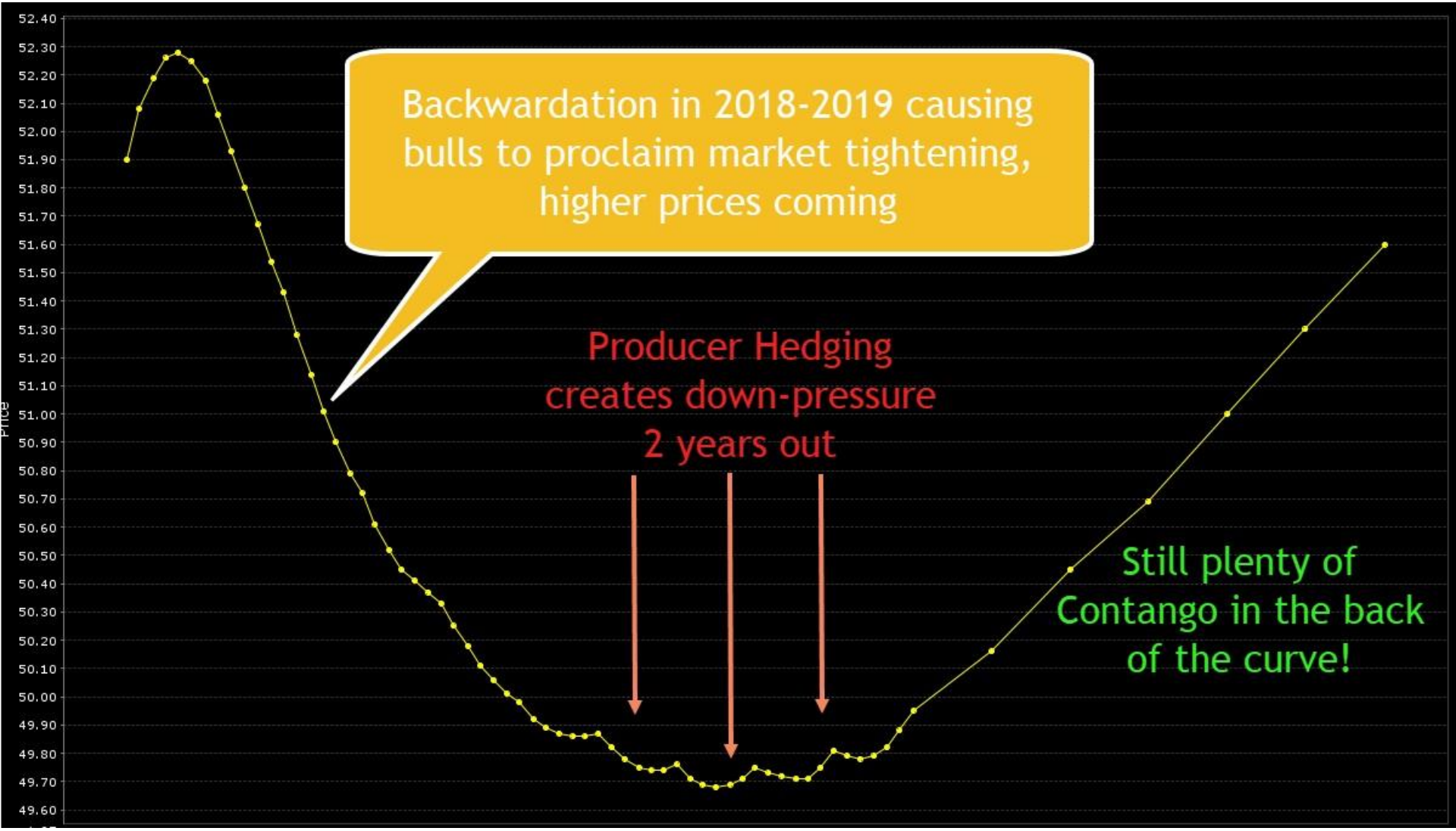

Does "WTI Backwardation" really signal tightening market, or is depression in the "hedging window" a result of shale producers hedging to finance new wells which will INCREASE (not decrease) future supply?

TMX | Montréal Exchange

TMX

Capital Formation

Toronto Stock Exchange
TSX Venture Exchange
TSX Private Markets
TSX Trust

Derivatives

Montréal Exchange
CDCC
NGX
Shorcan

Efficient Markets

Toronto Stock Exchange
TSX Venture Exchange
TSX Alpha Exchange
CDS

Market Insights

TMX Datalinx
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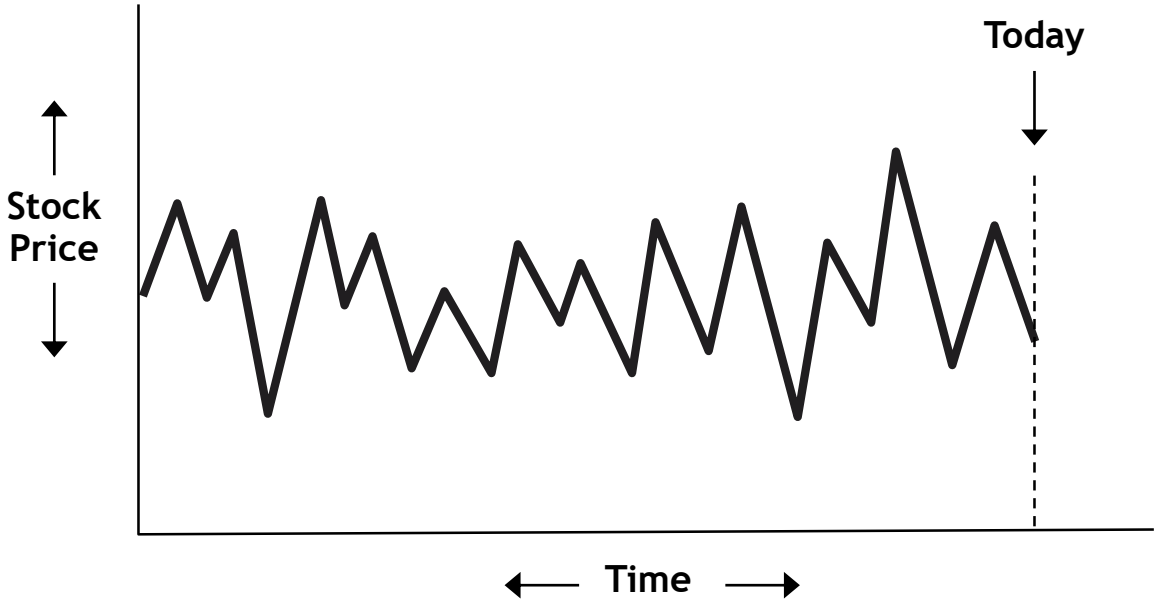
04 Historical Volatility

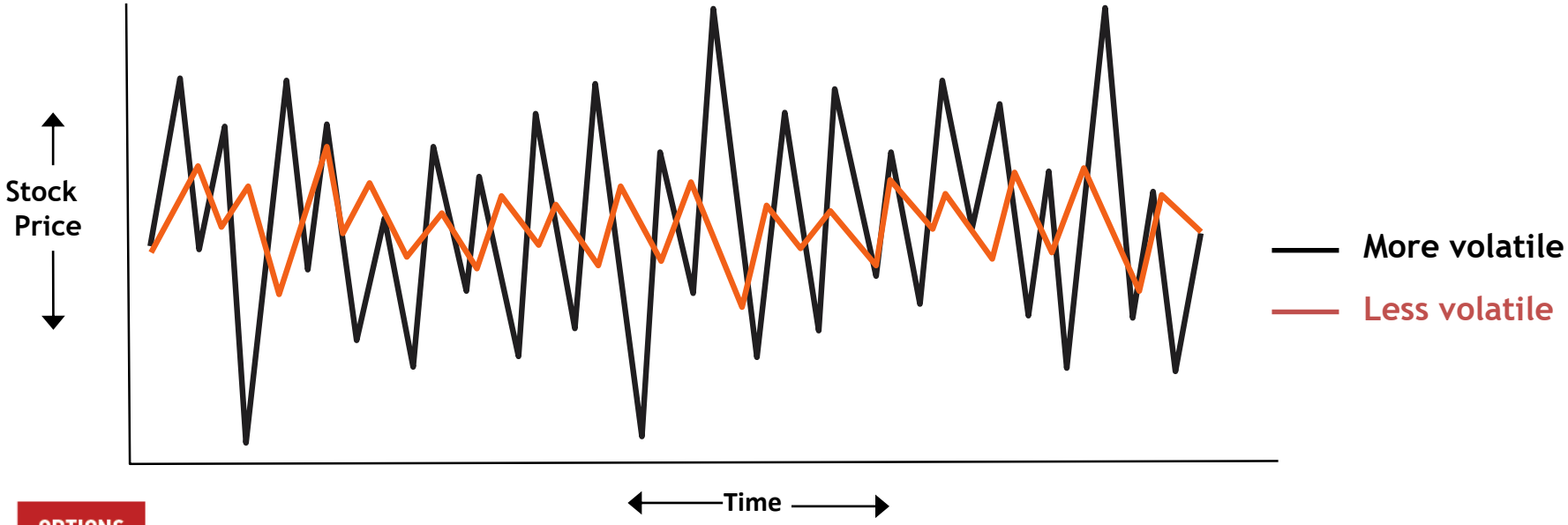
- A stock's volatility in the past:
  - Can be observed and quantified
  - This is "historical" volatility
  - A statistic, or a fact, not a prediction



OPTIONS EDUCATION DAY

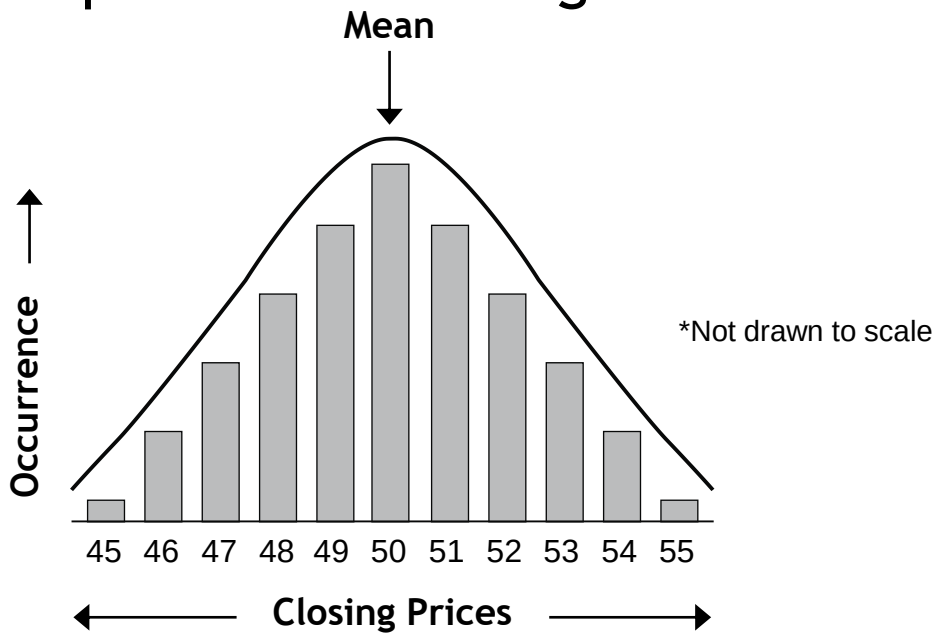
05 Higher vs. Lower Volatility

- Compare price action of two stocks over a given time period:
  - Both begin and end timeframe at same price
  - What happens during timeframe is **volatility**



06 Normal Distribution

- Consider stock XYZ and its distribution of closing prices over a short timeframe
- Normal distribution when number of occurrences and price range on upside mirror image of downside



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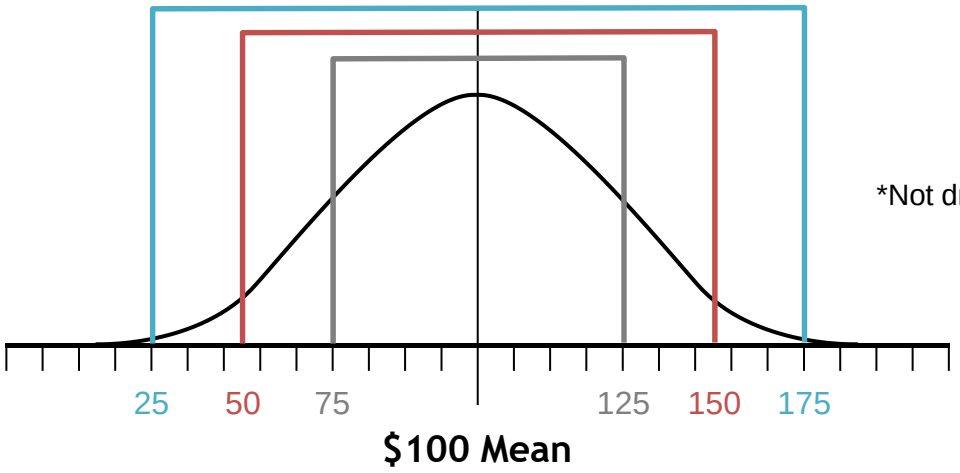
07 Historical Volatility and Standard Deviation

- With a 25% historical volatility XYZ has been
- within ± 1 SD of $25.00 from mean – 68% of the time
- within ± 2 SDs of $50.00 from mean – 95% of the time
- within ± 3 SDs of $75.00 from mean – 99% of the time



*Not drawn to scale

OPTIONS EDUCATION DAY

08 Standard Deviation Example

- XYZ is currently at $60
- Volatility assumption 20%
- XYZ to trade between $48 and $72 *(±20%)*
- 1 year time frame
- ≈68% of time or 1 standard deviation
- ≈32% of time outside of this range

09 Look into the Future: 1 Day

- XYZ is trading at $60.00 – options at ***annualized*** 20% implied volatility
- Standard deviation amount for **1-trading day**:

$$\frac{20\%}{\sqrt{252}} \times \$60.00 = \frac{.20}{15.87} \times \$60.00 = .012 \times \$60.00 \approx \$.76$$

- Statistically, you can expect the following results for XYZ over the next 1 trading day:

Variance	Standard Deviation Amount	Trading Range	Probability Within Range	Probability Outside Range
± 1 SD	$.76	$59.24 ⟷ $60.76	≈ 68%	≈ 32%
± 2 SD	$1.52	$58.48 ⟷ $61.52	≈ 95%	≈ 5%
± 3 SD	$2.28	$57.72 ⟷ $62.28	≈ 99%	≈ 1%

OPTIONS EDUCATION DAY

10 Implied Volatility: Definition

- Option implied volatility is:
  - Volatility assumption at which option is currently priced in market
  - Can be determined via option pricing as model
  - Volatility input value is now = current option market price
- Reflects underlying volatility expected by marketplace and is the consensus of all market participants
- Who ultimately determines option market prices?
  - Everybody who makes a bid/ask price and trades an option
  - Professionals and individual investors alike

11 Market Prices of Options

- When valuing an option with a pricing model (option calculator) You might start with a stock's *historical volatility* to predict *future volatility*. You could also use an *expected volatility* for the stock
- When the current market price for an option seems too high or too low to you, you can raise or lower the implied volatility input. If all other inputs are correct then it is implied volatility determining the current price.