So far, the only asset we considered was fiat money.

Introduce another asset – capital – that can, as an alternative to fiat money, be used to purchase goods at a later date.

**Technology:** If \( k_t \) units of the consumption good are converted into capital goods at time \( t \), you receive \( xk_t \) units of consumption good at time \( t + 1 \) and the capital goods disappear (depreciation rate is 100%).

The gross real rate of return on capital is \( x \geq 1 \).

The initial old hold a stock of capital of \( k_0 \) units.
An economy with capital

- Suppose there is no fiat money in the economy.
- The budget constraints for the future generations are:
  \[ c_{1,t} + k_t \leq y, \]
  \[ c_{2,t+1} \leq xk_t. \]
- The lifetime budget constraint is:
  \[ c_{1,t} + \frac{c_{2,t+1}}{x} \leq y. \]
- In this case, the rate of return on capital was assumed to be constant.
- An alternative assumption is that capital exhibits a **diminishing marginal product**. In this case, the rate of return on capital decreases as capital increases
Capital is only one among many alternatives to money. Other assets include land and loans, for example.

Is there a relationship that must hold between the rates of return on different assets?

Suppose there are both capital, with rate of return $x$, and private debt (loans), with rate of return $r$. If:

- $r < x$ people would be unwilling to make loans;
- $r > x$ people would be unwilling to invest in capital.
This implies that for people to be willing to hold both capital and loans as assets it must be that $r = x$: Rate-of-return equality.

This discussion implicitly assumes private debt and capital are perfect substitutes from the point of view of those saving.

Suppose we introduce fiat money into the economy with capital and private debt.

For lenders to be willing to hold the three assets, it must be that their rates-of-return are identical. This implies:

$$\frac{n}{Z} = r = x.$$
The Tobin Effect

- Suppose now that capital exhibits a diminishing marginal product.

- For both assets to be valued their rates of return must be equalized. This implies:

  \[ f'(k) = \frac{n}{z}. \]

- The above equation determines the stock of capital \( k^* \).

- Suppose there is a permanent increase in the rate of anticipated inflation from \( z \) to \( z' \).

- This induces people to switch away from money to capital. This switch caused by an increase in anticipated inflation is known as the *Tobin effect*. 
The Tobin Effect

- GDP is the sum of all endowments and the output generated by last period’s capital stock.

- A larger current capital stock today leads to an increase in future output.

\[
GDP_t = N_t y + N_{t-1} f(k_{t-1}).
\]

- Should anticipated inflation be used to increase output?

- No, for two reasons:
  - The goal is to maximize utility, not output. The stock of capital may be larger than the optimal.
  - Relative to the capital stock, the stock of money is very small (3%), so this effect will always be negligible.
Example

Consider an overlapping generations economy with two assets: capital and money. The population grows at rate 1.02 and capital pays a gross rate of return of 1.1.

For what values of $z$ will fiat money be valued (ie. people are willing to hold it)?

If capital is transformed into output according to $f(k) = k^{0.7}$ and both assets are held at the same time, how much capital will people hold?
A graph showing the relationship between \( R \) and \( k \), with points labeled \( n/z \) and \( f'(k) \). The graph illustrates how the rate of return decreases as capital increases from \( k \) to \( k' \).