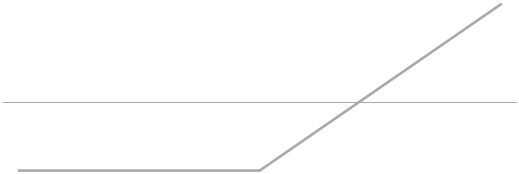
Introduction to Derivatives

Lecture 1

https://fatih.ai/sjtu/derivatives/



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Outline

Risk exposure and derivative contracts

Jet fuel price exposure

Consider a domestic airline that must purchase jet fuel in twelve months.

- Required quantity: **100,000 tonnes**.
- Current price: **¥6,000 per tonne**.
- Future purchase price: uncertain.

A change of ¥1,500 per tonne changes annual fuel cost by **¥150 million**.

> QUESTION — Can the firm reduce exposure to the future fuel price without changing the physical purchase of fuel?

Possible responses to fuel-price risk

The airline expects to buy the fuel next year. It can respond to the price uncertainty in several ways:

- **Remain unhedged**
  - no immediate action or upfront cost;
  - fuel cost remains exposed to next year's market price.
- **Buy and store fuel today**
  - fixes the input price through physical inventory;
  - requires storage capacity, financing, insurance, and working capital.
- **Reduce or pass through the exposure**
  - lowers the quantity at risk or shifts part of the cost to customers;
  - changes operations, demand, or competitive position.

> Risk-management objective — Keep the planned fuel purchase, but change how the firm's cash flows respond to the future fuel price.

Derivative contracts

Definition. A derivative is a contract whose value depends on an **underlying variable**, such as a commodity price, exchange rate, interest rate, equity price, or index.

In the fuel example, the underlying is the future jet-fuel price. The immediate purpose is **hedging**: changing the firm's exposure to that price while keeping the planned fuel purchase.

business exposure	underlying variable	derivative cash flow
needs fuel later	future fuel price S_T	depends on S_T

A derivative is linked to a specified variable; it does not remove the underlying business need.

Underlying variables

A derivative must specify the variable whose future value will determine the contract's value.

- **Commodity price:** jet fuel, crude oil, copper, soybeans.
- **Exchange rate:** RMB/USD, EUR/USD, USD/JPY.
- **Interest rate:** a money-market rate or bond yield.
- **Equity or index:** a stock price, CSI 300, S&P 500.
- **Other variables:** volatility, weather, credit spreads.

First identify the variable that creates the risk; then choose the contract written on that variable.

Derivative contracts: forwards and futures

Forwards and futures are contracts that replace an uncertain future price with an agreed pricing rule.

- **Forwards and futures**
  - today, choose a future date T, quantity Q, and contract price K;
  - at T, compare the market price S_T with K;
  - the contract then transfers fuel or cash according to the agreed price rule.

If $K = ¥6{,}300$ and $S_T = ¥7{,}800$, a long fuel hedge gains $¥1{,}500$ per tonne, offsetting the higher spot fuel cost.

- **Forward**: private OTC contract, usually customized.
- **Futures**: exchange-traded contract with standard terms and clearing rules.

The firm fixes a future pricing rule today, not its physical fuel consumption today.

Derivative contracts: options and swaps

The same underlying price can also be managed with contracts that give a choice or repeat the settlement over time.

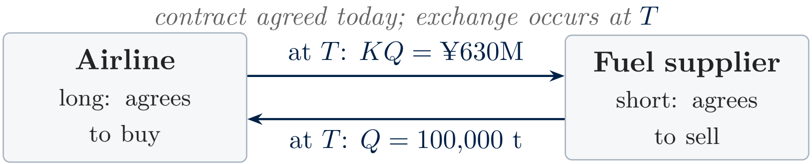
- **Options**
  - the buyer pays a premium for a right, not an obligation;
  - a call gives the right to buy; a put gives the right to sell;
  - the upfront premium pays for this one-sided protection.
- **Swaps**
  - settle repeatedly over several future dates, not just once;
  - typical idea: exchange fixed-price cash flows for floating-market cash flows;
  - useful when the exposure repeats, such as monthly fuel purchases or interest payments.

Options add flexibility; swaps repeat forward-style settlements across many dates.

The forward contract

A forward fixes the terms of a future transaction today.

In twelve months, the airline buys $Q = 100{,}000$ tonnes at $K = ¥6{,}300$ per tonne.



- K is the **delivery price**, fixed today and paid at maturity T.
- The **long** position agrees to buy; the **short** position agrees to sell.
- Both parties are obligated at T: a forward is not an option.
- A forward is usually an **over-the-counter** contract, with terms agreed bilaterally.

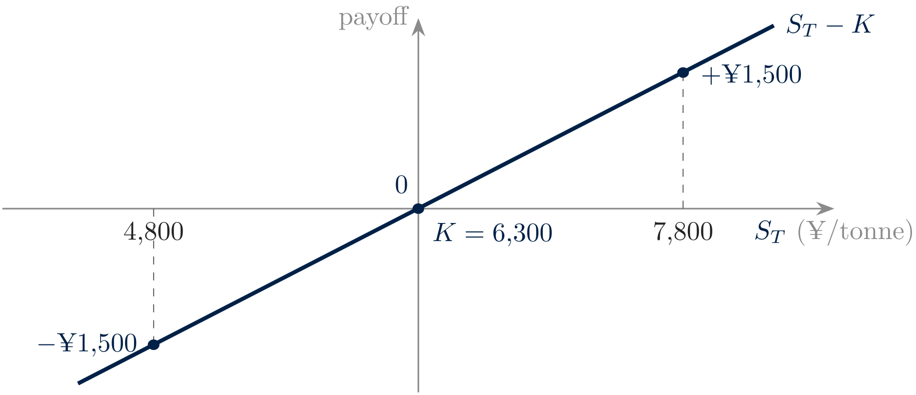
Payoff of the long forward at maturity

At maturity, compare the market price S_T with the delivery price $K = ¥6{,}300$. For the airline's long position, the payoff per tonne is $S_T - K$.

S_T	long position	payoff $S_T - K$
¥4,800	buying at K is above market	$-¥1{,}500$
¥6,300	buying at K equals market	¥0
¥7,800	buying at K is below market	$+¥1{,}500$

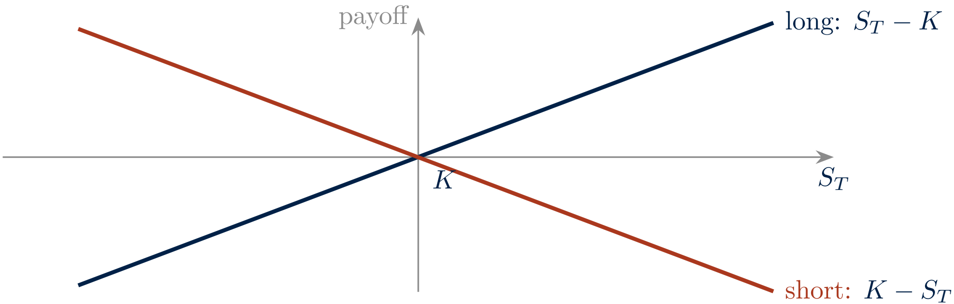
The payoff increases one-for-one with the future market price.

Long forward payoff diagram



- The payoff is zero when the market price equals the delivery price: $S_T = K$.
- If $S_T > K$, the long buys below market and the contract has positive value.
- If $S_T < K$, the long is obligated to buy above market and the payoff is negative.

Short forward payoff



- The short side agrees to sell at K; its payoff is $K - S_T$.
- The short payoff is the negative of the long payoff: $(S_T - K) + (K - S_T) = 0$.
- A zero-sum payoff at maturity can still serve both sides if they are hedging opposite business exposures.

The forward transfers price risk between the long and the short.

Hedged fuel cost in yuan

The airline hedges the full planned purchase: $Q = 100{,}000$ tonnes and $K = ¥6{,}300$ per tonne.

S_T	spot fuel cost QS_T	forward payoff $Q(S_T - K)$	**net cost**
¥4,800	¥480M	−¥150M	**¥630M**
¥6,300	¥630M	¥0M	**¥630M**
¥7,800	¥780M	+¥150M	**¥630M**

$$\text{net cost} = QS_T - Q(S_T - K) = QK = ¥630\text{M}.$$

A full forward hedge fixes the net cost, not the market price.

Evaluating a hedge after the outcome

Suppose the spot price at maturity is $S_T = ¥4{,}800$. The hedged airline pays ¥630M net; an unhedged airline would pay ¥480M.

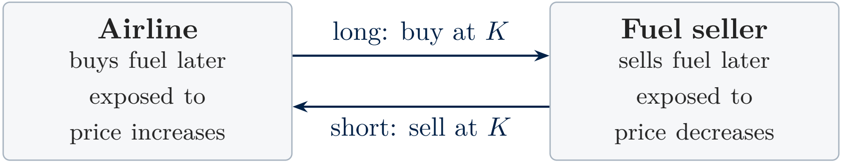
This does not mean the hedge was a mistake.

- The decision was made before S_T was known.
- The hedge removed exposure to price increases and also gave up the benefit of price decreases.
- The relevant question is whether ¥630M was an acceptable fixed cost when the contract was chosen.

Evaluate a hedge by the exposure it removes, not by the price that happens to occur.

Who takes the short side?

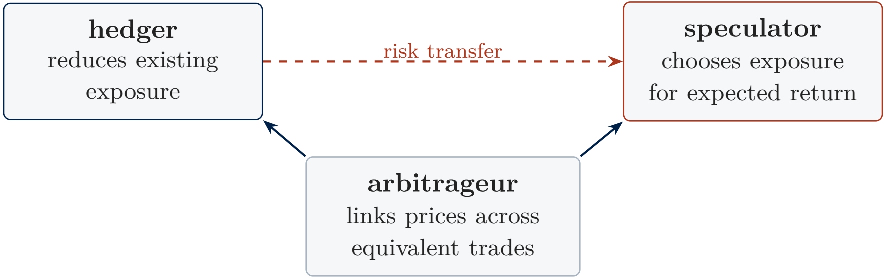
The other side of the forward is not necessarily a speculator. It may be a firm with the opposite operating exposure.



- The airline hedges an input cost by taking the long position.
- The fuel seller hedges future revenue by taking the short position.
- A dealer or trader may intermediate when natural hedgers do not match exactly.

Market participants

The same derivative contract can serve different roles. The role depends on why the position is taken.



These are roles in a transaction, not permanent identities. The same institution can hedge one exposure, speculate in another, and arbitrage a price discrepancy elsewhere.

Counterparty credit risk

Suppose fuel rises to $S_T = ¥9{,}000$. The airline's long forward is now valuable:

$$Q(S_T - K) = 100{,}000 \times (¥9{,}000 - ¥6{,}300) = ¥270\text{M}.$$

- If the short counterparty defaults, the airline must replace the hedge at the new market price.
- The credit exposure is largest when the hedge is most valuable.
- This is **counterparty credit risk**.

An OTC forward transfers price risk but creates counterparty credit exposure.

Why futures markets are needed

A private forward solves one problem but leaves two market-design problems.

- **Trading problem:** a customised bilateral contract is hard to transfer or close with a new trader.
- **Credit problem:** a large gain for one side can become a large unpaid obligation for the other side.

Futures markets respond with standard contract terms, exchange trading, clearing, and daily settlement. This lecture gives the first idea; Topic 2 builds the full margin and clearing system.

Futures are forwards redesigned so positions can be traded and credit risk can be managed by market rules.

Two market structures

Derivatives trade in two broad structures. The choice is a trade-off between customisation and market liquidity.

Over the counter (OTC)	Exchange-traded
contract terms negotiated bilaterally	standardised contract specifications
private pricing and documentation	transparent exchange prices
counterparty credit managed by the two parties	clearing house and margin reduce default risk
useful for tailored exposures	useful for liquidity and anonymous trading

Examples: Shanghai Futures Exchange (SHFE), Dalian Commodity Exchange (DCE), Zhengzhou Commodity Exchange (ZCE), Shanghai International Energy Exchange (INE), and China Financial Futures Exchange (CFFEX).

Use OTC when exact terms matter more; use exchange trading when liquidity, clearing, and transferability matter more.

How OTC market size is measured

OTC market statistics are usually a **stock of live contracts** at a reporting date, not a record of trades during a day or month.

measure	meaning
outstanding position	a deal already signed and not yet settled, expired, or terminated
trading volume	new trades executed during a period; this is a flow, not a stock
notional amount	reference amount used to scale payments; for the airline forward, $QK = ¥630\text{M}$
market value	current replacement value; about $¥0$ at initiation, later depends on price changes

Before reading a market-size number, identify what is being counted.

Size of the OTC derivatives market

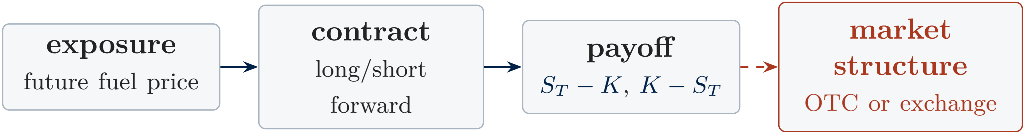
BIS statistics for end-June 2025 report outstanding OTC dealer positions:

$846tn	**notional outstanding** sum of reference amounts of live OTC deals
$21.8tn	**gross market value** sum of positive and negative replacement values before netting

- These are **outstanding positions**, not trading volume.
- The data cover interest-rate, foreign-exchange, equity, commodity, credit, and other OTC derivatives.
- The figures show market scale, not the amount that would be lost in a default.

Source: BIS OTC derivatives statistics, end-June 2025.

Where we are



We have connected business exposure, contract payoffs, and market structure.

Next: how futures exchanges make standardised contracts tradable.

Futures market design

Why futures exchanges emerged

Bilateral forwards solve price-risk problems, but they are difficult to trade, monitor, and enforce when counterparties do not know each other.

- **Dōjima rice market, Osaka (1730):** organised trading in standardised rice contracts.
- **Chicago Board of Trade (founded 1848):** organised grain trading around common grades, quantities, and delivery terms.
- **Modern Chinese futures exchanges:** Zhengzhou, Dalian, Shanghai, INE, and CFFEX apply the same market-design principles.

Standardisation makes contracts comparable, transferable, and easier to enforce.

Futures as standardized forwards

	forward	**futures**
terms	tailored, any size/date	standardised by the exchange
traded	privately (OTC)	on an exchange, anonymous
settlement	once, at maturity	daily mark-to-market settlement
credit risk	your counterparty	the exchange's clearing house
exit	negotiated or held to maturity	offset, roll, or delivery

- The payoff logic is similar; the institutional design is different.
- Standard terms make positions easier to trade and offset.
- Daily settlement and margin reduce counterparty credit exposure.

A futures contract is a forward adapted for exchange trading.

Why daily settlement matters

Daily settlement means the exchange calculates gains and losses each trading day instead of waiting until maturity.

Forward	**Futures**
gain or loss can build up until T	each day's gain or loss is settled today
losing party may owe a large unpaid amount at maturity	losing party pays cash as prices move
default risk can become large before anyone pays	unpaid exposure is reset repeatedly

$$\text{one large settlement at } T \quad \longrightarrow \quad \text{many smaller daily settlements.}$$

Futures reduce unpaid credit exposure by turning price changes into daily cash flows.

Variation margin and daily settlement

Consider a long position in one crude-oil futures lot: 1,000 barrels entered at ¥560 per barrel. Each day the exchange settles the price move.

day	settle price	daily price move ×1,000	cash flow to long
1	¥553.00	−¥7,000	−¥7,000
2	¥567.00	+¥14,000	+¥14,000
3	¥563.50	−¥3,500	−¥3,500

Cumulative cash flow: $+¥3{,}500 = (563.50 - 560.00) \times 1{,}000$.

Daily settlement prevents large unpaid gains and losses from accumulating until maturity.

← Crude Oil futures and options

View an Energy Product

Crude Oil

Futures and Options

GLOBEX CODE	LAST	CHANGE	VOLUME
CLQ6	76.54	+0.69 (+0.91%)	86,466

TRADING SIMULATOR

WATCHLISTS

Last Updated 20 Jun 2026 07:14:49 AM CT. Market data is delayed by at least 10 minutes

OVERVIEW QUOTES SETTLEMENTS VOLUME & OI SPECS MARGINS CALENDAR

FUTURES OPTIONS

CRUDE OIL FUTURES - SETTLEMENTS

TRADE DATE Thursday, 18 Jun 2026

Last Updated 18 Jun 2026 11:55:00 PM CT

ESTIMATED VOLUME TOTALS 796,893 **PRIOR DAY OPEN INTEREST TOTALS** 1,972,153

MONTH	OPEN	HIGH	LOW	LAST	CHANGE	SETTLE	EST. VOLUME	PRIOR DAY OI
JUL 26	75.53	76.99	73.58	76.56B	-.19	76.60	97,813	52,709
AUG 26	74.88	76.06	72.83	75.52B	-.16	75.85	288,801	273,365
SEP 26	74.17	75.28	72.19	74.69B	-.05	75.11	138,892	194,778
OCT 26	73.30	74.33	71.48	73.73B	-.04	74.17	63,691	109,464
NOV 26	72.80	73.46	70.85	72.89B	-.05	73.30	35,344	69,401
DEC 26	71.87	72.68	70.23	72.17	-.08	72.49	64,582	220,589
JAN 27	71.50	71.95B	69.71	71.52A	-.12	71.79	19,523	72,053
FEB 27	70.86	71.32	69.27A	70.92B	-.15	71.19	8,667	45,172
MAR 27	70.43	70.84B	68.91	70.43B	-.20	70.69	11,431	55,144
APR 27	70.05	70.43	68.63	70.09A	-.24	70.28	5,421	44,851

Reading a futures quote

An exchange quote gives the fields needed to track price movement, daily settlement, trading activity, and positions still open.

open	high	low	**settle**	volume	open interest
552.0	561.3	549.8	**558.6**	182,346	96,510

field	meaning	why it matters
open, high, low	first, highest, and lowest traded prices during the session	rough intraday price movement
settle	official exchange price used for daily mark-to-market	drives daily cash settlement
volume	number of contracts traded during the session	trading activity today
open interest	contracts still open after trading	exposure carried forward

Volume is activity during the session; open interest is the stock of live positions after the session.

Volume and open interest

The two quote fields measure different things.

Volume	**Open interest**
trading activity during the session	live contracts remaining after trades
a **flow**: how much changed hands today	a **stock**: how many positions are still open
can rise every time the same contract is traded again	changes only when contracts are created or closed

Volume is today's trading activity; open interest is outstanding exposure after trading.

How open interest changes

For each trade, volume rises by one contract. Open interest depends on whether the two sides are opening or closing positions.

two sides of the trade	volume	open interest	interpretation
both open new positions	$+1$	$+1$	new contract created
one opens, one closes	$+1$	0	contract changes owner
both close existing positions	$+1$	-1	contract disappears

Every trade adds to volume; only creation or closure changes open interest.

Most futures positions are offset

A futures hedge usually manages **price exposure**. The firm often buys or sells the physical commodity through its normal suppliers.

starting position	offsetting trade	result
long futures: agreed exposure to buy	sell the same futures contract	futures position closed
short futures: agreed exposure to sell	buy the same futures contract	futures position closed

- The offset removes future exposure in that contract.
- Daily margin gains or losses already paid remain in cash.
- If the position is not offset before expiry, delivery rules can become binding.

Most users close the futures position financially before delivery, but delivery terms still matter near expiry.

WTI May 2020: delivery pressure

The May 2020 WTI crude-oil futures contract was close to expiry on 20 April 2020. The contract was **physically deliverable** at Cushing, Oklahoma.

if a long position is held into delivery	the holder must be ready to receive oil at the delivery location
normal use of futures	close or roll the position before delivery
April 2020 pressure	demand collapsed and storage space was scarce

Near expiry, a futures position can become a delivery problem, not just a price exposure.

A negative settlement price

$$\text{WTI May-2020 settle:} \quad -\$37.63 \text{ per barrel}$$

The price was negative because the contract bundled oil with an urgent delivery obligation.

$$\text{value of accepting delivery} \approx \text{oil value} - \text{storage and logistics burden.}$$

- Some long holders did not want, or could not store, physical oil.
- To exit, they had to sell the expiring futures position.
- Buyers required compensation for taking over the delivery problem.

Negative price did not mean oil had no use; it meant accepting delivery at that time and place was costly.

Lessons from the negative price

The episode separates three ideas students often mix together.

lesson	practical meaning
contract $\neq$ commodity	the futures price reflects delivery location, timing, quality, storage, and financing
offset and roll dates matter	a trader who waits too long may face delivery pressure, not just price risk
market design affects prices	standardised contracts are tradable, but their delivery rules can bind near expiry

Before trading a futures contract, know what happens if you are still holding it at expiry.

Forward pricing and no-arbitrage

From mechanics to pricing

The WTI case showed that contract terms affect what a futures price means. Pricing asks the next question: what fair forward price F_0 can be agreed **today** without creating an arbitrage?

mechanics question	**pricing question**
who gains or loses when S_T changes?	what F_0 is consistent with S_0 and carrying costs?

F_0 is the fair delivery price set today; S_T is the unknown future spot price. In the simplest case with financing cost r and no storage or income:

$$F_0 = S_0(1 + r)^T.$$

If a quoted contract price K is far above or below F_0, traders compare:

$$\text{buy now and carry to } T \quad \text{vs.} \quad \text{buy at } T \text{ through a forward.}$$

We price the contract from today's spot price and carrying costs, without knowing S_T.

The law of one price

To price a forward, compare two strategies that deliver the **same** asset at the **same** future date.

Route 1: buy and carry	**Route 2: forward**
buy gold today at S_0	enter forward today
finance and hold it until T	pay F_0 at T
result at T: own one gram of gold	result at T: own one gram of gold

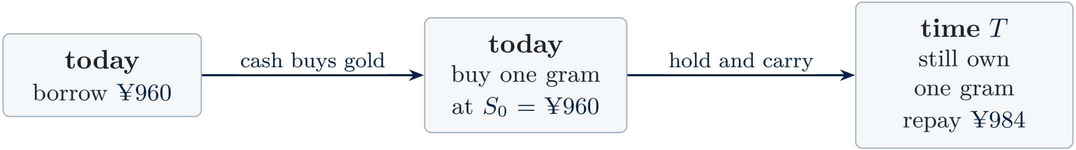
Same future result means the costs must be consistent:

$$F_0 = \text{future value of buying and carrying the asset today.}$$

If two routes deliver the same asset at T, a large price gap creates arbitrage.

Route 1: own the gold

Suppose $S_0 = ¥960$ per gram and the one-year interest rate is $r = 2.5\%$. To own one gram at T, buy it now and finance the purchase.



Financing turns today's spot cost into a cost at T:

$$S_0(1+r)^T \; = \; 960 \times (1.025)^1 \; = \; ¥984.$$

Buying now gives the gold at T, but the effective T-cost includes financing.

Route 2: forward purchase of gold

A forward gives the same gold at T, but the purchase price is agreed today and paid at maturity.

today
enter one-year forward
no gold changes hands

$\xrightarrow{\text{contract fixes } F_0}$

time T
pay F_0
receive one gram

same final asset as Route 1

Because both routes deliver one gram at T, the forward price must match the financed spot cost:

$$\boxed{F_0 \;=\; S_0(1+r)^T \;=\; ¥984}$$

The fair forward price is the T-cost of buying and carrying the gold today.

Quoted forward too high: $K = ¥1{,}000$

The quoted forward price is above the no-arbitrage price ¥984. The arbitrage is to buy the asset now and sell it forward.

action	today	at T
borrow ¥960	+960	−984
buy and store one gram	−960	deliver gram
short forward at ¥1,000	0	+1,000
net	**0**	**+¥16**

The terminal gold price never appears in the table. This is a **cash-and-carry arbitrage**.

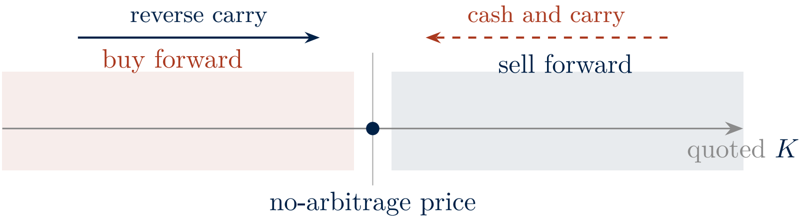
Quoted forward too low: $K = ¥970$

The quoted forward price is below the no-arbitrage price ¥984. The arbitrage is to sell the asset now and buy it forward.

action	today	at T
short one gram of gold	+960	return one gram
invest ¥960 at 2.5%	−960	+984
long forward at ¥970	0	−970, receive gram
net	**0**	**+¥14**

This is **reverse cash-and-carry arbitrage**. It pins the forward price from below.

Arbitrage pressure pins the price



The no-arbitrage price is the level at which neither route is clearly cheaper. Away from that level, arbitrageurs choose the cheap route and sell the expensive route:

- high quoted K: buy gold now, sell forward;
- low quoted K: sell or short gold now, buy forward.

Arbitrage does not predict S_T; it pushes inconsistent prices back toward the carry-based price.

What we assumed

We derived

$$F_0 = S_0(1+r)^T$$

for a clean asset: gold held for one year with financing cost and no other complications.

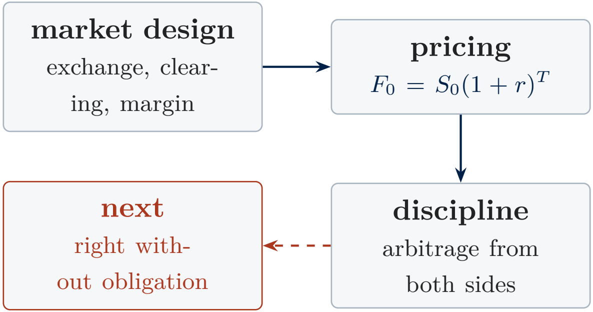
assumption	why it matters
storage negligible	no extra cost from holding the asset
no interim income	no dividend, coupon, lease income, or convenience yield
easy financing and shorting	arbitrage trades can actually be executed

In real commodity markets, the same no-arbitrage logic remains, but the carry term must be adjusted:

$$\begin{aligned} F_0 = {} & \text{future value of buying spot} + \text{carrying costs} \\ & - \text{benefits from holding the asset.} \end{aligned}$$

The formula changes with carrying costs, but the no-arbitrage method does not.

Where we are



We have priced an obligation to trade later.

Next: options, where only one side is obligated.

Options, leverage, and control

From obligation to choice

A forward solves one problem and creates another: it protects against high fuel prices, but it also removes the benefit of low fuel prices.

contract type	legal position	basic idea
forward or futures	obligation	both sides must trade or settle according to the contract
option	right, not obligation	the buyer chooses whether to use the contract

- A **call option** gives the right to buy at strike price K.
- A **put option** gives the right to sell at strike price K.
- Because the buyer receives choice, the buyer pays an upfront premium.

Why the option has a premium

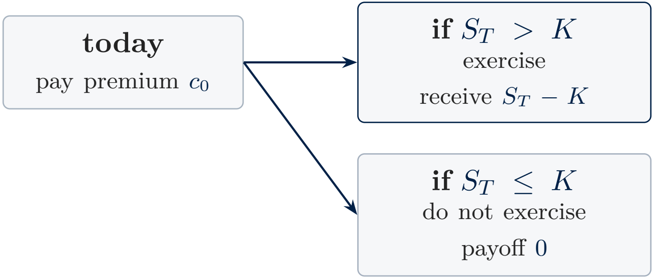
For the airline's fuel exposure, the relevant example is a **call option**: the right to buy fuel at strike $K = ¥6{,}300$. The airline decides after S_T is known.

future fuel price	airline's decision	economic effect
$S_T > K$	exercise the call	buy at K, avoiding the higher market price
$S_T \leq K$	do not exercise	ignore the option and buy at the lower market price

- The option pays off only in the unfavourable high-price state.
- In the favourable low-price state, the airline keeps the benefit.
- The upfront premium is the price of this asymmetry.

Call option: definition

A **call option** gives its buyer the right, but not the obligation, to buy the underlying at strike K at maturity T.



$$\text{call payoff at maturity} = \max(S_T - K, 0)$$

The premium is the price of one-sided protection.

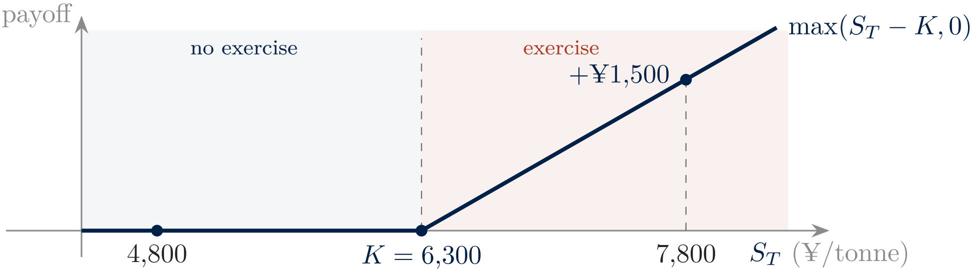
Call payoff at maturity

Let $K = ¥6{,}300$, per tonne.

S_T	exercise decision	payoff $\max(S_T - K, 0)$
¥4,800	do not exercise	¥0
¥6,300	indifferent	¥0
¥7,800	exercise	+¥1,500

The option pays only when the market price is above the strike. Below the strike, the buyer lets the contract expire.

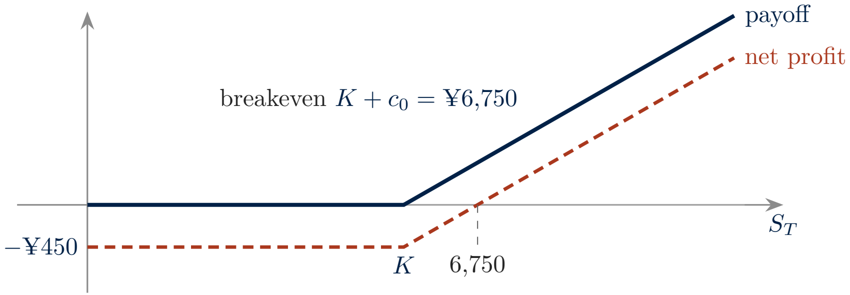
Call payoff diagram



The payoff is flat below K and rises one-for-one above K. That kink is the economic value of optionality.

Payoff and net profit

Suppose the premium is $c_0 = ¥450$ per tonne. Ignoring interest on the premium for now, net profit is $\max(S_T - K, 0) - c_0$.



Exercise is decided by payoff at maturity. Profit also subtracts the premium already paid.

Put option: definition and use

A **put option** gives its buyer the right, but not the obligation, to sell the underlying at strike K.

$$\text{put payoff at maturity} = \max(K - S_T, 0).$$

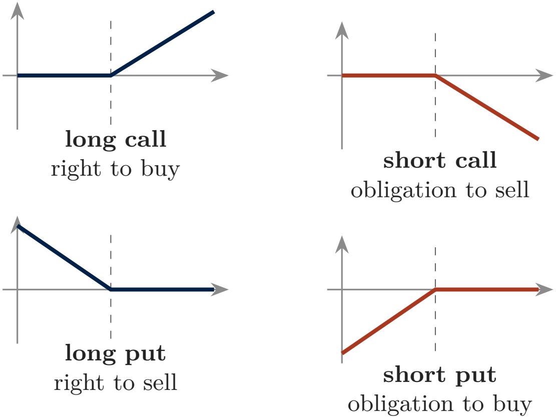
buyer of fuel
exposed to rising prices
natural option: call

$\xrightarrow{\text{start from exposure}}$

seller of fuel
exposed to falling prices
natural option: put

The instrument follows the exposure: a buyer worries about prices rising; a seller worries about prices falling.

Four option positions



Long option positions buy rights. Short option positions sell rights and accept obligations.

Calculating the policy costs

The decision table uses the same fuel quantity and three possible future prices:

$$Q = 100{,}000, \qquad S_T \in \{¥4{,}800, ¥6{,}300, ¥7{,}800\}.$$

Forward and call terms:

$$K = ¥6{,}300, \qquad \text{call premium} = ¥450 \text{ per tonne} \Rightarrow Q \times 450 = ¥45\text{M}.$$

policy	cost formula
no hedge	QS_T
forward	QK
call option	$Q \min(S_T, K) + ¥45\text{M}$

The call uses the lower of the market price and the strike, then adds the premium.

Risk-management choices for Skyline

Skyline needs 100,000 tonnes. Compare no hedge, a forward at ¥6,300, and a call with $K =$ ¥6,300 and premium ¥450 per tonne.

S_T	unhedged	forward	call, premium included
¥4,800	¥480M	¥630M	¥525M
¥6,300	¥630M	¥630M	¥675M
¥7,800	¥780M	¥630M	¥675M
exposure	full price risk	fixed cost	capped high price

Read the table by columns. Each column is a different risk-management policy, not a forecast of which outcome will occur.

Choosing the hedge

unhedged
lowest cost
if prices fall
full exposure
if prices rise

forward
budget certainty
gives up low-
price benefit

call
cap on high prices
premium paid
for flexibility

The correct policy depends on cash-flow tolerance, debt covenants, competitive pressure, and the cost of the premium.

— *A hedge is judged against the risk objective, not against the best outcome after the fact.* —

Forwards, futures, and options

	forward / futures	**option**
legal position	obligation for both sides	right for buyer; duty for writer
typical cash flow today	no premium	premium paid by buyer
payoff shape	straight line	kinked at strike K
risk-management use	lock in a price	cap one side of risk

Futures improve the market design of forwards. Options change the economic exposure by replacing an obligation with a right.

Leverage: same view, larger percentage swings

A share trades at ¥50. With ¥10,000, compare buying 200 shares with buying 4,000 call options at ¥2.50 each, strike ¥55.

terminal share price	200 shares		4,000 calls	
¥65	+¥3,000	+30%	+¥30,000	+300%
¥45	−¥1,000	−10%	−¥10,000	−100%

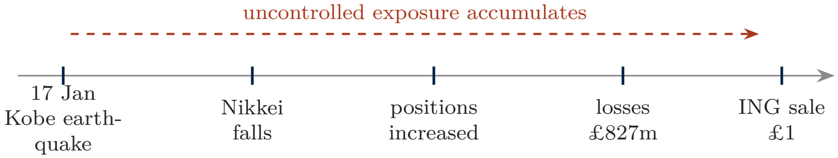
Options concentrate exposure into the premium. That is useful for some hedges, but it also makes speculative losses arrive quickly.

Barings, 1995: role drift

Nick Leeson's mandate at Barings' Singapore desk was arbitrage: exploit small price differences between Nikkei 225 futures in Singapore and Osaka.

The problem was not that futures existed. The problem was an arbitrage mandate becoming directional speculation without effective control.

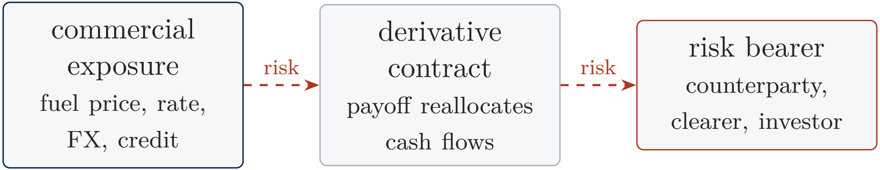
Barings, 1995: control failure becomes loss



Leeson both took positions and influenced how they were reported. Barings failed because trading risk, settlement, and reporting were not separated strongly enough.

Central lesson

Derivatives **redistribute** risk. They do not eliminate it.



The design question is whether the risk moves to someone with capital, information, and controls, or to someone merely willing to take it.

We have seen the idea: futures redesign forwards for exchange trading.

How does the clearing and margin system actually enforce it?

Lecture 2: central counterparties, margin accounts, margin calls, forced liquidation, and default resources.

— *Next step: the full clearing and margin mechanism.* —