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# **Will iRobot Inc. come out of the coronavirus as a winner?**

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## **Will iRobot Inc. come out of the coronavirus as a winner?**

### **Abstract**

iRobot Inc., a leader in the cleaning robot's arena, had experienced massive success in recent months due to COVID-19, when people looked for an alternative to human cleaners. This success can be seen in the surge in its stock price, which went up from \$33.91 at the end of the first quarter of 2020 to \$83.90 at the end of the second quarter. However, as more countries are starting to reopen, a question remains whether iRobot's recent success is an indicator of a longer-term effect, or whether it will go back down. This paper attempts to answer this question by conducting a valuation of iRobot and examining the robot's market, its company profile, and the industry in which it operates. Using the discounted cash-flow method suggests that iRobot's value should be \$112.11, which is 43% above its current market price. Thus, it is recommended to buy its stocks, since the current market highly undervalues iRobot.

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# 1. Introduction

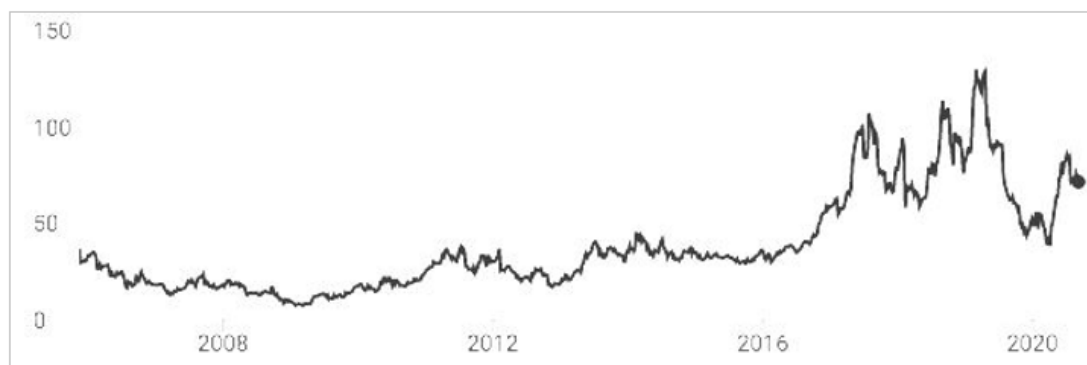
## 1.1 Motivation

One of the biggest trends in recent years is the automation of different processes using robots. According to Fior Markets, the global market for robots is expected to grow from USD 37.81 billion in 2017 to USD 158.21 billion by 2025 at a CAGR of 19.11% during the forecast period 2018-2025. Robots are now being used across a wide range of industries: defense and security, manufacturing, automotive, healthcare and electronics, to name a few.<sup>1</sup> Whereas in the past, most of these automation processes were designed for corporations, we are currently witnessing a growing trend toward the creation of household products by such manufacturers as Pool Robots, Dyson, Bissell, and Hoover.

One of the most successful companies in this area is iRobot, a leading American technology company designing consumer robots that allow people to accomplish complicated tasks in better ways. iRobot went public in 2005 at \$36.51. While the company experienced a slow start, its stock price started to gain momentum in 2012, eventually reaching a value of \$128.82 in April 2019, before dropping back to \$33.91 in March 2020. However, iRobot got its second wind due to COVID-19, when many people were locked in at home and were looking for cheap solutions to help keep their houses clean. Over the past five months, iRobot's stock price went back up to \$83.90 a share as of June 2020.

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<sup>1</sup> LLP, F. (2020, January 30). Global Robotics Market is Expected to Reach USD 158.21 Billion by 2025 : Fior Markets. Retrieved September 03, 2020, from <https://www.globenewswire.com/fr/news-release/2020/01/30/1977490/0/en/Global-Robotics-Market-is-Expected-to-Reach-USD-158-21-Billion-by-2025-Fior-Markets.html>



*figure.1.1<sup>2</sup>*

Despite its recent success, there are doubts about whether iRobot will keep enjoying the increased demand in the long term. First, countries are reopening, and people are going back to work, which could lower the need for iRobot's products. Second, the company faces increased competition from large companies such as Dyson, Bissell, and Hoover. Third, iRobot does not sell a subscription, and so it is unclear whether or not customers will stay loyal. This paper conducts a valuation of iRobot, discussing the intrinsic value of iRobot, and then answers the question: will iRobot Inc. come out of the coronavirus as a winner?

## 1.2 Valuation Method

Both qualitative and quantitative methods will be used to evaluate iRobot. Qualitatively, both the company and the industry, including information such as recent-year changes, threats, and opportunities, will be analyzed. For the quantitative analysis, since, there has been a global recession in 2020 due to COVID-19, a multiple method analysis which is a commonly used easy-to-carry valuation method will not be used, because it is heavily market-based. Instead, the discounted cash flow method (DCF)

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<sup>2</sup> Data are extracted from NASDAQ: IRBT

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will be used, because it calculates the intrinsic value of a company as opposed to its market value. The following sections will explain the rationale behind this method in detail, perform valuation analysis of iRobot, and discuss the pros and cons of using the DCF model.

### **1.3 Result**

According to the DCF analysis, the implied share price – the intrinsic fair value – of iRobot is \$112.11. Sensitivity analyses demonstrates that the suggested share price will fluctuate between a  $\pm 8\%$  range, from \$103.14 to \$121.08. Results from finbox.com is used to support this result. According to finbox.com, the estimate of the intrinsic value from financial analysts is \$103.77, which is within the expected  $\pm 8\%$  range.<sup>3</sup> This paper finally gives recommendations to invest in iRobot, since its current share price is undervalued.

## **2. The company analysis**

Founded in 1990, iRobot is a leading American technology company designing consumer robots that allow people to accomplish complicated tasks in better ways. iRobot operates in the technology sector of the consumer electronics industry.

It is headquartered in Bedford, Massachusetts, where it leases approximately 270,000 square feet.<sup>4</sup> Currently, iRobot employs 1,128 people, and its CEO and CFO are Colin Angle and Alison Dean, respectively.<sup>5</sup>

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<sup>3</sup> Dcf-ebitda-exit-5yr. Retrieved August 19, 2020, from <https://finbox.com/NASDAQGS:IRBT/models/dcf-ebitda-exit-5yr>

<sup>4</sup> Extracted from iRobot Inc.'s 2019 10K report.

<sup>5</sup> iRobot Corporation (IRBT) Company Profile & Facts. Retrieved July 23, 2020, from <https://finance.yahoo.com/quote/IRBT/profile/>

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Advanced technology is one of the key strategies for iRobot to succeed in the future. Founded by Rodney Brooks, Colin Angle, and Helen Greiner, brilliant roboticists who performed extensive research at the Massachusetts Institute of Technology (MIT), iRobot has developed proprietary technology incorporating concepts in mobility, navigation, manipulation, and artificial intelligence to build high-quality consumer robots. As of December 28, 2019, iRobot held 501 U.S. patents, more than 1,000 foreign patents, and additional design registrations, and had more than 1,500 patent applications pending worldwide.<sup>6</sup> iRobot's products mainly involve four robot families:

1. Roomba, floor vacuuming robots that collect dirt autonomously.
2. Braava, floor mopping robots designed specifically for hard-surface floors.
3. Terra, lawn mowing robots confined to a designated area by boundary wires.
4. Root, educational robots designed to teach children how to code.

iRobot also provides customer service and support. Thanks to the interconnected nature of the new robot technology of iRobot, consumer service representatives, who are proficient in the technical issues of their robots, can access robot information remotely. Thus, they can address customers' concerns effectively and quickly.

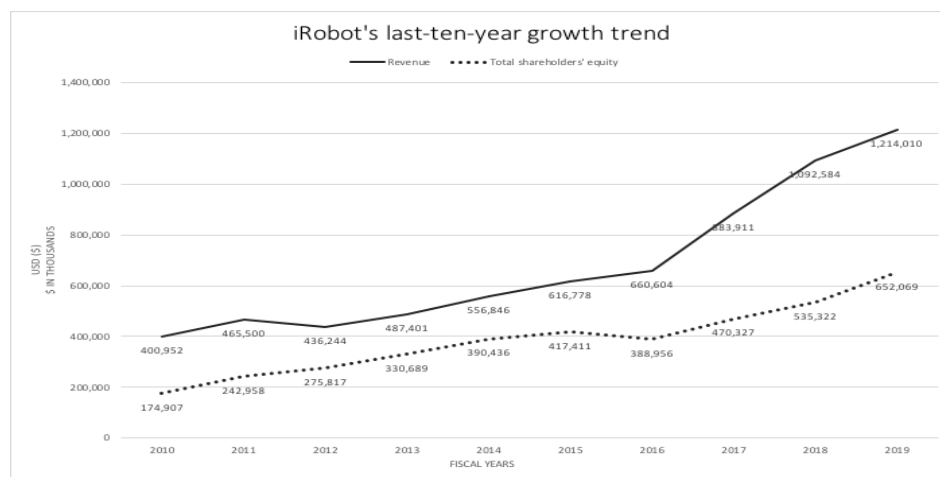
In addition to technology development, another business strategy is to form strategic alliances: licensing, acquisitions, venture investments, or other partnerships. iRobot relies on strategic partnerships to develop advanced technology and distribution systems to sell its products.

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<sup>6</sup> Extracted from iRobot Inc.'s 2019 10K report.

To illustrate this strategy, we should note that, during 2017, iRobot expanded its global operations with the acquisition of two of its major distributors in Japan and Europe: Sales On Demand Corporation ("SODC") and Robopolis SAS ("Robopolis"). These acquisitions provided iRobot more direct control of 75% of its global revenue through an immediate presence in countries such as Austria, Belgium, France, Germany, Japan, the Netherlands, Portugal, and Spain.<sup>7</sup> In 2019, iRobot began a Smart Home Partner Program to deliver enhanced product features and customer value. Moreover, iRobot cooperates with other smart home device firms that will allow their respective robots to be integrated more tightly and thereby work together more harmoniously.

These strategic alliances contribute to the overall success of iRobot, which is reflected through its financial statements. As depicted by *figure.2.1* below, from 2010 to 2019, both the revenue and the total shareholders' equity of iRobot are growing. Notably, starting from the fiscal year 2017, the growth rate of both the revenue and the total shareholders' equity of iRobot increases significantly, which is illustrated by a greater gradient for data from 2017 to 2019 compared with that of data from 2010 to 2016.



<sup>7</sup> Extracted from iRobot Inc.'s 2019 10K report.

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*figure.2.1*<sup>8</sup>

The industry in which iRobot operates is highly competitive. iRobot's main competitors include consumer electronics and consumer appliances companies such as Samsung, L.G., Panasonic, Xiaomi, Cecotec, Hitachi, Electrolux, Midea, and Shark; traditional floor cleaning brands with robotic offerings such as Dyson, Bissell, and Hoover; and firms primarily focused on automated cleanings, such as Ecovacs, Roborock, Neato and iLife.<sup>9</sup> Many of them have developed robots that compete directly with those of iRobot.

Nevertheless, iRobot remains committed to investing in innovations in new products and better marketing systems, and it believes that its ongoing performance in advanced product development and customer support will stimulate more consumer demand and enable it to be more competitive.

### **3. The industry analysis**

iRobot operates in the consumer electronics industry. This section will analyze the industry through a SWOT analysis and present its opportunities and threats.

#### **Opportunities**

- Opening up of new markets: new government agreements, the adoption of new technology standards, and government free trade agreements have provided iRobot with opportunities to enter new markets.
- Diverse consumer demand: new trends in consumer behavior can open up new markets for iRobot, which provide an excellent opportunity for iRobot to innovate

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<sup>8</sup> Data are extracted from iRobot Inc.'s 10K report from 2010 – 2019 respectively

<sup>9</sup> Extracted from iRobot Inc.'s 2019 10K report.



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new products to diversify its revenue streams and spread risks.

- New taxation policy: possible new taxation policies in the future would significantly impact the way of doing business and open new opportunities for established players such as iRobot to increase its profitability.<sup>10</sup>

## **Threats**

- Seasonal demand: demand for the highly profitable robotic products is seasonally high in holiday seasons, and any unexpected event during the peak season may impact the profitability of companies in this industry, such as iRobot, in short to medium term.<sup>11</sup>
- Intense competition: stable profitability has attracted more firms to the industry over the last two years, putting downward pressure not only on profitability but also on overall sales of iRobot.
- Intricate laws: iRobot faces different liability laws in different countries, and could be exposed to liability claims regarding consumer privacy or product standards given changes in policies in those markets
- The rising cost of product revenue: costs of labor and raw material has been increasing for the last few years, posing a threat to the profitability of iRobot.

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<sup>10</sup> Department, S. (2020). iRobot Corporation SWOT Analysis Matrix (Strengths, Weakness, Opportunities, Threats). Retrieved July 24, 2020, from <http://fernfortuniversity.com/terms-papers/swot/nyse/695-irobot-corporation.php>

<sup>11</sup> Extracted from iRobot Inc.'s 2020 10-q report.

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- Intellectual property theft: iRobot operates in jurisdictions where intellectual property theft or compromise is common. Imitation or counterfeit products will be a significant threat to iRobot, especially in the emerging markets.

## 4. Valuation

This part will use the discounted cash flow method (DCF) to calculate the intrinsic value of iRobot. Discounted cash flow analysis (DCF) is a fundamental valuation methodology broadly used by many finance professionals to value a company. It is premised on the principle that the value of a company can be derived from the present value of its projected free cash flow (FCF), which is derived from a variety of assumptions and judgments about its expected financial performance. A DCF serves as an essential alternative to market-based valuation techniques such as the multiple method. As a result, a DCF plays a vital role as a check on the overall market valuation for a publicly-traded company.<sup>12</sup>

In a DCF, a company's FCF is typically projected for five years. Given the difficulties in accurately projecting a company's financial performance over an extended period, a terminal value is used to capture the remaining value of the target beyond the projection period. The projected FCF and terminal value are discounted to the present at the target's discount rate, called the weighted average cost of capital (WACC), which can be comprehended as the weighted average of expected return of debtholders and shareholders.

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<sup>12</sup> Rosenbaum, J., & Pearl, J. (2009). *Investment banking: Valuation, leveraged buyouts, and mergers & acquisitions*. Hoboken (N.J.): John Wiley & Sons.

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The present value of the FCF and terminal value are summed to determine an enterprise value, which helps us to calculate the implied equity value and, finally, the implied share price. The WACC and terminal value assumptions have a significant impact on the output, and even slight variations of WACC and terminal value will have a substantial effect on the outcomes. Therefore, a sensitivity analysis will be performed to determine how slight differences in the assumptions can affect the implied valuation results.

Below are the steps of the DCF analysis.

1. Study the target and determine key performance drivers
2. Project FCF
3. Calculate WACC
4. Determine the terminal value
5. Calculate the present value and determine the valuation

The latter part of this paper will discuss each of these steps thoroughly.

#### **4.1 Study the company and determine key performance drivers**

The first step is to analyze iRobot and its consumer electronics industry. To construct a credible valuation, it is important to understand iRobot's business model, financial profile, the value proposition for customers, end markets, competitors, and key risks.<sup>13</sup> Realistic sets of financial projections, as well as WACC and terminal value, need to be set based on these factors.

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<sup>13</sup> Rosenbaum, J., & Pearl, J. (2009). Investment banking: Valuation, leveraged buyouts, and mergers & acquisitions. Hoboken (N.J.): John Wiley & Sons.

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Valuing a public company is relatively more straightforward than valuing a private company, since public companies have to release transparent financial data and a business profile online. For example, recent SEC filings, such as 10-Ks, 10-Qs, and 8-Ks, earnings call transcripts, equity research reports, and investor presentations, are excellent sources for providing reliable and essential information about a company.

The background information has been discussed in sections 2 and 3. This part will directly focus on determining key performance drivers. The key drivers of a company's performance can be both internal, such as opening new facilities or developing new products, and external, such as acquisitions, end market trends, or consumer buying patterns. Accordingly, a SWOT analysis of the company will be helpful. Since previous parts have already discussed the external opportunities and threats to iRobot, this part will analyze iRobot's internal strengths and weaknesses.

### **Strengths**

- High level of customer satisfaction: iRobot, with its dedicated customer relationship management department, has been able to achieve a high level of customer satisfaction among present customers and good brand equity among the potential customers.
- The innovation of products: over the past several years, iRobot has focused on research and development initiatives aimed at advancing overall cleaning efficacy, strengthening its robots' mapping and navigation capabilities, such as enabling its Roomba and Braava robots to work together, improving user interaction via cloud

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connectivity and app development, and facilitating integration between its products and other connected devices as part of a smart home ecosystem.

- Improve long-term operational profitability: iRobot will try to mitigate exposure to tariffs on products imported from China through a dual-track strategy of pursuing an exemption to those tariffs and ramping up production volumes in Malaysia.

### **Weaknesses**

- Low profitability: the profitability ratio and net contribution percentage of iRobot are below the industry average.
- High inventory: the daily inventory of iRobot is high compare to the competitors, so it has to raise more capital to invest in distribution channels and warehouses, which can impact its long-term growth.
- Not efficiently using its current assets: the liquidity ratio of iRobot is high, which suggests that the company could use the cash more efficiently than it is doing at present.
- Lacks a unique selling point (USP): the marketing of the products leaves a lot to be desired. Even though iRobot's products are successful in terms of sales, its unique selling point is not clearly defined, which in this segment of the market can lead to attacks from competitors.

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## 4.2 FCF Projection

This part will project its free cash flow (FCF). FCF is the cash generated by a company after paying all cash operating expenses and associated taxes, as well as the funding of capital expenditure and working capital, but before the payment of any interest expense (see Exhibit 1). FCF is independent of capital structure as it represents the cash available to both debt and equity holders.

### Exhibit 1 Free Cash Flow Calculation<sup>14</sup>

Earnings Before Interest and Taxes
Less: Taxes (at the Marginal Tax Rate)
<b>Earnings Before Interest After Taxes</b>
Plus: Depreciation & Amortization
Less: Capital Expenditures
Less: Increase/(Decrease) in Net Working Capital
<b>Free Cash Flow</b>

Here are some considerations for projecting FCF:

### Historical performance

The historical performance of iRobot provides valuable insight for developing defensible assumptions to project FCF. Past growth rates, profit margins, and other ratios are usually reliable indicators of future performance, especially for mature companies in non-cyclical sectors. Usually, the prior three-year period serves as a good proxy for projecting future financial performance. Thus, the financial performance of iRobot for the last three years will be utilized to construct the FCF projection.

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<sup>14</sup> Rosenbaum, J., & Pearl, J. (2009). Investment banking: Valuation, leveraged buyouts, and mergers & acquisitions. Hoboken (N.J.): John Wiley & Sons.

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## Projection period length

Since iRobot is in the early stage of rapid growth, this paper would project the FCF of iRobot for five years. Five years is sufficient for allowing iRobot to reach its steady-state level of cash flow. Since a five-year period typically spans at least one business cycle, it allows adequate time for the successful realization of in-process or planned initiatives.

## Sources

This paper will mainly use the Management's Discussion and Analysis (MD&A) section to project the FCF of iRobot, since managers have a more comprehensive understanding of the firm.

## Sales projections

(\$	Historical Period				Projection Period					
Millions)	2017A	2018A	2019A	Jun-2020A	Dec-2020E	2021E	2022E	2023E	2024E	2025E
Sales	883.9	1092	1214	472.4	1180	1274	1402	1570	1758	1970
%growth	34.0%	23.5%	11.2%	-5.1%	-2.8%	8.0%	10.0%	12.0%	12.0%	12.0%

*figure 4.2.1*

Due to COVID-19, iRobot faced design-driven engineering and supply chain challenges, and thus it was not able to completely fulfill anticipated first-quarter demand for certain premium robots. Therefore, the first-quarter sales of iRobot in 2020 are \$193 million, about 19.0% lower than sales in the same period in 2019, which were \$238 million. This poor performance is illustrated by the reduction in its share price from \$57.82 on February 05 to \$33.91 on March 17. Nonetheless, due to higher

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consumer demand, iRobot's second-quarter sales are \$280 million, about 7.6% higher than in 2019. This better performance is illustrated by a dramatic increase in the share price from \$33.91 on March 17 to \$87.98 on July 07.<sup>15</sup> Thus, iRobot has started to perform better since the beginning of the second quarter, so the sales projection for 2020 should rely more heavily on its second-quarter sales. Moreover, probably due in large part to increased demand around the December holiday season, the second-half-year sales usually represent 60% of iRobot's annual revenue, while the second-quarter sales generally represent only 23.7% of iRobot's annual revenue.<sup>16</sup> Thus, the projection of sales in 2020 should be \$1180 million ( $\$280 \text{ million} \times \frac{100\%}{23.7\%}$ ).

Over the next five years, the sales growth rate should return to normal as the pandemic alleviates, and then increase to a certain level and remain stable. As discussed in section 2, iRobot gained higher profitability due to its strategic alliances. After 2017, the annual sales increased sharply because those acquisitions provided iRobot with more direct control of 75% of its global revenue through an immediate presence in countries such as Austria, Belgium, France, Germany, Japan, the Netherlands, Portugal, and Spain. Thus, according to the historical trend, after COVID-19, the sales growth rate of iRobot will return to positive. In addition, ratings and comments on products from iRobot on Amazon are healthy, since the average ratings are over 4.5 stars, which demonstrates high consumer satisfaction. Therefore, combined with its innovative nature, iRobot sales will keep increasing, since, after all, the market for robots is far from saturated. However, there are no signs that iRobot will make revolutionary

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<sup>15</sup> Extracted from iRobot Inc.'s 2020 10-q report.

<sup>16</sup> Extracted from iRobot Inc.'s 2020 10-q report.



innovations. Thus, absolute sales should grow and maintain a steady upward trend after 2023.

### COGS, SG&A, and R&D expenses Projections

(\$	Historical Period				Projection Period					
millions)	2017A	2018A	2019A	Jun-2020A	Dec-2020E	2021E	2022E	2023E	2024E	2025E
<b>COGS</b>	450.8	537.2	670.1	215.0	584.1	599.0	665.9	753.6	852.9	965.1
%sales	51.0%	49.2%	55.3%	45.5%	49.5%	47.0%	47.5%	48.0%	48.5%	49.0%
<b>SG&amp;A</b>	247.3	309.0	315.7	134.1	300.9	337.7	385.5	447.5	501.2	561.3
%sales	28.0%	28.3%	26.0%	28.4%	25.5%	26.5%	27.5%	28.5%	28.5%	28.5%
<b>R&amp;D</b>	113.1	140.6	141.6	73.32	118.0	138.9	159.8	186.8	218.1	246.2
%sales	12.8%	12.9%	11.7%	15.5%	10.0%	10.5%	11.0%	11.5%	12.0%	12.5%

*figure 4.2.2*

The decrease in the cost of product revenue in 2020 is due to the recognition of tariff refunds of approximately \$48.7 million during the three months leading up to June 27, 2020. Also, the first-half-year COGS in 2020 was 215 million, about a 15.3% decrease from the first-half-year COGS in 2019, which was 254 million.<sup>17</sup> As COVID-19 will not be easily alleviated before 2021, iRobot will continue to try to reduce costs, continuing a series of cost reduction actions iRobot took during COVID-19. For example, the company has eliminated approximately 70 positions, primarily within its

<sup>17</sup> Extracted from iRobot Inc.'s 2020 10-q report.

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research and development organization.<sup>18</sup> Thus, the COGS in 2020 and 2021 should be lower than those before.

According to the 2019 annual report, the material costs and labor costs, which are the central part of COGS of iRobot, are uncertain in the future, and there is no assurance that their cost will not increase.<sup>19</sup> Therefore, the absolute value of COGS should keep growing but not too radically.

For SG&A, the company managers expect their selling and marketing expenses will increase during the second half of 2020, particularly in the fourth quarter, consistent with historical trends as they accelerate using media to drive demand around the holiday season.<sup>20</sup> However, this is again partially offset by many cost-reduction actions, including realigning working media with near-term revenue, reducing short-term incentive compensation, and adjusting travel costs.<sup>21</sup> Thus, the SG&A in 2020 should be slightly lower than in 2019.

Moreover, as the pandemic alleviates, iRobot would increase its expenses, such as go-to-market plans for its new products, to build awareness of its products. Therefore, due to the innovative nature of iRobot Inc, the SG&A expense should gradually recover starting from next year but reach a relatively constant trend after a few years.

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<sup>18</sup> Corporation, I. (2020, April 28). iRobot Reports First-Quarter 2020 Financial Results. Retrieved August 04, 2020, from <https://www.prnewswire.com/news-releases/irobot-reports-first-quarter-2020-financial-results-301048742.html>

<sup>19</sup> Extracted from iRobot Inc.'s 2019 10K report.

<sup>20</sup> Extracted from iRobot Inc.'s 2020 2Q report.

<sup>21</sup> Corporation, iRobot Reports First-Quarter 2020 Financial Results. Retrieved August 04, 2020, from <https://www.prnewswire.com/news-releases/irobot-reports-first-quarter-2020-financial-results-301048742.html>

R&D expenses will increase in absolute value due to the innovative nature of iRobot but remain a relatively consistent percentage of revenue, because, as a leading company, iRobot does not have to increase its R&D expense dramatically.

### Calculation of gross profit and EBIT

(\$	Historical Period				Projection Period					
millions)	2017A	2018A	2019A	Jun-2020A	Dec-2020E	2021E	2022E	2023E	2024E	2025E
<b>Gross Profit</b>	433.1	554.8	543.9	257.4	595.9	675.4	735.9	816.4	905.6	1004
%margin	49.0%	50.8%	44.8%	54.5%	50.5%	53.0%	52.5%	52.0%	51.5%	51.0%
<b>EBIT</b>	72.70	105.2	86.60	50.06	177.0	203.9	196.3	188.4	193.4	197.0
%sales	8.22%	9.63%	7.13%	10.6%	15.0%	16.0%	14.0%	12.0%	11.0%	10.0%

figure 4.2.3

To calculate Gross Profit:

$$EBIT = Sales - COGS$$

To calculate EBIT (earnings before interest and tax), since iRobot has already included depreciation and amortization in its SG&A parts:

$$EBIT = Sales - COGS - SG\&A$$

### D&A projection

(\$	Historical Period				Projection Period					
millions)	2017A	2018A	2019A	Jun-2020A	Dec-2020E	2021E	2022E	2023E	2024E	2025E
<b>D&amp;A</b>	25.63	37.13	37.63	17.78	37.76	40.78	44.86	50.24	56.27	63.02
%sales	2.90%	3.40%	3.10%	3.76%	3.20%	3.20%	3.20%	3.20%	3.20%	3.20%

figure 4.2.4

Since iRobot is a leading company in the robot industry, it has durable competitive advantages, so it does not have to upgrade its equipment continually to keep competitive. Since the company uses the straight-line method to compute depreciation, it is reasonable to take the average over the last few years as the future D&A projection.

### Calculation of EBITDA

(\$	Historical Period				Projection Period					
millions)	2017A	2018A	2019A	Jun-2020A	Dec-2020E	2021E	2022E	2023E	2024E	2025E
EBITDA	98.33	142.3	124.2	67.84	214.8	244.7	241.1	238.7	249.7	260.0
%margin	11.1%	13.0%	10.2%	14.4%	18.2%	19.2%	17.2%	15.2%	14.2%	13.2%

figure 4.2.5

To calculate EBITDA:

$$EBITDA = EBIT + D\&A \text{ Expenses}$$

### Tax projections

(\$	Historical Period				Projection Period					
millions)	2017A	2018A	2019A	Jun-2020A	Dec-2020E	2021E	2022E	2023E	2024E	2025E
Tax rate	33.3%	19.0%	13.7%	18.5%	22.0%	22.0%	22.0%	22.0%	22.0%	22.0%

figure 4.2.6

The effective income tax rate of 18.5% for six months leading up to June 27, 2020, differed from the federal statutory tax rate of 21% primarily due to the recognition of foreign tax credits and other tax benefits made possible by the income from the tariff refunds recognized during the period. The impact of these benefits was offset by discrete tax expenses associated with stock-based compensation. As there is

no further information available, and the statutory tax rate would not fluctuate to a large extent, it is appropriate to use the three-year-average tax rate for the following years.

### Calculation of After-tax EBIT

(\$	Historical Period				Projection Period					
millions)	2017A	2018A	2019A	Jun-2020A	Dec-2020E	2021E	2022E	2023E	2024E	2025E
<b>After-tax EBIT</b>	48.49	85.21	74.74	40.80	138.1	155.1	148.7	142.1	145.4	153.6

*figure 4.2.7*

### Capital expenditure projections

(\$	Historical Period				Projection Period					
millions)	2017A	2018A	2019A	Jun-2020A	Dec-2020E	2021E	2022E	2023E	2024E	2025E
<b>Capex</b>	22.98	32.76	35.21	19.00	38.94	40.78	16.82	17.27	24.62	19.69
%sales	2.60%	3.00%	2.90%	4.02%	3.30%	3.20%	1.20%	1.10%	1.40%	1.00%

*figure 4.2.8*

Again, due to the durable competitiveness of iRobot, it does not have to invest too much in its capital, so the capital expenditure should decrease and remain low. Also, this projection confirms a Wall Street analyst's expectation.<sup>22</sup>

### Changes in net working capital projections

(\$	Historical Period				Projection Period					
millions)	2017	2018	2019	Jun-2020A	Dec-2020E	2021E	2022E	2023E	2024E	2025E
<b>NWC</b>	(10.00)	132.00	11.00	(4.00)	2.00	14.00	20.00	26.00	29.00	20.00

*figure 4.2.9*

<sup>22</sup> Retrieved August 11, 2020, from <https://finbox.com/NASDAQGS:IRBT/models/dcf-ebitda-exit-10yr>

Due to the lack of information, a Wall Street analysts' forecast is used.<sup>23</sup>

## Calculate FCF

(\$	Historical Period				Projection Period					
millions)	2017A	2018A	2019A	Jun-2020 A	Dec-2020E	2021E	2022E	2023E	2024E	2025E
FCF	61.14	(42.42)	66.16	81.58	158.81	141.07	156.75	149.03	148.04	176.95

figure 4.2.10

## 4.3 Calculate WACC

WACC is a broadly accepted standard for use as the discount rate to calculate the present value of a company's projected FCF and terminal value. It represents the weighted average of the required return on the invested capital, debt, and equity in a given company; in other words, WACC can be thought of as an opportunity cost of capital or what an investor would expect to earn in an alternative investment with a similar risk profile.

### Exhibit 2 WACC Calculation<sup>24</sup>

	Debt		Equity
WACC =	$\text{After-tax Cost of Debt} \times \% \text{ of Debt in the Capital Structure}$	+	$\text{Cost of Equity} \times \% \text{ of Equity in the Capital Structure}$
WACC =	$(r_d \times (1 - t)) \times \frac{D}{D + E}$	+	$r_e \times \frac{E}{D + E}$
where: $r_d$ = cost of debt $r_e$ = cost of equity $t$ = marginal tax rate $D$ = market value of debt $E$ = market value of equity			

The ratio between debt and equity represents the capital structure of iRobot, and the return on debt,  $r_d$ , and return on equity,  $r_e$ , represent the opportunity cost of

<sup>23</sup> Retrieved August 11, 2020, from <https://finbox.com/NASDAQGS:IRBT/models/dcf-ebitda-exit-10yr>

<sup>24</sup> Rosenbaum, J., & Pearl, J. (2009). Investment banking: Valuation, leveraged buyouts, and mergers & acquisitions. Hoboken (N.J.): John Wiley & Sons.

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debtholder and shareholder, which also represent the market cost of debt and equity of iRobot. Thus, the weighted average cost of capital (WACC) is a weighted average of the company's cost of debt and the cost of equity based on the company's capital structure.

For calculating WACC, the process will be split into four steps:

1. Determine Target Capital Structure
2. Estimate Cost of Debt ( $r_d$ )
3. Estimate Cost of Equity ( $r_e$ )
4. Calculate WACC

### **Determine Target Capital Structure**

First, calculate the equity fair value of iRobot. The closing price of iRobot on July 30, 2020, was \$72.69, and the number of shares outstanding was 28,005,989.

### **To Calculate The Equity (Fair Value)**

$$\begin{aligned} \text{Equity(fair value)} &= \text{NO. of shares outstanding} \times \text{Share price} \\ &= 28,005,989 \times \$72.69 = \$2,036 \text{ million} \end{aligned}$$

Then, calculate the book value of the debt. Since the current liability of iRobot includes no interest-bearing debt, the book value of the debt includes only long-term debt.

### **To Calculate The Book Value of The Debt**

$$\begin{aligned} \text{Book Value of The Debt} &= \text{long term debt} = \$52,819 + \$12,066 \\ &= \$64,885 \text{ thousand} \end{aligned}$$

### **To Calculate The Weight of Equity And The Weight of Debt**

$$\begin{aligned} \text{weight of equity} &= \frac{\text{Equity}}{\text{Equity} + \text{Debt}} = \frac{\$2,036 \text{ million}}{\$2,036 \text{ million} + \$64,885 \text{ thousand}} \\ &= 0.969 \end{aligned}$$

$$\begin{aligned} \text{weight of debt} &= \frac{\text{Debt}}{\text{Equity} + \text{Debt}} = \frac{\$64,885 \text{ thousand}}{\$2,036 \text{ million} + \$64,885 \text{ thousand}} \\ &= 0.031 \end{aligned}$$

### Estimate Cost of Debt ( $r_d$ )

Since iRobot has no interest expense, its cost of debt is zero.

### Estimate Cost of Equity ( $r_e$ )

The capital asset pricing model (CAPM) will be used to calculate the rate of equity return.

### Exhibit 3 CAPM Calculation<sup>25</sup>

$$\begin{aligned} \text{Cost of Equity } (r_e) &= \text{Risk-Free Rate} + \text{Levered Beta} \times \text{Market Risk Premium} \\ \text{Cost of Equity } (r_e) &= r_f + \beta_L \times (r_m - r_f) \end{aligned}$$

where:

- $r_f$  = risk-free rate
- $\beta_L$  = levered beta
- $r_m$  = expected return on the market
- $r_m - r_f$  = market risk premium

The 10-year yield on U.S. Treasury Bonds on July 27, 2020, is taken as the  $r_f$ , which was 0.533%.<sup>26</sup> The expected annual return for international large-capitalization stocks,  $r_m$ , is 7.7% over those of the next ten years.<sup>27</sup> The current systematic risk,  $\beta_L$ , is 1.73.<sup>28</sup>

<sup>25</sup> Rosenbaum, J., & Pearl, J. (2009). Investment banking: Valuation, leveraged buyouts, and mergers & acquisitions. Hoboken (N.J.): John Wiley & Sons.

<sup>26</sup> CNBC, (2017, November 13). US10Y: U.S. 10 Year Treasury - Stock Price, Quote and News. Retrieved August 03, 2020, from <https://www.cnbc.com/quotes/?symbol=US10Y>

<sup>27</sup> Perianan, V. (2020, June 23). Why Market Returns May Be Lower and Global Diversification More Important in the Future. Retrieved August 03, 2020, from <https://www.schwab.com/resource-center/insights/content/why-market-returns-may-be-lower-in-the-future>

<sup>28</sup> iRobot Corporation (IRBT) Stock Price, Quote, History & News. Retrieved August 03, 2020, from <https://finance.yahoo.com/quote/IRBT/>



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### To Calculate The Cost of Equity

$$\begin{aligned} \text{Cost of Equity}(r_e) &= r_f + \beta_L \times (r_m - r_f) = 0.533\% + 1.73 \times (7.7\% - 0.533\%) \\ &= 12.93\% \end{aligned}$$

### To Calculate WACC

$$WACC = (r_d \times (1 - t)) \times \frac{D}{D + E} + r_e \times \frac{E}{D + E} = 12.93\% \times 0.969 = 12.54\%$$

According to the opinions of analysts on Gurufocus.com, the WACC for iRobot of August 03, 2020, as 12.54%, which perfectly matches the results in previous parts.<sup>29</sup>

## 4.4 Determine the terminal value

Essentially, the DCF model aims to determine the value of iRobot by summing up the present value of all future FCF it will generate. Since it is not feasible to project a company's FCF endlessly, this paper would employ a terminal value to capture the value of the company beyond the projection period. As its name suggests, a terminal value is typically calculated based on the company's FCF (or a proxy such as EBITDA) in the final year of the projection period.

The terminal value typically accounts for a substantial portion of a company's value in a DCF, sometimes as much as three-quarters or more. Therefore, the company's terminal year financial data must represent a steady-state level of financial performance, as opposed to a cyclical high or low. Similarly, the underlying assumptions for calculating the terminal value must be carefully examined and sensitized. This part will use the exit multiple method to calculate the terminal value of iRobot.

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<sup>29</sup> iRobot WACC %. Retrieved August 03, 2020, from <https://www.gurufocus.com/term/wacc/NAS:IRBT/WACC-/iRobot>

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## Exit Multiple Method (EMM)

The EMM calculates the remaining value of a company's FCF produced after the projection period based on a multiple of its terminal year EBITDA (or EBIT). Typically, analysts would use the average EV/EBITDA among the industry in which the target company operates as the exit multiple. As the exit multiple is a critical driver of terminal value, and hence overall value in a DCF, a sensitivity analysis will be performed in the latter part of this paper.

### To Calculate Terminal value

$$\text{Terminal Value} = \text{EBITDA}_n \times \text{Exit Multiple}$$

where:  $n$  is the terminal year of the projection period.

The average EV/EBITDA among the consumer electronics industry is taken as the exit multiple, which is 15.65, according to the statistics from NYU Stern.<sup>30</sup> Therefore, the terminal value is:

$$\$259.97 \text{ million} \times 15.65 = \$4055.59 \text{ million}$$

## 4.5 Calculate the present value and determine the valuation

As dollars can earn interest through investment, a dollar today is worth more than a dollar tomorrow. Thus, it is significant to calculate the present value of iRobot's projected FCF and terminal value.

The present value calculation is calculated by multiplying the FCF for each year in the projection period and the terminal value by its respective discount factor. Then,

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<sup>30</sup> Enterprise Value Multiples by Sector (US). Retrieved August 11, 2020, from [http://pages.stern.nyu.edu/~adamodar/New\\_Home\\_Page/datafile/vebitda.html](http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/vebitda.html)

discounted FCF and terminal value can be used to calculate the implied enterprise value, equity value, and share price. The mid-year convention will be used to calculate the discount factor of iRobot. A mid-year convention assumes that a company's FCF is generated throughout the year instead of at the year-end. Thus:

$$discount\ factor_n = \frac{1}{(1 + WACC)^{(n-0.5)}}$$

where:  $n$  is the years of the projection period

iRobot's discount period and discount factor are shown in *figure 4.5.1*.

	Dec-2020E	2021E	2022E	2023E	2024E	2025E
Discounted period	/	0.5	1.5	2.5	3.5	4.5
Discounted factor	/	0.94	0.84	0.74	0.66	0.59

*figure 4.5.1*

The discounted cash flow is shown in *figure 4.5.2*.

(\$	Projection Period					
millions)	Dec-2020E	2021E	2022E	2023E	2024E	2025E
Discounted Cash Flow	134.9	136.7	135.0	114.6	101.5	104.0

*figure 4.5.2*

To calculate the discounted terminal value:

$$\frac{EBITDA_5 \times Exit\ Multiple}{(1 + WACC)^5} = \frac{\$4055.59\ million}{(1 + 12.54\%)^5} = \$2246.57\ million$$

The implied enterprise value is calculated by summing up the discounted cash flow (DCF) and the discounted terminal value (DTV):

## Enterprise Value

$$\begin{aligned}
 &= DCF_{2020} + DCF_{2021} + DCF_{2022} + DCF_{2023} + DCF_{2024} + DCF_{2025} \\
 &+ DTV \\
 &= 134.88 + 136.73 + 134.95 + 114.57 + 101.54 + 103.98 \\
 &+ 2247.57 = \$2973.22 \text{ million}
 \end{aligned}$$

To calculate the implied equity value:

$$\text{Equity Value} = \text{Enterprise Value} - \text{Net Debt} + \text{Cash and Cash Equivalent}$$

$$= \$2973.22 - \$64.89 + \$230.73 = \$3139.06 \text{ million}$$

Finally, to calculate the implied share price:

$$\text{Share Price} = \frac{\text{Equity Value}}{\text{Shares Outstanding}} = \frac{\$3139.06 \text{ million}}{28,005,989} \$112.11$$

All these results can be seen in the final output table below:

## Exhibit 4 Overall Results

iRobot DCF Valuation										
		Historical Period					Projection Period			
(\$ in millions / Shares in millions)		2017A	2018A	2019A	Jun-2020 A	Dec-2020 E	2021E	2022E	2023E	2024E
<b>Sales</b>		<b>883.90</b>	<b>1092.00</b>	<b>1214.00</b>	<b>472.42</b>	<b>1180.01</b>	<b>1274.41</b>	<b>1401.85</b>	<b>1570.07</b>	<b>1758.48</b>
	% growth	34.00%	23.54%	11.17%	-5.10%	-2.80%	8.00%	10.00%	12.00%	12.00%
<b>COGS</b>		<b>450.80</b>	<b>537.20</b>	<b>670.10</b>	<b>214.98</b>	<b>584.10</b>	<b>598.97</b>	<b>665.88</b>	<b>753.63</b>	<b>852.86</b>
	% sales	51.00%	49.20%	55.30%	-0.15%	49.50%	47.00%	47.50%	48.00%	49.00%
<b>Gross Profit</b>		<b>433.1</b>	<b>554.8</b>	<b>543.9</b>	<b>257.44</b>	<b>595.90</b>	<b>675.44</b>	<b>735.97</b>	<b>816.44</b>	<b>905.62</b>
	% margin	49.00%	50.81%	44.80%	54.49%	50.50%	53.00%	52.50%	52.00%	51.50%
<b>SG&amp;A</b>		<b>247.30</b>	<b>309.00</b>	<b>315.70</b>	<b>134.06</b>	<b>300.90</b>	<b>337.72</b>	<b>385.51</b>	<b>447.47</b>	<b>501.17</b>
	% sales	28.00%	28.30%	26.00%	28.38%	25.50%	26.50%	27.50%	28.50%	28.50%
<b>R&amp;D expense</b>		<b>113.10</b>	<b>140.60</b>	<b>141.60</b>	<b>73.32</b>	<b>118.00</b>	<b>133.81</b>	<b>154.20</b>	<b>180.56</b>	<b>211.02</b>
	% sales	12.80%	12.90%	11.70%	15.52%	10.00%	10.50%	11.00%	11.50%	12.00%
<b>EBIT</b>		<b>72.70</b>	<b>105.20</b>	<b>86.60</b>	<b>50.06</b>	<b>177.00</b>	<b>203.91</b>	<b>196.26</b>	<b>188.41</b>	<b>193.43</b>
	% margin	8.22%	9.63%	7.13%	10.60%	15.00%	16.00%	14.00%	12.00%	11.00%
<b>D&amp;A</b>		<b>25.63</b>	<b>37.13</b>	<b>37.63</b>	<b>17.78</b>	<b>37.76</b>	<b>40.78</b>	<b>44.86</b>	<b>50.24</b>	<b>56.27</b>
	% sales	2.90%	3.40%	3.10%	3.76%	3.20%	3.20%	3.20%	3.20%	3.20%
<b>EBITDA</b>		<b>98.33</b>	<b>142.33</b>	<b>124.23</b>	<b>67.84</b>	<b>214.76</b>	<b>244.69</b>	<b>241.12</b>	<b>238.65</b>	<b>249.70</b>
	% margin	11.12%	13.03%	10.23%	14.36%	18.20%	19.20%	17.20%	15.20%	14.20%
<b>Tax rate</b>		<b>33.30%</b>	<b>19.00%</b>	<b>13.70%</b>	<b>18.50%</b>	<b>22.00%</b>	<b>22.00%</b>	<b>22.00%</b>	<b>22.00%</b>	<b>22.00%</b>
<b>After-tax EBIT</b>		<b>48.49</b>	<b>85.21</b>	<b>74.74</b>	<b>40.80</b>	<b>138.06</b>	<b>159.05</b>	<b>153.08</b>	<b>146.96</b>	<b>150.88</b>
<b>+: D&amp;A</b>		<b>25.63</b>	<b>37.13</b>	<b>37.63</b>	<b>17.78</b>	<b>37.76</b>	<b>40.78</b>	<b>44.86</b>	<b>50.24</b>	<b>56.27</b>
<b>-:Capex</b>		<b>22.98</b>	<b>32.76</b>	<b>35.21</b>	<b>19.00</b>	<b>38.94</b>	<b>40.78</b>	<b>16.82</b>	<b>17.27</b>	<b>24.62</b>
	% sales	2.60%	3.00%	2.90%	4.02%	3.30%	3.20%	1.20%	1.10%	1.40%
<b>-:increase in net NWC</b>		<b>-10.01</b>	<b>132.00</b>	<b>11.00</b>	<b>-4.01</b>	<b>2.00</b>	<b>14.00</b>	<b>20.00</b>	<b>26.00</b>	<b>29.00</b>
<b>Unlevered FCF</b>		<b>61.15</b>	<b>-42.42</b>	<b>66.16</b>	<b>81.59</b>	<b>134.88</b>	<b>145.05</b>	<b>161.12</b>	<b>153.93</b>	<b>153.53</b>
<b>Terminal Value</b>										<b>4055.59</b>
<b>Discount period</b>						/	0.5	1.5	2.5	3.5
<b>Discount factor</b>						/	0.94	0.84	0.74	0.66
<b>Discounted Terminal Value</b>										<b>2246.57</b>
<b>Discounted Cash Flow</b>						<b>134.88</b>	<b>136.73</b>	<b>134.95</b>	<b>114.57</b>	<b>101.54</b>
<b>Discounted Cash Flow</b>		<b>2973.22</b>								
<b>-:net debt</b>		<b>64.89</b>								
<b>+cash and cash equivalent</b>		<b>230.73</b>								
<b>Implied equity value</b>		<b>3139.06</b>								
<b>Shares outstanding</b>		<b>28.00</b>								
<b>Implied share price</b>		<b>112.11</b>								

Exit multiple: 15.6 x  
WACC: 12.54%

## 4.6 Perform sensitivity analysis

Every assumption incorporated in the DCF analysis can have a sizeable impact on the valuation result. Thus, the DCF output should be viewed in terms of a valuation range rather than as a single value. The process of deriving a valuation range by varying key inputs is called sensitivity analysis.

Crucial valuation drivers, such as WACC and Exit Multiple, are the most sensitized inputs in this valuation process. Thus, two sensitivity analyses using the input WACC and Exit Multiple will be performed. This part will take the original WACC as 12.54% and the Exit Multiple as 15.6 and slightly vary them to see how the outputs, implied enterprise value and the implied share price, will be affected.

### Exhibit 5 Implied Share Value

Implied Share Price						
WACC	(\$)	Exit Multiple				
		14.6x	15.1x	15.6x	16.1x	16.6x
	11.54%	110.41	113.1	115.79	118.48	121.17
	12.04%	108.67	111.3	113.93	116.56	119.19
	12.54%	106.97	109.54	112.11	114.68	117.25
	13.04%	105.31	107.82	110.34	112.85	115.37
	13.54%	103.7	106.16	108.62	111.08	113.54

### Exhibit 5 Implied Enterprise Value

Implied Enterprise Value						
(\$ in millions)		Exit Multiple				
WACC		14.6x	15.1x	15.6x	16.1x	16.6x
	11.54%	2925.77	3001.06	3076.36	3151.65	3226.94
	12.04%	2876.85	2950.47	3024.1	3097.72	3171.35
	12.54%	2829.2	2901.21	2973.22	3045.22	3117.23
	13.04%	2782.81	2853.24	2923.67	2994.09	3064.52
	13.54%	2737.63	2806.52	2875.41	2944.3	3013.19

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As Exhibit 5 and Exhibit 6 suggest, within the variations of WACC and Exit Multiple, the fluctuations of the implied share price are at most \$9.06, which is about 8% of \$112.11, and the changes of the implied enterprise value are at most \$253.72 million, which is about 8% of \$2973.22 million. Consequently, the implied share price is to trade in a  $\pm 8\%$  range, from \$103.14 to \$121.08. Expected share price from finbox.com is used to support this result, and the estimated share price, according to finbox.com, is \$103.77, which is within the 8% range from \$112.11.<sup>31</sup>

## **4.7 Key Pros and Cons of the DCF Method**

### **Pros**

- Market independent: the DCF method is more independent of fluctuations in the economic cycle than most other methods.
- Self-sufficient: the DCF method does not rely heavily on comparable companies to value a company.
- Flexibility: this method allows the banker to run different financial scenarios that all affect the outcome.

### **Cons**

- Dependence on estimates of financial performance: the DCF method heavily relies on financial forecasts, and accurately predicting these numbers is challenging.
- Sensitivity to assumptions: the smallest changes in inputs can cause considerable differences in the valuation range.
- Decreased relevance is given to annual FCF: the terminal value captures most of

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<sup>31</sup> Dcf-ebitda-exit-5yr. Retrieved August 19, 2020, from <https://finbox.com/NASDAQGS:IRBT/models/dcf-ebitda-exit-5yr>

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the DCF, which reduces the relevance of annual FCF projections.

## **5. Recommendation**

As the valuation process implied, the intrinsic value of iRobot is \$112.11, much higher than its market price of \$77.02 per share on September 14, 2020. Therefore, it is recommended to buy its stock, because the market highly undervalues iRobot. This optimistic expectation comes from many things: growing market for robots, cost-reduction activities, strategic alliances, leading position among the industry, innovative nature, high consumer satisfaction, and advanced technology.

## **6. Conclusion**

This paper calculated the intrinsic value of iRobot. First, the introduction part analyzed the big picture of the market of robots and the business and financial profiles of iRobot. Then, this paper analyzed the consumer electronics industry in which iRobot operates by presenting the external opportunities and threats. Afterward, the DCF valuation is performed to calculate the intrinsic value of iRobot through projecting its FCF, calculating its WACC, calculating its terminal value, and discounting its FCF. These analyses led to the final result: the implied share price of iRobot is \$112.11, fluctuating within a  $\pm 8\%$  range. Although the valuation result in this paper is somewhat different from that of financial analysts, it is healthy enough because it is within the fluctuating range of  $\pm 8\%$ . This slight divergence was primarily due to the different assumptions and key input values utilized in the valuation process. The final part of this paper gives recommendations to buy iRobot's stocks, since its implied share price suggests that the current market undervalued iRobot.

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