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From ML to M&A

Ten M&A Target Predictions through a Machine Learning Model

Sunday, December 15, 2019

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Our model is 6x more accurate than base rate in predicting M&A.

Machine learning models are powerful tools for predicting M&A and can be used to augment fundamental analysis. We built random forest, neural network, and ensemble models for predicting M&A activity and found that all of them have significant predictive power. The ensemble model proved to be most effective with 10.8% of its predictions in our test period being an acquisition target in the following 12 months. While this number may not sound high on its own, this rate is more than 6x the base rate of M&A activity for U.S. listed, publicly traded companies. We are excited about this performance, as it indicates that the model can be used as a powerful tool alongside fundamental analysis.

We highlight our top 10 predictions for M&A targets, including Mylan and ADT.

Our ensemble model predicted that Mylan N.V. (MYL) would be an acquisition target in the twelve months following June 30, 2019. One month later, on July 29, 2019, Pfizer (PFE) announced the acquisition of Mylan. Although the deal has not closed yet, our model correctly predicted the announcement event. Predicting the Mylan deal is a big win for our model given the overall rarity of M&A (the base rate for M&A announcements is 1.71%.)

Aside from Mylan, there are nine additional companies that our model predicted will be the target of an acquisition by June 2020. Our model used over 1 billion publicly available data points in three different machine learning models to make these predictions. From there, our team performed fundamental analysis to evaluate each of the model's predicted targets. From that analysis, our team has identified ADT as the most likely US-listed, publicly traded company to be acquired before next June.

Our process is not without shortcomings, and we note areas for improvement.

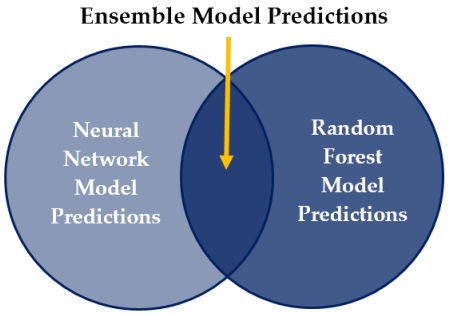
Merger and acquisition activity, especially for publicly traded companies, is rare in nature and provides a limited dataset to analyze. Our team has taken every step in our power to mitigate these shortcomings and improve the reliability of our models. We will make suggestions on areas for improvement—especially for developing a model to assist in live investment decisions.

For further reading and insight into our process and findings, please reference the Appendix, the Company Tear Sheets, and our Machine Learning Process Manual.

Contents

Our model is 6x more accurate than base rate in predicting M&A.

Ensemble Model



Our team used an ensemble model, which outputs predictions by using a combination of the neural network and random forest models, to make predictions. We took the top 10 predictions from the ensemble model to use as our final projections. Based on our model, we believe that these 10 companies have the highest likelihood of being acquired in the coming 12 months.

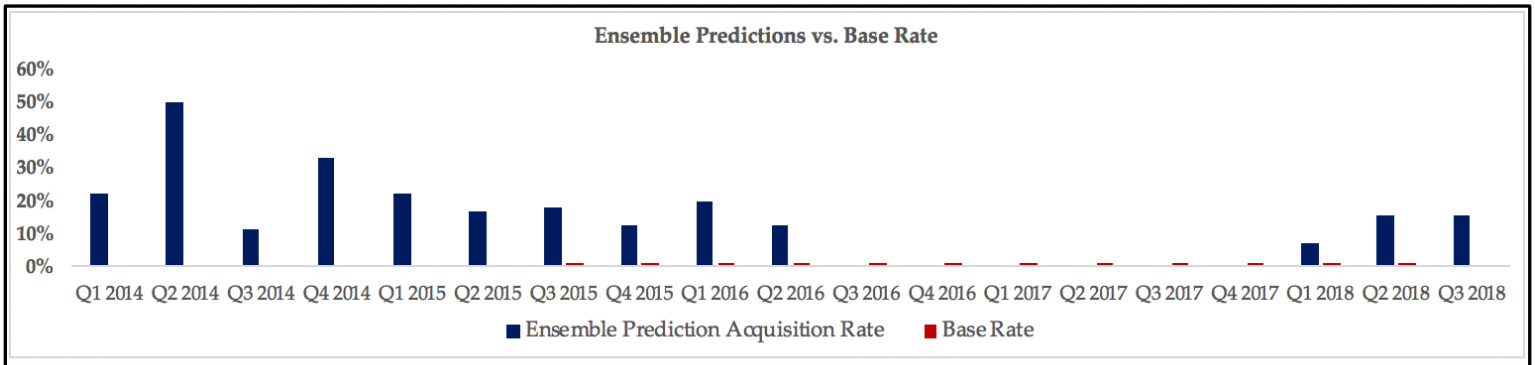
By taking the predictions of these two non-correlated models, the ensemble produced the strongest historical success rate of any of our models. Based on S&P Capital IQ data, we found the base rate for publicly traded acquisitions in the past 30 years to be 1.71%. This means that for any given set of 100 companies during the period, approximately 2 of them would be acquired each year. In back testing, 10.8% of the ensemble model's predictions were correct—over 6x the base prediction rate for that period.

Machine Learning: Why Ensemble Models Work

Just as a portfolio of non-correlated stocks will generate higher expected risk-adjusted returns than any individual constituent, an ensemble model is able to provide stronger, more consistent predictions than any of the individual models that it draws upon, due to non-correlated variations having off-setting effects on each other.

In the graph below, the success rate of the ensemble model is shown against the base rate for acquisitions during the testing sample time period. There was significant variability in the prediction rate quarter-by-quarter. This variability is an expected result of the small number of predictions being made and the overall rarity of M&A events, and also due to predictions that reoccur in consecutive quarters. We believe that this model provides significant value by generating around a dozen predicted M&A targets every quarter, with an average of one or two of those predictions being correct.

Graph 1: In our test period, 10.8% of the ensemble model's predictions were correct, more than 6x higher than base rate of 1.71%.

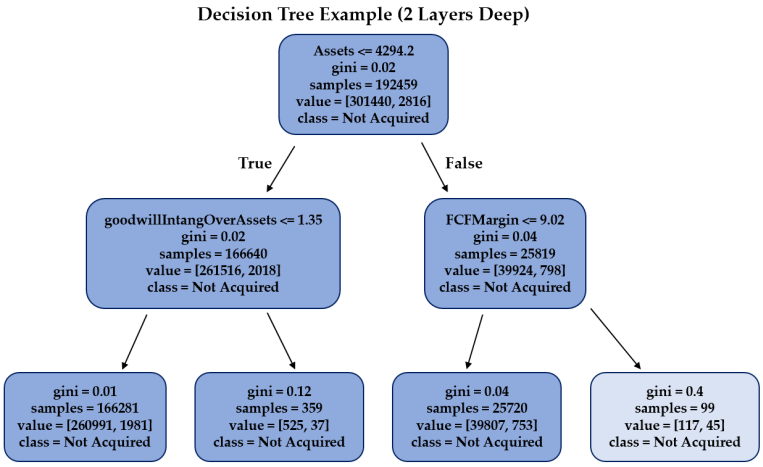


	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018	Q2 2018	Q3 2018
# Predictions	9	6	9	6	9	12	11	8	15	16	17	18	19	17	14	16	14	13	13
# of Predictions Acquired in NTM	2	3	1	2	2	2	2	1	3	2	0	0	0	0	0	0	1	2	2
Prediction Acquisition Rate	22%	50%	11%	33%	22%	17%	18%	13%	20%	13%	0%	0%	0%	0%	0%	0%	7%	15%	15%
Base Rate	0.74%	0.74%	0.62%	0.65%	0.68%	0.74%	0.91%	0.94%	1.25%	1.13%	1.02%	1.01%	0.85%	1.02%	0.87%	0.94%	0.93%	0.79%	0.76%

Random Forest Model

Our random forest model had an 8.28% prediction rate over our testing period. The model's period-by-period acquisition rates were more consistent than the ensemble model, likely due to the higher overall prediction count (~200 per period, compared to ~12 from the ensemble model.) While this does provide stronger proof for the effectiveness of the model, it also makes the predictions less actionable.

We used a random forest algorithm to systemically generate hundreds of unique decision trees, which in aggregate can output predictions for the acquisition likelihood of a given company.



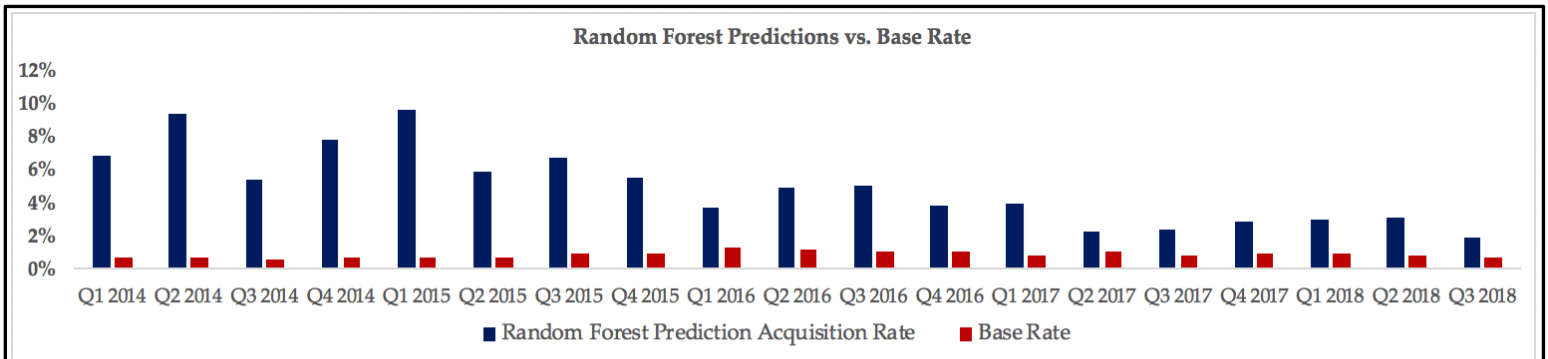
Each individual tree "votes" for its result, and the model uses the classification with the most votes in the forest for predicting y-variable probabilities.

Table 1: Companies predicted by our random forest model to be acquired over the 12 months following June 30, 2019.

Random Forest Predictions - June 2019	
CLF	6.9%
GPX	6.3%
BRN	5.9%
THC	5.4%
EVFM	5.4%
TLND	5.3%
VVUS	5.0%
NEBU	5.0%
LHC	4.5%
CMTL	4.5%

Unlike our neural network model, which makes binary predictions, our random forest model outputs acquisition likelihoods for each company. To test the predictive power of this model, we backtested the acquisition rate among companies with predicted likelihoods in the top 1% in a given period. The performance of the random forest versus the base rate is shown in the graph below. In June 2019, the random forest predicted that the companies listed in the table on the left have the highest probability of being targeted in an M&A event before June 2020.

Graph 2: Our random forest model had an 8.28% prediction rate over our testing period.



	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018	Q2 2018	Q3 2018
# Predictions	204	212	203	242	197	219	194	268	241	261	255	287	249	262	256	315	268	286	260
# of Predictions Acquired in NTM	14	20	11	19	19	13	13	15	9	13	13	11	10	6	6	9	8	9	5
Prediction Acquisition Rate	7%	9%	5%	8%	10%	6%	7%	6%	4%	5%	5%	4%	4%	2%	2%	3%	3%	3%	2%
Base Rate	0.74%	0.74%	0.62%	0.65%	0.68%	0.74%	0.91%	0.94%	1.25%	1.13%	1.02%	1.01%	0.85%	1.02%	0.87%	0.94%	0.93%	0.79%	0.76%

Neural Network Model

Our neural network model had a 5.57% prediction rate over the testing period. While this still demonstrates significant predictive power, its performance trails both of the other models. This is a sign that we may not have had enough data to fully utilize the power of a neural network.

The neural network model was the first model run by our team in this process. Neural networks are a black box-style model that uses weighted regressions in layers of nodes to calculate a prediction for the y-variable presented.

One of neural networks' greatest strengths is their ability to find complex, intervariable relationships within a dataset. However, they typically require very large amounts of data to be very effective, and care must be taken to avoid overfitting the model to the training data.

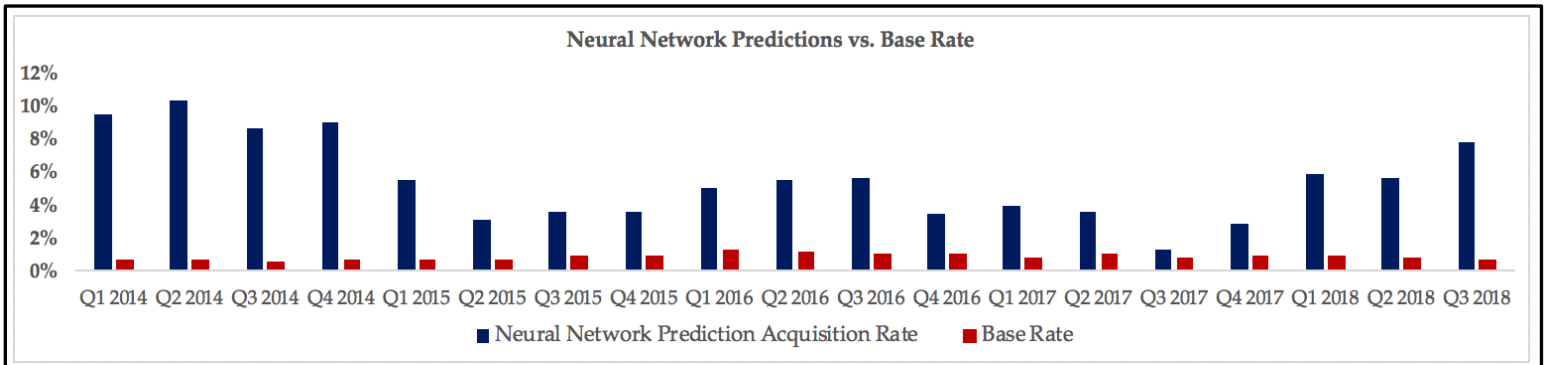
Unlike the random forest model, our neural network was not built to provide any specific likelihood in its predictions. The companies either show up as a 1, meaning that the company is predicted to be the target of an acquisition that is announced in the coming year, or as a 0, meaning that the model believes that the company will not.

In our model, we ran a three-layer neural network that produced around 60 predicted acquisition targets every period. The prediction success of the neural network is displayed in the graph below. See Appendix 3 for a more extensive chart of the model's predictions in Q3 2019.

Table 2: Companies predicted by our neural network model to be acquired over the 12 months following June 30, 2019.

Neural Network Predictions - Q3 2019		
BDX	S	IRM
CPB	WDC	SSNC
CMC	ORCL	VEON
TAP	ATUS	RELX
DHR	DELL	NLSN
DIS	TEVA	SNY
DOV	LH	SAP
ECL	PBCT	CCI
GD	ENTA	CHTR
JNJ	COMM	EQIX
JCI	MNK	DRRX
KMI	OGI	MDLZ
MDT	LILAK	INFO
CVS	QCOM	DISCA
MRK	ROP	VIAB
MXC	BSX	FIS
MYE	SBUX	ATEC
MYL	HPE	QRTEA
PG	FWONK	AVGO
RCI	AGN	NXPI
SHW	AZN	FMS
SJM	KDP	ORAN
T	BHC	BUD
SWK	ADT	MFGP
TMO	DISH	ZEAL
TSN	DVA	

Graph 3: Our neural network model had a 5.57% prediction rate over the testing period.



	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Q3 2016	Q4 2016	Q1 2017	Q2 2017	Q3 2017	Q4 2017	Q1 2018	Q2 2018	Q3 2018
# Predictions	42	48	46	44	54	65	56	56	59	72	71	87	75	82	76	70	68	71	64
# of Predictions Acquired in NTM	4	5	4	4	3	2	2	2	3	4	4	3	3	3	1	2	4	4	5
Prediction Acquisition Rate	10%	10%	9%	9%	6%	3%	4%	4%	5%	6%	6%	3%	4%	4%	1%	3%	6%	6%	8%
Base Rate	0.74%	0.74%	0.62%	0.65%	0.68%	0.74%	0.91%	0.94%	1.25%	1.13%	1.02%	1.01%	0.85%	1.02%	0.87%	0.94%	0.93%	0.79%	0.76%

We highlight our top 10 predictions for M&A targets, including Mylan and ADT.

Listed in Table 3 are the 10 companies most likely to be acquired over the coming 12 months, as predicted by our ensemble model. We started our project in September 2019, using the most recent data up through June 2019 for our model. The data in our model ends on June 30, 2019, which allowed the model to then predict M&A targets for the next twelve months thereafter.

Below, we highlight Mylan, which was successfully predicted by our model. We also include an analysis of ADT, which we consider the most compelling company from the list in Table 3. A more detailed outline of the top ten company predictions can be found in Exhibit 1 in the Appendix.

Table 3: Ten companies predicted by our ensemble model to be acquired over the 12 months following June 30, 2019.

Ensemble Model Predictions - June 2019	
Ticker	Company Name
QCOM	QUALCOMM
ADT	ADT
CPB	CAMPBELL SOUP CO
T	AT&T
CMC	COMMERCIAL METALS CO
MXC	MEXCO ENERGY
SJM	J.M. SMUCKER CO
DHR	DANAHER
BDX	BECTON DICKINSON & CO
MYL	MYLAN N.V.

Table 4: Listed below are the parameters that were used throughout the process of creating our models.

Project Parameters	
Problem Statement:	Predict the most likely publicly traded M&A targets to be acquired within the next year
Acquisitions:	We targeted acquisition announcements in the following 12 months. Based on date of announcement, not date of closure
Time Frame:	Quarterly, historical data from 1990 to Q2 2019
Acquirer Stake:	To maintain a large sample size, we included majority and minority stake acquisitions that fit the equity method definition
Companies:	All equities traded on major U.S. exchanges (NYSE, NASDAQ, AMEX)
Excluded Sectors:	Finance and Real Estate
Model Selection:	Three model types were used. A random forest model, a neural network model, and an ensemble model of the two.
Training and Testing:	The model was trained on historical data from 1990-2013 and tested from 2014 - Q2 2019
Prediction Tools:	To form our predictions, we used machine learning algorithms in SQL and Python
Data Collection:	Data was collected from widely available sources (Bloomberg, CapIQ, Compustat, EDGAR, FactSet, FRED, USPTO, and Yfinance)
Error Checking:	All datasets had to be error checked for accuracy. The model can only be as good as the data inputs.

MYL

Mylan N.V. (MYL) is a leading generics pharmaceutical manufacturer with over 7,500 products including, most notably, the EpiPen. Other business lines include prescription generic, branded generic, brand-name drugs, and over-the-counter (OTC) remedies. On July 29, 2019, Mylan announced that it had received an offer to be acquired by Upjohn, a division of Pfizer (PFE), for $12B in cash. The acquisition will allow Pfizer to spin-off its Upjohn generics business and combine it with Mylan. The deal is expected to close mid-2020.

Mylan stock had suffered in the first half of 2019 due to weaker sales and a probe by multiple state attorneys general into whether Mylan had participated in a generic drug price fixing scheme. We believe that our model was able to identify Mylan as having a strong underlying business that could potentially be acquired at an attractive price.

ADT

ADT Inc. (ADT), the leading home security and automation solutions company, has a lengthy M&A history as both an acquirer and a target. After being taken private by Apollo Management in 2016, ADT was taken public again in 2018—with only 15% of its shares outstanding being freely traded. As such, Apollo still holds a significant majority stake in the company and is likely prepared to exit. ADT is posting the highest growth in the industry, its strongest stock performance in years, giving Apollo a prime window to sell high and exit their position.

We found this prediction interesting because it is no secret that Apollo has for sale signs in the window. However, our model is not affected by Apollo's reputation and history of deals. Instead, the model evaluated the company with an unbiased quantitative lens. Removing Apollo from the equation, the leadership of ADT should still feel that now is a good time to sell. With Apollo involved, it feels like a merger announcement could be posted soon.

We believe that ADT's assets, and more specifically its IP, could be attractive to a potential acquirer. The company recently sold off its Canadian operations for approximately $550M in cash. This deal leaves ADT with all its core assets still remaining, resulting in a leaner business that should be more attractive to a potential acquirer. ADT's recent partnership with Lyft strengthens our belief that its assets could be very attractive to an acquirer, especially to a consumer facing tech company.

Some companies we view as potential acquirers include AAPL, FB, and WMT. We believe that corporations are doing everything they can to become part of their customers' daily lives, as shown by the strong growth in smart home devices. Walmart has been attempting to offer in-home deliveries on a large scale, and home security is of the utmost importance for this endeavor. Amazon's acquisition of Ring in 2018 serves as a signal to its intentions, and Walmart is unlikely to cede that market easily.

As consumer convenience becomes increasingly important, home security will be imperative. Apple, for example, has long been a lifestyle brand that is committed to privacy. Buying ADT would allow Apple to enter the home security space much like how they have entered the personal banking industry. Lastly, Facebook's increasing focus on its Portal products, combined with its privacy issues in the past, make an ADT acquisition seem very logical.

Fundamental Analysis

We do not believe that our model should be used on a standalone basis. The intent of our quantitative model is to identify companies that could be likely acquisition targets over the coming 12 months. Because this type of event is such a rarity, we believe that no quantitative model will be capable of successfully predicting companies on a standalone basis. As such, our team believes it is necessary to supplement the model outputs with fundamental analysis.

Some of the areas where we believe fundamental analysis could enhance the predictive capabilities of our outputs are company ownership structure, management compensation and background, company product offerings and timelines, and industry specific metrics. We have attempted to address some of these topics in our fundamental analysis of each predicted company. For more analysis on each of the ensemble model's predicted companies, please see the tear sheets at the end of this document.

Our process is not without shortcomings, and we note areas for improvement.

Rarity of M&A

When building a predictive model, the larger the amount of historical data available to the model, the better. Mergers and acquisitions of publicly traded companies are rare in nature, and thus provide a limited dataset for analysis. With the number of U.S. publicly

Machine Learning: Bias vs. Variance

Bias refers to adjusting the input data before running a model rather than providing untapped "pure" data and allowing the machine to do all adjustments. Bias often leads to overfitting our model and performing worse in predictions. While we want to reduce **variance** as much as possible, it is important to find the right balance between bias and variance.

listed companies shrinking significantly over time, we have seen the amount of public acquisitions shrink accordingly.

The performance of a machine learning model generally scales with the amount of data it is provided, but due to the rarity of the event that our model set out to predict, we were limited to a few thousand historical examples of M&A events. This makes it difficult for models to differentiate between complex signals in the data and noise. We have taken caution in order to avoid overfitting our model to the acquisitions in our training set.

While machine learning is able to provide analysis of highly complex sets of data, there are limitations to its capabilities, and often the process itself requires injections of human bias. With this is mind, we made every effort to limit human bias, but note that it is present and must be taken into consideration.

Machine Learning: Sensitivity vs. Accuracy

We are attempting to predict an event that occurs with less than 2% of companies in a given year, yet we want our model to output strong and accurate predictions. This means that we not only need our model to have high accuracy (which could be achieved by only making negative predictions), but also meaningful sensitivity. To achieve this, we used F1 scores and AUC - ROC curves to evaluate and optimize our models, which allowed us to consider both sensitivity and accuracy.

Data: Limitations, Usability, and Accuracy

We targeted data sources that provided methods of bulk downloading data in a machine-readable format. This allowed aggregation of data for model importation and manipulation. Undertaking a project with this breadth of data comes with inherent limitations which will cap the number of usable resources. There are many factors that can be used to predict M&A announcements but are unable to be quantified on a large-scale basis. This is another reason that we believe fundamental analysis should supplement any quantitative model of this type.

We used reputable financial sources such as Capital IQ and Yahoo Finance to ensure the quality of our data input. To double check the accuracy of our data inputs, we pulled sample data from each set and compared it to a second source. We also used this method to check our calculations of data before running our model.

For smaller companies, historical data may not be accurate. Smaller companies are not tracked nearly as closely as their larger counterparts, and less confidence should be given to their numbers.

Time

Generally, using more data points results in more effective machine learning models. However, there are some limitations to training a model on older data. One problem is that some data sources only have a few decades of historical data. Another issue is that older data may be less relevant when trying to predict current-period events. Due to these factors, we chose to use data from 1990-2019 when training and testing our model. Going back further than 1990 would have negatively impacted the number of variables that were able to be included in our models.

Areas for Improvement

Prediction Lag

Our data collection process took around three months. By the time we finished training and testing our final models in November, their most recent predictions were based on data from June. This means that even though the model successfully predicted Mylan as an acquisition target, that prediction wasn't generated until after the July announcement date. The model did not know that a deal would be announced, but we did not know that it had predicted Mylan until November. Now that we've finished building the model from scratch, it is possible to automate many of the steps in our process to significantly decrease the time it takes to collect data and generate predictions, allowing the model to make potentially actionable predictions much closer to real time.

Additional Data Sources

When collecting data for our model, we limited ourselves to data sources that are accessible by most financial professionals. While this allows for greater replicability, our models could likely be improved by adding alternative or proprietary data. In addition, it may be possible to add private company data in order to increase the pool of data available to the model. We think the variable selection process is the most vital part of this project. Identifying and quantifying the most predictive variables is the biggest challenge and opportunity for improvement. We believe future versions of the project could greatly expand the current variable list.

Number of Variables/Metrics Used in Our Model

Variable/Metric	Total
Profitability, Growth & Returns	74
Capital Structure / Liquidity	24
Trading Multiples / Security Stats	60
Executive Compensation & Demographics	33
Market / M&A Trends	32
Board Ownership / Share Class	21
Patent Profile	2
Industry Trends	7
Predicted Variables	1
Total Variables	**254**

Different Prediction Durations

We trained our model to predict acquisition events in the following twelve months, however this twelve-month span may be too long for some use cases and can be adjusted. If having a shorter time-horizon on the predictions is important, our model could be re-trained to make predictions for a shorter duration into the future. However, doing so will worsen some of the problems that are caused by the rarity of M&A.

Industry Expertise

In any investing landscape, industry expertise can be an invaluable asset. In order to have a large enough dataset, our model is generalist and could benefit from the addition of industry specific data and metrics.
Further, we expect that supplementing this type of model with industry specific, fundamental analysis would largely enhance the performance and reliability of our model.

Appendix

Exhibit 1

Ensemble Model Predictions – June 2019

These predictions are generated by taking the cross-section of companies predicted by the neural network model and companies in the top 10% of the random forest model's predictions in June 2019.

Ensemble Model			
Ticker	Company Name	Industry	Market Cap
QCOM	QUALCOMM	Semiconductors	97,388
ADT	ADT	Commercial Services	7,016
CPB	CAMPBELL SOUP CO	Packaged Foods	14,096
T	AT&T	Telecom	279,490
CMC	COMMERCIAL METALS CO	Metals and Mining	2,470
MXC	MEXCO ENERGY	Oil & Gas	8
SJM	J.M. SMUCKER CO	Packaged Foods	12,070
DHR	DANAHER	Healthcare	104,000
BDX	BECTON DICKINSON & CO	Healthcare	68,500
MYL	MYLAN N.V.	Healthcare	9,800

Exhibit 2

Random Forest Model Predictions – June 2019

These are the 10 companies which our random forest model assigns the highest likelihood of being targeted in an M&A event from June 2019 – June 2020.

Random Forest				
Ticker	Company Name	Industry	Market Cap	Likelihood
CLF	CLEVELAND-CLIFFS	Metals and Mining	2,228	6.9%
GPX	GP STRATEGIES	Commercial Services	221	6.3%
BRN	BARNWELL INDUSTRIES	Oil & Gas	3	5.9%
THC	TENET HEALTHCARE	Healthcare	3,380	5.4%
EVFM	EVOFEM BIOSCIENCES	Pharmaceuticals	291	5.4%
TLND	TALEND	Software	1,169	5.3%
VVUS	VIVUS	Pharmaceuticals	30	5.0%
NEBU	NEBULA ACQUISITION CORP	SPAC	352	5.0%
LHC	LEO HOLDINGS CORP	SPAC	257	4.5%
CMTL	COMTECH TELECOMMUNICATIONS	Telecom	895	4.5%

Exhibit 3

Neural Network Model Predictions – June 2019

These are the companies which our neural network model predicts will be targeted in an M&A event from June 2019 – June 2020.

Neural Network Predictions - Q3 2019		
Ticker	Company Name	Industry
BDX	BECTON DICKINSON & CO	Healthcare
CPB	CAMPBELL SOUP CO	Packaged Foods
CMC	COMMERCIAL METALS	Steel
TAP	MOLSON COORS BREWING CO	Brewers
DHR	DANAHER CORP	Healthcare
DIS	DISNEY CO	Media
DOV	DOVER CORP	Industrial Machinery
ECL	ECOLAB INC	Specialty Chemicals
GD	GENERAL DYNAMICS CORP	Aerospace & Defense
JNJ	JOHNSON & JOHNSON	Pharmaceuticals
JCI	JOHNSON CONTROLS INTL	Building Products
KMI	KINDER MORGAN INC	Oil & Gas
MDT	MEDTRONIC PLC	Healthcare
CVS	CVS HEALTH CORP	Healthcare
MRK	MERCK & CO	Pharmaceuticals
MXC	MEXCO ENERGY	Oil & Gas
MYE	MYERS INDUSTRIES INC	Metal & Glass
MYL	MYLAN NV	Pharmaceuticals
PG	PROCTER & GAMBLE CO	Household Products
RCI	ROGERS COMMUNICATIONS	Telecommunications
SHW	SHERWIN-WILLIAMS CO	Specialty Chemicals
SJM	J.M. SMUCKER CO	Packaged Foods
T	AT&T INC	Telecommunications
SWK	STANLEY BLACK & DECKER INC	Industrial Machinery
TMO	THERMO FISHER SCIENTIFIC INC	Life Sciences Tools
TSN	TYSON FOODS INC	Packaged Foods
S	SPRINT CORP	Telecommunications
WDC	WESTERN DIGITAL CORP	Technology Hardware
ORCL	ORACLE CORP	Software
ATUS	ALTICE USA INC	Media
DELL	DELL TECHNOLOGIES INC	Technology Hardware
TEVA	TEVA PHARMACEUTICALS	Pharmaceuticals
LH	LABORATORY CP OF AMER	Healthcare
PBCT	PEOPLE'S UNITED FINL INC	Regional Banks
ENTA	ENANTA PHARMACEUTICALS	Biotechnology
COMM	COMMSCOPE HOLDING CO INC	Communications
MNK	MALLINCKRODT PLC	Pharmaceuticals
OGI	ORGANIGRAM HOLDINGS INC	Pharmaceuticals
LILAK	LIBERTY LATIN AMERICA LTD	Entertainment

Neural Network Predictions - Q3 2019		
Ticker	Company Name	Industry
QCOM	QUALCOMM INC	Semiconductors
ROP	ROPER TECHNOLOGIES INC	Industrial Conglomerates
BSX	BOSTON SCIENTIFIC CORP	Health Care Equipment
SBUX	STARBUCKS CORP	Restaurants
HPE	HEWLETT PACKARD ENTERPRISE	Technology Hardware
FWONK	LIBERTY MEDIA FORMULA ONE	Entertainment
AGN	ALLERGAN PLC	Pharmaceuticals
AZN	ASTRAZENECA PLC	Pharmaceuticals
KDP	KEURIG DR PEPPER INC	Soft Drinks
BHC	BAUSCH HEALTH COMPANIES INC	Pharmaceuticals
ADT	ADT INC	Security & Alarm Services
DISH	DISH NETWORK CORP	Media
DVA	DAVITA INC	Health Care Services
IRM	IRON MOUNTAIN INC	Information Technology
SSNC	SS&C TECHNOLOGIES HLDGS INC	Application Software
VEON	VEON LTD	Telecommunications
RELX	RELX PLC	Research & Consulting
NLSN	NIELSEN HOLDINGS PLC	Research & Consulting
SNY	SANOFI	Pharmaceuticals
SAP	SAP SE	Application Software
CCI	CROWN CASTLE INTL CORP	Telecommunications
CHTR	CHARTER COMMUNICATIONS INC	Telecommunications
EQIX	EQUINIX INC	Information Technology
DRRX	DURECT CORP	Pharmaceuticals
MDLZ	MONDELEZ INTERNATIONAL INC	Packaged Foods
INFO	IHS MARKIT LTD	Research & Consulting
DISCA	DISCOVERY INC	Media
VIAB	VIACOM INC	Telecommunications
FIS	FIDELITY NATIONAL INFO SVCS	Data Processing
ATEC	ALPHATEC HOLDINGS INC	Healthcare
QRTEA	QURATE RETAIL INC	Internet Retail
AVGO	BROADCOM INC	Semiconductors
NXPI	NXP SEMICONDUCTORS NV	Semiconductors
FMS	FRESENIUS MEDICAL CARE AG&CO	Health Care Services
ORAN	ORANGE	Telecommunications
BUD	ANHEUSER-BUSCH INBEV	Brewers
MFGP	MICRO FOCUS INTL PLC	Application Software
ZEAL	ZEALAND PHARMA AS	Biotechnology

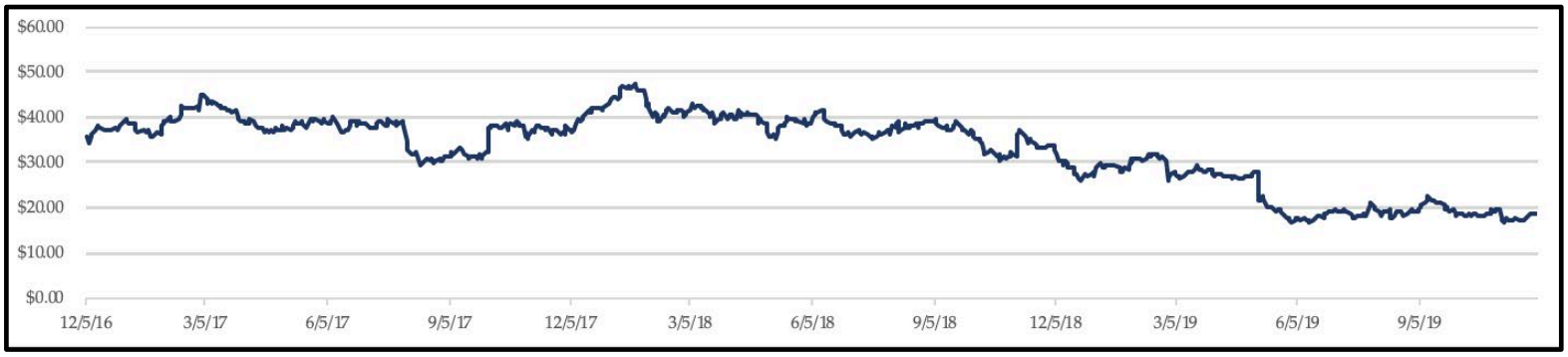
Top Ten Predicted Companies: Tear Sheets

Following are tear sheets for each of the top ten predicted companies. These tear sheets serve as an overview of the fundamental analysis we did on each of these companies.

Mylan N.V.

Ticker: MYL

3 Year Chart



Company Information, in MM$	
Company name	Mylan
Ticker	MYL
Share price	$18.88
Shares outstanding	516
Equity value	9,744
Net debt	(12,822)
Enterprise value	22,566
NTM EBITDA	3,589
EV/NTM EBITDA	6.3x
Industry median	8.9x

Financial Information				
In MM of $	CY 2017	CY 2018	CY 2019	CY 2020
Revenue	11,908	11,434	11,557	11,491
% growth y/y	*7.5%*	*(4.0%)*	*1.1%*	*(0.6%)*
EBITDA	3,614	3,596	3,499	3,589
% margin	*30.3%*	*31.5%*	*30.3%*	*31.2%*
Levered Free Cash Flow	1,789	2,090		
% margin	*15.0%*	*17.5%*		
Total debt / LTM EBITDA	6.2x	6.2x		

Business description		
Industry	Healthcare	Description:
Headquartered	Hatfield, U.K.	Mylan is a global generic and specialty pharma company.
Chief Executive Officer	Heather Bresch	They are the second-largest generic and specialty
Chief Commercial Officer	Anthony Mauro	pharmaceuticals company in the world.
Chief Financial Officer	Ken Parks	
Insider Holdings	$56MM	
Largest Holders	Robert Coury, 0.27% S/O	
Activist	Group of institutional investors(17')	

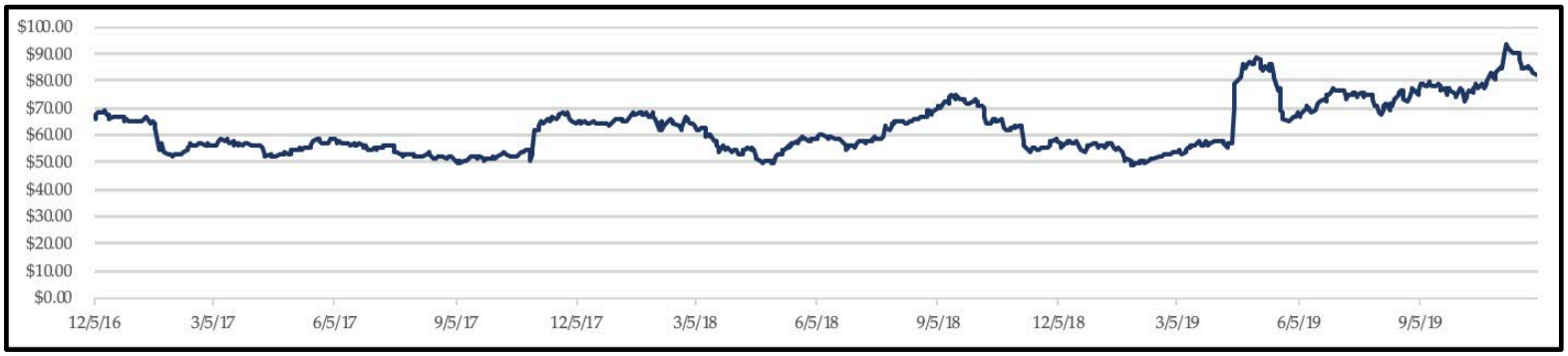
Analysis

1. Mylan experienced weaker sales and lowered guidance in the first half of 2019
2. The company was subject to a probe by multiple state attorneys general into whether it had participated in a generic drug price fixing scheme. One drug that has caught a particularly high amount of criticism is the pricing of EpiPen.
3. The company is currently saddled with a substantial amount of debt, but shouldn't have issues paying it off in the coming years. Debt/EBITDA has remained fairly constant at around 4x.
4. Insider ownership is negligible (<1%) and should not impede the acquisition process.

Qualcomm

Ticker: QCOM

3 Year Chart



Company Information, in MM$	
Company name	Qualcomm
Ticker	QCOM
Share price	$82.08
Shares outstanding	1,142
Equity value	93,719
Net debt	(3,673)
Enterprise value	97,392
NTM EBITDA	7,108
EV/NTM EBITDA	13.7x
Industry median	17.2x

Financial Information				
In MM of $	CY 2017	CY 2018	CY 2019	CY 2020
Revenue	22,258	22,611	24,273	27,036
% growth y/y	*(5.5%)*	*1.6%*	*7.4%*	*11.4%*
EBITDA	6,043	5,889	9,482	7,108
% margin	*27.1%*	*26.5%*	*42.6%*	*31.9%*
Levered Free Cash Flow	4,311	3,124		
% margin	*19.4%*	*14.0%*		
Total debt / LTM EBITDA	3.6x	2.8x		

Business description		
Industry	Semiconductors	Description:
Headquartered	San Diego, CA	Qualcomm is an American multinational semiconductor
Chief Executive Officer	Steve Mollenkopf	and telecom equipment company that designs and markets
President	Cristiano R. Amon	wireless products and services. It derives most of its
Chief Financial Officer	Akash Palkiwala	revenue from chipmaking and the bulk of its profit from
Insider Holdings	$111MM	patent licensing businesses.
Largest Holders	Steve Mollenkopf, 0.05% S/O	
Activist	Jana Partners (17')	

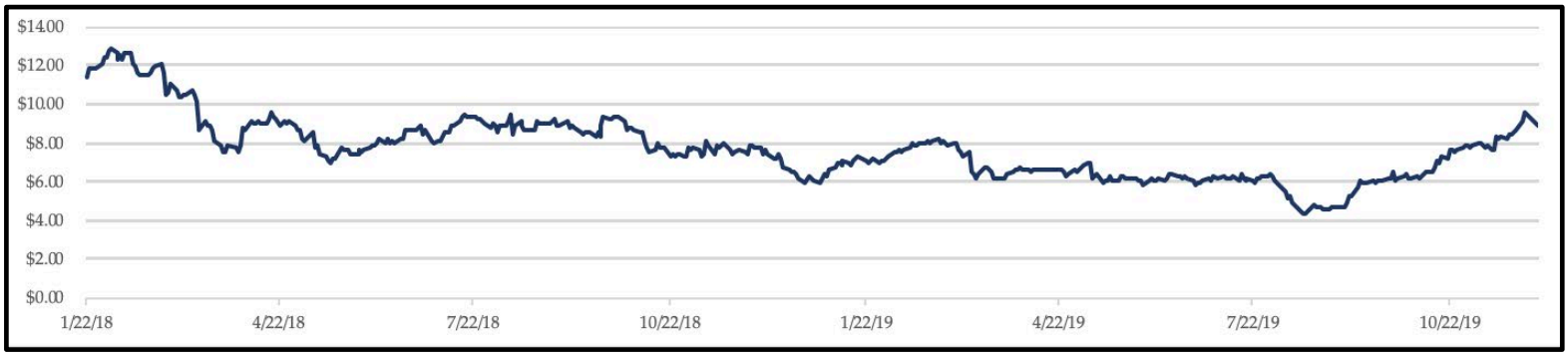
Analysis

1. Rebounded in 2019 with 7.4% LTM Revenue Growth despite most of industry flat or declining
2. 5G anticipated breakthrough in 2020 will highly impact future of the firm
3. Trading at 14x EBITDA compared to competitor median 16.4x EBITDA
4. NTM EPS growth of 21% compared to competitor median of 10%
5. Unlikely that Qualcomm could be acquired outright by competitor, but may be target of strategic tech acquisition or activist investor
6. Qualcomm's antitrust lawsuits may cause rift in industry and provide opportunity for competitor growth

ADT

Ticker: ADT

2 Year Chart



Company Information, in MM$	
Company name	ADT
Ticker	ADT
Share price	$9.06
Shares outstanding	754
Equity value	6,828
Net debt	(9,928)
Enterprise value	16,755
NTM EBITDA	2,464
EV/NTM EBITDA	6.8x
Industry median	9.7x

Financial Information				
In MM of $	CY 2017	CY 2018	CY 2019	CY 2020
Revenue	4,316	4,582	5,096	5,155
% growth y/y	*46.3%*	*6.2%*	*11.2%*	*1.1%*
EBITDA	2,211	2,276	2,464	2,473
% margin	*51.2%*	*52.7%*	*57.1%*	*57.3%*
Levered Free Cash Flow	879	1,085		
% margin	*20.4%*	*25.1%*		
Total debt / LTM EBITDA	4.9x	4.4x		

Business description		
Industry	Commercial services	Description:
Headquartered	Boca Raton, FL	ADT is an American company that provides residential,
Chief Executive Officer	Jim DeVries	small and large business electronic secuirty, fire protection
President	Bob Kupbens	and other related alarm monitoring services in North
Chief Financial Officer	Jeff Likosar	America. In February of 2016, the company was acquired
Insider Holdings	$81MM	by Apollo Global Management in a $6.9 billion LBO.
Largest Holders	Apollo, 83.78% S/O	
Activist	None	

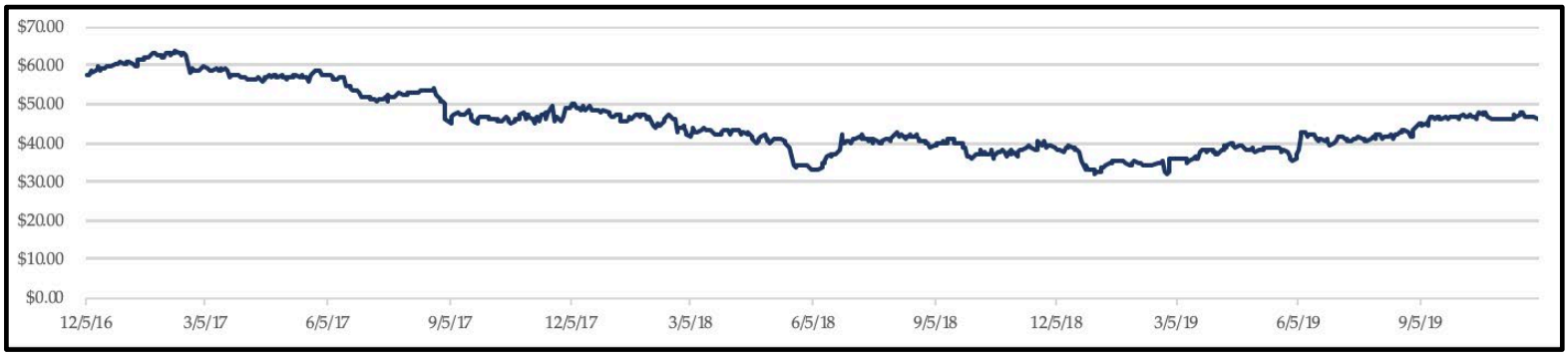
Analysis

1. EBITDA and Gross Margin of 46% and 74% compared to median competitor margins of 20% and 39% respectively. ADT's projected NTM growth is near the bottom of their comparable company group.
2. Acquired several competitors in 2019. Divested their Canadian business and paid special dividend in 11/19.
3. Based on performance since Apollo's takeover in 2016, it appears that ADT is likely at its peak value.
4. Given Apollo's desire to exit at the maximum possible return, ADT is a strong candidate for acquisition within the next 12 months.
5. There is risk of an acquirer overpaying if Apollo chose to exit now.

Campbell Soup Company

Ticker: CPB

3 Year Chart



Company Information, in MM$	
Company name	Campbell
Ticker	CPB
Share price	$48.47
Shares outstanding	302
Equity value	14,623
Net debt	(8,539)
Enterprise value	23,162
NTM EBITDA	1,638
EV/NTM EBITDA	14.1x
Industry median	12.4x

Financial Information				
In MM of $	CY 2017	CY 2018	CY 2019	CY 2020
Revenue	5,837	6,615	8,107	8,152
% growth y/y	*(26.7%)*	*13.3%*	*22.6%*	*0.6%*
EBITDA	1,696	1,671	1,457	1,638
% margin	*29.1%*	*28.6%*	*25.0%*	*28.1%*
Levered Free Cash Flow	898	1,003		
% margin	*15.4%*	*17.2%*		
Total debt / LTM EBITDA	2.1x	5.7x		

Business description		
Industry	Packaged foods	Description:
Headquartered	Camden, NJ	Campbell's is an American processed food and snack
Chief Executive Officer	Mark A. Clouse	company which is closely associated with its flagship
President - CPB Snacks	Carlos Abrams-Rivera	canned soup products. Through M&A it has become
Chief Financial Officer	Mick Beekhuizen	one of the largest processed food companies in the U.S. with
Insider Holdings	$5,329MM	a large variety of brands and products lines.
Largest Holders	Dorrance's and Third Point	
Activist	Third Point (18')	

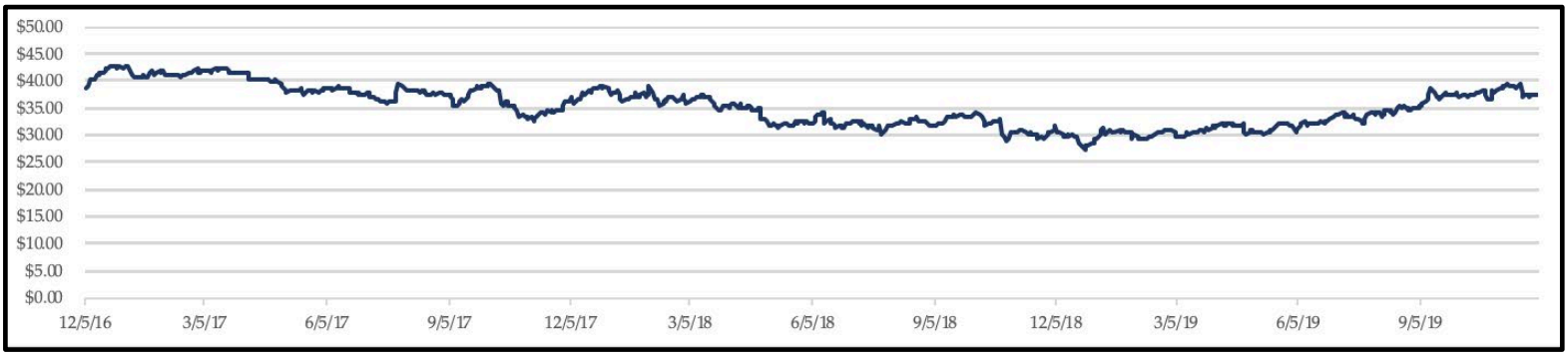
Analysis

1. CPB beat earnings estimates for 5 straight quarters.
2. CPB engaged in numerous divestitures and asset sales in 2019. Planned divesture of International Business by 1H20.
3. Third Point has ~5.6% ownership of CPB; two activists on CPB's board. Have been pushing for the sale or restructuring of CPB.
4. CPB is 37% individual/insider owned.
5. Weak Balance Sheet: low cash, high debt

AT&T

Ticker: T

3 Year Chart



Company Information, in MM$	
Company name	AT&T
Ticker	T
Share price	$38.10
Shares outstanding	7,305
Equity value	278,321
Net debt	(190,803)
Enterprise value	469,124
NTM EBITDA	59,940
EV/NTM EBITDA	7.8x
Industry median	7.9x

Financial Information				
In MM of $	CY 2017	CY 2018	CY 2019	CY 2020
Revenue	160,546	170,756	181,630	182,220
% growth y/y	*46.3%*	*6.4%*	*6.4%*	*0.3%*
EBITDA	45,572	56,956	59,799	59,940
% margin	*28.4%*	*35.5%*	*37.2%*	*37.3%*
Levered Free Cash Flow	16,460	22,351		
% margin	*10.3%*	*13.9%*		
Total debt / LTM EBITDA	3.8x	4.5x		

Business description		
Industry	Telecom	Description:
Headquartered	Dallas, TX	AT&T is the world's largest telecom company, the largest
Chief Executive Officer	Randall Stephenson	provider of mobile telephone services, and the largest
Chief Operating Officer	John Stankey	provider of fixed telephone services in the U.S. through
Chief Financial Officer	John Stephens	AT&T Communications. Since June of 2018, it is also the
Insider Holdings	$199MM	world's largest media and entertainment company in terms
Largest Holders	Randall Stephenson, 0.03% S/O	of revenue, through its subsidiary WarnerMedia.
Activist	Elliott Management (19')	

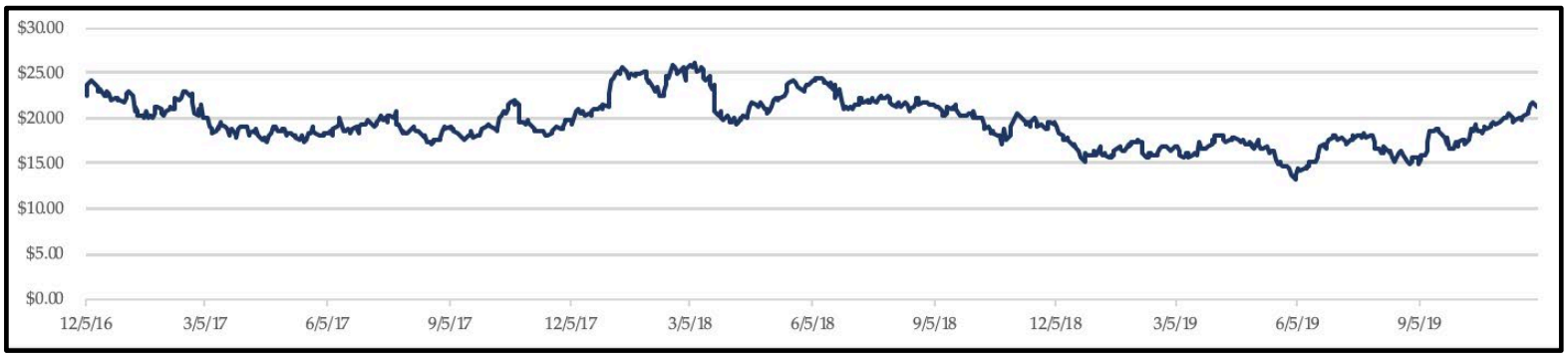
Analysis

1. AT&T invaded by activist investor Elliot Management in 09/19
2. CEO exit is one of Elliot's priorities
3. Current multi-industry conglomerate trends more towards divestment than acquisition
4. Diversity of businesses rolled into AT&T likely damages potential value in trading multiples of high-value units (HBO, Time Warner)
5. Very few potential suitors for an acquisition of a business this size

Commercial Metals Company

Ticker: CMC

3 Year Chart



Company Information, in MM$	
Company name	Commercial Metals Co.
Ticker	CMC
Share price	$184.34
Shares outstanding	328
Equity value	60,519
Net debt	18,525
Enterprise value	41,994
NTM EBITDA	7,236
EV/NTM EBITDA	5.8x
Industry median	7.7x

Financial Information				
In MM of $	CY 2017	CY 2018	CY 2019	CY 2020
Revenue	3,844	4,644	5,829	5,942
% growth y/y	*46.3%*	*20.8%*	*25.5%*	*1.9%*
EBITDA	259	352	485	599
% margin	*6.7%*	*9.2%*	*12.6%*	*15.6%*
Levered Free Cash Flow	(736)	(609)		
% margin	*(19.2%)*	*(15.8%)*		
Total debt / LTM EBITDA	3.2x	3.3x		

Business description		
Industry	Metals & Mining	Description:
Headquartered	Irving, TX	Commercial Metals Co. ("CMC") is a steel and metal
Chief Executive Officer	Barbara Smith	manufacturer based in Irving, TX. The company owns steel
Chief Operating Officer	Tracy Porter	mills throughout the Southern regional of the United States.
Chief Financial Officer	Paul Lawrence	
Insider Holdings	$29MM	
Largest Holders	Barbara Smith, 0.36% S/O	
Activist	None	

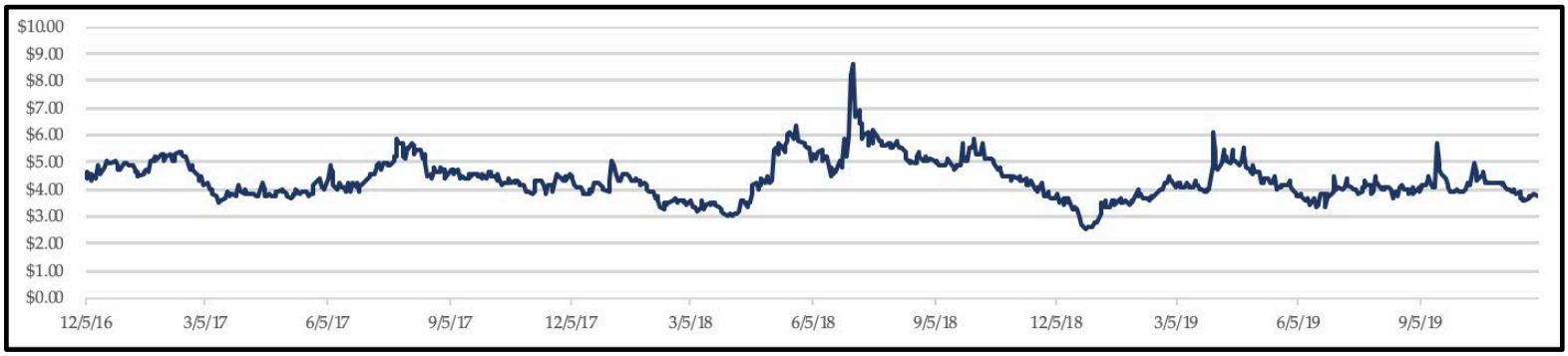
Analysis

1. In March 2018, a buyer acquired CMC's Structural Steel Fabrication Business in South Carolina and Texas.
2. CMC consistently beating earnings estimates. YTD, CMC's shares are up 22.6%, against industry 8.2% decline.
4. CMC's stock is cheap based on TTM EV/EBITDA ratio; they are generating earnings by effectively managing assets (ROA); and they are efficiently utilizing shareholders' funds (ROE.)
5. Activist interest from Icahn Capital LP in July 2011, but the proxy fight was discontinued in January 2012.
6. The metals industry negatively affected by current global trade tensions. A 25% tariff on steel, one of CMC's main products, went into effect in March 2018.
7. Ownership: ~93% institutional. ~6% public. ~1% individuals/insiders.

Mexco Energy

Ticker: MXC

3 Year Chart



Company Information, in MM$	
Company name	Mexco Energy Co.
Ticker	MXC
Share price	$4.14
Shares outstanding	2
Equity value	8
Net debt	0
Enterprise value	8
NTM EBITDA	1
EV/NTM EBITDA	12.4x
Industry median	12.2x

Financial Information				
In MM of $	CY 2017	CY 2018	CY 2019	CY 2020
Revenue	2	3		
% growth y/y	*46.3%*	*15.7%*		
EBITDA	1	1		
% margin	*22.3%*	*29.1%*		
Levered Free Cash Flow	(1)	(1)		
% margin	*(25.4%)*	*(27.9%)*		
Total debt / LTM EBITDA	5.6x	1.0x		

Business description		
Industry	Oil & Gas	Description:
Headquartered	Midland, TX	Mexco Energy is an independent oil and gas company
Chief Executive Officer	Nicholas Taylor	that engages in the acquisition, exploration, development
VP & Secretary	Donna Gail Yanko	and production of natural gas, crude oil, condensate and
Chief Financial Officer	Tamala McComic	LNG in the United States.
Insider Holdings	$5MM	
Largest Holders	Nicholas Taylor, 46.57% S/O	
Activist	None	

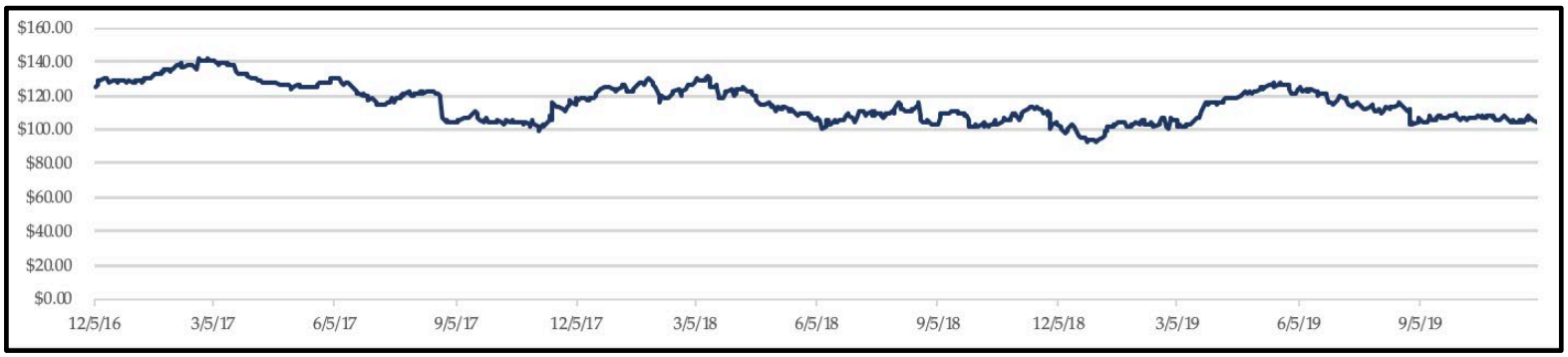
Analysis

1. ROA/ROE are currently negative, but higher than peers
2. 3-year revenue CAGR: 6%, peers have 3% and -8%
3. LTM debt/EBITDA is 6% compared to the median of 65%; one of the lowest default probabilities in its class.
4. LTM gross margin percent for Mexco is 65%, more than double the 31% of its peer median
5. CEO Nicholas Taylor, controls over 45% of the CSO; age 81
6. Currently the stock of MXC is assessed to be over-valued
7. Company may divest portions of business to cover debt expenses

J.M. Smucker Company

Ticker: SJM

3 Year Chart



Company Information, in MM$	
Company name	J.M. Smucker
Ticker	SJM
Share price	$106.27
Shares outstanding	114
Equity value	12,125
Net debt	(5,976)
Enterprise value	18,101
NTM EBITDA	1,672
EV/NTM EBITDA	10.8x
Industry median	13.1x

Financial Information				
In MM of $	CY 2017	CY 2018	CY 2019	CY 2020
Revenue	7,392	7,357	7,838	7,622
% growth y/y	*46.3%*	*(0.5%)*	*6.5%*	*(2.8%)*
EBITDA	1,717	1,693	1,597	1,672
% margin	*23.2%*	*22.9%*	*21.6%*	*22.6%*
Levered Free Cash Flow	867	896		
% margin	*11.7%*	*12.1%*		
Total debt / LTM EBITDA	3.1x	2.9x		

Business description		
Industry	Packaged foods	Description:
Headquartered	Orrville, OH	J.M. Smucker is an American manufacturer of jam, peanut
Chief Executive Officer	Mark Smucker	butter, beverages and other products in North America.
Chief Operating Officer	Geoff Tanner	In May of 2008, Smucker's announced it had bought the food
Chief Financial Officer	Mark Belgya	division of Knott's Berry Farms from ConAgra Foods.
Insider Holdings	$486MM	In June of 2008 Smucker's purchased the Folger coffee
Largest Holders	Smucker family	brand division from Procter & Gamble for $3.3 billion.
Activist	None	

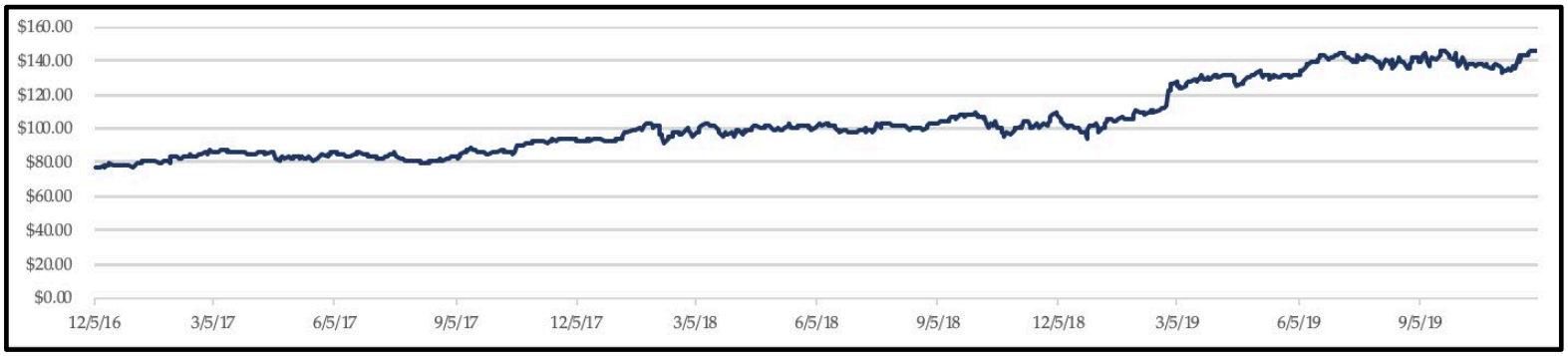
Analysis

1. SJM is unloading low-margin businesses in order to protect profitability. On July 9, 2018, Brynwood Partners VII L.P. acquired U.S. Baking Business from The J. M. Smucker Co. for ~ $380M.
2. SJM is facing challenges in the pet food division, it's largest segment by sales—particularly the premium brands.
3. SJM beat earnings expectations in most recent quarter, but they lowered net sales forecast for the year to -3%.
4. Ownership: ~4% individuals/insiders. ~81% institutional. ~15% public.

Danaher

Ticker: DHR

3 Year Chart



Company Information, in MM$	
Company name	Danaher
Ticker	DHR
Share price	$147.31
Shares outstanding	720
Equity value	106,078
Net debt	(6,709)
Enterprise value	112,787
NTM EBITDA	6,071
EV/NTM EBITDA	18.6x
Industry median	18.4x

Financial Information				
In MM of $	CY 2017	CY 2018	CY 2019	CY 2020
Revenue	18,330	19,893	20,608	24,112
% growth y/y	*46.3%*	*8.5%*	*3.6%*	*17.0%*
EBITDA	4,419	4,819	4,851	6,071
% margin	*24.1%*	*26.3%*	*26.5%*	*33.1%*
Levered Free Cash Flow	2,858	3,366		
% margin	*15.6%*	*18.4%*		
Total debt / LTM EBITDA	2.4x	2.0x		

Business description		
Industry	Healthcare	Description:
Headquartered	Washington, D.C.	Danaher Corporation is a globally diversified conglomerate.
Chief Executive Officer	Thomas Joyce, Jr.	It operates in three segments: environmental & applied
Executive Vice President	Daniel Comas	solutions, life sciences, and diagnostics.
Chief Financial Officer	Matt McGrew	
Insider Holdings	$11,938MM	
Largest Holders	Rales Brothers, ~11% S/O	
Activist	None	

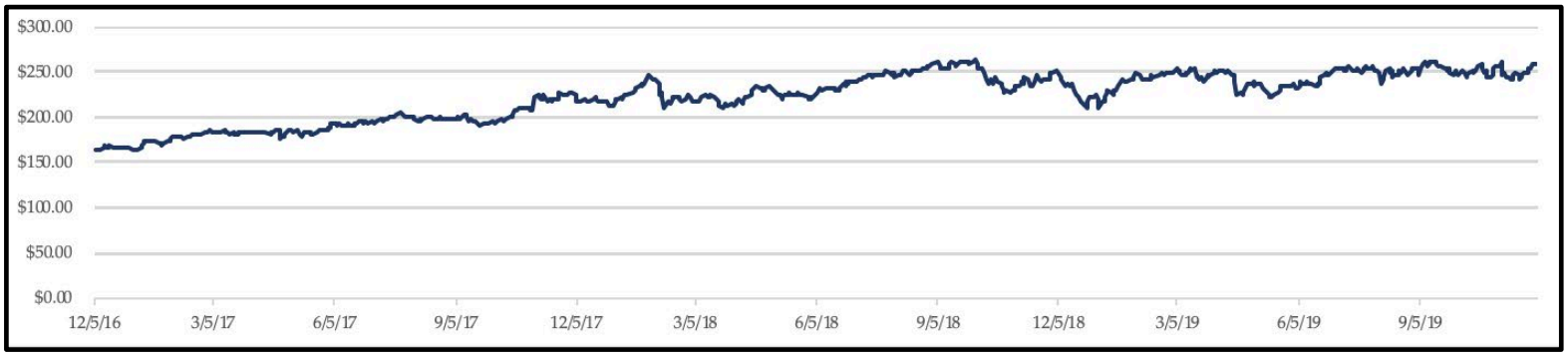
Analysis

1. LTM revenue growth of 4% is less than peer median of 6%
2. One of the largest companies in its space
3. LTM Debt/EBITDA is 3.8x compared to peer median of 2.7x
4. P/E is higher than peers for TTM
5. Revenue growth YoY is on the lower end of peers
6. Assessed to be currently over-valued
7. Large size makes an acquisition less likely, but a divestiture or strategic acquisition by DHR is feasible

Becton Dickinson & Company

Ticker: BDX

3 Year Chart



Company Information, in MM$	
Company name	Becton, Dickinson & Co.
Ticker	BDX
Share price	$257.23
Shares outstanding	271
Equity value	69,581
Net debt	(18,824)
Enterprise value	88,405
NTM EBITDA	6,146
EV/NTM EBITDA	14.4x
Industry median	18.5x

Financial Information				
In MM of $	CY 2017	CY 2018	CY 2019	CY 2020
Revenue	12,093	15,983	17,290	18,971
% growth y/y	*46.3%*	*32.2%*	*8.2%*	*9.7%*
EBITDA	3,331	4,750	5,174	6,146
% margin	*27.5%*	*39.3%*	*42.8%*	*50.8%*
Levered Free Cash Flow	1,823	1,970		
% margin	*15.1%*	*16.3%*		
Total debt / LTM EBITDA	5.7x	4.5x		

Business description		
Industry	Healthcare	Description:
Headquartered	Franklin Lakes, NJ	Becton, Dickinson & Co. (BD) is an American medical tech
Chief Executive Officer	Vincent Forlenza	company that manufactors and sells medical devices,
Chief Operating Officer	Tom Polen	instrumental systems, and reagents. BD also provides
Chief Financial Officer	Christopher Reidy	consulting and analytics services in certain geographies.
Insider Holdings	$170MM	BD is divided into three segments: BD Medical, BD Life
Largest Holders	Vincent Forlenza, .09% S/O	Sciences and BD Interventional.
Activist	No	

Analysis

1. In 2018, BDX acquired TVA Medical and divested Acutronic and Vyaire Medical
2. Market Cap. approximate size of median peers
3. NTM P/E of 19.37 is less than median peers (23.86)
4. LTM Debt/EBITDA of 3.8 is higher than peers (2.6)
5. Recent earnings call focus on reducing debt from the acquisition of Bard in 2017 and maintaining growth
6. High debt and recent acquisitions make the acquisition of BDX more problematic, but may have strategic value for certain companies