

Lecture 10: Growth Accounting

I. OVERVIEW

- In the last few lectures, we described how economic growth could be achieved through increases in labor, increases in capital and increases in technology. An interesting exercise is to decompose economic growth of a country into the portions attributable to growth in capital, growth in labor and growth in technology.
- Economists have shown that while the end result of more economic growth is of pivotal importance to an economy the means of achieving that end is also very important. That is to say that whether the increased economic growth came from increases in labor, increases in capital or increases in technology has important consequences for the economic well being of a country.
- If/when you take Economics 202, you will study this distinction between growth driven by more inputs (increases in K, L) and growth driven by more technology in a more rigorous fashion. For now, we will concentrate on deriving some economic intuition for the importance of the sources of economic growth.

II. PRODUCTIVITY

- Productivity is one of the big "buzzwords" of macroeconomics. The concept of productivity helps determine the long run viability of current economic growth. Essentially, we can think of productivity as measuring how good we are at producing output from inputs.
- We can then see that productivity is closely related to technology - better technology will mean that we are more productive. So more productive economies will be able to produce more output from the existing level of inputs.
- The best way is to think of a simple example of two countries, Brainland and Brawnland that have both grown at 5% a year for the last five years.
 - Brainland can attribute 4% of its growth to increased inputs and 1% to better use of inputs.
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- Which country is likely to continue to enjoy high growth in the future? Economic analysis suggests that Brainland is more likely to continue to enjoy faster growth. Why?
- Brawnland is going to run into hurdles because it will find it difficult to continue to achieve more economic growth by adding inputs. This can occur for a couple of reasons
 1. The inputs may be limited. For example, if Brawnland started out with a large pool of underutilized labor resources then it can increase the number of workers for a while: it can bring the unemployed and those not in the labor force back into employment. However, after a while they would have increased the labor force as much as possible and will not be able to get gains that way.
 2. Even if the input has no inherent limitations on the quantity (e.g. capital), the productive use of that input may be reduced because of diminishing returns. For example, if one of the factors (labor) is limited, adding more and more capital will soon lose its effectiveness because diminishing returns will set in. Additional units of capital will cease to be as productive because of the absence of other complementary inputs like labor.

- Given the finiteness of resources, the country that is continually coming up with better ways to use those resources is likely to be better off than the country relying exclusively on more inputs being available. In other words, more productive countries are able to sustain rates of growth for longer.

III. MEASURING PRODUCTIVITY

- There are two measures of productivity that are commonly used by economists and in the media. In the popular media, “productivity” is often used to refer to “labor productivity”: output per hour of work.
- Labor productivity is a good measure of the productivity of workers (as the name suggests!) but not a great measure of the productivity of the economy. For example, increases in capital will raise labor productivity, but we are in fact using more inputs rather than making better use of inputs.
- The second measure of productivity, used more by economists is total factor productivity or TFP. Instead of measuring output per worker, TFP is an attempt to measure output per unit of input.
- In practice measuring TFP is difficult and often ends up being an exercise where we try to subtract out the contribution of economic growth attributable to more inputs from overall economic growth. The remainder is growth attributable to more technology.
- $TFP \text{ Growth} = GDP \text{ growth} - (\text{Labor Driven Growth} + \text{Capital Driven Growth})$
- So in our example, Brawnland’s TFP growth is lower than Brainland’s TFP growth; In Brawnland, GDP growth was 5%. Since the growth of inputs can be measured, we can calculate that 4% of this growth comes from increased inputs. So TFP growth must be 1% in Brawnland.
- In contrast, since only 1% of Brainland’s 5% GDP growth can be measured as coming from increased inputs, the remaining 4% of Brainland’s economic growth must come from technology improvements.

IV. GROWTH ACCOUNTING

- An interesting exercise is to decompose economic growth of a country into the portions attributable to growth in capital, growth in labor and growth in technology.
- The decomposition of economic growth is known as “Growth Accounting”; first described by Robert Solow, a Professor of Economics at MIT, who won a Nobel Prize for his work on economic growth.
- Growth accounting can provide powerful insights into the future of an economy. An important application of growth accounting is to understand the background behind the economic crisis that hit East Asia in 1997.
- We will focus our attention on 7 East Asian countries which made remarkable progress in upgrading their living standards: alleviating poverty, equalizing income distribution, educating their people etc. The 7 countries we focus on are Hong Kong, Indonesia, Malaysia, Singapore, South Korea, Taiwan and Thailand.
- The dramatic improvements these countries made were reflected in extremely high growth rates of real GDP from the early 1960's to the late 1990's.
- The crisis was a hodge-podge of falling currencies, spiraling deficits, collapsing stock markets, high inflation and financial bankruptcies. We will not discuss the details of the crisis in this course. More details can be studied in Economics 202 and in Economics 213.

- A series of papers by Alwyn Young, "The Tyranny of Numbers" and "A Tale of Two Cities" decomposed growth in these East Asian countries using good primary sources of data.
- "Decomposing" growth is essentially a growth accounting exercise. Young separated the growth in these countries into "growth from capital and labor accumulation", and "growth from TFP".
- Young showed that these East Asian countries made remarkable progress in
 - a) Labor force participation
 - b) Educational attainment
 - c) Investment
- However, TFP growth was relatively small for all of these countries. So Young speculated that, despite the stellar record of performance that these countries had displayed over the last 30 years, that they would not be able to continue to grow very fast in the future.
- His ideas were essentially grounded on the idea that long run growth rate was closely related to the growth rate of technology; after all technology was the engine of growth. While the above improvements could bring short run improvements in growth rates: it seems unlikely that the improvements could be long-term.
- Lots of controversy surrounding the analysis in the paper when it first came out. With hindsight, Young has been vindicated because economic growth in East Asia slowed dramatically in 1997.
- However, there are many positive lessons to be learned from the East Asian countries. Many countries need to figure out how to accumulate factors like investment and improve educational attainment. However, it is important to realize that once gains on the input accumulation front have been made, then countries should focus attention on improving the level of technological progress in order to sustain economic growth for a long period of time.
- Countries should try to enact policies that encourage the production of new technologies because technology is what is known as the "engine of long-run economic growth".

CRUDE GROWTH ACCOUNTING EXERCISE
SELECTED EAST ASIAN COUNTRIES 1966-1990

	Hong Kong	Singapore	South Korea	Taiwan
GDP Growth	7.30%	8.50%	8.50%	8.60%
GDP Per Capita Growth	5.70%	6.60%	6.90%	6.80%
GDP Per Worker Growth	4.70%	4.00%	5.70%	5.50%
LF Participation	38% -> 49%	27% -> 51%	27% -> 36%	28% -> 37%
Investment/GDP	30% -> 30%	10% -> 41%	8% -> 40%	9% -> 21%
No Schooling	19% -> 6%	55% -> 0%	31% -> 6%	17% -> 4%
Primary School Only	54% -> 23%	28% -> 34%	42% -> 19%	57% -> 28%
Secondary School	27% -> 71%	16% -> 66%	27% -> 75%	26% -> 68%