

# 1.1 Callable bonds

A callable bond is a fixed rate bond where the issuer has the right but not the obligation to repay the face value of the security at a pre-agreed value prior to the final original maturity of the security.

## Topics

- Structure of callable bonds is described.
- Valuation of callable securities is discussed
- Applications of callable bonds for both issuers and investors are examined.
- Use of options on swaps to monetize callable bonds is outlined.
- Variations on callable structures are described.

## Callable Bonds - Structure

Amount	US\$100 million
Issue Date	15 September 2006
Maturity	15 September 2016 (10 years)
Coupon	8.00% pa (payable annually)
Call Provision	Callable, subject to 30 days notice, as follows:

<b>Call Date</b>	<b>Call Price</b>
5 years (15 September 2011)	103% of Face Value
6 years (15 September 2012)	102% of Face Value
7 years (15 September 2013)	101% of Face Value
8 years (15 September 2014)	100% of Face Value
9 years (15 September 2015)	100% of Face Value

- The bond is *call protected* for the early period of 5 years.
- The call is exercisable at a premium to the face value of the bond. The initial call premium is 3% of face value, declining at the rate of 1% per annum. This reflects the fact that the value of the callable feature is decreasing with respect to time.

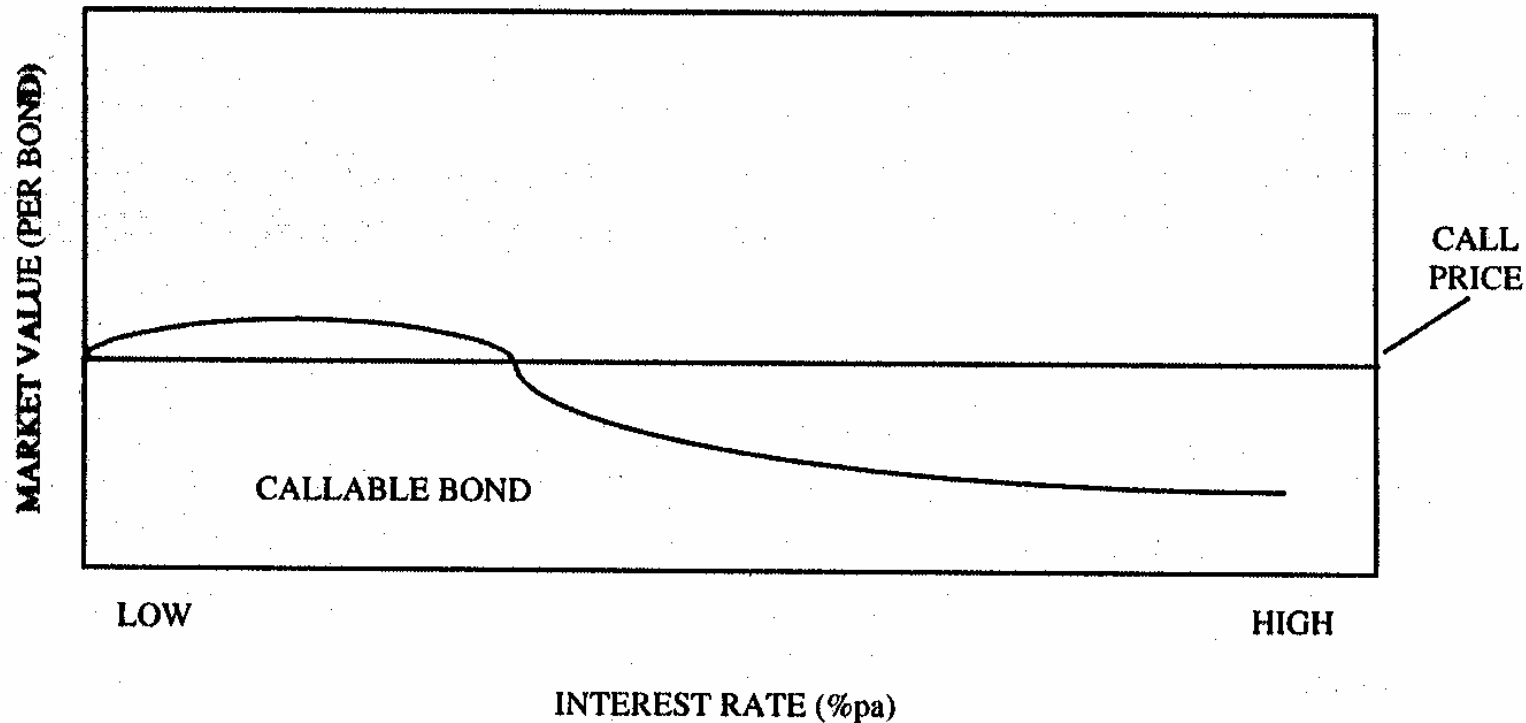
### *Interest rates consideration*

If the interest rates decrease, then the issuer will call the bond and pre-pay the debt. The issuer can re-finance at lower interest rates.

Callable bond = straight (or non-callable) bond plus option

# Features

- The underlying asset (debt security) has a variable life. The value of the debt option will be a factor of the shape of the yield curve and its dynamics (optionality nature of the callable feature).
- The call option has multiple exercise dates – Bermudan feature.
- The premium for the option sold by the investor is incorporated in the bond by way of a higher coupon (relative to comparable non callable transaction) and/or lower value.



The bond may be traded at a value above the call price over a narrow range of interest rates when the interest rate falls below some threshold level. Transaction costs and other corporate finance consideration may allow the bond price to stay slightly above the call price.

## Callable Bonds – Price Behaviour

Change in Rates (bps pa)	Price (%) of 8% pa Coupon 10 Year Non Callable Bond	Price (%) of 8% pa Coupon 10 Year Bond Callable After 5 Years at Par
-300	123.17	105.20
-200	114.72	108.42
-100	107.02	104.10
0	100.00	100.00
+100	93.58	94.21
+200	87.71	89.25
+300	82.33	85.47

- With potential shortening of bond's life (shorter duration), the decrease in bond value for callable bond with increasing interest rates would be smaller.
- When the drop in interest rates is more significant, the chance of being called is higher so that the bond price may decrease instead

Duration  $D$  is the *weighted average* of the times of cash flows, weighted according to the present value of the cash flow. Longer duration means higher sensitivity of the percentage change in bond value  $\frac{\Delta P}{P}$  on the change in interest rates  $\Delta r$ :

$$\frac{\Delta P}{P} \sim -D\Delta r.$$

For bonds generally, duration falls (increases) as interest rate increases (decreases).

## *Duration behaviour of a callable bond*

- The duration of a callable bond is most affected by the call feature when the call option has a high value (high propensity of being called). Under the scenario of decreasing interest rates, the price appreciation of a callable bond relative to a comparable non callable bond is reduced.
- The sold call option has the effect of *decreasing* duration as rates fall. This reflects the likelihood of early repayment.
- The duration of a callable bond is sensitive to the passage of time. As the call protection period diminishes, the uncertainty regarding the remaining cash flows of the bond increases. The value of the call feature increases and impacts on duration to a greater degree.



Consider the *call adjusted duration* of the following security:

Maturity	27 years
Coupon	12% pa
Call Provision	After 2 years at 109.60

- When the yield on the underlying bond is 11% pa and assuming an annualised yield volatility of 12%, the call adjusted duration is approximately 6.6 years.
- If the yield falls to 9% pa, then the callable bond's duration falls to 4.4 years.
- This contrasts with a duration of a non callable bond with the above characteristics of around 9 years and a duration of a bond with a maturity equal to the call date of around 1.8 years.

## Issuer applications

- Use of call options to enable issuers to prepay debt to eliminate any restriction on the activities of the firm. The call provision allows the issuer to retire debt where the terms and conditions (particularly the covenants associated with the issue) are restrictive to the company. The restrictions include maintenance provisions (requiring compliance with financial ratios such as leverage restrictions, fixed charge coverage, minimum capital levels etc) and negative provisions (preventing the issuer from undertaking certain investment, sale of business, corporate restructures etc).
- Freedom to adjust the debt-equity ratio of the firm.
- Reduction of interest rate sensitivity of a bond's value to changes in interest rates.

## Optimal call strategy

- The benefit to shareholders from calling the bond is a function of the repurchase of the coupon and principal at less than its market value and the difference is greater than the refinancing costs.
- This is reflected in the actual trading behaviour of callable bonds that trade close to the call price when the market anticipates that the security will be repaid.
- Callable bonds often trade at a level above the call price even where the interest rates have fallen below the bond coupon, reflecting investor consideration of issue expenses that will defer refunding.

## Investors' perspectives

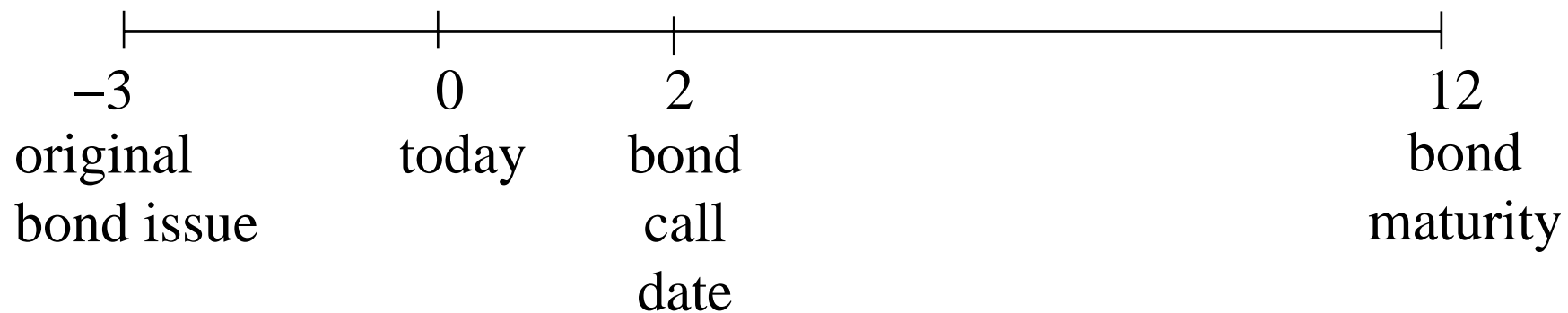
- **Naïve strategies** – bearing the risk of being called, investors receive higher nominal returns either relative to a benchmark or in absolute terms.
- **Value based strategies** – designed to value callable securities in terms of the underlying components and seek to sell expensive securities and purchase cheaper securities (based on the component values), arbitraging between the universe of comparable callable and non callable securities.

## **Call monetization via swaptions**

- The buyer of a swaption has the right to enter into an interest rate swap by some specified date. The swaption also specifies the maturity date of the swap.
- The buyer can be the fixed-rate receiver (put swaption) or the fixed-rate payer (call swaption).
- The writer becomes the counterparty to the swap if the buyer exercises.
- The strike rate indicates the fixed rate that will be swapped versus the floating rate.
- The buyer of the swaption either pays the premium upfront or the premium is structured into the swap rate.

## Management of callable debt

Three years ago, XYZ issued 15-year fixed rate callable debt with a coupon rate of 12%.

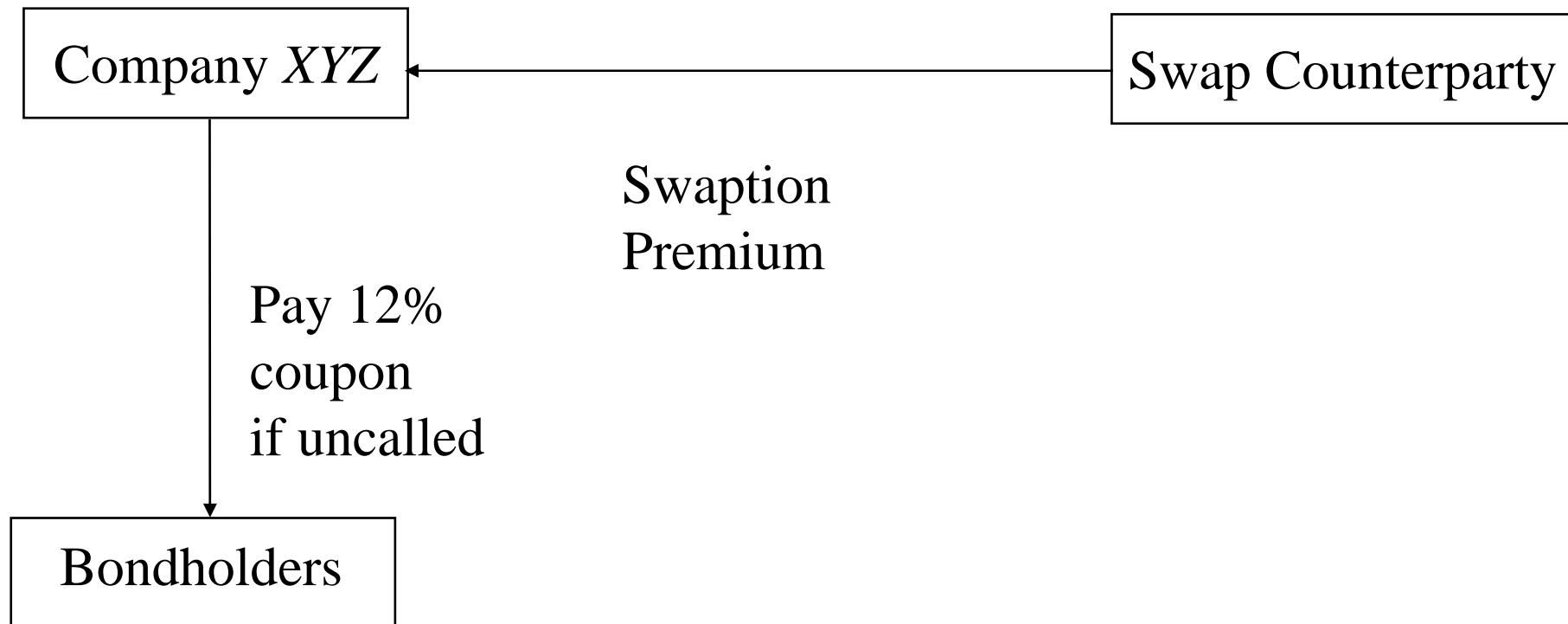


### *Strategy*

The bond issuer sells a two-year receiver option on a 10-year swap, that gives the holder the right, but not the obligation, to receive the fixed rate of 12%.

By selling the swaption today, the bond issuer *XYZ* has committed itself to paying a 12% coupon for the remaining life of the original bond.

- The swaption was sold in exchange for an upfront swaption premium received at date 0.



# Cash Flow on Swaption Expiration Date

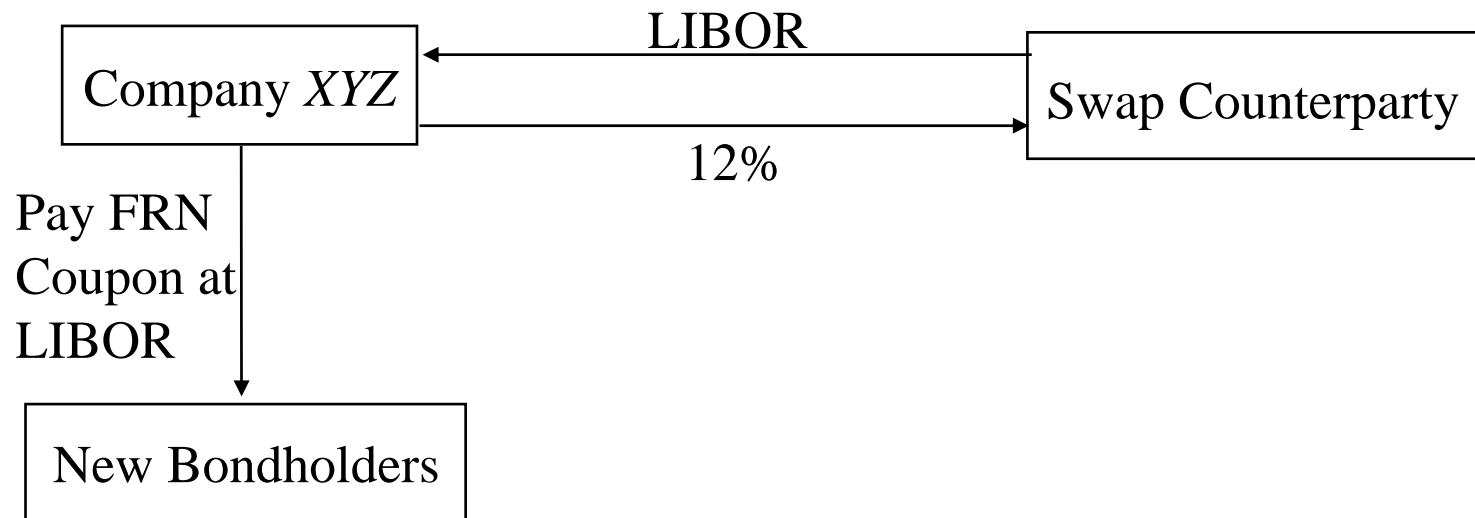
*Interest Rates  $\geq 12\%$*



The bond is not called and the swaption is not exercised.



*Interest Rates < 12%*



Both the bond is called and the swaption is exercised. The LIBOR received from the swap counterparty is used to pay for the floating coupons of newly issued floating rate bonds.

## Disasters for the bond issuer *XYZ*

- The fixed rate on a 10-year swap was below 12% in two years but its debt refunding rate in the capital market was above 12% (due to credit deterioration of *XYZ*)
- The company would be forced to enter into a swap that it does not want and call the bond at a disadvantage and not be able to refinance its borrowing profitably.

## Using Swaptions to Asset Swap Callable Bonds

Assume that the following bond is available in the secondary market:

### Terms of the callable bond

Issue Date	1 July 2001
Maturity	1 July 2011 (10 years)
Coupon	7.00% pa annual
Call provisions	Callable at the option of the issuer commencing 1 July 2006 (5 years) and annually thereafter on each coupon date.  Initially callable at a price of 101 decreasing by 0.50 each year and thereby callable at par on 1 July 2008 and each coupon date thereafter.
Bond price	Issued at par

An investor purchases the bond and enters into the following swap to convert the fixed rate returns from the bond into floating rate payments priced off LIBOR.

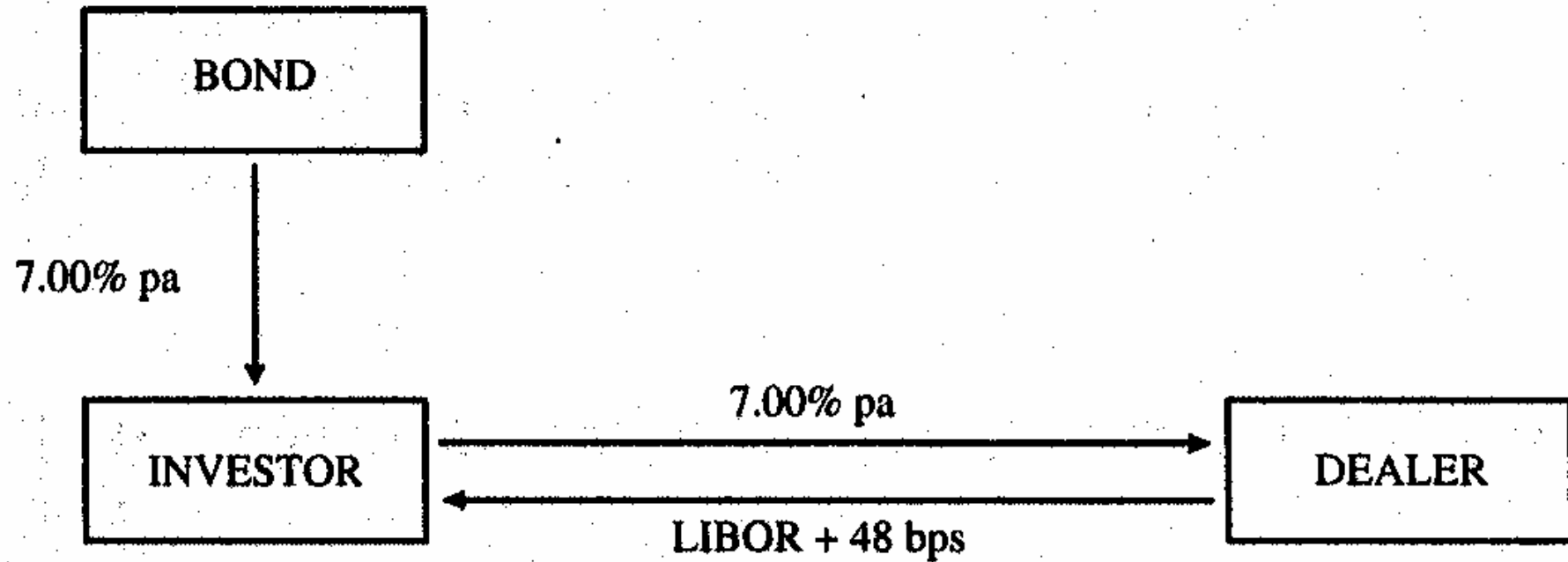
## Terms of the cancellable swap

Final Maturity	1 July 2011
Fixed coupon	Investor pays 7.00% pa annually (matching the bond coupon).
Floating coupon	Investor receives 6 months LIBOR + 48 bps pa
Swap Termination	Investor has the right to terminate the swap commencing 1 July 2005 and each anniversary of the swap. On each termination date, the investor pays the following fee to the swap counterparty:

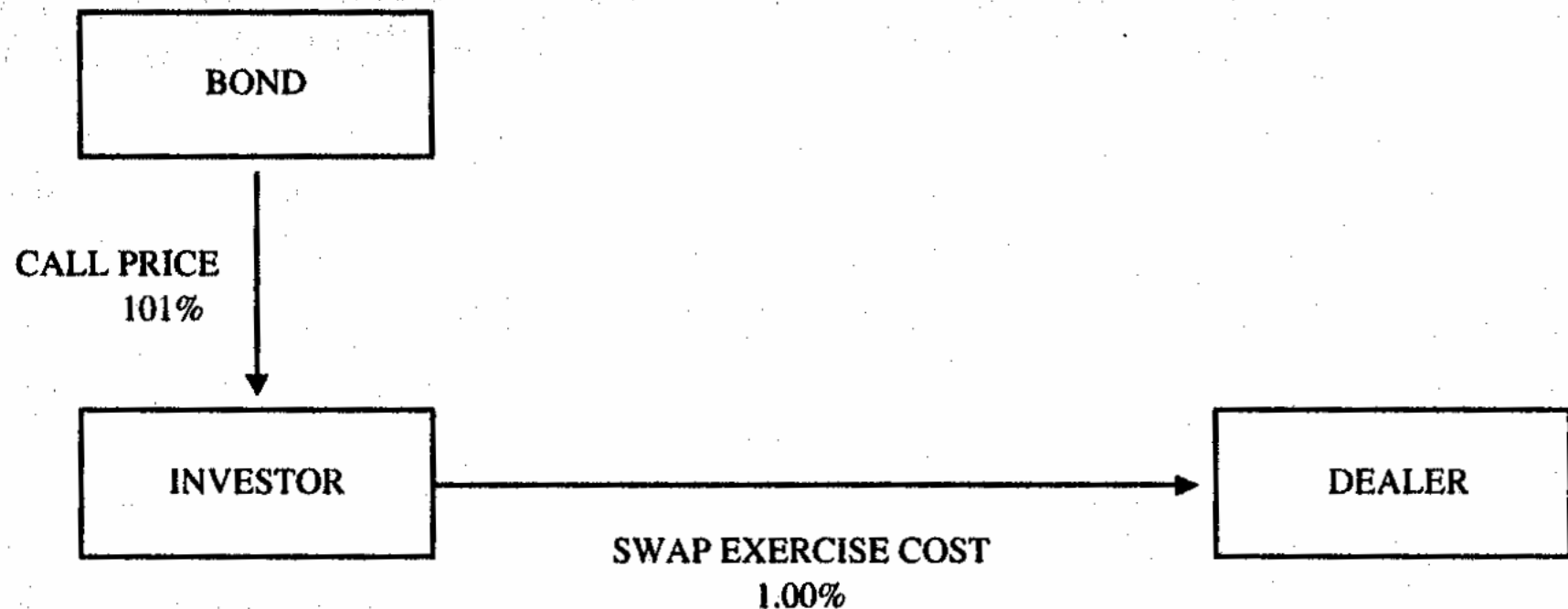
<b>Date</b>	<b>Fee (%)</b>
1 July 2006	1.00
1 July 2007	0.50
1 July 2008 to 1 July 2010	0.00

- The swap combines a conventional interest rate swap (investor pays fixed rate and receives LIBOR) with a receiver swaption purchased by the investor to receive fixed rates (at 7.00% pa) and pay floating (at LIBOR plus 48 bps).
- The swaption is a Bermudan style exercise. The investor can exercise the option on any annual coupon date commencing 1 July 2006 (triggering a 5 year interest rate swap) and 1 July 2010 (triggering a 1 year interest rate swap).
- There are no initial cash flows under this swap. The only initial cash flow is the investment by the investor in the underlying bonds.

The investor's cash flow on each interest payment date will be as follows:



If the bond is called, then the investor is paid 101% of the face value of the bond by the issuer (assuming call on 1 July 2006). The investor passes 1% to the dealer for the right to trigger the swaption and cancel the original 10 year interest rate swap. This effectively gives the investor back 100% of its initial investment.



The pricing of the overall transaction will incorporate the following elements:

- Interest rate swap rate.
- Pricing of the swaption purchased by the investor.
- Call premium received and swap termination fee paid in the event of exercise of the swaption. In effect, this can be treated as an adjustment to the effective strike rate on the swaption.

If the bond was not purchased in the primary market and was trading at a premium or discount, then the initial cash payment or receipt may also be incorporated in the swap pricing.



## *Rationale for doing these transactions*

- There is a limited universe of non-callable fixed rate bonds.
- When interest rates decrease below the coupon, the bond is called. The investor is left with an out-of-the-money interest rate swap position (the swap fixed rate is above market rates).
- The swap is expensive to reverse, creating losses for investors. Cancellable swaps are structured as a means of mitigating the potential loss resulting from early redemption of the asset swap.

# Callable bond management

## *Market background*

- In August 2004 (two years ago), a corporation issued 7-year bonds with a fixed coupon rate of 10% payable semiannually on Feb 15 and Aug 15 of each year.
- The debt was structured to be callable (at par) offer a 4-year deferment period and was issued at par value of \$100 million.
- In August 2006, the bonds are trading in the market at a price of 106, reflecting the general decline in market interest rates and the corporation's recent upgrade in its credit quality.

## *Question*

The corporate treasurer believes that the current interest rate cycle has bottomed. If the bonds were callable today, the firm would realize a considerable savings in annual interest expense by taking advantage of the current low interest rate environment.

### **Considerations**

- The bonds are still in their call protection period.
- The treasurer fears that the market rate might rise considerably prior to the call date in August 2008.

## *Notation*

$T$  = 3-year Treasury yield that prevails in August, 2008

$T + BS$  = refunding rate of corporation,  
where  $BS$  is the company specific bond credit spread

$T + SS$  = prevailing 3-year swap fixed rate,  
where  $SS$  stands for the swap spread

*Strategy I. Enter an off-market forward swap as the fixed rate payer*

*Agreeing to pay 9.5% (rather than the at-market rate of 8.55%) for a three-year swap, two years forward.*

Initial cash flow: Receive \$2.25 million since the fixed rate is above the at-market rate.

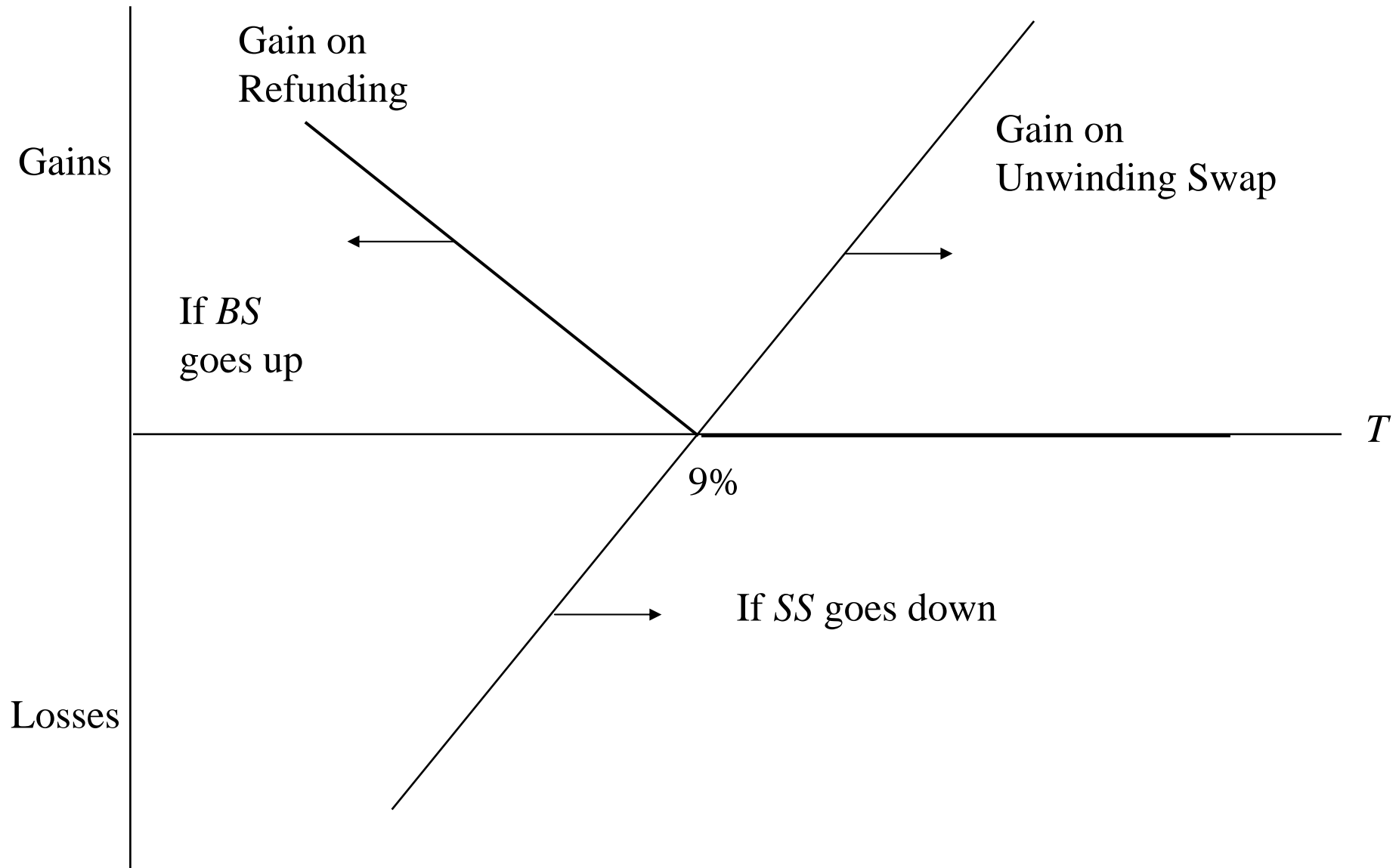
Assume that corporation's refunding spread remains at its current 100 bps level and the 3-year swap spread over Treasuries remains at 50 bps, the annual reduction in interest rate expense after refunding

$$= \begin{cases} 10\% - (T + 1.0) & \text{if the firm chooses to call} \\ 0 & \text{if it is not.} \end{cases}$$

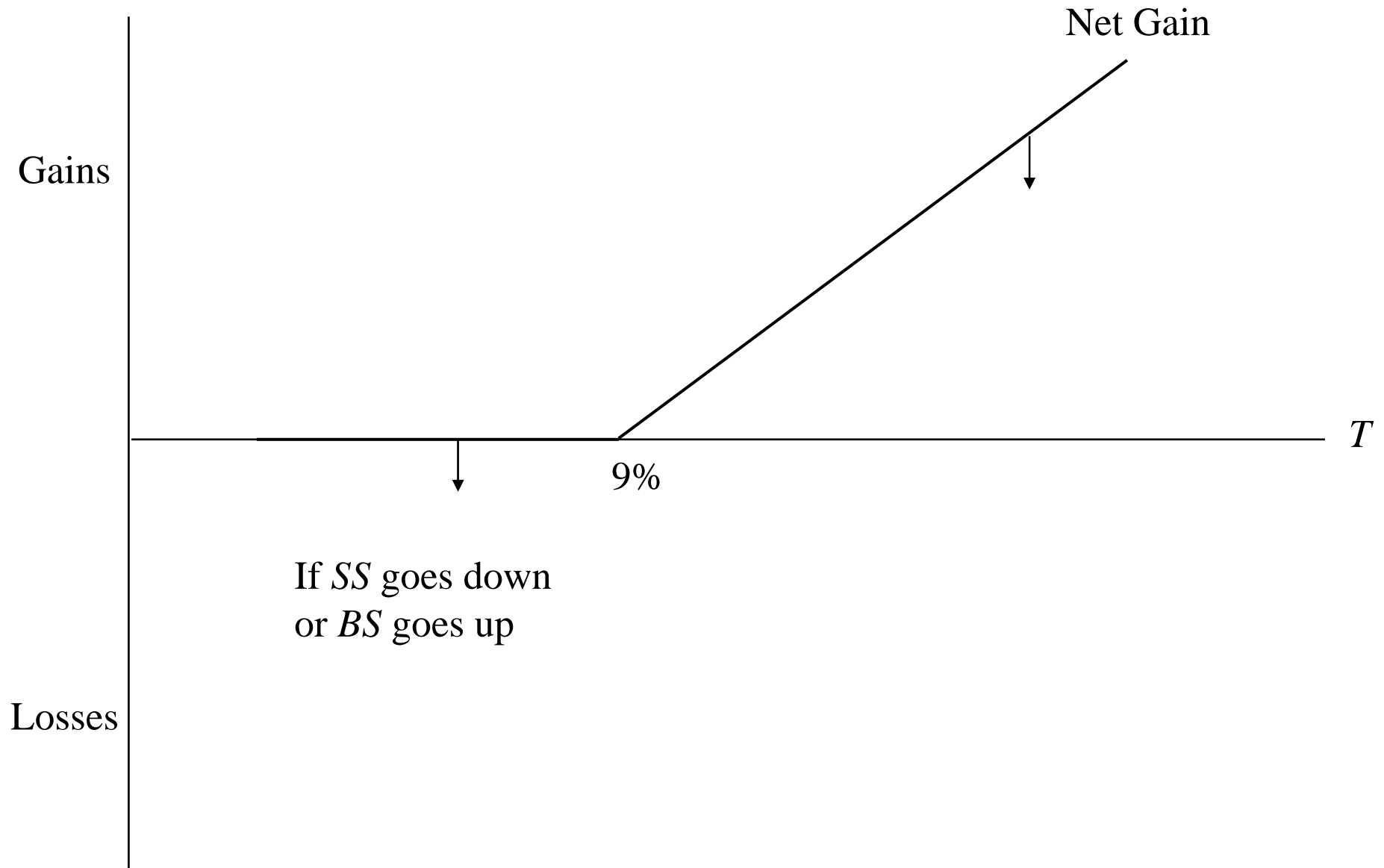
The gain (or loss) from the forward swap position  
=  $[T + 0.5\% - 9.5\%]$ .

- With respect to  $T$ , the payoff of the callable right resembles a put payoff structure while that of the forward swap is a forward.

# Refunding Option plus Forward Swap



# Net Position





## *Comment on the strategy*

- Since the company stands to gain in August 2008 if rates rise above 9%, it has not fully monetized the embedded call options. This is because a symmetric payoff instrument (a forward swap) is used to hedge an asymmetric payoff (callable right).
- Higher refunding rate or lower swap spread is unfavorable to the bond issuer.

*Strategy II. Buy payer swaption expiring in two years with a strike rate of 9.5%.*

Initial cash flow: Pay \$1.10 million as the cost of the swaption (the swaption is out-of-the-money since the current fixed swap rate is 8.55%, which is less than 9.5%)

August 2010 decisions:

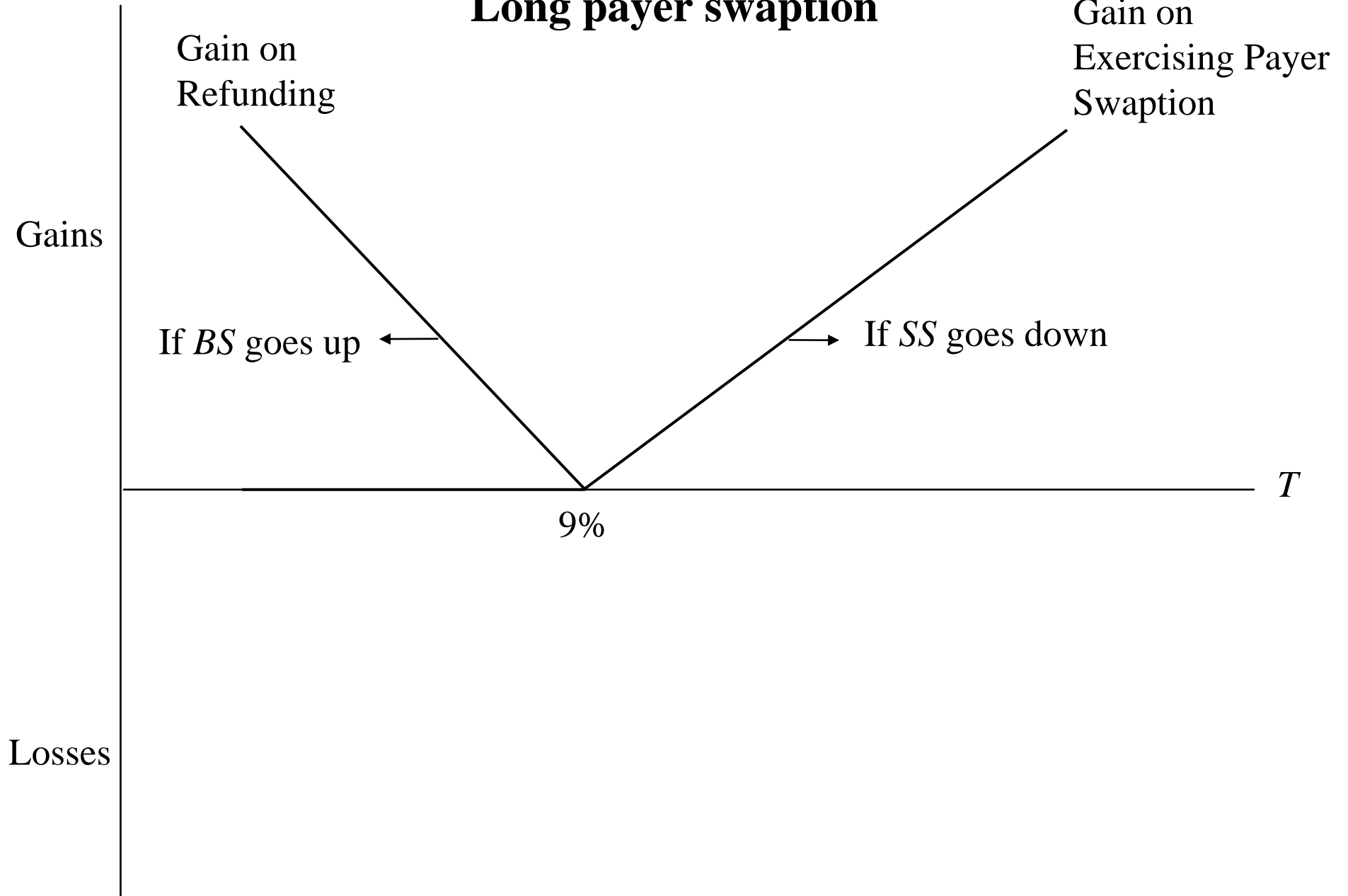
- Gain on refunding (callable right):

$$= \begin{cases} [10 \text{ percent} - (T + BS)] & \text{if } T + BS < 10 \text{ percent,} \\ 0 & \text{if } T + BS \geq 10 \text{ percent.} \end{cases}$$

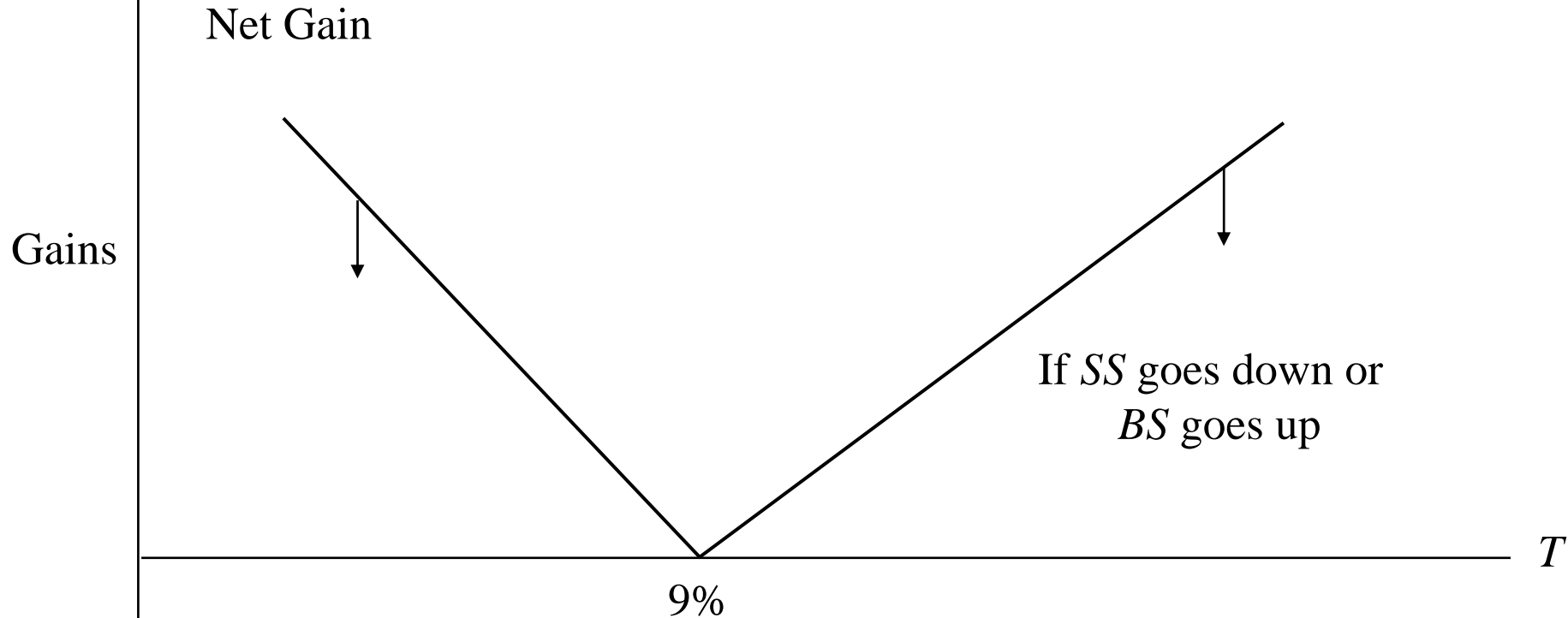
- Gain on exercising the payer swaption

$$= \begin{cases} [(T + SS) - 9.50 \text{ percent}] & \text{if } T + SS > 9.50 \text{ percent,} \\ 0 & \text{if } T + SS \leq 9.50 \text{ percent.} \end{cases}$$

# Long payer swaption



# Net Position



## *Comment on the strategy*

The company will benefit from Treasury rates being either higher or lower than 9% in August 2010. However, the treasurer had to spend \$1.1 million to lock in this straddle.

- With respect to  $T$ , the payoff of the payer swaption resembles a call payoff with strike at 9%. The holder of the payer swaption gains when the prevailing fixed rate  $T + SS$  is higher than 9.5%.

*Strategy III. Sell a receiver swaption at a strike rate of 9.5% expiring in two years.*

Initial cash flow: Receive \$2.50 million (in-the-money swaption)

August 2010 decisions:

- Gain on refunding (callable right):

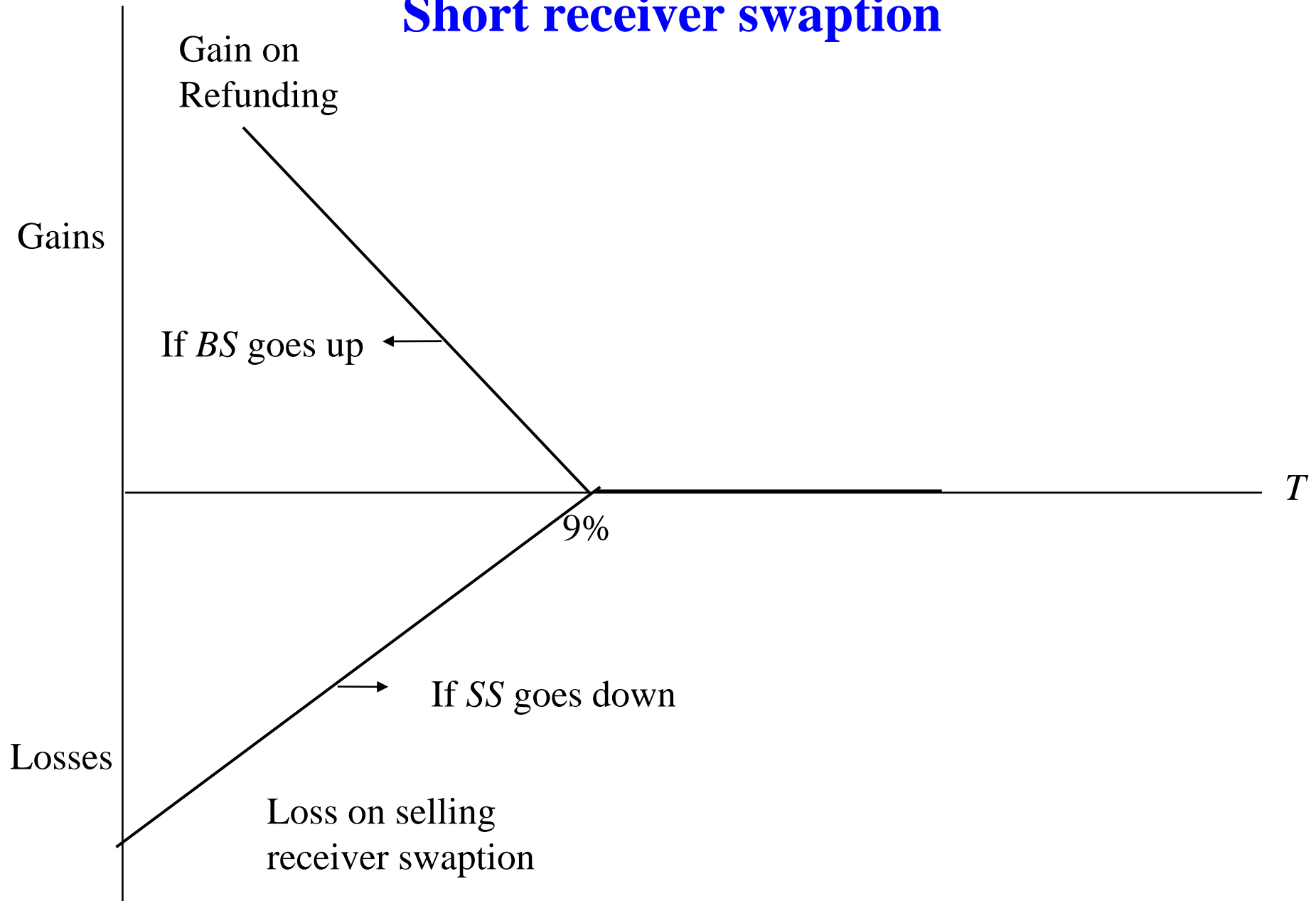
$$= \begin{cases} [10 \text{ percent} - (T + BS)] & \text{if } T + BS < 10 \text{ percent,} \\ 0 & \text{if } T + BS \geq 10 \text{ percent.} \end{cases}$$

- Loss upon exercising of the receiver swaption:

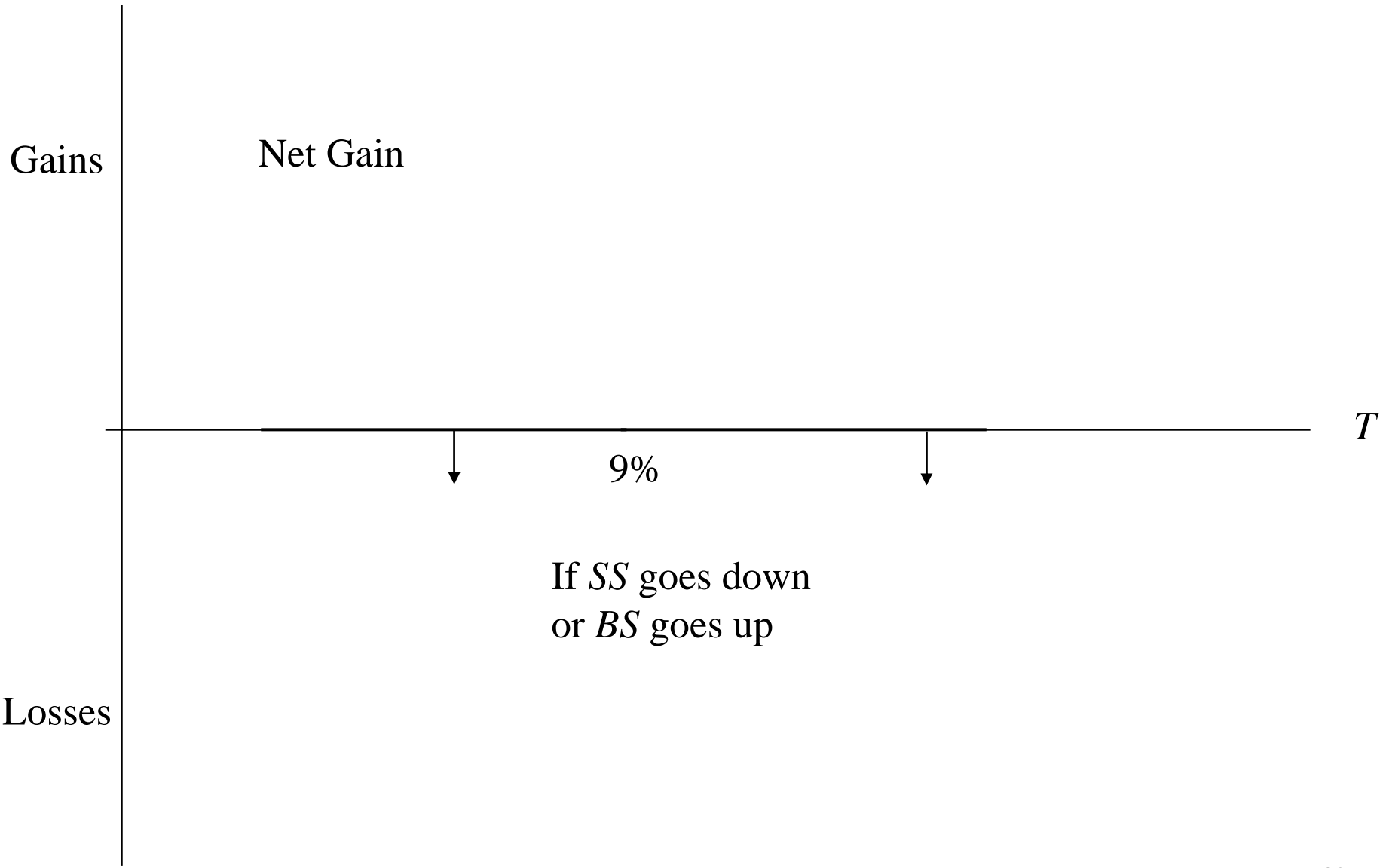
$$= \begin{cases} [9.50 \text{ percent} - (T + SS)] & \text{if } T + SS < 9.50 \text{ percent,} \\ 0 & \text{if } T + SS \geq 9.50 \text{ percent.} \end{cases}$$

With  $BS = 1\%$  and  $SS = 0.5\%$ , the two payoffs cancel.

# Short receiver swaption



# Short receiver swaption





## *Comment on the strategy*

By selling the receiver swaption, the company has been able to simulate the sale of the embedded call feature of the bond, thus fully monetizing that option. The only remaining uncertainty is the basis risk associated with unanticipated changes in swap and bond spreads.

## *Capital Market Valuation of Debt Options*

- Central to the use of swaptions for monetising the embedded options in callable bonds is the relative value of options in the fixed income and derivative markets.
- The securitisation of embedded options in callable debt relies on the relatively low priced options implicit within the bond.
- The embedded option is then sold through the swaption at a higher price in a different market segment (the interest rate derivative market).

Goal: To increase the value of the embedded option and enhance the attractiveness of the bond. Higher coupon rate means higher propensity of calling by issuer.

- Step up callable notes.
- Multi-step callable notes.

### *Background*

- In the early 1990s, the high implied US\$ forward rates meant that the option embedded in a callable bond was substantially out-of-the-money, contributing to the low premium value for the option.
- Investor behaviour reflected an expectation that the rate structure would stay relatively static and that forward rates were *overestimating* the rise in actual interest rates.

## Step Up Callable Notes

Issuer	AAA/Aaa Rated Issuer	
Amount	US\$100 million	
Maturity	10 years	
Issue price	100	
Coupon	<b>Year</b>	<b>Coupon (% pa semi-annually)</b>
	1 to 5	6.75 (64 bps above 5 Year Treasury)
	5 to 10	8.25 (156 bps above 10 Year Treasury)
Call Options	Callable at the option of issuer at Year 5	

The initial (lower) coupon applies until the call date (usually only a single call date is used). The coupon increases if the bond is not called. The increase in the coupon gives rise to the term “step up”.

## Multi-Step Callable Notes

Issuer	AAA/Aaa Rated Issuer	
Amount	US\$100 million	
Maturity	7 years	
Issue Price	100	
Coupon	<b>Year</b>	<b>Coupon (% pa semi-annually)</b>
	1	4.75 (67 bps above 1 Year Treasury)
	2	5.00 (31 bps above 2 Year Treasury)
	3	5.50 (21 bps above 3 Year Treasury)
	4	6.00 (21 bps above 4 Year Treasury)
	5	6.50 (34 bps above 5 Year Treasury)
	6	6.75 (42 bps above 6 Year Treasury)
	7	7.00 (41 bps above 7 Year Treasury)
Call Options	Callable at the option of the issuer on each semi-annual coupon date commencing on the second coupon date (after 1 year)	

- The adjustment in the coupon at the call dates has the effect of placing the call option at-the-money or closer to the money.
- In the case of the multi-step callable note structure, the option is structured as a Bermudan exercise option, allowing for exercise at various dates up until final maturity that serves to further enhance the value of the option.

## *Extension risk*

- Issuers normally set the front coupon at a higher level relative to their cost of borrowing for the shorter maturity. The step up rate is set with reference to implied forward rates.
- Investors view this type of callable bonds as *short term investments (to the call date) with extension risk*. This derives from the fact that unless interest rates rise at the rate implied by the forward curve, the higher step-up coupon on the call date dictates that the bond will be prepaid.
- This will leave the investor with a short term investment at an enhanced yield, the trade-off between the spread of the initial coupon to comparable investments and the risk of maturity extension.

## Summary

1. Callable bonds combine a traditional fixed income security with a call option written by the investor in favour of the issuer.
2. In recent times, the call feature has been effectively monetised or securitised through the use of swaption transactions which seek to capture the value differences between the pricing of these debt options between the fixed income and derivative markets.