

LM02 · DERIVATIVES · CFA LEVEL I

Forward Commitment & Contingent Claim Features and Instruments

The full instrument taxonomy: forwards, futures, swaps, options (call & put), credit derivatives — plus option payoffs and profit

Why This Matters

All five derivative instruments share four building blocks — **size, underlying, cash-flow schedule, agreed price**. The exam tests you on (1) which category each instrument falls in, (2) the **option payoff/profit formulas**, (3) the **swap vs forward vs option** profit comparisons, and (4) the full intuition of long vs short in each.

Learning Outcome Statements

- LOS a** Define forward contracts, futures contracts, swaps, options (calls & puts), and credit derivatives; compare their basic characteristics
- LOS b** Determine the value at expiration and profit from a long or short position in a call or put option
- LOS c** Contrast forward commitments with contingent claims

Exam Tip: Four formulas you must have memorized before exam day: call payoff = $\text{Max}(0, S_T - X)$, put payoff = $\text{Max}(0, X - S_T)$, call BEP = $X + c_0$, put BEP = $X - p_0$.

LOS A · FORWARD CONTRACT

Forward Contract

Forward — an **OTC** obligation for one party to buy and another to sell an underlying asset at a specific price at a specific time in the future.

Four common elements of *all* commitments

- 1 Specific contract **size**
- 2 Specific **underlying**
- 3 One or more **exchanges of cash flow / underlyings** on specific dates
- 4 An agreed-on **price** (the forward price, $F_0(T)$)

Payoff at Expiration

$$\text{Long forward} = S_T - F_0(T) \quad | \quad \text{Short forward} = F_0(T) - S_T$$

S_T	spot price of underlying at expiration T	$F_0(T)$	forward price agreed at initiation	T	time to expiration (settlement date)
-------	---	----------	---------------------------------------	-----	---

If $S_T > F_0(T)$:

Buyer gains $S_T - F_0(T)$

Seller loses $-(S_T - F_0(T))$

If $S_T < F_0(T)$:

Buyer loses $F_0(T) - S_T$

Seller gains $-(F_0(T) - S_T)$

Forward profit/payoff is a **linear function of S_T** ; the forward is a **zero-sum game**. Forwards may be **physically settled** or **cash-settled**.

LOS A · FUTURES CONTRACT

Futures Contract — the Standardized Exchange-Traded Forward

Futures are exchange-traded forwards → **standardized** sizes, dates, underlyings. Futures price $F_0(T) = S_0e^{rT}$ (continuous compounding) or $S_0(1+r)^T$ (discrete).

- 1 **Daily settlement** (mark-to-market, MTM) — buyer's gains pulled from seller's account and added to buyer's account at close of each trading day.
- 2 **Clearinghouse is counterparty to all contracts.**
- 3 **Initial margin** posted by each side; **maintenance margin** is a level below initial margin; if account falls below maintenance, a **margin call** restores to initial margin (*variation margin*). If call not met, contract is closed (forced liquidation).
- 4 As volatility ↑, exchanges usually **increase initial margin** requirements.
- 5 **Price limits** / circuit breakers — upper limit = "limit up", lower limit = "limit down"; only trades at better prices can occur.

WORKED EXAMPLE

GC Gold Futures — Margin Mechanics

GIVEN

GC contract — 100 oz of gold. $F_0(T) = 1,792.13$. Initial margin = 4,950. *Maintenance margin* = 4,450.

DAY-BY-DAY MECHANICS

Day 1 close: $f_1(T) = 1,797.13$ (price ↑ $5/oz \times 100oz = +500$ to buyer, -500 to seller)

- Buyer margin: $4,950 + 500 = 5,450$
- Seller margin: $4,950 - 500 = 4,450$ → triggers margin call (at threshold). Seller posts \$500 variation margin → back to 4,950.

Day 2 close: $f_2(T) = 1,787.13$ (price ↓ $10/oz \rightarrow -1,000$ to buyer, $+1,000$ to seller)

- Buyer margin: $5,450 - 1,000 = 4,450$ → margin call → top up \$500 → 4,950.
- Seller margin: $4,950 + 1,000 = 5,950$.

TAKEAWAY

The clearinghouse guarantees performance to both sides. Futures have the *same linear payoff profile as forwards*, and can also be physically or cash settled.

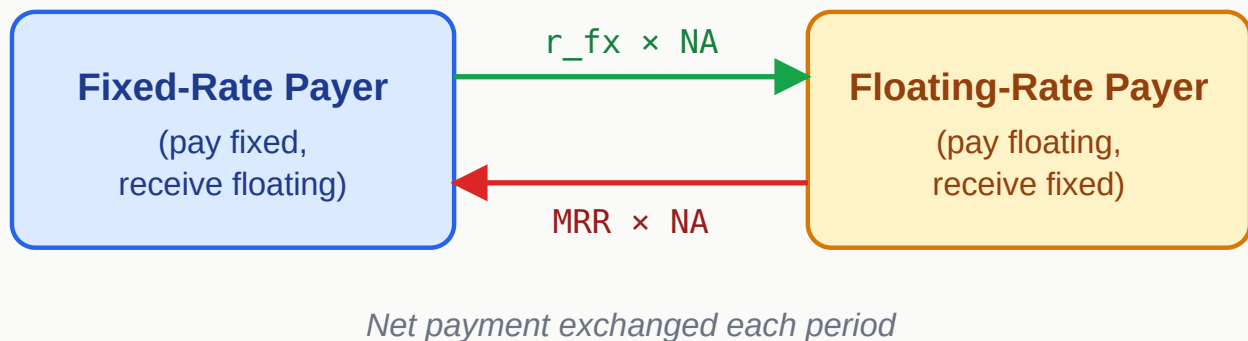
LOS A · SWAP

Swap

A **swap** is an OTC contract in which two counterparties agree to **exchange a series of cash flows** in the future:

- 1 One leg is **floating** — tied to a short-term **market reference rate** that resets each period.
- 2 The other is **fixed** or tied to a different asset or rate.

Interest Rate Swap — "Plain Vanilla" (fixed-for-floating)



Tenor	e.g., 5 years, annual resets
Fixed rate	Also called the swap rate
Floating rate	$MRR_1, MRR_2, \dots, MRR_5$ — known at start of each period, paid at end
Payments	Netted each period — only the difference changes hands
Notional	Used to size payments; not exchanged in rate swaps (but <i>is</i> exchanged in currency swaps)
Day 0	Floating leg = 100 (par); the fixed (swap) rate is the coupon that makes a par bond given the term structure of interest rates

Duration intuition. Pay floating, receive fixed = short a floating-rate bond (low D) + long a fixed-rate bond (high D) → net positive duration. So *receive-fixed* swaps **add duration**; *pay-fixed* swaps **reduce**

duration.

Exam Tip: Swap contracts may or may not include collateral; increasingly they are centrally cleared through a CCP.

QUIZ 1 · COMMITMENTS CHECKPOINT

Forwards, Futures & Swaps

Q1. The payoff to a **long forward** at expiration is:

Q2. In the gold futures example ($F_0(T) = 1,792.13$, initial margin = 4,950, *maintenance* = 4,450), after a day-1 close at 1,797.13 and a day-2 close at 1,787.13, the **seller** will most likely:

Q3. In a **plain-vanilla interest rate swap**, the party that *receives fixed and pays floating*:

Q4. Which statement about the notional amount in a **plain-vanilla interest rate swap** is *most accurate*?

Q5. As market volatility rises, exchanges typically:

LOS A · OPTIONS

Contingent Claims — Options

Contingent claims trade both OTC and ETD; **options** are the most common. The **buyer (long)** has the *right* to determine if delivery takes place; the **seller (short, writer)** has the obligation if the buyer exercises.

Call Right to **buy** the underlying at strike X

Put Right to **sell** the underlying at strike X

European Exercise **at maturity only** (typically OTC)

American Exercise **any time** before maturity (typically ETD)

Premium Paid by buyer to seller at inception (c_0 for calls, p_0 for puts)

WORKED EXAMPLE

Call Option — Exercise Decision

GIVEN

$c_0 = 5$ at $t = 0$; strike $X = 30$.

TWO SCENARIOS

At $S_T = 40$ (ITM): Buyer exercises. Value of call = $S_T - X = 40 - 30 = 10$. Buyer profit = $V_T - c_0 = 10 - 5 = +5$. Seller loses 5: $c_0 - V_T = 5 - 10 = -5$.

At $S_T = 25$ (OTM): Buyer does not exercise. Value of call = 0. Buyer profit = $0 - 5 = -5$. Seller gains 5: $5 - 0 = +5$.

TAKEAWAY

Options are a **zero-sum game** — no wealth is created, only transferred.

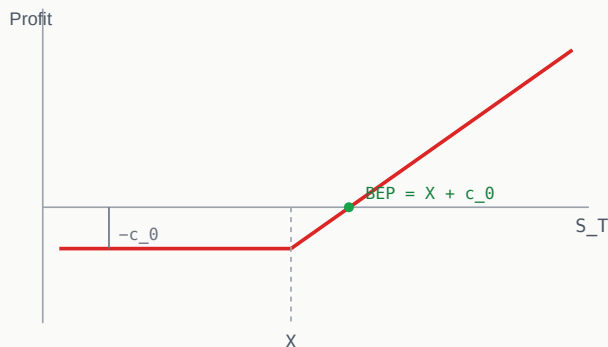
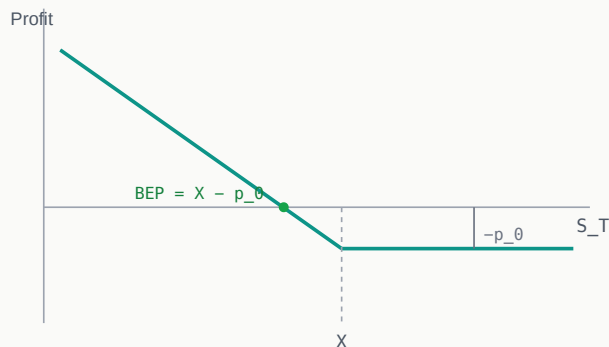
LOS B · OPTION VALUE & PROFIT

Option Payoff & Profit — the Four Positions

POSITION	PAYOFF AT EXPIRATION	PROFIT	MAX GAIN	MAX LOSS	BREAK-EVEN
Long Call	$c_T = \text{Max}(0, S_T - X)$	$\text{Max}(0, S_T - X) - c_0$	Unlimited	c_0	$X + c_0$
Short Call	$-\text{Max}(0, S_T - X)$	$\Pi = -\text{Max}(0, S_T - X) + c_0$	c_0	Unlimited	$X + c_0$
Long Put	$p_T = \text{Max}(0, X - S_T)$	$\Pi = \text{Max}(0, X - S_T) - p_0$	$X - p_0$	p_0	$X - p_0$
Short Put	$-\text{Max}(0, X - S_T)$	$\Pi = -\text{Max}(0, X - S_T) + p_0$	p_0	$X - p_0$	$X - p_0$

Memorize:

- Long call: unlimited gain, loss capped at premium
- Short call: gain capped at premium, **unlimited loss**
- Long put: gain capped at $X - p_0$, loss capped at premium
- Short put: gain capped at premium, loss capped at $X - p_0$

Long Call Profit**Long Put Profit**

Exam Tip: The **long side has counterparty risk** — the seller either owes nothing or something. The seller's performance depends on collateral / clearing. A long call can lose at most c_0 ; a short call has *unlimited* downside.

LOS A · MONEYNESS

Moneyiness, Intrinsic Value, Time Value

IV (call)	$\text{Max}(0, S - X)$ — positive when $S > X$ (ITM)
IV (put)	$\text{Max}(0, X - S)$ — positive when $X > S$ (ITM)
TV	Option price – IV; $\text{TV} \geq 0$; TV grows with time to expiration
At expiration	$\text{TV} = 0 \rightarrow c_T = \text{IV only}; p_T = \text{IV only}$

S VS X	CALL	PUT
$S > X$	ITM — IV > 0	OTM — IV = 0
$S = X$	ATM — TV only	ATM — TV only
$S < X$	OTM — IV = 0	ITM — IV > 0

Option price before expiration = **IV** + **TV**. Longer time to maturity → higher TV component.

Direction of benefit

Long call — benefits when $S \uparrow$

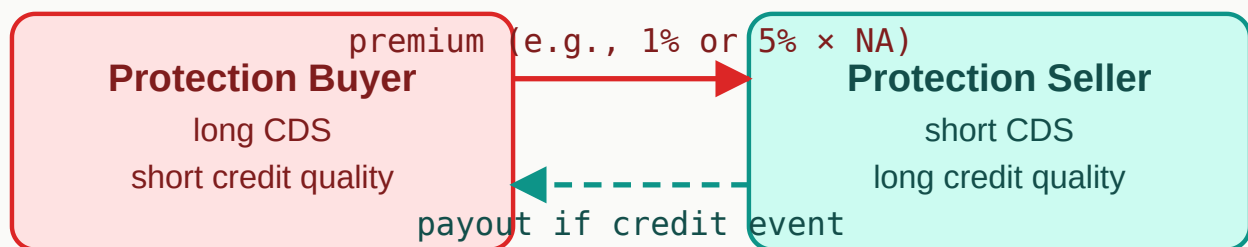
Long put — benefits when $S \downarrow$

LOS A · CREDIT

Credit Derivatives — CDS

Credit derivatives are based on the default risk of an issuer or group of issuers. The most common is the **Credit Default Swap (CDS)** — a **contingent claim**.

IG bonds	CDS spread $\approx 1\%$
HY bonds	CDS spread $\approx 5\%$
Reference entities	Corporate, sovereign, index of HY or IG, SPV
Premium timing	Typically paid quarterly (e.g., $25 \text{ bps} \times \text{NA}$)



Buyer stops paying after a credit event

What happens on a credit event

- 1 Once a default occurs (**credit event**), the **buyer stops paying premiums**.
- 2 The **seller covers buyer's losses** on the bond (or equivalent cash amount).
- 3 CDS **gains value as the credit spread widens** — the buyer's position appreciates when credit quality deteriorates.

Uses of CDS: **hedge** existing credit risk, or take a **directional view on credit spreads**.

QUIZ 2 · OPTIONS & CDS

Option Payoffs — Numeric Drill

Q6. A long call has $c_0 = 5$ and $X = 30$. At $S_T = 40$, the buyer's **profit** is:

Q7. The break-even price for a **long put** with $X = 50$ and $p_0 = 3$ is:

Q8. The **maximum loss** for the writer of an uncovered (naked) call is:

Q9. A call on a stock trading at $S = 45$ has strike $X = 40$ and sells for \$7. The intrinsic and time values are:

Q10. The CDS protection **buyer**:

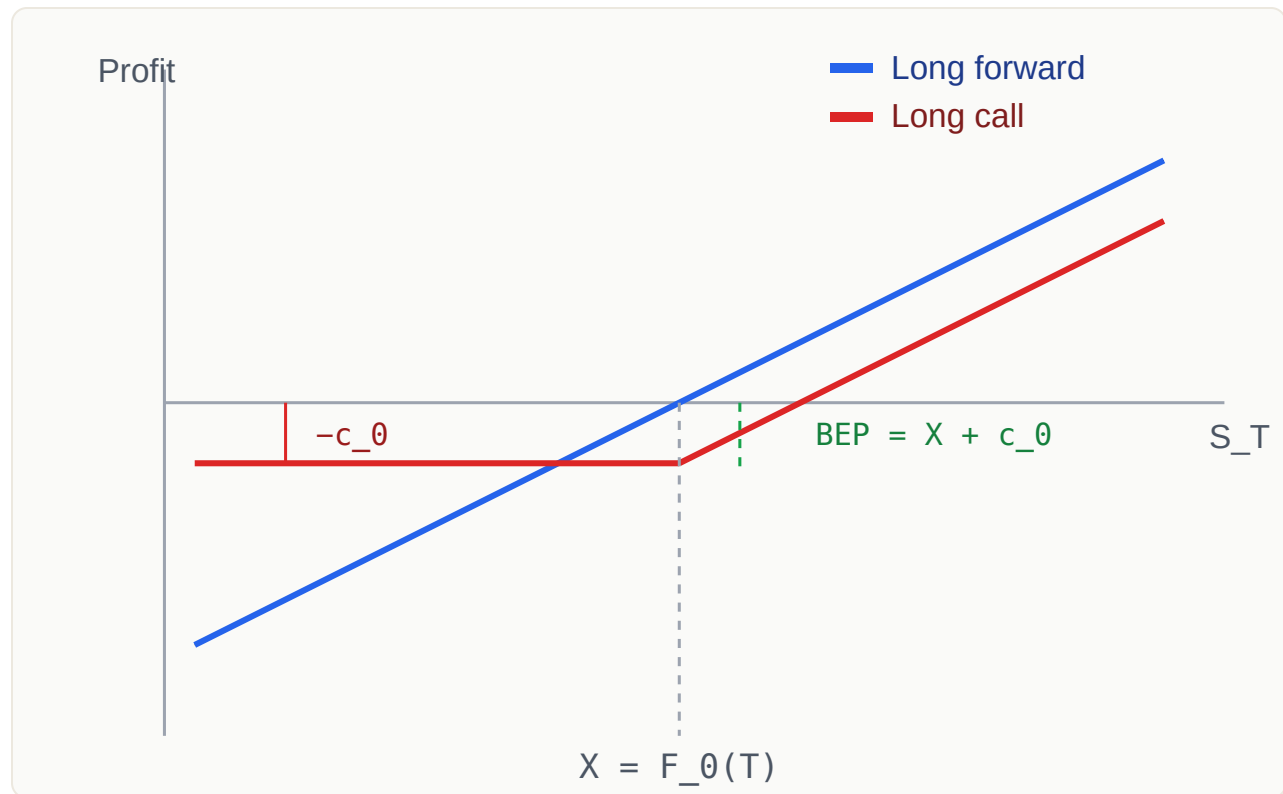
LOS C · CONTRAST

Forward Commitment vs Contingent Claim — the Profit Charts

Long forward vs long call

Both benefit when $S_T \uparrow$, but:

- 1 **Below X** ($S_T < X$): long call profit = $-c_0$ (capped loss). Forward profit = $S_T - F_0(T)$ (can be very negative).
- 2 **Indifference point**: where forward profit = option profit. Above this, forward outperforms option by c_0 . Below it, option outperforms.



Long forward vs short put

Both have upside, but the **short put has capped upside** = p_0 . Above $S_T = X$, the forward outperforms; below, the short put's loss profile mirrors the forward's (plus the premium pad).

FEATURE	FORWARD COMMITMENT	CONTINGENT CLAIM
Obligation	Both parties obligated	Buyer has right, seller has obligation

Payoff shape	Linear (unlimited up & down)	Kinked (Max of 0 and something)
Up-front payment	None (price set to make $V_0 = 0$)	Buyer pays premium at $t = 0$
Credit risk	Bilateral (both sides owe potentially)	Only long has credit risk on short
Examples	Forward, future, swap	Option, CDS

Exam Tip: A common exam framing: "which instrument allows the holder to benefit from a price rise while limiting downside?" The answer is *long call* — the hallmark of a contingent claim.

QUIZ 3 · INTEGRATION

Integration Questions

Q11. An investor wants to benefit if $S_T > X$ but limit her downside to a known amount at inception. Which position is *most appropriate*?

Q12. Which statement is *most accurate* about a forward vs a long call, both on the same underlying, when S_T is well above $F_0(T)$?

Q13. American options are *most likely* to be:

Q14. Long a CDS on an HY bond (spread $\approx 5\%$) is most similar to:

Q15. For a call on a stock at $S = 100$, $X = 95$, priced at \$8, which values are correct?

MODULE COMPLETE

Your Scorecard

0 / 15

LM02 Key Takeaways — Exam-Ready Cheat Sheet

Forward Commitments

- 1 **Forward** (OTC): payoff $S_T - F_0(T)$ for long; linear, zero-sum.
- 2 **Future** (ETD): standardized; margin; daily MTM; clearinghouse counterparty; price limits.
- 3 **Swap** (OTC, often cleared): exchange series of cash flows; netted each period; notional NOT exchanged in IRS (IS exchanged in currency swap). Receive-fixed adds duration.

Contingent Claims

- 4 **Call payoff**: $\text{Max}(0, S_T - X)$; **Put payoff**: $\text{Max}(0, X - S_T)$.
- 5 Long call: unlimited gain, loss = c_0 , BEP = $X + c_0$.
Short call: gain = c_0 , loss unlimited, BEP = $X + c_0$.
Long put: gain = $X - p_0$, loss = p_0 , BEP = $X - p_0$.
Short put: gain = p_0 , loss = $X - p_0$, BEP = $X - p_0$.
- 6 Price = IV + TV. At expiration TV = 0.
- 7 European = at expiry; American = anytime. Long side has counterparty risk.

CDS

- 8 Protection buyer = long CDS = short credit quality; pays premium (often 25 bps/qtr $\times$ NA). On credit event, buyer receives payoff and stops paying.

- 9 IG CDS spread $\approx 1\%$; HY CDS spread $\approx 5\%$. Used to hedge or take directional views on spreads.

Last-Minute Checklist

Forward payoff: $S_T - F_0(T)$, linear · **Call:** $\text{Max}(0, S - X)$ · **Put:** $\text{Max}(0, X - S)$

BEPS: call $X + c_0$; put $X - p_0$ · **Unlimited loss:** short call only

Commitment vs claim: forward/future/swap vs option/CDS · **Zero-sum:** all of them

Swap duration: rec-fixed adds D ; pay-fixed reduces D