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# What Does Implied Volatility Actually Tell You?

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# What Does Implied Volatility Actually Tell You?

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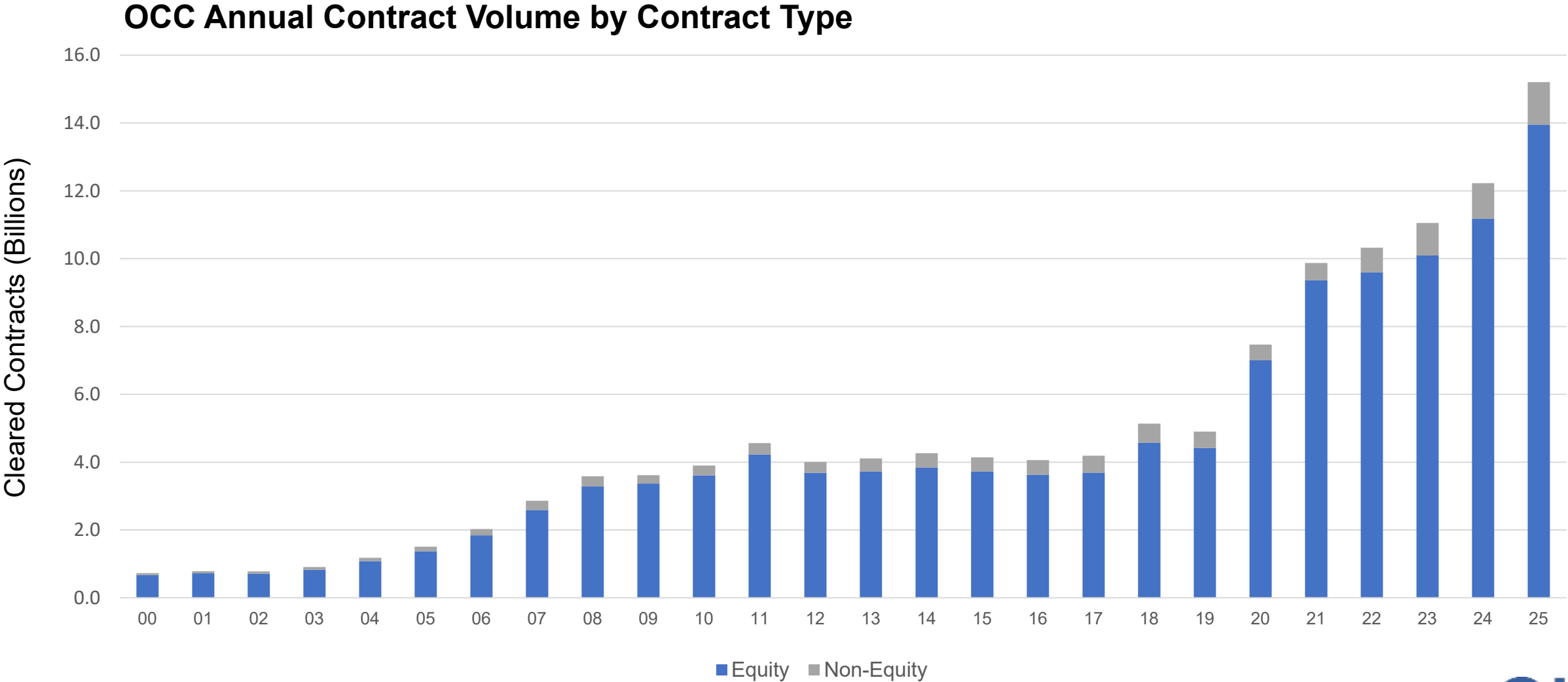


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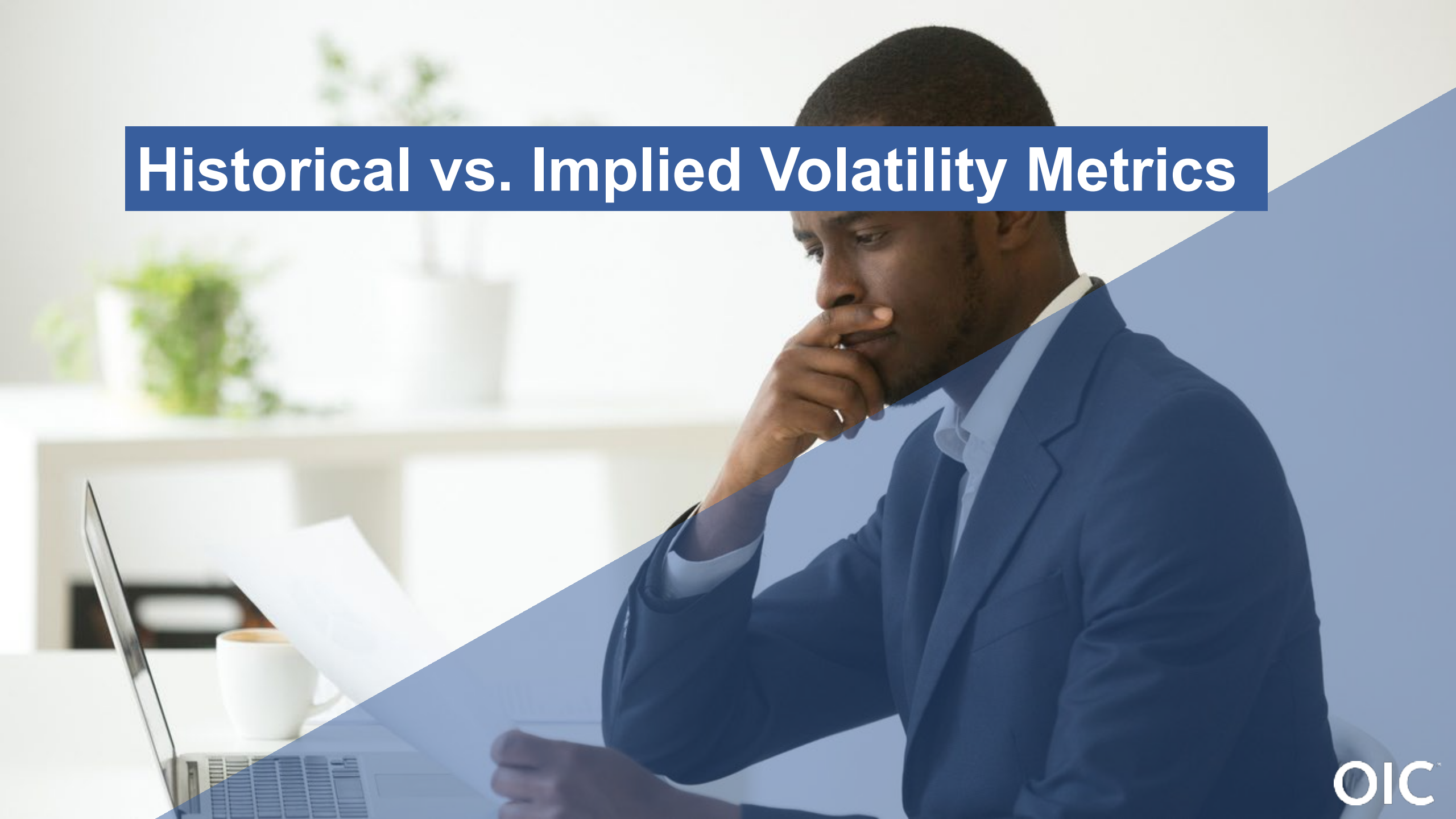
# Annual Options Volume 2000-2025



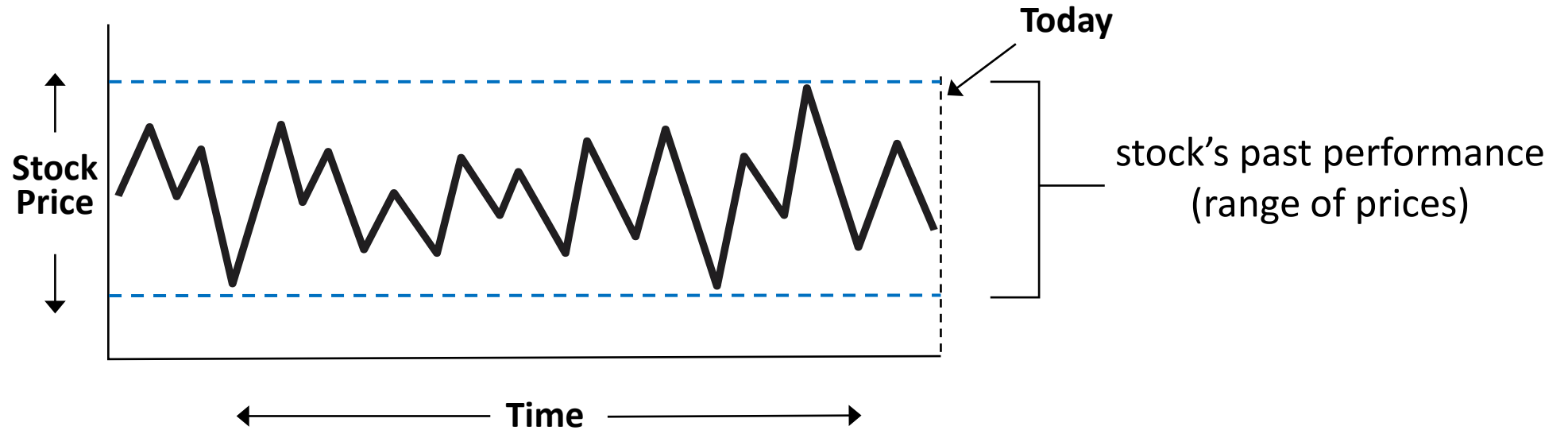
# Presentation Outline

- **Historical vs. Implied Volatilities**
- **A Relative Value Framework**
- **Interpreting Volatility Ratios**
- **Tracking Volatility Relationships Over Time**
- **The Rule of 16**
- **Translating Annualized Volatility into Daily Movement**
- **Real-World Applications**
- **Q & A**

# Historical vs. Implied Volatility Metrics

A man in a blue suit is sitting at a desk, looking at a laptop and holding a document. He has a thoughtful expression, with his hand resting on his chin. On the desk, there is a white coffee cup and some papers. The background is a bright, modern office with a white shelf holding a potted plant. A large blue diagonal shape is overlaid on the right side of the image.

# Historical Volatility

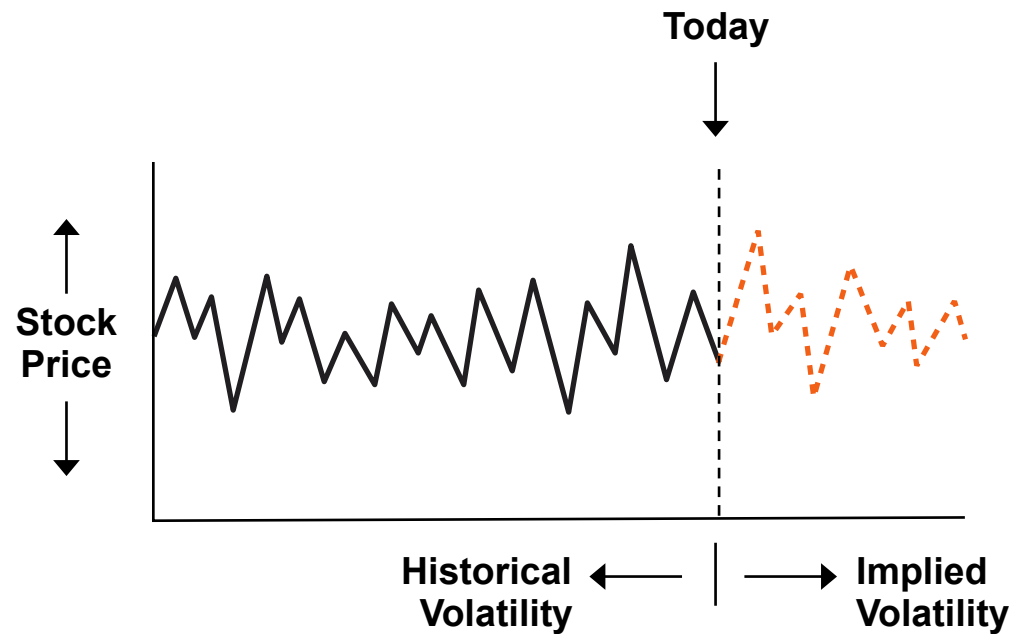


- A stock's previously delivered volatility
  - Can be observed and quantified (backward looking)
  - This is "historical" volatility
  - A statistic, or a fact, not a prediction or a forecast

# Implied Volatility: Definition

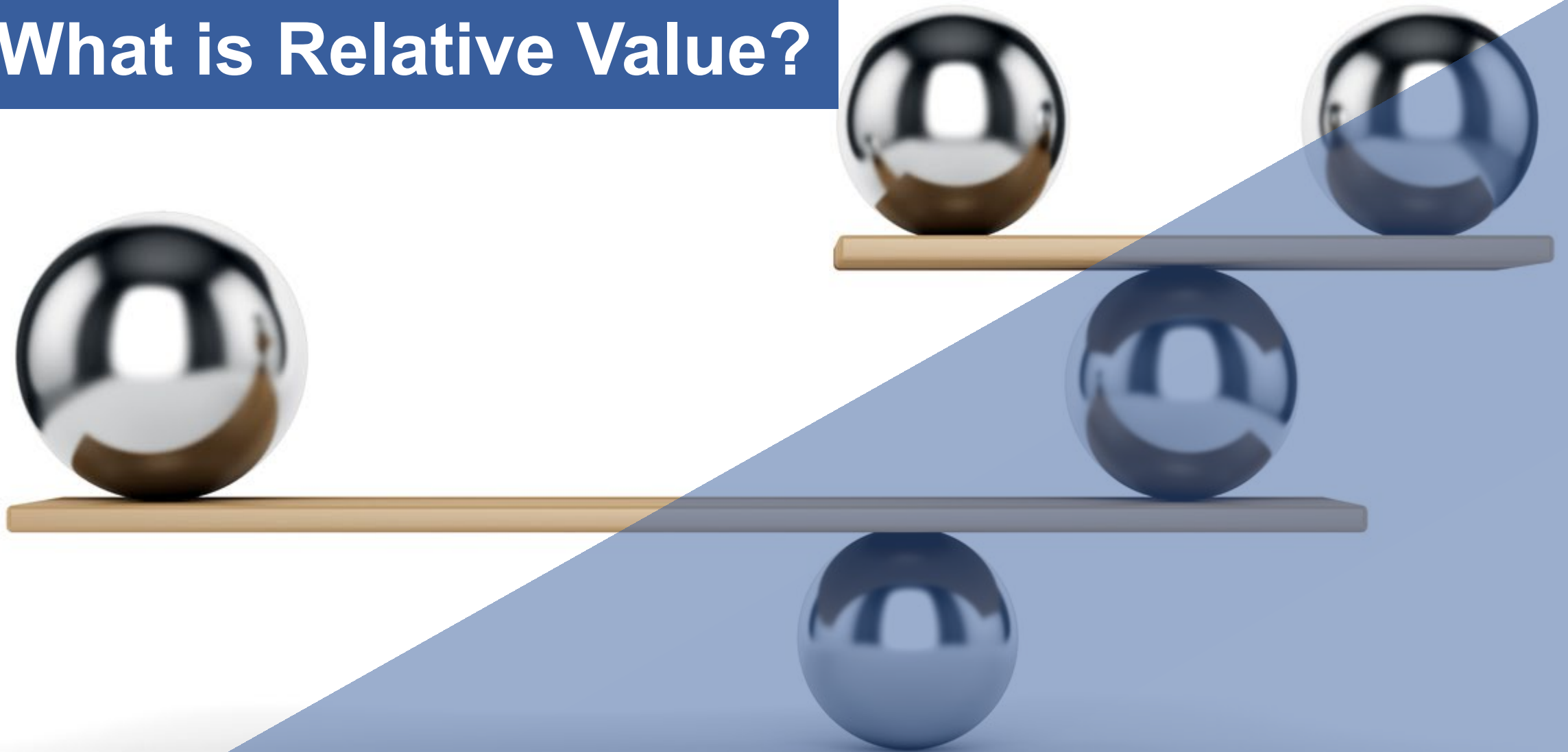
- Only options have implied volatility
  - Main input for all option pricing models
  - Reflects current forecasted volatility assumptions with respect to current underlying price and movement
- Reflects the marketplace's current forecast for underlying stock's future volatility
  - Consensus of all market participants
  - Dynamic input into options prices – constantly moving.

# Implied Volatility Represents the Future



- Option implied volatility reflects current expectations of future stock volatility (forward looking)

# What is Relative Value?



# Relative Value: A Definition In Volatility Terms

- A Framework to evaluate Historical and Implied Volatilities against each other
  - Generally expressed as a mathematical ratio ( *Implied Vol* ÷ *Historical Vol* )
  - Simplicity of the concept allows for many use-cases.
- Resultant ratio is always expressing one asset in terms of another asset. Its power is in its reductive potential.
  - Can be used to compare Implied Vol to Historical Vol or Implied to Implied.
  - Can be used to compare assets and Volatilities across asset classes as well.
  - Takes away absolute value bias by expressing everything as a ratio.

# Building a Picture of Forecasted and Actual Underlying Movement using Historical and Implied Volatility

| Implied Volatility | 10 – day Implied Volatility | 30 – Day Implied Volatility | 60 – Day Implied Volatility | 90 – Day Implied Volatility |
|--------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Stock #1           | 65.00%                      | 35.25%                      | 22.00%                      | 17.00%                      |
| Stock #2           | 16.25%                      | 16.50%                      | 17.00%                      | 17.25%                      |



| Historical Volatility | 10 – day Historical Vol | 30 – day Historical Vol | 60 – day Historical Vol | 90 – day Historical Vol |
|-----------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| Stock #1              | 58.00%                  | 30.25%                  | 20.05%                  | 12.00%                  |
| Stock #2              | 15.00%                  | 16.25%                  | 16.00%                  | 15.50%                  |



| Implied/Historical Volatility Ratio | 10 – day Ratio | 30 – day Ratio | 60 – day Ratio | 90 – day Ratio |
|-------------------------------------|----------------|----------------|----------------|----------------|
| Stock #1                            | 1.12           | 1.16           | 1.09           | 1.41           |
| Stock #2                            | 1.08           | 1.01           | 1.06           | 1.11           |

This suggests the Market is forecasting Stock #1 to have a very distinct curve to its Volatility profile (more movement now / less movement later)

While Stock #2 Implied Volatility Curve looks much more placid – forecasting a similar amount of movement throughout, regardless of duration.

The Historical Volatility numbers tell a similar story here – Stock #1 has much more movement in the 10 – day Historical Numbers than in the 90 – day set. Meaning it has been moving more lately than during its longer duration set of data.

While Stock #2 has much less variance in its shape and a more narrow range of values.

When you express these volatility numbers as ratios, the ratios themselves start to tell their own story.

It's not always evident in looking at the individual volatility numbers on their own – What could a higher ratio value tell you vs. a lower ratio value?

# Interpreting the Ratios: What can they tell you?

| <b>Example #1</b> | <b>30 – day Implied Vol</b> | <b>30 – day Historical Vol</b> | <b>30 – day Implied / Historical Ratio</b> |
|-------------------|-----------------------------|--------------------------------|--------------------------------------------|
| Stock #1          | 20.25%                      | 15.00%                         | <b>1.35</b>                                |
| Stock #2          | 58.00%                      | 42.9%                          | <b>1.35</b>                                |



**135 %**

Implied Volatility is  
OVER Historical  
Volatility

| <b>Example #2</b> | <b>30 – day Implied Vol</b> | <b>30 – day Historical Vol</b> | <b>30 – day Implied / Historical Ratio</b> |
|-------------------|-----------------------------|--------------------------------|--------------------------------------------|
| Stock #1          | 19.50%                      | 25.00%                         | <b>0.78</b>                                |
| Stock #2          | 73.00%                      | 93.00%                         | <b>0.78</b>                                |



**78 %**

Implied Volatility is  
UNDER Historical  
Volatility

| <b>Example #3</b> | <b>30 – day Implied Vol</b> | <b>30 – day Historical Vol</b> | <b>30 – day Implied / Historical Ratio</b> |
|-------------------|-----------------------------|--------------------------------|--------------------------------------------|
| Stock #1          | 15.50%                      | 15.00%                         | <b>1.03</b>                                |
| Stock #2          | 75.00%                      | 72.75%                         | <b>1.03</b>                                |



**103 %**

Implied Volatility is  
roughly EQUAL to  
Historical Volatility

# Interpreting the Ratios: What can they tell you?

| Example #1 | 30 – day Implied Vol | 30 – day Historical Vol | 30 – day Implied / Historical Ratio |
|------------|----------------------|-------------------------|-------------------------------------|
| Stock #1   | 20.25%               | 15.00%                  | 1.35                                |
| Stock #2   | 58.00%               | 42.9%                   | 1.35                                |



These metrics can be interpreted as Implied Vol trading higher than the commensurate duration historical volatility. Some people would term this as options being expensive relative to historical vols. One possible explanation for this relationship would be a forecasted event on the horizon that has raised Implied levels above their Historical Delivered counterparts.

No matter what word you use to describe this current relationship – the volatility metrics expressed as a ratio tell you something about how it lines up – the Implied Volatility is 135% of the Historical Volatility metric for that same duration.

# Interpreting the Ratios: What can they tell you?

| Example #2 | 30 – day Implied Vol | 30 – day Historical Vol | 30 – day Implied / Historical Ratio |
|------------|----------------------|-------------------------|-------------------------------------|
| Stock #1   | 19.50%               | 25.00%                  | 0.78                                |
| Stock #2   | 73.00%               | 93.00%                  | 0.78                                |

These sets of metrics tell the same story in an inverse way to Example #1. The Implied volatility metrics are below the historical volatility metrics. One possible explanation is the underlying has experienced a previous period of elevated Delivered Volatility, but the market is forecasting a resolution to that period, and thus a lower volatility metric for the next 30 days.

Notice that the ratio of the two volatility numbers can generate the same value (.78 in this case) regardless of their individual levels – Stock #1 and #2 have the same value for their resultant ratio, but vastly different overall Vol levels – this speaks again to the reductive nature of the ratio as a method of expression.

# Interpreting the Ratios: What can they tell you?

| Example #3 | 30 – day Implied Vol | 30 – day Historical Vol | 30 – day Implied / Historical Ratio |
|------------|----------------------|-------------------------|-------------------------------------|
| Stock #1   | 15.50%               | 15.00%                  | 1.03                                |
| Stock #2   | 75.00%               | 72.75%                  | 1.03                                |

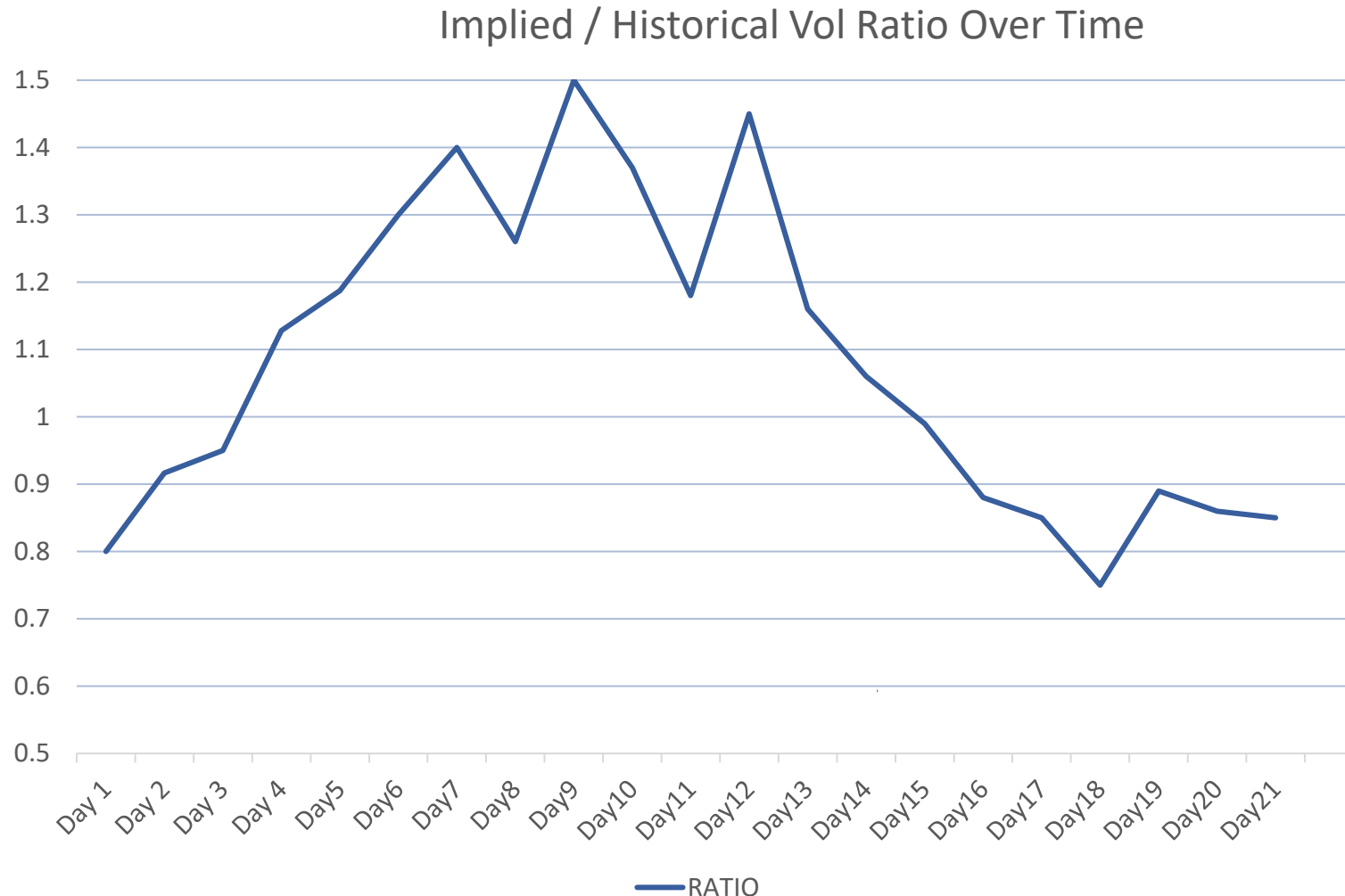
The final ratio from Example #3 tells a story of an Implied Volatility number that very closely relates to the associated Historical Volatility number over a period of time. These situations can occur when Option volatility metrics and Historical metrics are closely linked.

Again, notice that the ratio of the two volatility numbers can generate the same value (1.03 in this case) regardless of their individual levels – Stock #1 and #2 have the same value for their resultant ratio, but vastly different overall volatility levels – This gives you an idea of how the two numbers are related in a relative sense – how you can characterize the relationship – again a vastly different way to look at two stocks that have completely different Implied Volatility metrics.

# The Implied Volatility Ratio Over Time



# How you can Track the Ratio Over Time



Just like any metric, you can graph these ratios and look at them over time.

What does this say about the last 20 days of Implied / Historical Vol?

The ratio rallied for the first 10 days and sold off for the next 10 days, but how did it move? And Why?

Additionally, sometimes a little more perspective goes a long, long way.....

# How you can Track the Ratio Over Time

Implied / Historical Vol Ratio Over Time



In some ways, you can view these ratios much like you view stock charts.....

However, in order to fully understand the nature of the movement, it requires some investigation as to which part of the equation is causing the movement. Is it the numerator, or the denominator?

# What is The Rule of 16?



# What is the Rule of 16?

- The Rule of 16 is a way to convert annual implied volatility metrics into a daily expectation for underlying movement in smaller chunks.
- It can simplify risk calculations by creating a daily standard deviation framework.
- You can think of a daily standard deviation as how much you might expect something to move on any normal trading day, based on the given Implied Volatility level - Here's the math:

$$\text{Daily Standard Deviation} = \frac{\text{Implied Volatility} \times \text{Stock Price}}{\sqrt{\text{Trading days}}}$$

# The Formula for the Rule of 16

$$\text{Daily Standard Deviation} = \frac{\text{Implied Volatility} \times \text{Stock Price}}{\sqrt{\text{Trading days}}}$$

For simplicity, the square root of 252 trading days in a year is rounded to 16, which is why we refer to this as [The Rule of 16](#).

*Now, let's talk about the Numerator and the Denominator separately....*

# The Numerator of the Equation 'The Big Block of Variance'

$$\text{Daily Standard Deviation} = \frac{\text{Implied Volatility} \times \text{Stock Price}}{\sqrt{\text{Trading Days}}}$$

- Think of the Numerator as the 'Big Block of Variance' – or how much you expect this underlying to move for the entire year.
- Some refer to it as Annual Variance:

$$\text{Annual Variance} = \text{Implied Volatility} \times \text{Stock Price}$$

# The Numerator of the Equation 'The Big Block of Variance'

$$\textit{Annual Variance} = \textit{Implied Volatility} \times \textit{Stock Price}$$

- This is the starting point for expected movement – given an IV level you can estimate how much a stock might move over the course of a year – then this expectation can be sliced into smaller pieces of expectation for movement – days, weeks, or months.
- **Example: If Implied Vol is 20% and the stock price is \$100, Annual Variance = \$20**

*Now that we have that expectation for an annual amount of movement, let's slice it into more manageable pieces....*

# Breaking Down Annual Variance Using the Denominator



# Annual Variance into What?

Slicing this annual variance amount into smaller pieces can yield more useful and 'localized' expectations of movement. Some commonly used standard deviations to calculate are:

**Daily Standard Deviation** - An estimate of how much you might expect something to move on any given trading day in the year



**Weekly Standard Deviation** - An estimate of how much you might expect something to move on any given week of the year



**Monthly Standard Deviation** - An estimate of how much you might expect something to move on any given month of the year



*\*all assumptions based on current Implied Volatility levels*

# Breaking Down Annual Variance

- Because Variance is the expected value of the squared deviation from the mean, to remove the squared nature of the total Annual variance calculation, you must also divide by a square root of some fixed amount of time.
- Standard Deviation (SD) is the ***Square Root*** of the Variance.
- This is needed to slice the 'Big Block of Variance' – the Numerator from our equation - into many equal smaller blocks like daily, weekly, or monthly expectations for movement – smaller, and possibly more useful metrics



# Converting to a Daily Standard Deviation



# Converting to a Daily Standard Deviation

To slice this annual variance into a daily standard deviation expectation, use  $\sqrt{\textit{Trading days}}$  as your denominator:

## Daily Standard Deviation

- Use square root of Trading Days in the denominator
- 252 Trading days in an average year
- $\sqrt{252} = 15.8745$
- For simplicity, we round to **16** for this denominator

**But what does this look like in practice?**

# Converting to a Daily Standard Deviation

Assume a \$100 dollar stock with a 20% Implied Volatility for a 30 DTE option, Let's find how much movement this Implied Volatility level forecasts for any average trading day during that 30 day duration:

$$\text{Daily Standard Deviation} = \frac{\text{Implied Volatility} \times \text{Stock Price}}{\sqrt{\text{Trading days}}}$$

$$\text{Daily Standard Deviation} = \frac{.20 \times 100}{\sqrt{252}} = \frac{20}{16} = \text{\textbf{\$1.25}}$$

**Daily Standard Deviation is \$1.25 per trading day**

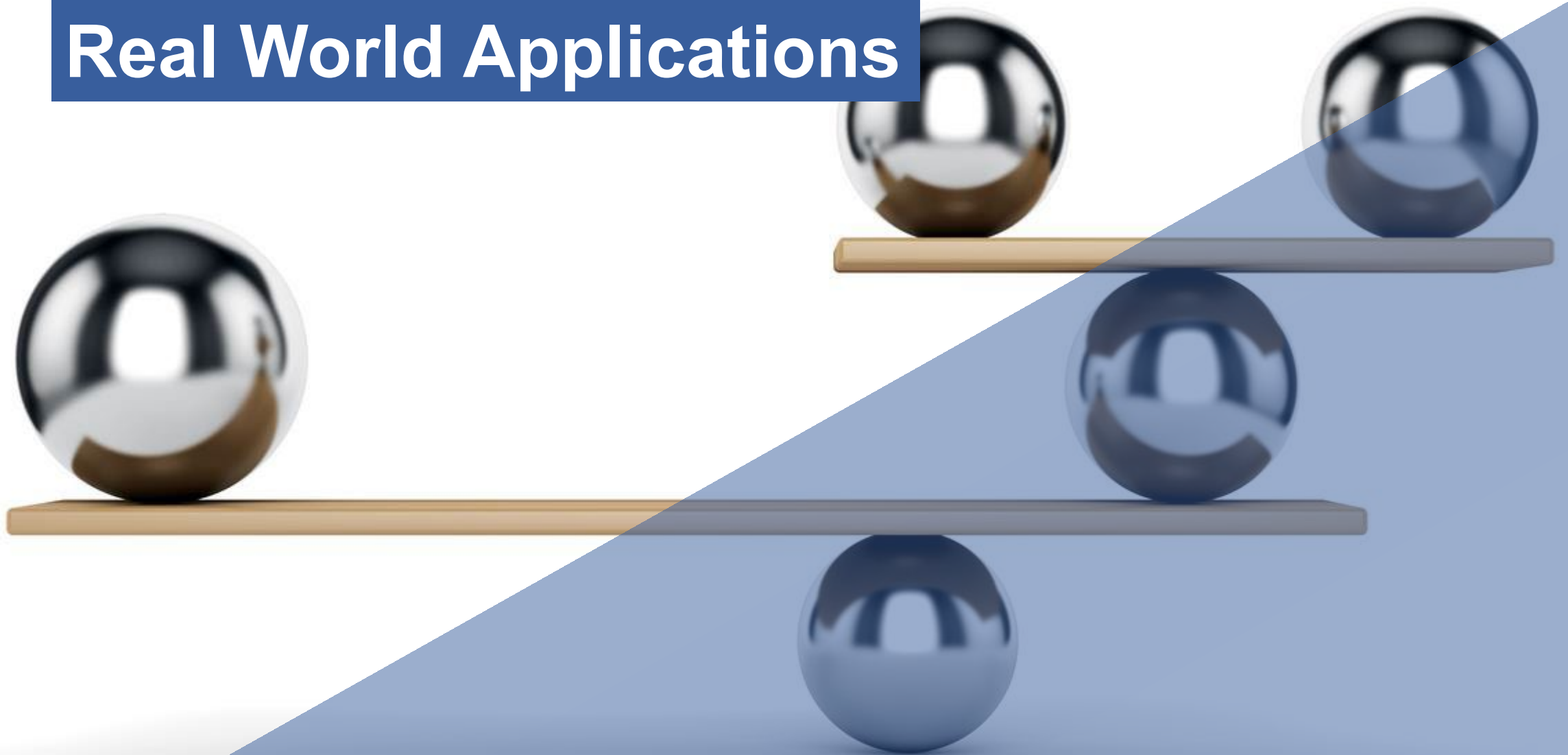
# Annual Variance into a Daily Standard Deviation in Practice

$$\text{Daily Standard Deviation} = \frac{.20 \times 100}{\sqrt{252}} = \frac{20}{16} = \$1.25$$

This means a \$100 dollar stock with a 20% Implied Volatility option is implying the average daily underlying stock movement over the lifetime of the option at its current price is \$1.25 for any trading day.

The standard deviation does not denote direction – only movement away from the mean.

# Real World Applications



# Real World Applications

Using Daily Standard Deviation expectations can provide a way to contextualize underlying movement when it happens – a framework for evaluation. Consider our previous example:

**\$100 Dollar stock**  
**20% Implied Volatility**  
**30 DTE Options**  
**\$1.25 Implied Daily Standard Deviation**

One random day, the stock moves up \$7.00 dollars on positive corporate news, such as a potential buyout, and is now trading \$107.

# Real World Applications

From this previous example, the stock is trading up 7% on the day – a large move by all accounts. In terms of raw movement, the stock moved \$7.00 dollars – but in terms of the forecasted movement from the option prices and Implied Volatility, there's 5.6x days worth of movement in one day of price action. You just witnessed a 5.6 Standard Deviation Move.

**Does this change the way you think about the options going forward?**

**If you were long options in this situation, does it change your opinion?**

**How about if you were short options?**

# Real World Applications

Now let's suppose that during this move, the Implied Volatility of the options increases to 40%, as there are many more options bought than sold over the course of the move. Now we have:

**\$107 Dollar stock**

**40% Implied Volatility**

**29 DTE Options**

**\$2.67 Implied Daily Standard Deviation**

Is this reflective of your expectations for daily underlying movement going forward? **These options are very different from the previous day's options.**

# Solve for the Daily Standard Deviation

$$\text{Daily Standard Deviation} = \frac{\text{Implied Volatility} \times \text{Stock Price}}{\sqrt{\text{Trading days}}}$$

## Example #1

Stock Price: **\$256.00**

Implied Volatility: **38%**

$$\text{SD} = \frac{.38 \times 256}{16}$$

Standard Deviation

**\$6.08**

## Example #2

Stock Price: **\$35.00**

Implied Volatility **76%**

$$\text{SD} = \frac{.76 \times 35}{16}$$

Standard Deviation

**\$1.66**

## Example #3

Stock Price: **\$84.00**

Implied Volatility **110%**

$$\text{SD} = \frac{1.10 \times 84}{16}$$

Standard Deviation

**\$5.78**

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