Average Directional Index (ADX)

Reference from Investopedia

Description: The average directional index (ADX) is a technical analysis indicator used by some traders to determine the strength of a trend. The trend can be either up or down, and this is shown by two accompanying indicators, the negative directional indicator (-DI) and the positive directional indicator (+DI). Therefore, the ADX commonly includes three separate lines. These are used to help assess whether a trade should be taken long or short, or if a trade should be taken at all. The ADX makes use of a positive (+DI) and negative (-DI) directional indicator in addition to the trendline. The trend has strength when ADX is above 25; the trend is weak or the price is trendless when ADX is below 20. Non-trending doesn't mean the price isn't moving. It may not be, but the price could also be making a trend change or is too volatile for a clear direction to be present.

Usage: The ADX, negative directional indicator (-DI), and positive directional indicator (+DI) are momentum indicators. The ADX helps investors determine trend strength, while -DI and +DI help determine trend direction. The ADX identifies a strong trend when the ADX is over 25 and a weak trend when the ADX is below 20. Crossovers of the -DI and +DI lines can be used to generate trade signals. For example, if the +DI line crosses above the -DI line and the ADX is above 20, or ideally above 25, then that is a potential signal to buy. On the other hand, if the -DI crosses above the +DI, and the ADX is above 20 or 25, then that is an opportunity to enter a potential short trade. Crosses can also be used to exit current trades. For example, if long, exit when the -DI crosses above the +DI. Meanwhile, when the ADX is below 20 the indicator is signaling that the price is trendless and that it might not be an ideal time to enter a trade.

Limitations: Crossovers can occur frequently, sometimes too frequently, resulting in confusion and potentially lost money on trades that quickly go the other way. These are called false signals and are more common when ADX values are below 25. That said, sometimes the ADX reaches above 25, but is only there temporarily and then reverses along with the price. Like any indicator, the ADX should be combined with price analysis and potentially other indicators to help filter signals and control risk.

Formulas:

1. Calculate +DM, -DM, and the true range (TR) for each period. Fourteen periods are typically used.
2. +DM = current high - previous high.
3. -DM = previous low - current low.
4. Use +DM when current high - previous high > previous low - current low. Use -DM when previous low - current low > current high - previous high.
5. TR is the greater of the current high - current low, current high - previous close, or current low - previous close.
6. Smooth the 14-period averages of +DM, -DM, and TR—the TR formula is below. Insert the -DM and +DM values to calculate the smoothed averages of those.
7. First 14TR = sum of first 14 TR readings.
8. Next 14TR value = first 14TR - (prior 14TR/14) + current TR.
9. Next, divide smoothed +DM value by smoothed TR value to get +DI. Multiply by 100.
10. Divide the smoothed -DM value by the smoothed TR value to get -DI. Multiply by 100.
11. The directional movement index (DMI) is +DI minus -DI, divided by the sum of +DI and -DI (all absolute values). Multiply by 100.
12. To get the ADX, continue to calculate DX values for at least 14 periods. Then, smooth the results to get ADX.
13. First ADX = sum 14 periods of DX / 14.
14. After that, ADX = ((prior ADX * 13) + current DX) / 14.

$$+\text{DI} = \left(\frac{\text{Smoothed } +\text{DM}}{\text{ATR}} \right) \times 100$$

$$\text{-DI} = \left(\frac{\text{Smoothed -DM}}{\text{ATR}} \right) \times 100$$

$$\text{DX} = \left(\frac{|\ +\text{DI} - \text{-DI}\ |}{|\ +\text{DI} + \text{-DI}\ |} \right) \times 100$$

$$\text{ADX} = \frac{(\text{Prior ADX} \times 13) + \text{Current ADX}}{14}$$

where:

$+\text{DM (Directional Movement)} = \text{Current High} - \text{PH}$

$\text{PH} = \text{Previous High}$

$\text{-DM} = \text{Previous Low} - \text{Current Low}$

$\text{Smoothed } +/\text{-DM} = \sum_{t=1}^{14} \text{DM} - \left(\frac{\sum_{t=1}^{14} \text{DM}}{14} \right) + \text{CDM}$

$\text{CDM} = \text{Current DM}$

$\text{ATR} = \text{Average True Range}$