Equity Delta One Derivatives Fundamentals

Fair Value of Equity Forwards

The fair value of an equity forward can be calculated by adding the **interest cost** and **subtracting** the **received dividends:**

$$FV_{equity\ fwd} = spot\ price + spot\ price\ * i\ * \frac{days}{basis} - dividends$$

$$FV_{equity\ fwd} = spot\ price * \left(1 + i * \frac{days}{basis}\right) - dividends$$

For dividends to be included in the calculation the ex-div date **must fall** between the **transaction date** and the **forward date**

In the above formula the **future value of all included dividends** at the **forward date should be used**

Please note: The formula shown only applies for forwards with a forward date up to 12 months

Fair Value of Equity Forwards

Spot price of the asset:	100
12-month interest rate:	5%
12-month future value of dividends:	6
12-month fair forward price:	99

Forward vs. Futures

Forwards

OTC: Contracts and their **terms** are bilaterally agreed between the **counterparties**

- Offers greater flexibility
- Requires valuation model

Futures

Exchange traded: Terms of futures contract (underlying, contract size, expiry date, settlement procedure etc) are set by the **futures exchange**

- Liquidity often superior
- Positions can be valued using the available central market price
- Exchanges provide data on volume and open interest

Volume vs Open Interest

Volume

Measures the **trading activity** in a **specific futures contract** on the trading day

It is reset daily to **start from 0 at the open**

Open Interest (OI)

Shows the number of **outstanding futures contracts** held by **market participants** (usually at end of day basis)

Only includes **positions** that have **not yet been closed** or **settled** and is therefore an **indicator for the risk** held by **participants** via these contracts

Assume that a new that a new futures contract was launched today

As no trading has occurred, volume and open interest are 0

Trade	Buyer		Exchange		Seller	Total Volume	OI
First trade:	Trader A	← 100 contracts	Exchange	← 100 contracts	Trader B	100	100
Second trade:	Trader B	← 50 contracts	Exchange	← 50 contracts	Trader C	150	100
Third trade:	Trader C	← 50 contracts	Exchange	← 50 contracts	Trader A	200	50

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CME E-Mini S&P 500 Futures

Contract Specifications:

Product code:	ES
Contract size:	$50 x S&P 500 index
Tick size:	0.25 index points
Tick value:	$12.50
Contract months:	Contracts listed for 21 consecutive quarters in the cycle Mar, Jun, Sep, Dec
Expiry:	3rd Friday of the contract month, trading terminates 9:30 AM ET that day
Settlement:	Cash

Contract example[1]:

Contract code:	ESZ3
Expiry:	15 Dec 2023
Last price:	4565.75
Contract value:	$228,287.50
Open interest:	2,195,765 contracts

Assume you **bought 100 ESZ3 contracts** at the last price and are able to **sell it 10 index points higher.** Ignoring transaction costs, **what is your profit?**

Data as of 22/11/2023. Source: CME

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Hedging with Equity Index Futures

Equity index futures are frequently used to **hedge equity portfolios**

For example: long positions in stocks are hedged with **short positions** in **equity index futures**

Basic hedge

A basic hedge is based on the relation between the **value of the equity portfolio** that should be hedged and **the value of the relevant futures contract:**

$$\text{Hedge Ratio} = \frac{\text{Value of equity portfolio}}{\text{Futures contract size}}$$

Example

An investor is looking to hedge their long position in S&P 500 companies with a current market value of 100M USD

The front month e-mini futures contract trades at 4,565.75

$$\text{Hedge Ratio} = \frac{\$100{,}000{,}000.00}{\$228{,}287.50} = \text{438.04 Contracts}$$

Hedging with Equity Index Futures

Beta Adjusted Hedge

The basic hedge assumes a perfect correlation between the **cash equity position** and the **equity futures contract**

In case of a beta adjusted hedge, the **individual risk** of the **cash equity portfolio** is considered **using the portfolio beta**

The portfolio beta is measured by **comparing the returns** of the **cash equity portfolio** with the **underlying index** and it indicates the **relative volatility** of the **portfolio compared to the index:**

Beta = 1	The cash portfolio will move in line with the broader market
Beta = 2	The cash portfolio moves in the same direction but twice as much as the broader market
Beta = 0.5	The cash portfolio moves in the same direction but only half as much as the broader market

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Hedging with Equity Index Futures

Example:

An investor is looking to hedge their long position in S&P **500 companies** with a **current market value of 100M USD**

The front month e-mini futures contract trades at 4,565.75

The portfolio beta is 1.2

As the portfolio is 20% more volatile than the index, the investor would need **1.2 times** the **basic hedging amount:**

$$\text{Beta adjusted hedge ratio} = \frac{\$100{,}000{,}000.00}{\$228{,}287.50} * 1.2 = 525.65 \text{ Contracts}$$

Hedging with Equity Index Futures

Advantages

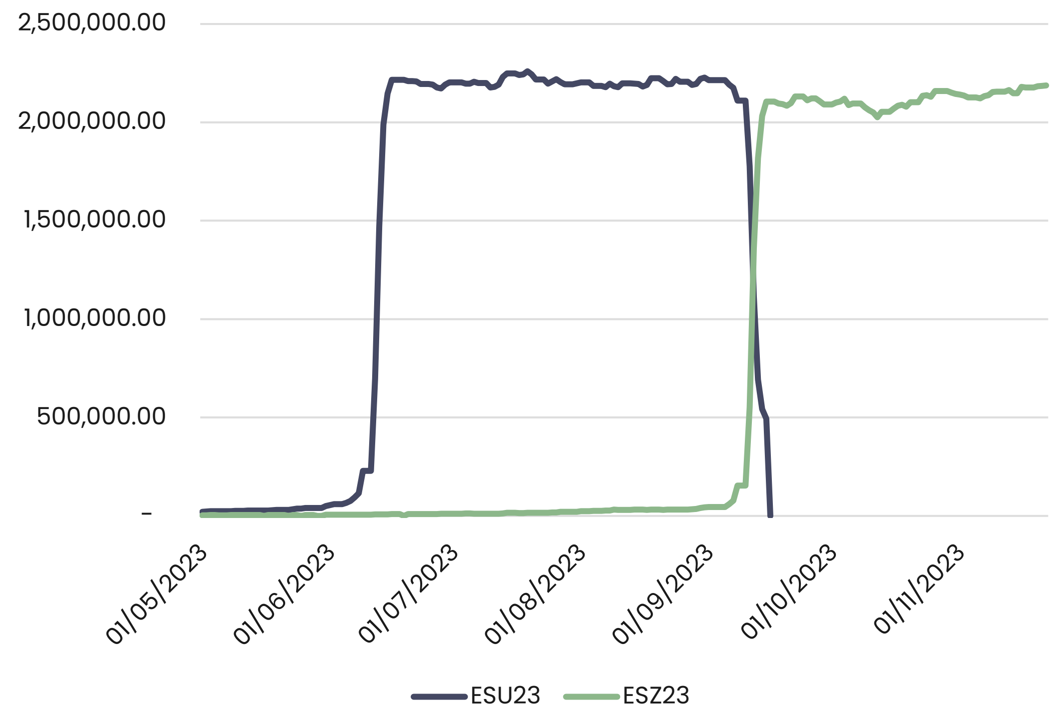
- High liquidity in index futures
  - Narrow bid/offer spreads
  - Deep markets
- Market transparency
- Practically zero counterparty risk due to central clearing
- Significant leverage

Considerations

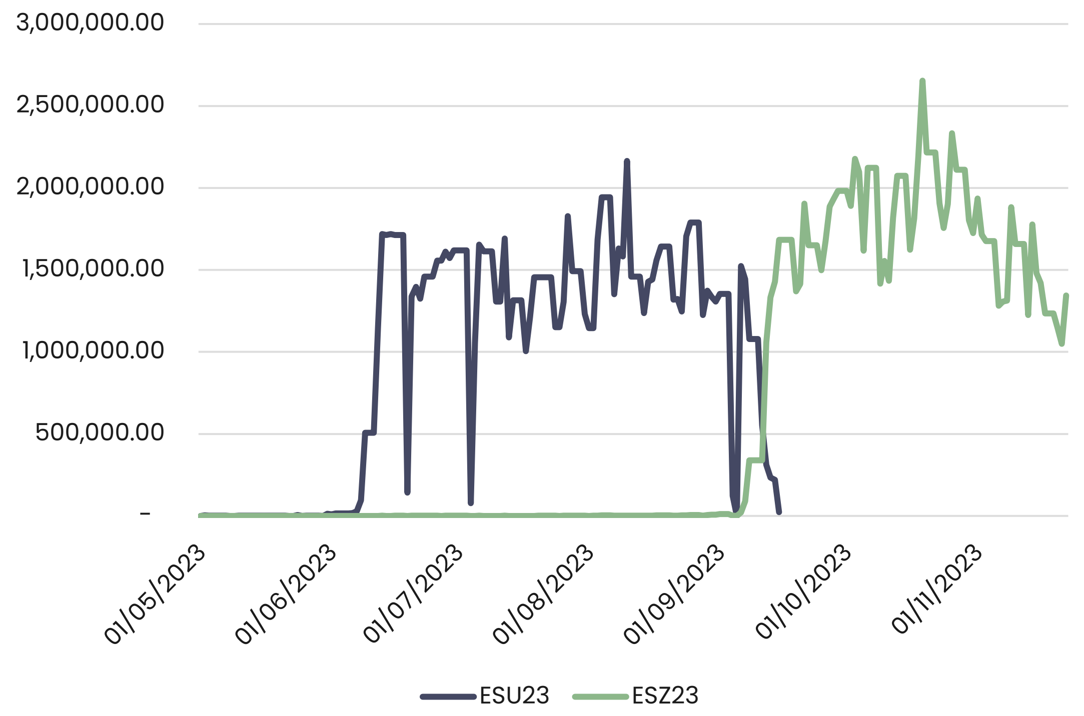
- Portfolio constituents vs. index constituents, stability of beta
- Interest rate and dividend exposure
- Basis and roll risk

CME E-Mini S&P 500 Futures Liquidity

Open Interest



Daily Trading Volume



Source: Infront

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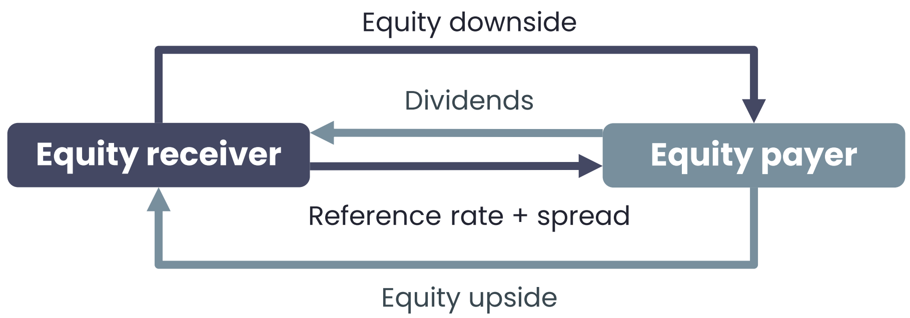
Equity Swaps

An equity swap is an agreement between the two counterparties to swap the returns on an equity index, custom equity basket, or single stock for an interest rate (RFR or IBOR +/- spread). The two counterparties are referred to as equity payer (pays equity returns) and equity receiver (receives equity returns)

Key equity swap determinants:



Notional

The notional amount on which interest rate payments and equity returns are calculated

Tenor

The time to maturity of the swap

Please note: equity swaps usually include the mutual right of early termination

Return type

Total return (price and dividends) vs. price return

Ref. rate & spread

The reference rate is the agreed upon benchmark interest rate that is used to determine payments on the floating leg

Reset frequency

Frequency of payments of accumulated obligations and reset of reference rate

Margin reset

Initial margin may be static or reset as the trade notional changes

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Variable vs. Fixed Notional

Variable notional

Notional amount is adjusted at each reset by price performance of underlying

Simulates a position of fixed number of shares

Index level at trade inception: 2,605.00

Time:	Period notional:	Index level:	Index performance:	1M rate:	Total (rec.):
1M	$100,000,000.00	2,666.50	2.3608%	1.8870%	$2,203,594.53
2M	$102,360,844.53	2,721.32	2.0559%	1.9093%	$1,941,549.95
3M	$104,465,259.12	2,716.54	-0.1757%	1.9803%	-$355,887.08
4M	$104,281,765.83	2,818.82	3.7651%	2.0921%	$3,744,489.02
5M	$108,208,061.42	2,897.52	2.7919%	2.0815%	$2,833,417.34
6M	$111,229,174.66	2,913.98	0.5681%	2.0758%	$439,453.87

Total over term: $10,806,617.64

Fixed notional

Notional amount remains unchanged over life of the swap

Simulates a position with fixed value of equity investment: cash investor would buy/sell shares to maintain level of initial investment

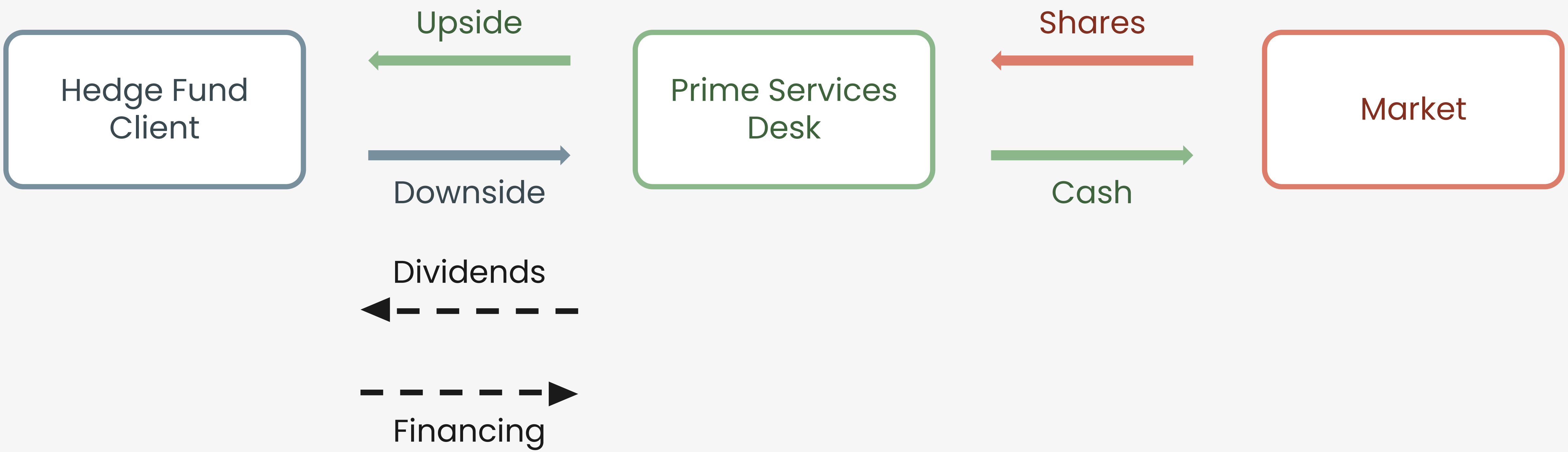
Index level at trade inception: 2,605.00

Time:	Period notional:	Index level:	Index performance:	1M rate:	Total (rec.):
1M	$100,000,000.00	2,666.50	2.3608%	1.8870%	$2,203,594.53
2M	$100,000,000.00	2,721.32	2.0559%	1.9093%	$1,896,770.16
3M	$100,000,000.00	2,716.54	-0.1757%	1.9803%	-$340,675.05
4M	$100,000,000.00	2,818.82	3.7651%	2.0921%	$3,590,741.86
5M	$100,000,000.00	2,897.52	2.7919%	2.0815%	$2,618,490.07
6M	$100,000,000.00	2,913.98	0.5681%	2.0758%	$395,088.67

Total over term: $10,364,010.24

Long Equity Swap – Cash Flows

Client will receive the total performance (moves up and dividends paid) of the equity.
Bank trader will hedge client trade by buying shares in the market



Long Equity Swap – Financing

Financing charge will be a function of the interest rate paid (reference rates plus a spread) and the reset period or the length of time the swap is open. Broker commission is also paid to the Bank

Hedge Fund Client

Opening Trade
BUY 750,000 shares SMT LN @ 832.73p

Notional swap position
(750k * £8.3273) £6,245,475

Prime Services Desk

Financing charge
SONIA + 40bp

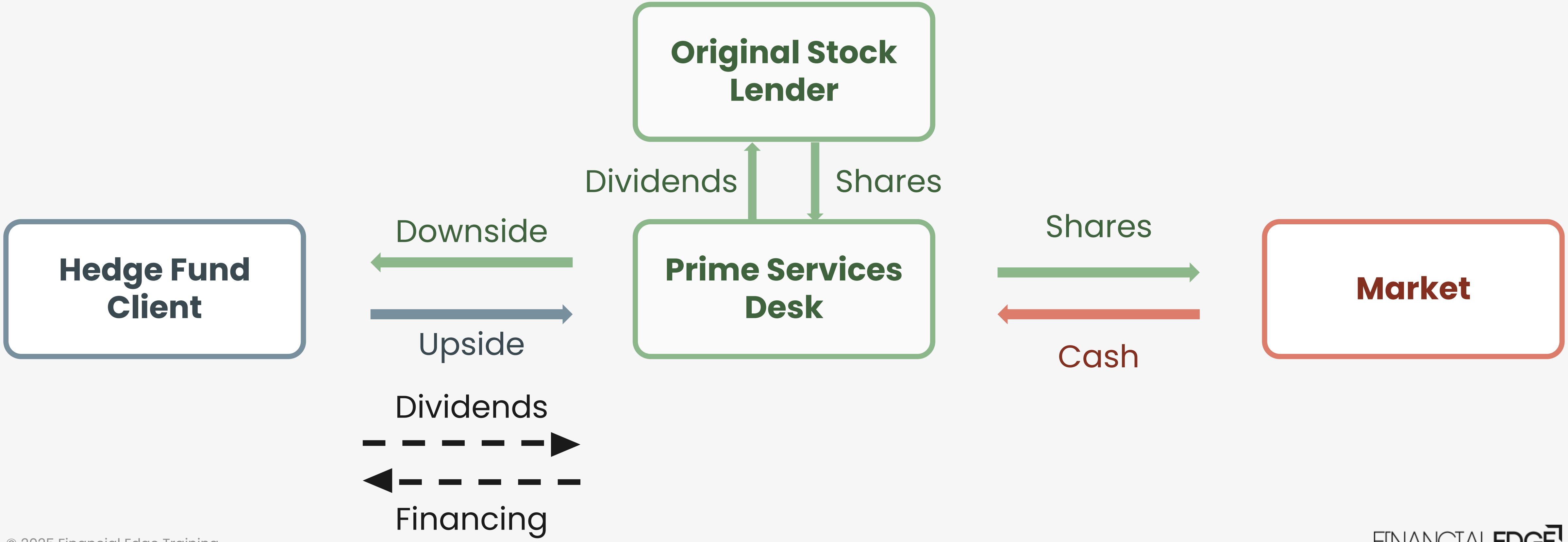
Financing Fee

Closing trade 22 days later
SONIA compounded at 5.1% over the life of the swap

£6,245,475 * 5.5% * 22/360
= £20,992

Short Equity Swap – Cash Flows

The client will pay the total performance (moves up and dividends paid) of the equity.
Bank traders will hedge client trade by selling shares in the market. Shares sold short will have been borrowed from stable institutional investor for a fee



Short Equity Swap – Financing

Financing charge will be a function of the interest rate paid (reference rates less a spread) and the reset period or length of time the swap is open. Broker commission is also paid to the Bank

Hedge Fund Client	Opening Trade **SHORT 750,000 shares SMT LN @ 832.73p**	Notional swap position (750k * £8.3273) £6,245,475
Prime Services Desk	Financing charge (*credit to hedge fund*) SONIA less 60bp	Spread includes 20bp stock loan fee
Financing Fee	Closing trade 22 days later SONIA compounded at 5.1% over the life of the swap	£6,245,475 * 4.5% * 22/360 **= £17,175**

Equity Swap Valuation

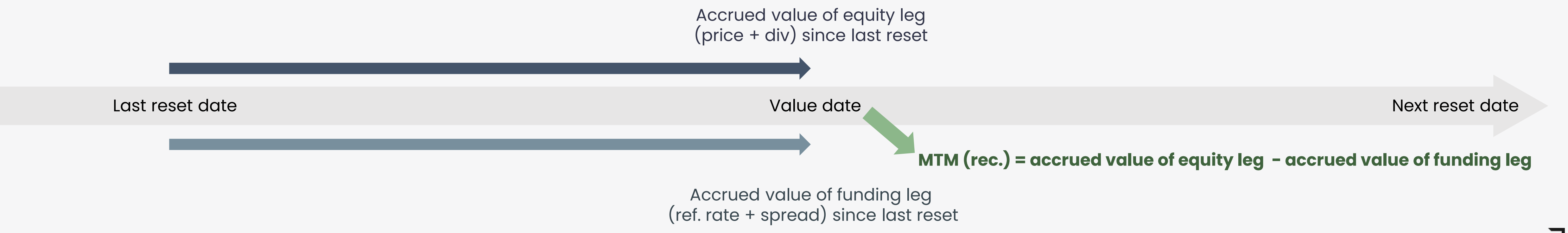
In many cases equity swaps are hedged with a position in the underlying equity

Equity swaps are therefore generally marked-to-market using the accrual method:

Each day the performance of the underlying equity position (price moves and/or dividends) is accrued to the equity leg and one day of accrued interest is added to the financing leg

The sum of the two legs is the current value of the equity swap

This is rather unique as other derivatives use the NPV approach. However, users of equity swaps see swaps as cash equivalent positions and hedgers mainly use cash positions to hedge – so this purely backward-looking approach is actually advantageous for all involved parties



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Equity Swaps – Pros and Cons

Advantages	Disadvantages
Leverage. The initial margin (IM) paid is less than the notional size of the position	**Financing.** The cost of financing a swap will rise as reference interest rates rise
Tax treatment. In many countries, stamp duty is paid on the purchase of ordinary shares. An equity swap is not a share, rather an agreement between parties to swap cash flows	**Lack of ownership rights.** A long position will have to be 'exchanged for physical' to be able to vote shares in EGM or AGM
	Counterparty risk. Each party to the swap bears credit exposure to the other

Equity swaps are an important instrument for hedge funds when taking equity positions. They provide synthetic exposure to the physical equity

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