# A FiCycle Analysis of GameStop

## Do the Math!

Over the past month, there has been a spectacular run up in the price of the stock of GameStop (Ticker symbol: GME). The price rose from $18.84 per share at the end of December to $325.00 per share at the end of January. Most of the discussion about GameStop has been about the relative power of individual investors and Wall Street hedge funds. While this is an important debate, at FiCycle, we want to dip deeper into determining the value of the stock to a long-term investor and "Do the Math."

## Understanding Valuation of a Stock

Suppose once you bought a stock you needed to hold it forever so the value would be determined by the cash flows (paid as dividends) of the company. Imagine the company pays a dividend equal to their earnings every year. We could add up those dividends to get the value of the stock.

However, we also know that money we receive sooner is worth more than money we receive later so we would need to reduce the value of the cash flows received in the future based on the time value of money. This is called **discounting.**

Now for the math:

*See Unit 2 Topic 5 of the FiCycle Math course for more details.*

Let $P$ be the sum of the discounted value of future cash flows.
Suppose
- $c$ is the cash flow at the end of year one
- $r$ is the discount rate.

Then, the value of the cash flow we receive at the end of one year is $\frac{c}{1+r}$

The value of the cash flow we receive at the end of the second year is discounted for two years, so its value would be $\frac{c}{(1+r)^2}$. Where $(1+r)^2 = (1+r)(1+r)$.

We can repeat these payments out into the future, and we get the sum of all of the discounted payments far into the future. In math notation we can write this using the Greek letter Sigma to represent this sum as:

$$P = \sum_{n=1}^{N} \frac{c}{(1+r)^n}$$

Consider too, that we do not expect the cash flow of a company to stay constant. If we believe that the cash flow will increase each year at a growth rate of $g$, the next year we expect the cash flow to grow from $c$ to $c(1 + g)$ at the end of second year and to be $c(1 + g)^2$ in the third year. In math notation we can write this as:

$$P = \sum_{n=1}^{N} c\,\frac{(1+g)^{n-1}}{(1+r)^n}$$

While this formula may look scary and would seem to be quite complex to calculate, it can be simplified using the mathematics of geometric series. Assuming that $N$ (the number of years in the analysis) is a very large number we can transform the above formula into a formula that is much easier to compute and is often called the *dividend discount model*.

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Dividend Discount Model: $P = \dfrac{c}{r-g}$

*Formula Key:*

$P$ = the sum of the discounted value of future cash flows
$c$ = the cash flow at the end of year one
$r$ = the discount rate
$g$ = the growth rate

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## Computing P/E Ratios

Now let's apply the formula.

Suppose:
- $c$, the earnings of the company, is $1 billion per year
- $r$, the discount rate, is 15%
- $g$, the growth rate, is 5%
- Then the value of the company would be $10 billion.

$$\frac{\$1\ billion}{15\% - 5\%} = \$10\ billion$$

*Reminder:* Percentages can be written as numbers. 15% can be written as 0.15. $0.15 - 0.05 = 0.1$, and $\frac{1}{0.1} = 10$.

If the growth rate is 10% per year (so that the cash flow doubles every 7 years), the value would be $20 billion.

$$\frac{\$1 \ billion}{15\% - 10\%} = \$20 \ billion$$

Suppose the company has 100 million shares:

- Then the earnings per share is $10 since $\frac{\$1 \ billion}{100 \ million \ shares} = \$10$.
- With a 5% growth rate the value of one share would be $100 since $\frac{\$10 \ billion}{100 \ million \ shares} = \$100$.
- With a 10% growth rate the value of one share would be $200 since $\frac{\$20 \ billion}{100 \ million \ shares} = \$200$.

The ratio between the price of the share and the earnings of the company is called the **price to earnings ratio** (P/E ratio).

Suppose the price of a share is $150. Then the P/E ratio is 15 since $\frac{\$150}{\$10} = 15$.

Thus, the price based upon our calculation with a 5% growth rate would imply a P/E ratio of 10 and a 10% growth rate would imply a P/E ratio of 20. If the P/E ratio based on the actual stock price is 15, you would like to buy the stock if you think the growth rate is going to be 10%, however you probably would not want to own the stock if you thought the growth rate was going to be 5%. You might even want to sell the stock and hope that you could buy it back later when its price fell. This is called *short selling* and is the source of much of the concern about Wall Street and hedge fund practices.

What do you think the price of the stock would be if the company were losing money and its revenue was declining?
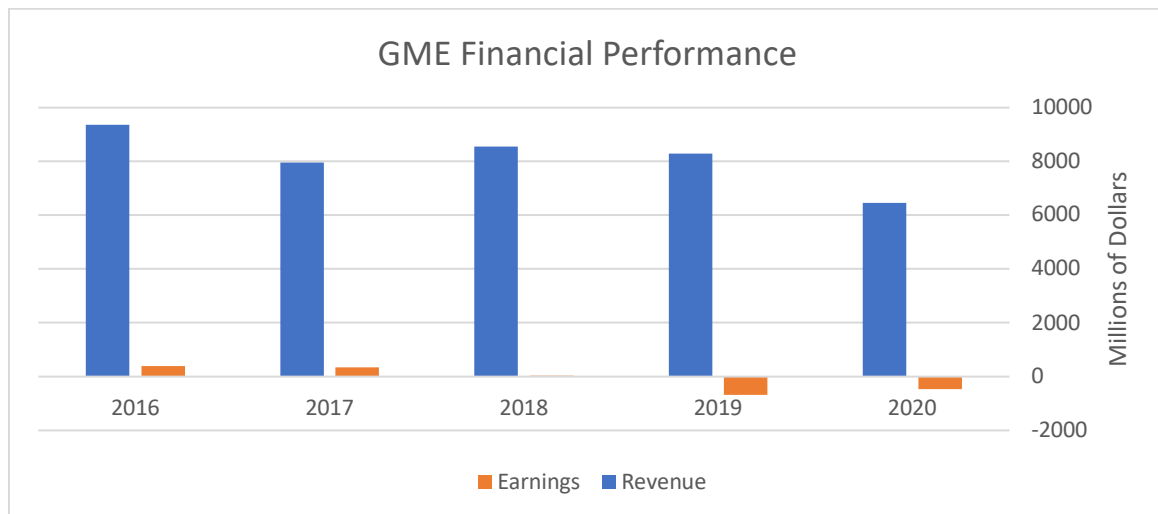
## Analyzing GameStop

Let's look at the financial performance of GameStop (GME) over the past few years.

| GameStop Financial Performance (millions except per share amounts) | | | | | |
|---|---|---|---|---|---|
| | **2016** | **2017** | **2018** | **2019** | **2020** |
| Revenue | $9364 | $7965 | $8547 | $8285 | $6466 |
| Earnings | $403 | $353 | $35 | -$673 | -$471 |
| Shares | 106.7 | 103.8 | 101.5 | 102.1 | 87.5 |
| **EPS In dollars** | **$3.78** | **$3.40** | **$0.34** | **-$6.59** | **-$5.38** |

*EPS is earnings per share source:*
*https://www.macrotrends.net/stocks/charts/GME/gamestop/financial-statements*



From a financial perspective, this is not a pretty picture. GameStop's revenue has been falling by an average of about 9% per year and its earnings, which were a small percentage of revenue (4.3%) in 2016, are now negative. That is, the company is losing money.

In 2016, the earnings per share of GME was $3.78 and the price in the middle of the year was around $25.50. That would produce a price to earnings ratio, or P/E, of 6.7. A P/E below 10 indicates that the market was expecting a near zero growth rate for the company. Since that time, revenue has declined and the company is losing money. Do you think the value of the company should go up or down?

Because GameStop is now losing money, we cannot calculate a P/E ratio since E, the company's earnings, are negative. Another tool used by financial analysts is to look at the **ratio of Price to Revenue**.

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|---|---|---|---|---|---|
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| Earnings | $403 | $353 | $35 | -$673 | -$471 |
| Shares | 106.7 | 103.8 | 101.5 | 102.1 | 87.5 |
| **Rev/Share** | **$87.76** | **$76.73** | **$84.21** | **$81.15** | **$73.90** |

We can see that the revenue per share has declined from $87.76 to $73.90, even as the number of shares outstanding has declined.

In 2016, the price to revenue ratio of the company was 0.29. [25.50/87.76]. This is a very low number as the average company generally has a price to revenue ratio of about 1.5 or 2.0.

If GME had the same price to revenue ratio now as it did in 2016, it's price would be $21.47, which is not far from its year-end price of $18.84.

## Dream Big

Suppose for a moment that GameStop could turn its fortunes around.

Let's suppose that GME suddenly becomes profitable and its earnings go from negative to 20% of revenue. Then, the earnings per share would be $14.78 per share. Additionally, suppose also that it could go from revenue declining at 9% per year to revenue growing at 10% per year. Then the stock would have a P/E ratio of 20 and the price of the stock based on the *dividend discount model* would be:

$$\frac{\$14.78}{0.15 - 0.10} = \$14.78 \; x \; 20 = \$295.29$$

## Back to Reality

The closing stock price on January 29th for GME was $325.

Which is more likely to be the value of the stock to a long-term investor?

   a.  The year-end price of $18.84, which is close to the price based on the historical price to revenue; or
   b.  The January month end price of $325 which is higher than the P/E derived price from assuming a 20% profit margin and 10% per year growth.

In other words, how likely is it that a company with shrinking revenue and losing money will suddenly become very profitable and have strong growth?

## Conclusion

While the Reddit inspired investors in GameStop may have other goals in mind, GameStop might be better off if all the people who recently bought its stock had instead gone to gamestop.com and bought a few games.

And the people buying games might have something greater in value when the frenzied buying ends.

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## About FiCycle

Financial Life Cycle Education (FiCycle) is a not-for-profit organization dedicated to ensuring every student has access to knowledge of the financial concepts necessary to live a prosperous life and the math skills needed to put those concepts into practice. Made up of knowledgeable leaders with decades of experience across education, financial analytics, and research, the FiCycle team combines its integrated expertise and close relationships to educators across the US to develop high-quality, standards-aligned solutions to the real challenges present in math and finance education. Our innovative project-based curriculum and student-centered, research-backed approach have helped thousands of high school students explore the essential principles of personal finance and acquire the algebra, probability, and statistics skills needed to make sound financial decisions throughout their lives.

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