Market Making 101:
What is Market Making?

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What This Topic Is About

This first chapter introduces the core idea of market making: providing continuous liquidity by posting both buy and sell limit orders. Before discussing models or code, we must understand what a market maker is actually paid for and why this role involves substantial risk.

Why Market Making Exists

Financial markets function only when buyers and sellers can trade at any time. However, they rarely arrive simultaneously or agree on the same price. A market maker solves this mismatch by continuously quoting:

Bid: price at which the market maker will buy, Ask: price at which it will sell.

For example:

$$\text{Bid} = 99, \qquad \text{Ask} = 101.$$

Any participant can immediately:

- sell to the market maker at 99,
- or buy from the market maker at 101.

The difference between these prices, the *spread*, represents potential profit.

What Market Makers Get Paid For

A market maker earns money by capturing the spread:

$$\text{Spread} = \text{Ask} - \text{Bid}.$$

However, earning this spread is not risk-free. Posting two-sided quotes exposes the market maker to two types of risk: inventory risk and execution risk. Managing these risks is the fundamental challenge in market making.

Risk #1: Inventory Risk

When a market maker's quotes are hit, it accumulates a position called *inventory*. If the price moves adversely, this inventory can cause losses that outweigh the spread captured.

Example:

- The market maker buys at 99 (its bid is filled).
- The mid-price then drops to 95.

The market maker loses 4 per share, even though it may eventually sell at 101 for a spread of 2. Inventory risk is asymmetric: the potential loss from price movement may far exceed the spread earned.

Risk #2: Execution Risk

If a market maker quotes too conservatively (far from the mid-price), its orders may not fill at all. If it quotes too aggressively (too close to mid), it may:

- accumulate excessive inventory,
- be exposed to large swings in price,
- or experience fills from informed traders.

Execution risk reflects the trade-off between receiving desirable fills and avoiding harmful ones.

Adversarial (Toxic) Order Flow

Adversarial order flow refers to trades that occur when the counterparty possesses superior information or reacts to information faster than the market maker. Such traders transact only when it is favorable to them and unfavorable to the market maker.

Examples:

- A fast trader hits your stale quote just before the price drops.
- A trader with private information buys from you just before positive news.

In both cases, the market maker is "picked off." This is a major source of losses and becomes more severe when quoting tight spreads or in high-volatility conditions.

Market Making as a Balancing Problem

At every moment, a market maker must balance:

(1) **Profit motive**: capturing the spread,

(2) **Risk management**: limiting inventory exposure,

(3) **Execution quality**: avoiding adverse selection and toxic flow.

Because of these competing objectives, market makers do not quote symmetrically around the mid-price. They modify quotes based on inventory, volatility, order flow, and time horizon.

The Fundamental P&L Equation

A market maker's P&L can be summarized as:

$$\text{P\&L} = \text{Spread Capture} - \text{Inventory Loss}.$$

Spread Capture

Profit earned through buying at the bid and selling at the ask.

Inventory Loss (or Gain)

Profit or loss from holding a position while prices fluctuate. Inventory P&L often dominates spread P&L, especially during volatile periods.

Why Volatility Matters

Holding inventory is riskier when:

- volatility σ is high,
- the position size q is large,
- the time horizon $T - t$ is long.

This relationship appears explicitly in quantitative models (e.g., in the reservation price formula of Avellaneda–Stoikov).

How Market Makers Blow Up

Most failures follow the same trajectory:

1. Inventory accumulates too quickly.
2. Price moves sharply and unexpectedly.
3. Losses exceed spread capture.
4. The strategy fails to reduce risk in time.

Successful market makers focus on minimizing catastrophic losses rather than maximizing short-term profit.

Summary

Market making is not about predicting prices. It is fundamentally the business of:

- providing liquidity,
- capturing small profits repeatedly,
- managing inventory risk,
- and avoiding toxic order flow.

A good market maker quotes dynamically, adjusts for inventory and volatility, and incorporates safeguards against informed trading.