Interest Rate Derivatives

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Outline

Interest Rate Derivatives

- Definition

Forward Rate Agreements

- Motivation
- Mechanics

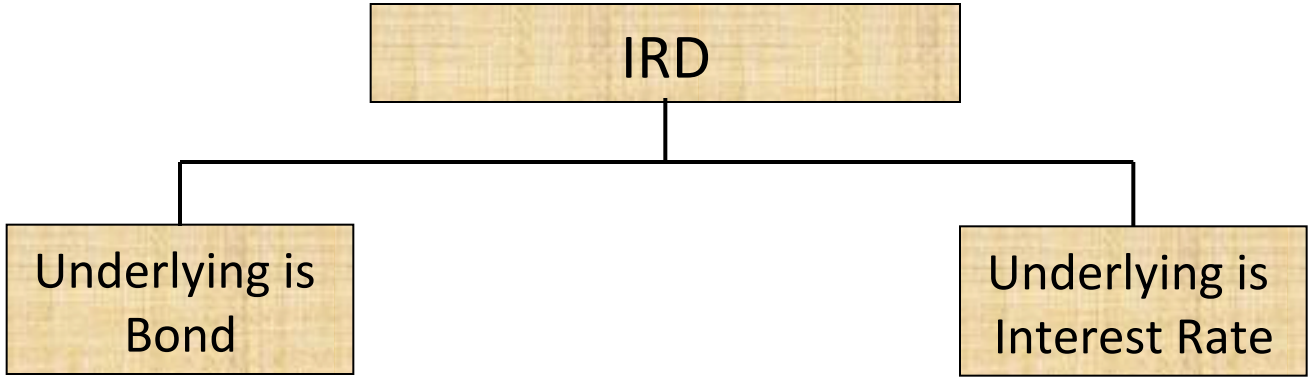
Interest Rate Swaps

- Motivation
- Mechanics

Interest Rate Derivatives

- Fixed Income Derivative:
  - The payoff of a derivative on a bond is based on the price of the bond relative to a fixed price.
  - The payoff of a derivative on an interest rate is based on the interest rate relative to a fixed interest rate.
- In some cases these can be shown to be the same.
- In most other cases, however, a derivative on an interest rate is a different instrument than a derivative on a bond.

Interest Rate Derivatives



T Bond Future

EuroDollar Future

Forward Rate Agreement

Swaps

Caps and Floors

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Interest Rate Swaps

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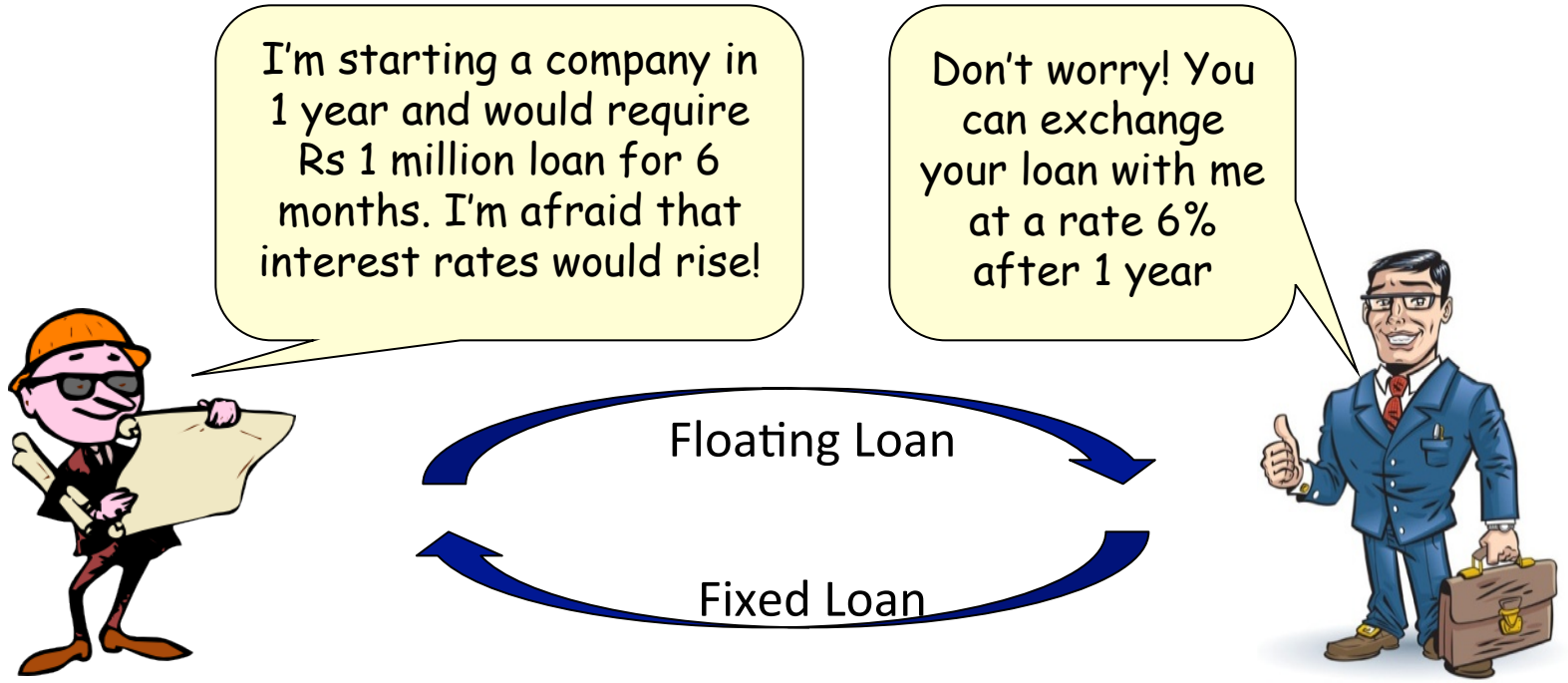
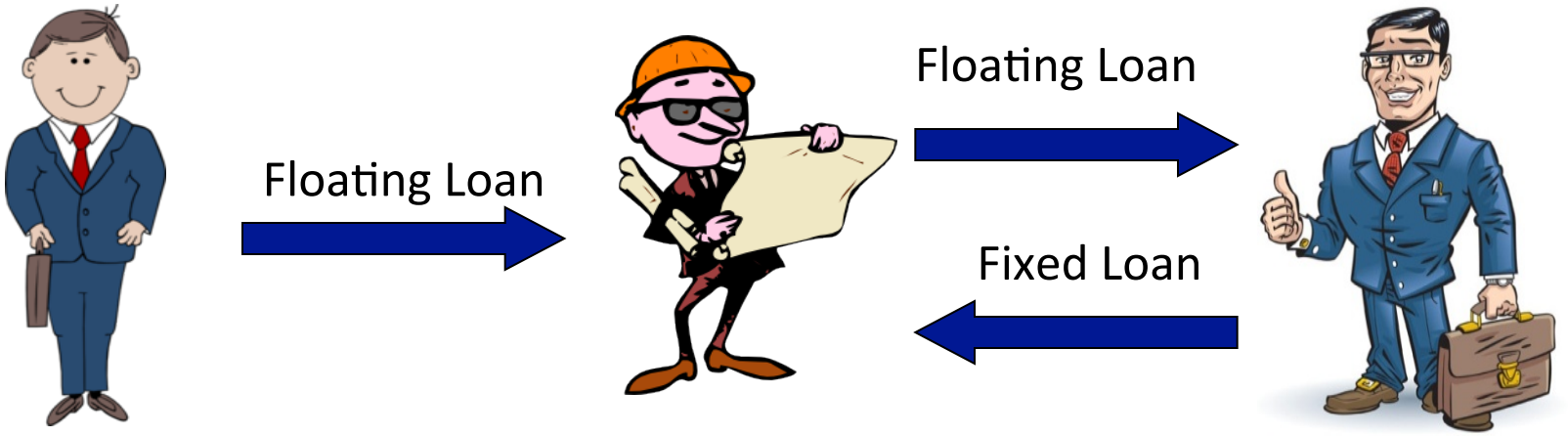
Forward Rate Agreement (FRA)

- Forward Rate Agreement is an arrangement to exchange Floating Rate Loan with a Fixed Rate Loan.



Forward Rate Agreement (FRA)

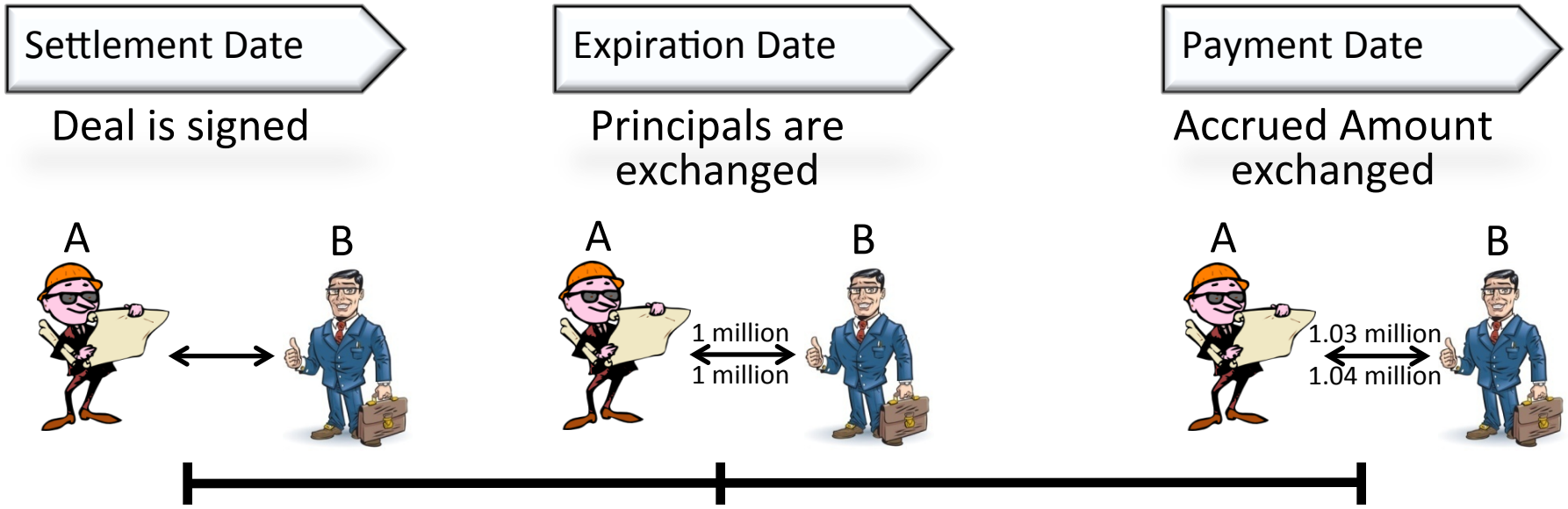
- Forward Rate Agreement helps converting a Floating Rate Loan into a Fixed Rate Loan



Forward Rate Agreement (FRA)

- A forward rate agreement (FRA) is an agreement that a certain rate will apply to a certain principal during a certain future time period
- An FRA can work better than a forward/ futures on a bond, because its payoff is tied directly to the source of risk, the interest rate.
- Underlying is usually LIBOR.
- 30/360 Day Count Convention is used. ☹
- Payoff is made at expiration rather than when the loan period ends.
- Of course at expiration, only the discounted payoff is exchanged.

FRA: Intention



Deal is signed with a promise that floating loan would be exchanged with 6% rate

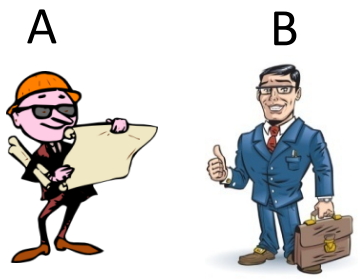
It is noted that the 6 month rate is 8%. A gives a 8% loan to B while B gives a 6% loan to A.

A gives 1*(1+0.06*(6/12)) million to B

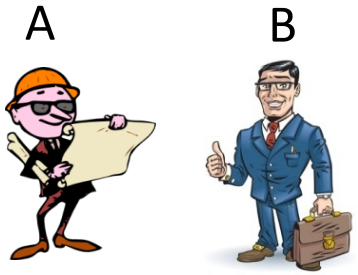
B gives 1*(1+0.08*(6/12)) million to A

FRA: Outcome

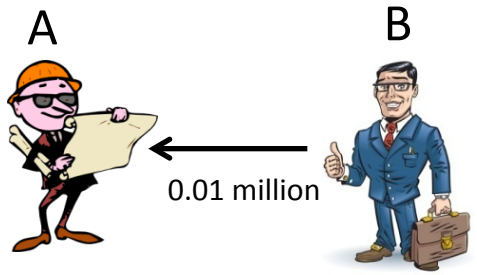
Deal is signed



Nothing is exchanged



Difference is exchanged



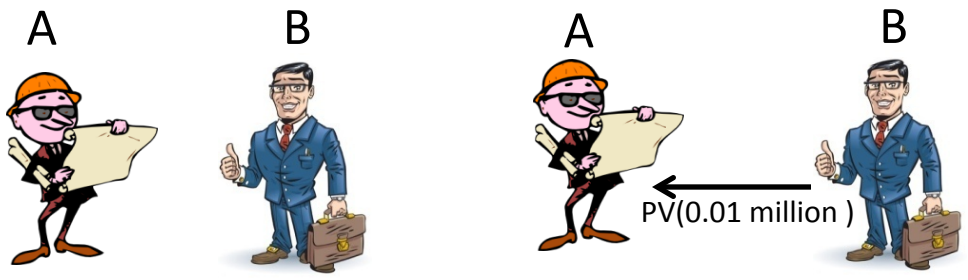
t = 0 t = 1 t = 1.5

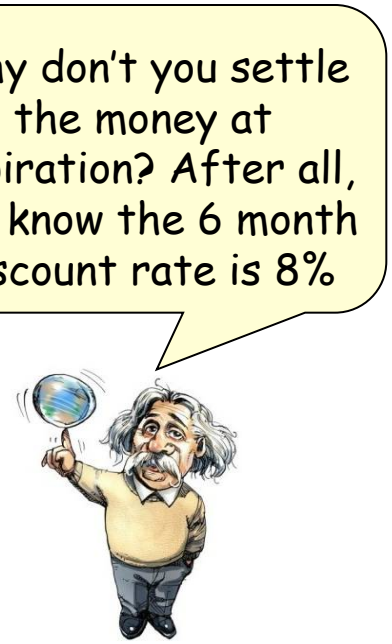
B gives
1*(0.08-0.06)*(6/12)
million to A

FRA: Reality

Deal is signed

Discounted Payoff Given





t = 0 t = 1 t = 1.5

$$(1\,\text{million})\left(\frac{(8\%-6\%)(6/12)}{1+8\%(6/12)}\right)$$

FRA: Example

- An FRA on 90-day LIBOR expiring in 30 days. Notional principal of $20 million. Agreed upon rate is 10 percent.
- 1X3 FRA
  - Position: Long
  - Notional: $20 million
  - Expiration: 1 months (30 days)
  - Rate: 3 month LIBOR (90 days)
  - Strike: 10%
  - Payoff: Expiration (Discounted Value)
- Suppose after 1month, 3 month LIBOR is 8%
- Payoff:

$$(\$20{,}000{,}000)\left(\frac{(0.08-0.10)(90/360)}{1+0.08(90/360)}\right)=-\$98{,}039$$

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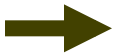
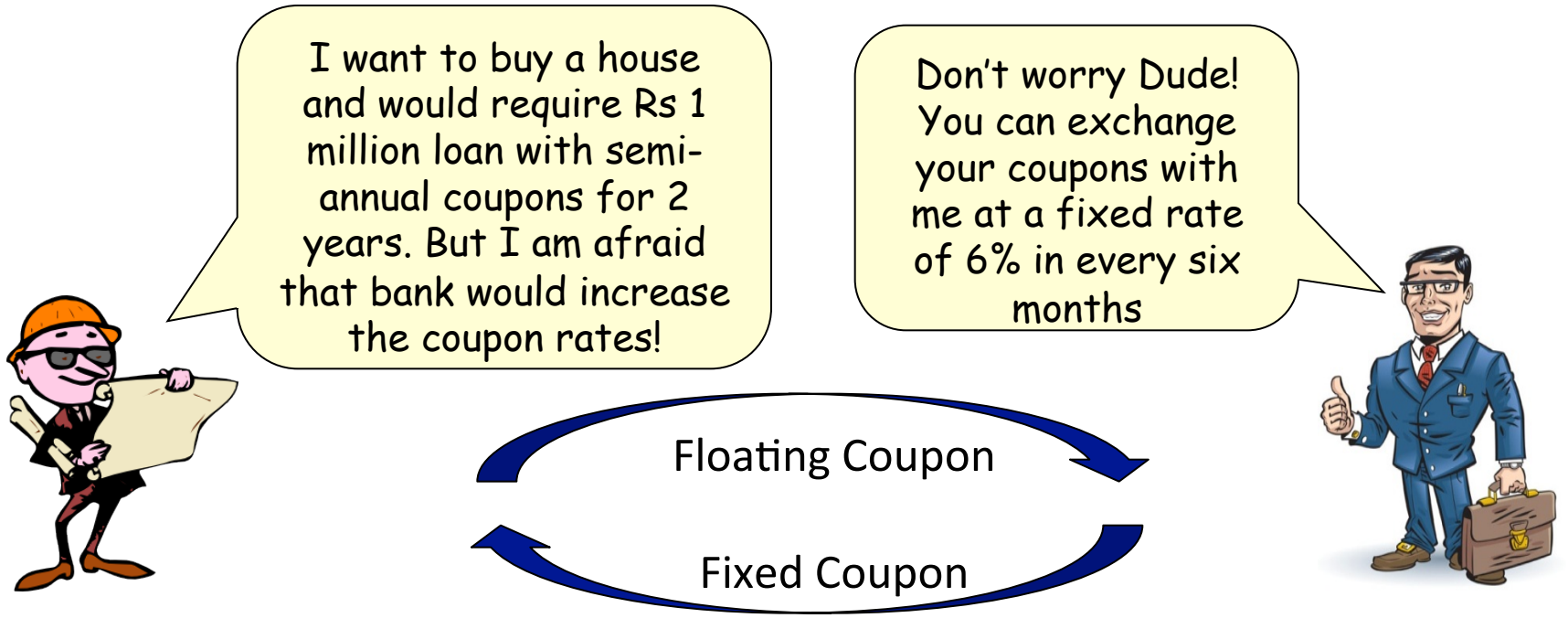


Interest Rate Swaps

- Motivation
- Mechanics

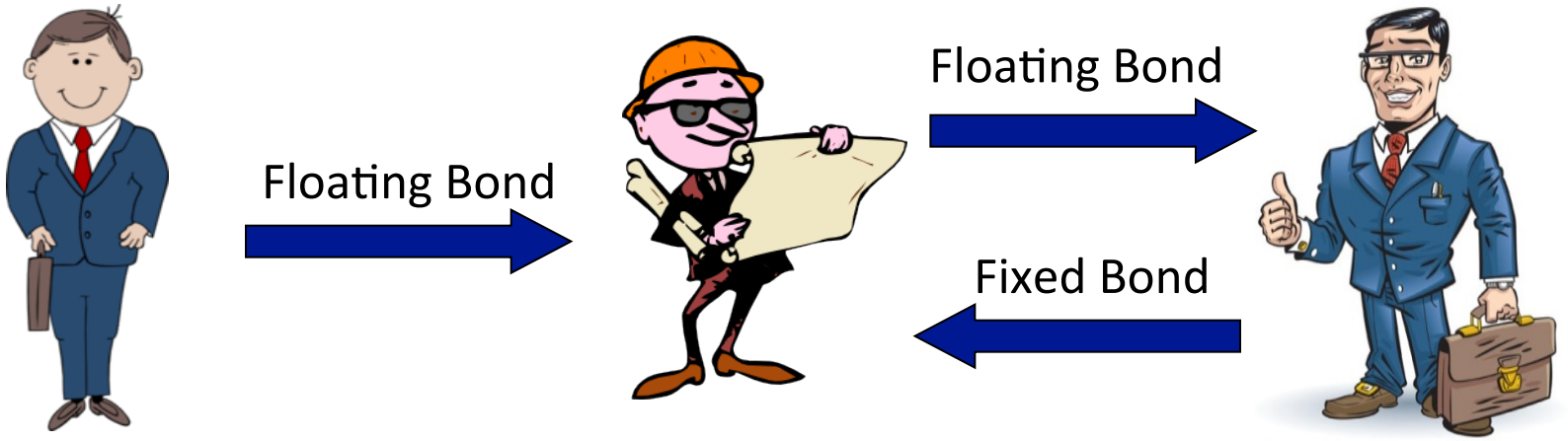
Interest Rate Swap

- Interest Rate Swap is an arrangement to exchange Floating Rate Bond with a Fixed Rate Bond.



Interest Rate Swap

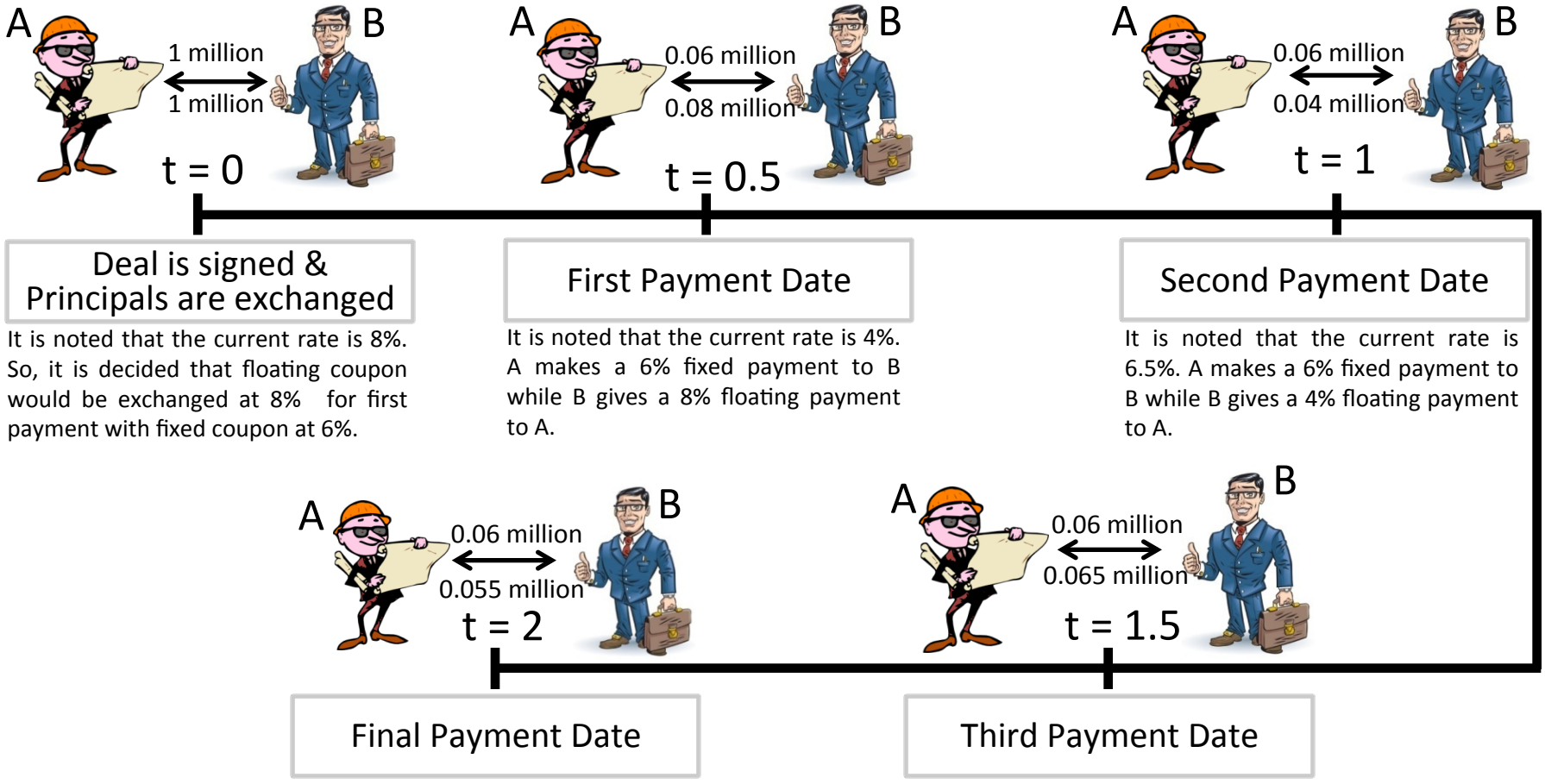
- Interest Rate Swap helps converting a Floating Rate Bond into a Fixed Rate Bond.



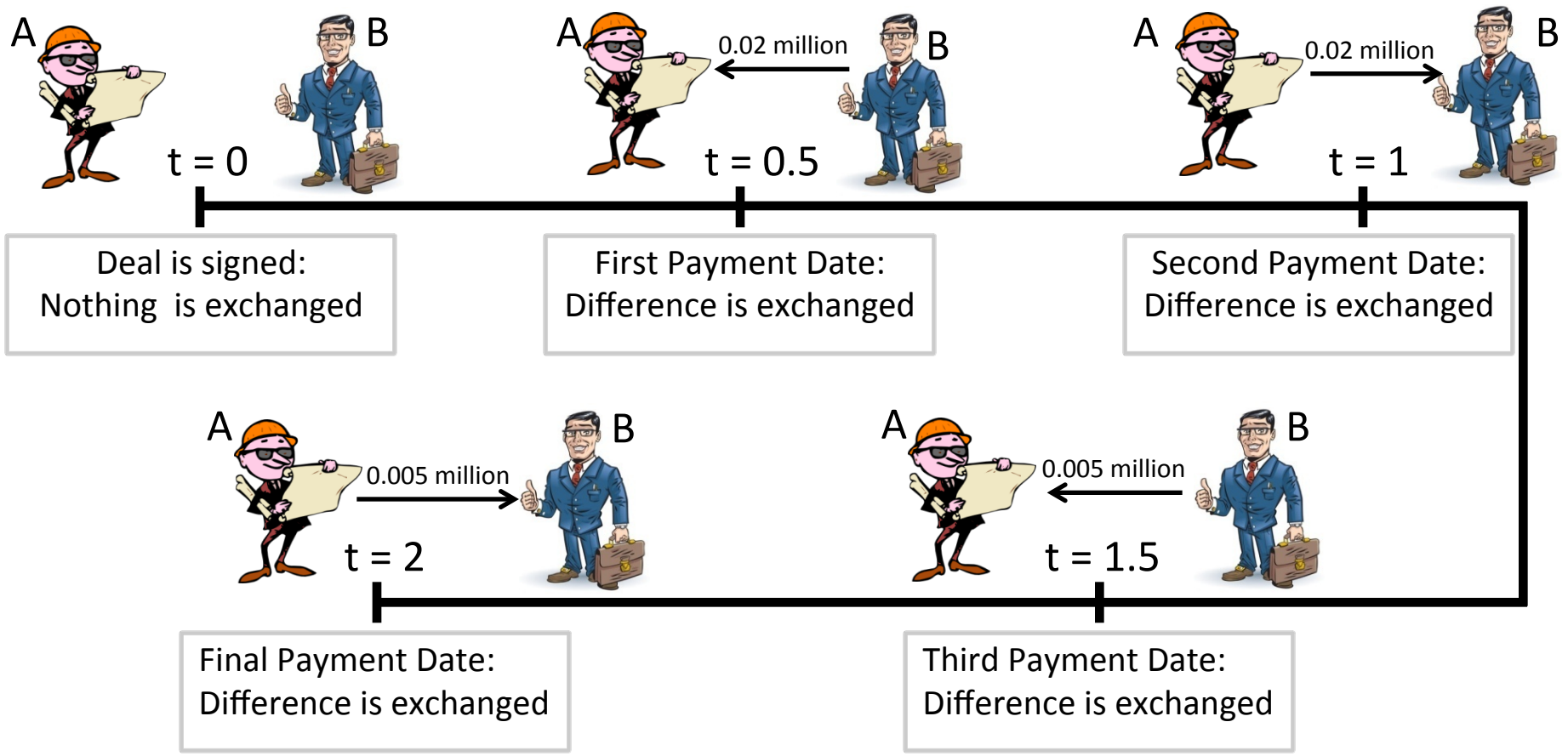
Interest Rate Swap

- An Interest Rate Swap is an agreement between two parties to exchange interest payments on a certain principal for a specific maturity.
- Interest payments based on a fixed rate are exchanged for Interest payments based on a floating rate.
- Payoff is made at the payment dates pre-decided while signing the deal.
- First floating coupon is known as beforehand.

Interest Rate Swap: Intention



Interest Rate Swap: Outcome



IRS: Example

- A two year, quarterly Interest Rate Swap on a 3 month LIBOR. Notional principal of $10 million. Agreed upon rate is 7.5 percent.
- IRS
  - Position: Long
  - Notional: $10 million
  - Rate: 3 month LIBOR
  - Strike: 7.5 %
  - Time: 2 years

1-Feb-00	1-May-00	1-Aug-00	1-Nov-00	1-Feb-01	1-May-01	1-Aug-01	1-Nov-01
7.35	7.42	7.45	7.67	8.05	7.75	7.8	8

IRS: Example

Reset Date	Payment Date	LIBOR	Floating Payment	Fixed Payment	Net Cash Flow
01-Feb-00	**01-May-00**	**7.35**	**$183,750**	**$187,500**	**($3,750)**
01-May-00	**01-Aug-00**	**7.42**	**$185,500**	**$187,500**	**($2,000)**
01-Aug-00	**01-Nov-00**	**7.45**	**$186,250**	**$187,500**	**($1,250)**
01-Nov-00	**01-Feb-01**	**7.67**	**$191,750**	**$187,500**	**$4,250**
01-Feb-01	**01-May-01**	**8.05**	**$201,250**	**$187,500**	**$13,750**
01-May-01	**01-Aug-01**	**7.75**	**$193,750**	**$187,500**	**$6,250**
01-Aug-01	**01-Nov-01**	**7.8**	**$195,000**	**$187,500**	**$7,500**
01-Nov-01	**01-Feb-02**	**8**	**$200,000**	**$187,500**	**$12,500**

Questions