Lectures 19-20: Savings and Technology

- Review
- Cont.: Change in Saving rate
- Technological progress

Solow's Growth Model

$A = 1, N = 1$

$Y = y = f(k)$

$S = sY$

$I = S$

$K(t+1) = (1-d) K(t) + I(t)$

$\Rightarrow$

$k(t+1) - k(t) = s f(k(t)) - d k(t)$

Steady State and the Saving Rate

In steady state: $k(t+1)=k(t)=k^*$

$k(t+1) - k(t) = s\, f(k(t)) - d\, k(t)$

=>

$sf(k^*) = d\, k^*$

$g\_y^* = 0$ (if $n>0$, $g\_y^*=0 \Rightarrow g\_Y=g\_K=n>0$)

In steady state, the saving rate does NOT matter for per-capita growth.

It does matter, however, for the level of per-capita output and transitional dynamics

Figures 11-3, 11-4

Some numbers

- $Y = (KN)^{0.5}$ => $y = (K/N)^{0.5} = k^{0.5}$
- $k(t+1)-k(t)= s\, k(t)^{0.5} - dk(t)$
- St.St: $k^*=(s/d)^2$; $y^*=(s/d)$
- s0=d=0.1; s1=0.2 =>
- k* goes from 1 to 4 and y* from 1 to 2.
- Higher saving=> need to maintain more capital
- $c^* = y^* - dk^*$
- The Golden Rule: Table 11-1

Dynamics

- Dynamics: $k(1) = 1+0.2-0.1 = 1.1>1$
- … and so on
- Figure 11-7

Technological Progress

- Table 12-2
- $Y = F(K,N,A)$ ….. $Y=F(K,NA)$
- $y = Y/NA = F(K/NA,1) = f(K/NA) = f(k)$
- $I/AN = s\ Y/AN$
- In order to maintain a given k, we need to invest at least:

$$(d+g\_A + g\_N)\ K$$

Technological Progress

$I/AN > (d+g_A + g_N)(K/AN)$

$\Rightarrow$ k grows

Figure 12-2

Table 12-1

Figure 12-3 / 12-4

A Decline in g_A

- Table 12-2
- Table 12-1
- (use) Figure 12-2
- Why? (we don't know…)
  - Measurement error?
  - The rise of the Service Sector?
    - Figure 12-5
  - Decreased R&D Expenditure?
    - Table 12-3

The New Economy and Productivity Growth

Private Non-Farm Business	1948-1973	1973-1979	1979-1990	1990-1995	**1995-2000**
Labor productivity	2.9	1.2	1.4	1.6	**2.5**
Multifactor productivity	1.9	0.4	0.3	0.6	**1.1**
Manufacturing	1.5	-0.6	1.1	1.3	**2.1**
Industrial Mach.	0.7	0.2	3.2	3.1	**5.8**
Electronic Mach.	2.1	1.0	3.0	6.0	**7.4**

Source: BLS.

Investment Has Increased

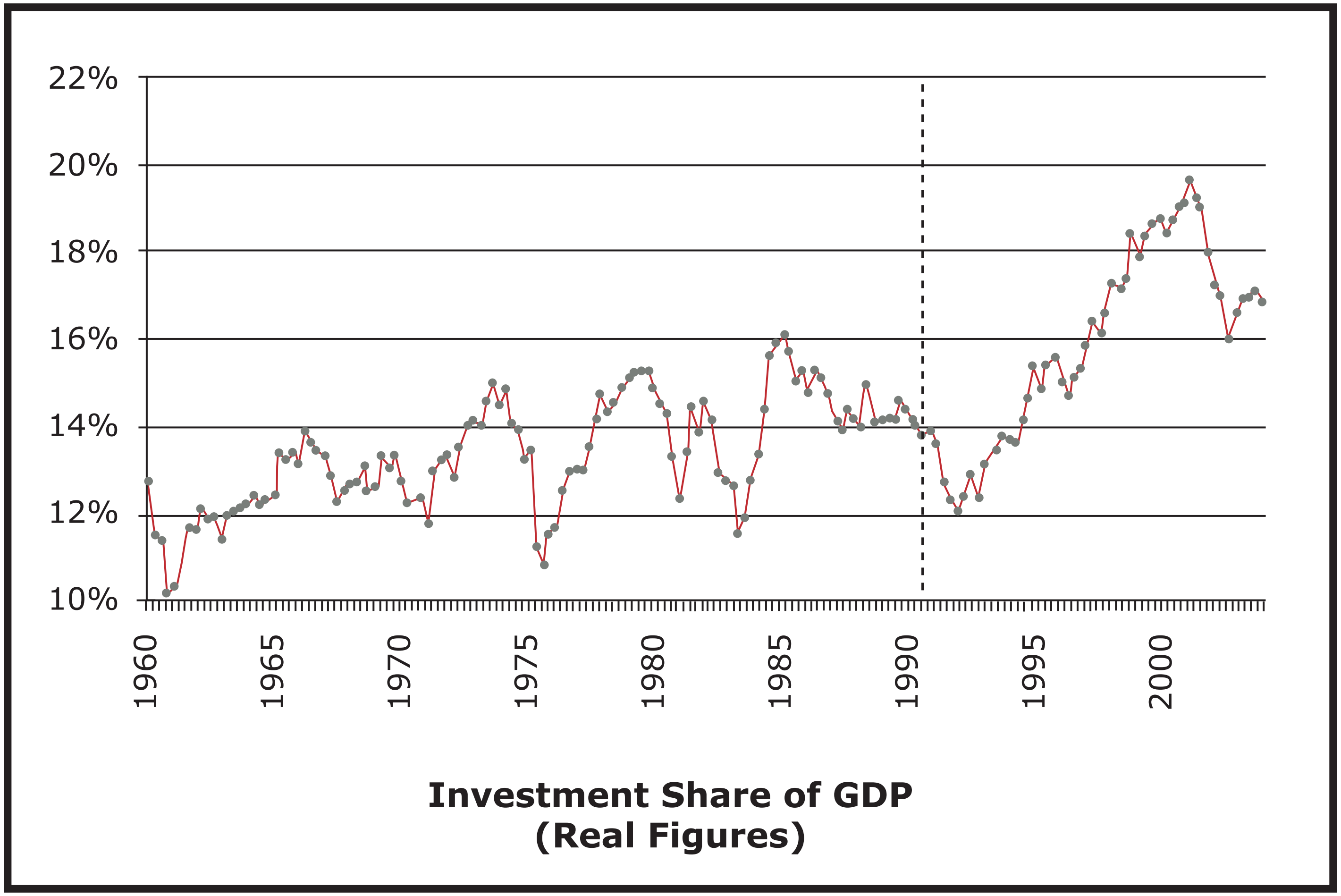
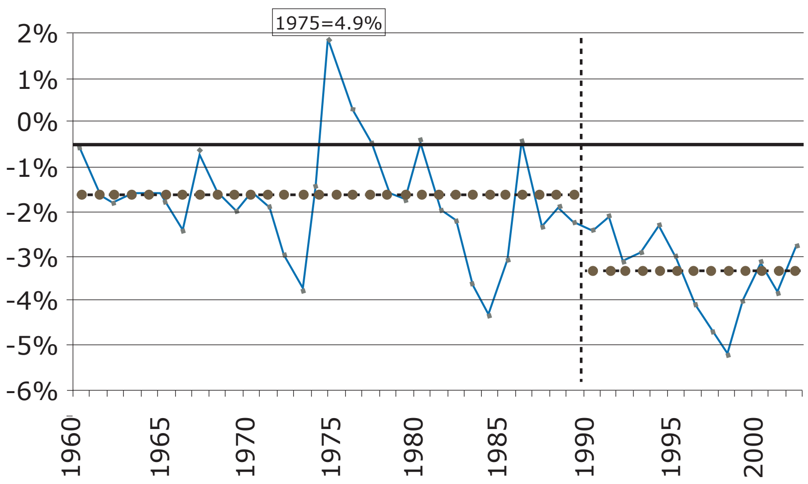


Figure by MIT OCW. After source: BEA; Datastream; St. Louis Federal Reserve.

The Price of New Capital

Real Interest Rates

(Constant maturity nominal rates minus Un. of Michigan inflation expectations)



Change in Relative Price of Equipment

(1996 Relative price normalized to one; log changes)

Figure by MIT OCW. After source: BEA; Datastream; St. Louis Federal Reserve.