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### Analysis of Optimal Capital Structure of Technological Companies

**Abstract.** This article considers theoretical and practical concepts of optimal capital structure formation. Financial statements of Samsung Electronics Co., Ltd. during 2014-2018 have been analyzed. In particular, a lot of attention was paid to analyzing the liquidity and financial position of the firm. The capital structure of industry comparables has been considered to calculate unlevered beta. Cost of Equity, Cost of Debt and Equity Risk Premium for Samsung Electronics Co., Ltd. have been calculated to assess the optimality of the current capital structure. The current and optimal capital structures have been compared and explained.

**Keywords:** optimal capital structure; weighted average cost of capital; beta coefficient; equity; debt.

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### Аналіз оптимальної структури капіталу технологічних компаній

**Анотація.** Одним з найважливіших напрямів фінансової діяльності компанії є оптимізація структури капіталу. Існують різні методи визначення оптимальної структури капіталу. У міжнародній практиці найчастіше для знаходження оптимального міксу боргового та власного фінансування застосовується підхід, який базується на вартості капіталу. Відповідно до підходу вартості капіталу, оптимальною структурою капіталу для підприємства вважається та, яка мінімізує середньозважену вартість капіталу для компанії, максимізуючи її ринкову вартість.

Метою статті є розрахунок та аналіз оптимальної структури капіталу для технологічних компаній на прикладі міжнародної корпорації Самсунг Електронікс, використовуючи підхід, який базується на визначенні мінімальної вартості капіталу.

Розглянуто теоретичні та практичні концепції формування оптимальної структури капіталу. Досліджено фінансову звітність Samsung Electronics Co., Ltd. за 2014-2018 рр. Проаналізовано фінансову позицію та ліквідність компанії. Для розрахунку бета-коефіцієнту без врахування ефекту левериджу було розглянуто структуру капіталу компаній-конкурентів. Для оцінки оптимальності структури капіталу було розраховано вартість власного капіталу, вартість боргу та премію за ризик інвестування в акції. Порівняно поточну та оптимальну структуру капіталу та пояснено можливі причини її відхилення.

Станом на кінець 2018 р. міжнародна корпорація Самсунг була значно недокредитованою. По-перше, це значить, що компанія не використовує всі переваги податкового щита для підвищення чистого прибутку. По-друге, це говорить про можливість підвищення вартості компанії за рахунок залучення більшого обсягу боргового фінансування. Значна різниця між фактичним рівнем левериджу та оптимальним, розрахованим за методом вартості капіталу, може бути пояснена прагненням менеджменту компанії зберегти фінансову гнучкість для здійснення майбутніх інвестицій та необхідністю підтримання цільового кредитного рейтингу, як одного з головних детермінантів надійності.

**Ключові слова:** оптимальна структура капіталу; середньозважена вартість капіталу; бета-коефіцієнт; капітал; борг.

**Problem statement.** Creating a balanced strategy of capital financing is one of the most important tasks of financial management. Debt ration greatly influences not only the operational activity of a company. It influences investment and financial activities as well. By changing the proportion between equity and debt one can regulate financial stability, liquidity, riskiness and profitability of a business – the main indicators of an enterprise's performance. It is important to understand how optimal capital structure is defined and the reasons why

sometimes companies prefer to stay not in a theoretically optimal condition.

**Analysis of recent researches and publications.** Capital structure theory is a quite popular area for modern researches. There are a lot of scientists who dealt with optimal capital structure problems. Among the most recent there are Kavous Ardalan [1], Peter Brusov, Tatiana Filatova, Natali Orekhova, Mukhadin Eskindarov [2], Congming Mua, Anxing Wanga, Jinqiang Yang and others. The majority of modern researches are done to reconsider fundamentals of capital structure formation and to prove

that as an area of corporate finance, optimal capital structure should be defined not only using technical tools such as mathematical models but one should also take into consideration ethical, moral, ideological, and political activity which form the environment where a company operates.

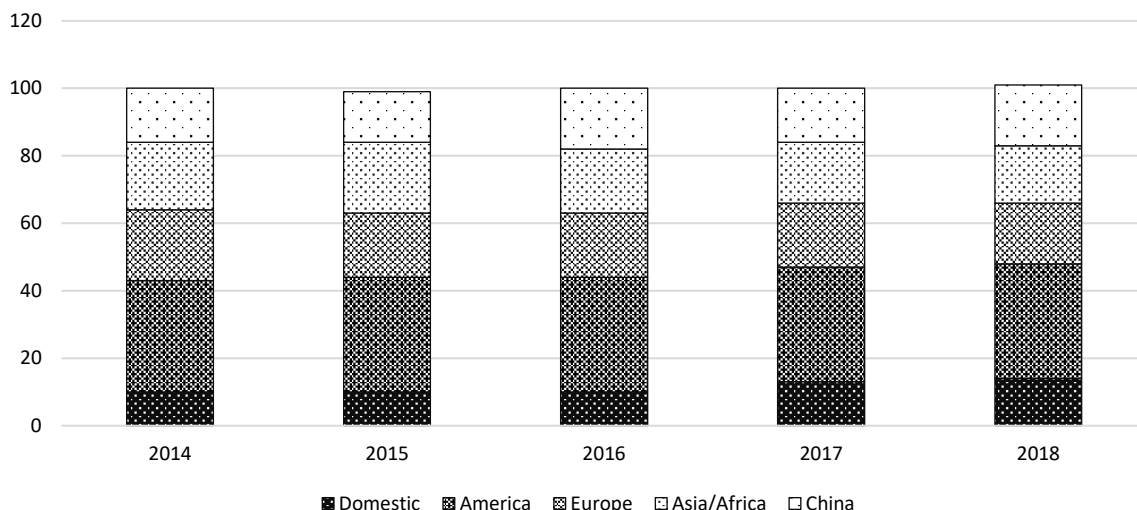
**The main purpose of the article.** The main purpose of this article is to determine an optimal capital structure for Samsung Electronics Co., Ltd using the cost of capital approach, to compare it with the current level of leverage of the company and explain possible deviation if it exists.

**Results and discussions.** Established as a leader of home appliances back in 1969, Samsung Electronics is now one of the most recognizable companies, producing

consumer electronics, IT and Mobile communications and device solutions. Each sector has its subcategories: CE – visual display business, digital appliances business, health & medical equipment business, IM – mobile communications business, network business, DP – memory business, system LSI business, foundry business.

At the end of the past year, Samsung had 217 worldwide operation hubs, manufacturing subsidiaries, sales subsidiaries, design and research centers, as well as 15 regional operating offices in Korea, North America, Europe, Southeast Asia, Africa and other regions of the world.

The distribution of total revenue from different parts of the world is shown in the picture 1 [5].



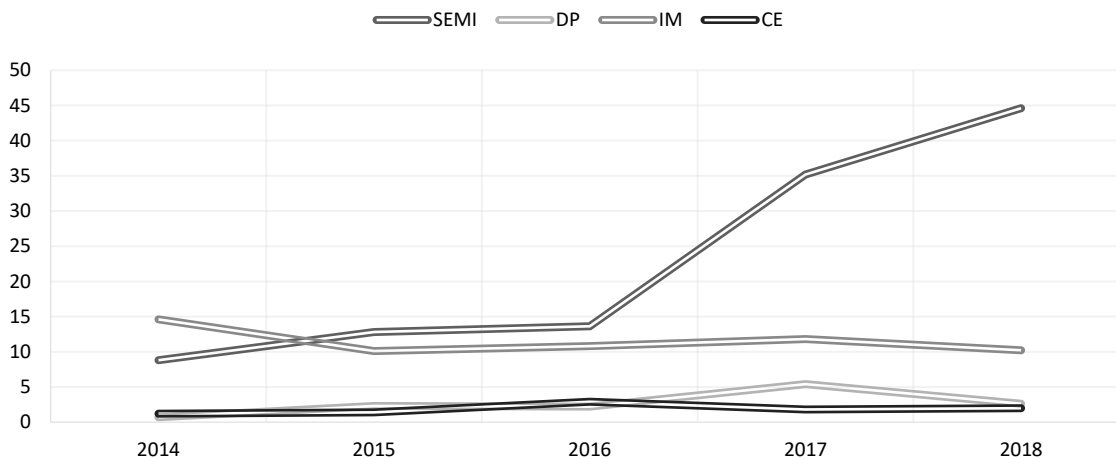
Picture 1 – The regional portion of revenue in 2014-2018

Source: Financial Highlights [5]

The greatest revenues the company gets from American and European markets, while the least ones from China and the domestic market.

The company is diversified but still, the highest profits are generated from the selling of semiconductor

equipment and materials, mobile communications business, network business, while the lowest amounts are gained from visual display business, digital appliances business, health & medical equipment business and memory business (pic. 2) [5].



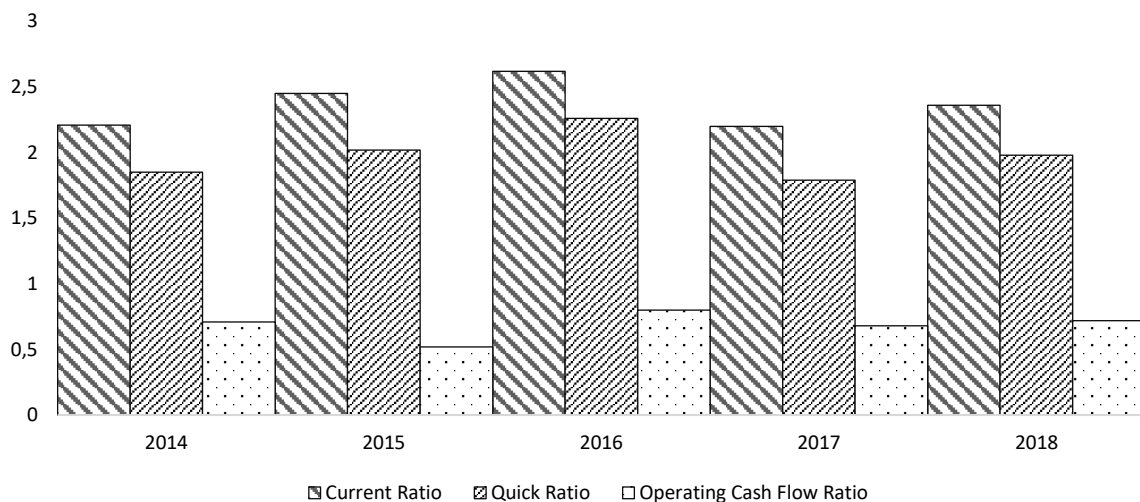
Picture 2 – Operating profit by segment

Source: Financial Highlights [5]

Profits from semiconductor sales have increased by more than 3 times since 2016. That's a great example of how a company adapts to a changing environment. In the case of Samsung, it was difficult to get high profits from mobile phones and tablets sales because of tough competition in this market but the company managed to

focus on what they can do better than others and profits increased substantially.

Now we are going to consider the strengths and weaknesses of the company concerning the firm's capital structure. Dynamics of the company's liquidity presented on the pic. 3 [5].



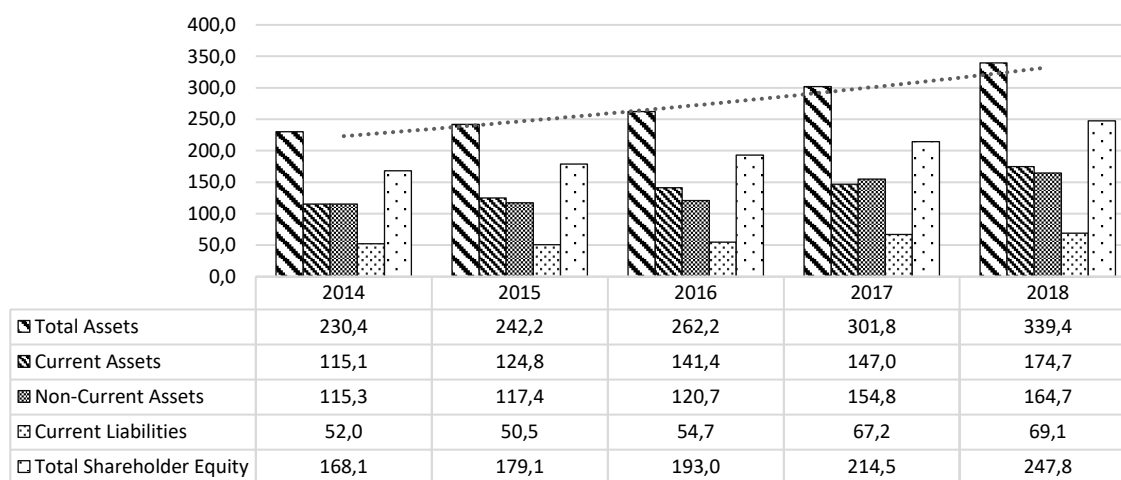
Picture 3 – Dynamics of the main liquidity indicators

Source: Financial Highlights [5]

The firm's liquidity remains stable throughout the last years. Commonly acceptable industry current ratio is 2; it's a comfortable financial position for most enterprises. The current ratio of the closest competitor – Apple is twice as small. The main reason for relatively high liquidity is a high amount of current assets. Even though creditors consider a high liquidity to be better than a low liquidity,

because it means that the company is more likely to meet its liabilities, if the current ratio and the quick ratio are too high (much more than 2), then the company may not be using its current assets or its short-term financing facilities efficiently.

Financial position is presented on the pic. 4 [5].



Picture 4 – Capital and assets structure dynamics

Source: Financial Highlights [5]

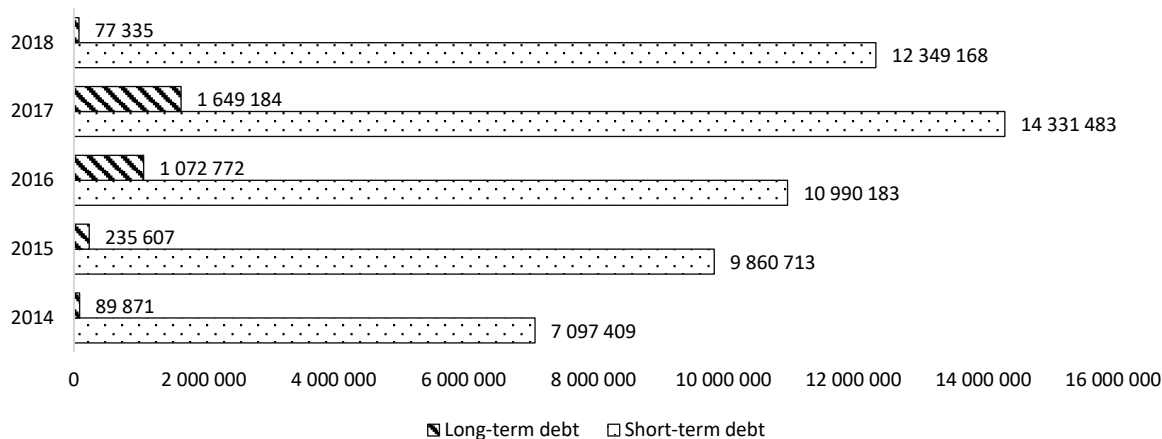
Samsung marked the first private company in Korea, excluding financial firms like banks, to see its total assets cross the 300-trillion-won. An increase in the firm's assets means that the firm increases its investments. Samsung

increased investments into tangible assets like facilities and real estate.

The interest coverage ratio is 79.46. So high interest coverage ratio may suggest a company is "too safe" and is

neglecting opportunities to use all the benefits of leveraging and tax shield and potentially generate higher earnings and returns for shareholders. This also means that the company could use a cheaper source of capital

financing (i.e. debt) to increase the enterprise value. Short-term and long term debt is compared in the pic. 5 [5].



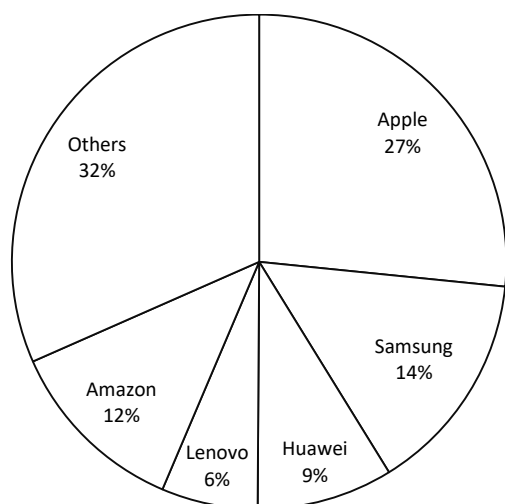
Picture 5 – Dynamics of short and long-term debt

Source: Financial Highlights [5]

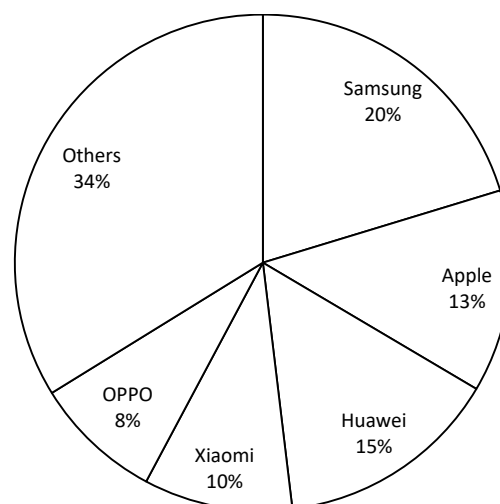
The presence of a short-term loan can inflate the numbers and make it appear that a business is in financial trouble. Open loans reduce the ability to get approved for long-term loans and increase current overhead. Investors see business as a risky investment that could falter under the pressure of a short-term loan. Also, short-term loans are usually cheaper. But from the other side, short term debt is easier to get and it offers more flexibility for a company. As for the end of 2018, Samsung Electronics's market capitalization was equal to 293,59 TR KRW. According to the data from statista.com the median company in the Information Technology sector has a market capitalization of 537.6 million. Samsung Electronics's market capitalization is significantly greater than the sector median for the most recent period.

The industry of mobile phones and tablets is highly competitive. Some of the major players are well-known companies with a good reputation and some of them are young who attract customers with more affordable products. While tablets and smartphones production is a core business for some competitors of Samsung, others are more diversified (Google, Amazon, Microsoft, etc.).

The first step of the industry analysis is getting a look at the market share and finding out noticeable companies to compare with. Pictures 6 and 7 represent shares of major players in tablets and smartphone market respectively in 2018 [6]. All the further calculations are done using annual 2018 data. Risk-free rates, equity risk premiums, levered betas, market capitalization at the beginning of 2019 were taken for the analysis to match the period of financial statements.



Picture 6 – The mobile phone market shares



Picture 7 – Tablets market shares

Source: Consumer Electronics Market Research [6]

Although some companies are listed and work in the industry of mobile phones and tablets, comparison with them would not be relevant. As mentioned before, Amazon and Microsoft are information technology giants and that kind of business is non-core for them. However, Apple is a good example to compare (despite it is a giant), because this company is mainly specializing in smartphones, tablets, and laptops. Apple is one of the industry leaders as could be seen on the market share graph. Such companies as Sony and LG Electronics are similar to Samsung and are good examples to compare with. These companies become famous as producers of household appliances and electronics and they still maintain these businesses but also succeed in smartphones and tablets markets. HP is more focused on office equipment and computers. Lenovo, Acer, and Asus are more famous in the laptop market than in the market

of smartphones. ZTE and Nokia are producers of smartphones and telecommunication equipment. They used to be more powerful in the market of smartphones and today Nokia is actively trying to regain market share. Xiaomi is a developing company which becomes 4th in market share last year. This company became public only in 2018.

Finally, consideration of the financial structure of comparables is important. The financial structure of selected firms tells us about how firms finance their projects, do they want to be more stable or flexible. Book values of cash, debt, and equity were extracted as well as D/E ratio, interest coverage ratio and total debt to EBITDA ratio. An interesting finding is that some of the companies also have such a high interest coverage ratio as Samsung does.

Table 1 Industry comparables analysis

Company	Cash & Short-Term Investment	Total Debt	Total Liabilities	Total Shareholder's Equity	Total Debt to Total Equity	Interest Coverage	P/E Ratio (TTM)	Total Debt to EBITDA
Apple	66.30 B	114.48 B	258.58 B	107.15 B	106.85	21.93	14.26	1.42
LG	4.62 T	11.50 T	28.62 T	14.47 T	71.46	6.36	7.71	2.24
Lenovo	18.95 B	42.67 B	218.13 B	23.64 B	136.68	1.53	-	4.22
ZTE	19.59 B	35.24 B	110.94 B	25.84 B	144.89	1.53	-	9.64
Sony	2.88 T	1.31 T	16.30 T	3.37 T	45.33	55.8	10.87	0.91
Nokia	5.61 B	3.74 B	23.50 B	14.97 B	23.34	3.34	-	1.55
Asus	76.55 B	7.11 B	181.90 B	169.46 B	3.86	72.67	14.36	0.47
Acer	31.41 B	3.60 B	99.20 B	57.72 B	11.31	15.39	16.06	1.43
Xiaomi	53.59 B	11.22 B	91.24 B	76.44 B	-	21.53	-	30.3

Source: composed by the author using data from The Wall Street Journal [7]

The list of comparables was shortened again. Asus, Acer, and Xiaomi are excluded from the list of the companies whose betas were used to find an average market beta. The reason behind that is a lack of their presence in the global market, meaning that even though these mobile phone producers have a significant share in particular local markets they are not presented worldwide as Samsung is. So, we came up with a list of 6 competitors of Samsung in the market of smartphones and tablets. Usually, all the sources of financial information provide their users only with the values of companies levered beta, while for our analysis we need to find an average (or median) of unlevered betas. It is possible to calculate levered beta assuming that Hamada's equation holds:

$$B_{levered} = B_{unlevered} \times [1 + (1 - TaxRate) \times \frac{Debt}{Equity}] \quad (1)$$

To do so we need to know the market value of equity (MVE), the market value of debt (MVD), a tax rate of the country where the company was founded and finally a levered beta. In this article, betas from YahooFinance were used. The market value of equity is given specifically on The Wall Street Journal website, while the market value of debt is estimated using data from the same source using the following formula:

$$Enterprise\ Value = MVE + MVD - Cash\ \&\ Equivalents \quad (2)$$

All the results are presented in the table below. It is worth noting that we are averaging betas from different financial markets, but we believe that it is rather an advantage than the opposite since Samsung operates worldwide.

Table 2 Calculation of  $B_{unlevered}$  for mobile phones industry

Company	Trade Market	Tax Rate	Beta Equity	MVE	MVD	Debt/Equity	Beta - Unlevered
Apple	NASDAQ. USA	0.21	1.21	799.55	122	0.15	0.98
LG	KSE. Korea	0.25	0.94	11.37	11.16	0.98	0.67
Lenovo	HKG. China	0.25	0.51	66.2	9.54	0.14	1.01
ZTE	SHZ. China	0.25	0.84	79.09	40.27	0.51	1.53
Sony	TYO. Japan	0.31	1.22	7.4	1.49	0.2	1.07
Nokia	HEL. Finland	0.2	0.84	27.62	3.34	0.12	0.81
Average							0.75

Source: composed by the author using data from The Wall Street Journal, Yahoo Finance [7,8]

After obtaining the average unlevered beta the only thing we need to have to finish the bottom-up approach of cost of equity calculation is to find an appropriate equity risk premium (ERP). It was calculated using revenue

shares of the company and ERP of the corresponding regions. Samsung data and ERP calculations are given below.

Table 3 Results

Samsung Electronics Co Ltd				
Debt	Equity	Tax Rate	Risk-free rate	Debt/Equity
9.294	293.59	25%	1.89%	0.03

Source: calculated by the author using data from [7, 8, 11]

We need to find out Global Equity Risk Premium for Samsung Electronics Co., Ltd. for calculating of cost of equity and WACC. The results are presented below.

Table 4 Global Equity Risk Premium

Region	Korea	USA	Europe	Asia/Africa	China
Revenue Share	13%	33%	18%	18%	18%
ERP Region	5.65%	5.08%	6.01%	8.45%	5.89%
ERP <sub>global</sub> = 6.07 %					

Source: calculated by the author using data [12]

To compute WACC at first, we need to find  $B_{levered}$  for Samsung using average  $B_{unlevered}$ :

$$B_{levered} = 0.75 \times [1 + (1 - 0.25) \times 0.03] = 0.77 \quad (3)$$

Now we will define the cost of equity and cost of debt:

$$\begin{aligned} \text{Cost of Equity} = R_e &= \text{Risk Free Rate} + \text{Beta}_{levered} \times \\ \text{ERP}_{global} &= 6.66\% \end{aligned} \quad (4)$$

$$\text{Cost of Debt} = R_d = \frac{\text{Interest Expenses}}{\text{Total Debt}} = \frac{0.675 T}{14.67 T} = 3.27\% \quad (5)$$

Finally, we compute WACC:

$$\begin{aligned} \text{WACC} = R_e \times \frac{\text{Equity}}{\text{Debt} + \text{Equity}} + (1 - \text{Tax Rate}) \times R_d \times \\ \frac{\text{Debt}}{\text{Debt} + \text{Equity}} = 6.54\% \end{aligned} \quad (6)$$

Next, we want to assess the optimality of the current capital structure of the company. To do that, we need to estimate the cost of equity and the cost of debt for any possible D/E ratio so that to be able to calculate WACC for any capital structure available. Assuming that the free cash flow to the firm does not depend on capital structure, the lowest WACC will mean that the optimal structure is found. Recalculating the cost of equity does not require anything except data presented earlier and Hamada's equation to de-lever beta as D/E changes. Cost of debt recalculation requires to know a new level of default spread as debt capacity increases and the firm becomes riskier. In this article, the following is supposed:

$$R_d = \text{Risk Free Rate} + \text{Default Spread} \quad (7)$$

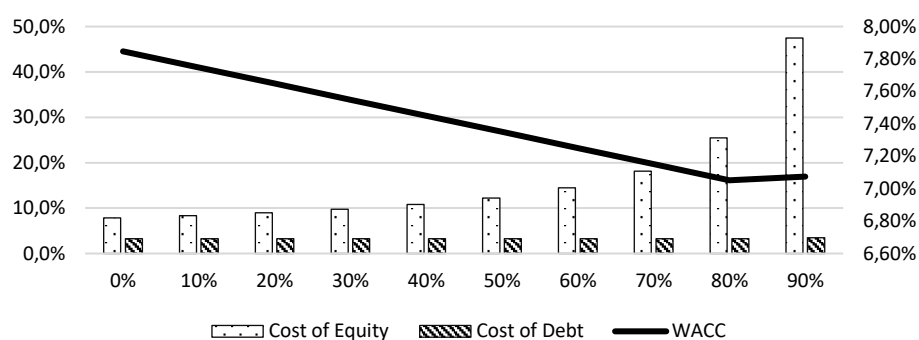
where the default spread depends on the rating of the bond issued by the company which is a function of the interest coverage ratio of the company. The default spread corresponding to any value of interest coverage ratio was taken from the data provided in "Applied Corporate Finance" by Aswath Damodaran [13]. The Samsung bond Moody's rating as for the end of 2018 was Aa3. The results are presented below.

Table 5 The change in WACC with the change in D/E ratio

Debt ratio	Debt/Equity	Beta	Cost of Equity	Cost of Debt	WACC
0%	0.00	0.97	7.85%	3.7%	7.85%
10%	0.11	1.05	8.34%	3.27%	7.75%
20%	0.25	1.15	8.95%	3.27%	7.65%
30%	0.43	1.28	9.73%	3.27%	7.55%
40%	0.67	1.45	10.78%	3.27%	7.45%
50%	1.00	1.69	12.25%	3.27%	7.35%
60%	1.50	2.05	14.45%	3.27%	7.25%
70%	2.33	2.66	18.11%	3.27%	7.15%
80%	4.00	3.87	25.45%	3.27%	7.05%
90%	9.00	7.49	47.45%	3.45%	7.07%

Source: calculated by the author using data from previous tables

For better comparison, the results are graphed on the pic. 6.



Picture 6 – The optimal capital structure according to the Cost of Capital Approach

Source: calculated by the author

Thereby, the optimal capital structure for Samsung is 80% in debt and 20% in equity. These numbers may seem unrealistic since they are biased because of the outstandingly high level of EBIT, the most important message received is that the current capital structure is highly underlevered. Such results may be explained by the fact the segment of smartphones and tablets is highly competitive and it requires companies to stay flexible to better adapt to changes in the market environment. Moreover, the operating activity of the company is connected with innovative technologies and requires substantial research and development expenses, that's why the management of the company may be not sure about the scale of future investment projects which may need some external financial in form of debt.

**Conclusion.** An optimal capital structure for Samsung Electronics has been estimated using the cost of capital

approach. Optimal capital structure is defined by the proportion of debt and equity which minimizes the weighted average cost of capital. As for the end of 2018, the company was highly under levered. That means that there is a possibility to greatly increase the enterprise's value by adding more debt to its capital structure. Such a high deviation of the current capital structure from the optimal one can be explained by the pursuit of saving flexibility to finance future investment projects. On the other hand, management might have specified a "desired bond rating" and tried to keep it by the cost of the difference in the firm's value. Samsung Electronics is not the only under levered company among large technological companies, so there is a need to further deeply research the motives which drive management and consequences of such decisions on the enterprises' activity.

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