оценочной деятельности в Российской Федерации» от 29.07.1998 №135-ФЗ (последняя редакция) [Электронный ресурс]. – Режим доступа: https://www.consultant.ru/

3. Order of the Ministry of Economic Development of the Russian Federation No. 200 dated April 14, 2022 «On Approval of Federal Valuation Standards and on Amendments to Some Orders of the Ministry of Economic Development of the Russian Federation on Federal Valuation Standards» from https://www.consultant.ru/

4. Федеральный стандарт оценки «Структура федеральных стандартов оценки и основные понятия, используемые в федеральных стандартах оценки (ФСО I)» [Электронный ресурс]. – Режим доступа: https://www.consultant.ru/

5. Chugunova I.V. Business valuation: A textbook for students of economic fields / Rubtsovsky Industrial Institute. – Rubtsovsk, 2020 from https://yandex.ru

6. Damodaran Aswath Valuation from valuation.ppt (date of application: 15.10.2023).

7. Esipov V.W. Business assessment: educational tools / V.W. Esipov, G.A. Makhovikova from Оценка-бизнеса_Под-ред.-Есипова-В.Е-Маховиковой-Г.А_2010.pdf (date of application: 15.10.2023).

8. Fernandez P. Company valuation methods. The most common errors in valuations from Microsoft Word – DI-0449-E.doc (date of application: 15.10.2023)

9. Gryaznova A.G., Fedotova M.A., Eskindarov M.A., Tazikhina T.V., Ivanova E.N., Shcherbakova O.N. Valuation of an enterprise (business): textbook for students of higher educational institutions studying in economic specialties from https://yandex.ru (date of application: 15.10.2023)

10. lyubova O.V. Business valuation and company value management: an educational and methodological guide for students – Naberezhnye Chelny, 2019 from UMP_OBiUSK_38.03.02.pdf (kpfu.ru)

11. Annual report of the company «X5 Group» - 2022 from https://www.x5.ru/wp-content/uploads/reports/2022/ (praxisgroup.ru)

12. Consolidated financial statements of the company «X5 Group» - 2022 from https://www.x5.ru/wp-content/uploads/reports/2022/

13. Official website of the company «X5 Group» from https://www.x5.ru/ru/investors/dividends/

14. Official website of the Bank of Russia from https://www.cbr.ru/hd_base/infl/

15. «Forbes» rating of 200 largest Russian private companies from https://www.forbes.ru/biznes/440795-200-krupnejsih-castnyh-kompanij-rossii-2021