



Empirical Finance 101  
- by Harvey Huang

# Who are they?

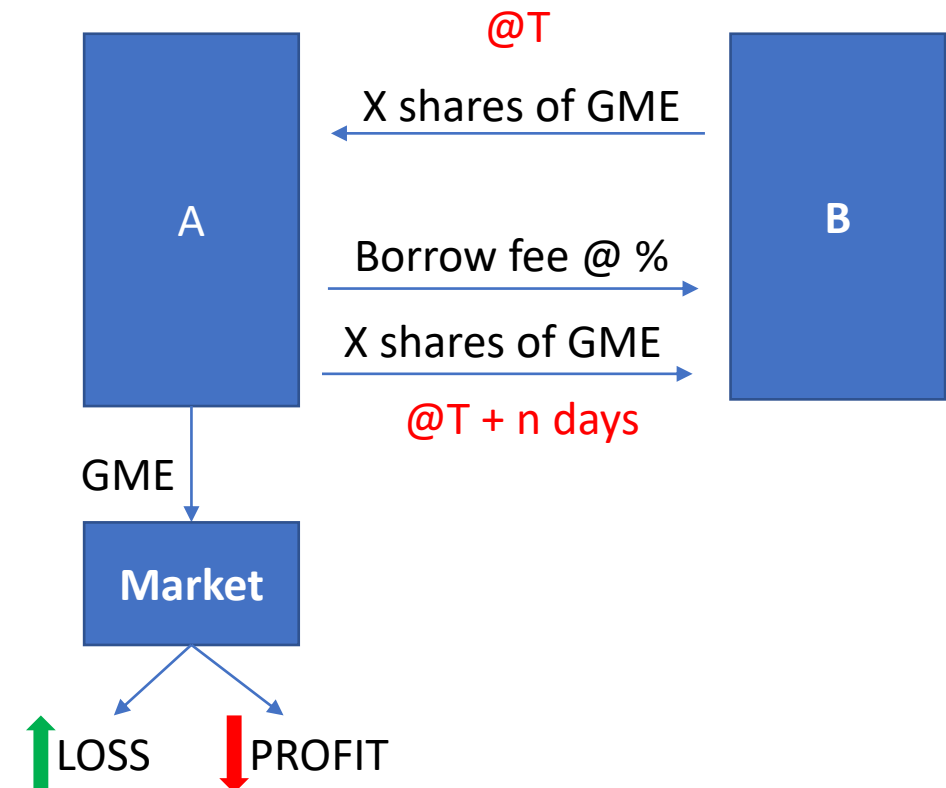
- GameStop (NYSE: GME): owns EBGames.
- Wallstreetbets (WSB): a sub-forum on reddit, a place where millennials joke about everything and make memes.
  - There are five major investment related sub-reddits.
- Melvin Capital/Citron Research/Citadel: institutions (Hedge funds)
- Robinhood/Interactive Broker: dealer-broker (market maker).
- National Security Clearing Corporation (NSCC): clearing house that settles ~90% of all the trades.
  - <https://www.dtcc.com/about/businesses-and-subsidiaries/nscc>

- ✓ r/wallstreetbets
- ✓ r/investing
- ✓ r/stocks
- ✓ r/StockMarket
- ✓ r/pennystocks

Long (retails) vs. Short (institutions)  
How is it possible that short interest  $> 100\%$ ?

# How did everything start?

- Someone on wallstreetbets found out that the short interest of GME reached ~130%, and they
  - were not happy, or
  - believed in GME.
- So collectively they decided to “squeeze the short”.
- Let’s start with some terminologies..
- **Float: no. of shares available for trading.**
- Outstanding: floats + restricted shares.
- Restricted shares: typically owned by employees in the company, (subject to SEC rule 144 or similar)
  - Those shares are bounded by certain rules, e.g. you cannot sell before X dates.





# Short interest on 29/01/2021

- Short interest = shorted stocks / floats
  - How is it possible that this figure is > 100%?
- <https://www.highshortinterest.com/>

All	Nasdaq	NYSE	AMEX	Low Float Stocks			
Ticker	Company	Exchange	ShortInt	Float	Outstd	Industry	
GME	GameStop Corp.	NYSE	121.07%	51.03M	69.75M	Retail (Technology)	
AMC	AMC Entertainment Holdings Inc	NYSE	78.97%	56.57M	287.28M	Motion Pictures	
SPCE	Virgin Galactic Holdings Inc	NYSE	71.95%	53.65M	195.59M	Investment Holding Companies	
FUBO	Fubotv Inc	NYSE	71.91%	54.47M	67.56M	Online Services	
BBBY	Bed Bath & Beyond Inc.	Nasdaq	65.48%	114.36M	126.01M	Retail (Specialty Non-Apparel)	
LGND	Ligand Pharmaceuticals Inc.	Nasdaq	64.88%	15.43M	16.08M	Biotechnology & Drugs	
FIZZ	National Beverage Corp.	Nasdaq	62.62%	11.65M	46.65M	Non-Alcoholic Beverages	
SPWR	SunPower Corporation	Nasdaq	57.49%	80.92M	170.16M	Semiconductors	
SKT	Tanger Factory Outlet Centers	NYSE	52.41%	90.14M	93.47M	Real Estate Operations	
GSX	GSX Techedu Inc	NYSE	50.32%	128.62M	128.69M	Personal Services	
TR	Tootsie Roll Industries, Inc.	NYSE	45.91%	16.11M	39.34M	Food Processing	
GOGO	Gogo Inc	Nasdaq	43.95%	40.46M	85.25M	Communications Services	
AXDX	Accelerate Diagnostics Inc	Nasdaq	43.08%	31.03M	57.03M	Scientific & Technical Instruments	
BYND	Beyond Meat Inc	Nasdaq	42.89%	35.99M	62.44M	Food Processing	
OTRK	Ontrak, Inc.	Nasdaq	42.56%	7.41M	17.42M	Healthcare Facilities	
CLVS	Clovis Oncology Inc	Nasdaq	42.13%	85.73M	88.20M	Biotechnology & Drugs	
RKT	Rocket Companies Inc	NYSE	40.72%	102.38M	100.37M	Consumer Lending	
SRG	Seritage Growth Properties	NYSE	38.69%	34.27M	38.64M	Real Estate Operations	
IRBT	iRobot Corporation	Nasdaq	38.45%	27.43M	28.13M	Electronic Equipment & Parts	
PRTS	Carparts.Com Inc	Nasdaq	37.50%	37.11M	47.93M	Retailers - Auto Vehicles, Parts & Service	



# Short interest > 100%

- Naked short
  - In theory, you have to own the shares first and then sell them.
  - In rare conditions, dealer-brokers are **permitted** by the SEC to do naked shorts (i.e. you sell first and then own the shares) if they cannot find shares timely (because they are required to **make** the market).
  - Retail traders cannot do that.
  - <https://www.sec.gov/investor/pubs/regsho.htm>

# Short interest > 100%

- However, even without naked short, this is possible.
  - Say 100 floating shares @ \$10.
  - On Jan. 3<sup>rd</sup> I short 100, immediately sell @\$10, the contract requires me to return shares back on Feb 1<sup>st</sup>.
  - On Jan. 10<sup>th</sup> the price drops to \$9, I borrow 50, sell @\$9, this second contract requires me to return shares back on Feb 10<sup>th</sup>.
  - The total amount of shorted shares = 150, so short interest = 150%.
  - “Double-down” approach.
  - This is legal in the US.
- <https://www.quora.com/Can-a-stock-have-100-of-its-shares-shorted>

# Short squeeze

- If the share price continues to go down, eventually hedge funds can make a huge profit.
- Institutions like Citron Research and Melvin Capital often go after companies with dogie accounting numbers or lazy management teams (or sometimes just malicious short).
  - Short first, then publish negative reports, wait for the share price to go down (or manipulate the market).
  - Eventually they want to buy back the shares at a much lower price.
  - This is their business model.

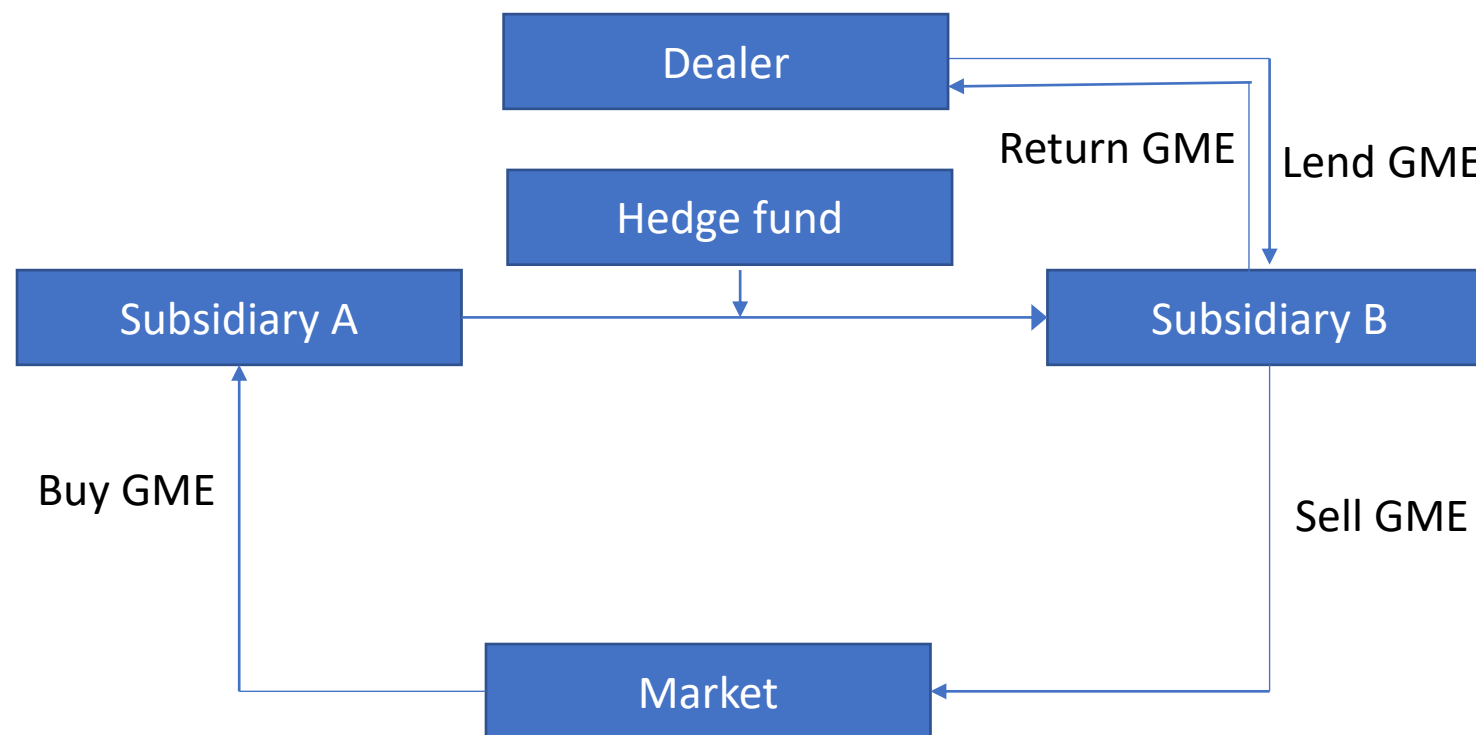


# Short squeeze

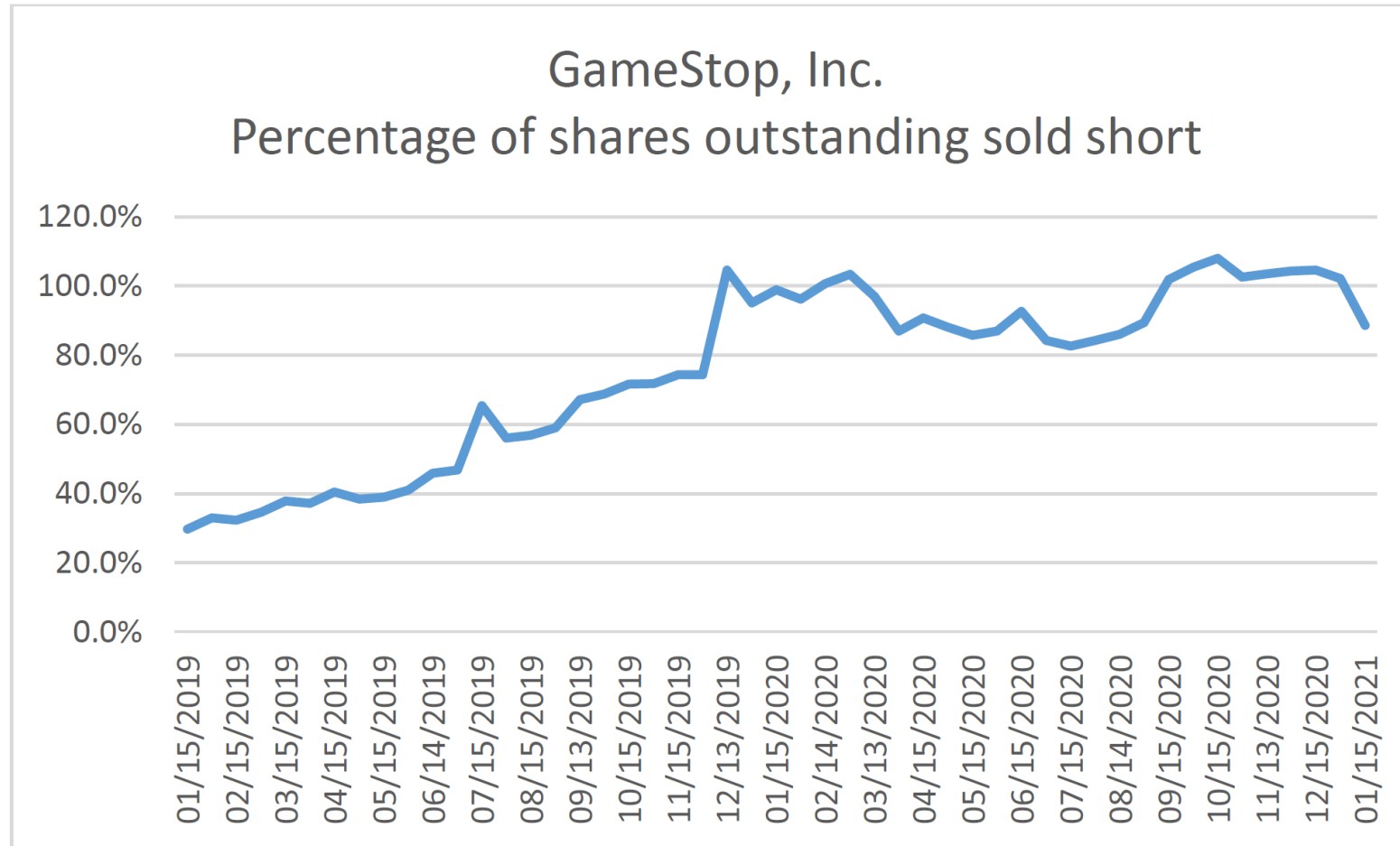
- However, if the price instead goes up, the short sellers will be forced to close out their position at some point (the short side has contractual obligation) because of the margin call (IB will request collateral deposits from short sellers).
- Plus it's very costly to borrow shares: borrow interest rate depends on the liquidity of the shares.
  - GME borrow interest rate at >20% p.a.
- Melvin Capital was reported to close its short position on Jan 26<sup>th</sup> Tuesday (further pushed the share price up).
- Citadel and Point72 injected \$2.75 billions to Melvin Capital.
- Melvin Capital was reported to make a loss of ~50% in January (~\$6 billion).

# Another way (market manipulation)

- In principle, under certain conditions this is strictly illegal (wash trade).



# The short side has planned to short GME for a long time



# Why GME?

- Short sellers on GME
  - Most players choose to download games (yes on PC games but questionable on console games) so GME has no future.
  - GME is overvalued (even at \$3-6 per share).
- Based on financials, looks like they indeed suffered in 2020 but short sellers placed their positions in 2019.
- Sure, it appeared that they borrowed ST debt, liquidated their PPE, and were 'bleeding' cash.
  - Why were they massively buying inventories using cash proceeds from various sources?
  - Not sure if my suspicion is true but both PS5 and XBOX X launched in Nov. 2020 (so stockpiling).
  - Given how popular the consoles are, GME is likely to have a nice upcoming quarterly report.

(\$millions)	Oct. 2020	Aug. 2020	May. 2020	Feb.2020	Nov. 2019	Aug. 2019	May. 2019
Operating income	-84.2	-96	-104.1	99.7	-20.4	-49.7	17.5
Sale of PPE	43.7	51.8	0	0	0	0	0
Total Debt issued	23.5	23.6	150	0	0	0	0
Total Debt repaid	-10	-103	-17.3	0	0	-54.1	-353.1
Cash & equivalent	445.9	735.1	570.3	499.4	290.3	424	543.2
Inventory	861	474.6	654.7	859.7	1,290	948.9	1.150
Total current asset	1,650	1,380	1,420	1,630	1,860	1,670	1,920
Total current liabilities	1,580	1,310	1,520	1,240	1,570	1,220	1,300

These figures  
are changes

These figures  
are balances



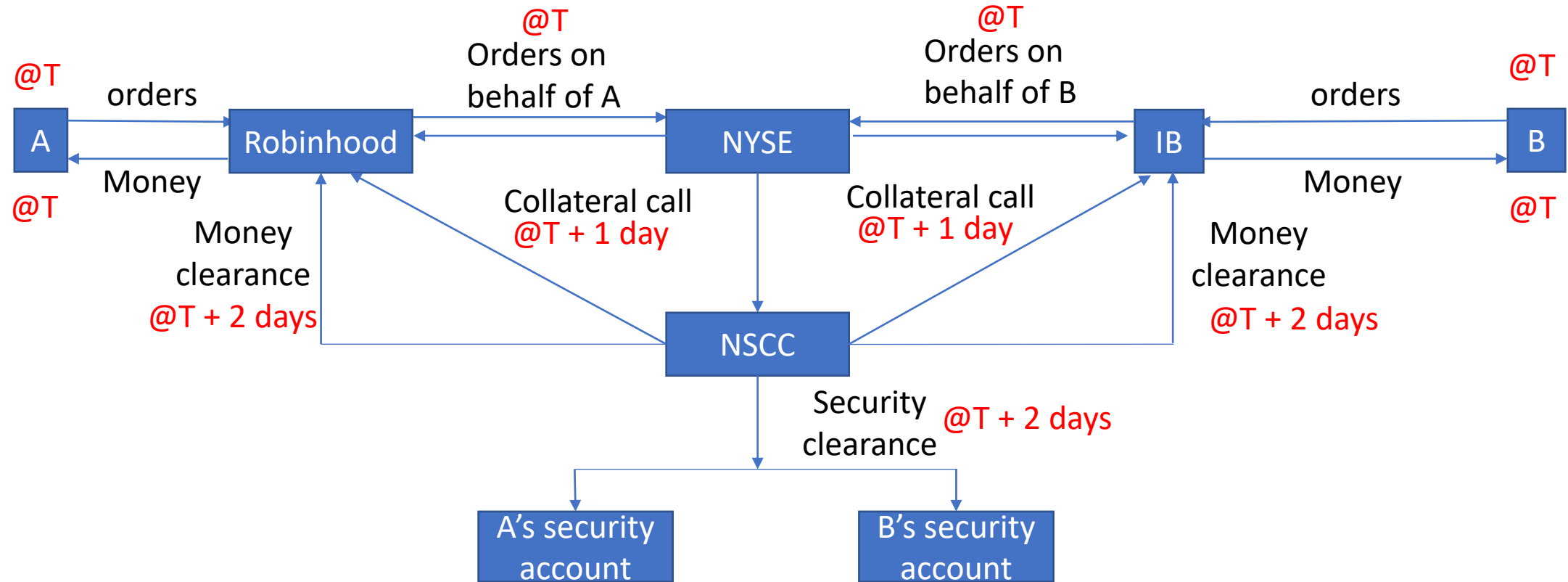
# Short interest (Feb. 14<sup>th</sup> , 2021)

- Is 130% a crazy number?

	Company Name	Exchange:Ticker	Short Interest as a % of Float [Latest]
1	Roth CH Acquisition I Co. (NasdaqCM:ROCH)	NasdaqCM:ROCH	982.2
2	GigCapital3, Inc. (NYSE:GIK)	NYSE:GIK	489.1
3	Northern Genesis Acquisition Corp. (NYSE:NGA)	NYSE:NGA	321.2
4	ION Acquisition Corp 1 Ltd. (NYSE:IACA)	NYSE:IACA	155.2
5	Apex Technology Acquisition Corporation (NasdaqCM:APXT)	NasdaqCM:APXT	131
6	Pershing Square Tontine Holdings, Ltd. (NYSE:PSTH)	NYSE:PSTH	109.5
7	Juniper Industrial Holdings, Inc. (NYSE:JIH)	NYSE:JIH	87.6
8	Greencity Acquisition Corporation (NasdaqCM:GRCY)	NasdaqCM:GRCY	82.3
9	FinServ Acquisition Corp. (NasdaqCM:FSRV)	NasdaqCM:FSRV	61.4
10	Naked Brand Group Limited (NasdaqCM:NAKD)	NasdaqCM:NAKD	59.3
11	Gogo Inc. (NasdaqGS:GOGO)	NasdaqGS:GOGO	52.9
12	iHeartMedia, Inc. (NasdaqGS:IHRT)	NasdaqGS:IHRT	51.6
13	Esperion Therapeutics, Inc. (NasdaqGM:ESPR)	NasdaqGM:ESPR	45.9
14	Silver Spike Acquisition Corp. (NasdaqCM:SSPK)	NasdaqCM:SSPK	45.3
15	National Beverage Corp. (NasdaqGS:FIZZ)	NasdaqGS:FIZZ	45.2
16	GameStop Corp. (NYSE:GME)	NYSE:GME	44.9
17	Clovis Oncology, Inc. (NasdaqGS:CLVS)	NasdaqGS:CLVS	44.8
18	Alpha Healthcare Acquisition Corp. (NasdaqCM:AHAC)	NasdaqCM:AHAC	43.7
19	GSX Techedu Inc. (NYSE:GSX)	NYSE:GSX	43.4
20	Trident Acquisitions Corp. (NasdaqCM:TDAC)	NasdaqCM:TDAC	43
21	Tanger Factory Outlet Centers, Inc. (NYSE:SKT)	NYSE:SKT	41.1
22	Madrigal Pharmaceuticals, Inc. (NasdaqGS:MDGL)	NasdaqGS:MDGL	39.4
23	Ligand Pharmaceuticals Incorporated (NasdaqGM:LGND)	NasdaqGM:LGND	39.1
24	Seritage Growth Properties (NYSE:SRG)	NYSE:SRG	38.4
25	Dillard's, Inc. (NYSE:DDS)	NYSE:DDS	38.4
26	GTT Communications, Inc. (NYSE:GTT)	NYSE:GTT	37.8
27	iSun, Inc. (NasdaqCM:ISUN)	NasdaqCM:ISUN	37.7
28	Invacare Corporation (NYSE:IVC)	NYSE:IVC	36.5
29	Futu Holdings Limited (NasdaqGM:FUTU)	NasdaqGM:FUTU	36.3
30	Accelerate Diagnostics, Inc. (NasdaqCM:AXDX)	NasdaqCM:AXDX	36

Why did RH decide to halt GME trade  
(allowed only sell if you owned GME shares)?

# Basics: what really happens when you make a trade.



# More on clearing: deposit

- NSCC rule 4 clearing fund: Each member shall make and maintain on an ongoing basis a deposit to the **Clearing Fund**.
  - Robinhood has an account at NSCC for clearing.
- Rule 4(A): Special Activity Peak Liquidity Need
  - Basically means that if NSCC anticipates the market to be highly volatile (or strong single-side trade or a large amount of options due), they will make a deposit call to the brokers (Robinhood).
- [https://www.dtcc.com/~media/Files/Downloads/legal/rules/nscc\\_rules.pdf](https://www.dtcc.com/~media/Files/Downloads/legal/rules/nscc_rules.pdf)



# More on clearing: deposit

- How does the NSCC determine how much money the brokers should maintain?
- “clearinghouses look at a firm’s customer holdings as a portfolio. They use a volatility multiplier, looking at specific stocks, to quantify their risk. The clearinghouse **may assign significant additional charges** based on how much of one stock a firm’s customers hold. If a firm’s customers have more buy than sell orders, and the securities they’re buying are more volatile, the deposit requirement will be higher. Clearinghouses can also require additional deposits if certain thresholds are met. ”
- <https://blog.robinhood.com/news/2021/1/29/what-happened-this-week>

# What happened?

- On Wednesday Jan. 27<sup>th</sup>, 2021, GME stock price reached ~\$350 per share, as opposed to ~\$65 per share on Friday Jan. 22<sup>nd</sup>, 2021.
- On Thursday Jan. 28<sup>th</sup> 3AM pacific, RH operation team received a file from the NSCC that requested ~\$3Billion.
  - There were some “discretionary” judgements.
  - Two negotiations were conducted:
    - Within a couple of hours, RH and NSCC made a deal to reduce the amount to ~\$1.4 Billion.
    - Later the amount was further reduced to \$700 million (which RH eventually paid).
- To compare, RH raised ~\$3Billion in total from all sources so far.
- RH had to STOP its customers from buying GME because they simply could not keep up with the “margin call” from the NSCC.
- This is basically a liquidity crisis (Recall the ridiculous T+2 clearing).
- <https://www.youtube.com/watch?v=1L8mI0i4XSA>



# Why must the brokers commit their own capital?

- SEC Rule 15c3-3: the customer protection rule.
  - Investors deposit money to IB and RH from their bank.
  - But the money is heavily protected, just like a bank.
  - Brokers cannot touch customers money to make a collateral deposit in the NSCC.
- Brokers must use their own capital, or source from somewhere else.

# RH seemed to be the most suffered broker

- Other brokers like IB merely limited margin trading (including options), most restrictions were lifted the next day.
  - Buying and selling without margin were not restricted.
- In contrast, RH allowed only SELL if you had long positions.
  - They blamed the NSCC and the fact that this event is a “five-sigma black swan”.

# Statement from IB on Jan. 30<sup>th</sup> , 2021

- “We are seeing unprecedented volatility in GME, AMC, BB, EXPR, KOSS and a small number of other U.S. securities that has forced us reduce the leverage previously offered to these securities and, in certain instances, limit trading to risk reducing transactions. IBKR currently has no restrictions on trading shares in those companies, and customers can open or close positions in those shares. Like many other brokers, IBKR placed options on certain of those stocks in closing only earlier this week. The plan is to lift those restrictions in an orderly manner while closely monitoring market conditions. To be clear, IBKR has not restricted clients’ ability to close existing positions in any of the U.S. securities subject to market volatility, and does not plan to do so.”
- “The limits IBKR has placed have applied to all customers and were not limited to “retail clients” or any other group.”

How can the retail investors have enough capital (money) to fight against the institutional investors?

# Leverage

- A straightforward way
  - Borrow money (mostly from brokers, called margins) and buy shares
  - Requirements and rules are very strict (minimum wage, minimum capital, one cannot borrow X% or more, frequent margin call, etc.)
- Less obvious way
  - Financial derivatives
  - These are effectively contracts that are “derived or agreed” by two parties on a particular asset.
    - It’s like a bet on the US election with very specific terms agreed by two (or more) parties.
  - Futures (forwards), options, swaps, etc.
  - The derivative market is much larger than the underlying spot market.

# Options 101

- Options give the buyer of the contract the right to buy (call)/sell (put) the underlying asset at a specific price by(American)/ on(European) a specific date upon request from the buyer to the seller,
  - Underlying asset: GME
  - Exercise price: \$10
  - Expiration date: 16:00 pacific time, March 1st, 2021
- Buyer of the contract has the right; seller of the contract has the obligation.
  - Pretty obvious that seller will charge some money from the buyer due to risks.
  - But the price is often some % of buying the underlying shares (hence, leverage).
- Party B (seller) is often an institution, typically a market maker.
- Stock options on NYSE are American options.



Contract

Party A: Harvey  
Party B: BMMLab

Terms:

- Upon request, Part B will sell 100 shares of GME at \$10 to Part A.
- Expiration date: 16:00 pacific time, March 1st, 2021
- etc.



# Options and leverage

- Price of the contracts will vary when the price of the underlying shares change.
  - It's like the price of the bets will vary due to polls or even on the night of counting.
- Market makers want to “lock” the profits when they sell the call option.
  - To achieve that, they will buy “delta” number of shares to “hedge” the share price movement. → Delta hedge.
- But.... this delta value itself will change due to share price shift (at a rate of “gamma”).
  - To implement a “gamma” hedge, the strategies are complicated.
  - In a nutshell, because of this mechanism, market markers may have to buy more shares if the underlying share price goes up *dramatically* so that they are “hedged”.

# Options and leverage

- Infinity loop: share price goes up → delta increases → market makers have to buy more to hedge → share price increases →...
- At the same time, there were more demands for GME call options...
  - RH reports that ~13% of its customers trade options.
- Retail traders can use this mechanism to boost up the share price in a short period of time, aka “squeeze the shorts”.
- NOTE: the actual mechanism can be much more complicated >> market makers do not have to buy the spot.
- In many cases they do buy the shares and immediately lend the shares to the shorter sellers (or unload however they can).

# How bad(good) was it?

- Jan. 12<sup>th</sup>:
  - GME price: \$19.95
  - Buyer would pay \$3.15 on a contract of buying GME at \$20/share, expired on Feb.19<sup>th</sup> .
  - As a call option buyer, maximum loss would be  $\$3.15 * 100 = \$315$  (the contract ended up worthless).
- Jan. 26<sup>th</sup>:
  - GME price: \$147.98
  - The same contract was worth ~\$350, so the return per contract was 11,500%.

# How bad(good) was it?

- Many institutions would think it was crazy to pay \$350 per contract on Jan. 26<sup>th</sup> .
  - However, on Jan.27<sup>th</sup> , GME was traded at \$347.51 (double the price of the previous day).
- Market was boiling, GME call options were ridiculously expensive, yet there were still some people who believed that GME was undervalued and wanted to buy call options.
- The entire GME call option market was worth \$15 Billion at that time (GME market cap @\$60 per share ~\$4.1 Billion).

# How bad(good) was it?

- Dealer-brokers like IB were freaked out.
- They buy shares to hedge their risk exposure, but usually they immediately lend the shares out to the short sellers.
- It's not clear how bad it was, but for sure IB was afraid of credit risks.
  - If the price went heavily against the short sellers like Melvin Capital, short sellers could possibly declare bankruptcy and chose not to buy back those shares.
  - Brokers like IB would end up being forced to deliver the shares themselves upon request (American options) due to SEC rule 204.
    - By law, they must pay any price to purchase enough quantities.

# Reference and Others

- <https://wallstreetbots.net/>
  - Bots that capture live feed and count the hot topics
- Angel, J. (2021). GameStonk: What happened and what to do about It.