

## Economic Development and Population Growth

Let us consider a modification of the Solow neoclassical one-sector growth model. Whereas in the standard Solow model, the rate of population growth is a fixed value  $n$ , instead let the rate of population growth depend on the level of economic development. Here the capital/labor ratio  $k$  is the measure of economic development—a higher value signifies a more developed economy.

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In a poor economy (low  $k$ ), population growth is negative. The society is so poor that the people lack food and care.

In a richer but still less developed economy (moderate  $k$ ), population growth is positive and high. Today a typical less developed economy does have high population growth.

In a rich, developed economy (high  $k$ ), population growth is low or negative. Today in some European countries the birth rate is so low that deaths outnumber births.

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## Uniform Technology

For simplicity, assume that every economy has the same technology (the same aggregate production function).

It is *not* the case that a rich economy has superior technology; instead it just has a higher capital/labor ratio.

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## Capital Accumulation

The standard Solow equation for the capital/labor ratio applies.

The change in the capital/labor ratio (capital deepening) is saving *per capita* less capital widening *per capita*,

$$\frac{dk}{dt} = sf(k) - n(k)k,$$

except that here  $n$  depends on  $k$ .

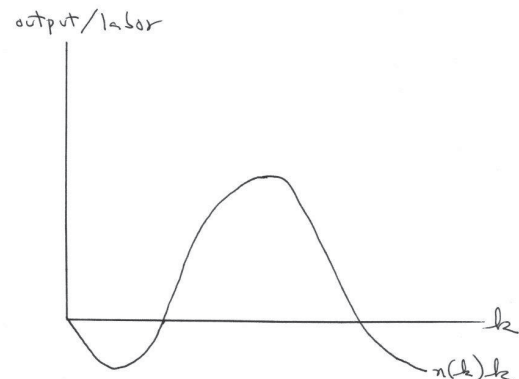
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## Capital Widening

Figure 1 graphs  $n(k)k$ , capital widening *per capita*, as a function of  $k$ . For low  $k$ , it is negative. For moderate  $k$ , it reaches its peak. As  $k$  rises further, it falls, as the population growth is less.

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Figure 1: Capital Widening



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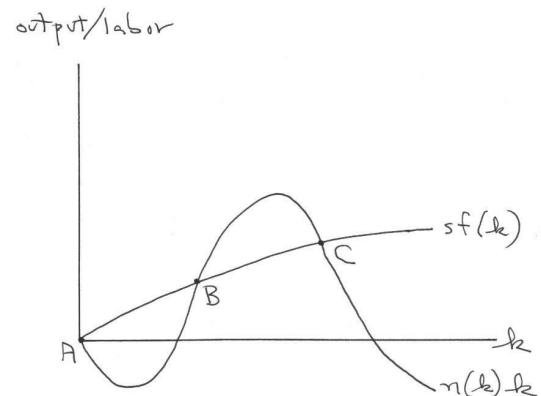
### Long-Run Steady State Growth

In the Solow model, there is steady-state growth if the capital/labor ratio stays constant. Saving is totally devoted to capital widening, so no saving remains to raise the capital/labor ratio.

In figure 2, a steady-state growth occurs at  $k$  such that  $sf(k) = n(k)k$ . The graph shows three possibilities—points A, B, and C.

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Figure 2: Long-Run Growth



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### Stability

Steady-state growth at B is stable. If  $k$  starts somewhat below the steady-state value, then  $k$  rises, as  $sf(k) > n(k)k$ . Conversely, if  $k$  starts somewhat above the steady-state value, then  $k$  falls. In the long run the economy moves to the  $k$  value at B.

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### Instability

In contrast, steady-state growth at C is unstable.

If  $k$  starts somewhat below the steady-state value, then  $k$  falls, moving toward B.

If  $k$  starts somewhat above the steady-state value, then  $k$  rises. As population growth is so low that the saving required for capital widening is small, saving raises  $k$  indefinitely.

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Analogously, steady-state growth at A is unstable.

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### Growth in a Developed Economy

A developed economy has values of  $k$  above point A. The economy grows permanently. Both  $k$  and  $f(k)$  rise indefinitely.

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### Low-Level Equilibrium Trap

In contrast, a less developed economy is trapped at a lower capital/labor ratio. It is moving toward the steady-state growth at point B. Population growth is high, so the requirement for capital widening is great. Saving is insufficient to keep  $k$  growing.

### Big Push

Perhaps the less developed economy can break out of the low-level equilibrium trap, by temporarily saving and investing at a high rate.

In the 1950's some development economists recommended this "big push" strategy. They argued that the government should impose a socialist economy, with government ownership of industry and high government saving. They also advocated foreign aid, to increase investment temporarily.