Valuation Research Paper

Rating: BUY
Target Price: $61
Beta: 1.08
52-Week Range : $42.04-$57.60
Industry Group: Semiconductor

Researcher:

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	2017A	2018 E	2019E
EPS	2.04	4.52	
EPS Growth	-6%	122%	
P/E	15.9X	17.4 X	
Revenue	$62.8B	$71.2B	
EV/Revenue	3.6X	3.43X	

	4Q2017	1Q2018	2Q2018	3Q2018
EPS	-0.15	0.93	1.05	1.38
Revenue	17.1	16.1	17	19.2

	mm	per share
Debt	27800	5.98
Cash	34070	7.33
S/H Equity	71.483	0.02
Enterprise Value ($MM)	237	0.05
Net Debt-to Capitalization	-3%	0.00
Net Debt	-6270	-1.35
Shares O/S(FD)		4,648
Market Cap		217,730
AVG. Daily Vol.(12 mos.)		296,000,000
Dividend		5.5776
Yield:		2.58%

INTEL CORPORATION
(INTC - $48.37)
INTC: Data Center climbs substantially; initiating at BUY

Key Takeaways:

➢ **Researcher's suggestion:** while the semiconductor sector shows strong sign of sinking in the third quarter 2018 due to disappointing earnings, Intel beats analysts' expectation again with its third quarter earnings of 19.2 Billion, 19.3% up from 2017. Also, with peer companies such as Nvidia and AMD trading at 30 P/E, Intel has been trading around 14. So this is a strong buy.

➢ **Revenue beat expectation again while semiconductor industry going down:** Semiconductor industry get struck in the third and fourth quarter 2018 due to saturated PC markets, trade war, failure in meeting investors' expectations. However, Intel shows strong revenue growth in its 3Q report. This is due to its less tying with the chip-making industry and strong leader position in data-booming era

➢ **Data center Group keeps growing at two digit speed and is expected to keep the momentum:** Contrary to analysts' expectation of a slower growth in its Data center group. The third quarter financial report shows 6.1 billion revenue in DCG, 26% up from last year. Besides, new introduction of Intel Xeon Scalable are expected to be new revenue drivers for Intel.

➢ **PC sector profit remains strong and Intel grabbing profit from gaming booms:** Even with the PC demand shrinking as a whole, Intel's PC centric Group gained 27.1 Billion revenue in the first three quarters in 2018, up 8.2% from 2017. This is partly due to the new introduction of 8th Gen Intel® CoreTM processors and Intel Core i9-9900K processor, which can be only quarterly driver for revenue. However, deeper integration in the gaming sector recently enables Intel to grab the demand from this gaming sector.

➢ **Strong growth potential from AI chips as Intel approaching independent GPU eventually:** After three years of platform establishing through series of acquisition, Intel reveals its ambition and shows clearer path of its development in AI chip sector. With declaration of joining the GPU competition, Intel has for now touched all kinds of possible future trend for AI chips: CPU,GPU,FPGA,ASIC. It's corporation witn AMD in GPU would give them competitive strength in face of Nvidia's dominance in GPU market.

➢ **Nonvolatile Memory solution Group becomes profitable in 3Q 2018 eventually and demand for larger memory is increasing:** NSG's revenue reached 1.1 billion in the third quarter 2018 and for the first time since 2015, it becomes profitable. new SSD with storage capacity of 32 terabytes (TB) is already adopted by Microsoft and IBM. And the new optane DC persistent Memory is out for customer for trail. This new memory stands out from normal SSD and DRAM for its large storage, fast speed, stability and flexibility, which is targeted at the server customers. With the demand for more powerful data-computing servers, the demand for such high-quality memories are going up.

Investment thesis:

➢ With revenue expected to grow at a low double-digit rate this year, Intel shows the undrained potential for expanding, especially in the data center market, as well as the AI chip market. Also, Intel's expectation-breaking performance in the period of sector-turmoil shows its strong market power and stable position in the market. So a strong buy is recommended.

Industry Overview

The key demand of customers for semiconductor industry product, if can be concluded by three words, are smaller, faster, and cheaper. That reveals that the semiconductor industry is highly demand-side business. Usually the targeted customers for semiconductor companies are enterprise customers and retailer customers.

By 2017, Semiconductor industry grow to a market with $412 billion revenue generated, with average 13% growth annually. However, this industry bears cyclical and volatile features, as it swings with the demand side development and depreciation. Also, the Semiconductor industry is extremely competitive, as it is a fast-growing, technology-dependent, demand-driven industry. Even the large ones such as IBM in old times can be beaten by incorrect market decision or one time lagging in technology improvement. That's why many players in this industry have set up its own ecosystem by partnering with their major customers and building exclusive products. Due to the competitive and volatile nature of this industry, it is currently a typical oligopoly market with just a few giants competing against each other.

Company description

Founded in 1968, Intel is now the world second largest semiconductor producer by revenue. Intel offers products ranging from CPUs, memory chips for PCs, to server scalable, and memory chips for server clusters, to modems for phones, to AI chips for self-driving cars. It is the major supplier for the computer manufacturers such as Apple, HP, Lenovo. Intel is headquartered in Santa Clara, California and has a little over 100,000 employees worldwide until November 2018. The companies' revenue are currently broken into 5 parts, with two parts being the major revenue and profit source. They are: (1) Client Computing Group (CCG), which targets PCs and Notebooks and composes 52.1% of the company's revenue in the 12 month training. (2) Data Center Group (DCG), which targets servers with processors and memory chips and composes 32.2% of the company's revenue in the 12 month training. The company's three other segments include: (3) Programmable Solutions Group (PSG); (4) Non-Volatile Memory Solution Group (NSG) ; (5) Internet of Things Group (IOTG)

Competitor analysis

> **Rivalry is medium to high**

Intel's competitors differs according to sectors :

1. CPU sector: AMD
   >Intel has competitive advantage for Technology value, Brand value, pricing power and complete product chain.
2. Mobile sector: Qualcomm
   >Intel withdraw most of the business in the mobile sector yet still competing in the mobile modem with Qualcomm. Considering Apple's recent shift from Qualcomm to Intel, Intel has opportunity to grab more in this market.
3. GPU sector : NVIDIA
   >For years, Intel dominates 70% of GPU market by integrating GPU into its CPU sale. Now Intel announced its development in discrete GPU, ambitious to compete with Nvidia in the high-end discrete GPU market
4. Server sector : AMD & ARM
   >Intel's previous 99% server market dominance is threatened by AMD & ARM, who prices lower to those who don't demand high computing power. Also, some of the large cloud computing service companies such as Amazon and Alibaba are developing their own server chips, which main cut partial market for Intel, even they would probability not going to sell those chips.

> **Threat of substitute is low**

Some view ARM framework as a disruptive technology for Intel's X86 framework. The major difference between the two processors is that ARM uses RISC(Reduced Instruction-Set Computer) yet Intel uses CISC(complex instruction set computer). The major differences between RISC & CISC is that:

	RISC	CISC
Instruction system	Simple & efficient	Rich & specific
Compiling	Complex and need large storage	Simple & Efficient
Power dissipation	Low	High
Design circle	short	Long
Generality	low	High
Special function	Not supporting	Supporting

As seen from the comparison, it make sense that RISC dominates the mobile market for its simplicity and low power dissipation while CISC dominates the PC & Server market for powerful and general computing. One reason I don't think RISC is a disruptive technology is that when RISC shifts from simple instruction system to more complicated ones, its loses its competitive advantage of being efficient and being specific in its original architecture, which would increase the design circle to a great extent and make it inferior to CISC.

➢ **Threat of new Entry is low**
1. The semiconductor industry is highly capital & technology-demanding, with certain dominance ahead of the rest for years. It's so hard for a completely new company to penetrate the market.
2. Some attempts have been seen from other technology firms to enter the market. For example, Amazon announced its plan for developing its own server chips. Yet it's unlikely that it's going to sell to the market. I believe Amazon did so to cut cost and customize their server functionality. And only giants like Amazon and Google are affordable for their own chips. So from the future perspective, Intel could lose several customers but not to competitors. Considering growing number of companies in market not able to afford developing their own chips, I expect Intel's service to expand.

➢ **Demand side bargaining power is medium**
The demand comes from several side -- the traditional PC producers such as IBM, HP; the cloud server provider such as google; the mobile producer such as Apple; other big companies demanding large cloud computing power. The client from the traditional PC producers are sticky because the advantage of Intel processors is still prevailing, especially in the booming gaming sector. Another reason for their stickiness with Intel is that the switch cost is high and not many companies offers business bundle like Intel, which provides all-round functionality. The worry for intel's demand volatility may lie in with its client in the mobile and server side. The worry may come from the scale number of customers and the rising competition. To maintain the market share, Intel may have to set lower prices, compared to the previous price premium.

➢ **Supply side bargaining power is low**
The most important ingredient for making chips is Epistar, which is purified from the basic sand. Hundreds of factories can supply this ingredient and intel is currently outsourcing this procedure. The number of the supplier made their power minor, as for bargaining.

SWOTS analysis of Intel

➢ **Strength**
1. Advanced manufacturing procedure: Not just in density of transistors, but in power dissipation management, clock speed and packaging.
2. Allowing customizing chips: it may seem impossible to stack logic chips. But with Intel's advanced manufacturing procedure, especially the new "3D" packaging that just get introduced in December, Intel can package CPU, GPU, ASIC chips into one chip and provide customers with specially-designed, customizing functionality.
3. High-speed internal storage & SSD: The high-speed internal storage & SSD removes the delay in data-sharing across different modules.
4. Self-developed Software support: Intel has made huge progress in using its "openVINO" to upgrade the machine-learning functionality in its Xeon server processor. This year, Intel introduces another software called "One API", simplifying the programming in between CPU, GPU ASIC & FPGA by providing its designed packages and tools. This essentially creates a platform for Intel's customers to utilize all data, even from different logic chips.

From my perspective, the biggest strength for Intel is that it has a complete framework to support its customers, and all of those strengths internally support each other, trying to provided end-to-end support for its customers.
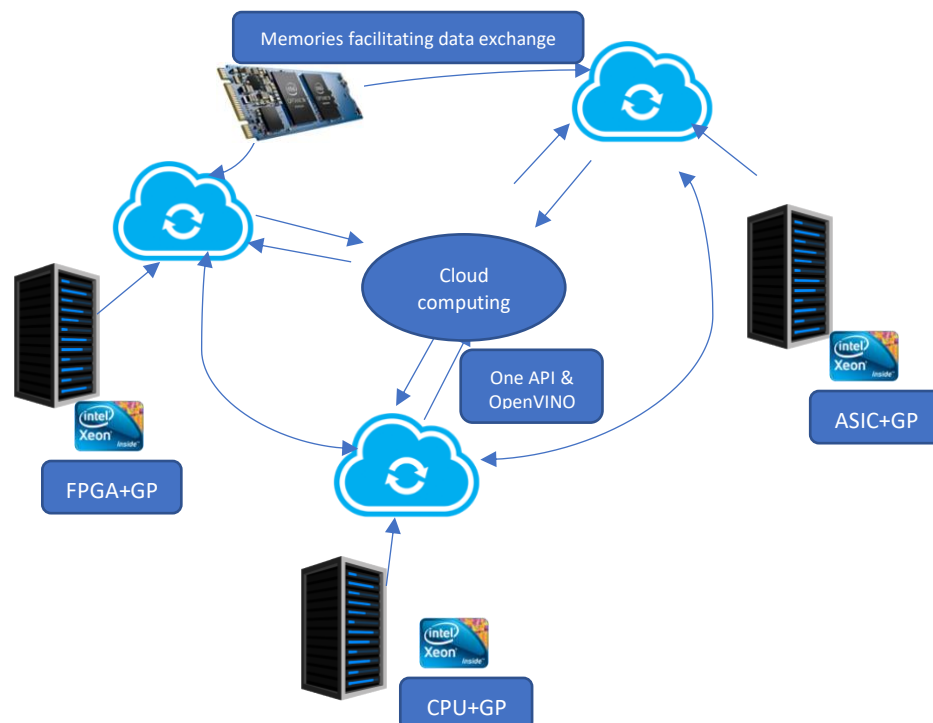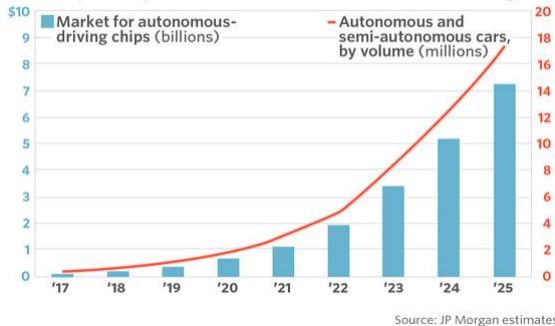
> **Weakness**
>   1. Intel is very high-end and enterprise-centric. On the retail side, Intel is slow in releasing its technology.
>   2. Ambition can be a weakness as seen from the lagged 10nm case.
> **Opportunities**
>   1. From 45 billion PC market to 300 billion IoT (Internet of Things) market.
>   2. Enjoy the faster cycle from the server side : Intel's PC customers replace or upgraded the chips on annual basis. Yet it's server-side customers upgrades the chips by quarters, providing more frequent revenue stream for Intel.
>   3. Data grow exponentially, so as the demand for data computing: Not just the traditional server market is in need of data-processing, the rising self-driving industry is also in highly need of data-processing. In another world, they need chips.


Chips driving higher
Forecasts predict big market for automotive semiconductors in self-driving cars

Market for autonomous-driving chips (billions) — Autonomous and semi-autonomous cars, by volume (millions)

Source: JP Morgan estimates

Forecast Revenue Big Data Market Worldwide 2011-2027
Big Data Market Size Revenue Forecast Worldwide From 2011 To 2027 (in billion U.S. dollars)

statista
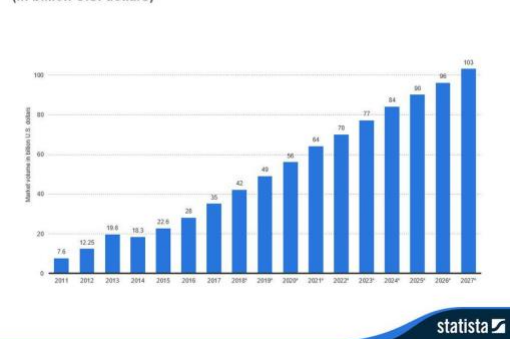
> Threats
> **Threats**
>   1. AMD and ARM trying to compete in server market
>   2. PC side may go through continuous shrinking

Investment thesis

Expecting revenue from Client Computing to maintain single digit, steady growth. Despite the lower shipping Volumes for PC chips this year to the customers, revenues have already grown by 8% for the first three quarters 2018, compared to that in last year. New processors, especially the 8th Gen Intel® CoreTM processors, turns out to be well-accepted on the customer side. Deeper integration into the gaming market gives Intel's processors another edge in competing with its rival for their higher demand for stability and speed in CPU. Considering the almost 40% international growth rate in revenue centering esports, Intel is attempting to lead by specifically designing CPU for powering gaming experience, rending live videos. In 2018, Intel introduced Core i9-9900K processor, which upgraded the core quality of the processor by an astonishing 34%, being the largest improvement so far in its history to handle the new generation AMD Ryzen. Looking at its overall arrangement in investment in e-sporting such as holding Intel Master Challenger, Intel is trying to cooperating with others in building an e-sporting ecosystem where more professional players , viewers, medias, as well as hardware providers are involved.
As reported by JP Morgan Chase after talking with Intel's customers, certain risk to be paid attention to may be the estimated shortage of supply for the 14nm processor in the fourth quarter, as more productivity is placed on the lagged 10nm to be delivered in quantity next year. So I estimate a slight decline in the PC chip revenue in the fourth quarter 2018. Yet with the delivery of 10nm processor in 2019, revenue should be expected to revive and increase. Though doubt on the Intel's lagging in 10nm technology never stopped, people knowing the semiconductor manufacturing industry knows that the size of the chip is just the name while the true performance for processors lies in the density for transistors. The reason for the lagged 10nm lies in Intel's over ambitious about putting more transistor. Normally, when Chips are made from 14nm to 10nm, the size is cut in half, making transistors 2X in density. Yet the design for Intel is targeted at 2.7X. Technically speaking, Intel's 10nm is better than 10nm produced by other brand, and comparable with or even better than other 7nm. For example, the 10nm Intel transistor density is at 100MTr/mm2, compared with Samsung's 64.4MTr/mm2 8nm or 101.23MTr/mm2 7nm.

Expecting double-digit revenue growth in Data Center Group in 2019. In the first three quarters of 2018, the revenue for Data Center Group grows by 26% from that in 2017. The dominant power in server infrastructure supporting business made Intel's capacity expanding but focused. The consistent cost -cutting on the server management side shows Intel's good cost and administrative management efficiency as well as the ambition for scaling.

Internet and Things: Cloud computing centering, with hardware designed for supporting.

Cloud computing in the data centric business have taken over to be the profit driver with continuous expanding potential. Yet people may doubt Intel's previous money losing sectors such as Programmable Solutions Group (PSG) and Non-Volatile Memory Solution Group (NSG). Yet they are part of Intel's strategy as maintaining long-run innovation-edge by empowering the customers with larger, safer, quicker server-side memory and customizable functionality. The scalability for those sectors may not be substantial currently because not many firms in the world needs such powerful computing power of data. Yet with data doubling in 2021 and the proceeding popularity of AI and machine learning, more firms, not restricted to technology firms, would appeal to build their own data center for maintaining competitive advantage.

Deeper integration into AI market could be Intel's next growth driver.
Intel's ambition to spare a share or even lead the AI market can be revealed in previous acquisition of AI companies such as Saffron, Nervana, Movidius and Mobileye. Not like some acquisition only gaining market share, Intel turns out to have a clear vision about how their existing hardware can carry those technology and how they can be structured to build an applicable ecosystem. It is revealed in Intel AI conference held in Beijing that three mutual-beneficial approach for AI development has been shaped: Tools, hardware, and ecosystem. For example, most of the Tools developed by Intel is run on Intel Xeon CPU and provided on the platform for developers or other users. This year, Intel even extend its hardware core business to develop at least two AI supporting softwares BigD and Analytics Zoo which set up framework for users to incorporate different AI or data analysis tools in dealing with clustering data. Intel now possesses the AI technology for all three AI chips that is viewed as future for the AI: GPU, FPGA, ASIC. Also, Intel is in line with AMD in competing with Nvidia in GPU market. I expect AI still have chance for being the driver for profit for Intel in the near future.

Opportunities from the GPU market as Intel plans to supply Discrete GPU in 2020.
Intel grabs almost 70% of the graphic chips market share by integrating graphic chips into CPU. They can beat 80% of the discrete graphic chips already by this integrated graphic CPU for its quality, low power dissipation. Yet, the high-end, discrete GPU market is grabbed by Intel's competitor Nvidia, which is more powerful in supporting graphic processing demanding users such as gamers. As deeper development and larger ambition in supporting the gaming industry, it's not a surprise for Intel to target at developing its own discrete GPU. From my perspective, this market strategy not only benefits Intel from being more competitive in its market place for Nvidia, but also target at supporting its "All in deep learning" business strategy, since GPU, compared to CPU, is essentially for the future of "Matrix calculation" and Artificial intelligence.

Business strategy Assessment

"Industrial-wide layout is Intel's ambitious business strategy and brings industrial reliance":
Not like many firms focusing on growth and advantage in one or two points, Intel always focus on providing end-to end service. This means that it layout their product industrial-wide, providing framework-level products so that they make enterprise customers reliant on their products and brand. The variety of product also enables Intel to create various product sets to better cater to the customer and compete on price. For example, Nvidia has the best GPU. Yet when Intel bundled its processor and GPU, it creates a good choice for people for the combined quality and less-expensive price. Another advantage this strategy could bring is that it helps encountering the disruptive technology as rare it is that the new technology is going to replace all the function Intel products are powering. Furthermore, this grants Intel with bargaining power with its customers, who are mainly big PC companies and server providers.

"Cost management & one technology two markets strategy":
Intel's high-end, cutting edge technology development cost it tens of billions of dollars invested in R&D each year, many of it are specific technologies targeted at enterprise-level customers, or to support the sale of other products. That means many invested money can't be retrieved by transforming into marketable products. This can be a burden to the whole company. However, Intel tried to balance that loss by making huge profit by transforming its partial technology into the marketable product. And it continues to do by developing its discrete GPU. Though viewed by some to target at the gaming market, which it has advantage in. Intel's ultimate target may be to use the Matrix calculation focused GPU technology to support its future AI product development. So the gaming consumption market would be its strategy to cover the loss in the high-end development.

Management Assessment

"Top Engineers leading CPU & GPU innovation divisions":
Raja Koduri, Jim Keller, two top engineer specializing separately om GPU & CPU development is leading Intel. As professionals, they would have cleaner vision on what they are pursuing in the future to bring Intel to the next level.

Risk Analysis:

"Monopolistic pricing power might be squeezed in the Data Center Group as more competitions coming up": Up until 2016, almost 100% of server chip market is dominated by Intel. Yet with the entry of AMD in the server chip market, some customers who demand less-powerful server chips has been lost for Intel. Another possible threat comes from the larger customers such as Amazon starting to self-design server chips for themselves.

"Quantity beats Quality": While the majority of the market understands Intel's leading technology position, the surging of chips demanded on the mobile side poses a real threat on Intel. Intel's chips are so powerful that only the cutting-edge technology firms or those who need powerful computing power would equip themselves with Intel chips. The view from the market is not how well you are doing but how well you are doing compared to the peers. So we might see a negative view from the market as mobile chip providers enjoys higher volume demand and Intel's peers who focus on the lower-end side keeps on growing.

"We don't need such powerful chips: threat of disruptive technology": The market is worried about Intel's obsession with high-end technology. For example, Huawei views the Intel's acquisition of Mobileye a crazy act. They believe that the future of self-driving car replying partially on powerful infrastructures, which means cars may not need chips as powerful as what Intel is pursuing. Also, the market is viewing the RISC-based ARM framework, which is adopted by all mobile makers, as a disruptive technology for Intel's CISC-based framework. Some think that once the computing power for RISC-based framework improves, Intel's CISC-based framework can be replaced.

"Brand value dilemma: Intel can only be on the high-end and leader" : Intel's facing a hard time with dealing with the lower-price competitors, who are welcomed by the individual users. Yet Intel's biggest dilemma comes that they are able to, but they can't go to the lower-end market. The main reason is the limited productivity power and brand erosion.

"More Companies are outsourcing for production to manage cost, but not Intel": Most Intel's rivals backed to focus on designing and outsourcing the production onto Samsung or TSMC. Both Samsung and TSMC have improvised on their production technology and get to the 7nm chip production yet Intel is struggling with the 10nm production, even their criteria differs. Although Intel didn't lag in the technology side, the later entry into market still gives it a disadvantage of competing for market share. Also, though integrating manufacturing and designing can maintain the tech advantage and produce in quantity with relative low yield rate, it limits the capital and productivity deployment of Intel and that may be a real threat for the advancing progress.

"With large money invested, products like 3D Xpoint is still losing money": Intel, for years, has developed new memory that provides higher computing power, more memory space, yet gaining little scale in most new products despite the fascinating technology. For example, the 3D Xpoint Intel developed with Micron from 2016, which tries to offer an intermediate solution between efficiency of DRAM and large memory of NSND, is still making a loss for both company. Despite Intel's belief in this technology's future, Micron decided to ended the partnership by 2019 because of the accumulative loss. The market's little acceptance of this new storage memory is primarily because of the high switching cost. Because of the new storing method introduced in this new technology, it's costly for firms to switch in between the memories. In fact, being too aggressive in technology breakthrough and ignoring the market acceptance is a problem as well as opportunity for Intel. Despite the loss of money, Intel is still confident of the 3D Xpoint memory because they believe that this technology has been helping with the sale of Xeon series chips. And They want to maintain the technology advantage and avoid being disrupted.

Valuation

➢ DCF approach

Considering Intel's 50 year operating history and new opportunities from the data-booming era, I decided to implement a two-stage FCFF model. The DCF assumptions and results are as follows:

	High Growth	Stable Growth
Length of growth period	5	Forever
Growth Rate	5.39%	2.9%
Debt Ratio	23%	11%
Beta	0.94	1.05
Risk-free Rate	2.9%	2.9%
Risk Premium	5.5%	5.5%

FCFF (LTM)	$ 13,464 (million)
Value of operating asset	$ 3,110,732.17 (million)
Firm value	$ 316,377.17 (million)
Equity value	$ 285,338.40 (million)
Shares outstanding	$ 4,648 (million)
Price / share	$ 61.39

Cost of Debt	3.75%	4.04%
Effective Tax rate	10%	21%
Return on Capital	13.72%	9.53%
Reinvestment Rate	39.27%	30.35%
Cost of Equity	8.07%	8.67%
Cost of Capital	6.89%	8.07%

Operating Margin \ Growth Period	2	5	10
25%	$44.42	$46.61	$51.90
31.60%	$56.73	$60.56	$68.87
36%	$64.93	$69.86	$80.19

As being a tech-intense, premium pricing company, the biggest drivers for Intel's value are its operating margin and the sustainability of its ROC, which can be measured by the years of its high growth. To see how the value of Intel stock can varies from my assumption about these two factors, I performed a sensitivity analysis on its stock price.

From it, I find that the stock price is most sensitive to my assumption of the operating margin. Looking into history, Intel has never had an operating margin below 29%. Also, we even find trend for operating margin going up from 2016. This is due to Intel's cost management in its rising mature data center group business. And I expect this cost reduction to continue as the management gets more sophisticated and this business gains more scale. That is to say, it's rare to see Intel's operating margin jump down that much in recent years.

➢ Relative valuation
1. Large-cap comparison

On the P/E basis, over the last 6 months, 1 year, and 2 years INTC has traded at an average of 16.1X,15.9X, 15.3X respectively, its current multiple of 15.34. For the EV/EBIT basis over the last 6 months, 1 year, and 2 years, INTC has traded at an average of 9.6X, 9.8X, 10.2X, its current multiple of 9.62.

When comparing INTC versus other mega-cap tech hardware companies, I believe that the company is currently trading under its peers.

large camp hard ware	ticker	price	capitalization	enterprise value	EV/SALE	EV/EBIT	P/E	sale growth
apple	AAPL	$ 174.60	828.64 B	898.4 B	3.38	11.8	14.84	15.86%
Cisco system,Inc.	CSCO	$ 45.60	204.88 B	187.85 B	3.74	12.59	15.9	7.70%
HP Inc.	HPQ	$ 22.80	36.09 B	36.44 B	0.64	11.46	10.81	13.06%
International Business Machine (	IBM	$ 119.60	108.66 B	141.22 B	1.76	11.7	8.76	(-0.98%)
Intel Corporation	INTC	$ 47.50	216.56 B	231.77 B	3.35	9.57	14.76	14%
large cap Tech Average					2.574	11.424	13.014	12.21%
Large cap tech Median					3.38	11.7	14.76	13.53%

Given Intel's low double-digit revenue growth and increasing profit margin, I believe Intel should be traded in parallel to its semiconductor peers. INTC is currently trading at 14.76X P/E while its peers are trading at an industry average of 30.1X. Looking at P/E ratio of Intel and Cisco, which is has similar capitalization, Cisco is trading at 15.9X P/E ratio while Intel is only at 14.76X. This doesn't seem to make sense Cisco is growing much slower and bears more volatility on the market swings (one year Beta being 1.21 compared to Intel's 1.03). Rationally it make sense to assign a higher price for companies who has higher growth and fewer risk. So I think Intel is undervalued by the market. One reason for this undervaluation can be market's concern about the growth sustainability about Intel. Yet as I believe, the momentum in term of revenue driver and cost cut is still substantial as business is diversifying risk and introducing market-catering products.

2. Regression Relative valuation

I handpicked 17 comparable firms based on their most similarity with Intel's business. Particularly, I added in Intel's biggest competitors such as Nvidia and Qualcomm.

Since Intel is in the high-tech semiconductor industry, growth is considered the major driver for market's pricing of the stock. So we choose the PEG multiple.

The data we use are :
1. PEG (1 year estimation, analyst consensus)
2. Bottom-up Beta (5 years, historical)
3. Payout ratio (LTM)
4. Growth in EPS (estimate 2 years, analyst consensus)

When we primarily regress PEG on all three regressor, the payout ratio shows extremely insignificance (p value >0.1). When checking the distribution of payout ratio in this sample, I find polarizing features about the payout ratio -- they either not paying or paying out a lot. Then I argue this is because the different stage those companies are at. Mature companies pay out a lot while new companies tend to reinvest everything. And the market does not care much about the payout ratio since growth is valued more in the high-tech industry. So when we drop payout ratio and regress, we get:

PEG = 3.081783-1.38098 * g(EPS) -1.238558 * Beta

```
                        OLS Regression Results
==============================================================================
Dep. Variable:                    PEG   R-squared:                       0.380
Model:                            OLS   Adj. R-squared:                  0.307
Method:                 Least Squares   F-statistic:                     5.204
Date:                Thu, 13 Dec 2018   Prob (F-statistic):             0.0173
Time:                        09:26:56   Log-Likelihood:                -29.131
No. Observations:                  20   AIC:                             64.26
Df Residuals:                      17   BIC:                             67.25
Df Model:                           2
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
Intercept      3.0818      0.507      6.079      0.000       2.012       4.151
Beta          -1.2386      0.456     -2.714      0.015      -2.202      -0.276
g             -1.3810      0.604     -2.288      0.035      -2.655      -0.107
==============================================================================
Omnibus:                       18.476   Durbin-Watson:                   2.019
Prob(Omnibus):                  0.000   Jarque-Bera (JB):               23.290
Skew:                           1.617   Prob(JB):                     8.76e-06
Kurtosis:                       7.182   Cond. No.                         4.05
==============================================================================
```

Based on this regression and Intel's g(EPS) = 14.2% & Beta = 1.09, Intel's predicted PEG is 1.536 > actual PEG (1.1), suggesting Intel undervalued by 28.4%.

Further I regress on 80 companies are selected based on Intel's major business, all being US listed companies. This 80 firms are selected from the more specific sectors under semiconductor industry such as Analog, computing. And I filtered out those listed less than 5 years or those without PEG ratio due to negative earning. Again I find the payout ratio being statistically insignificant. Then when I drop payout ratio and regress, we get:

PEG = 3.1155-0.9122 * Beta -1.1670 * g (EPS)

```
                        OLS Regression Results
==============================================================================
Dep. Variable:                    PEG   R-squared:                       0.082
Model:                            OLS   Adj. R-squared:                  0.058
Method:                 Least Squares   F-statistic:                     3.451
Date:                Fri, 14 Dec 2018   Prob (F-statistic):             0.0367
Time:                        09:57:55   Log-Likelihood:                -178.62
No. Observations:                  80   AIC:                             363.2
Df Residuals:                      77   BIC:                             370.4
Df Model:                           2
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
Intercept      3.1155      0.490      6.355      0.000       2.139       4.092
Beta          -0.9122      0.436     -2.093      0.040      -1.780      -0.044
g             -1.1670      0.762     -1.532      0.130      -2.684       0.350
==============================================================================
Omnibus:                      114.158   Durbin-Watson:                   2.174
Prob(Omnibus):                  0.000   Jarque-Bera (JB):             2760.650
Skew:                           4.648   Prob(JB):                         0.00
Kurtosis:                      30.236   Cond. No.                         4.32
==============================================================================
```

Based on this regression and Intel's g(EPS) = 14.2% & Beta = 1.09, Intel's predicted PEG is 1.95 > actual PEG (1.1), suggesting Intel undervalued by 43%.

➢ Final Valuation summary

Based on the Fundamental valuation and the relative valuation, Intel is suggested to be undervalued. This is further true if we consider the whole semiconductor industry disappointing the market while Intel beats market expectation again in the third quarter earning 2018. So Intel is a strong buy.

Intel Corporation(INTC) – Income Statement
December 19, 2018

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FYE:DEC (in millins)	Actual 16-Mar	Actual 16-Jun	Actual 16-Sep	Actual 16-Dec	Actual 17-Mar	Actual 17-Jun	Actual 17-Sep	Actual 17-Dec	Actual 18-Mar	Actual 18-Jun	Actual 18-Sep	Estimate 18-Dec	Actual FY-2016	Actual FY-2017	Estimate FY-2018
Revenue	13,702	13,533	15,778	16,374	14,796	14,763	16,149	17,053	16,066	16,962	19,163	19,000	59,387	62,761	71,191
Y/Y Change					8%	9%	2%	4%	9%	15%	19%	11%		6%	13%
Q/Q change		-1%	17%	4%	-10%	0%	9%	6%	-6%	6%	13%	-1%			
COGS(GAAP)	5,572	5,560	5,795	6,269	5,649	5,665	6,092	6,286	6,335	6,543	6,803	7,030	23,196	23,692	26,711
Gross Profit	8,130	7,973	9,983	10,105	9,147	9,098	10,057	10,767	9,731	10,419	12,360	11,970	36,191	39,069	44,480
Gross Margin	59%	59%	63%	62%	62%	62%	62%	63%	61%	61%	64%	63%	61%	62%	62%
R&D	3,246	3,145	3,069	3,280	3,326	3,275	3,223	3,274	3,311	3,371	3,428	3,800	12,740	13,098	13,910
% revenue	24%	23%	19%	20%	22%	22%	20%	19%	21%	20%	18%	20%	21%	21%	20%
SG&A	2,226	2,007	2,006	2,158	2,104	1,854	1,666	1,850	1,900	1,725	1,605	1,900	8,397	7,474	7,130
% revenue	16%	15%	13%	13%	14%	13%	10%	11%	12%	10%	8%	10%	14%	12%	10%
Other OPEX Expense/Adjustment	90	1503	446	141	118	142	53	248	50	50	-22	0	2,180	561	78
% revenue	1%	11%	3%	1%	1%	1%	0%	1%	0%	0%	0%	0%	4%	1%	0%
Total Operating expenses	5,562	6,655	5,521	5,579	5,548	5,271	4,942	5,372	5,261	5,146	5,011	5,700	23,317	21,133	21,118
% revenue	41%	49%	35%	34%	37%	36%	31%	32%	33%	30%	26%	30%	39%	34%	30%
EBIT	2,568	1,318	4,462	4,526	3,599	3,827	5,115	5,395	4,470	5,273	7,349	6,270	12,874	17,936	23,362
Operating Margin	19%	10%	28%	28%	24%	26%	32%	32%	28%	31%	38%	33%	22%	29%	33%
Gains/Loseese on equities	22	478	-12	18	252	342	846	1211	643	-203	-75	122	506	2,651	487
Interes income/Expense,other, net	-82	-126	-132	-104	-36	403	-31	-571	-102	459	-132	75	-444	-235.00	300
Pre-Tax Income	2,508	1,670	4,318	4,440	3,815	4,572	5,930	6,035	5,011	5,529	7,142	6,073	12,936	20,352	23,755
Income Tax Expense (benefit)	462	340	940	878	851	1,764	1,414	6,722	557	523	744	790	2,620	10,751	2,614
Tax rate	18%	20%	22%	20%	22%	39%	24%	111%	11%	9%	10%	13%	20%	53%	11%
															0
Net Income	2,046	1,330	3,378	3,562	2,964	2,808	4,516	(687)	4,454	5,006	6,398	5,284	10,316	9,601	21,142
% revenue	15%	10%	21%	22%	20%	19%	28%	-4%	28%	30%	33%	28%	17%	15%	30%
shares(diluted)	4,875	4,866	4,877	4,881	4,881	4,845	4,821	4,683	4,790	4,747	4,648	4,700	4,875	4,808	4,721
EPS (diluted)	0.42	0.27	0.69	0.73	0.61	0.58	0.94	-0.15	0.93	1.05	1.38	1.12	2.12	2.00	4.48
Y/Y Change					45%	112%	35%	-120%	53%	82%	47%	-866%		-6%	124%
Q/Q change		-35%	153%	5%	-17%	-5%	62%	-116%	-734%	13%	31%	-18%			
GAAP EPS Sensitivity															
Revenue 5% Higher	0.53	0.38	0.82	0.86	0.73	0.67	1.06	-0.17	1.08	1.22	1.56	1.37	2.60	2.31	5.22
Revenue 5% lower	0.31	0.16	0.57	0.60	0.49	0.49	0.81	-0.13	0.78	0.89	1.19	1.02	1.63	1.69	3.88
Gross Margins 50 Basis Pts Higher	0.43	0.28	0.71	0.74	0.62	0.59	0.95	-0.15	0.94	1.07	1.39	1.21	2.16	2.03	4.62
Gross Margins 50 Basis Pts lower	0.41	0.26	0.68	0.72	0.60	0.57	0.92	-0.14	0.91	1.04	1.36	1.18	2.07	1.97	4.49
OPEX 50 Basis Points higher	0.42	0.27	0.69	0.73	0.60	0.58	0.93	-0.15	0.92	1.05	1.37	1.19	2.10	1.99	4.53
OPEX 50 Basis Points lower	0.42	0.28	0.70	0.73	0.61	0.58	0.94	-0.15	0.93	1.06	1.38	1.20	2.14	2.01	4.57