Market Complacent in Pumping Up Penumbra

Investment Recommendation: SELL

Target Price: $68.07

Stock Downside Potential: 20.43%

Date: Monday 1st May 2017

- Market is over-confident in Penumbra's exclusive FDA Approval in Acute Ischemic Stroke Treatment.
- Historic post-IPO revenue growth rates results in a CAGR of 15.17%.
- Penumbra to decrease operating expenses to industry levels (46%) by 2022.
- DCF Analysis indicates that Penumbra share price is trading at a premium of 20.43%.
- Precedent transactions analysis suggests potential acquirers will wait for Penumbra stock to fall before making any bid.
- Supplementary analysis including comparable ratios and short interest in Penumbra supports 'Sell' recommendation.

Penumbra

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Penumbra Inc [PEN]

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Yale SCHOOL OF MANAGEMENT

Capitalization as at 15/04/2017	
Share Price ($)	85.45
Shares Outstanding (MM)	34
Market Cap ($ MM)	2,874
- Cash & STI ($ MM)	13
+Total Debt ($ MM)	20
+ Preferred Equity (MM)	-
= Enterprise Value ($ MM)	2,881

Trading Multiples	
P/E	194.20
P/B	10.00
EBITDA ($ MM)	43.20
EBITDA ($ MM)	25.10

DCF Valuation	
Value of Unlevered Firm ($ MM)	2,286
Precedent Transaction	2,299

Important Disclosure:

Please read important disclaimer on p. 29

Company Overview

Penumbra Inc. is a designer, developer, manufacturer and marketer of medical devices headquartered in Alameda, California, United States. Penumbra was founded by Adam Elsesser and Arani Bose in 2004. Elsesser currently holds the roles of Chief Executive Officer, Chairman and President of the company. Bose is the Chief Innovator and a member of the Board of Directors. Penumbra also have three other regional offices in Germany, Brazil and Australia. However, the majority of Penumbra's revenue comes from the United States.

Penumbra's sales by geography is detailed below in Figure 1:

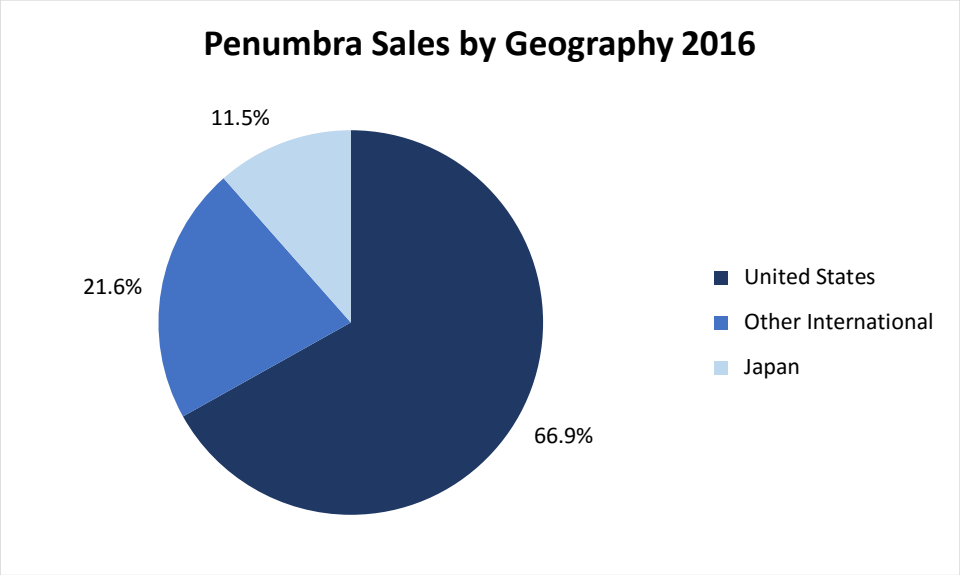

Figure 1: Sourced from Penumbra 10-K

Initial Public Offering

In September 2015, Penumbra listed on the New York Stock Exchange for the first time after successfully completing an IPO. Penumbra used the proceeds across a number of different areas across the business, from the addition of nearly 400 employees to the continued development of products.

Recent Financial Performance:

Since Penumbra completed its IPO in September 2015, its share price has soared. Its share price has risen 113% since then, from $40.10 in September 2015 to $85.45 in April 2017. It has considerably outperformed three benchmarks – the S&P 500, the S&P Healthcare and the iShares Medical Devices ETF. If $100 was invested in Penumbra in September 2015, the investment would now be worth $185.82. This stellar performance is depicted in Figure 2.

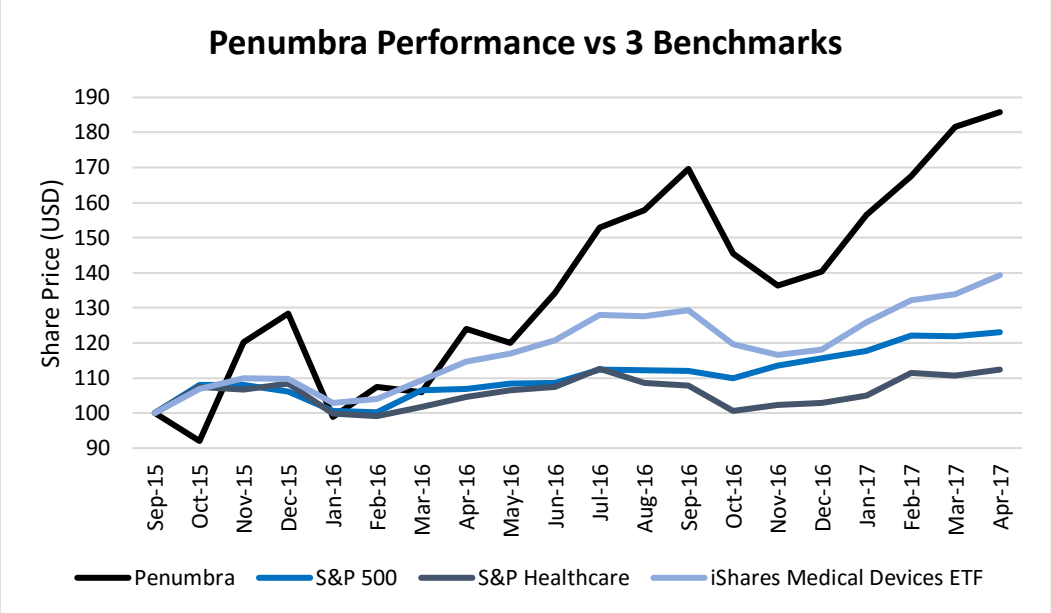

Figure 2: Prices sourced from Bloomberg

Product Portfolio:

Their product portfolio is concentrated in two main areas: neurovascular and peripheral vascular devices. These products are designed to treat patients suffering from, among others, haemorrhagic stroke, ischemic stroke and other peripheral vascular conditions. Penumbra have an innovative product pipeline that can be used in a variety of different medical and surgical procedures.

During their Q4 2016 Earnings Call, CEO Adam Elsesser declared that their immediate priority was to continue focusing on the development of their existent product portfolio and gave no indication of any new products that will be released in the near future.

Penumbra's sales by segment in 2016 is shown in Figure 3:

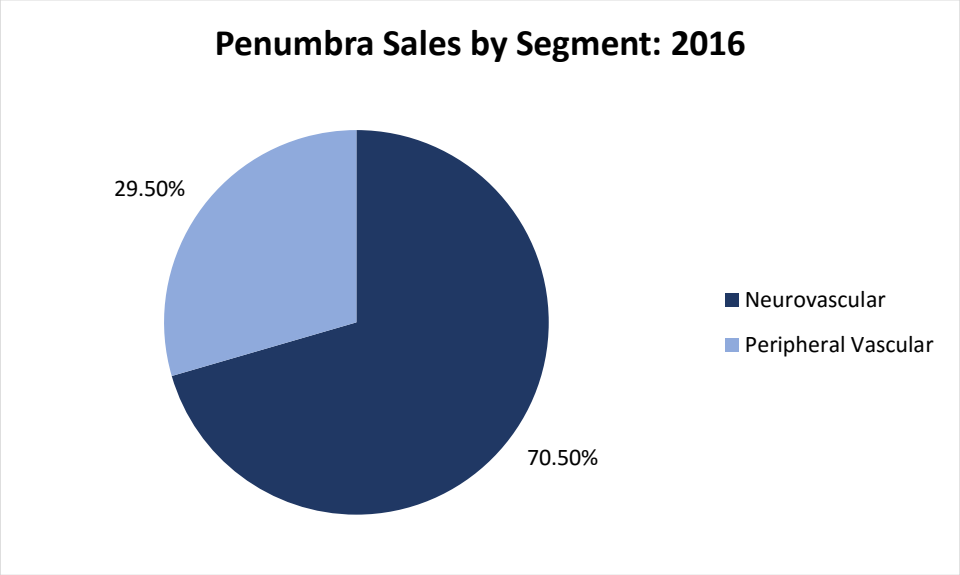

Figure 3: Sourced from Penumbra 10-K

Neurovascular Products:

Penumbra produce a number of products that target diseases that occur in the nervous and vascular system. These include, but are not limited to, the following:

Penumbra System:

The Penumbra System is designed for patients who have suffered acute ischemic stroke. Acute ischemic stroke is caused by the development of blood clots within blood vessels supplying blood to the brain. Acute ischemic stroke patients require a thrombectomy surgical procedure to remove blood clots from the blood vessel in question. The Penumbra System is designed to restore revascularization in the circulatory system after the thrombectomy procedure. The Penumbra System was first granted US FDA 510(k) clearance in December 2016 and it is the only FDA-cleared integrated aspiration system for the revascularization of acute ischemic stroke patients with large vessel occlusions.

Figure 4: Penumbra System. Sourced from Penumbra website

Penumbra ACE Family:

The Penumbra Ace family are a line of reperfusion catheters designed to supplement the Penumbra System. These are designed to facilitate the draining of the blood clot after the thrombectomy procedure. It first received 510(k) clearance in December 2015, with the ACE 68 Reperfusion Catheter being the latest member of the product line receiving approval in July 2016. The ACE 68 is the most powerful catheter Penumbra have produced to date and it is designed to deal with particular troublesome blood vessels due to its incorporation of the MAX vacuum.

Figure 5: Penumbra ACE 68 Reperfusion Catheter. Sourced from Penumbra website

Penumbra SMART COIL:

The Penumbra SMART COIL is one of Penumbra's neuro embolization systems designed to target the presence of aneurysms and other emboli that occur. The purpose of the SMART COIL is to prevent blood flow to neurovascular lesions after its implementation. As blood flow decreases to the area in question, the coils of the SMART COIL become softer and this allows it to be fitted to delicate complex aneurysms. Therefore, the device restricts the development of these aneurysms and eventually cures the problem.

Figure 6: Penumbra SMART COIL. Sourced from Penumbra website

Peripheral Vascular Products:

Penumbra's peripheral vascular portfolio comprises devices that focus on the prevention of the narrowing and blocking of blood vessels outside of the heart and the brain. These include, but are not limited to, the following:

Indigo System:

The Indigo system is focused on removing emboli and thrombi from vessels within the confines of the peripheral venous and arterial systems. It is used to treat conditions, such as acute limb ischemia, where a rapid flow of blood flow is needed. The Indigo system is very versatile and can be applied in a number of different cases from the revascularization of visceral arteries to rescue revascularization. Penumbra's existing devices, such as the Penumbra Pump MAX and the Indigo Aspiration Tubing, are used in the Indigo System. The Indigo System was first granted US FDA 510(k) approval in May 2015.

Figure 7: Penumbra Indigo System. Sourced from Penumbra website

Ruby Coil:

Similar to the SMART COIL, Perumba's Ruby Coil is designed for arterial and embolization in the peripheral vascular areas. The Ruby Coil was first approved in 2013 and comes in two levels of softness – Standard and Soft – which gives the device versatility and allows it to be implemented when dealing with a wide variety of different emboli.

Figure 8: Penumbra Ruby Coil. Sourced from Penumbra website

Current Valuation:

As of 1st May 2017, Penumbra's Price/Earnings ratio stands at an enormous 194. There are a number of reasons why we believe the market currently values Penumbra so highly. Figure 9 shows the neurovascular and peripheral vascular industry revenues forecasted at historical growth rates (5-year CAGR – 3.3%). Using this estimate, market sales are expected to reach $9.7bn by 2021. Given the level of innovation and technological advancements occurring in this industry, it could easily be argued that the industry will grow at a faster rate than this. The market currently believes that Penumbra, with its unique FDA approval for the Penumbra System in the acute ischemic stroke revascularization market, can capitalize on this industry revenue and experience high growth rates following its successful IPO in 2015.

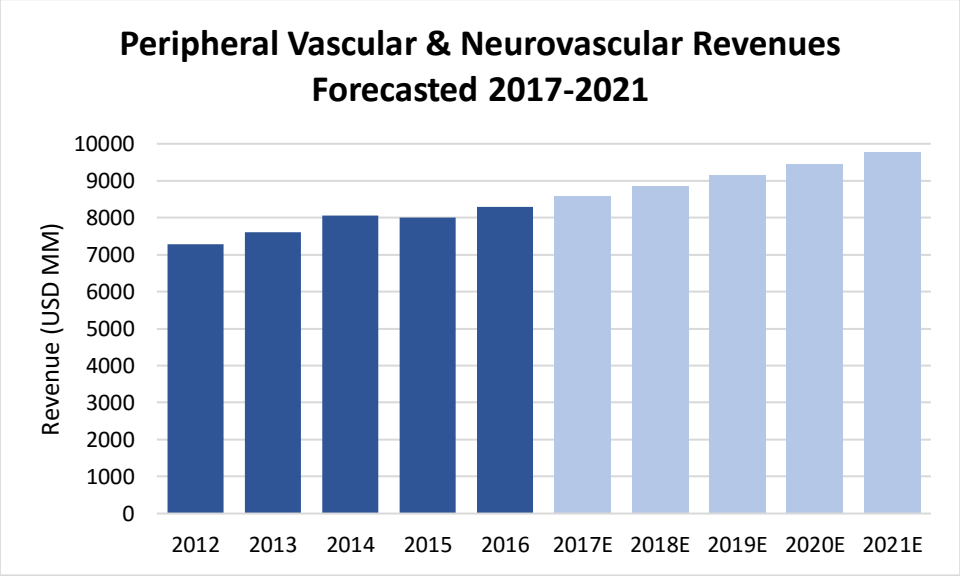

Figure 9: Sourced from Bloomberg and authors' projections

Another argument is that Penumbra is viewed by the market as a possible takeover target. Given the highly acquisitive practices of medical device firms, Penumbra represents a likely target for firms wanting to gain a foothold in this growing industry or those who are looking to expand an existing portfolio.

Investment Thesis:

The purpose of our report is to convince the SOM/Smurfit Committee that Penumbra is completely over-valued by the market. The valuation methods we have chosen seek to address the way the market currently views Penumbra. The two methodologies we used are:

1. Discounted Cash Flow (DCF) model
2. Precedent Transactions model

Our valuation methods indicate that Penumbra is trading between a 14.3% and 20% premium to the true share price. Therefore, we are issuing a 'Sell' recommendation on Penumbra.

Valuation Method 1: DCF Model

We examined Penumbra's capital structure in order to determine the most appropriate valuation model. We found that Penumbra has had no debt on its balance sheet for the last three years and therefore we decided to use a DCF Model with the Weighted Average Cost of Capital (WACC) as our discount rate. In this case, because the company's D/E ratio is zero, the WACC is simply the Return on Equity of Penumbra's share price.

Revenue Forecasts

In order to forecast Penumbra's revenue figures, we adopted a cross sectional analysis approach. Using Bloomberg, we were able to gather data for all of the medical device firms which have completed an IPO since 1995. This data set consisted of 275 medical device companies, all of which have publicly listed their shares on a US stock exchange. We then refined our search to so that the companies included in our list approximately matched the revenue levels and margins of Penumbra which left is with 165 medical device companies. Please see appendix for the refined list of companies we have used to calculate our revenue growth figures.

This allowed us to calculate revenue growth rates for the year the company was listed and every subsequent year. Please see below the growth rates we have calculated:

Year	IPO Year	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11
Growth Rate	47.20%	25.05%	33.62%	27.19%	22.88%	16.50%	16.83%	12.05%	11.81%	11.49%	10.38%	8.72%

Table 1: Sourced from Bloomberg and authors' calculations

Since Penumbra first listed their shares on a public exchange in 2015 (IPO Year), the growth rate which corresponds to our first projection period is in column 2. We expect Penumbra's revenues to grow 34% in 2017 compared to a 41% increase in revenues in 2016 and a 4 year CAGR of 44%.

The growth rates laid out in the above table correspond to a CAGR over the next ten years of 15.17%. We believe that this is a reasonable estimate for a growth company within the med-tech sector. However, we decided to compound our estimates by conducting further research into historical growth rates. We further refined our search to only include neuro/peripheral vascular companies whereas before we included all medical device companies with similar revenue and margin sizes. We found four companies which floated on an American Stock Exchange since 1995 who we believe are very similar to Penumbra.

Micro Therapeutics Inc:

This company offers protection devices, liquid embolics, embolization coils, flow diversion, thrombectomy catheters and occlusion balloons. From the year it IPO'd to the year it was acquired, the company grew at a CAGR of 44.51%. This was during a period of favourable and buoyant market conditions. They grew almost 40 percentage points higher than the estimates that we have provided making us more comfortable in our revenue projections.

Micro Therapeutics Inc.										
Year	1997	1998	1999	2000	2001	2002	2003	2004	CAGR IPO	CAGR IPO +2
Revenue	2.7	4.2	4.1	5.7	8.8	12.7	24.5	35.7	44.51%	54.20%

Table 2: Sourced from Bloomberg

EV3 Inc:

This company develops, distributes and manufactures products for peripheral vascular and neurovascular disease – much like Penumbra. The company floated in 2005 before it was acquired by Covidien in 2010. It grew at a CAGR of 26% from two years after its listing until its takeover. This again solidifies our belief that our 10 year CAGR estimate of 15.17% is reasonable.

EV3 Inc.							
Year	2005	2006	2007	2008	2009	CAGR IPO	CAGR IPO +2
Revenue	133.7	202.4	284.2	422.1	449.1	35%	26%

Table 3: Sourced from Bloomberg

Rita Medical Systems Inc:

Rita Medical manufactured very similar products to Penumbra which were used to treat different types of diseases. They developed catheters to treat solid cancerous and benign tumors, whereas Penumbra treat aneurisms and blood clots. They listed in 2000 and grew at a CAGR of 35.92% until they were acquired by Angiodynamics. It must be noted that this was also during a period of considerable market conditions.

Rita Medical Systems								
Year	2000	2001	2002	2003	2004	2005	CAGR IPO	CAGR IPO +2
Revenue	10	14.8	17.4	16.6	28.2	46.4	35.92%	38.73%

Table 4: Sourced from Bloomberg

Micrus Endovascular LLC:

Micrus Endovascular's products are very similar to Penumbra and are used by endovascularly trained neurosurgeons. Two years after they were listed, they grew at a CAGR of 15.71% before they were acquired by medical device giant Johnson & Johnson. This rate is very close to the one which corresponds to the CAGR for our 10 year forecasting period, further strengthening the case for the revenue projections we have attributed to Penumbra.

Micrus Endovascular LLC								
Year	2005	2006	2007	2008	2009	2010	CAGR IPO	CAGR IPO +2
Revenue	24	32.8	58.8	69.2	78.2	91.1	30.56%	15.71%

Table 5: Sourced from Bloomberg

We have tremendous confidence in our revenue projections and believe that they are an accurate representation of Penumbra's future earnings. They have been based on a sample of 165 medical device companies and have been further supplemented by four mini-case studies on the specific sub-segment of neuro/peripheral vascular manufacturers. You can find a detailed analysis of our revenue projections and costs in Appendix A.

Expenses

Cost of Goods Sold

Penumbra's COGS as a percentage of sales has remained incredibly stable over the last four years.

Year	2013	2014	2015	2016	Average
COGS	34.86%	34.00%	33.34%	35.12%	34.33%

Table 6: Sourced from Penumbra 10-K's

We have projected Penumbra's COGS to remain stable over the course of our projection period at 34.33%.

$$\frac{COGS}{Revenue} = 34.33\%$$

Operating Expenses

For Penumbra to command any intrinsic value, the company's operating expenses must converge to the industry average over the coming years. If we were to forecast operating expenses as a percentage of revenues at the current rate, the company would be loss making forever and the share price's intrinsic value would be zero. This is something which NYU Professor Aswath Damodaran calls the "pathway to profitability" and is a common occurrence in growth firms. In its first few years, the company must incur extremely high operating expenses to grow revenues and gain market share. Once revenues have increased to levels that are sustainable or to a level where the marginal benefit of incurring more operating costs has reached zero then the company will begin to lower its operating expenses. We believe that this convergence to industry levels will begin in 2017 and will converge by the year 2022. Please see below our forecasted operating expense percentages:

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
OE %	66%	64%	64%	65%	62%	58%	55%	52%	49%	46%	46%	46%	46%	46%

Table 7: Authors' calculations

The industry average has been calculated below:

Operating Expenses						
	2012	2013	2014	2015	2016	Average
Abbott Labs	43.82%	39.68%	38.74%	40.72%	38.20%	40.23%
Boston Scientific	55.14%	57.09%	56.64%	56.29%	54.54%	55.94%
Johnson & Johnson	42.45%	42.09%	40.96%	41.72%	40.03%	41.45%
Medtronic	46.02%	45.73%	45.12%	46.86%	47.62%	46.27%
Stryker	43.99%	44.14%	42.98%	43.69%	43.96%	43.75%
Average	46.28%	45.74%	44.89%	45.86%	44.87%	45.53%

Table 8: Sourced from Bloomberg

Taking a look at the four companies we have studied in our revenue projections, we see that they had to decrease their operating expenses to levels that would allow them to survive in the market. Detailed below are the four 'case-study' companies which have followed the "pathway to profitability".

Micrus Endovascular LLC							
Year	2005	2006	2007	2008	2009	2010	Change
Rev	24	32.8	58.8	69.2	78.2	91.1	-
OE	23	32.1	51.3	70.1	66.5	58.5	-
OE %	96%	98%	87%	101%	85%	64%	**32%**

Table 9: Sourced from Bloomberg

Rita Medical Systems							
Year	2000	2001	2002	2003	2004	2005	Change
Rev	10	14.8	17.4	16.6	28.2	46.4	-
OE	18.6	23.1	24.4	21.7	24.4	33.2	-
OE %	186%	156%	140%	131%	87%	72%	**114%**

Table 10: Sourced from Bloomberg

EV3 Inc.						
Year	2005	2006	2007	2008	2009	Change
Rev	133.7	202.4	284.2	422.1	449.1	-
OE	180.4	185.7	265.1	311.8	295.9	-
OE %	135%	92%	93%	74%	66%	**69%**

Table 11: Sourced from Bloomberg

Micro Therapeutics Inc.									
Year	1997	1998	1999	2000	2001	2002	2003	2004	Change
Rev	2.7	4.2	4.1	5.7	8.8	12.7	24.5	35.7	-
OE	8.5	11.3	12.7	14	19	33	41.7	42.1	-
OE%	315%	266%	310%	246%	217%	260%	170%	118%	**196%**

Table 12: Sourced from Bloomberg

Depreciation & Amortization:

Since Penumbra are in the early stages of their public life-cycle we believe that the company will continue to acquire assets to sustain the revenue growth figures detailed above. For this reason, we felt that leaving depreciation at current levels would be an unrealistic assumption to make. We believe that depreciation and amortization will continue to grow at its current rate (50.26%) until 2021 and after this point we have kept it constant. Please see below:

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
D&A	0.68	0.75	1.75	2.30	3.45	5.19	7.79	11.71	17.60	17.60	17.60	17.60	17.60	17.60

Table 13: Sourced from Bloomberg and authors' calculations

Change in Net Working Capital:

We have taken the change in net working capital of the year after the IPO and kept it constant for our projection period. We feel that out of our three observations this is the best representation of how the firm will manage its working capital. It would be inaccurate to assume that the firms net working capital would be negative as we believe there is a requirement to increase assets in order to achieve revenue growth rates. The figure chosen is the smallest figure out of the last three years and anything higher will only serve to solidify our sell recommendation.

$$\Delta_{NWC} = \$11.8mm$$

Capital Expenditure

In 2016, the company spent $13.6mm on capital expenditures. We have projected that they will spend $15mm in 2017 and have kept this constant over the projection period. We believe that the company will require this kind of capital outlay in order to support the growing nature of the business. Increasing or decreasing CapEx by $15mm YOY is immaterial to our final recommendation.

$$CapEx = \$15mm$$

Beta

Traditionally, we would regress the company's share price against the return on the market index to get our levered beta, but since Penumbra was only listed in 2015 we did not have enough data to accurately portray the company's true beta.

Instead, we have gathered 120 monthly returns for five of Penumbra's closest competitors and regressed them against the Russell 3000.

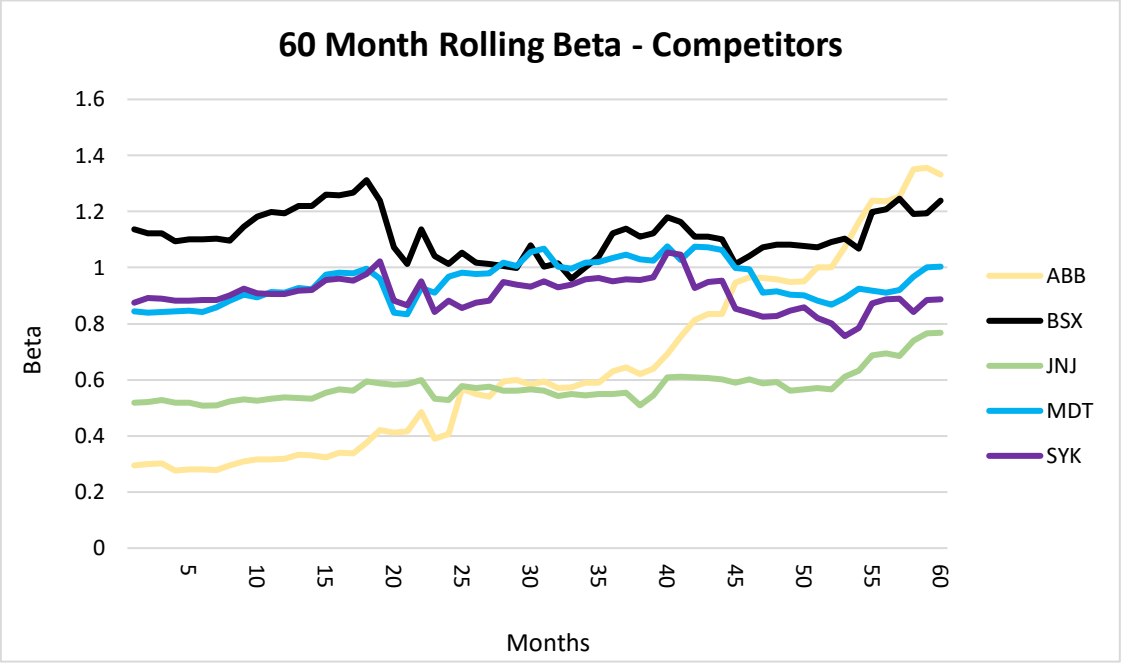

Figure 10: Authors' calculations

We noticed that two of the five competitors had unusual betas (ABB & JNJ) and decided to remove them from our calculations to ensure our beta calculation remained accurate.

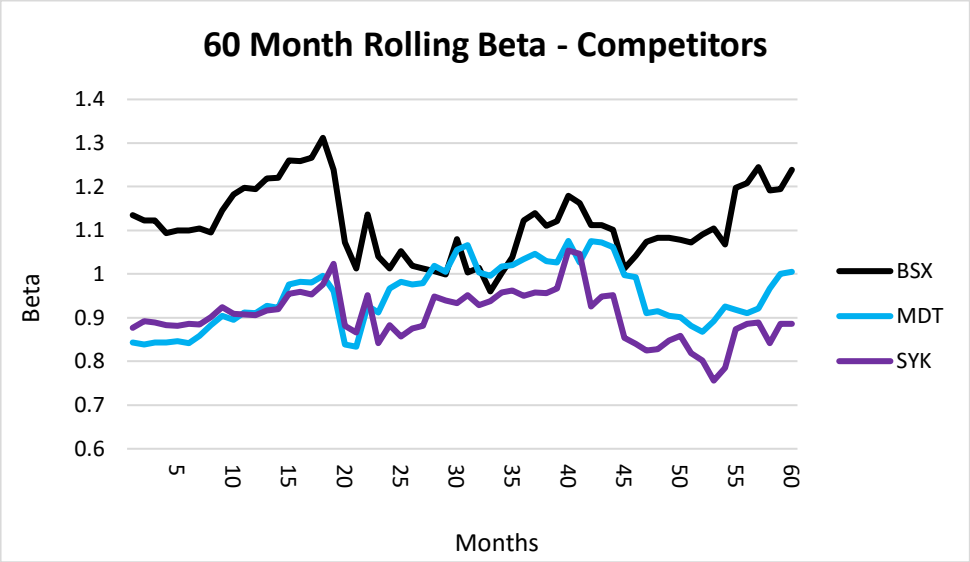

Figure 11: Authors' calculations

Please see below a table containing our levered beta calculations and subsequent unlevered beta calculation for Penumbra Inc.

Comparable Companies Beta Calculation					
Company	Levered Beta	Debt (USD)	Equity (USD)	Tax Rate	Unlevered Beta
Boston Scientific	1.12	5,484	6,733	0.12	0.65
Medtronic	0.95	31,240	52,063	0.18	0.64
Stryker	0.90	6,914	9,550	0.14	0.56
Average	**0.99**		**2,873**	**0.15**	**0.99**

Table 14: Sourced from Bloomberg and 10-K's

Penumbra have no debt on their balance sheet and as such their levered beta is equal to their unlevered beta. We can now use this beta figure to calculate the cost of equity for Penumbra.

Risk-free rate

We used the yield from the 1-year US Treasury bill as at 28th April 2017.

$$r_f = 1.06\%$$

Market Return:

The market risk premium is the required rate of return an investor requires to invest in the market. It is the compensation an investor receives for bearing the risk involved with investing in the market security. It is one of the most figures in finance with hundreds of financial literatures debating the topic. To calculate the market risk premium, we have utilised the library of Eugene Fama and Kenneth French. In 1992, Fama and French developed an asset pricing model known as the Three-Factor Model. One of the inputs to the model is the market risk premium. As such, we believe their extensive online library will provide us with the most accurate figure to use in estimating the market risk premium. Using monthly data stretching back to the start of 1930, we took an average of the monthly market risk premium's and annualised. This gave us a figure of 7.62%.

$$(r_m - r_f) = 7.62\%$$

Return on Equity

Using the CAPM formula, we were able to calculate Penumbra's Return on Equity.

$$ROE = r_f + \beta_U(r_m - r_f) = 8.6\%$$

Tax Rate:

Over the past four years the company has experienced extreme effective tax rates because of tax provisions and deferrals. We have taken the effective tax rates of all the companies listed in Penumbra's 10-k as a direct competitor and this gives us an effective tax rate of 20%.

Industry Tax Rate	
Company	Effective Tax Rate
Abbott Laboratories	25%
Boston Scientific	12%
Johnson & Johnson	17%
Medtronic	18%
Stryker	14%
Terumo	34%
Average	20%

Table 15: Sourced from Bloomberg

Implied Valuation

We believe that Penumbra is currently trading at a 20.43% premium and that it is overpriced. We are urging the members of the investment committee to sell any holdings in Penumbra as the share price is not trading at its fair value and will soon correct itself. We have set the target price of Penumbra at $68.07.

Projected Free Cash Flows											
Year	1	2	3	4	5	6	7	8	9	10	TV
Free cash flow	-14.9	0.0	20.6	45.5	77.9	111.7	127.6	145.0	162.4	178.6	4035.4
Discount Factor	0.92	0.85	0.78	0.72	0.66	0.61	0.56	0.52	0.48	0.44	0.45
Present Value of FCF	-13.7	0.0	16.1	32.7	51.5	68.1	71.6	74.9	77.3	78.3	1829.34

Table 16: Authors' calculations

DCF Valuation	
Market Cap ($ MM)	2873
DCF Valuation ($ MM)	2286
Discount/(Premium)	-20.43%
Current Share Price ($)	85.54
Implied Share Price ($)	68.07

Table 17: Authors' calculations

Valuation Method 2: Precedent Transactions

Our second investment thesis revolves around Penumbra being a potential takeover target for one of the existing large-cap medical device firms. Penumbra could be perceived as an ideal takeover target for a number of reasons. If the peripheral vascular and neurovascular market revenues continue to grow at historical growth rates (3.3% 5-year CAGR) until 2021, the industry will be worth $9.8bn and this represents an opportunity for Penumbra to gain market share.

This growth in revenues will need to be supported by innovative products and new technologies. Given Penumbra's strong presence in the acute ischemic stroke market and the acquisitive nature of large medical device firms such as Medtronic and Johnson & Johnson, Penumbra represents the ideal opportunity to enter this industry and expand an existing portfolio of products. By purchasing Penumbra and gaining ownership of its product portfolio, this can reduce the time to make the same advances through in-house research and development.

Therefore, we decided to conduct a Precedent Transactions analysis on Penumbra. This will allow us to assess the viability of Penumbra as a takeover target and determine if there is any value for investors to hold the stock in the event of a takeover.

When conducting our previous analysis on revenue projections with respect to IPO's, we discovered that a large portion of medical device firms tend to be acquired by these aforementioned large-cap companies. This gave us access to lots of data and allowed us to be very specific about the criteria regarding the selection of appropriate transactions. These are listed below:

1. Target had to undertake an Initial Public Offering (IPO) within 10 years of being acquired.
2. Target had to have products in the neurovascular and/or peripheral vascular area.
3. Target had to have limited number of products in portfolio.

Damodaran (2009) notes that several problems can occur when analysing growth companies using Transaction Value (TV)/EBIT and TV/EBITDA multiples. Given the recent expansion of Penumbra's business and large cost base following the IPO, we felt that these multiples would not be appropriate to use. Therefore, we have decided to use the TV/Revenue multiple.

The five transactions we chose are listed below in Table 17:

Precedent Transactions Chosen					
Target	**Acquirer**	**Year**	**Deal Size (MM USD)**	**TV/Sales**	**Price Premium (%)**
Arterial Vascular Inc	**Medtronic**	1999	3,210	**6.14x**	61.32
Micro Therapeutics Inc	**ev3 Inc**	2006	130	**8.84x**	57.76
AGA Medical Holdings Inc	**St Jude Medical**	2010	1,298	**6.19x**	41.45
ev3 Inc	**Covidien**	2010	2,490	**5.27x**	19.71
Boston Scientific (Neuro)	**Stryker**	2010	1,500	**4.41x**	Unknown

Table 18: Acquisition details sourced from Bloomberg

We calculated the mean value of the TV/Sales multiples across all five transactions to be 6.17x. We are calculating the value of Penumbra as a potential takeover target within the following 12 months. Therefore, the estimated 2017 revenue figure is used for this valuation. Table 18 shows our precedent transaction implied share price.

Precedent Transaction Valuation	
Mean TV/Sales	**6.17x**
Penumbra 2017E Sales (MM USD)	352
Penumbra EV (MM USD)	**2,171**
+ Cash & STI (MM USD)	129
- Total Debt (MM USD)	-
- Preferred Equity	-
- Minority Interest	-
= Implied Market Cap (MM USD)	**2,299**
Current Market Cap (MM USD)	2,873
Shares Outstanding (MM)	34
Implied Share Price (USD)	68.43
Current Share Price (USD)	85.52
Discount (Premium)	**-20.0%**

Table 19: Acquisition details sourced from Bloomberg

As can be observed from Table 18, Penumbra's current share price is still trading at a premium to the market and our recommendation remains a 'Sell'. Despite the large premiums paid for some of the target companies, including 61% for Medtronic's acquisition of Arterial Vascular, and incorporated into the valuation, the current share price is still vastly over-priced. Any potential buyer would stay clear of Penumbra at the current price and would wait until the current market value of the company depreciates.

Supplementary Information:

Multiples

We calculated multiples for Penumbra and seven similar firms we identified to Penumbra that had undergone an IPO and operated in the peripheral vascular and neurovascular market. We believe that these represent better competitors to choose than large-cap established firms such as Johnson & Johnson, Stryker, etc. This was used to supplement our previous valuation methods. From Table 19, it can clearly be observed that Penumbra is very over-priced in comparison to its competitors. This reaffirms our belief that Penumbra's current market value is far too high at the moment.

Valuation Multiples			
	Trailing P/E	P/Book	EV/EBITDA
AGA Medical Holdings (Sep 2010)	130.2	30.3	103.5
Arterial Vascular (Sep 1998)	15.0	7.0	8.2
Endologix Inc (Mar 2017)	3.1	6.3	-
ev3 (Apr 2010)	29.4	2.3	22.1
LeMaitre Vascular (Mar 2017)	56.1	6.3	26.4
Micro Therapeutics (Oct 2005)	5.5	6.1	5.4
Tactile Systems (Dec 2016)	109.4	4.6	46.3
Comp Median	29.4	6.3	24.3
Penumbra	**194.2**	**10.0**	**2,898.3**

Table 20: Sourced from Bloomberg

Short Interest

A very popular sentiment indicator is the short interest ratio. Short interest is the quantity of shares which investors have sold "short" i.e. they have borrowed the shares and sold them immediately in anticipation for the share price to fall so they can buy them back cheaper and make a profit. Short interest is a strong indicator for market sentiment and the higher the short interest the stronger the market believes that the share price will fall. The short interest ratio is short interest divided by the average daily trading volume and is used by fundamental and technical traders to identify the prevailing sentiment the market has for a security.

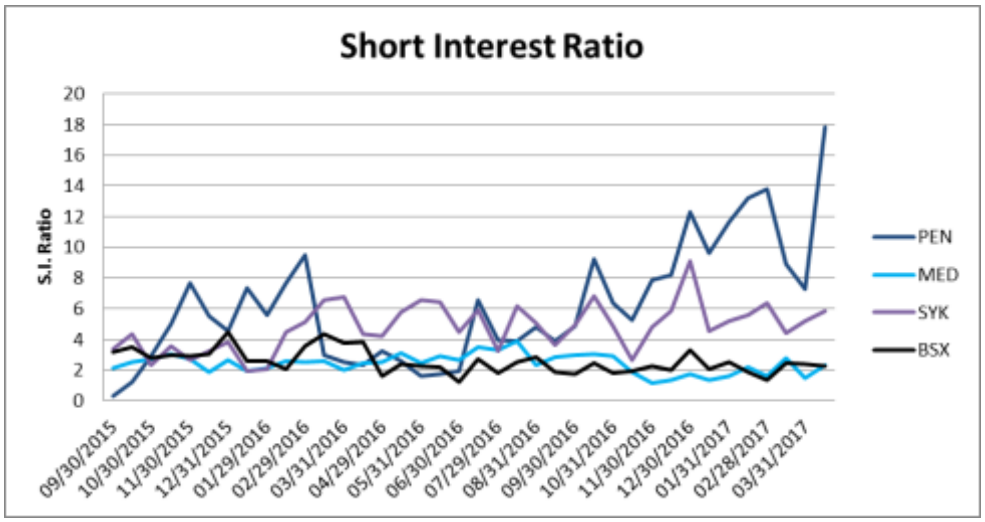

Figure 12: Sourced from Bloomberg

Figure 12 details the short interest ratio for Penumbra, Medtronic, Stryker and Boston Scientific. It is quite clear that the market has a strong feeling that the share price of Penumbra will decline as indicated by its short interest ratio of 18. The nearest competitor has a short interest ratio of just 6. It is also alarming to observe the rate of change in Penumbra's short interest ratio increasing from 2.31 on 04/15/2015 to 17.82 on 04/13/2017. We believe this is a strong indicator that the market is beginning to realise that the share price of Penumbra is overpriced and that the stock's price will decline.

Overall Recommendation:

Our overall recommendation is to sell any holdings in Penumbra. While the company has performed exceptionally over the past couple of years we believe that the market is currently overpricing Penumbra's potential and will soon correct itself. Penumbra's share price has appreciated substantially in the years since its IPO and has yielded excellent returns for its investors. However, we believe that the value of the firm is equivalent to the present value of its future cash-flows and that currently the share price does not reflect this. Our analysis of a large sample of medical device companies indicate that the future revenue streams attributable to this firm do not match its current share price. Our precedent transaction analysis tells us that any potential acquirer will postpone negotiations until a time when the share price is trading at a fairer value. We are urging the members of the SOM/Smurfit Investment Committee to sell any holdings in Penumbra Inc.

Appendix A:

Forecasted Free Cash Flows

Penumbra Inc (PEN) - DCF Model																
In Millions of USD	FY 2013	FY 2014	FY 2015	FY 2016	CAGR ('13-'16)	FY 2017E	FY 2018E	FY 2019E	FY 2020E	FY 2021E	FY 2022E	FY 2023E	FY 2024E	FY 2025E	FY 2026E	CAGR ('17-'26)
Revenue	**88.8**	**125.5**	**186.1**	**263.3**	*43.64%*	**351.8**	**447.5**	**549.9**	**640.7**	**748.5**	**838.7**	**937.7**	**1,045.4**	**1,153.9**	**1,254.6**	*15.17%*
- Neuro	81.3	106.2	141.4	185.5		246	313	385	448	524	587	656	732	808	878	
- Peripheral Vascular	7.5	19.3	44.7	77.8		106	134	165	192	225	252	281	314	346	376	
Cost of Goods & Services	**31.0**	**42.7**	**62.0**	**92.5**		**120.8**	**153.6**	**188.8**	**219.9**	**256.9**	**287.9**	**321.9**	**358.9**	**396.1**	**430.7**	
Gross Profit	**57.9**	**82.8**	**124.1**	**170.8**		**231.1**	**293.9**	**361.1**	**420.7**	**491.5**	**550.8**	**615.8**	**686.6**	**757.8**	**823.9**	
+ Selling, General & Admin	44.9	64.3	101.9	148.3		161.2	190.7	216.5	231.6	246.3	248.9	278.3	310.3	342.4	372.3	
+ Research & Development	14.1	15.6	18.0	23.9		55.8	70.9	87.2	101.6	118.6	132.9	148.6	165.7	182.9	198.9	
+ Other Operating Expense	0.0	0.0	0.0	-0.1		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
- Operating Expenses	**59.0**	**79.8**	**119.8**	**172.0**		**217.0**	**261.6**	**303.7**	**333.1**	**365.0**	**381.8**	**426.9**	**476.0**	**525.4**	**571.2**	
EBITDA	**-1.1**	**3.0**	**4.2**	**-1.2**		**14.1**	**32.3**	**57.4**	**87.6**	**126.6**	**168.9**	**188.9**	**210.6**	**232.4**	**252.7**	
- Depreciation & Amortization	0.7	0.8	1.8	2.3		3.5	5.2	7.8	11.7	17.6	17.6	17.6	17.6	17.6	17.6	
EBIT	**-1.8**	**2.3**	**2.5**	**-3.5**		**10.6**	**27.1**	**49.6**	**75.9**	**109.0**	**151.3**	**171.3**	**193.0**	**214.8**	**235.1**	
EBIT*(1-Tc)						8.5	21.6	39.6	60.6	87.1	120.9	136.9	154.2	171.7	187.9	
Add Depreciation/Amortization						3.5	5.2	7.8	11.7	17.6	17.6	17.6	17.6	17.6	17.6	
Less Increase in NWC						11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	
Less CapEx						15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	
FCF						**-14.9**	**0.0**	**20.6**	**45.5**	**77.9**	**111.7**	**127.6**	**145.0**	**162.4**	**178.6**	

Figure 21: Forecasted Free Cash Flows

DCF model using our analysis

Projected Free Cash Flows											
Year	1	2	3	4	5	6	7	8	9	10	TV
Free cash flow	-14.9	0.0	20.6	45.5	77.9	111.7	127.6	145.0	162.4	178.6	4035.4
Discount Factor	0.92	0.85	0.78	0.72	0.66	0.61	0.56	0.52	0.48	0.44	0.45
Present Value of FCF	-13.7	0.0	16.1	32.7	51.5	68.1	71.6	74.9	77.3	78.3	1829.34

Figure 22: DCF Valuation

Appendix B:

Bloomberg. (2017) *Bloomberg Professional*. [Online]. Available at: Subscription Service (Accessed: 29 April 2017).

Damodaran, A. (2009). 'Valuing Young, Start-up and Growth Companies: Estimation Issues and Valuation Challenges'. *NYU Stern School of Business*.

Penumbra Earnings Call Q4 2016.

Penumbra Form 10-K 2015

Penumbra Form 10-K 2016

IMPORTANT DISCLOSURE

Please read this disclosure before reading this report. This report has been written by MBA students at Yale's School of Management in partial fulfilment of their course requirements. The report is a student and not a professional report. It is intended solely to serve as an example of student work at Yale's School of Management. It is not intended as investment advice. It is based on publicly available information and may not be complete analyses of all relevant data. If you use this report for any purpose, you do so at your own risk.

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