

# Group 7

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# USD/MYR Vanilla Lookback PGN

**“Capitalising on the Ringgit’s  
strengthening against the Greenback”**





The background of the slide features a dark, atmospheric scene of several oil pumpjacks (jackhammers) silhouetted against a twilight or sunset sky. The sky has a gradient of colors from deep blue at the top to a warm orange and yellow near the horizon. The pumpjacks are in various stages of their pumping cycle, with their long arms and counterweights visible. The overall mood is industrial and somewhat somber.

# **Economic Motivations**

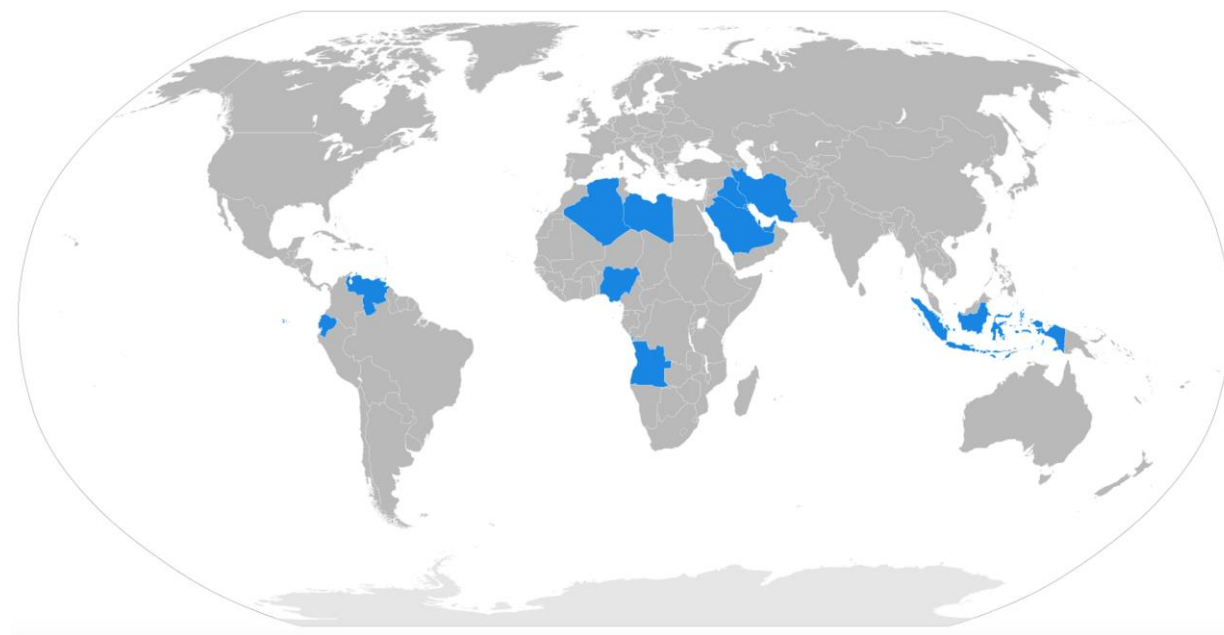
**Short Term: Fall of USD/MYR**

# Rebound of Crude Oil

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## Brent Crude Price

- Rebound from **\$28** (Jan 2015) to **\$40** levels (Apr 2016)



## OPEC April Report

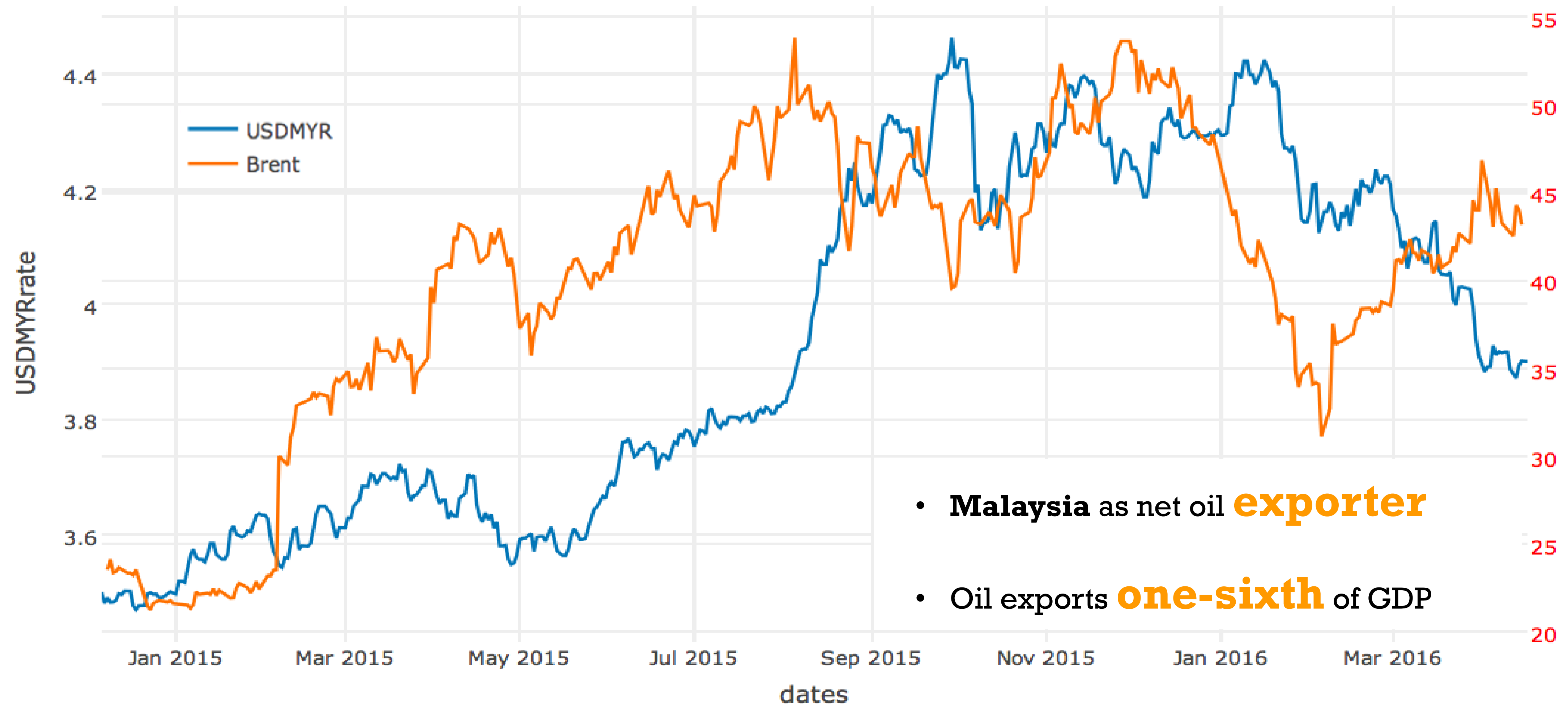
- Steep oil production **downfall** in 1Q16
- Predicts decline to **continue** in 2Q16

## Instability in the Middle East

- Workers **strike** over pay reforms in Kuwait
- Escalating **political conflicts** (Iran vs. Saudi Arabia)



# Rebound of Crude Oil



# Low interest rates in U.S.

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## Janet Yellen

- Persistent on declaring a **status quo** on low interest rates

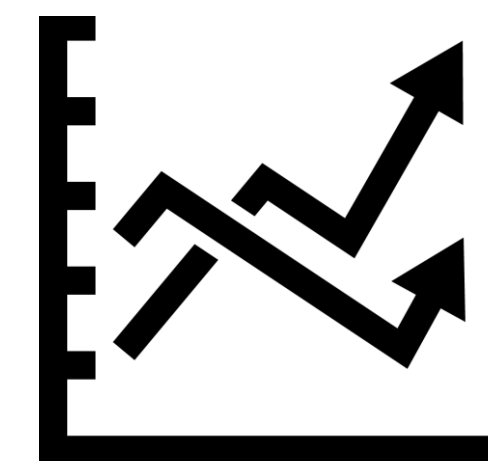


## Depreciation

- of **USD** against all other currencies

## Additional Pressure

- on currencies **correlated** with oil production





# Chinese Economic Recovery

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## GDP

- Growth: 6.7% (2016Q1) → **6.8%** (2016Q2, predicted)
- Aggressive monetary **stimulus**

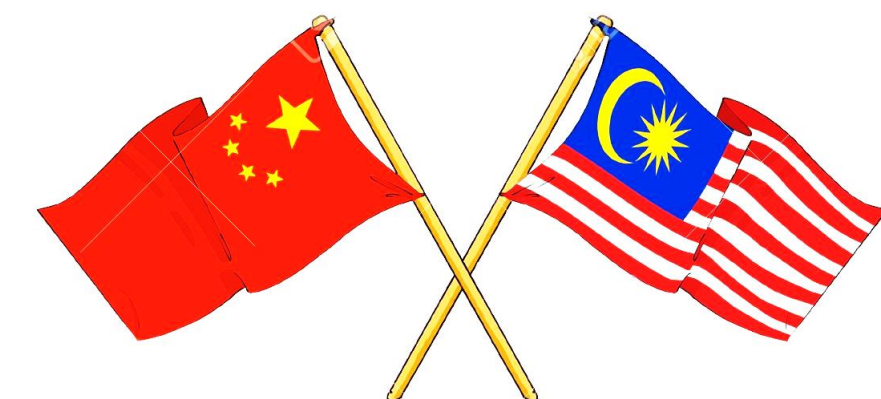


## Exports

- Rose **11.5%** in March y-o-y (USD)
- Increase in Services and Manufacturing **PMI** in March

## Trading

- China is Malaysia's **largest** trading partner
- Accounts for **11%** (RM20.56bil) of Malaysia's total exports
- Stabilization lends support to **appreciation** of MYR



# Long-Term: ???

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## Crude Oil Prices

- **Uncertain** outcome of meeting in June

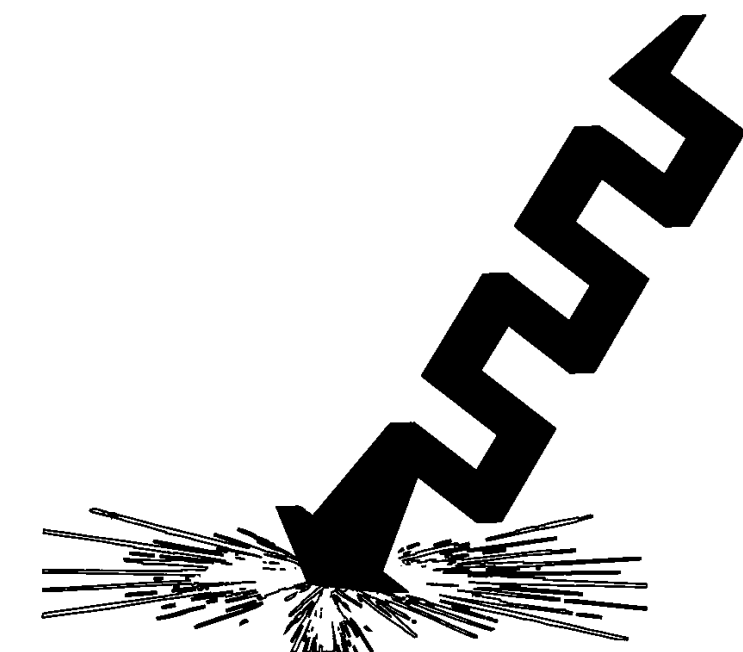


## Possible interest rate hikes

- **Earlier than expected** interest rate hike by the FED

## Reclining Chinese Economy

- **Instability** of trade and supply chain links
- Uneven Global Economy





An aerial night view of a city skyline, featuring the Petronas Towers in the center. The city is illuminated with various lights, and the sky is dark with some clouds. The text is overlaid on a semi-transparent white box.

# **Investment Objectives**

**How can investors benefit from our product ?**



# Investment Objective

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## Short Term



### Principal Guaranteed

- Minimum payoff of **principal** at maturity



### Fall of USD/MYR

- Downtrend to **continue** for next 6 months
- Capture payoff with vanilla **put option**



### Choice to Exit

- Choice to **exit** contract in 6 months
- Avoid risk of USD/MYR **stabilizing**

# Investment Objective

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## Long Term



### Principal Guaranteed

- Minimum payoff of **principal** at maturity



### Continue Fall of USD/MYR

- **Higher payoffs** if USD/MYR continues to fall
- Payoffs captured by **lookback option**



### Reduced Risk

- Lookback option captures **minimum price** of underlying
- **Reduced risk** in case USD/MYR rallies



# Product Design



# Product Features

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## ✓ Principal **Guaranteed**

✓ Initial investment: **I**

## ✓ Tracks Performance of **USD/MYR** (Underlying)

## ✓ Maturity: **T**

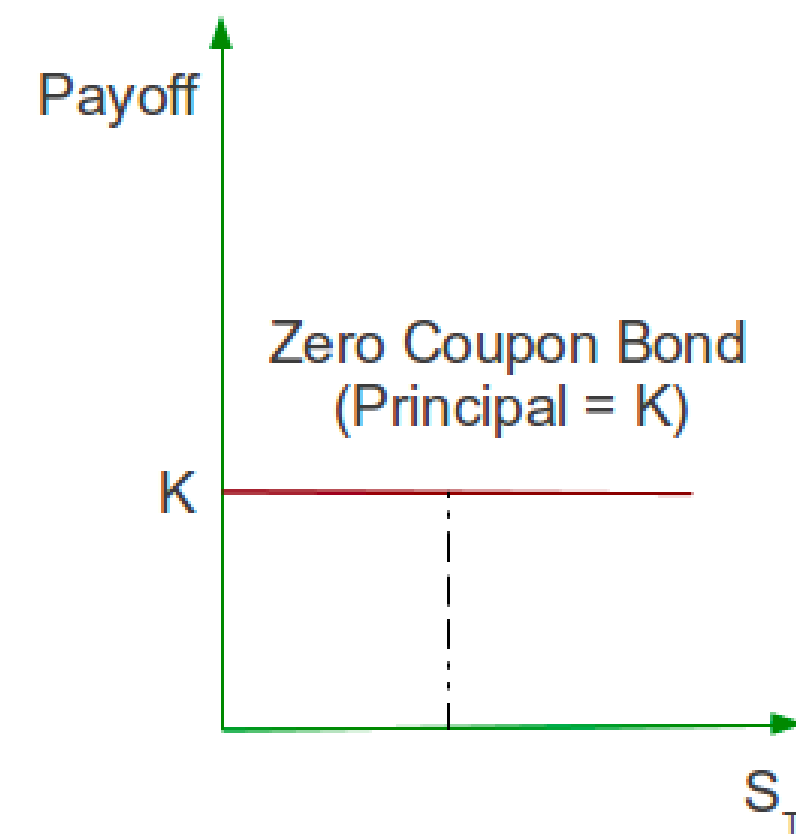
## ✓ Decision Point at **T/2** (Bermudan)

✓ **Continue:**  
Payoff at T =  $I + \pi_{LB} \times \max(K - \min_{\frac{T}{2} \leq t \leq T} S_t, 0)$

✓ **Discontinue:**  
Payoff at T =  $I + \pi_p \times \max(K - S_{\frac{T}{2}}, 0)$

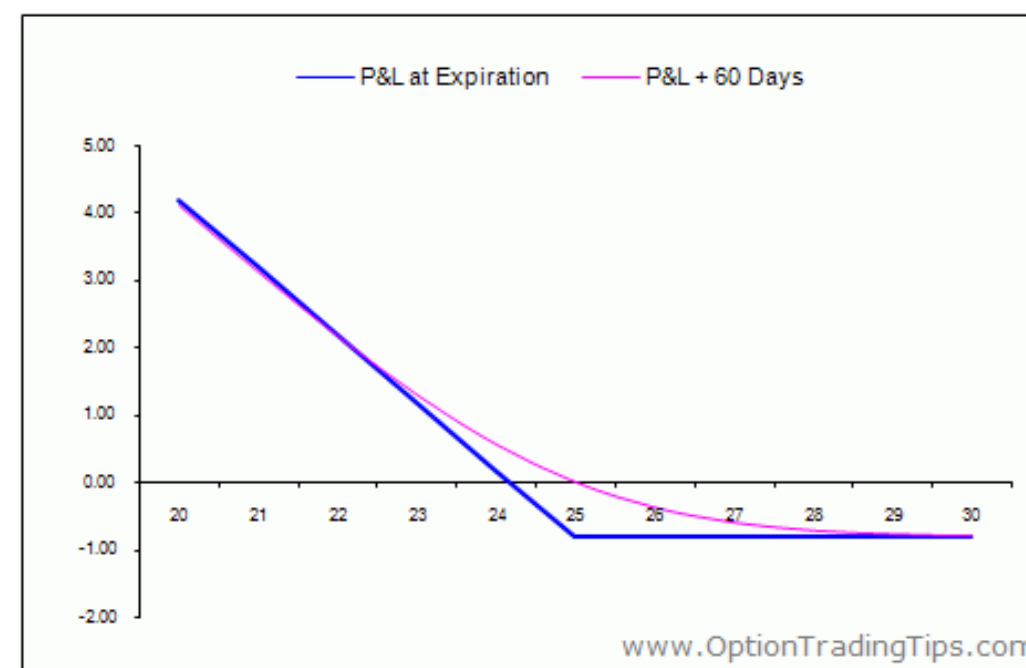
# Product Structure

## Components:



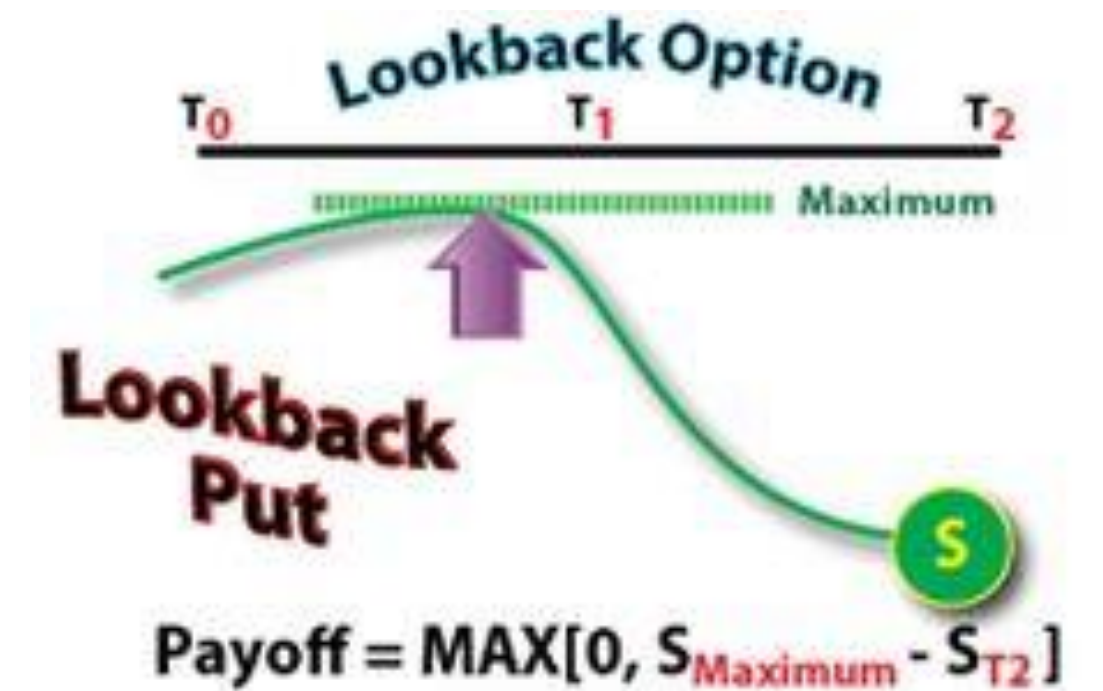
### Bond

- Principle =  $I$
- Starts at  $t = 0$
- Matures at  $T$



### European Put Options

- Starts at  $t = 0$
- Matures at  $T/2$
- $K = S_0$



### Lookback Put Options

- Starts at  $T/2$
- Matures at  $T$
- $K = S_{T/2}$



# Product Structure

**Scenario:**  **Continue** after  $\frac{T}{2}$

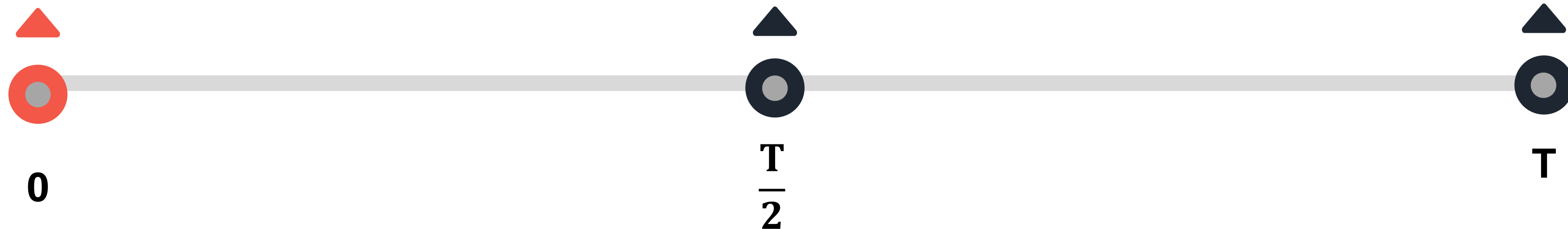
- **Investor** pays:  $I$
- **Buy Bond:**  $Ie^{-rT}$
- **Buy Put:**  $I - Ie^{-rT} = \pi_p P_0$

- **Put** Matures
- **Use Payoff from Put to buy Lookback:**

$$\pi_p \max(S_0 - S_{\frac{T}{2}}, 0) = \pi_{LB} LB_0$$

- **Bond** Matures
- **Lookback** Matures
- **Final Payoff:**

$$I + \pi_{LB} \times \max(S_{\frac{T}{2}} - \min_{\frac{T}{2} \leq t \leq T} S_t, 0)$$



**Decision Point**

# Product Structure

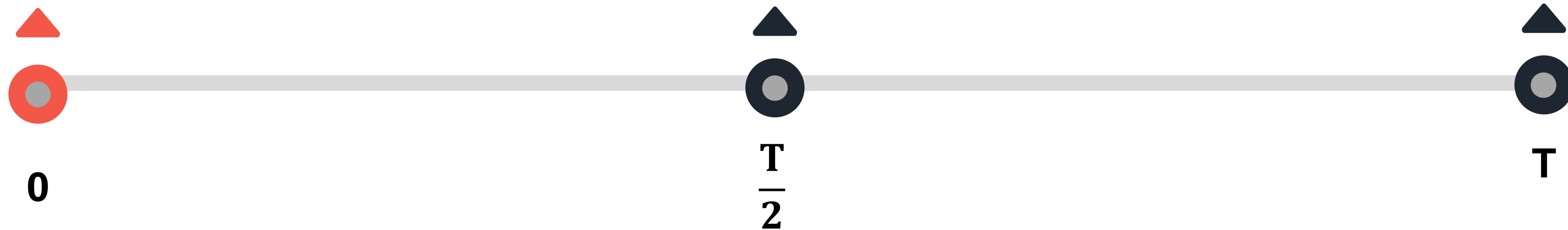
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**Scenario:**  **Discontinue** after  $\frac{T}{2}$

- **Investor** pays:  $I$
- **Buy Bond:**  $Ie^{-rT}$
- **Buy Put:**  $I - Ie^{-rT} = \pi_p P_0$

- **Put** Matures
- **Capture Put Payoff** at  $\frac{T}{2}$

- **Bond** Matures
- **Final Payoff:**  
$$I + \pi_p \times \max(S_0 - S_{\frac{T}{2}}, 0)e^{\frac{rT}{2}}$$



**Decision Point**

# Participation Rate

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**Scenario:**  **Continue** after  $\frac{T}{2}$

**Recall: Use Payoff from Put to buy Lookback:**

$$\pi_p \max(S_0 - S_{\frac{T}{2}}, 0) = \pi_{LB} LB_0$$

Since  $\pi_p = \frac{I - Ie^{-rT}}{p_0}$  and  $\pi_{LB} = P \times I$

Participation Rate:  $P_{LB} = \frac{(I - Ie^{-rT}) \max(S_0 - S_{\frac{T}{2}}, 0)}{I \times p_0 \times LB_0}$



# Participation Rate

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**Scenario:**  **Discontinue** after  $\frac{T}{2}$

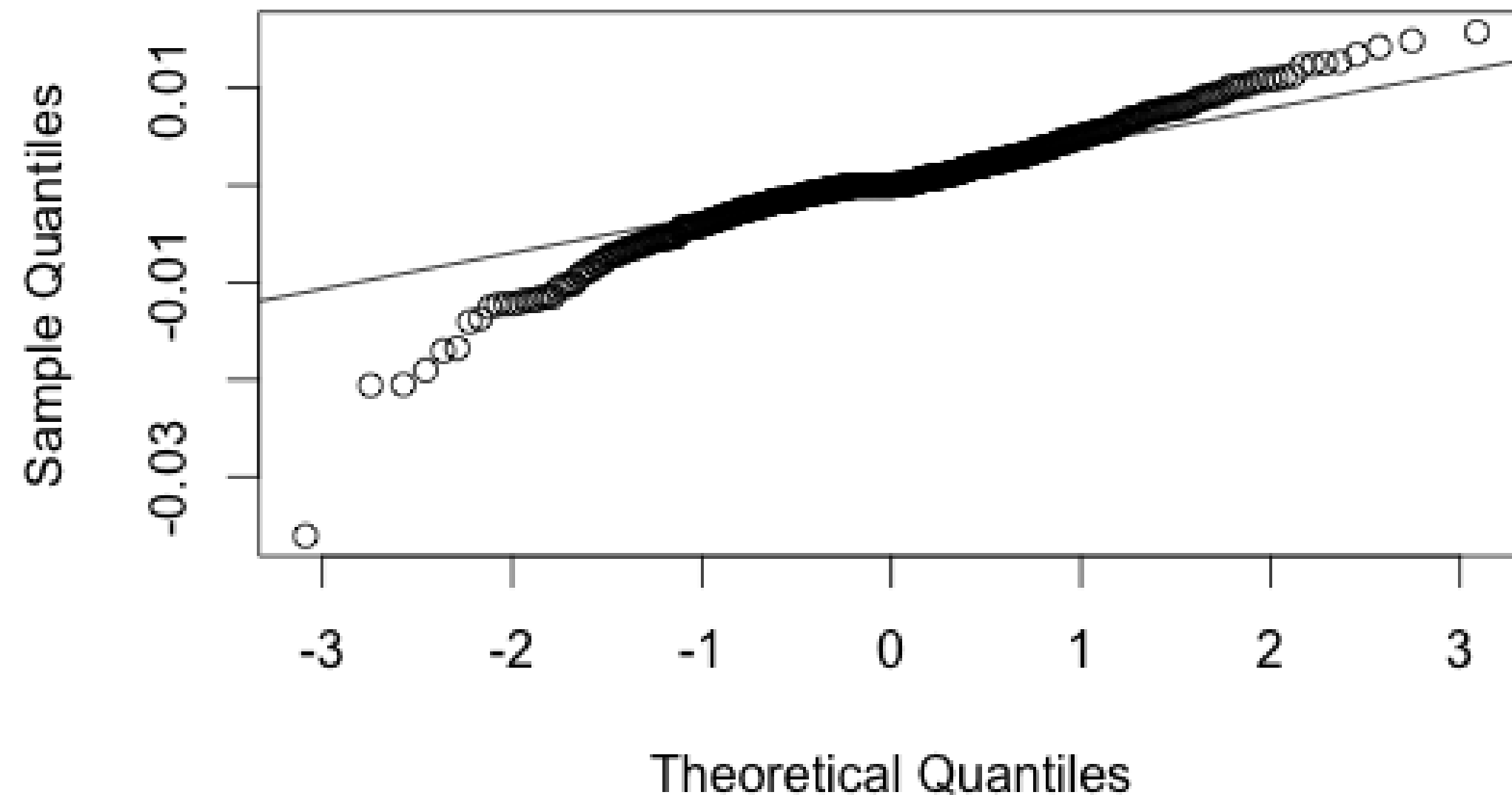
- Should investors choose to discontinue, product reverts to a **Normal Bear PGN**
- Hence Participation Rate, P :

$$P_p = \frac{I - Ie^{-rT}}{I \times p_0}$$

# Pricing Methodology

## Modelling Underlying (USD/MYR)

Normal Q-Q Plot



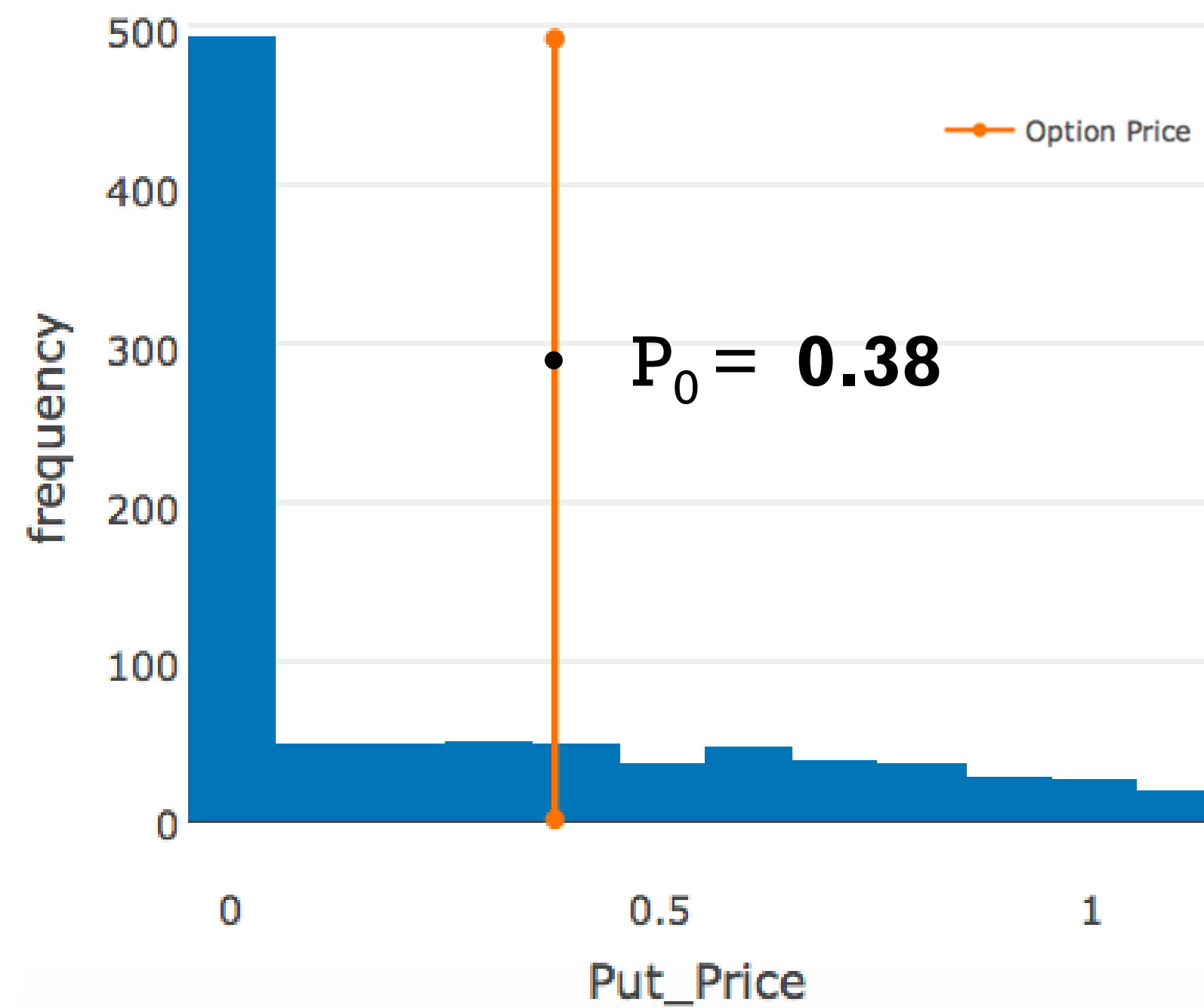
- Underlying returns show **fat tails**
- Use **Heston Model** to model underlying
- Parameters used:
  - $r = 2\%$
  - $\sigma = 30\%$
  - $\kappa = 9.7$
  - $\xi = 4.8$
- **Simulated Annealing** used to estimate  $\kappa$  and  $\xi$

# Pricing Methodology

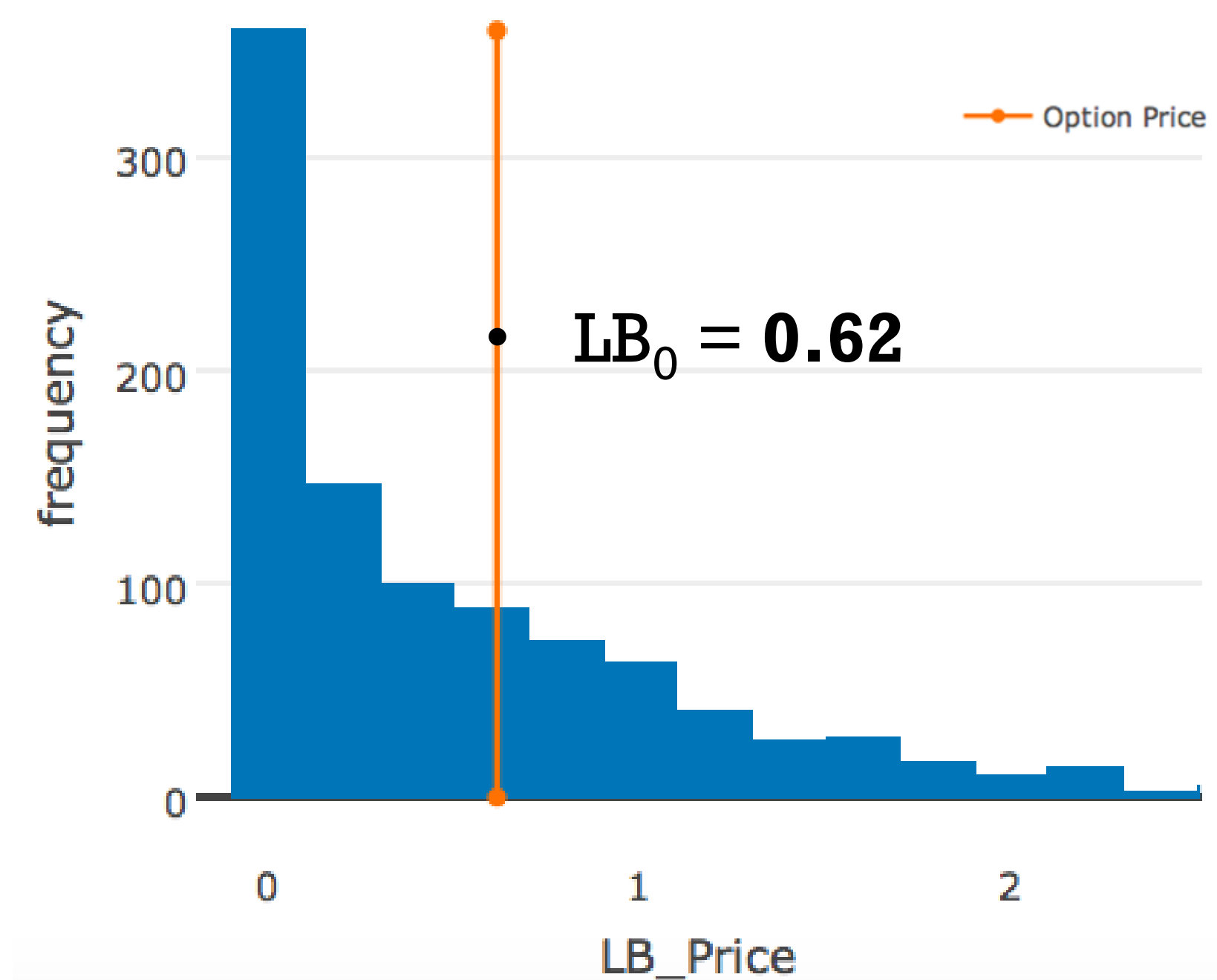
## Options Pricing

- We used **Monte Carlo Simulation** to price our embedded options

Put Option Histogram



Lookback Option Histogram





# Pricing Methodology

## Determining Participation Rate

- We used the following formulas and values:

$$P_0 = 0.38 \quad S_0 = 4.31 \quad I = 10,000 \quad T = 1$$

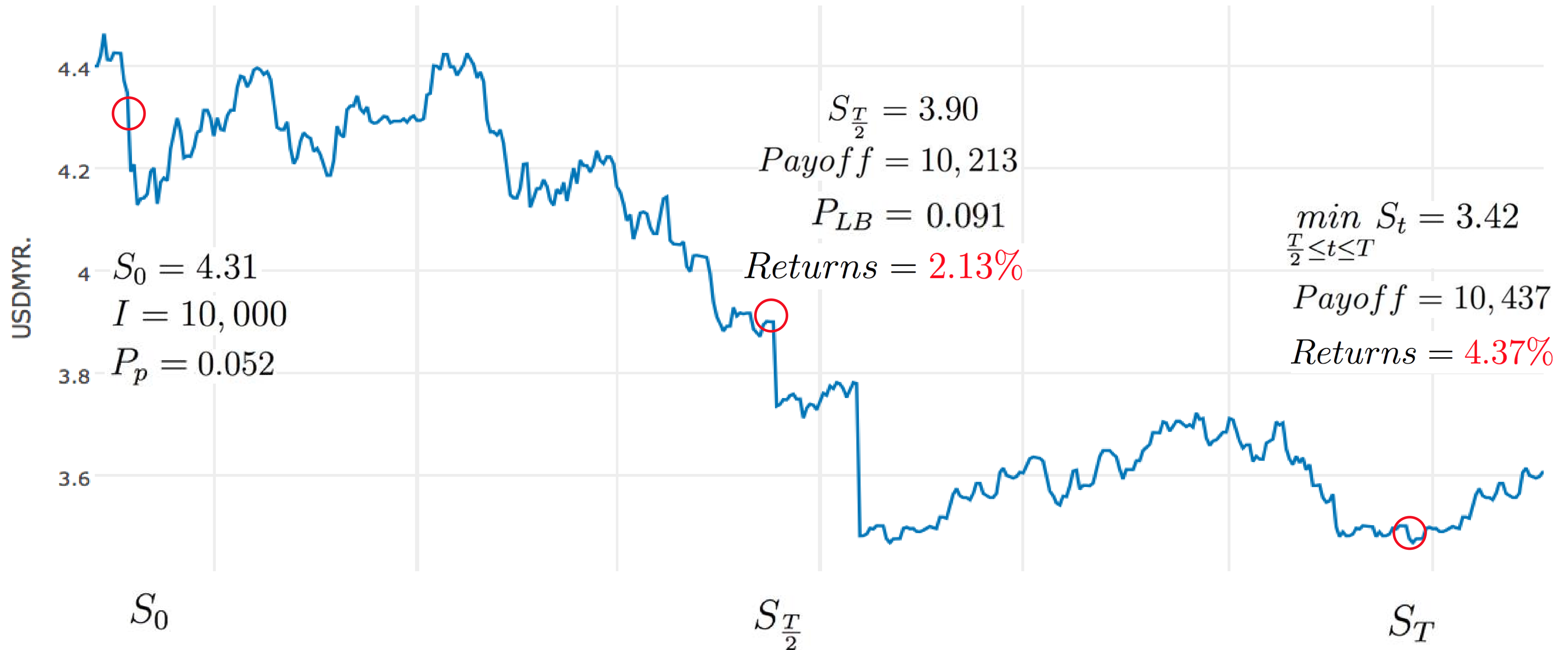
$$LB_0 = 0.62 \quad S_{\frac{T}{2}} = 3.90 \quad r = 0.02$$

Put Participation Rate: 
$$P_p = \frac{I - Ie^{-rT}}{I \times p_0} = \frac{10,000 \times (1 - e^{-(0.02 \times 1)})}{10,000 \times (0.38)} = 0.052$$

Lookback Participation Rate: 
$$P_{LB} = \frac{(I - Ie^{-rT}) \max(S_0 - S_{\frac{T}{2}}, 0)}{I \times p_0 \times LB_0}$$
$$= 0.052 \times \frac{(4.31 - 3.90)}{0.38 \times 0.62} = 0.091$$

# Pricing Methodology

## Potential Payoffs





# Investment and Hedging





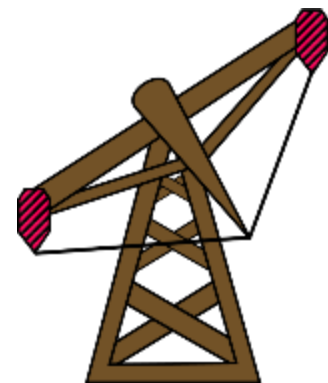
# Investment Advice

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Our product fits investors who have:



A **bearish** view  
on USD/MYR



A **bullish** view on  
the oil price



A **mild** risk  
appetite



# Hedging strategy

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**$T = 0$**

- Invest  $Ie^{-rT}$  in risk-free bond with maturity  $T = 1$
- Long  $\pi_p$  units of European put options with maturity  $T = \frac{1}{2}$

**$T = 1/2$**

- Long  $\pi_{LB}$  units of lookback put options with maturity  $T = 1$  if the contract continues

**$T = 1$**

- Perfect hedge !!





# Risk

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## Currency risk

- Underlying **put option** in the first 6 months
- Underlying **lookback option** in the later 6 months;



## Interest rate risk

US Fed decisions;  
  
Low interest rate  
environment globally;



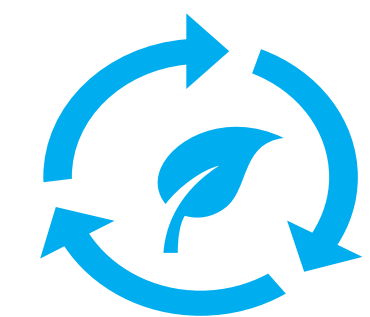
## Oil price risk

The trading volume  
of oil import and  
export in Malaysia;  
  
Global production  
and utilization of  
crude oil;



## Credit risk

The principal  
guaranteed are  
subject to the credit  
risk of the guarantor;



# Risks



## Currency Risk

- Underlying **put option** in the first 6 months
- Underlying **lookback option** in the later 6 months

## Interest Rate Risk

- US **Fed** decisions
- Low interest rate environment **globally**



# Risks



## Oil Price Risk

- The trading **volume** of oil import and export in Malaysia
- Global production and utilization of **crude oil**

## Credit Risk

- US **Fed** decisions
- The principal guaranteed are subject to the credit risk of the **guarantor**

