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**Information Release and Stock Price Movements:
The Tesla Earnings Announcement and the Musk Tweet**

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1. Introduction

On rare occasions individual observations of stock price movements are sufficiently informative that interesting insight can be gained even from single observations. The response of the market to Tesla's earnings announcement on August 1, 2018 and the Elon Musk tweet on August 7 are prime examples.

After the market closed on August 1, Tesla reported financial results for the second quarter of 2018 followed by a conference call with analysts. Before the announcement, Tesla closed at \$300.84. By the end of trading on August 2, Tesla had jumped to \$349.54 – an increase of \$48.70 or 16.2%. This was the largest daily percentage increase in Tesla's stock price since December 2013. The market capitalization of the company rose by \$8.16 billion dollars. The dramatic price increase raises the obvious question of what information was conveyed to justify the jump.

Next, on August 7 at 12:48 Eastern time, Elon Musk tweeted, *Am considering taking Tesla private at \$420. Funding secured.* Prior to the tweet, the stock had closed at 341.99 August 6. Following the tweet, it rose 11.0% to close at 379.57 on August 7. Due to the chaos caused by the tweet trading was halted in Tesla between 2:08 and 3:45.

Before turning to the details of those events, however, it is helpful to provide perspective by starting with a fundamental valuation model that relates the market price to the present value of future cash flows. For this exercise, we rely on the work of Prof. Aswath Damodaran who posts on his website detailed, and fully transparent, discounted cash flow valuation models for a variety of companies including Tesla.

As of August 1, 2018, Prof. Damodaran's most recent valuation of Tesla was posted on June 28, 2018. Prof. Damodaran is often referred to as a "Tesla bear" because at that

time his estimated value was \$165.96 per share, barely half the price of the stock on August 1. However, examination of the model details reproduced in Exhibit 1 reveals that Prof. Damodaran was hardly pessimistic. In his model, Tesla's revenues grow from \$12.47 billion to \$97.53 billion over the ten-year forecasting period – a compound growth rate of 22.8%. At the same time, operating margins improve from -11.4% to 10.0%. By comparison, among the ten largest auto manufacturers in the world, none had an operating margin of 10.0%. The highest was BMW at 9.9%. Thus, Prof. Damodaran was projecting both rapid revenue growth and dramatic improvement in margins to industry leading levels, hardly pessimistic assessment of the company.

In addition to his base model, Prof. Damodaran also posted what he called his “royal flush” scenario. This scenario employed what he believed were the most optimistic possible assumptions. His royal flush valuation came to \$395.52. By combining the two sets of projections, it is possible to reverse engineer the market price of \$300.84 on August 1, 2018. The result of that exercise is shown in Exhibit 2. Exhibit 2 makes three major changes to Exhibit 1. First, the revenue growth rates are increased so that the compound rate is now 25.1%. Second, the operating margins become positive more quickly and rise to 11.6%, well above that of Tesla's competitors. Third, the probability of failure is reduced from 5% to 0%. With these changes to Damodaran's baseline assumptions, the estimated share price comes to \$300.91, seven cents greater than the market price.

Following Prof. Damodaran, in both Exhibits 1 and 2 the assumption is made that Tesla will maintain a sales-to-capital ratio approximately equal to that of its major competitors. This assumption is important because it determines the amount of

reinvestment. It implies, contrary to statements by Mr. Musk, that as sales ramp up while operating cash flow remains meager, additional capital raises will be required.

It is helpful to pause for a minute to digest these projections. Elon Musk has been in an ongoing verbal battle with “Tesla shorts.” Mr. Musk’s comments often imply that he has concluded that the shorts view Tesla as a distressed company. While this may be true of some short sellers, it hardly needs to be the case. Look back, for example, at Damodaran’s baseline projections in Exhibit 1. They reflect a highly successful future for Tesla that is quite remarkable given the competitive and capital-intensive nature of the automobile industry. Damodaran projects a combination of both rapid growth in revenue and pronounced improvements in operating margins to industry leading levels, hardly the earmarks of a failing company. Nonetheless, his valuation of \$165.96 implies that a rational investor should short the stock because his projections, optimistic as they may be, are significantly less optimistic than those impounded in the pre-announcement market price of \$300.84.

The fundamental point is that the rationality of the market’s response to Tesla’s earnings announcement or Mr. Musk’s tweet cannot be analyzed in the abstract. They can only be assessed properly with reference to the projections already impounded in the market price prior to the announcements. With that in mind, we first turn to the earnings announcement.

2. The Earnings Announcement and the Stock Price Response

In analyzing the response of Tesla’s stock price to the earnings announcement, we dispense with the distinction between raw and residual returns. This is because in comparison to the 16.2% increase in the price of Tesla movements in the general market

and the automotive industry were immaterial. On August 2, the S&P 500 rose 0.49% and the NASDAQ increased by 1.23%. On the other hand, stock prices of auto makers were generally lower. Toyota and GM, fell by 0.5% and 1.4%, respectively, while Ford was flat.

During trading on August 1, 2018, Tesla's stock price fluctuated around \$300 as the market awaited the earnings announcement and investor call before closing at \$300.84. The investor letter was released by Tesla at 4:05 Eastern time on August 1. The company reported revenue of \$4.00 billion, compared to \$3.41 billion the prior quarter and \$2.79 billion for the same quarter one year earlier. The year-over-year revenue growth was an impressive 42.8%, but there is a caveat. In 2018, Tesla adopted a new revenue recognition rule, ASC 606, which changed the way it accounts for automobile sales with a resale value guarantee and cars leased through leasing partners. The effect of the change was to increase reported revenue. Had the same convention been used in the previous year, revenue would have been \$2.93 billion and the year-over-year growth rate would have been 36.5%.

Earnings are more ambiguous because Tesla reports results on both a GAAP and a non-GAAP basis. Here we focus on the GAAP results, but note that the non-GAAP results show the same picture. On a GAAP basis, the company reported earnings of -\$743 million (-\$4.22 per share) compared to -\$785 million (-\$4.19 per share) the quarter before and -\$401 million (-\$2.04 per share) the same quarter the previous year.

Tesla also reports free cash flow in a non-standard fashion. The company includes cash flows from non-recourse financing activities, which is typically a source of financing, not free cash flow. The company also excludes solar panels from its definition of free cash flow. We use the company's definition with regard to the reported results, but not in the

valuation model. Finance theory makes it clear that value depends on free cash flow as conventionally defined. Based on its definition, Tesla reported free cash flow -\$739 million compared to -\$1,054 million the quarter before and -\$1,159 million in the same quarter the previous year.

Exhibit 4 plots the price of Tesla on a minute-by-minute basis from the close of the market on August 1 to the close on August 2, including after-market trading on August 1. In response to the release of the financial information, the stock price initially bounced up and down in after-market trading. However, by 4:20, as the information was digested, the stock price rose to \$315.00 and held that level until the beginning of the investor call at 5:37. During the call the stock price ran-up twice. The first run-up, to about \$325, followed Mr. Musk's comments about potential improvements in autopilot and the role of artificial intelligence starting at 5:47. The second run-up, beginning at 6:03, to a price of \$335, occurred following Mr. Musk's statements that he hoped to achieve production of 7,000 Model 3s per week by the end of the year and that he expected the company to turn profitable in the third quarter. He also apologized for his behavior during the previous quarter's earnings call. The stock price remained at around \$335 until the call ended at 6:08 and after-market trading largely ceased.

The next day, on August 2, 2018, Tesla opened at \$328.44 and remained around the \$330 level until noon when it became a bumpy increase to close at \$349.54. Though there was widespread media coverage and analyst discussion during trading hours on August 2, the company did not release any further financial data that could explain the late day increase.

3. Interpretation and Implications

Because stock prices in a relatively efficient market should respond solely to new information, the starting point for analyzing the reaction of stock prices to financial announcements are the forecast errors or “surprises”. Exhibit 3 presents the surprises for Tesla’s revenue, earnings (both GAAP and non-GAAP), and free cash flow (as defined by the company). The overall takeaway is that the surprises were mixed and not very large in any event. Revenues were slightly greater than expected and earnings, by either measure, were slightly less. The biggest positive surprise was for free cash flow which came in 17.6% above the consensus estimate, but that result is not as positive as it appears. The improvement was due to the company’s active decision to cut capital expenditures. Although such a cut improves short-term free cash flow by definition, the long-term impact is inconsistent with the company’s plans for dramatic growth along the lines forecast in Exhibit 2. Clearly a ten-fold increase in revenue will require new factories, new delivery points, and new service centers at a minimum.

Taken as a whole, it is hard to see how the surprises associated with the earnings announcement could account for much movement in the stock price. Looking at the results without knowledge of the stock price reaction it would be difficult to predict the direction of movement. There is nothing to suggest a 16.2% increase. The rational answer, to the extent that there is one, must lie in the conference call.

As noted above, the conference call was associated with two run-ups in the stock price. The first occurred at 5:47 when Mr. Musk discussed innovations in Tesla autopilot and the possible incorporation of artificial intelligence. The second occurred when he said that weekly production could reach 7,000 vehicles and he expected the company to be

“profitable” in the third quarter and cash flow positive by the end of the year. He also apologized for his rude treatment of several analysts during the prior quarter’s earnings call.

The added information in the conference call was interpreted in much of the media as “good news.” The company was forecasting future growth and technological innovation and believed it was on the road to profitability. But this begs the key question, good news relative to what? The news should not be interpreted relative to a scenario in which Tesla remains static, but relative to the projections impounded in the market price prior to the announcement. In particular, was the news sufficient to require a significant upward adjustment in the projections shown in Exhibit 2 to justify a 16.2% jump in price?

While it is true that the announcement revealed impressive revenue growth, with the proper accounting adjustment, the growth rate is almost identical to the projected growth in Exhibit 2. The announcement and the call also pointed to improved operating margins, but the improvement in margins in Exhibit 2 is dramatic. It is hard to see how the announcement would warrant an upward revision. The biggest discrepancy between Exhibit 2 and the announcement is with regard to capital expenditures. The exhibit shows capital expenditures rising with sales, whereas Tesla was actually cutting investments. As noted previously, however, it is hard to interpret this as a bullish signal. The cutback appears to be part of a short-run effort to move toward positive free cash flow. As such, it could well undermine the growth assumptions that drive the high valuation reported in Exhibit 2. For these reasons, we cannot reconcile the price 16.2% increase with a rational assessment of information contained in the earnings announcement and follow-up conference call.

Though we are admittedly moving into the realm of speculation, there is one hypothesis we find intriguing. In reacting so strongly, it is as if the market is interpreting the information in the earnings announcement in the abstract without reference to the projections already impounded in the stock price. While the overall news conveyed by the announcement was “positive,” in that it implied improvement in the company’s operations, such positive developments, indeed one could say even more positive developments, were all ready incorporated in the stock price prior to the announcement. This underscores our main point, changes in stock prices in response to the release of information must be analyzed in the context of a reversed engineered DCF model whose output equal the price of the stock prior to the release.

4. The Musk “Going Private” Tweet on August 7, 2018

Exhibit 5 plots the minute-to-minute price of Tesla on August 7, 2018. It was at 12:48 pm when Elon Musk tweeted, *Am considering taking Tesla private at \$420. Funding secured.* Prior to that time the stock had already increased about 5% to around \$355 on news that the Saudi sovereign wealth fund had purchased between three and five percent of Tesla’s stock. Following the tweet, the stock jumped again to about \$370 and trading volatility spiked. In response to the chaos, trading was halted at 2:08 pm and did not resume until 3:45. In the last 15 minutes, Tesla traded around \$380 before closing up 11.0% at \$379.57.

Once again, the proper way to evaluate the impact of the tweet is to begin with a reverse engineered DCF model. In this case, we focus on the price of \$420 mentioned by Mr. Musk in his tweet. Exhibit 6 starts from the model in Exhibit 2 and makes further positive adjustments. The period of rapid growth is extended compared to Exhibit 2 and the

operating margins are adjusted upward slightly. The main change is a reduction in the reinvestment required to achieve the revenue growth. Put bluntly, Exhibit 6 assumes Tesla will perform a trifecta of rapid revenue growth, operating margins rising to heretofore unheard-of levels for major auto manufactures, while maintaining an industry leading sales-to-capital ratio. With the changes, the fair value estimate shown in Exhibit 6 is \$420.09

But there is another problem. Even if Tesla were able to live up to the financial model shown in Exhibit 6, investors in the buyout would only earn the model's public market cost of capital – an average of somewhat less than 8%. That hardly seems like a return that a private equity fund or sovereign wealth fund would find sufficient for taking Tesla private, in part because of the reduced liquidity. To the extent that investors require a higher return, the projections would have to be adjusted upward further to justify a buyout price of \$420. Furthermore, the model in Exhibit 6 assumes that Tesla remains public so that none of the legal, accounting and regulatory costs associated with going private have been deducted. All of this suggests that a buyout of Tesla at \$420 is not economically rational and is unlikely to occur. The market apparently had some doubts as well. The closing price of \$379.57 was well below \$420.

But our point is not to argue over the fair value of Tesla. There will always be projections sufficiently optimistic to justify a buyout at \$420 or even more. The first step in analyzing a possible buyout, like the starting point for analysis of the market response to the earnings, must be a reversed engineered discount cash flow model whose output equals the price in question. It is only with reference to the financial projections that result from reverse engineering of market prices that the rationality of the market's response to new information or the rationality of a potential transaction can be assessed properly.

Exhibit 1: Damodaran Baseline Valuation of Tesla on June 28, 2018

	Last 12 mos	1	2	3	4	5	6	7	8	9	10	Terminal
Revenue growth rate		32.00%	32.00%	32.00%	32.00%	32.00%	26.20%	20.40%	14.60%	8.80%	3.00%	3.00%
Revenues	\$ 12,471	\$ 16,462	\$ 21,730	\$ 28,683	\$ 37,862	\$ 49,978	\$ 63,072	\$ 75,939	\$ 87,026	\$ 94,684	\$ 97,525	\$ 100,450
EBIT(Operating) margin	-11.37%	-7.09%	-2.82%	1.45%	5.73%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
EBIT (Operating income)	\$ (1,418)	\$ (1,168)	\$ (613)	\$ 417	\$ 2,168	\$ 4,998	\$ 6,307	\$ 7,594	\$ 8,703	\$ 9,468	\$ 9,752	\$ 10,045
Tax rate	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%
EBIT(1-t)	\$ (1,418)	\$ (1,168)	\$ (613)	\$ 417	\$ 1,967	\$ 3,748	\$ 4,730	\$ 5,695	\$ 6,527	\$ 7,101	\$ 7,314	\$ 7,534
- Reinvestment	\$ 1,995	\$ 2,634	\$ 3,477	\$ 4,589	\$ 6,058	\$ 8,729	\$ 8,578	\$ 7,391	\$ 5,106	\$ 1,894	\$ 2,260	
FCFF	\$ (3,163)	\$ (3,247)	\$ (3,060)	\$ (2,622)	\$ (2,310)	\$ (3,999)	\$ (2,882)	\$ (864)	\$ 1,996	\$ 5,421	\$ 5,274	
NOL	\$ -	\$ 1,167.88	\$ 1,780.84	\$ 1,364.12	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Cost of capital		8.29%	8.29%	8.29%	8.29%	8.29%	8.13%	7.97%	7.82%	7.66%	7.50%	7.50%
Cumulated discount factor		0.9234	0.8527	0.7874	0.7272	0.6715	0.6210	0.5751	0.5334	0.4955	0.4609	
PV(FCFF)	\$ (2,921)	\$ (2,769)	\$ (2,410)	\$ (1,907)	\$ (1,551)	\$ (2,483)	\$ (1,658)	\$ (461)	\$ 989	\$ 2,498		

Terminal cash flow	\$ 5,274
Terminal cost of capital	7.50%
Terminal value	\$ 117,192
PV(Terminal value)	\$ 54,014
PV (CF over next 10 years)	\$ (12,672)
Sum of PV	\$ 41,342
Probability of failure =	5.00%
Proceeds if firm fails =	\$ 20,671
Value of operating assets =	\$ 40,309
- Debt	\$ 11,875
+ Cash	\$ 2,666
Value of equity	\$ 31,100
- Value of options	\$ 2,927
Value of equity in common stock	\$ 28,173
Number of shares	169.76
Estimated value /share	\$ 165.96

Exhibit 2: Reverse Engineering the Market Price on August 1, 2018

	Last 12 mos	1	2	3	4	5	6	7	8	9	10	Terminal
Revenue growth rate		37.00%	36.00%	35.00%	34.00%	33.00%	29.00%	23.50%	17.00%	9.50%	3.00%	3.00%
Revenues	\$ 12,471	\$ 17,086	\$ 23,236	\$ 31,369	\$ 42,035	\$ 55,906	\$ 72,119	\$ 89,067	\$ 104,208	\$ 114,108	\$ 117,531	\$ 121,057
EBIT(Operating margin	-11.37%	-6.70%	-2.50%	2.50%	7.33%	12.00%	11.60%	11.60%	11.60%	11.60%	11.60%	11.60%
EBIT(Operating income)	\$ (1,418)	\$ (1,145)	\$ (581)	\$ 784	\$ 3,080	\$ 6,709	\$ 8,366	\$ 10,332	\$ 12,088	\$ 13,236	\$ 13,634	\$ 14,043
Tax rate	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%
EBIT(1-t)	\$ (1,418)	\$ (1,145)	\$ (581)	\$ 784	\$ 2,545	\$ 5,032	\$ 6,274	\$ 7,749	\$ 9,066	\$ 9,927	\$ 10,225	\$ 10,532
- Reinvestment		\$ 2,307	\$ 3,075	\$ 4,066	\$ 5,333	\$ 6,936	\$ 10,808	\$ 11,299	\$ 10,094	\$ 6,600	\$ 2,282	\$ 3,160
FCFF		\$ (3,452)	\$ (3,656)	\$ (3,282)	\$ (2,788)	\$ (1,904)	\$ (4,534)	\$ (3,550)	\$ (1,028)	\$ 3,328	\$ 7,943	\$ 7,372
NOL	\$ -	\$ 1,144.73	\$ 1,725.64	\$ 941.41	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Cost of capital		8.29%	8.29%	8.29%	8.29%	8.29%	8.13%	7.97%	7.82%	7.66%	7.50%	7.50%
Cumulated discount factor		0.9234	0.8527	0.7874	0.7272	0.6715	0.6210	0.5751	0.5334	0.4955	0.4609	
PV(FCFF)		\$ (3,188)	\$ (3,118)	\$ (2,584)	\$ (2,027)	\$ (1,279)	\$ (2,816)	\$ (2,042)	\$ (548)	\$ 1,649	\$ 3,661	

Terminal cash flow	\$ 7,372
Terminal cost of capital	7.50%
Terminal value	\$ 163,830
PV(Terminal value)	\$ 75,510
PV (CF over next 10 years)	\$ (12,291)
Sum of PV	\$ 63,218
Probability of failure =	0.00%
Proceeds if firm fails =	\$ 31,609
Value of operating assets =	\$ 63,218
- Debt	\$ 11,875
+ Cash	\$ 2,666
Value of equity	\$ 54,010
- Value of options	\$ 2,927
Value of equity in common stock	\$ 51,082
Number of shares	169.76
Estimated value /share	\$ 300.91

Exhibit 3: Analyst Consensus Forecasts and Realized Financial Performance

	Consensus Analyst Forecast	Realized Value	Surprise	Percentage Surprise
Total Revenue (billions)	3.92	4.00	0.08	2.0%
Earnings per share (GAPP)	-3.98	-4.22	-0.24	-5.7%
Earnings per share (as reported)	-2.87	-3.06	-0.19	-6.2%
Total Free Cash Flow (millions) (as reported excluding solar panels)	-869	-739	130	17.6%

Exhibit 4: Tesla Minute by Minute Stock Price Following the Earnings Announcement

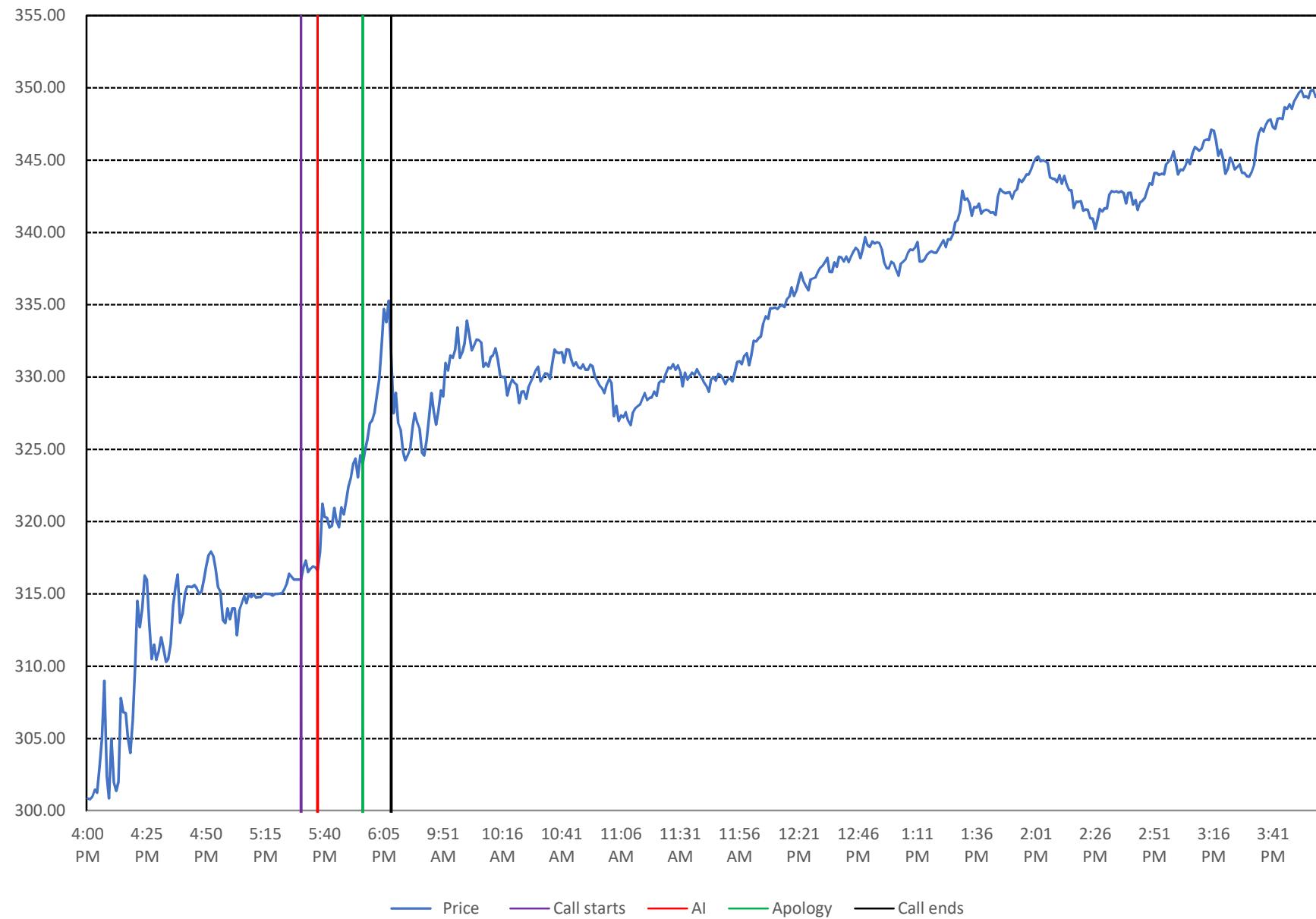


Exhibit 5: Tesla Minute by Minute Stock Price on August 7, 2018

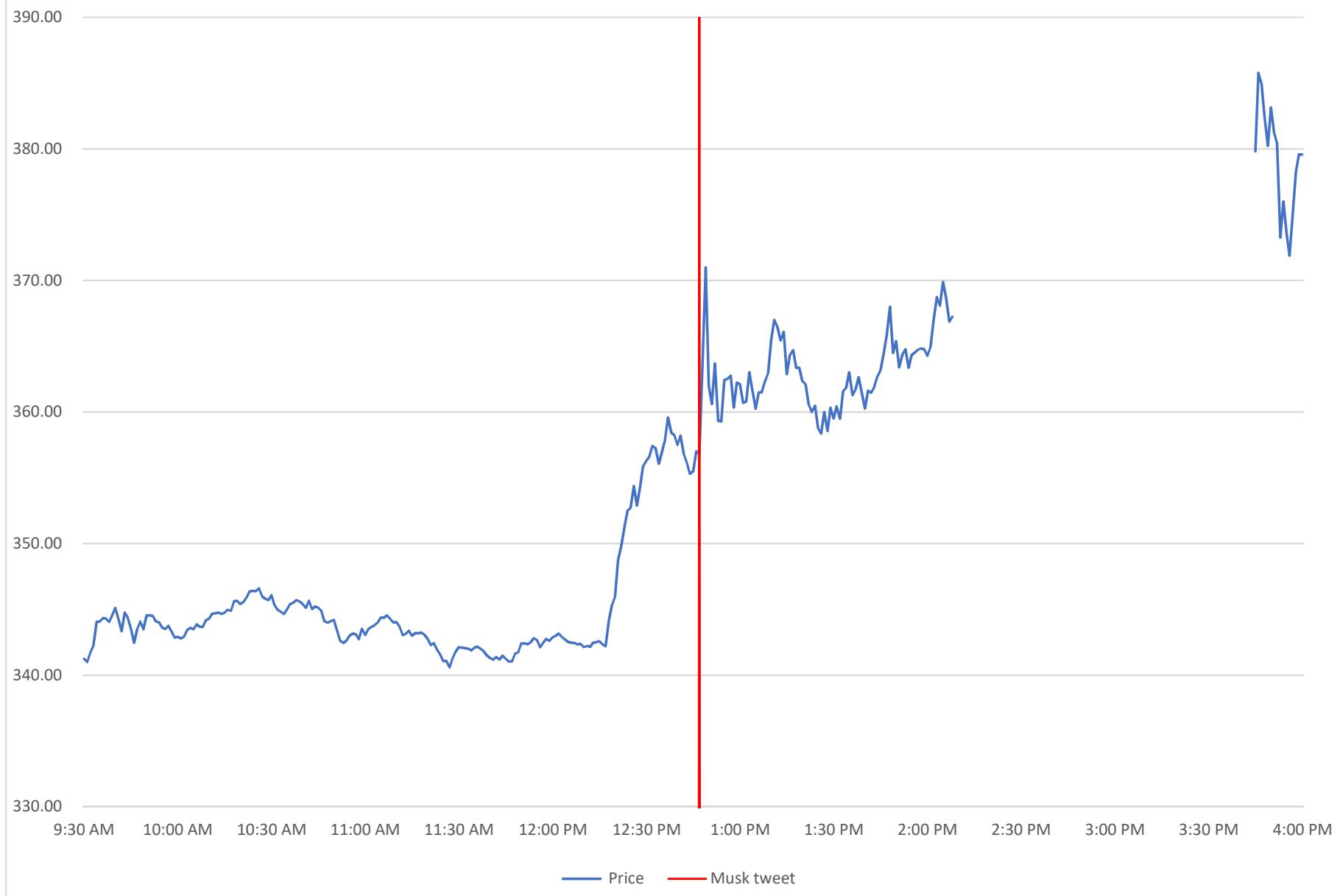


Exhibit 6: Reverse Engineering a Buy-out Price of \$420

	Last 12 mos	1	2	3	4	5	6	7	8	9	10	Terminal
Revenue growth rate		37.00%	36.00%	36.00%	36.00%	33.00%	29.00%	23.50%	18.00%	10.00%	5.50%	3.25%
Revenues	\$ 12,471	\$ 17,086	\$ 23,236	\$ 31,601	\$ 42,978	\$ 57,161	\$ 73,737	\$ 91,065	\$ 107,457	\$ 118,203	\$ 124,704	\$ 128,757
EBIT (Operating margin)	-11.37%	-6.70%	-2.50%	7.20%	9.60%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%	12.00%
EBIT (Operating income)	\$ (1,418)	\$ (1,145)	\$ (581)	\$ 2,275	\$ 4,126	\$ 6,859	\$ 8,848	\$ 10,928	\$ 12,895	\$ 14,184	\$ 14,965	\$ 15,451
Tax rate	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%	25.00%
EBIT(1-t)	\$ (1,418)	\$ (1,145)	\$ (581)	\$ 2,138	\$ 3,094	\$ 5,144	\$ 6,636	\$ 8,196	\$ 9,671	\$ 10,638	\$ 11,223	\$ 11,588
- Reinvestment	\$ 2,051	\$ 2,734	\$ 3,718	\$ 5,056	\$ 6,303	\$ 7,367	\$ 7,701	\$ 7,285	\$ 4,776	\$ 2,889	\$ 3,766	
FCFF	\$ (3,196)	\$ (3,315)	\$ (1,580)	\$ (1,962)	\$ (1,159)	\$ (731)	\$ 494	\$ 2,386	\$ 5,862	\$ 8,334	\$ 7,822	
NOL	\$ -	\$ 1,144.73	\$ 1,725.64	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Cost of capital		8.29%	8.29%	8.29%	8.29%	8.29%	8.13%	7.97%	7.82%	7.66%	7.50%	7.50%
Cumulated discount factor		0.9234	0.8527	0.7874	0.7272	0.6715	0.6210	0.5751	0.5334	0.4955	0.4609	
PV(FCFF)	\$ (2,951)	\$ (2,826)	\$ (1,244)	\$ (1,427)	\$ (778)	\$ (454)	\$ 284	\$ 1,273	\$ 2,905	\$ 3,841		

Terminal cash flow	\$ 7,822
Terminal cost of capital	7.50%
Terminal value	\$ 184,047
PV(Terminal value)	\$ 84,828
PV (CF over next 10 years)	\$ (1,377)
Sum of PV	\$ 83,450
Probability of failure =	0.00%
Proceeds if firm fails =	\$ 41,725
Value of operating assets =	\$ 83,450
- Debt	\$ 11,875
+ Cash	\$ 2,666
Value of equity	\$ 74,242
- Value of options	\$ 2,927
Value of equity in common stock	\$ 71,314
Number of shares	169.76
Estimated value /share	\$ 420.09