Time and the Discount Rate

- Project flows of costs and benefits are not even over time.

Flow of Costs and Benefits

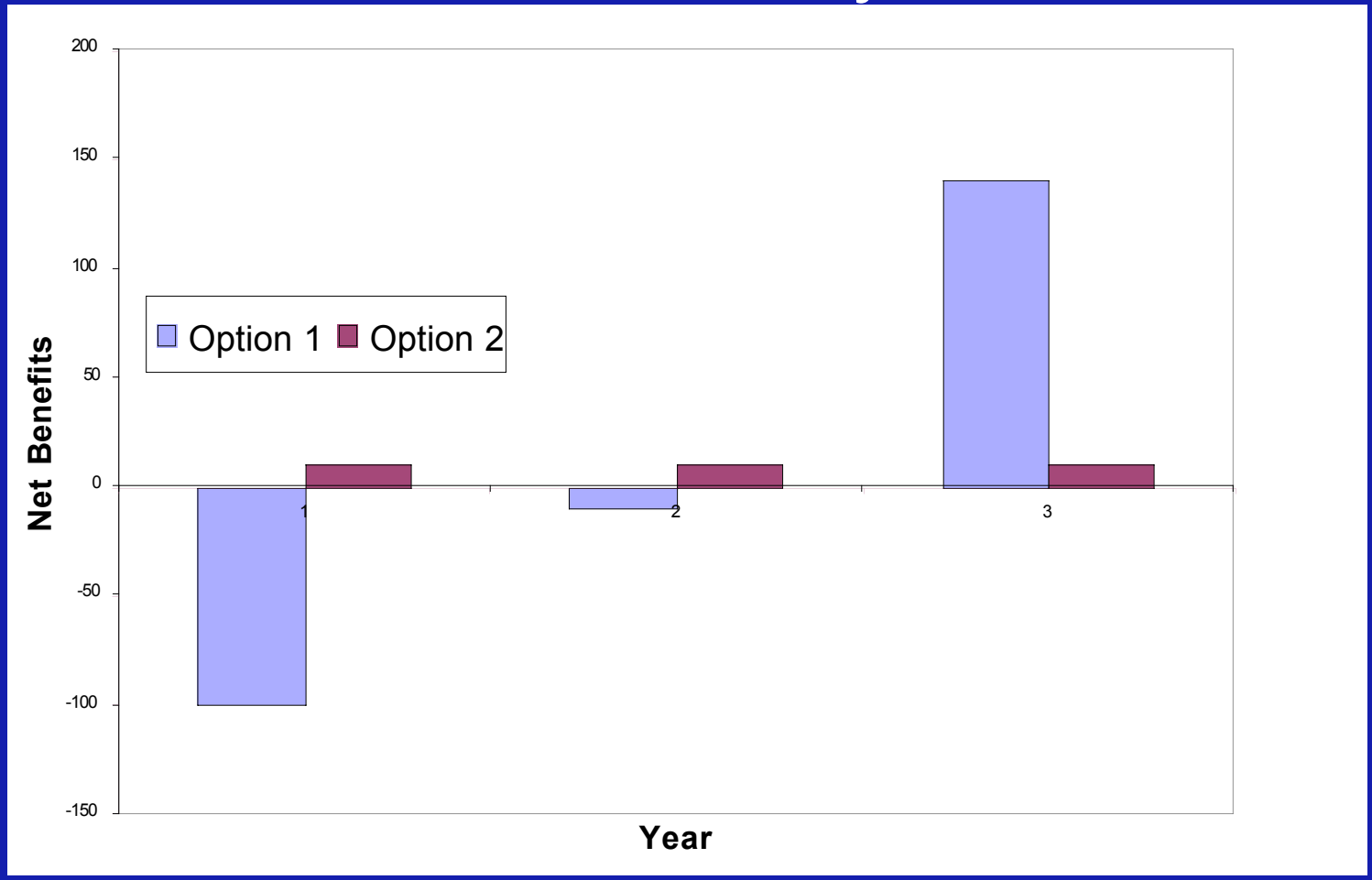
Consider 2 Investment Options

Option1			
Year	Cost	Benefit	Net
1	100	0	-100
2	10	0	-10
3	10	150	140
Sum	120	150	30

Option 2			
Year	Cost	Benefit	Net
1	40	50	10
2	40	50	10
3	40	50	10
Sum	120	150	30

Flow of Costs and Benefits

Net Benefits by Year



Flow of Costs and Benefits

- These two options have very different flows of costs and benefits over time.
- Is there any difference between these two options?
- Which is preferred?

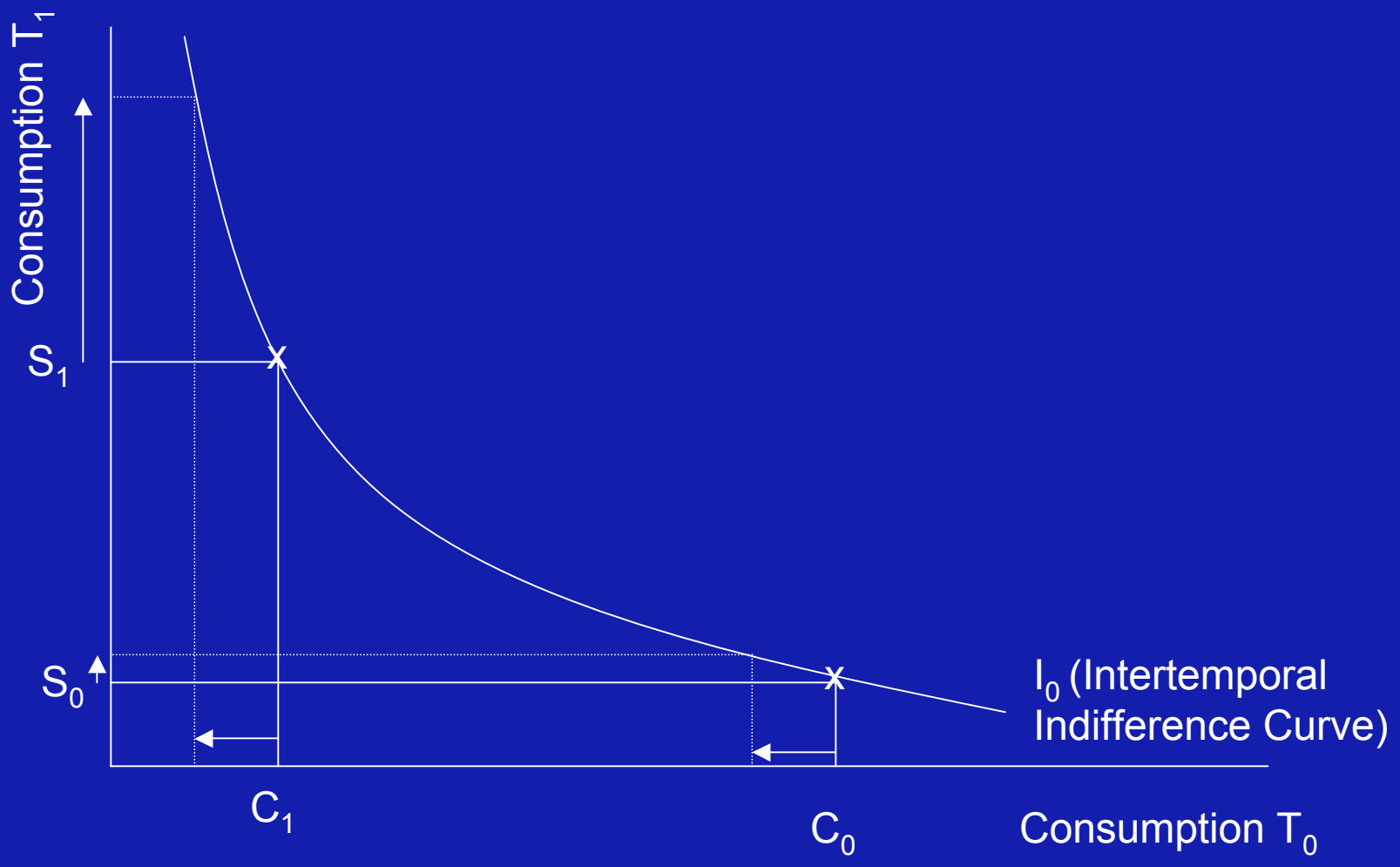
Flow of Costs and Benefits

- In order to address this question, need to understand how the future is valued relative to the present:
  - Intertemporal time preferences
  - The interest rate

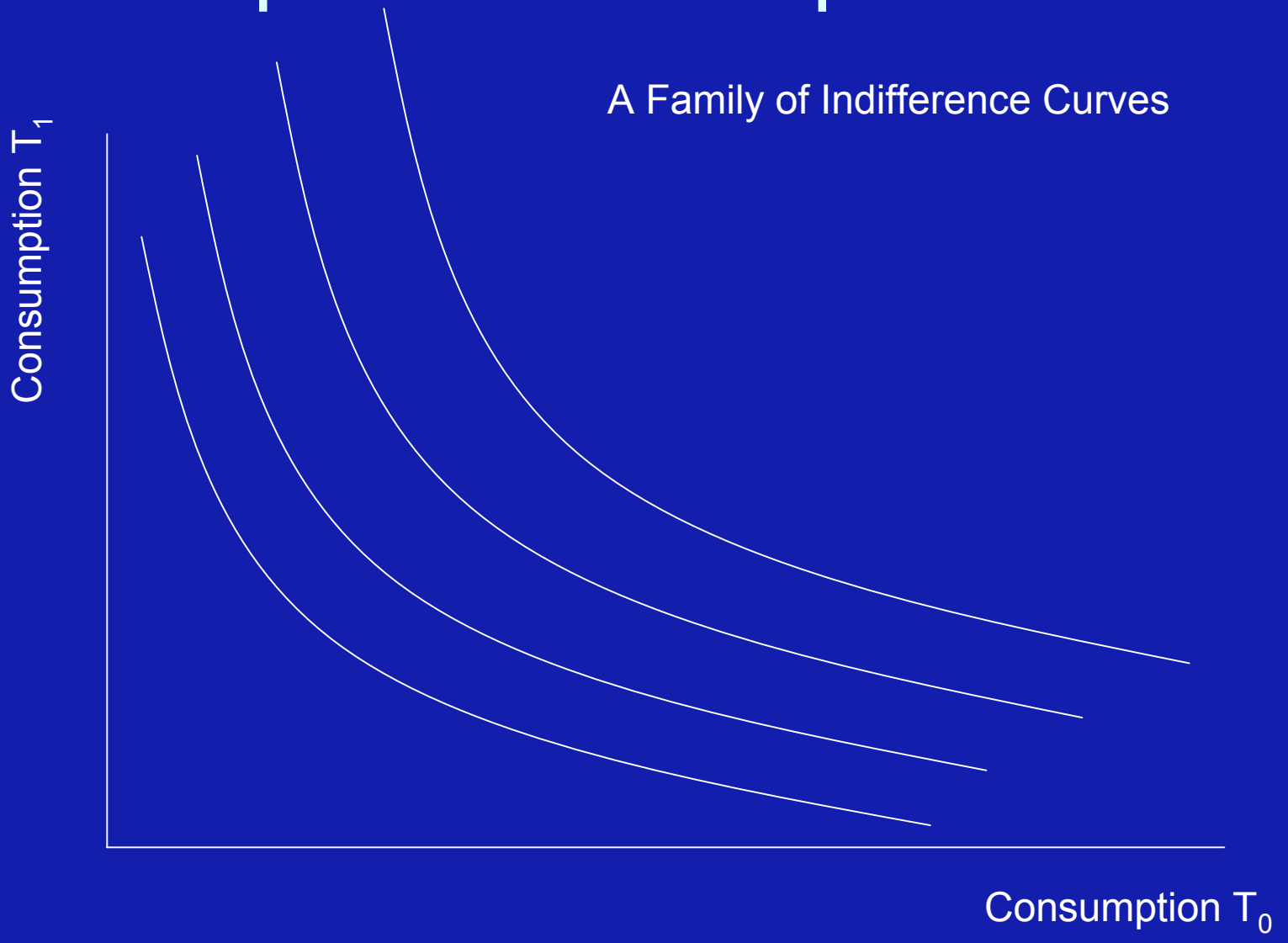
Time Preference of Consumers

- Consider consumers have a stock of wealth today, and must choose to consume between today and tomorrow.
- Intertemporal indifference map
  - Time indifference
  - Intertemporal indifference curve

Intertemporal Consumption Choice



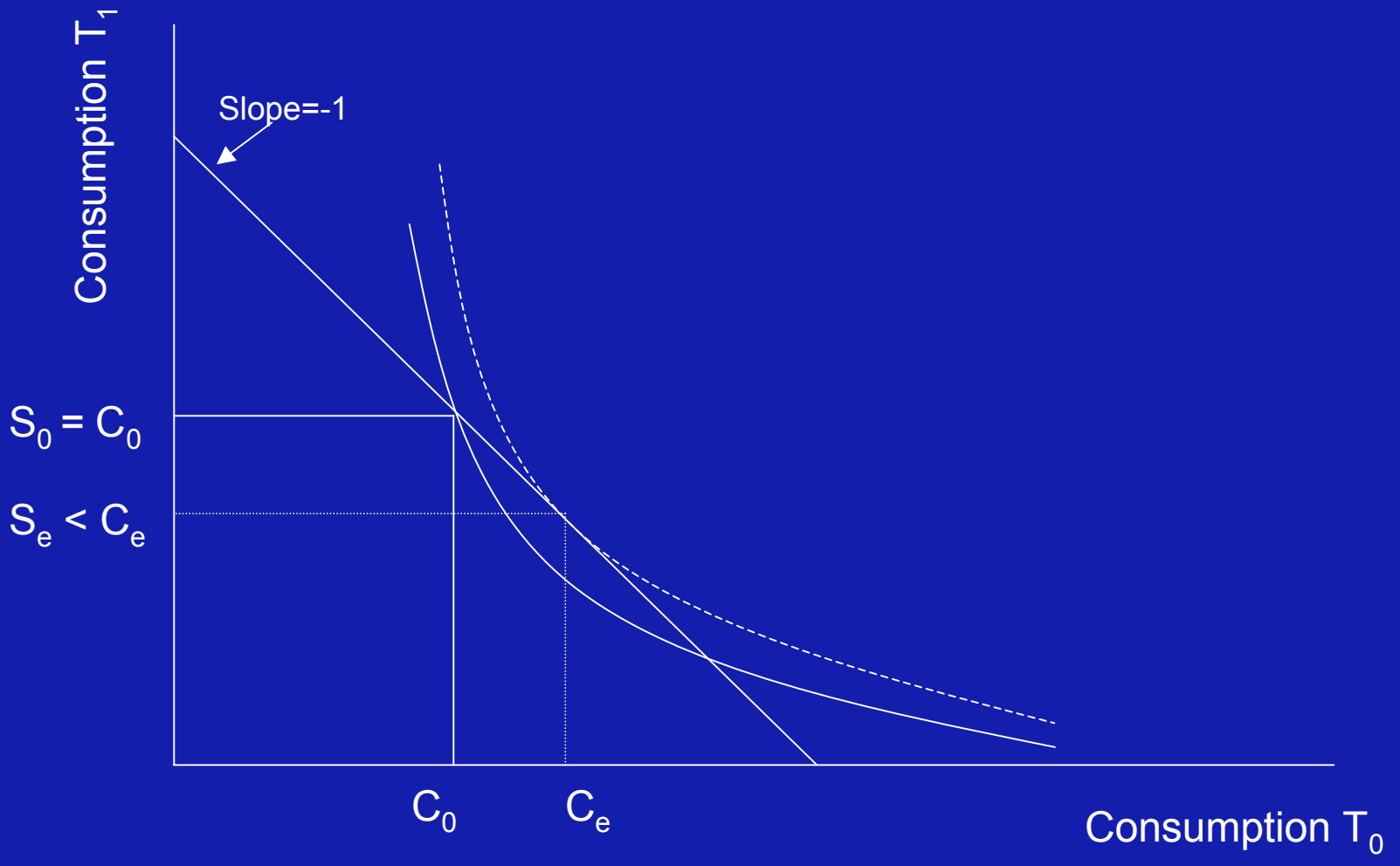
Intertemporal Consumption Choice



Time Preference of Consumers

- Expect consumers to have "*positive time preference*" :
  - prefer consumption today rather than in the future
- Why?
  - There is a chance that will not be able to consume in the future
    - *(in the long run we are all dead)*
  - Expectation that income will be higher in the future (economy will grow)
    - *(Goods and services will be more abundant in the future as a result of economic growth)*

Intertemporal Consumption Choice



The price of current consumption

- Income or wealth that is consumed today is not available to be saved for consumption in the future.
- What is the price of consuming today?
- Interest rate: amount that savings today can be increased in the future, through investment.

Interest Rate

- The price (or opportunity cost) of consuming a dollar of income or wealth today rather than saving for consumption in the future
- Expressed as a percentage increase:
  - $(K_1/K_0)-1\} * 100$

    K_0 money invested in time 0

    K_1 money obtained from investment in time 1

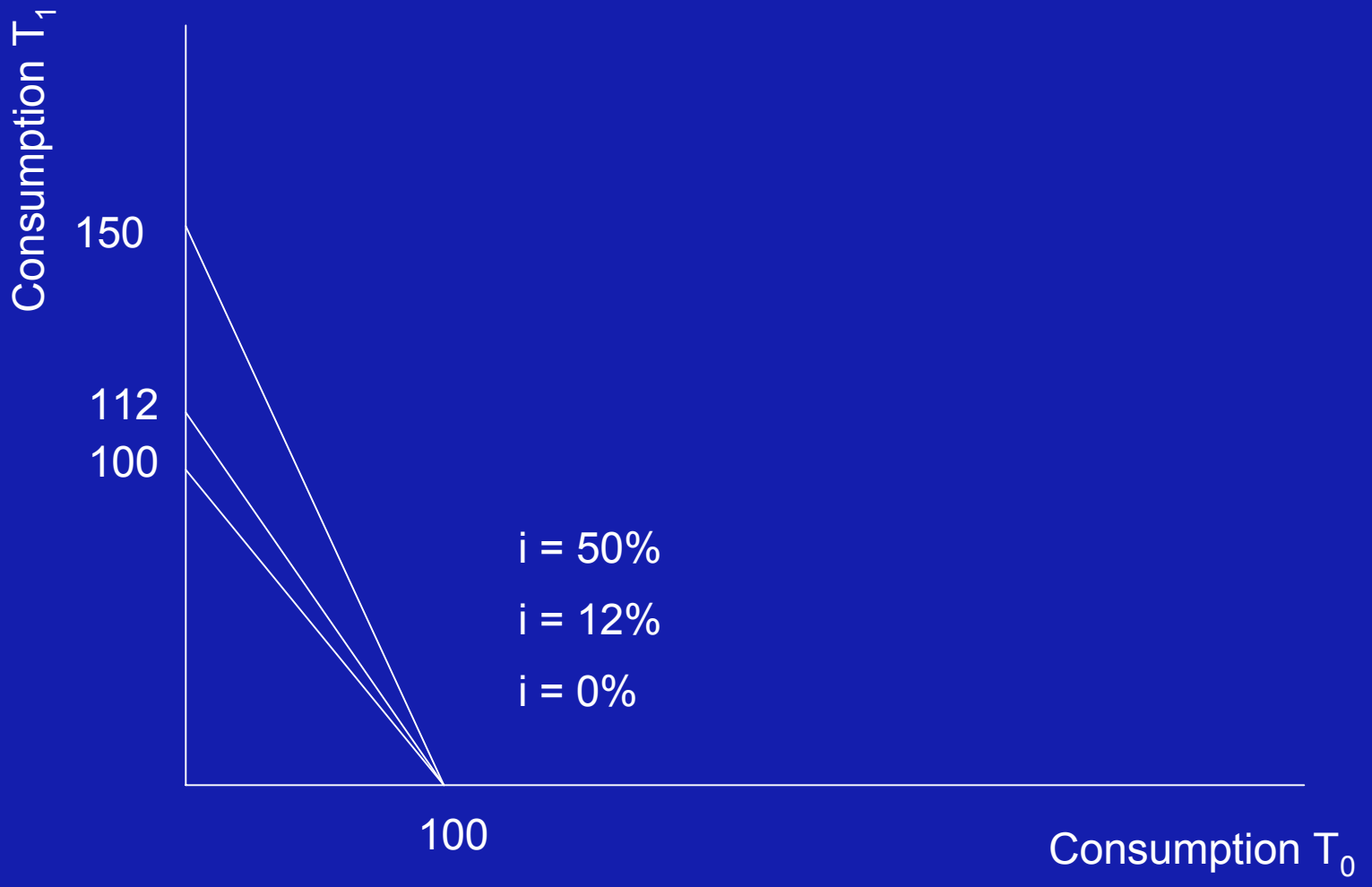
Interest Rate

- Example:
- Invest $100 in time 0
- Return = $112 in time 1
- Interest rate=

  (112/100-1) * 100

  = 12%
- A unit-free measure, expressed as a ratio

Interest Rate

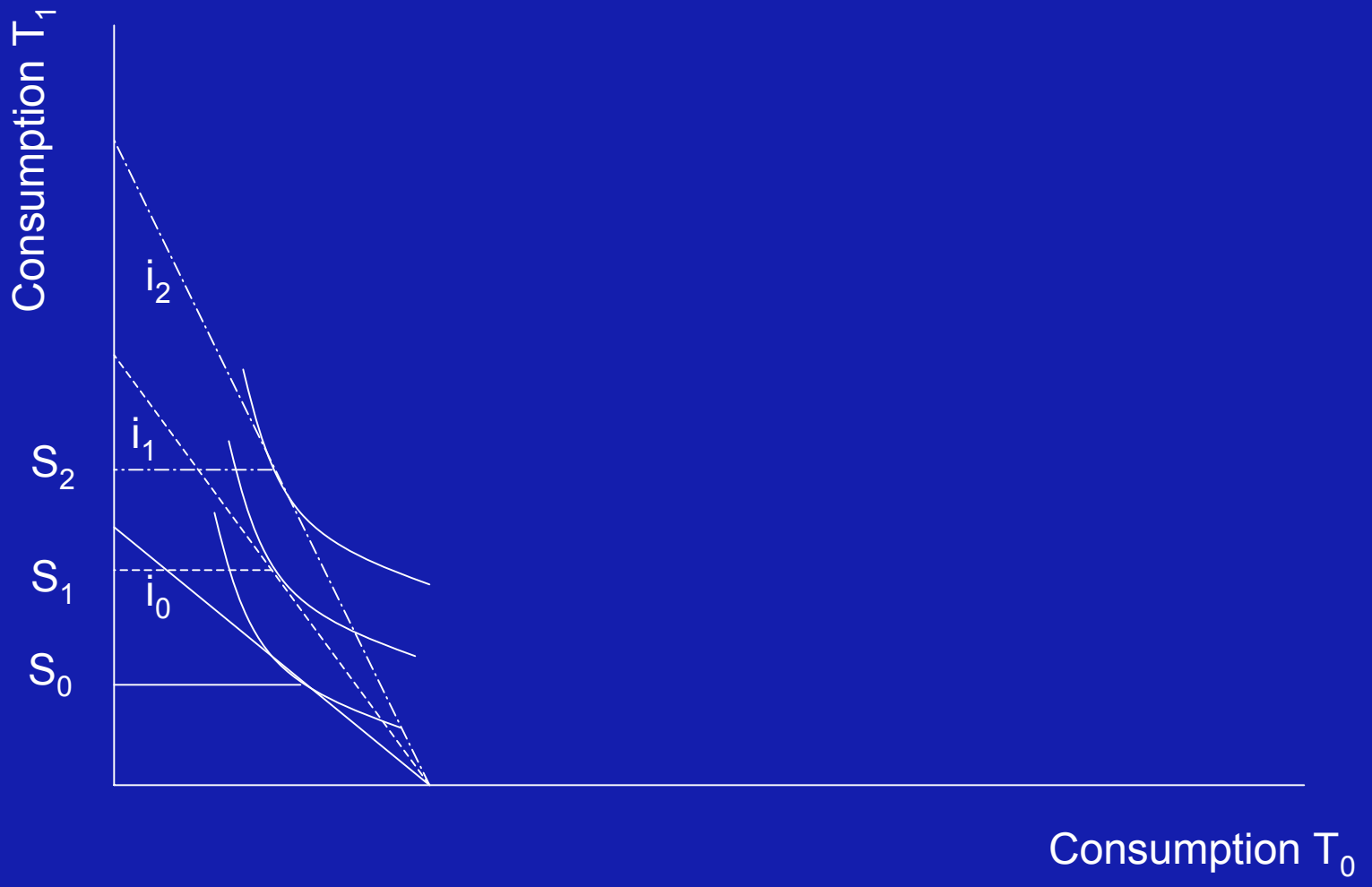


Time Preference of Consumers

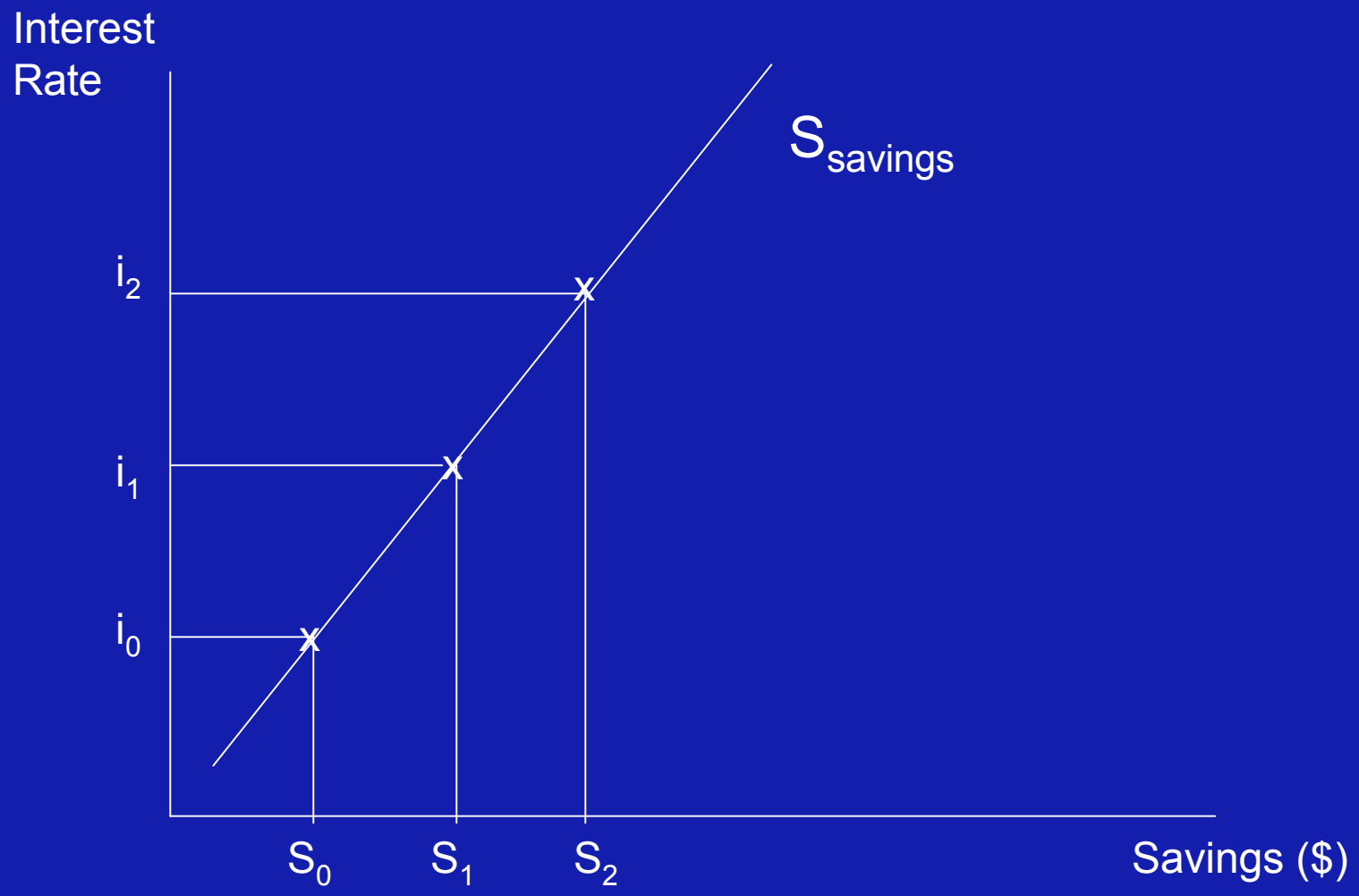
- From consumers' time preferences, derive the supply of savings.

  Determine amount of income and wealth that households will save for the future at different interest rates.

Response to change in interest rate



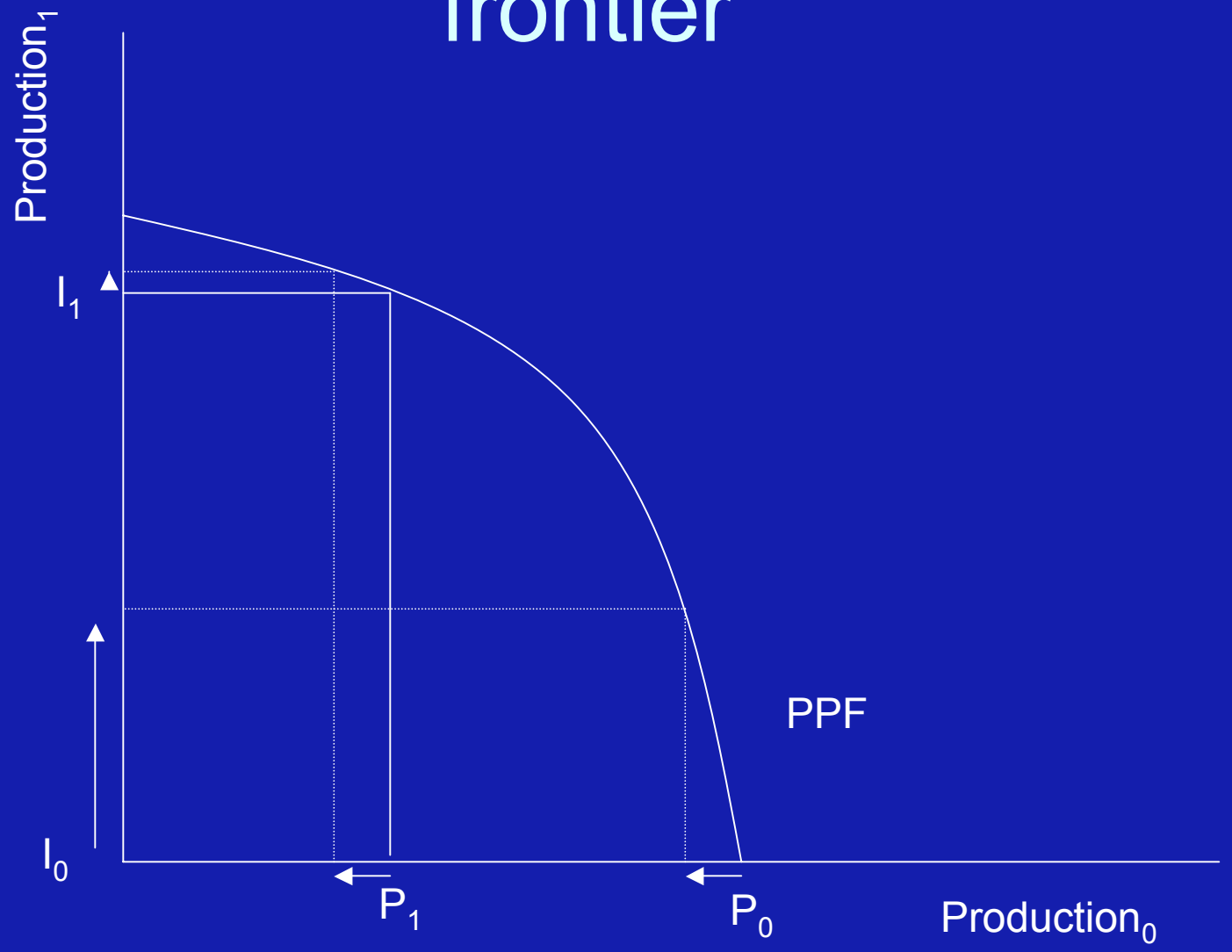
Response to change in interest rate



Investment opportunities

- Investment opportunities generate the demand for savings (capital)
  - Intertemporal production possibility frontier

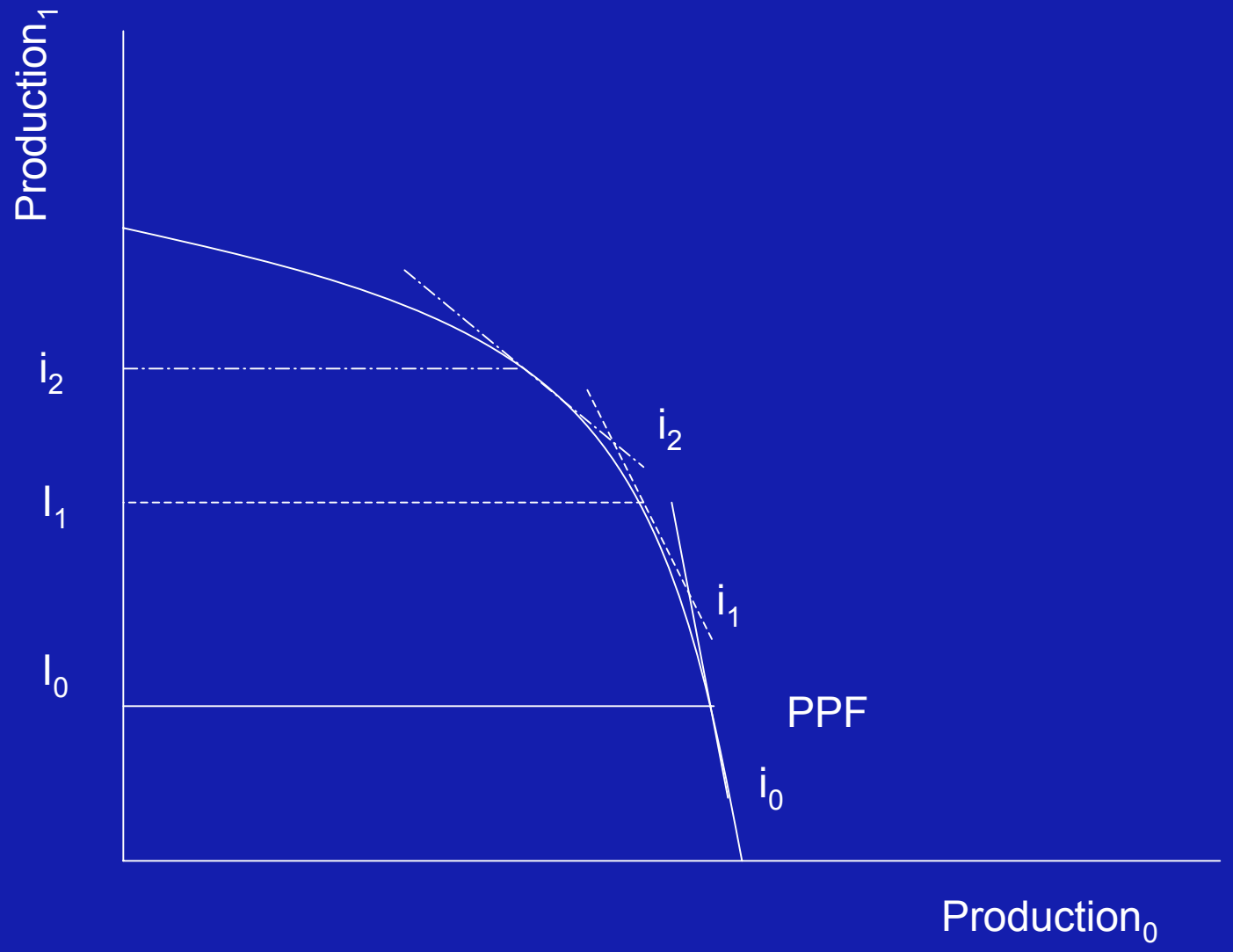
Intertemporal production possibility frontier



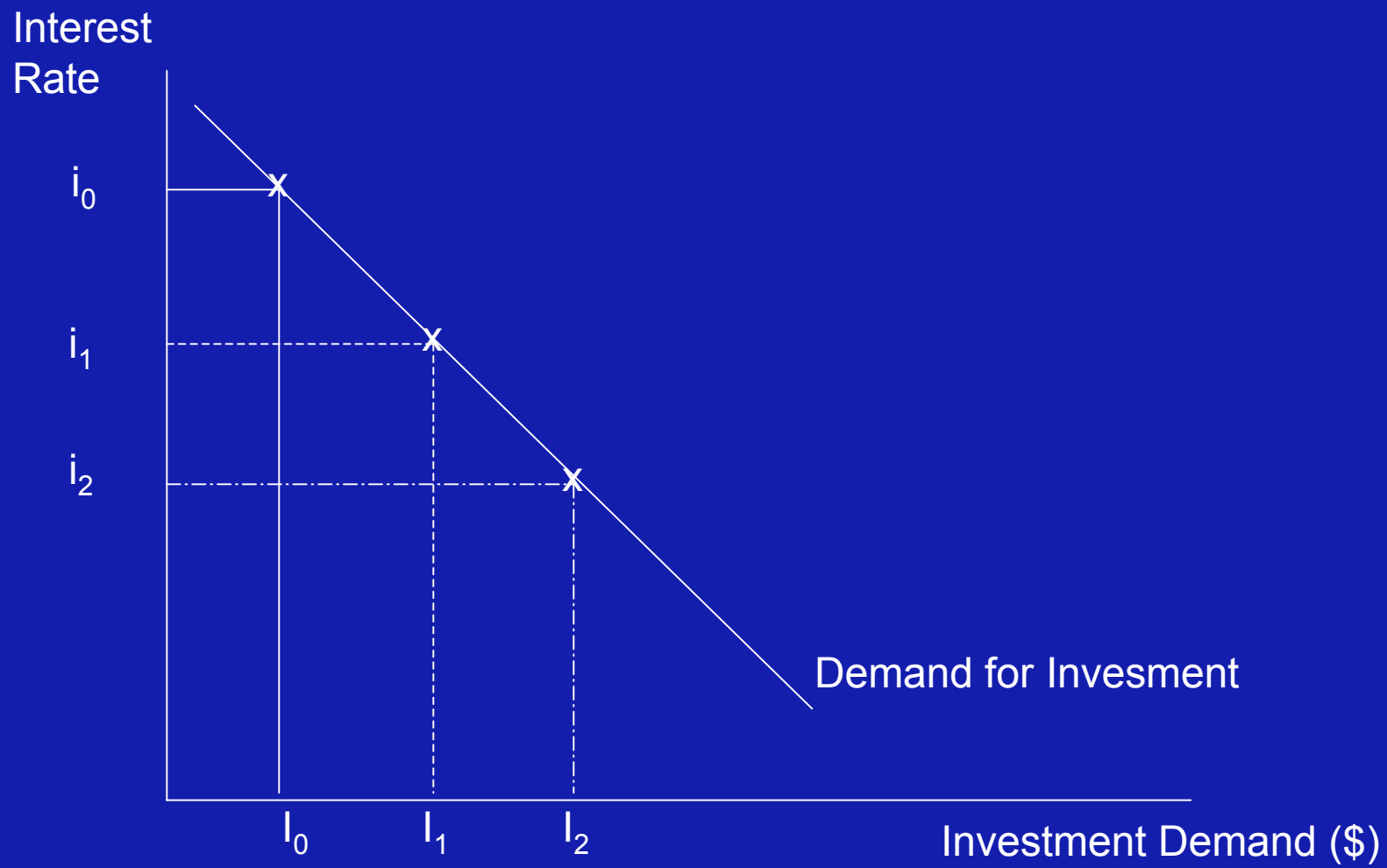
Demand for Investment

- Rank potential investments according to the rate of return, from highest to lowest.
- This will give the derived demand schedule for savings

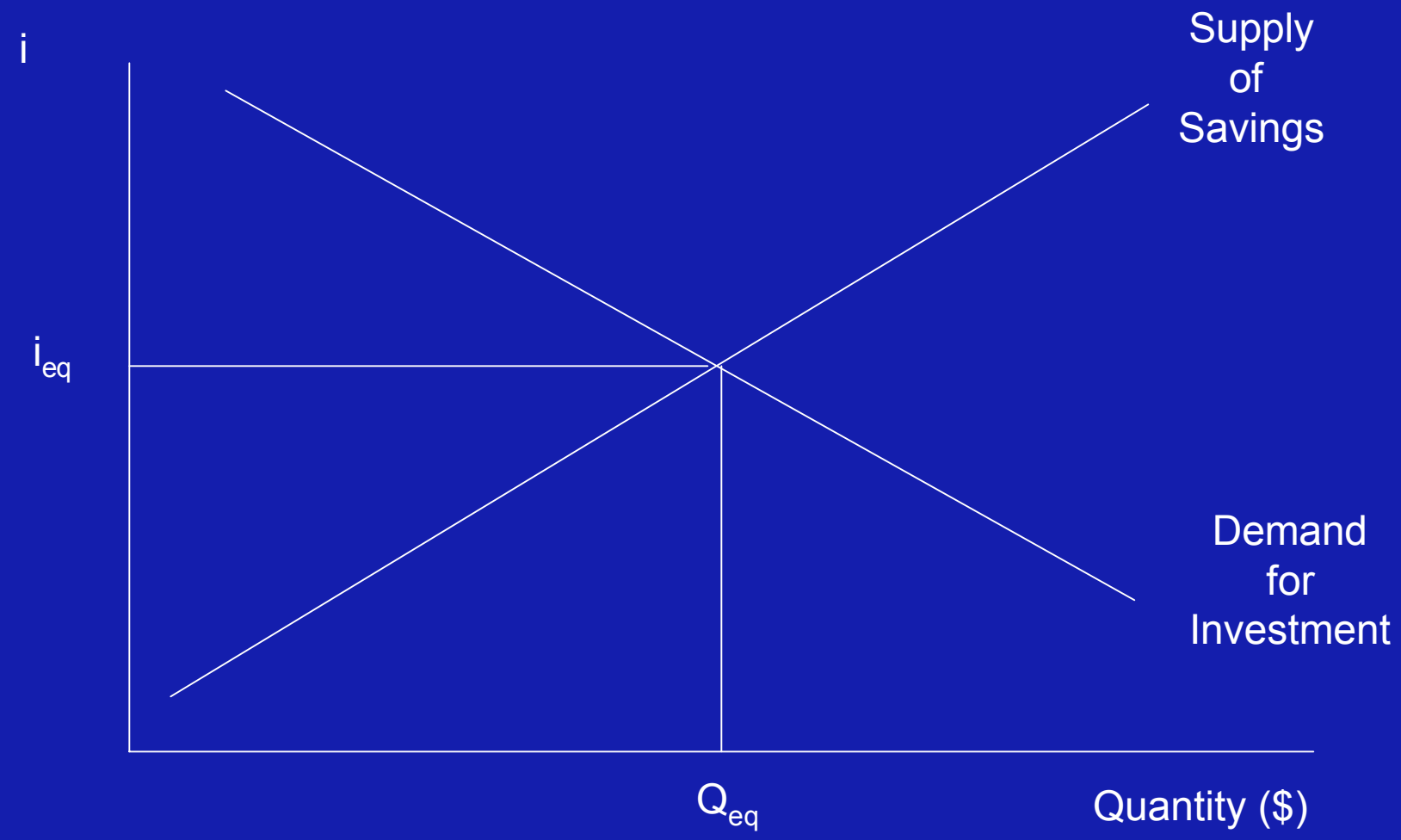
Demand for Investment



Response to change in Interest Rate



Capital Market



Interest rate

- In market equilibrium
- interest rate (r) = MRS = MRT
- In reality: transactions costs associated with matching up suppliers and demanders of savings:
  - Financial intermediation (banks)
  - Spread between savings and borrowing rate
  - Risk premia