BOSTON MA
CHICAGO IL
MIAMI FL
PORTLAND OR
SAN DIEGO CA
LONDON UK

DERIVATIVES: PRIMER

Timur Kaya Yontar

MEKETA INVESTMENT GROUP
100 Lowder Brook Drive, Suite 1100
Westwood, MA 02090
meketagroup.com

September 2017

EXECUTIVE SUMMARY

Derivatives are useful financial instruments that, in many cases, should be considered for inclusion in institutional portfolios. With the goal of improving understanding of derivatives, this primer will cover what they are, including the main varieties; portfolio applications of each different type; risks and implementation considerations; and the types of institutional investors whose investment needs make them most likely to utilize derivatives.

WHAT ARE DERIVATIVES?

Derivatives are financial contracts between two parties whose value is derived from that of some other "underlying" security, such as a bond or share of stock. This is in contrast with "physical" financial instruments, the value of which is based upon claims on current or future cash flows, such as interest payments or dividends.

Meketa Investment Group views derivatives as a potentially useful addition to the investment toolkit. Derivatives enable investors to gain "synthetic" exposures to various drivers of return, in many cases more cost-effectively than via physicals. Derivatives can also hedge or amplify exposures — hedge against an existing "long" exposure because they provide the effect of shorting without the complexity of actually short-selling assets, or amplify because they provide implicit leverage and can allow investors to take on exposure in excess of their assets. Therefore, depending on specific circumstances, derivatives can be an appropriate component of investors' portfolios. Despite popular perceptions of derivatives as exotic — and potentially even scary[1], they are not necessarily hard-to-understand, risky, or dangerous; the purpose of this white paper is to help demystify them.

Main varieties of derivatives, and examples thereof

While they come in several varieties, there are three major types of derivatives in use in financial markets: **forwards and futures**, **options**, and **swaps**.[2] They all have potential applications in institutional investment portfolios but are not used to the same extent. Below we define and provide examples of derivative contracts that investors A and B might enter into.

- Both forward and futures contracts are legally-binding agreements between two parties to buy and sell an asset at a price agreed upon today, but with delivery and payment occurring at some point in the future. Forward contracts are privately-arranged (a.k.a. "over the counter") between two counterparties. Futures are a special case of forwards in which the terms of the contract have been standardized, which enables them to be traded and cleared on an exchange.

[1] Derivatives are the third of the "three dirty words of investments," along with Leverage and Shorting (mnemonic: LSD).

[2] If that seems like four, not three, it's because forwards and futures are extremely closely related and considered together.

  - **Forwards:** A and B agree now that A will buy 30,000 lbs. of robusta coffee for $1.40/lb., with payment to B and delivery by B in October 2017.
  - **Futures:** A and C, where C is the "clearinghouse" or exchange, agree now that A will buy 37,500 lbs. of arabica coffee for $1.40/lb., with payment and delivery in September 2017. This differs from the forward contract because the contract size, the specific variety of the underlying, and the delivery date are standardized values traded on the exchange.[3]

- **Options** are contracts that confer upon their buyer the right, but not the obligation, to buy or sell an asset at a price agreed upon today, but with that right "exercised" at some point in the future. The option's seller has an obligation to fulfill the transaction if the buyer exercises. This is in contrast with forwards and futures, in which both sides of the transaction have obligations.
  - A and B agree now that A may buy 100 shares of Apple (AAPL) stock from B on October 20, 2017, for $160 per share, the "strike price." For this right, a "call option," A pays B a premium of $3.50 per share. If AAPL is less than $160 per share on October 20, A does not have to exercise the option – and will not do so.[4]
- **Swaps** are contracts in which the two parties agree to exchange one series of cash flows for another for a specified period of time.
  - A and B agree now that annually A will pay B the fixed interest rate of 2.5% on $1 million, and B will pay A the floating interest rate of LIBOR+1.5% on the same $1 million. In practice the parties only exchange the difference in cash flows. The $1 million size of the contract is referred to as the "notional" value; while it is used to calculate the cash flows, it never changes hands.

These building blocks can be assembled into a wide range of combinations; as they are contracts between investors, these additional types of derivatives can flexibly take on whatever features are desirable to both parties. For example, one may buy "swaptions" — options that allow the owner to enter into a swap at a later date — or "options on futures" — giving the owner the right to purchase a futures contract at a particular price at a later date.

An important concept is the difference between "over-the-counter" (or OTC) and exchange-traded.

- **OTC** are derivative contracts directly between two parties, the terms of which may be anything permissible by law. Thus, they are fully customizable or "bespoke," but that makes them less fungible and less liquid. Additionally, they expose both sides

[3] Note that C is also making an agreement with another party, B, such that B is selling the same contract, and C is merely a conduit for it to pass from B to A.

[4] While this is an over-the-counter agreement directly between two counterparties, A and B could also make the same agreement with an exchange.

to counterparty risk, which is the risk that the other party will fail to deliver on its contractual obligations to provide some payment, causing financial harm to the first party (although legal recourse is of course possible). Forwards, some options, and many swaps are OTC.

Party A buys from Party B / Party B sells to Party A

- **Exchange-traded** are derivative contracts with standardized terms such as the price, quantity, exact type of the underlying, and delivery or exercise dates. Each investor party enters into the contract with an extremely well-capitalized central clearinghouse, vastly reducing counterparty risk. Because the terms are standardized, these derivatives may be freely traded and in most cases are much more liquid and easy to "unwind" (i.e., remove or close out the exposure from the contract).[5] Futures, some options, and some swaps, including the most widely-used form of interest rate swaps, are exchange-traded. Futures are simply exchange-traded versions of forwards.

Party A buys from Party C / Party B sells to Party C

Unlike many contracts, derivative contracts have an expiration date. Investors seeking to gain or modify exposures in their portfolio with derivatives on a long-term or permanent basis will need to "roll" their positions periodically; that is, they must renew their derivatives contracts before they expire. This can become costly if an upfront premium must be paid each time the derivatives are rolled.

[5] An exception to this general rule is FX (currency) forwards, which are typically used for synthetic currency exposure rather than futures, and yet are even more liquid than FX futures.

APPLICATIONS OF DERIVATIVES

To help illustrate the potential uses for derivatives, we have set forth the most prevalent applications for the major types of derivatives in this section.

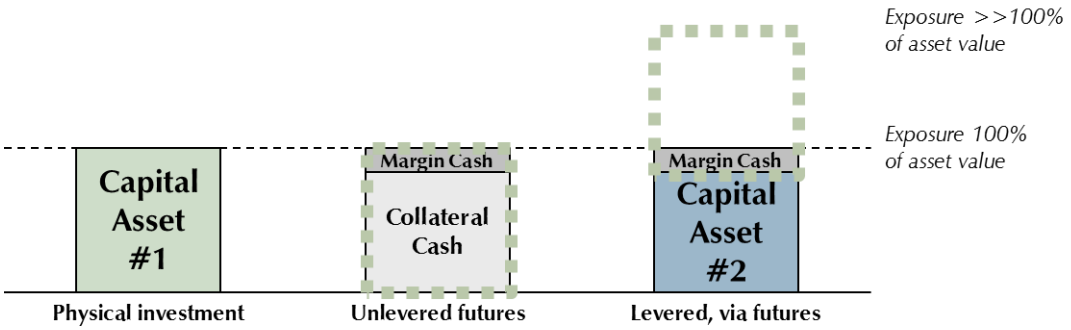
Forwards and Futures

1. **To gain synthetic exposure.** (*Futures*) Also known as an overlay or an equitization program. If investors have excess cash, but do not want to hold much in an asset class with such a low expected return, they can use a small portion of the cash (typically 5-15%) as "margin" for a futures contract, such as on an equity index.[6] Doing so gets investors the same economic exposure as the index, because the futures contract will gain or lose value in sync with the index, just as if they had invested the cash in the physical asset such as a passive equity index fund.
2. **To hedge currency.** (*Forwards*) If an investor owns an asset denominated in a foreign currency, but does not want exposure to the price fluctuation caused by that currency's variation vis-à-vis the home currency, they may enter into a forward contract in which they sell an appropriate amount of the foreign currency and buy the home currency. Doing so effectively removes the foreign currency exposure and isolates the change in fundamental value of the asset — an excellent example of the usefulness of derivatives to take economic exposures that are intertwined together in a single asset and "unbundle" them.[7]
3. **To gain exposure to commodities.** (*Futures*) Because commodities are economic inputs and have often held their value during periods of surprise inflation, they may serve as inflation hedges, and thus investors may want to gain exposure to them. However, owning the physical asset can be problematic for many reasons (e.g., being able to store thousands of barrels of oil). Since the value of commodities futures will fluctuate with that of the underlying physical, investing in such futures offers a less cumbersome way to gain the desired exposure; before taking delivery on the settlement date, the futures contracts are unwound and any gains or losses are realized. While institutional investors could directly invest in futures, typically they will have a manager run a commodities fund for them.
4. **To add leverage to a portfolio.** (*Futures*) As noted above, only a small portion of a futures contract's notional value must be held as cash margin. If no excess leverage (i.e., economic exposure greater than the amount of capital held) is desired, then the rest of the notional value should also be held as cash, and the futures contract is called "fully collateralized." That way, if the value of the contract were to crash to zero, the remaining cash could be used to settle with the clearinghouse. If, however, some of the remaining notional value is invested in an

[6] The most common such use is with equity indices, hence the term "equitization," but other asset indices for which there are futures contracts may be used instead.

[7] This can be done relatively affordably for most developed market currencies (USD, EUR, JPY, GBP, CHF, CAD, AUD), but more expensively or not at all for most emerging market currencies. Please see our Currency Hedging white paper.

asset other than cash, the economic exposure will exceed the capital, intentionally adding leverage to the portfolio, and magnifying both potential gains and losses. This is done, for example, in most risk parity portfolios, to lever up the bond exposure and increase the expected return of the whole portfolio.

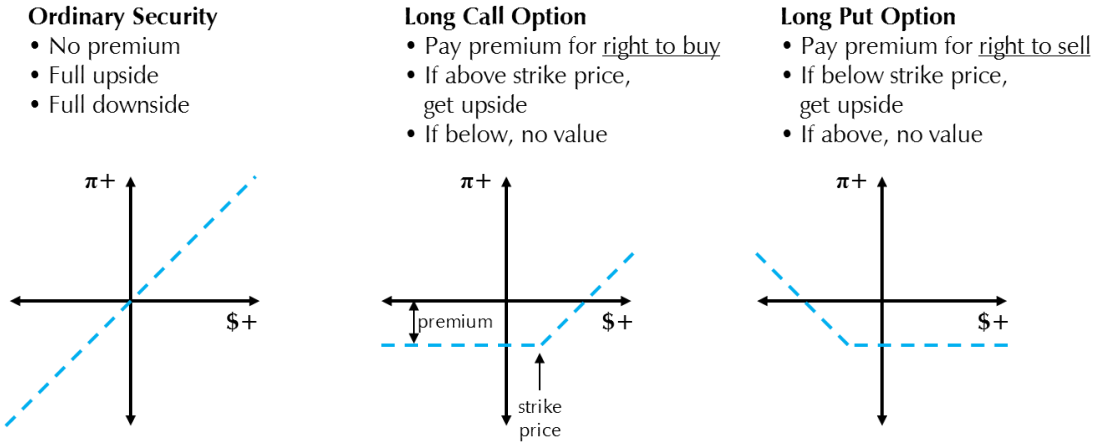


(Green dotted box is economic exposure identical to Capital Asset #1)

Options

The primary benefit of options is their asymmetric payoff. For forwards and futures, both parties to the transaction have an obligation to fulfill the contract, whereas for options, the buyer has the right but not an obligation, while the seller has the obligation (if the buyer exercises his/her right). For this asymmetric privilege, the buyer pays the seller a premium. The following graphic may help to illustrate this in practice:

How to think about Options: Asymmetric Payoffs



The horizontal axis measures the price ($) of the underlying security, the vertical axis measures the profit (π) of the position, and the dotted blue line shows the relationship between the two for a security or for an option at expiry. For an ordinary security, price and profit move in lockstep, one for one. For options, the relationship is kinked at the strike price, and profit is negative for those prices where the option expires without value but the premium cost has been paid upfront. Additional examples are shown in the Appendix.

1. **To hedge.** Hedging involves removing undesired exposures from a portfolio. This often means mitigating the downside risk of one's core holdings: if they go down, the investor wants to hold something else that will go up to offset that decline. The familiar analogy is buying insurance: one definitely pays a little (the premium), but under the right circumstances, that can eliminate the risk of losing a lot.

    a. **Long[8] puts** are the most straightforward way to hedge using options. Being long a put option confers upon the contract owner the right to sell an asset at a specified "strike" price, even if the asset trades at below that price. If an investor holds a specific underlying asset (say, a passive equity index fund), owning a long put contract provides offsetting gains if the underlying security declines below the strike price. The combination of the option with the underlying limits the downside that can be incurred. However, since options expire, they must be renewed periodically. The required premiums to do so can be costly, and tend to get most expensive when they are most needed, because demand for hedges drives their prices up.

    b. **Collars,** a combination of a long put and a short call, are sometimes also considered for hedging. Because the cost of the long put's premium may give investors pause, they may choose to finance that premium by "writing" (selling) a call option, for which they are paid a premium. If the right strike prices are chosen, this can result in no up-front cash cost, a.k.a. a "cashless collar." The drawback is that the short call option gives its owner the right to buy the underlying for that option's strike price, capping the underlying's upside — thus the owner of a collar will have both the downside and the upside of the underlying constrained within a range. The initial appeal of downside insurance without a cash outlay typically fades when the amount of potential upside foregone is grasped; this drawback limits the usefulness of collars to only those investors for whom capital preservation is paramount, e.g., those with debt covenants requiring that assets or ratios not fall below a certain value.

2. **To "monetize volatility."** Over the long term, investors overpay for insurance[9] — on average the total paid on premiums will exceed the total benefit received when insurance pays off. With this in mind, instead of buying insurance, some investors are willing to sell insurance. Specifically, they write call options while holding the underlying, or write puts while holding cash. This strategy, however, is not a hedge. It will outperform simply holding the underlying in down, sideways, or modestly up markets; it will lag in moderately to strong up markets because it

[8] Being "long" a derivative position refers to being on the buying / owning side of a contract – it does not refer to the time until expiry.

[9] This is believed to be because investors are *collectively* more risk-averse than risk-seeking, even though many are willing to accept a certain amount of risk if properly compensated for it.

caps upside. An investor or money manager who is bearish to mildly bullish about markets, or who is committed to sell a security at a certain price target and in the meantime wants to enhance income, can benefit from using this strategy. However, it is likely best left to those experienced in the operational side of trading and rolling derivatives, since this insurance-selling strategy creates a payoff profile with undesired asymmetry, known in the investment world as "picking up pennies from in front of a steamroller." This is because it provides certain but limited gains (the premium earned from selling the option) with a nontrivial risk of very large losses.

Swaps

As discussed above, swaps involve the counterparties periodically exchanging cash flows based on a predetermined formula. While some swaps are exchange-traded, most are OTC, which means that they can be customized in myriad ways. The most commonly-used types of swaps are:

1. **Interest rate swaps:** Exchange cash flows based upon a fixed interest rate for those based on a floating rate, which transforms a fixed-rate loan into a floating-rate loan, and vice versa. Depending on the cash flows, this can also modify the duration of the loans, allowing investors either to hedge away or to take on additional duration risk, or to better match the assets' duration to that of the liabilities. For the most common ("plain vanilla") rate swaps, exchange-based clearing was required starting in 2013.
2. **Currency swaps:** Exchange the interest rate payment (and often the principal) on a loan in one currency for those in another currency.
3. **Credit default swaps:** Exchange a periodic payment from the buyer (analogous to an insurance premium) for a conditional payment from the seller (analogous to an insurance payout) if a credit event occurs, such as a loan default.
4. **Total return swaps:** Exchange a periodic payment for the total return (capital gain/loss plus any interest or dividends) on an asset. This allows the party making the periodic payments to experience the economic exposure to the underlying asset without having to actually own it.

Broadly speaking, swaps bring counterparties together, each of which may have some advantage in different markets (e.g., one is better able to secure fixed rate debt and the other floating, even though they might prefer the opposite), which allows them jointly to make use of global financial markets more efficiently.

Risks

Derivatives create market exposures for investors, with all their attendant risks. Use of derivatives entails additional risks inherent in the type of financial instruments that they are. These include:

1. **Basis risk**. Also known as tracking error risk, this arises from any mismatch between the available derivative contract and whatever underlying security the contract seeks to synthetically replicate or hedge. These are more pronounced the less common and less liquid the underlying or benchmark may be.
2. **Counterparty risk**. For derivatives that are not exchange-traded, this occurs if the counterparty defaults on its side of a derivative contract. When the counterparty is the central clearinghouse of an exchange, this risk is minimized through daily flows of margin deposits (collateral) and through the insurance of a guarantee fund.
3. **Margin and liquidity risk**. Markets can move in a direction that requires a derivatives investor to provide additional margin as collateral. If this is not provided – if the liquidity is not available at the needed time — the position can be closed by the exchange, causing the investor to realize losses.
4. **Leverage risk**. If derivatives are utilized to take on market exposures in excess of assets, and markets decline, the investor's losses are multiplied and in a worst case could exceed total assets.

IMPLEMENTATION CONSIDERATIONS

The versatility of derivatives in flexibly introducing and modifying economic exposures in an investment portfolio is substantial. In practice, though, putting derivatives in place can pose some obstacles. The main considerations are in relation to whether OTC derivatives will be used and how the exposures will be achieved.

1. **The ISDA.**[10] OTC derivatives, because they can be customized, are especially flexible, but they introduce counterparty risk. To use OTC derivatives, the parties must first negotiate and sign an ISDA Master Agreement, which takes a fair amount of time and legal cost. Having an ISDA in place is quite useful, but setting one up (or perhaps several, with multiple counterparties, to have more price negotiation power) poses a substantial hurdle. The alternative is to rely solely on exchange-traded derivatives, but they may not meet the investor's specific needs.
2. **Who trades?** The largest investors may have the resources to employ in-house traders with the necessary experience. All the rest will have to rely upon third-party service providers. The main choices are:
    a. **Dedicated overlay managers**, which provide the equivalent of discount broker service. Typically they do not provide advice or active management. After an initial minimum, fees tend to be attractive.

[10] International Swaps and Derivatives Association: the trade organization of OTC derivatives-market participants.

b. **Custodian banks** may offer derivatives services to their clients, although the larger custodians have shown less interest in doing so for smaller accounts.

c. **Investment banks** also offer derivatives services but for a premium price, particularly for one-off requests (i.e., for those other than their long-term clients), and the premium does not pay for any discernible added value.

LIKELIHOOD OF UTILIZATION

Whether an institutional investor will employ derivatives as part of its investment toolkit is likely to depend upon two main drivers: the specific application and the specific circumstances of the investor.

Applications

- **Overlays / equitization** are the most common use of derivatives and can help with transition management, due to the flexibility of putting on and taking off exposures.
- **Currency hedging** may appeal to more investors as their portfolios incorporate more foreign assets; additionally, investors with non-USD home currencies necessarily have a greater portion of their investments in foreign currency assets, and currency hedging has a stronger appeal.
- **Commodities futures** will be a portion of many investors' inflation hedges, typically through a manager rather than directly. In these situations, care must be taken that Investment Policy Statements do not prohibit managers from utilizing derivatives.
- A small portion of investors express interest in **adding excess leverage** (e.g., for risk parity), in **hedging with options**, or in **monetizing volatility** by writing options or by engaging a manager do so for them.

Investor type

- **Many investors** are already utilizing derivatives **through their investment managers**. Specifically, those employing "alternative" investments such as hedge funds or commodities are doing so by allowing a manager to use derivatives to pursue a specific strategy. Also, many traditional fixed income strategies use various derivatives to pursue portfolio positioning more efficiently.
- **Large, sophisticated institutional investors** with internal staffs may have the expertise to trade derivatives themselves.
- Some **investors in special situations**, such as the inability to tolerate a decline of more than X% over the next Y months (e.g., because of loan covenants, or funded ratios), may benefit from exploring derivatives-based solutions.

Many investors still pause before utilizing derivatives, again because of the unfamiliarity and perceived headline-risk; some may have prohibitions written into their Policy Statements.

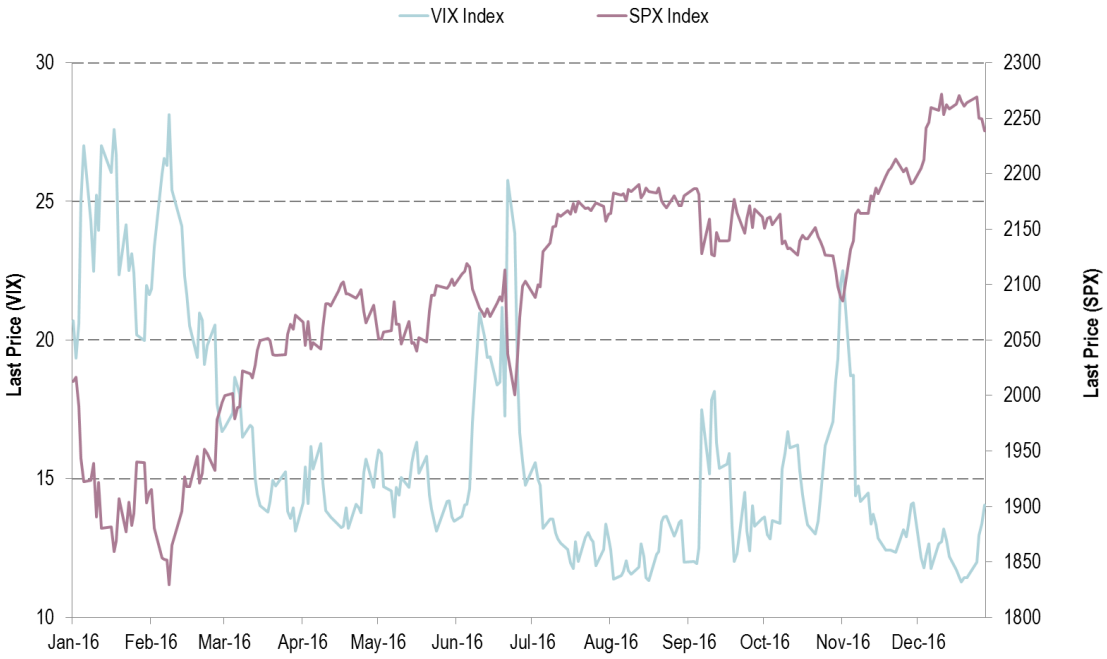
CONCLUSION

Derivatives constitute an additional category of non-traditional investments that spans a broad set of types with similarly wide-ranging uses. For many investors, there is no cause to add the complexity of derivatives to their portfolios. But for a certain set of institutions, with specific needs, derivatives' ability to swiftly and flexibly modify portfolios' economic exposure could be powerful. Despite their unfamiliarity to many investors, which sometimes leads to prohibitions on their use, Meketa Investment Group encourages investors to keep an open mind regarding the employment of derivatives should their circumstances merit it.

APPENDIX A: OPTION PRICING

Thinking about Option Pricing

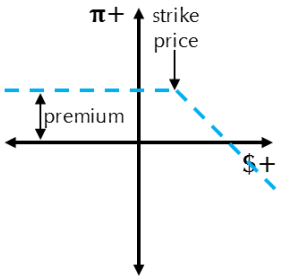
- Options increase in value (and price) as their underlying's volatility increases.
  - Higher volatility increases the chance that an option will expire "in the money" (market price above the strike price if a call, below the strike price if a put).
  - Volatility spikes when markets fall – protection gets costlier just as the need increases.
    - The graph below shows the inverse relationship observed in 2016 between the underlying SPX (S&P 500) index and the index that measures its short-term volatility, the VIX.



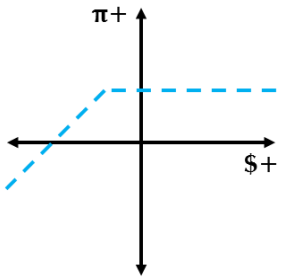
Source: Bloomberg

APPENDIX B: ADDITIONAL OPTION STRUCTURES WITH PAYOFF DIAGRAMS

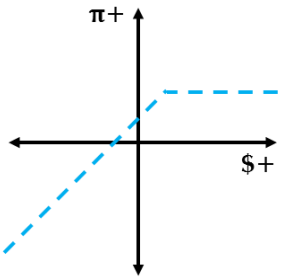
Short Call Option
- Receive premium
- Someone else has right to buy
- If above strike price, exposed to downside
- If below, no value (or liability)



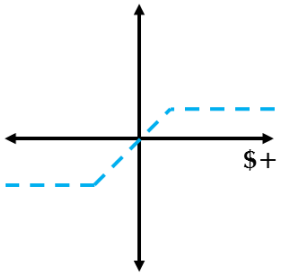
Short Put Option
- Receive premium
- Someone else has right to sell
- If below strike price, exposed to downside
- If above, no value (or liability)



Covered Call
- Short call + underlying
- Receive premium
- Same payoff shape as short put (different strike price)



Cashless collar
- Long put + short call + underlying
- Premium received for short call pays for long put
- Limits downside and upside



Bear Put Spread
- Long put + short put + underlying
- Premium received for short put partially pays for long put
- Only partial downside protection