"Betting on the Likelihood of a Short Squeeze"

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Motivation: Skewness-Seeking

- Claim: Skewness is a first order factor in investing.
  - Especially, right skewness.
  - Like in a lottery ticket.
  - Small probability of large gains
- Foundations:
  - Friedman and Savage (JPE 1948).
  - Relative wealth concerns, status considerations:
    - Retail investors: *Barbell* strategies.
    - Mutual Funds: *Gambling for resurrection*.
  - But NOT through CRRA preferences.

Menu of Skewed Financial Assets

- Obvious examples:
  - Growth stocks.
  - VC/Private equity.
  - Penny stocks.
  - Distressed stocks: Hertz's bankruptcy announcement
- General problem:
  - Skewness in stocks is difficult to assess *ex ante*.
  - (Not so much in options).
- Solution (for stocks):
  - Use *proxies*.
  - Growing literature.

Enter the Short Squeeze

- According to the SEC:

  "The term 'short squeeze' refers to the pressure on short sellers to cover their positions as a result of sharp price increases or difficulty in borrowing the security the sellers short. The rush by short sellers to cover produces additional upward pressure on the price of the stock, which then can cause an even greater squeeze."

  (*Key Points About Regulation SHO*, SEC.com)

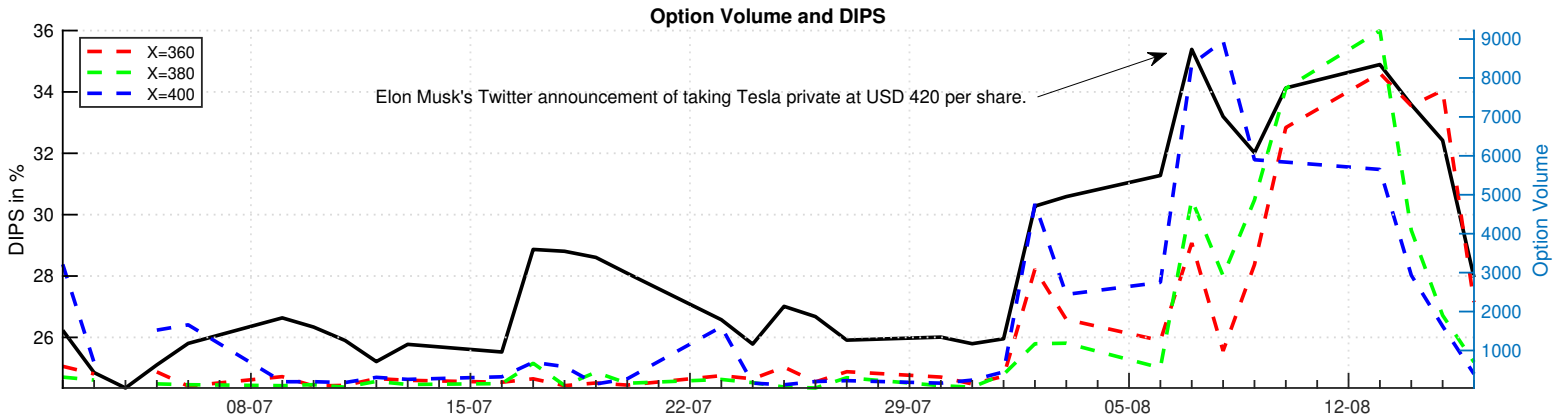
This Paper

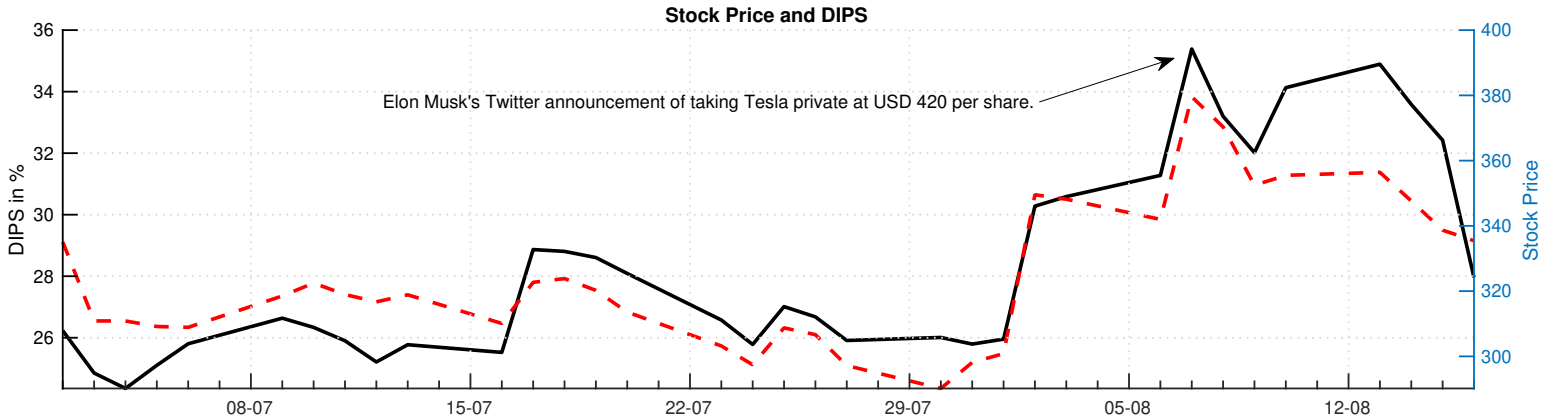
- We identify a possible proxy for right-skewness of stocks:
  - Likelihood of a short-squeeze.
  - Data Explorers Increasing Price Squeeze indicator (DIPS).
    - Measure of the probability of a short squeeze.
    - We compare it with other measures.
    - That is proprietary and objective.
- Short squeezes trigger a positive jump in the stock price.
- Uncertainty about short squeeze likelihood increases skewness.
- Investors pay a premium for calls written on the stock.
  - More bang for the buck that with underlying.

A Famous Short Squeeze: Tesla

- 8/7/18: Tesla is the most-shorted stock in the U.S.
- Elon Musk's twitter states:
  - Considering to take it private, funding secured.
- Effects:
  - Sent the share price up as much as 13.3%.
  - 500,000 options traded, twice daily average.
- Short sellers lost about $1.3 billion (Ihor Dusaniwsky, S3).

Tesla's short squeeze





Lottery Stocks

- Kumar (2009):
  - Idiosyncratic volatility.
  - Idiosyncratic skewness.
  - Low price.
- Bali, Cakici and Whitelaw (2011):
  - Sort stocks according to maximum 10-day return.
  - Also 5-day.
  - Verify they are overpriced.
  - As in a lottery.

Lottery Options

- Boyer and Vorkink (2014):
  - They develop their own measure.
  - Based on lognormality of the underlying stock return.
  - And the truncated nature of the option payoff.
  - They verify as negative expected return.
  - As with lottery stocks.
- Byun and Kim (2016):
  - Study options on lottery stocks.
  - At-the-money options.
  - Lower expected return the higher the lotteryness of stock.

Lottery Stocks and Options

- Filippou, Garcia-Ares and Zapatero (2020):
  - Lottery Options replace lottery stocks.
  - OTM options are strongly preferred.
  - ATM covered call strategies.

Short Squeezes

- Danielsen and Sorescu (2001), Chen and Singal (2003):
  - Short squeezes contribute to the cost of short sale.
- D'Avolio (2002):
  - Cost of "recall squeezes."
  - Short sellers can buy back at falling prices.
  - 10% of the stocks are never shorted - small with poor liquidity.
- Lamont and Stein (2004):
  - Fear of a short squeeze.
  - Short interest is low during the apparent market overvaluation.
- Liu and Xu (2016), Xu and Zheng (2017):
  - Cost of short squeezes is economically meaningful.
  - Short squeezes are higher for stocks with greater liquidity.
  - The role of capital and short sale constraints.

Short Squeeze Data

- Data Explorers Increasing Price Squeeze indicator (DIPS):
  - From Markit.
- It compares securities lending data to cash market data:
  - In order to estimate probability of a short squeeze.
  - It typically occurs when DIPS exceeds 20%.
- We compute its monthly standard deviation:
  - As a proxy for right-skewness.
  - Additional layer of uncertainty.
- Data period: July 2006 to September 2019.

Portfolio Construction

- At the expiration day each month:
  - Form 10 equally-weighted option portfolios.
  - Based on their prior month DIPS standard deviation.
- Evaluate return over one-month holding period.
- Compute return of long-short strategy:
  - Invests \$1 in the top, and shorts \$1 of the bottom portfolios.
  - According to std(DIPS).

Percentage of Firms with Extreme Returns in Std(DIPS) Portfolios

Panel A: %firms with dailyret>15% of Portfolios of ATM options sorted based on std(DIPS)

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P10-P1	t-stat
Mean	0.005	0.010	0.012	0.018	0.022	0.031	0.039	0.056	0.073	0.107	0.102	(7.31)

Panel B: %firms with dailyret>20% of Portfolios of ATM options sorted based on std(DIPS)

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P10-P1	t-stat
Mean	0.002	0.003	0.004	0.006	0.007	0.013	0.015	0.021	0.030	0.050	0.048	(6.61)

Panel C: %firms with up (down) dev of price (SI) of 2 std of Portfolios of ATM options sorted based on std(DIPS)

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P10-P1	t-stat
Mean	0.035	0.037	0.038	0.039	0.039	0.043	0.045	0.052	0.051	0.067	0.032	(9.21)

Std(DIPS): Delta-hedged Call Option Returns

Panel A: Portfolios of ATM options sorted based on std(DIPS)

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P10-P1	t-stat
EW	-0.010	-0.012	-0.014	-0.017	-0.020	-0.021	-0.026	-0.029	-0.035	-0.043	-0.033	(-12.59)
OIW	-0.008	-0.009	-0.011	-0.009	-0.017	-0.020	-0.025	-0.027	-0.036	-0.041	-0.033	(-8.61)

Panel B: Risk-adjusted Returns of ATM options sorted based on std(DIPS)

	CAPM	Three-Factor	Four-Factor	Five-Factor
EW	-0.033	-0.033	-0.033	-0.034
	(-10.25)	(-9.75)	(-9.78)	(-11.06)
OIW	-0.032	-0.031	-0.031	-0.031
	(-6.92)	(-6.64)	(-6.79)	(-6.71)

Options Sorted on Lottery Features

- We run Fama-MacBeth (1973) cross-sectional regressions:
  - Option returns on the previous period std(DIPS), MAX and BV-SKEW.

$$\mathrm{RX}_{i,t+1} = \gamma_{0,t} + \gamma_{1,i}\mathrm{std(DIPS)}_{i,t} + \gamma_{2,i}\mathrm{MAX(10)}_{i,t} + \gamma_{3,i}\mathrm{BV\text{-}SKEW}_{i,t} + \gamma'_{4,i}\mathbf{Z}_{i,t} + \varepsilon_{i,t+1},$$

  - $\mathrm{RX}_{i,t+1}$: delta-hedged call option returns of asset i at time $t+1$.
  - $\mathbf{Z}_t$: set of control variables of asset i at time $t+1$.

- Control Variables:
  - log size (Ln(Size)),
  - log stock price (Ln(Price)),
  - institutional ownership (IOR),
  - book-to-market (B/M),
  - debt-to-assets (D/A),
  - turnover,
  - idiosyncratic volatility (IVOL),
  - illiquidity (ILLIQ),
  - reversals (REV),
  - momentum (MOM).

Cross-Sectional Regressions

At-the-money Call Options

	(1)	(2)	(3)
	Delta-hedged Call Options		
$std(DIPS)$	-0.838	-0.422	-0.190
	(-13.19)	(-6.69)	(-3.87)
$MAX(10)$		-0.659	-0.349
		(-13.42)	(-4.84)
$BV-SKEW$		-0.003	-0.002
		(-4.52)	(-3.61)
$Ln(Size)$			0.003
			(6.61)
$Ln(StockPrice)$			0.004
			(6.89)
IOR			-0.002
			(-1.00)
B/M			0.004
			(3.63)
D/A			0.006
			(3.49)
$Turnover$			0.001
			(4.25)
$IVOL$			-0.218
			(-3.75)
$ILLIQ^{Stocks}$			-0.390
			(-3.45)
REV			-0.005
			(-1.27)
MOM			-0.002
			(-1.07)
Constant	-0.006	0.003	-0.059
	(-3.06)	(1.49)	(-8.79)
R-squared	0.029	0.053	0.114

Std(DIPS) and Other Predictors of Short Squeezes

Panel A: Short Float and Days to Cover of Portfolios of ATM options sorted based on std(DIPS)

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P10-P1	t-stat
						Short Float of DIPS Portfolios						
Mean	0.016	0.024	0.034	0.045	0.057	0.070	0.083	0.101	0.124	0.175	0.159	(18.93)
						Days to Cover of DIPS Portfolios						
Mean	1.824	2.079	2.471	2.865	3.192	3.625	3.836	4.141	4.341	4.805	2.981	(12.41)

Panel B: Option Returns of portfolios based on Short Float and Days to Cover

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P10-P1	t-stat
						Short Float Portfolios						
Mean	-0.013	-0.014	-0.018	-0.020	-0.023	-0.025	-0.026	-0.028	-0.031	-0.027	-0.014	(-6.21)
						Days to Cover Portfolios						
Mean	-0.016	-0.016	-0.020	-0.021	-0.022	-0.025	-0.026	-0.026	-0.027	-0.028	-0.012	(-5.95)

Std(DIPS) and Option Order Imbalances

Panel A: Option Imbalances of Customers

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P10-P1	*t*-stat
						Small Customers						
Mean	-20,970	1,810	15,001	12,645	6,540	13,249	13,256	17,733	19,414	23,335	44,156	(5.19)
						Medium Customers						
Mean	-1,830	-1,079	-4,913	-176	-581	1,311	1,409	1,985	1,188	1,741	3,560	(1.95)
						Large Customers						
Mean	9,897	9,787	14,807	5,130	393	6,384	13,692	9,408	6,440	5,390	-4,541	(-0.55)

Panel B: Relative Open Interest

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P10-P1	*t*-stat
Mean	0.089%	0.134%	0.210%	0.331%	0.465%	0.605%	0.847%	0.981%	1.108%	1.409%	1.320%	(19.32)

Std(DIPS) and Robinhood Popularity

	Robinhood Popularity											
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P10-P1	t-stat
Mean	632	490	413	406	474	515	517	609	761	1192	560	(17.60)

Std(DIPS) and Short Squeeze Triggers

Panel A: Portfolios of ATM options sorted based on Abnormal Volume and std(DIPS)

	Low std(DIPS)	P2	P3	P4	High std(DIPS)	HML	t-stat
Low Abnormal Volume	-0.010	-0.012	-0.016	-0.020	-0.032	-0.022	(-8.65)
High Abnormal Volume	-0.012	-0.018	-0.024	-0.031	-0.043	-0.032	(-9.55)

Panel B: Portfolios of ATM options sorted based on 8K filings Sentiment and avg(DIPS)

	Low avg(DIPS)	P2	P3	P4	High avg(DIPS)	HML	t-stat
Low Sentiment	-0.012	-0.014	-0.018	-0.024	-0.032	-0.021	(-7.80)
High Sentiment	-0.015	-0.019	-0.027	-0.036	-0.047	-0.032	(-11.02)

Panel C: Portfolios of ATM options sorted based on earnings surprises and std(DIPS)

	Low std(DIPS)	P2	P3	P4	High std(DIPS)	HML	t-stat
Low Earnings Surprises	-0.014	-0.016	-0.022	-0.028	-0.038	-0.024	(-9.75)
High Earnings Surprises	-0.012	-0.013	-0.021	-0.025	-0.037	-0.025	(-9.42)

Threshold List and Fails to Deliver of Std(DIPS) Portfolios

Panel A: Percentage of firms in Threshold List

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P10-P1	t-stat
Mean	0.00%	0.00%	0.04%	0.09%	0.10%	0.10%	0.20%	0.20%	0.33%	1.85%	1.85%	(10.25)

Panel B: Fails to Deliver

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P10-P1	t-stat
Mean	0.10%	0.22%	0.25%	0.48%	0.20 %	0.29%	0.35%	0.57%	1.06%	2.66%	2.55%	(3.12)

Block-holder Ownership of Std(DIPS) Portfolios

Equally-weighted Portfolios												
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P10-P1	t-stat
Median	20.021	22.357	24.534	26.614	28.463	30.254	31.424	32.947	34.403	36.731	16.710	(29.81)
Median Number of Blocks	2.513	2.771	2.997	3.207	3.376	3.529	3.554	3.669	3.650	3.541	1.029	(14.79)

Conclusions

- Probability of a short-squeeze is a proxy for right-skewness.
- Skewness-seeking investors focus on call options.
- They pay a premium for this opportunity.
- We use a proprietary measure to estimate the probability.
- But our results are robust to other measures.

Lotteryness proxies: average DIPS, max(DIPS) and std(DIPS)

Panel A: Portfolios of ATM options sorted based on avg(DIPS) and std(DIPS)

	Low std(DIPS)	P2	P3	P4	High std(DIPS)	HML	*t*-stat
Low avg(DIPS)	0.229	0.153	0.155	0.112	0.097	-0.132	(-2.79)
High avg(DIPS)	0.146	0.125	0.097	0.022	-0.010	-0.156	(-3.76)

Panel B: Portfolios of ATM options sorted based on std(DIPS) and avg(DIPS)

	Low avg(DIPS)	P2	P3	P4	High avg(DIPS)	HML	*t*-stat
Low std(DIPS)	0.250	0.228	0.165	0.180	0.220	-0.030	(-0.74)
High std(DIPS)	0.112	0.081	0.091	0.090	-0.049	-0.162	(-3.97)

Panel C: Portfolios of ATM options sorted based on 3 months max(DIPS) and std(DIPS)

	Low std(DIPS)	P2	P3	P4	High std(DIPS)	HML	*t*-stat
Low max(DIPS)	0.257	0.182	0.201	0.231	0.110	-0.147	(-3.08)
High max(DIPS)	0.111	0.097	0.085	0.050	-0.005	-0.116	(-2.98)

Panel D: Portfolios of ATM options sorted based on 3 months std(DIPS) and max(DIPS))

	Low max(DIPS)	P2	P3	P4	High max(DIPS)	HML	*t*-stat
Low std(DIPS)	0.243	0.222	0.177	0.211	0.191	-0.052	(-1.31)
High std(DIPS)	0.108	0.087	0.087	0.065	-0.023	-0.131	(-3.73)

Lotteryness proxies: average DIPS, max(DIPS) and std(DIPS)

Panel A: Portfolios of OTM options sorted based on std(DIPS)

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P10-P1	t-stat
EW	-0.012	-0.013	-0.016	-0.010	-0.018	-0.027	-0.030	-0.031	-0.046	-0.048	-0.035	(-5.48)
OIW	-0.013	-0.011	-0.016	-0.006	-0.021	-0.036	-0.035	-0.041	-0.054	-0.056	-0.043	(-4.42)

Panel B: Delta-hedged, risk-adjusted Returns of OTM options sorted based on std(DIPS)

	CAPM	Three-Factor	Four-Factor	Five-Factor
EW	-0.035	-0.035	-0.035	-0.036
	(-5.11)	(-5.27)	(-5.28)	(-5.51)
OIW	-0.032	-0.031	-0.031	-0.031
	(-6.92)	(-6.64)	(-6.79)	(-6.71)