A Gentle Story About a Make-Believe Stock

Reading Price Pictures Like a Simple Comic

This notebook is written to understand the very basics of the stock market.
We will explain everything **slowly** and with a **story**.

Imagine a company called **ABC Toys**. People can buy tiny pieces of ABC Toys called **shares**.

- If many people want to **buy** shares, the price tends to go **up**.
- If many people want to **sell** shares, the price tends to go **down**.

We will:

1. Draw simple **pictures of the price** of ABC Toys over many days.
2. Learn what it means when we say *"buyers won today"* or *"sellers won today"*.
3. Add simple tools (called **indicators**) on top of the picture to help us read the story:

    - Moving averages (smooth lines)
    - Support and resistance (floors and ceilings)
    - RSI (how fast the price is running)
    - MACD (when the running speed changes)
    - Bollinger Bands and ATR (how wild the moves are)
    - OBV (if the crowd is shouting loudly or softly)

What Is a Price Picture?

For each day, the share of ABC Toys has a **price**.

You can think of price as **one number** for the day, like:

- Day 1: 10 dollars
- Day 2: 11 dollars
- Day 3: 9.5 dollars

If we join these points with a line, we get a **line chart**. This is like drawing how tall a child is every birthday.

But in real trading, **many trades happen inside the same day**. So we often store **more than one number per day**:

- **Open**: price at the very **start** of the day.
- **High**: **highest** price during the day.
- **Low**: **lowest** price during the day.
- **Close**: price at the very **end** of the day.

These four letters together are called **OHLC**.

Making Up a Story for ABC Toys

We will **invent** how the price of ABC Toys moves, like writing a comic:

1. **Days 0–60** – ABC Toys slowly becomes more popular.
    - Price goes **gently up**.
    - Volume (number of shares traded) is **medium**.
2. **Days 60–120** – A new toy becomes a hit.
    - Price goes **up faster** (strong uptrend).
    - Volume becomes **very high** (many people trading).
3. **Days 120–160** – The excitement cools down.
    - Price moves **sideways** (up a bit, down a bit).
    - Volume becomes **small** (people are waiting).
4. **Days 160–200** – A new competitor appears.
    - Price **falls slowly** (mild downtrend).
    - Volume grows a little again.

We will build prices and volumes in this shape, then read the story from the charts.

Candles: “Who Won Today?” – Buyers or Sellers?

For each day:

- At the **start** of the day we have the **Open** price.
- At the **end** of the day we have the **Close** price.

We say:

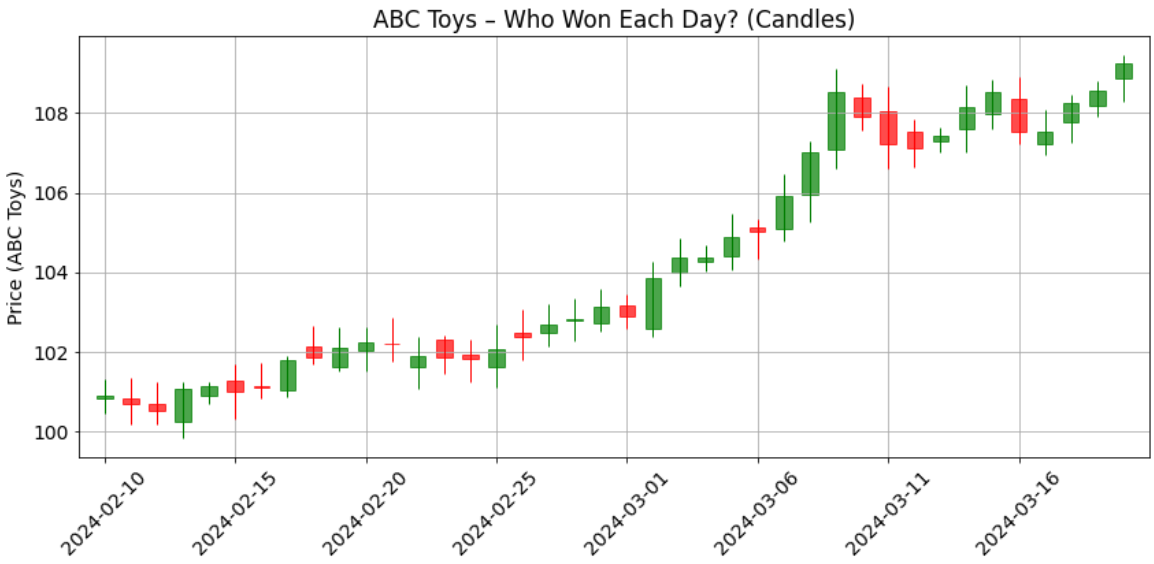
- If **Close > Open**, we say **buyers were stronger that day** (buyers “won the day”).
    - To make the price finish higher than it started, buyers had to accept trades at **higher** prices.
    - Sellers were offering shares, but buyers kept saying “OK, I’ll pay that higher price”.
    - So the **last trade** of the day happened at a **higher** price than in the morning.
- If **Close < Open**, we say **sellers were stronger that day** (sellers “won the day”).
    - To make the price finish lower than it started, sellers had to agree to trade at **lower** prices.
    - Buyers were only willing to pay less, and sellers accepted those cheaper offers.
    - So the **last trade** of the day happened at a **lower** price than in the morning.

This does **not** mean there were no sellers on up days or no buyers on down days. There are always both. It just means that, over that day, **one side pushed the price more in its preferred direction**.

We draw a little **candle** for each day:

- A **green candle** means *buyers won* (price closed above open).
- A **red candle** means *sellers won* (price closed below open).
- The **fat part** (body) goes from Open to Close.
- The **thin line** (wick) goes from Low to High and shows the whole day’s travel.

In [21]:
```
1
```



Volume: How Many People Traded Today?

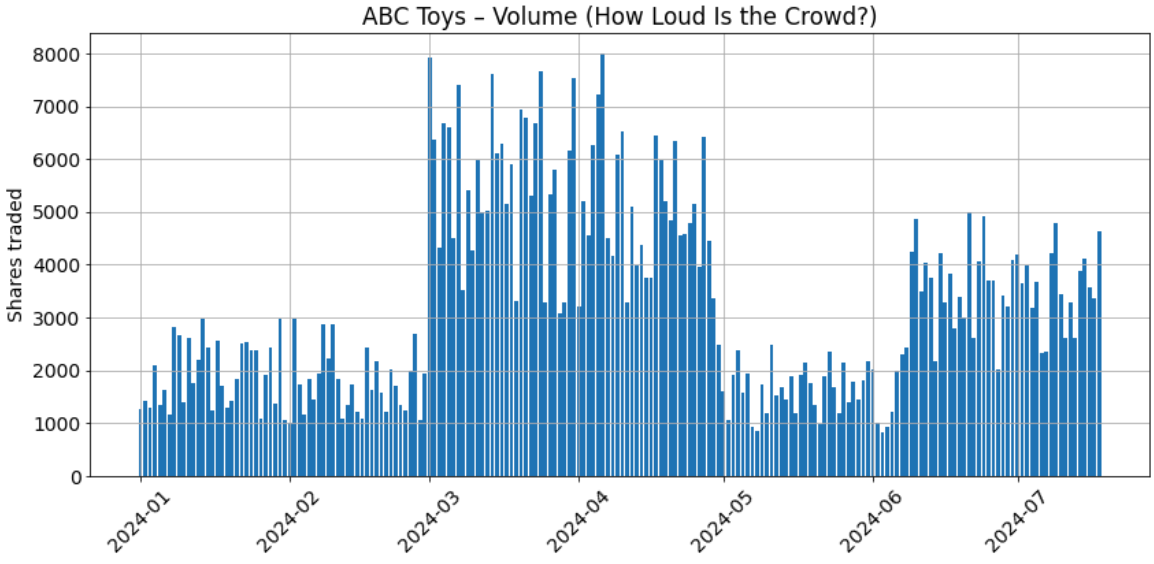
Volume is just a count of how many shares were traded in a day.

- Big volume bar = **many** trades (the market is noisy and busy).
- Small volume bar = **few** trades (the market is quiet).

You can imagine volume as **how loud the crowd is shouting**.

- Price goes up **with loud shouting** → many people agree with the move.
- Price goes up **but the crowd is quiet** → fewer people are pushing; the move may be weaker.

In [22]:
```
1
```



Moving Averages: Smoothing the Wiggles

The daily price jumps up and down like a child hopping.
A **moving average** is like using a thick marker to draw a **smooth line** through those hops so we can see the overall direction more clearly.

Basic idea (simple moving average):

- Pick a number of days, say **N**.
- Take the closing prices of the **last N days**.
- Add them up and divide by **N** → this is the **average price** of those days.
- Move one day forward and repeat.
- Plot all these averages as a line.
  Because the set of days keeps **moving**, this line is called a **moving average**.

In this notebook, we use:

- **20-day SMA** – average of the last 20 closing prices (short-term view).
  It follows recent price more closely and changes faster.
- **50-day SMA** – average of the last 50 closing prices (medium-term view).
  It is smoother and changes more slowly.

You can think of them as two friends:

- The **20-day line** has a short memory and reacts quickly.
- The **50-day line** has a longer memory and reacts slowly.

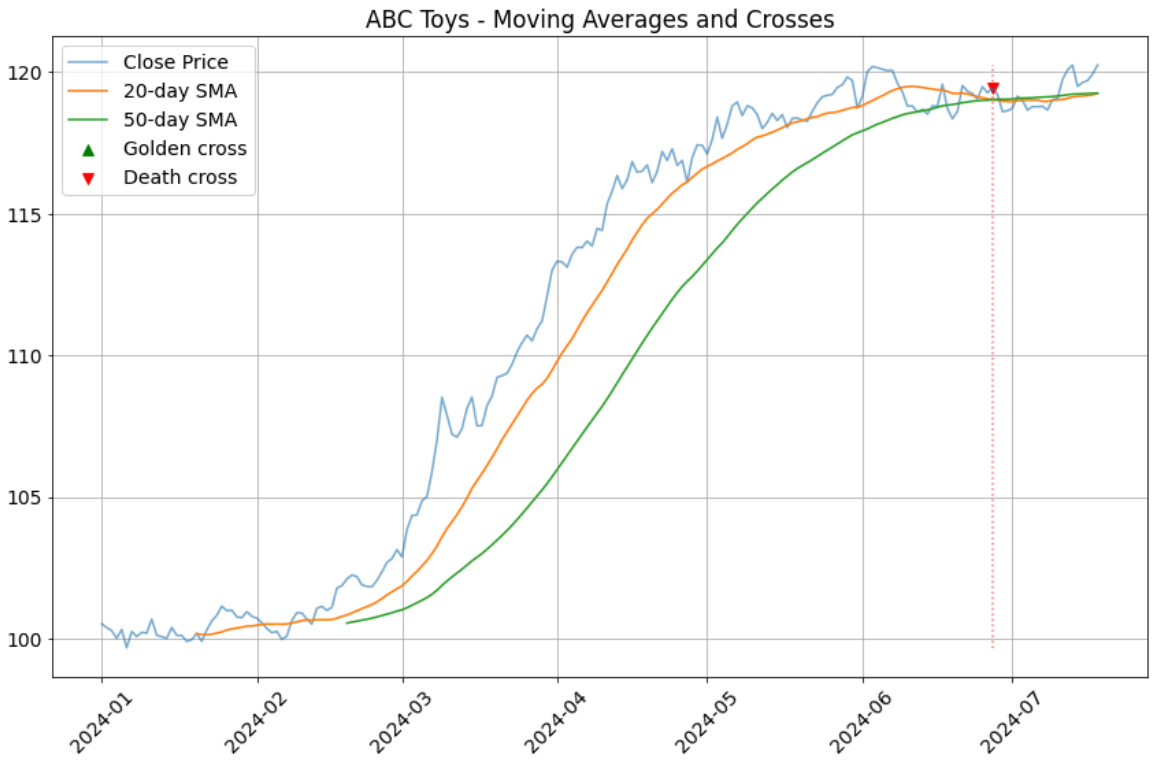
Traders often read them like this:

- If the **price is above both lines**, they say “the trend is **up**”.
- If the **price is below both lines**, they say “the trend is **down**”.

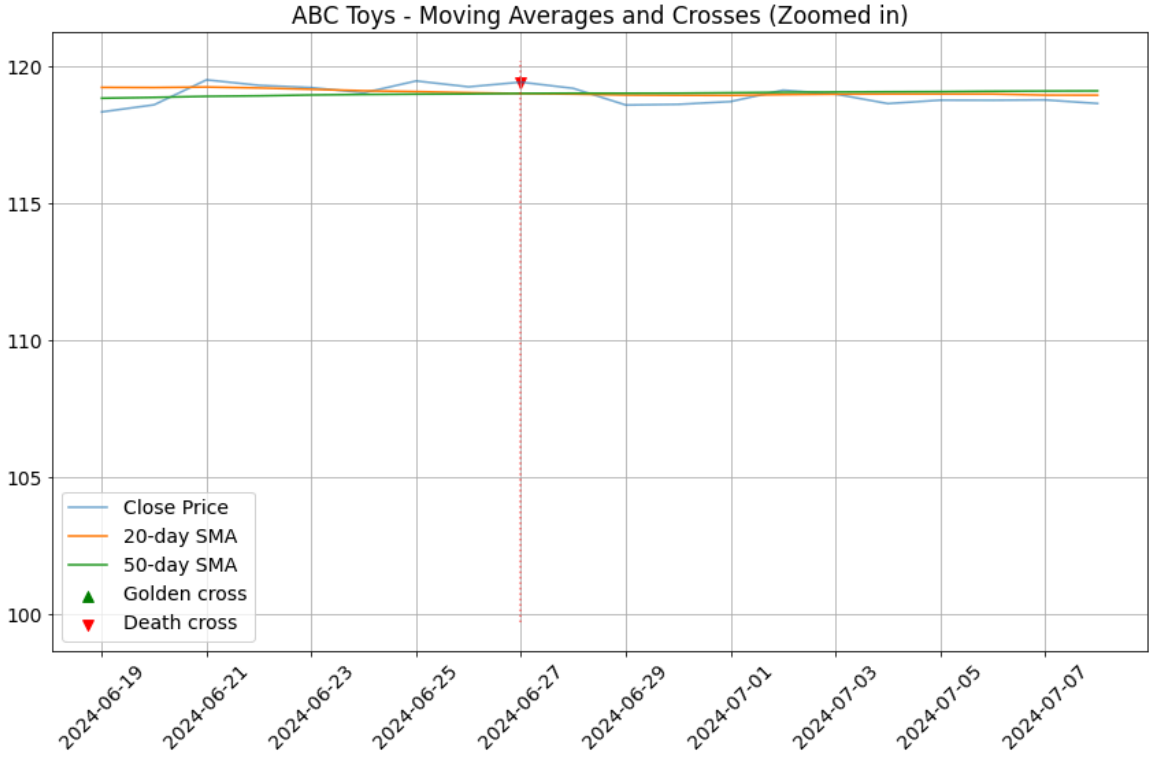
Special crossing events:

- When the **short (20-day) line crosses above** the long (50-day) line, this is called a **golden cross**.

In [28]:
```
1
```



In [32]:
```
1
```



Reading this picture like a story:

- When the **green 20-day line** climbs above the **blue 50-day line**, it tells us: “Recently, prices have been doing **better** than they did in the past 50 days.”
- Many traders treat a **golden cross** as a sign that the up-move is strong or starting.
- A **death cross** is the opposite: “Recent prices are doing **worse** than the bigger past window.”

It is often read as a warning that the uptrend might be ending or a downtrend might

Support and Resistance: Floors and Ceilings

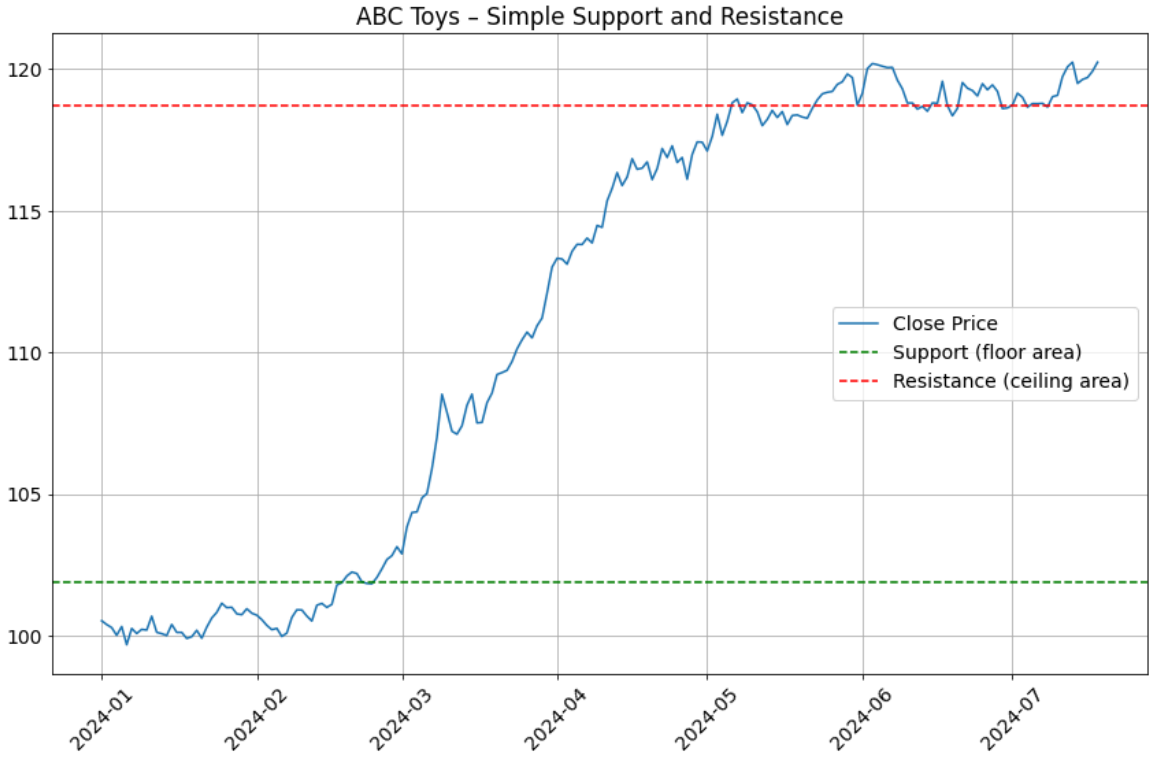
When you bounce a ball in a room, it keeps hitting the **floor** and the **ceiling**.

Stock prices often act a bit like that:

- **Support** is like a **floor**:
  - Price falls down to this zone and then often **bounces up** again.
  - Many buyers seem to appear around here ("it looks cheap now").
- **Resistance** is like a **ceiling**:
  - Price rises up to this zone and then often **falls back**.
  - Many sellers appear ("it looks expensive now").

These are not exact single numbers but **areas** where price has turned many times.

In [33]:
```
1
```



How someone might use this:

- If price keeps **bouncing up** near the green support line, a buyer might say:
  "If it comes to this floor again, I may buy, but I will run away (sell) if it breaks below."
- If price keeps **failing** near the red resistance line, a seller might say:
  "This is where people keep giving up and selling; I may take profit here."

RSI: Is the Price Running Too Fast?

RSI (Relative Strength Index) tries to measure **how strong the recent up-moves are compared to the recent down-moves**.

- If, in the last days, price mostly went **up** and the up days were big, RSI becomes **high**.
- If, in the last days, price mostly went **down** and the down days were big, RSI becomes **low**.

RSI is always a number between **0** and **100**:

- Above **70** → "**overbought**" area (price has run up very fast recently).
- Below **30** → "**oversold**" area (price has fallen very fast recently).

> Important:
>
> - "Overbought" does **not** mean price must fall right now.
> - In a strong uptrend, RSI can stay above 70 for a long time.

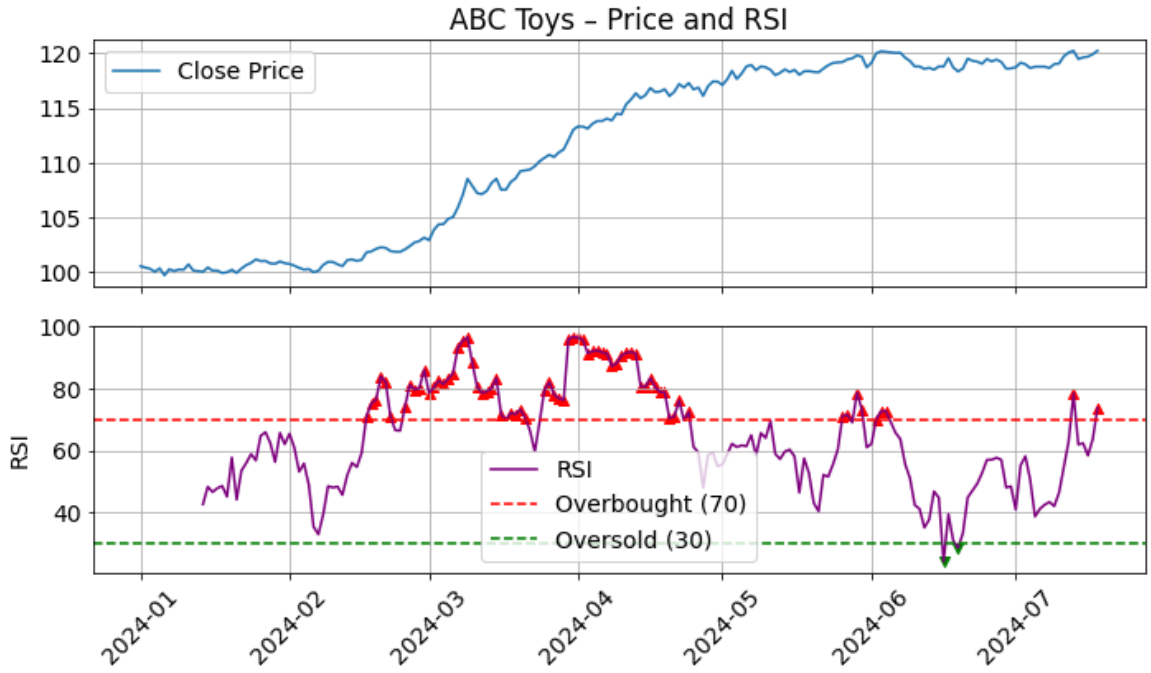
How RSI is computed (for a lookback window of (N) days, often (N=14))

Let P_t be the closing price on day t.

1. **Daily change**: $\Delta_t = P_t - P_{t-1}$.
2. **Separate gains and losses**:
$$\text{Gain}_t = \begin{cases} \Delta_t & \text{if } \Delta_t > 0, \\ 0 & \text{otherwise,} \end{cases} \qquad \text{Loss}_t = \begin{cases} -\Delta_t & \text{if } \Delta_t < 0, \\ 0 & \text{otherwise.} \end{cases}$$
3. **Average gains and losses over the last (N) days**:
$$\text{AvgGain}_t = \frac{1}{N}\sum_{k=t-N+1}^{t} \text{Gain}_k, \qquad \text{AvgLoss}_t = \frac{1}{N}\sum_{k=t-N+1}^{t} \text{Loss}_k.$$
4. **Relative Strength (RS)**: $\text{RS}_t = \frac{\text{AvgGain}_t}{\text{AvgLoss}_t}$. (If $\text{AvgLoss}_t = 0$, we typically treat RSI as 100.)
5. **RSI value between 0 and 100**: $\text{RSI}_t = 100 - \frac{100}{1+\text{RS}_t}$.

- If average gains $\gg$ average losses $\rightarrow \text{RS}_t$ is large → RSI close to 100.
- If average losses $\gg$ average gains $\rightarrow \text{RS}_t$ is small → RSI close to 0.
- If average gains $\approx$ average losses $\rightarrow \text{RS}_t \approx 1 \rightarrow$ RSI $\approx$ 50 (neutral).

In [34]:
```
1
```



Story view:

- During the **fast up-move** (our hit toy phase), RSI may go above 70.
  This says: "Price has been going up again and again; it is running fast."
- If later, during a **pullback** near support, RSI drops below 30, it may tell us:
  "Price has fallen very quickly; sellers may be tired soon."

Traders sometimes wait for:

- A strong drop (RSI low) **and then** a small rise in price to guess that the fall might be ending.

MACD: When Does the Trend Change Its Mind?

MACD (Moving Average Convergence Divergence) is a tool that compares a **fast** moving average of price with a **slow** moving average of price.

Terms

- **Closing price** P_t: the last traded price on day t.
- **EMA (Exponential Moving Average)**: a moving average that gives more weight to recent prices: $\mathrm{EMA}_t = \alpha P_t + (1-\alpha)\,\mathrm{EMA}_{t-1}, \quad \alpha = \frac{2}{\text{span}+1}$.
- **Fast EMA**: EMA with a smaller span (e.g. 12), reacts quickly.
- **Slow EMA**: EMA with a larger span (e.g. 26), reacts more slowly.
- **Trend**: general direction of price (mostly up = uptrend, mostly down = downtrend).

How MACD is built (common settings: 12, 26, 9)

1. **Fast and slow EMAs of price**:
   $\mathrm{FastEMA}_t = \text{EMA of } P_t \text{ with span } 12, \quad \mathrm{SlowEMA}_t = \text{EMA of } P_t \text{ with span } 26.$

2. **MACD line** (difference between fast and slow EMAs):
   $\text{MACD}_t = \text{FastEMA}_t - \text{SlowEMA}_t$.
   - If $\text{MACD}_t > 0$: recent prices are stronger than the older baseline (bullish bias).
   - If $\text{MACD}_t < 0$: recent prices are weaker than the older baseline (bearish bias).
3. **Signal line** (smoothed MACD line): $\text{Signal}_t = \text{EMA of MACD}_t \text{ with span } 9$. This is a smoother, slower line that follows the MACD line.
4. (Optional) **Histogram**: $\text{Hist}_t = \text{MACD}_t - \text{Signal}_t$, which shows the distance between MACD and its Signal line.

How traders read MACD

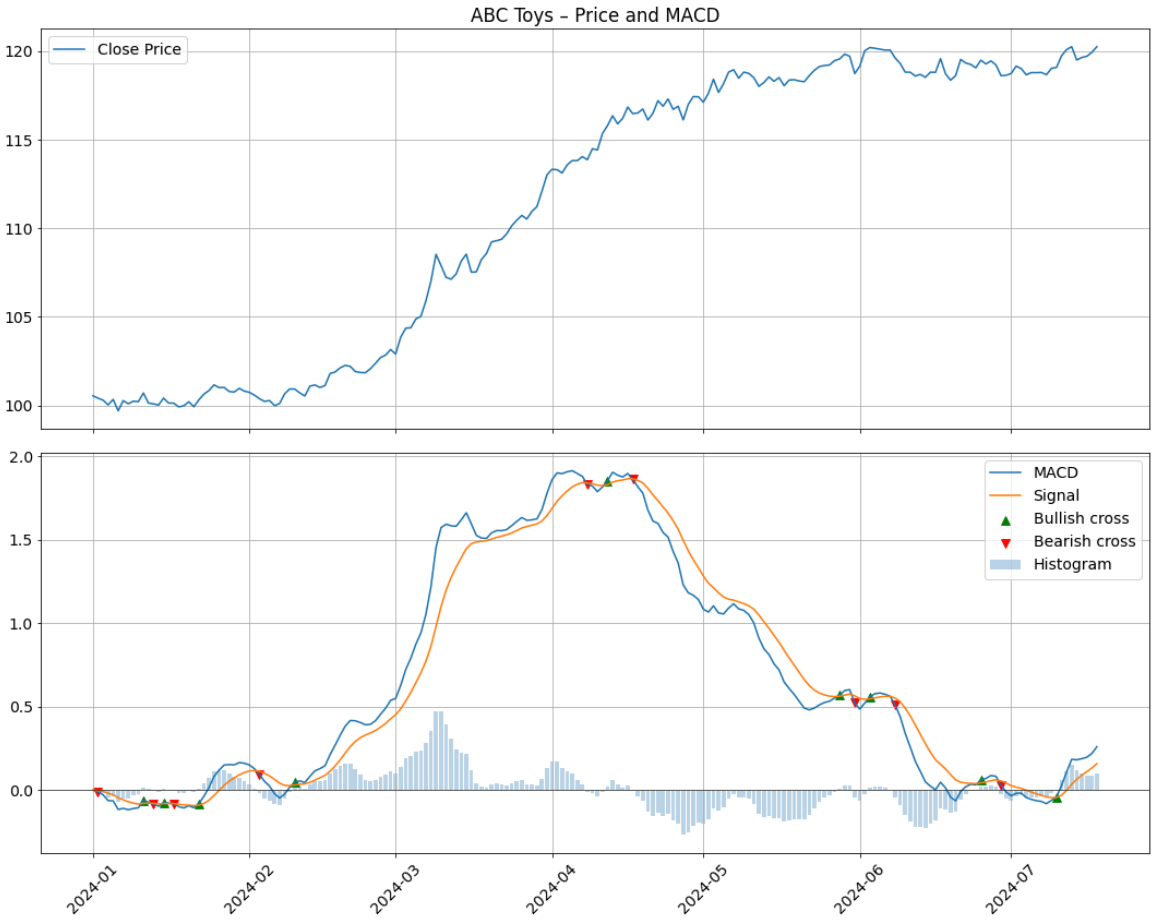
- If the **fast EMA is above the slow EMA** $(\text{MACD}_t > 0)$, recent prices are **stronger** than the older past → uptrend bias.
- If the **fast EMA is below the slow EMA** $(\text{MACD}_t < 0)$, recent prices are **weaker** than the older past → downtrend bias.

Special crossing events between MACD and the Signal line:

- **Bullish cross**: MACD line crosses **above** the Signal line.
  - Interpreted as: recent upward strength is starting to increase; the trend may be turning **up**.
- **Bearish cross**: MACD line crosses **below** the Signal line.
  - Interpreted as: recent upward strength is fading; the trend may be turning **down**.

MACD does **not** predict the future on its own; it is one more piece of the story, used together with price charts, moving averages, RSI, volume, etc., to judge whether an existing

In [39]:
```
1
```



Reading the story with MACD:

- After our **sideways phase**, a **bullish cross** (MACD above signal) may say:
  "The sleepy price is waking up and starting to run upward again."
- After the **strong rally**, a **bearish cross** can say:
  "The running is slowing; the up-trend may be ending or resting."

Bollinger Bands: How Wide Is the Road?

Bollinger Bands draw a kind of **road** around the price:

- Middle of the road: a 20-day moving average.
- Top of the road: middle + 2 × "spread" (how far prices wander).
- Bottom of the road: middle – 2 × "spread".

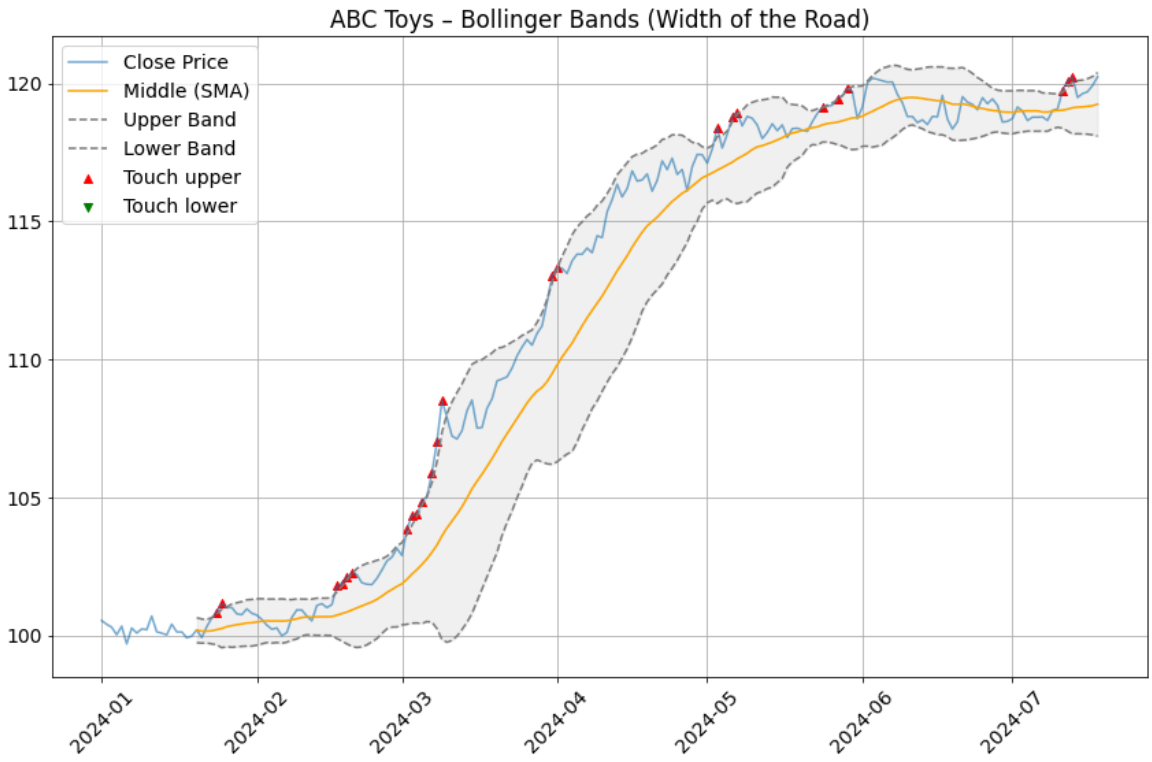
When the road is:

- **Narrow** → price is quiet, not moving much (low volatility).
- **Wide** → price is jumping around a lot (high volatility).

People often watch for:

- **Squeezes** (very narrow road) → often followed by a big move.
- Price touching or peeking outside the band → shows a strong push in that direction.

In [40]:
```
1
```



Story reading:

- In the **quiet sideways period**, the bands get **tight**: the road is narrow.
  Traders think: *"The spring is being compressed; a strong move may come later."*

- During the **hit toy rally**, the price may walk near the **upper band**. This means buyers are pushing hard; touching the band is normal in a strong trend.
- A sudden move from a very narrow band to a wide one is like a child suddenly starting to run after standing still.

ATR: How Far Does Price Travel in a Day?

Average True Range (ATR) measures how big the price moves are on a typical day, including gaps from one day to the next. It is a way to quantify **volatility**.

- If on most days the price only moves a little, ATR is **small** (calm market).
- If on many days the price jumps a lot, ATR is **big** (wild / noisy market).

True Range (TR) for a single day

Let

- H_t = high price of day t
- L_t = low price of day t
- C_t = close price of day t
- C_{t-1} = close price of the previous day

The **True Range** for day (t) is

$$\mathrm{TR}_t = \max\Big(H_t - L_t,\ \big|H_t - C_{t-1}\big|,\ \big|L_t - C_{t-1}\big|\Big).$$

This formula considers:

- The inside-day range $H_t - L_t$.
- Any **gap up** from yesterday's close C_{t-1} to today's high H_t.
- Any **gap down** from yesterday's close to today's low L_t.

By taking the maximum, TR captures the **largest relevant move** from yesterday's close through today's trading.

ATR over N days (e.g. $N = 14$)

To get the **Average True Range**, we average the True Ranges over the last N days:

$$\mathrm{ATR}_t = \tfrac{1}{N} \sum_{k=t-N+1}^{t} \mathrm{TR}_k.$$

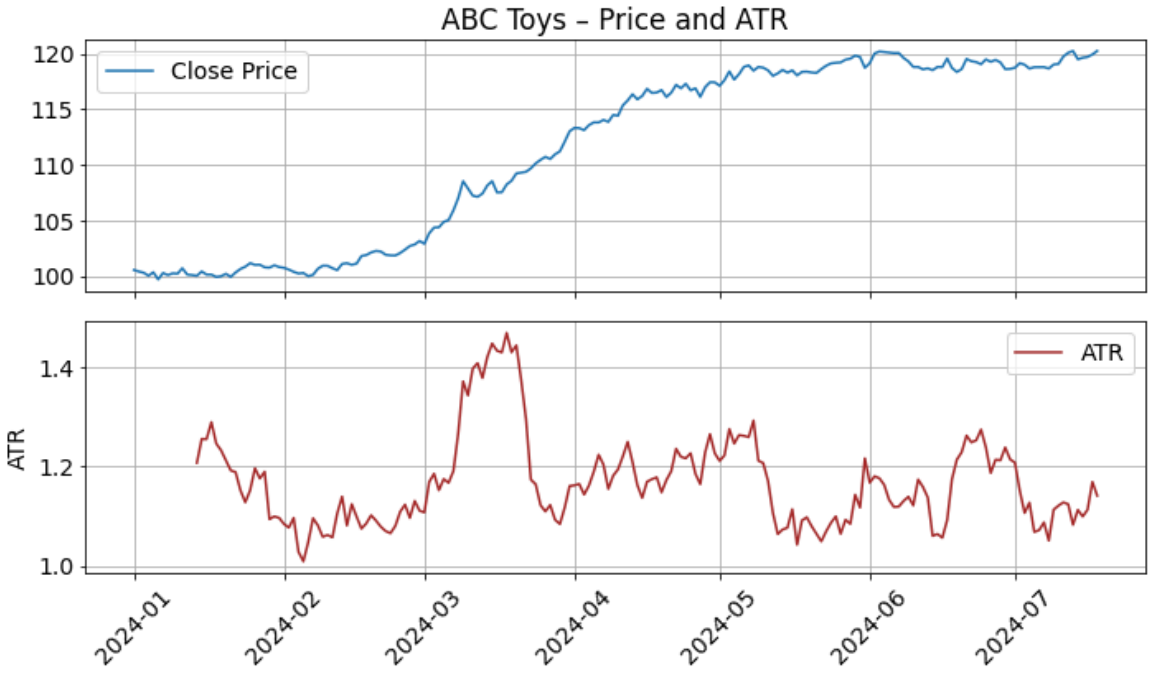
(Original definitions use a smoothed version, but this simple average shows the idea.)

- High ATR → the price has been moving **far** each day (high volatility).
- Low ATR → the price has been moving **only a little** each day (low volatility).

How traders use ATR

1. **Measuring "noise"**
    - High ATR: the market is noisy and jumps a lot.
    - Low ATR: the market is quiet and move

In [42]:
```
1
```



Story reading:

- During the **strong up-move**, ATR often gets **bigger** – the price is jumping more each day.
- During the **quiet sideways phase**, ATR may **shrink** – things calm down.

A simple rule of thumb some people use:

- "I will not risk more than 1 or 2 times the usual ATR on any trade."

OBV: Is the Crowd Walking With the Price?

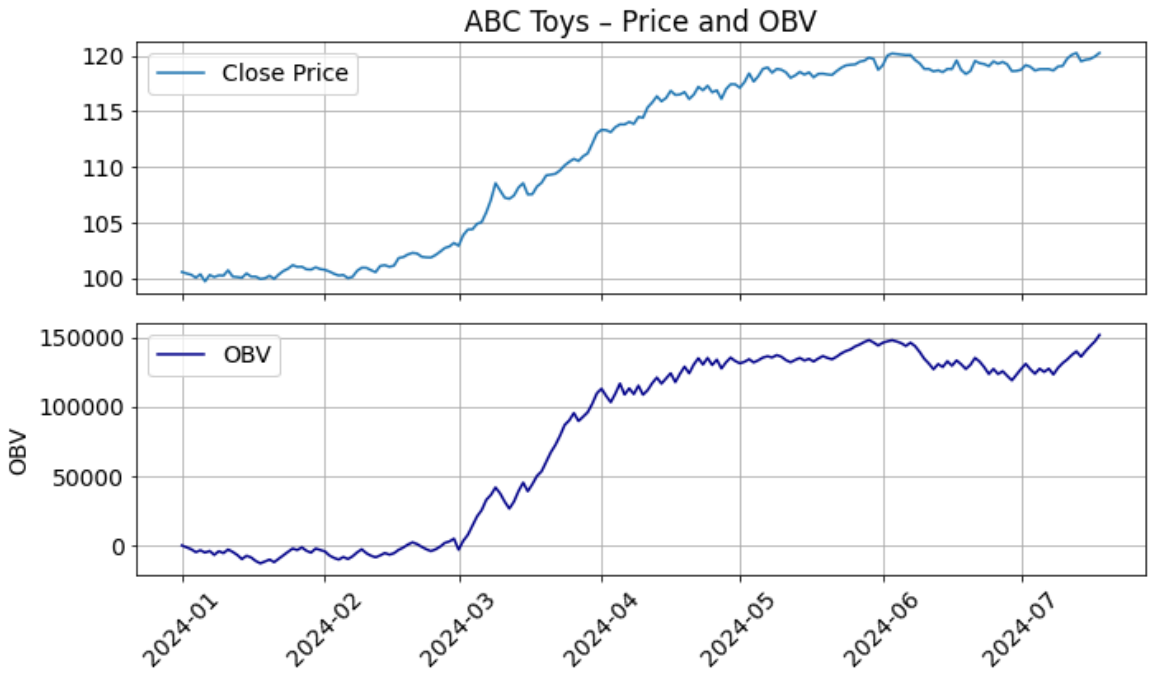
On-Balance Volume (OBV) tries to see if **volume agrees** with the price move:

- If price closes **higher** than yesterday → we **add** today's volume.
- If price closes **lower** than yesterday → we **subtract** today's volume.
- If price is the same → we do nothing.

Over many days, OBV becomes a line:

- If price goes **up** and OBV also goes **up**, the crowd is walking *with* the price move (stronger).
- If price goes **up** but OBV goes **flat or down**, the crowd is *not* really joining; the move may be weak.

In [43]:
```
1
```



Story reading:

- In the **hit toy rally**, if both price and OBV climb, we can say:
  "Many traders are joining the up-move; it looks healthy."
- Near the top, if price still inches higher but OBV starts to fall, we can say:
  "The crowd is getting tired; fewer people are helping the price go up."

Big Picture – How All These Things Fit Together

We told a story about **ABC Toys** and learned to read its **price pictures**.

- **Candles** show who won each day:
  - Green: buyers win (price closes higher than it opened).
  - Red: sellers win (price closes lower).
- **Volume** shows how many people traded, like how loud the crowd is.
- **Moving averages** are smooth lines that tell us if the story is mostly up or mostly down.
- **Support and resistance** are floors and ceilings where price likes to bounce.
- **RSI** tells us if the price has been running up or down *too fast*.
- **MACD** tells us when the strength of the trend may be changing.
- **Bollinger Bands** and **ATR** tell us if the market is calm or wild.
- **OBV** checks if the crowd is really walking with the price move.

A careful trader usually:

- Looks at **all these pieces together**, not just one.
- Remembers that **nothing is certain**; indicators are **tools**, not magic.
- Tries to tell a **simple story**:

> “Is this price mostly going up or down? Is the move strong or weak? Is the crowd joining or not?”