<u>Summary of Growth Rates in Solow Model</u>

The table below summarizes the implications for economic growth, steady state, and the golden rule in the Solow growth model under various assumptions:

	No population growth No technological progress (Lecture 3)	Population growth = *n* No technological progress (Lecture 5 – Part 1)	Population growth = *n* Technological progress = *g* (Lecture 5 – Part 1)
Labor	*L* is constant (no growth)	*L* grows at rate *n*	*L* grows at rate *n* *L×E* grows at rate *(n + g)*
Capital	*K* is constant *k = K/L* is constant	*K* grows at rate *n* *k = K/L* is constant	*K* grows at rate *(n + g)* *k = K/L* grows at rate *g*
Output	*Y* is constant *Y = Y/L* is constant	*Y* grows at rate *n* *Y = Y/L* is constant	*Y* grows at rate *(n + g)* *y = Y/L* grows at rate *g*
Steady state condition:	$sf(k) = \delta k$	$sf(k) = (n+\delta)k$	$sf(k) = (n+g+\delta)k$
Golden Rule	$MPK = \delta$	$MPK = n+\delta$	$MPK = n+g+\delta$

Technological progress
We incorporate this assumption into the model to explain the fact that per-capita GDP grows over time. We assume that technological progress takes the following form:

$$Y = F(K, L \times E)$$

where *E* = efficiency and *E* grows at rate *g*. Notice that efficiency augments labor (e.g., labor-augmenting technological progress). The idea is that a more skilled and better-trained workforce can produce more output with a given capital stock. This implies that even if *K* and *L* remain constant, production will increase because each worker will be able to produce more output over time.

- To keep things simple, you can imagine the Solow growth model with technological growth and population. If the economy has no technological progress, this is simply a special case with *g* = 0. If the economy has no population growth and no technological progress, this is a special case where *n* = 0 and *g* = 0.
- In the model with technological progress (and population growth), there are three sources of economic growth: capital stock, population growth, and technological progress. You should be familiar with these sources of growth (summarized in the table above) and how they affect the growth rates of labor, capital, and output and per-capita capital and output.
- An increase in the growth rate of technological progress (*g*) implies that $\tilde{k}$ (per-effective worker capital stock) and $\tilde{y}$ are lower, but the country is actually better off in terms of GDP (*Y*) and GDP per-capita (*y*). In this case, the economy experiences an immediate increase in output and in output-per worker because the growth rates of both output (*n* + *g*) and output per-worker (*g*) rise.