Contingent Premium Options
A Primer

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Introduction

Contingent premium options are options which do not require the upfront payment of a premium. In some sense, they allow clients to "borrow" premiums from the payout at expiry. They are also a particularly appealing application of digital options. In this write-up, we discuss various topics pertaining to contingent premium structures and why they may be interesting to our clients. In this paper we'll discuss caps, the same ideas apply also to floors.

What are they?

Consider a regular cap (floor). The holder of the option pays a premium to the issuer. After the premium is paid, the holder of the option enjoys protection against a rise (a decline) in interest rates. In the discussion below, we will talk about caps but the same ideas also apply to floors.

In a "contingent premium cap", the holder does not pay an up front premium. At the expiry of the option, the issuer may pay the holder of the option or , alternatively, the holder of the option will be required to pay the issuer.

Advantages to User

Clients typically use caps in several types of scenarios:
1. When they are legally required to do so (e.g. a leveraged financing deal)
2. When caps are perceived as a good strategy (e.g. when volatility levels are low)

Since caps are options, they are priced off volatility. Currently, interest rate volatility levels are at their lowest levels in may months. Therefore, this may be a good time to purchase interest rate options in general, and caps in particular.

However, like all options, caps have a drawback. They require the payment of an up-front premium. As one can see in the table, contingent premium caps require no up front premiums. They may therefore, be a better instrument for clients who are short of cash today.

Consider a cash poor client with a project which, they expect, will be very profitable. The client is interested in purchasing a cap, but has no funds to pay for the premium. A contingent premium cap may be a very interesting structure for such a client.

Another advantage of contingent premium caps is that, as we shall see, they are comprised of a long position together with a short position. This combination has two positive effects:

1. Reduces the time decay - A cap, like any other option, suffers from time decay. All other things being equal, the value of the cap declines as time goes by. Contingent premium options are much better at retaining their market value.
2. Sensitivity to volatility is reduced - A standard cap is sensitive to volatility. When volatility declines, so does the value of the cap. In contrast, contingent premium caps, are much less sensitive to swings in volatility.

The above two items have the combined effect that contingent premium caps retain their value through time even if there are volatility swings. Hence, it will be relatively painless for a client to get out of a contingent premium cap.

How are they constructed?

A contingent premium cap is composed of:
1. A long position in a standard cap
2. A short position in a digital (all or nothing) option

Let us reconsider the client who wishes to reduce their financing costs. One available strategy for them is to be short options. The short position will fund their long position. For example, the client who is long a cap may also be short a floor. However, when a client is short traditional caps and floors, their potential liability may be unlimited.

This explains the popularity of the contingent premium cap. Since the short position is in a digital option, the maximal amount that the holder may have to pay out is capped. It is guaranteed to not be larger than the payout amount of the digital. On the other hand, the long position is in a regular cap. Thus the upside is unlimited.

Thus, a contingent premium cap eliminates the need to pay an upfront premium and reduces time decay and exposure to volatility. It has an unlimited upside but only a limited downside risk.

Several structures

The structure is constructed so that the premium of the standard cap is exactly equal to the premium of the digital. Thus no premium needs exchange hands at the initiation of the deal.

There is a wide latitude in the type of deal that can be constructed. After the details of the cap have been chosen, we need to choose the details of the digital. In particular, the strike of the digital and the amount which will be paid out may be chosen. Since the premium of the digital must match the premium of the cap, once we choose a strike for the digital, the amount which will be paid is determined.

Consider a quarterly cap whose strike is 5.25%. We assume a trade date of 6-Mar-96, an effective date of 6-Sep-96 and an expiry date of 6-Dec-96. The graph below shows the payout of this cap and also the probability of receiving that payout.

Conventional Cap
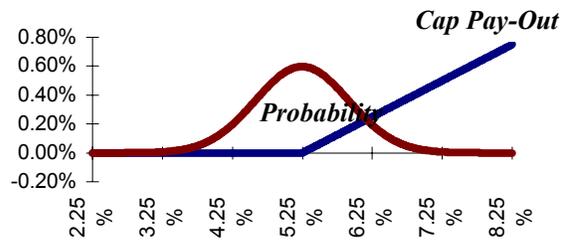
For example, if Libor at expiry is 8.25% the payout of this cap is (8.25-5.25)*0.25 = 0.750

Intuitively, this graph shows that there is a positive probability multiplied payout. That's why a regular cap commands a premium, in this case about 4.90 bps.

Now, we consider several contingent premium caps. All of them are quarterly instruments with the same dates as the original cap.

We add a digital option with the same strike (5.25%). The first issue is to compute the payout of the digital. We already know the premium of the digital. Thus, by working backwards we can find that the payout of the digital must be about 49 bps. The following graph shows the payout profile of a standard contingent premium cap:

## Standard Contingent Premium Cap
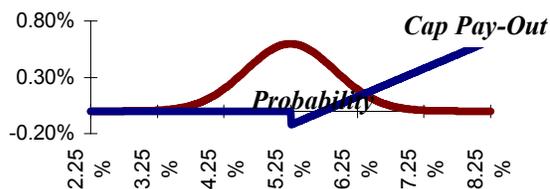
Intuitively, this graph shows that the probability multiplied payout sums out to zero. That's why a contingent premium cap does not require an upfront premium. This graph also shows an interesting feature of digitals. If Libor ends at 5.24%, both the digital and the cap are out of the money so no money changes hands. If Libor closes at 5.26%, both options are in the money. The standard cap has a payout which is almost negligible. The writer of the digital option, on the other hand, is liable for the entire payout.

Suppose that Libor closes above 5.25% and the digital option expires in the money. In this case the holder, who has written the digital, will pay 49 bps. This amount is payable by the holder and is deducted from the payout of the standard cap. The worst case for the client happens when the standard cap pays nothing and the digital option is payable. In this case, the client will be forced to pay 49 bps out of pocket.

Can the client reduce their maximal exposure? Can we construct a structure in which, at the worst case, the client will have to pay less? The answer lies in adjusting the strike of the digital. If we lower the strike of the digital, we can use a lower payout and achieve the same premium.

The next graph shows a contingent premium cap in which the strike of the digital was set at 4.75%, way below the strike of the standard cap.

A Contingent Premium Cap
(with a low strike digital)
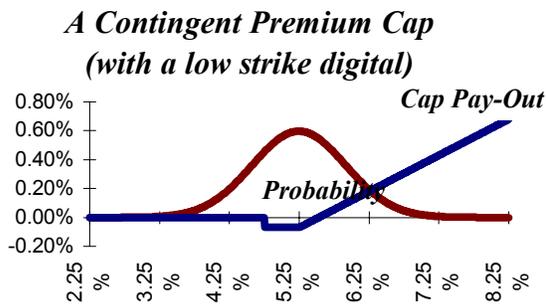
In this structure, the payout of the digital is only 28 bps. This is the maximal exposure of the client. By "pulling" the strike of the digital downward, we reduce the payout of the digital and the maximal exposure of the client. On the other hand, we increase the probability that the client will have an out of pocket expense. We can see that the area where the payout chart is negative corresponds to the high probability region.

A low strike digital lowers the maximal exposure of the client. What about a high strike digital? The following graph shows a contingent premium cap with a digital struck at 5.75%, well above the strike of the standard cap.

A Contingent Premium Cap
(with a high strike digital)
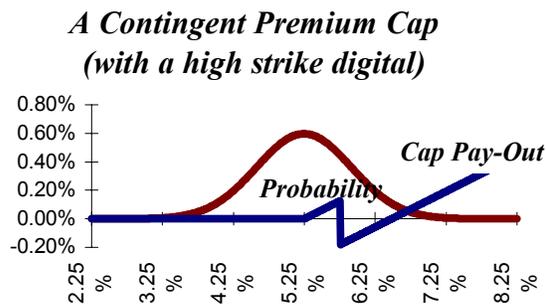
We've determined that the strike of the digital is 5.75%. The payout amount of the digital is 123 bps. However, in this case, the client will never be required to pay the full amount. In the worst case, Libor closes just above 5.75%. The client will be required to pay 123 bps. for the digital. However, the same client also receives 50 bps. from the standard cap. The computation is 5.75%-5.25% = 0.50. Thus the client has to pay 73 bps (50-123 = -73 bps) over a period of 3 months or 18.25 bps annualized.

This last structure is very interesting. The payout of the digital is 123 bps. However, the client will never have to pay the entire cost out of pocket. On the other hand, if Libor becomes very high, the holder will receive less money than in the other structures.

The following table summarizes the payout of the digital, the maximal out of pocket penalty payable by the holder of the contingent premium cap and the payout which would be received by the holder of the cap if Libor closes at very high levels (e.g. 8.25%).

Type	Payout of Digital	Max Penalty	Payout at 8.25%
Standard Contingent	49 bps	49 bps	(300-49)/4=62.75
Contingent w/ low strike digital	28 bps	28 bps	(300-28)/4=68
Contingent w/ high strike digital	123 bps	18.25 bps	(300-123)/4=44.25

In a contingent premium cap the holder, in a sense, borrows the upfront premium from the future payouts. Unfortunately, if no future payouts exist, the holder will have to pay. This is the maximal penalty presented in the table above.

Summary

Contingent premium caps are instruments which allow clients to defer payment of the premium. In addition they have the following traits:
- Small time decay.
- Reduced sensitivity to volatility.
- Tremendous flexibility in their creation.