Advanced Capital Budgeting

By

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**Executive Summary:**

For this project we created a capital budgeting model to determine if a project is feasible or not. To do so we the weighted average cost of capital (WACC: 8.32%) by multiplying the weight of capital time the return on capital for investors and then utilized the sales growth (sales growth average: 7.94%) to forecast 10 years of business operation. Having these information we used three different methods to model: capital budgeting with results of NPV: $125,861, IRR: 10%, MIRR: 9%; capacity budgeting with results of NPV: $223,742, IRR: 11%, MIRR: 10%; demand budgeting with results of NPV: $223,269, IRR: 11%, MIRR: 10%. After modeling, the projects break-even year is year 9 and if we were to optimize the models to break-even on year five, the most significant input to change would be the SG&A expense.

Word Count 136.

1. **Introduction:**

Capital budgeting is a modeling technique used to assess the potential projects to take from a financial perspective. Since capital is a limited resource, for this project we created a model with different methods to determine if a project is feasible or not. To do so we used three different methods, capital, capacity, and demand budgeting. Each method takes as input the cost of capital and an estimation of future demand into the model. After that we take net income for the period and add back the depreciation to calculate the net present value of the cashflows. We also calculate the IRR which is how much return we will get from investing after investing into this project, and the MIRR which is the same as IRR but instead of investing on the project we buyback our stock. After having these ending values, we can take a decision on the project or see a way to alter the financing and IRRs into the future.

**2.0 Data and Sample:**

2.1 Data

The data utilized for this analysis is based on a stock and values assigned by the professor and was pulled from the ‘Compustat – Capital IQ’ in the Wharton Research Data Services (WRDS) database. To build these models we used information from the company’s Ten last year’s balance sheets (2008 – 2018). The sales forecast was built using sales from the last 25 years (1994 – 2018). To calculate the WACC we utilized 10 bonds from the company assigned we gather from the Morningstar-FINRA website.

2.2 Sample

BSX - Boston Scientific Corporation develops, manufactures, and markets medical devices for use in various interventional medical specialties worldwide. It operates through three segments: MedSurg, Rhythm and Neuro, and Cardiovascular. It’s part of the healthcare industry and is headquartered in Marlborough, Massachusetts.

**3.0 Results:**

3.1 Input parameters

The input parameters used for the models will are the ones that set the rules of the results, at the end the output is based on the relationship with the input. An important input is the cost of capital which was calculated using the WACC formula for this we took 10 corporate bonds from the assigned company and calculated a contribution yield. Then the value obtained is divided by the total capital the company has to have weight of debt in the company. After that we multiply the weight of debt, with the yield contribution to have the total cost of debt and finally we have to discount the tax from the value.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Table - 1 Bonds | | | | | | | | | |
| # | Bond | Maturity | YTM | Price | Offering Outstanding | Bond Count | Value | % Value | Yield Contribution |
| 1 | BSX4039299 | 10/1/23 | 4.07% | $ 1,001.70 | $ 243,571.00 | 244 | $ 243,985.07 | 3.64% | 0.148% |
| 2 | BSX4800731 | 3/1/24 | 3.36% | $ 1,003.30 | $ 850,000.00 | 850 | $ 852,805.00 | 12.74% | 0.428% |
| 3 | BSX4243438 | 5/15/25 | 2.88% | $ 1,046.20 | $ 522,883.00 | 523 | $ 547,040.19 | 8.17% | 0.235% |
| 4 | BSX4800732 | 3/1/26 | 3.31% | $ 1,022.90 | $ 850,000.00 | 850 | $ 869,465.00 | 12.99% | 0.430% |
| 5 | BSX4602368 | 3/1/28 | 2.78% | $ 1,083.80 | $ 433,545.00 | 434 | $ 469,876.07 | 7.02% | 0.195% |
| 6 | BSX4800733 | 3/1/29 | 3.86% | $ 1,010.20 | $ 850,000.00 | 850 | $ 858,670.00 | 12.83% | 0.495% |
| 7 | BSX.GE | 11/15/35 | 4.21% | $ 1,317.60 | $ 350,000.00 | 350 | $ 461,160.00 | 6.89% | 0.290% |
| 8 | BSX4801033 | 3/1/39 | 4.06% | $ 1,062.80 | $ 750,000.00 | 750 | $ 797,100.00 | 11.91% | 0.484% |
| 9 | BSX.GJ | 1/15/40 | 3.30% | $ 1,588.30 | $ 300,000.00 | 300 | $ 476,490.00 | 7.12% | 0.235% |
| 10 | BSX4801034 | 3/1/49 | 4.00% | $ 1,117.80 | $ 1,000,000.00 | 1000 | $ 1,117,800.00 | 16.70% | 0.668% |
|  |  |  |  |  |  |  | $ 6,694,391.34 |  | 3.61% |

|  |  |
| --- | --- |
| Table 2 - WACC | |
| Tax Rate | 39% |
| Value of Equity | $ 47,685,782 |
| Value of Debt | $ 4,803,000 |
| Return Equity | 8.94% |
| Return Debt | 3.61% |
| WACC | 8.32% |

The value of equity was taken from the current market cap for the stock and divide it to total capital of the company to have the weight of equity. Then we multiply it times the return on equity from the company to have the cost of equity. Finally, we add the two values and we have the weighted average cost of capital, this value is used to discount the cashflows of the project we will assess.

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| Table 3 – inputs |  |  |  |  |
| Capital | $ 1,658,087 |  | VC | $ 2.56 |
| Salvage Value | 0 |  | Price | $ 4.28 |
| Years | 10 |  | Units | 386,728 |
| Tax Rate | 39% |  | SGA | 22.60% |
| Discount Rate | 8.32% |  |  |  |
| Reinvestment Rate | 8.32% |  |  |  |

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| Table 4 - Sales Growth | | |
| Year | % Sales Change | % Error |
| 2019 |  |  |
| 2020 | 4.02% | 8.60% |
| 2021 | 3.87% | 8.39% |
| 2022 | 3.72% | 8.21% |
| 2023 | 3.59% | 8.04% |
| 2024 | 3.46% | 7.89% |
| 2025 | 3.35% | 7.76% |
| 2026 | 3.24% | 7.63% |
| 2027 | 3.14% | 7.52% |
| 2028 | 3.04% | 7.42% |

Table 3 has final table of input parameter we used to build the models. Sales growth assumption is based on our change of slope linear regression forecast first 10 years of forecast and we took the change %. In table 4 we can also observe the percentage for the forecasted year and the error rate produced, in average we have an forecast error of 7.95%

3.2 NPV, IRR, MIRR

Table – 5 final results per model

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Capital | NPV | ($1,434,458) | ($1,221,920) | ($1,020,088) | ($828,571) | ($646,976) | ($474,909) | ($311,977) | ($157,792) | ($11,971) | $125,861 |
| IRR | -85% | -53% | -31% | -17% | -8% | -2% | 3% | 6% | 8% | 10% |
| MIRR | -85% | -44% | -21% | -9% | -2% | 2% | 5% | 7% | 8% | 9% |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Capacity | NPV | ($1,198,474) | ($994,072) | ($799,752) | ($615,170) | ($604,137) | ($432,070) | ($269,137) | ($114,952) | $30,869 | $223,742 |
| IRR | -84% | -50% | -27% | -13% | -12% | -3% | 2% | 6% | 9% | 11% |
| MIRR | -84% | -41% | -18% | -6% | -3% | 2% | 5% | 7% | 9% | 10% |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Demand | NPV | ($1,195,940) | ($991,971) | ($798,062) | ($613,870) | ($602,860) | ($431,156) | ($268,568) | ($114,709) | $30,803 | $223,269 |
| IRR | -84% | -50% | -27% | -13% | -12% | -3% | 2% | 6% | 9% | 11% |
| MIRR | -84% | -41% | -18% | -6% | -3% | 2% | 5% | 7% | 9% | 10% |

The table 5 has a summary of results for the 3 models used, the capacity model is the one that can generate the highest NPV at the end of the periods and the capital model generates the lowest NPV at the of the periods. if we watch closely the IRR follows closely the MIRR but once we hit a break-even the IRR surpasses the MIRR. The fact that some models have a higher return that the others does not mean that they are correct or better, in fact we fall into no free lunch theorem problem, but we can definitely use it to estimate the constraint of our decision.

Figure 1 shows the relationships of the capital budgeting model results. capital budgeting plans out for a big capital expenditure. Sometimes planning for this can be tough specially if it’s hard to calculate how the asset helps to generate cashflow.

These big expenses can be balanced to not spend a big chunk of our cash in the first period. For this we use the capacity budgeting show in Figure 2. We adapt the cash loadouts according to some goals or easier expenses we can make. In our capacity model we see that if we spend less at the beginning and at the fourth period, we invest again we can generate bigger and healthier cashflows and a bigger NPV at the end of the venture.

The quantity demand assumption is fixed so we can take into consideration the supply and demand function on price and quantity. In our third model shown in Figure 3, we replaced the quantity sold by a forecast made with a linear regression based on price and demand. Then results of the analysis we quite astonishing, like an R2 of 98%, but since these assumptions are randomly generated or the sample is not to big this is common.

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| Table 6 - Demand estimation | | | | | | | |
| Price | Price Squared | Demand | Forecast Demand |  | X^2 | X | Int |
| $ 3.90 | 15.21 | 388,916 | 394,104 |  | -7036.73602 | 35999.6882 | 360733.6 |
| $ 4.30 | 18.49 | 383,637 | 385,423 |  | 2817.229353 | 33273.32888 | 93452.97 |
| $ 4.90 | 24.01 | 382,565 | 368,180 |  | 0.986476875 | 10901.0939 | #N/A |
| $ 5.70 | 32.49 | 335,424 | 337,308 |  | 109.4211114 | 3 | #N/A |
| $ 6.70 | 44.89 | 276,195 | 286,052 |  | 26005863491 | 356501544.8 | #N/A |
| $ 7.90 | 62.41 | 210,299 | 205,968 |  |  |  |  |

3.3 Optimization

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| --- | --- | --- | --- | --- | --- |
| Table 7 - Optimal break even in year 5 | | | | | |
| Balancing | Price | Units | Capital | SG&A | Tax Rate |
| capital | $ 5.11 | 718,087 | $ 892,968 | 7.53% | NA |
| capacity | $ 5.06 | 696,146 | $ 921,112 | 8.53% | NA |
| demand | $ 5.06 | NA | $ 919,164 | 8.39% | NA |

In table 6 we see the comparison table that show the values that we have to achieve in each input to break-even during the fifth period of the models. The biggest drop comes from the SG&A expense in each model the values get decreased by 3X. The NAs in the table mean that a break even by changing that values was not achievable. The easiest and most viable, yet the hardest way to achieve the goal is to increase the units sold. Other is to consider the constraint of the project and modify all the values achieve a consensus.

**4.0 Conclusion:**

In this project we learned some types of capital budgeting that we can perform to allocate capital wisely. The reality is that our models are based on so many assumptions that is very hard to determine if they provide a reasonable estimation of our returns. The most realistic model would be the basic capital budgeting method, this remind us again that the simpler the better.