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Derivatives Basics

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While derivatives have become increasingly popular and varied, most users tend to rely on a limited number of instruments in a finite set of applications. It never hurts, however, to consider alternative instruments capable of achieving alternative economic goals. With that objective, this article highlights the features of the most plain vanilla derivatives – forward contracts, swaps, and options – the most common derivatives that serve as the building blocks for a host of more esoteric structures.

Each of these contracts is a contractual arrangement between two parties, whereby each party accepts an obligation to pay the other on the basis of some requirement or formula. Ultimately, these contracts can be used either for speculation or for hedging or risk management purposes.

Forward Contracts

A forward contract is a contract between two parties that serves to fix a price in connection with an intended, forthcoming value date. Such contracts are actively traded in foreign exchange markets. International transactions involving entities having different functional currencies inherently involve foreign exchange risk, and forward contracts are the most common tool used to manage these risks. For example, consider a U.S.-domiciled buyer, whose functional currency is the dollar (USD), and a U.K.-domiciled seller, whose functional currency is the British pound (GBP). One of the parties necessarily bears currency risk. That is, if the price of the good is set in USD, the British seller bears the risk of the dollar weakening (equivalent to the GBP strengthening) – i.e., the set number of USD received would convert to fewer GBP. On the other hand, if the price is set in GBP, the U.S. buyer bears the risk of the GBP strengthening (the USD weakening) – i.e., a greater number of USD would be needed to buy the required number of GBP.

Without a forward contract, the party bearing the risk would be subject to the prevailing exchange rate as of the payment due date. A forward contract allows that party to fix this exchange rate in advance of that date. Thus, a forward contract specifies a quantity of foreign currency units to be bought or sold at a future value date, at an exchange rate determined on the trade date of the forward contract.

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Swap Contracts

A swap contract is simply a contractual arrangement that obligates two parties to exchange cash flows. While the forward contract discussed above satisfies this definition, the term swaps is more commonly reserved for those situations when multiple cash flows are covered under the contract. Typically, these cash flows will take place over a specified time, with a specified frequency. The respective cash flows for the standard, plain vanilla swap are timed to be coincident; and in such cases it is typical for the swap counterparties to operate under a netting agreement, whereby only the differences between the two respective obligations passes from the counterparty with the larger obligation to the counterparty to the smaller obligation.

Any mutually agreed upon set of prospective cash flows is possible under the umbrella of a swap contract, but the normal case is one where the arrangement commences without any initial cash being paid or received by either party – the implication being that the present values of the two respective cash flows would be the same. Put another way, at the start of the swap transaction, for both parties to the transaction, the present value of the expected cash *outflows* should be equal to the present value of the expected cash *inflows.*

For cases where the swaps do not involve any optionality (e.g., where there are no caps or floors embedded in the cash flow amounts, or where there are no features allowing for early exit from the transaction) it would be unusual for there to be any significant disagreement as to the value of a swap. That is, valuation methodologies for swaps are based on principles that have long been well understood by the professional finance community. These valuations rely on discounting *expected* future cash flows, where each cash flow would be discounted by a discount rate specific to the timing of the cash flow in question; and this discount rate, in turn, would be determined on the basis of current yield curve conditions as of the time the valuation is being made. Thus, parties who rely on the same yield curve data would be expected to generate quite similar valuations. In recent periods (say, since the failure of Lehman Brothers), valuation practices have changed somewhat, whereby much greater consideration has been given to the credit quality of the parties in determining the valuation. Industry has yet to coalesce on any particular methodology for *how* these credit considerations should affect the determination of the swap's present value, so some variance in present value estimates from different analysts should be expected for any given instrument at any time.

For interest rate swaps, the two respective cash flows are defined by formulas, whereby each cash flow is found by multiplying a *notional amount*, times an *interest rate*, times *time*. These calculations are repeated with a specified frequency for some defined time period. For example, the swap might define the notional to be $100 million, the tenor (or term) might be five years, the frequency might be quarterly. In one direction, the interest rate might be, say, six percent, while in the other direction, the interest rate might be three-month LIBOR, which would change over time throughout the term of the swap. Under this design, 20 discrete cash flows would be anticipated.

The typical rationale for entering into a swap would be to exchange one set of cash flows for another. Ordinarily, the counterparty to a swap would have an existing asset or liability that had an associated expected cash flow – either an *inflow* or an *outflow* -- with certain characteristics

that fostered an undesirable exposure; and the swap contract would be used to replace those undesirable cash flows with a second set of cash flows, thereby offloading the undesired exposure to the counterparty to the swap. The most conventional case is one where a company borrows with a variable-rate debt instrument and uses the swap to convert that debt to fixed-rate financing, or vice versa.

Option Contracts

Historically, options were designed where they conveyed *rights* relating to the purchase or sale of some underlying good at a specified *strike price* or *exercise price*. These rights persist for a finite time period – i.e., until some specified expiration date. While various exotic structures have evolved over time, basic options come in two types: Calls and puts. Calls are the right to buy; puts are the right to sell.

Calls and puts are transacted between two parties, such that in any option trade there's a buyer of the option (long) and a seller of the option (short). Normally, trading an option requires payment of the option *price* (or the option *premium*) on (or shortly following) the trade date – i.e., buyer pays the seller the initial premium. Subsequent to the trade date, the option buyer then has the right to exercise the option. Call buyers can exercise their right to *buy* the underlying good at the strike price (and necessarily, the call seller must serve as the seller, at the strike price). Similarly, put buyers can exercise their right to *sell* the underlying good at the strike price (and necessarily, the put seller must serve as the buyer of the underlying good at the strike price).

From the perspective of the option buyer, at expiration, the option is always either of zero value or it's an asset. From the perspective of the option seller, the option is always either of zero value or it's a liability. Given this property, it should readily be understood that the option buyer's risk is limited to the initial option premium. In the worst case, the option pays a premium up front, and at the expiration date, the instrument is worthless. Thus, the prospective loss is limited to the option premium. On the other hand, the prospective gain on a purchased option is virtually unlimited. Calls become increasingly valuable as underlying prices rise further and further above the strike price; puts become increasingly valuable as underlying prices fall below the strike price. Thus, it's common to think of purchased options as having limited risk (equal to the initial option premium) with unlimited profit potential, while sold options have the reverse: a capped profit potential (equal to the initial option premium)with unbounded risk.

For hedgers using options, these instruments serve to offer one-sided protection. For example, for the purchasing entity exposed to rising prices, buying a call with a strike price of, say, $100, gives the right to buy at $100, thereby serving to protect against the risk of prices rising *above* $100. Similarly, for the selling entity exposed to falling prices, buying a put with a strike price of $100 serves to protect against the risk of prices falling below $100.

For the most part, calls and puts used for hedging purposes are rarely exercised. Instead, they're *cash settled.* For example, returning to the purchasing entity exposed to the risk of rising prices, suppose that entity purchased a $100-strike call for $3. Upon the expiration of the option (timed to coincide with the intended purchase date), it turned out that market prices for the underlying good were less than $100. The entity would buy that good at the market price, and the call

would expire worthless. On the other hand, if the price rose to, say, $125, the call option would be liquidated at a terminal value of $ 25 (= the market price less the strike price = $125 - $100), and the underlying good would be purchased at the market price of $125. On a combined basis, the effective price is the cash out lay of $125 less the ending $25 value of the option. Thus, for the cost of the $3 initial premium, the call buyer assures that the effective purchase price on the purchase date will be capped at $100.

A defining difference between forwards and swaps, on one hand, and options, on the other, is that the payoff of forwards and swaps is symmetric, while the payoff of options is asymmetric. Put another way, with forwards and swaps gains or losses on the derivative will be commensurate with any associated market move *in either direction*. Options, on the other hand, offer one-sided protection. Thus, whenever a payoff or performance references a threshold or limit value, you can be assured that somewhere within, you're dealing with an option.

With this orientation, it should be clear that caps and floors are, in fact, options. But like swaps, we generally use the terms (e.g., interest rate caps and floors) in conjunction with multiple periods. Thus, puts and calls generally relate to a single exposure and a single settlement, while caps and floors relate to a series of repetitive exposures and the prospect of multiple settlements.