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Skew and the Implied Volatility of Options – Are They Connected?

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Option Skew and Implied Volatility: Relationships and Risks

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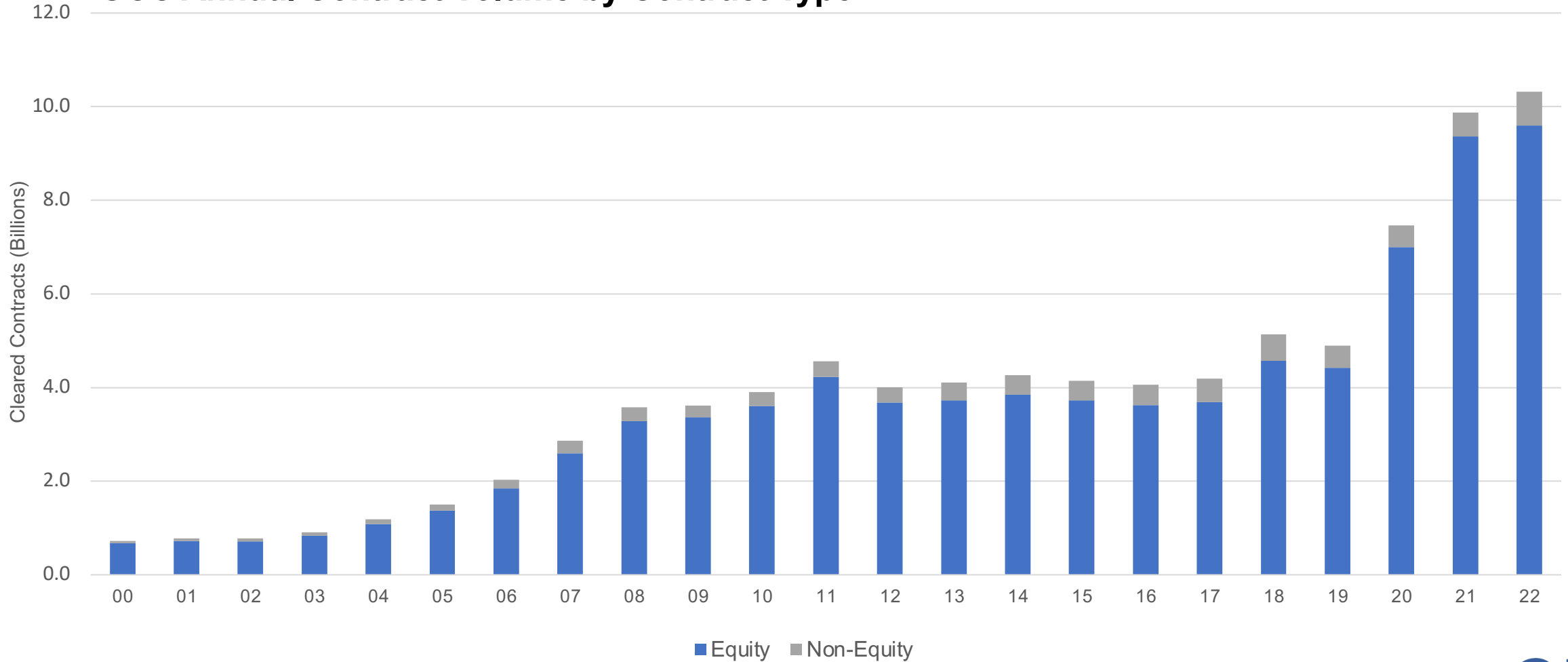
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Annual Options Volume 2000-2022

OCC Annual Contract Volume by Contract Type



Presentation Outline

- Historical vs. Implied Volatilities
- What is Skew?
- How are Skew and Implied Volatility Related?
- How to Interpret the Metrics
- Q & A



Historical Volatility

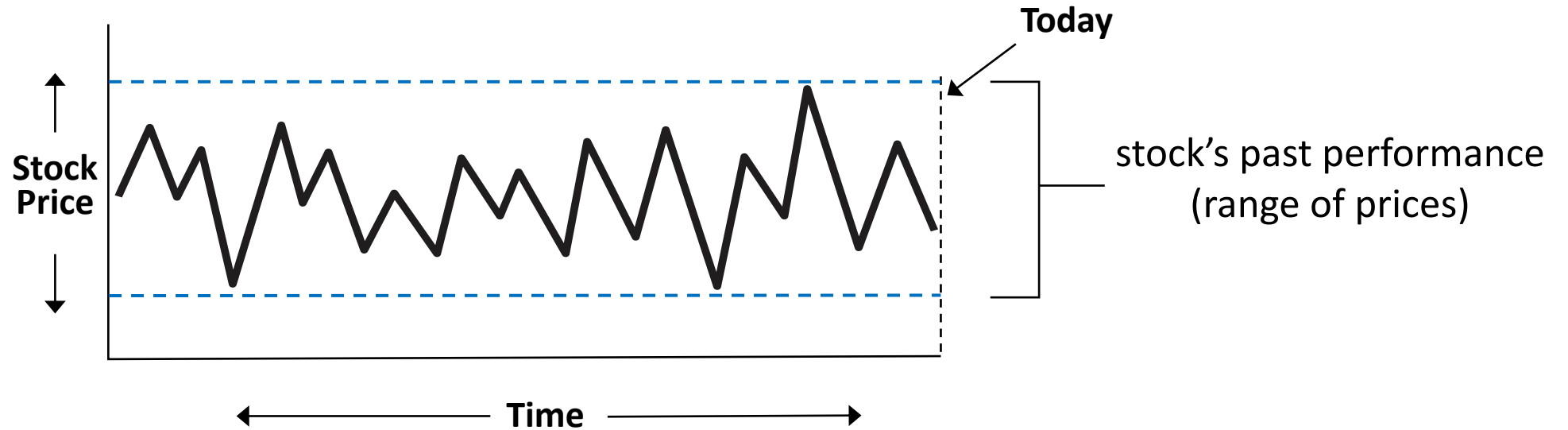


Volatility Defined: What is It?

- Volatility reflects fluctuations in underlying stock price
 - Moves to the upside/moves to the downside
 - Over days, weeks, months, or longer
 - Does not imply a price trend



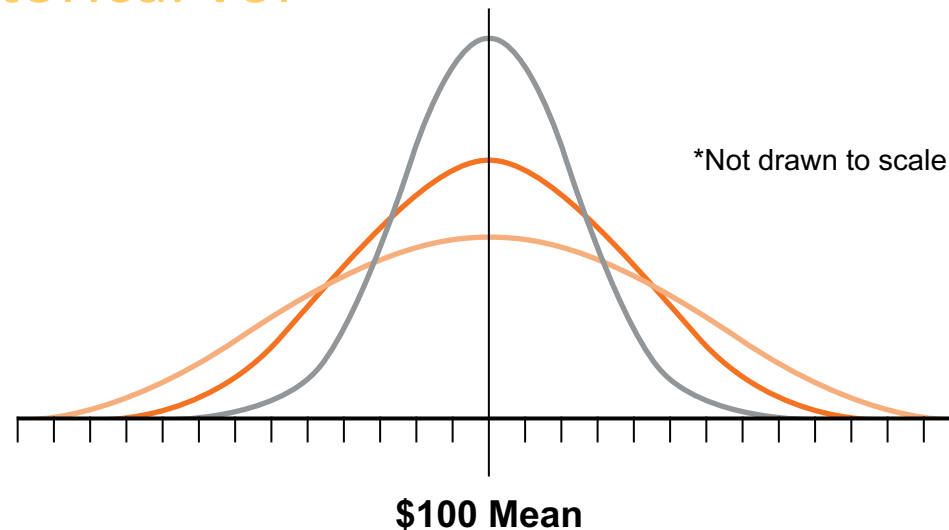
Historical Volatility



- 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

Comparing Distributions

- Compare distributions of three stocks – each with different delivered volatility profiles
 - Stock A = 15% historical vol
 - Stock B = 25% historical vol
 - Stock C = 35% historical vol



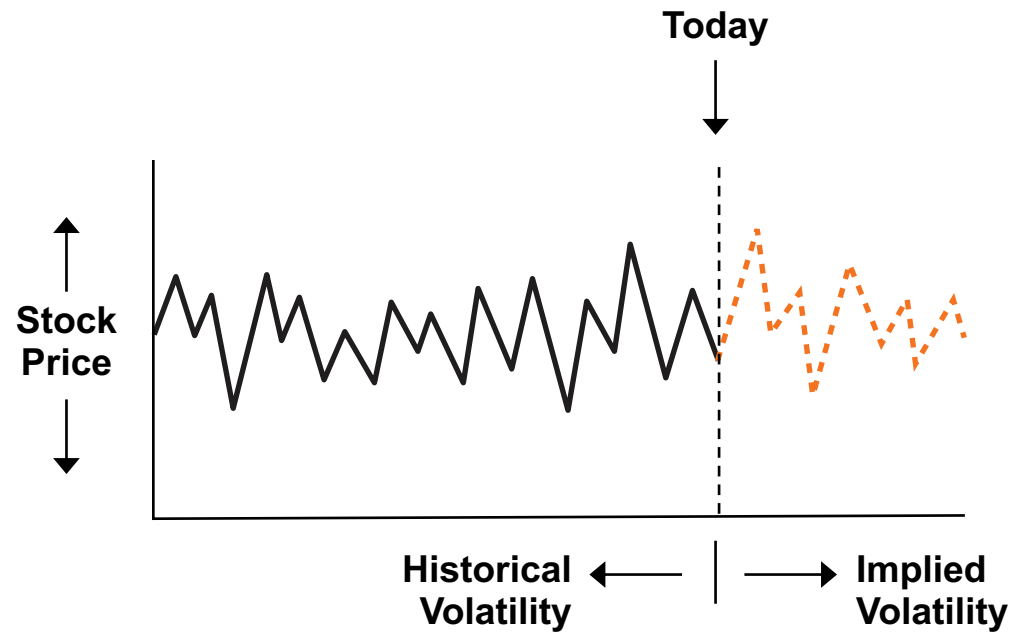
Implied Volatility



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)

Implied vs. Historical Volatility

- Implied volatility
 - Can be at great variance with a stock's historical vol
 - Prediction of future stock volatility is not necessarily right or wrong
- Expect implied volatility to change
 - May occur intra-day or over time
 - May occur abruptly and significantly
 - Does not require change in stock price
 - Generally a dynamic feature of any option's premium

Implied vs. Historical Volatility

- Will an option's implied volatility return to its underlying stock's historical / delivered volatility level?
 - Not necessarily
 - Not safe to assume it will
- Why be concerned about implied volatility?
 - Directly affects market value of your options (time/extrinsic value)
 - Not always predictable

Implied Volatility: Effect on Option Prices

- **Other pricing factors remaining constant, a change in implied volatility will affect option prices:**
- As implied volatility increases ↑
 - both call and put prices will increase ↑
- As implied volatility decreases ↓
 - both call and put prices will decrease ↓

Skew: A Definition



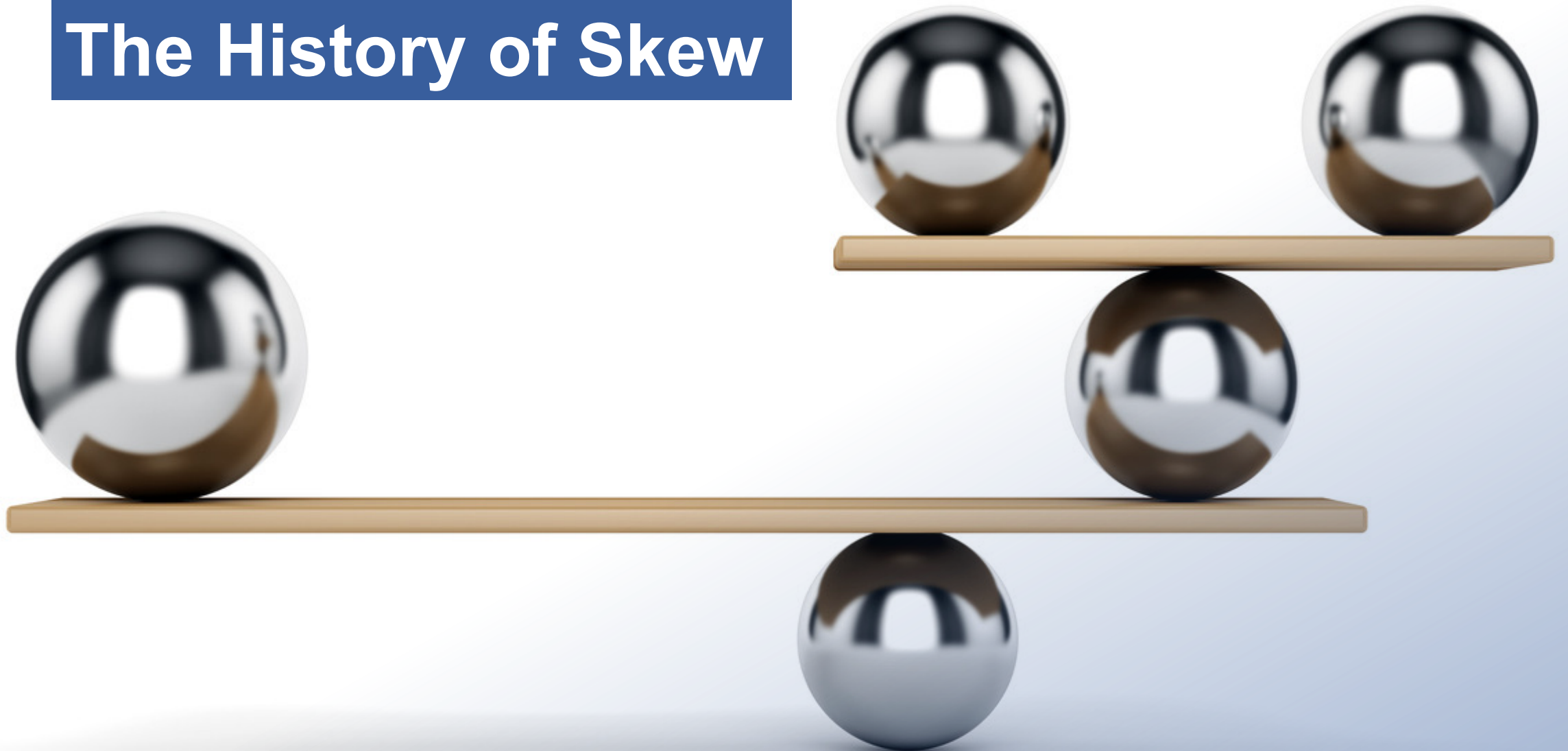
Skew: A Definition

- Option skew refers to the potentially asymmetrical implied volatility of options with different strike prices but the same expiration date. It is the difference in implied volatility between out-of-the-money (OTM), at-the-money (ATM), and in-the-money (ITM) options.
- Skew can be measured / quantified in many different ways:
 - Simple price terms:
 - the price differential of a 25 Delta put and a 25 Delta Call
 - As a ratio of the two Implied Vols:
 - 25 Delta put / 25 Delta Call
 - 25 Delta put / At-the-money Implied Vol
 - 25 Delta call / At-the-money Implied Vol

Skew: A Definition

- Skew is ultimately a function of Supply and Demand, meaning:
 - It can be quite dynamic
 - It can be unpredictable
- Some people view it as a sentiment indicator - considering it an indication of which directional tail is more in-demand
- Skew can be POSITIVE or NEGATIVE!

The History of Skew



The History of Option Skew

- Option skew has existed for as long as modern options trading has been around
- Many people consider the financial crises of the late 1980s, 1990's and early 2000's to be the birth of modern skew
- Since then, option skew has become a standard feature of options markets, with traders and investors using it to price options and design trading strategies

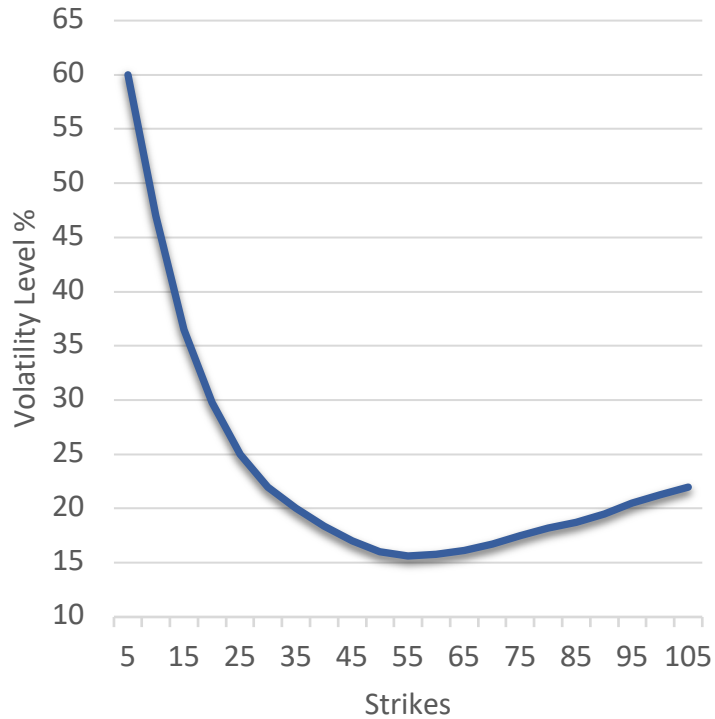


Positive and Negative Skew



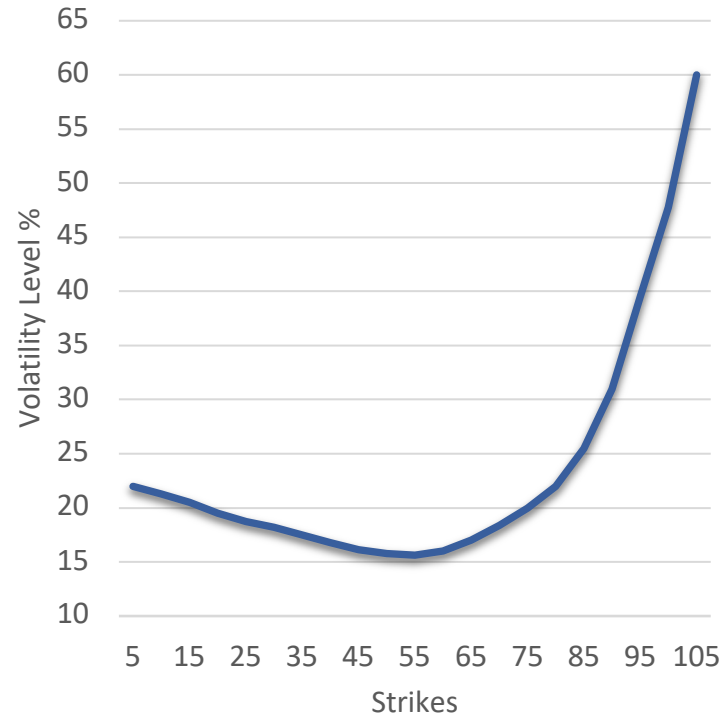
Is it Put Skew, Call Skew, or Smile Skew?

Negative Volatility Skew



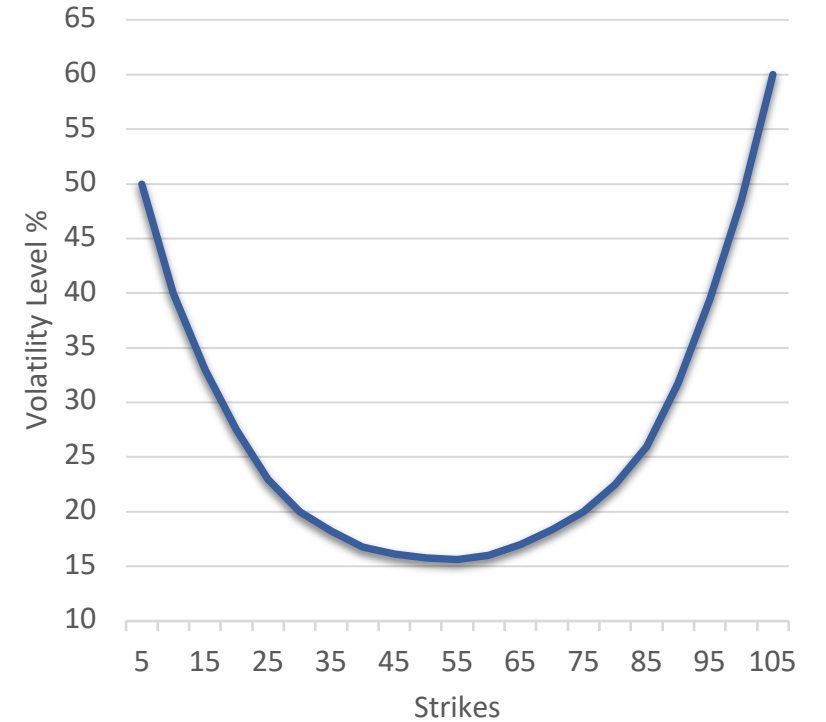
— Implied Volatility

Positive Volatility Skew



— Implied Volatility

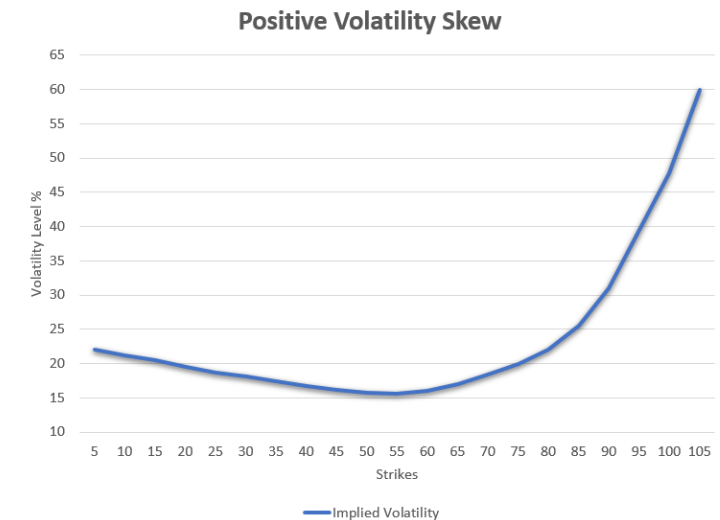
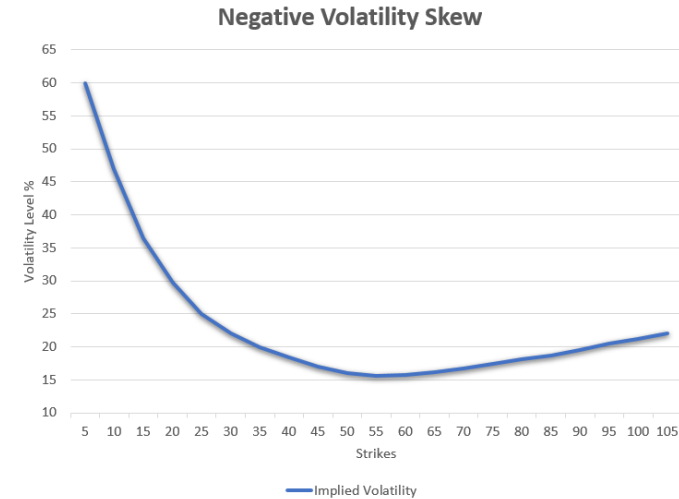
Smile Volatility Skew



— Implied Volatility

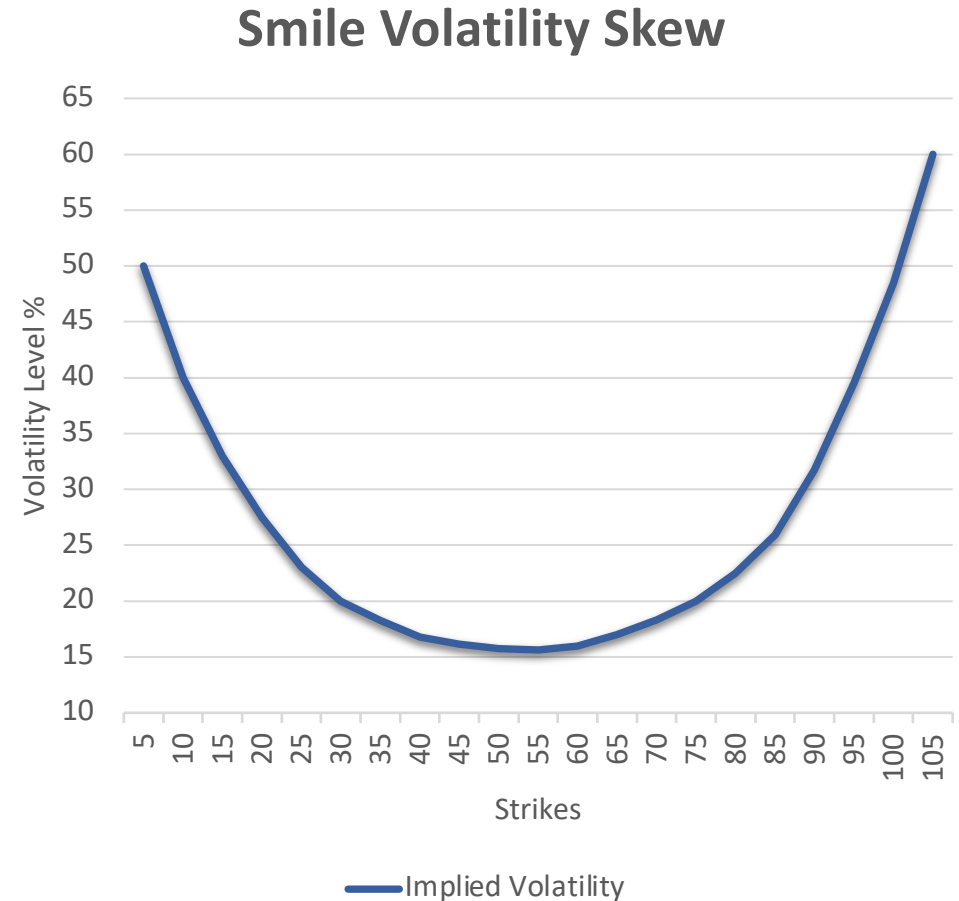
Is it Put Skew or Call Skew?

- Equities and Indices tend to have a skew with higher OTM puts than OTM calls – generally dictated by long term price history – sometimes referred to as “Negative skew” or “Put skew”
- Some commodities tend to have a demand Skew – with higher volatility levels for OTM calls than OTM puts – and are generally dictated by long term price history – generally referred to as “Positive skew” or “Call skew”



What about the Smile Skew?

- Smile Skew can be seen in markets where uncertainty or risk is perceived to exist in both directions. Thus, both OTM puts and OTM calls can have higher implied volatility levels than the ATM options

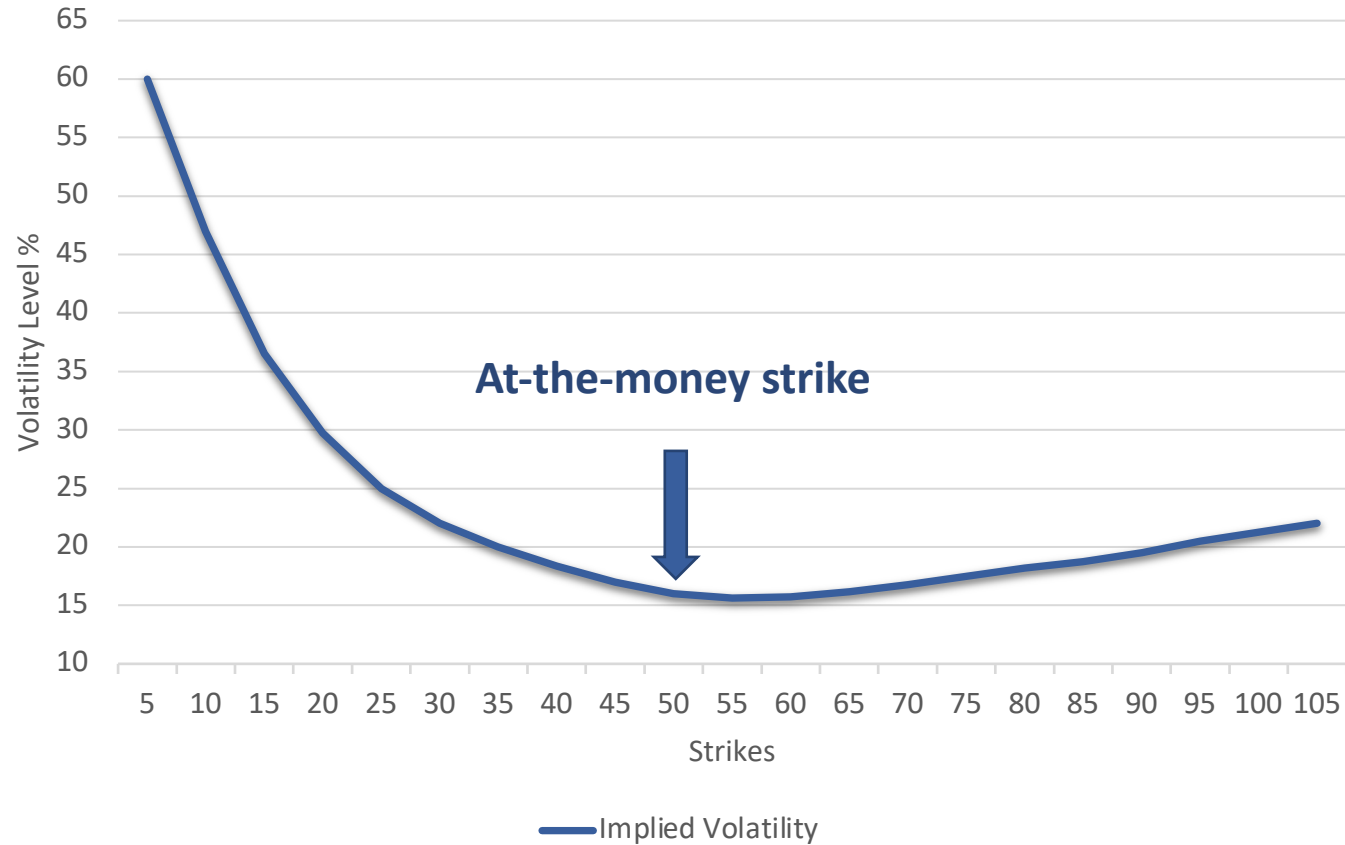


Negative Skew - How it might look

Strike Price	Implied Volatility %
5	60.00
10	47.00
15	35.00
20	29.00
25	25.00
30	22.00
35	20.00
40	18.00
45	17.00
50	16.00
55	15.63
60	15.75
65	16.00
70	16.75
75	17.50
80	18.00
85	18.75
90	19.50
95	20.50
100	21.25
105	22.00

At-the-money strike

Negative Volatility Skew



Positive Skew - How it might look

Strike Price	Implied Volatility %
5	22
10	21.25
15	20.5
20	19.5
25	18.75
30	18.2
35	17.5
40	16.75
45	16.15
50	15.75
55	15.625
60	16
65	17
70	18.35
75	20
80	22
85	25.5
90	31
95	39.5
100	47.75
105	60

At-the-money strike

Positive Volatility Skew

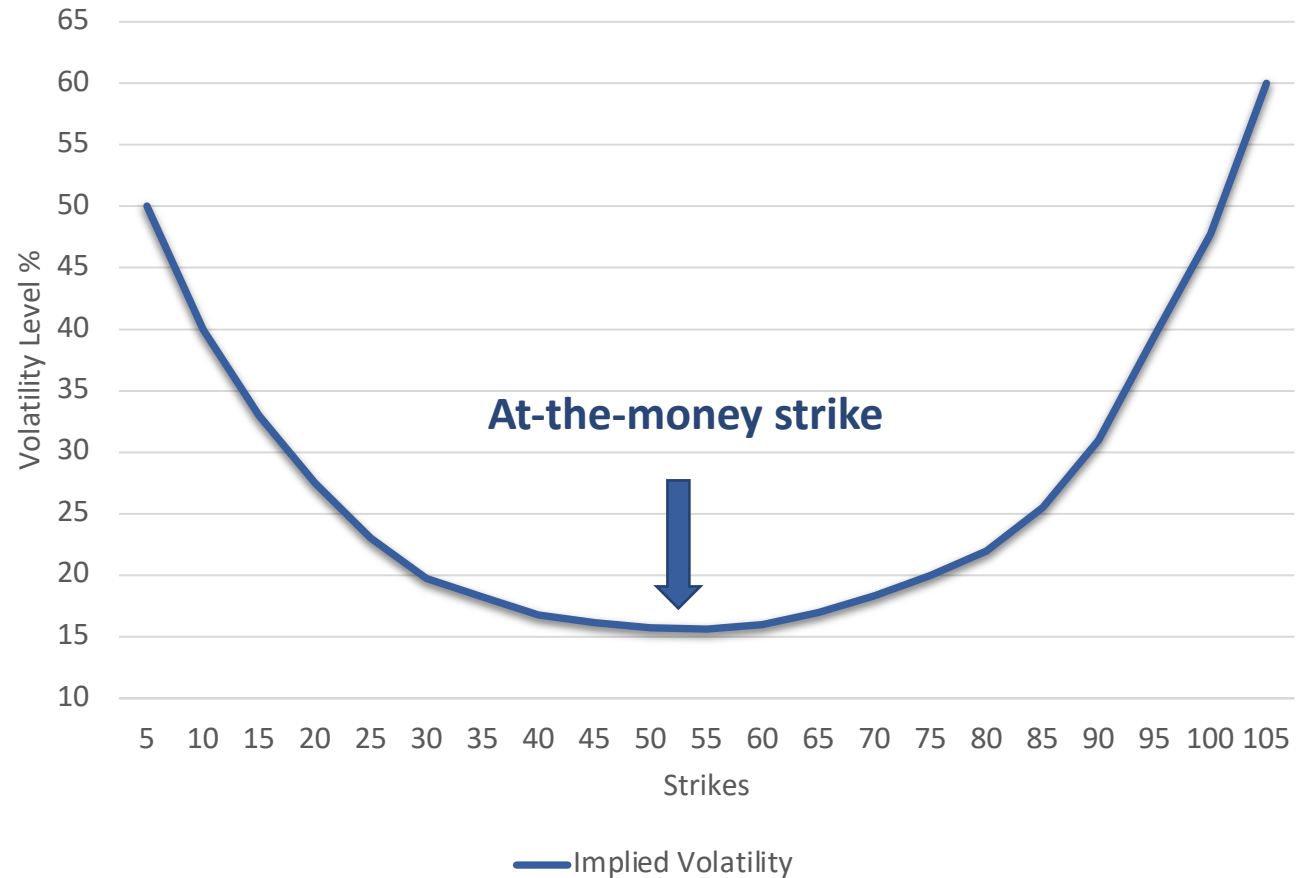


Smile Skew - How it might look

Strike Price	Implied Volatility %
5	50
10	40
15	30
20	27.5
25	23
30	19.75
35	18.25
40	16.75
45	16.15
50	15.75
55	15.625
60	16
65	17
70	18.35
75	20
80	22
85	25.5
90	31
95	39.5
100	47.75
105	60

At-the-money strike

Smile Volatility Skew



Measuring and Tracking Skew



Measuring and Tracking Skew Metrics by Price

Delta (Calls)	Implied Vol (Calls)	Price (Calls)	STRIKE	Price (Puts)	Implied Vol (Puts)	Delta (Puts)
.80	21.8	10.00	203.00	1.20	21.8	-.20
.75	20.1	8.30	206.00	1.75	20.1	-.25
.60	18.3	4.59	210.00	2.78	18.3	-.40
.50	17.2	3.35	212.00	3.48	17.2	-.50
.40	15.9	2.16	214.00	4.36	15.9	-.60
.26	14.4	1.06	216.50	5.77	14.4	-.74
.21	13.75	.90	217.00	6.10	13.75	-.79

One Method of Tracking Skew is by comparing the prices near the 25 Delta Put and the 25 Delta Call for options sharing the same expiration date. In the case of a product with Put skew, the put is generally going to be more expensive.

In this case, that leaves us with the following:

25 Delta Put – 25 Delta Call = Price of the “Risk Reversal”

$$1.75 - 1.06 = .69 \text{ cents}$$

Measuring and Tracking Skew Metrics using the Volatility Ratio (25 Delta Put ÷ 25 Delta Call)

Delta (Calls)	Implied Vol (Calls)	Price (Calls)	STRIKE	Price (Puts)	Implied Vol (Puts)	Delta (Puts)
.80	21.8	10.00	203.00	1.20	21.8	-.20
.75	20.1	8.30	206.00	1.75	20.1	-.25
.60	18.3	4.59	210.00	2.78	18.3	-.40
.50	17.2	3.35	212.00	3.48	17.2	-.50
.40	15.9	2.16	214.00	4.36	15.9	-.60
.26	14.4	1.06	216.50	5.77	14.4	-.74
.21	13.75	.90	217.00	6.10	13.75	-.79

Another Method of Tracking Skew is by comparing the Implied Volatility levels near the 25 Delta Put and the 25 Delta Call for options sharing the same expiration date. In the case of a product with Put skew, the put is generally going to have a higher Implied Volatility level.

In this case, that leaves us with the following:

25 Delta Put Vol ÷ 25 Delta Call Vol = Skew Volatility Ratio

$$20.1 \div 14.4 = 1.39$$

Measuring and Tracking Call Skew Metrics using only the Calls (50 Delta Call ÷ 25 Delta Call)

Delta (Calls)	Implied Vol (Calls)	Price (Calls)	STRIKE	Price (Puts)	Implied Vol (Puts)	Delta (Puts)
.80	21.8	10.00	203.00	1.20	21.8	-.20
.75	20.1	8.30	206.00	1.75	20.1	-.25
.60	18.3	4.59	210.00	2.78	18.3	-.40
.50	17.2	3.35	212.00	3.48	17.2	-.50
.40	15.9	2.16	214.00	4.36	15.9	-.60
.26	14.4	1.06	216.50	5.77	14.4	-.74
.21	13.75	.90	217.00	6.10	13.75	-.79

Another Method of Tracking only the Call Skew is by comparing the Implied Volatility levels near the 50 Delta Call and the 25 Delta Call for options sharing the same expiration date. In the case of a product with Negative skew, the 50 Delta Call Implied Vol is generally going to have a higher Implied Volatility level.

In this case, that leaves us with the following:

50 Delta Call Vol ÷ 25 Delta Call Vol = Call Skew Volatility Ratio

$$17.2 \div 14.4 = 1.19$$

Measuring and Tracking Put Skew Metrics using only the Puts (50 Delta Put ÷ 25 Delta Put)

Delta (Calls)	Implied Vol (Calls)	Price (Calls)	STRIKE	Price (Puts)	Implied Vol (Puts)	Delta (Puts)
.80	21.8	10.00	203.00	1.20	21.8	-.20
.75	20.1	8.30	206.00	1.75	20.1	-.25
.60	18.3	4.59	210.00	2.78	18.3	-.40
.50	17.2	3.35	212.00	3.48	17.2	-.50
.40	15.9	2.16	214.00	4.36	15.9	-.60
.26	14.4	1.06	216.50	5.77	14.4	-.74
.21	13.75	.90	217.00	6.10	13.75	-.79

The Last Method of Tracking Skew is by comparing the Implied Volatility levels near the 50 Delta Put and the 25 Delta Put for options sharing the same expiration date. In the case of a product with Put skew, the 25 Delta put is generally going to have a higher Implied Volatility level, so this ratio will generally be less than 1.00.

In this case, that leaves us with the following:

50 Delta Put Vol ÷ 25 Delta Put Vol = Put Skew Volatility Ratio

$$17.2 \div 20.1 = .855$$

Knowledge Check

- For an option in a month with Negative Skew, are the implied volatilities generally higher for Out-of-the-Money Puts or Calls? **Puts**
- Do equities and indices generally have Negative (Put) skew or Positive (call / demand) Skew? **Negative**
- Skew is dynamic and moves around during the trading day: T/F? **True**
- Skew is a function of Supply and Demand, and is closely tied to option prices and Implied Volatility levels: T/F? **True**

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