Title: Principles of Economics

Production and growth

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In chapter 23 and 24, we discussed the aggregate amount of output, an aggregate income in the economy as changing over time.

But when we discussed the changes over time, we only looked at a particular level of output and we discussed changes in prices.

In chapter 25, we will look at what determines the output level in any time period, and how GDP, how the country's output and income grow overtime.

In chapter 26, we will look at one determinant of growth, which is the growth in the capital stock in the economy.

And we will look at what determines the saving of individuals and investment by households and corporations that would allow the nation's income to grow in the future.

So, in this chapter, there are three important concepts that you should learn to distinguish.

One is the output or the amount of production in the economy, and you should distinguish that from productivity.

Productivity is the average output produced from each unit of input.

In this case, we will be implicitly talking about labor as the input of interest. So, productivity will be the average amount of output per worker in the economy.

Second, set of concepts that we should learn to distinguish is that of the level of output and income in the economy and growth in them overtime.

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We will say that some factors can help us increase, can help us obtain one-time increase in the output and income in the economy but will not provide for a long-term continuous growth overtime.

And the background piece of information that motivates this chapter is that it's the

productivity of workers that determines incomes and standards of living of citizens in any country.

We can think that of course when we compare different economies in the world and different time periods, there are many factors that determine people's quality of living. But you should think that the one central factor is how productive the workers are.

So, let's look at the factors that determine the amount of production that takes place in the economy, and as a consequence of that, what determines the productivity which is the output per capital.

We can say to that the nation's level of production is determined by the amount of factors of production being used.

And it's interesting to distinguish five different factors used in the production process: Physical capital, natural resources, human capital, technological knowledge, and the amount of labor in the economy.

So, if we talked about the aggregate amount of output or aggregate amount of income in the economy such as the gross domestic product, we would say that these five factors determine the level of GDP.

Now, the reason why we mention each of these is that there are subtle differences among them.

You may wonder how is physical capital distinguished from natural resources.

Well, one difference is that natural resources are given to a particular economy. Natural resources are not produced by any production process.

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So, the amount of land, raw materials, energy available are given to a particular economy whereas physical capital or human capital have to be produced.

So, we can think that capital, the work capital, refers to goods that are used in the production process in the future.

But, they are themselves the result of a production process in the past.

Next, what is the difference between physical capital and human capital?

So, physical capital, we should think it that's any physical good that can be used in the production process: machinery, cars, furniture, any physical object used in the production process.

Human capital, we say, is embodied in the workers. Human capital has to be produced under human capital. We should understand that we're talking about education that workers receive, nutrition, maybe ethical standards, and all the

characteristics of particular workers.

The difference between physical capital and human capital is that human capital is given to a particular worker and cannot be easily transferred.

So once the society invests in a particular worker, this investment cannot be transferred to another part of the economy.

If the worker dies, the human capital invested in this individual disappears whereas physical capital, you may think it doesn't disappear per say.

It might, the machinery might slowly become obsolete, it might get amortized, but it doesn't. It is not embodied in a particular worker. It can be easily transferred among workers and between different sectors in the economy.

Technological knowledge is the, we say cumulative stock of knowledge that can, that is used in the production process.

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So the difference between technological knowledge and the knowledge embodied in workers is that, we think that, technological knowledge only accumulates over time.

All the past investments, all the past discoveries can be used forever in the future whereas human capital disappears when the worker leaves labor market.

And finally, the amount of labor is, of course, the effective number of workers and work hours that can be used in any time period.

Now, so these factors influence the aggregate level of output of GDP in a nation.

If we talk about productivity or GDP per capita, we might wonder "will all of these factors still be important?"

And in that case, you can think that it really depends on the production process in question.

We would still expect these four factors to be important to how much each worker can produce

But maybe the fifth factor, labor, is not itself important.

In a second, I will say that if the technology used in production exhibits constant returns to scale, then the amount of labor force does not determine how much each particular worker can produce.

So, a little bit conceptually, you should think that amount of output in the economy depends on the amount of each of these inputs.

And, let's realize that the amount of technological knowledge is a special factor of production because it is accumulated over time.

The economy doesn't have to expand any resources in a particular time period to still be able to use this factor of production.

So, generally economists prefer to write the production function used in the economy this way where technological knowledge has a special position.

And it simply multiplies the amount of output produced by the remaining for factors of production.

And we would say that this production function exhibits constant returns to scale with respect to labor, physical capital, human capital, and natural resources.

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When we divide or multiply both sides of the equation by a certain constant, we will still get equality.

Let me say one more time.

We will say that the production function exhibits constant returns to scale.

Every time we double these four inputs in production, the amount of output produced will also double.

Or if we divide by two each of these four inputs in production, output level will also fall in half.

So if the economy has constant returns to scale in the production process, we can divide the production function by L, the amount of workers.

And we would get the property that productivity depends in a very simple fashion on the physical capital per capita, so physical capital per worker, human capital per worker, and natural resources per worker.

We do not divide the state of technological knowledge by the number of workers because intuitively we should think that technological knowledge does not require any outlay in any time period by any worker.

All of the stock of technological knowledge can be used by any member of the society in any future time period.

So each worker has access to the entire stock of technological knowledge.

So the production function told us that there is a very simple relationship between the amount of inputs and the amount of output that can be produced in the economy. When we discuss these inputs over time, we might wonder "how do these inputs

change so that the amount of output would grow over time?", and "how could the government get involved if it try to increase production and productivity in the economy?"

So, one possible government policy would be to encourage saving and investment.

We will look at saving and investment in the next chapter in detail.

And we would notice that as a result of investment the amount of physical capital in the economy will increase.

If the government encourages foreign direct investment from abroad, again, the amount of capital in our domestic economy will increase.

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If the government encourages education, quality nutrition, health care, and training in the economy, we can say that the effective amount of human capital will increase.

And this can increase output and productivity in the domestic economy.

As a side note on this policy, we may think that some individuals in an economy suffer from so-called poverty trap.

In order to become productive workers they require some investment in their human capital.

Workers require some education, nutrition, health, and training to be able to enter the labor force.

But the only way to afford quality nutrition, education, and so on is to have some resources to pay for them.

And you should think that these individuals, because they cannot get started, they don't have basic level of education, basic level of nutrition, can never become productive.

And the society loses the potential outcome of their labor.

So you can think that this is unfortunate for those individuals as well as for the society overall because the society loses potentially very productive resources in the represented by the minds of these people.

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And even we compare different countries and the world, some, we can say that some countries suffer from poverty trap.

Entire economies cannot lift themselves up because they don't have the minimum sufficient of resources to enter the production process.

And in that case, non-profit international organizations or governments of other nations should help poor countries to lift them above the poverty trap so that even economies of other countries could benefit from the production processes taking place those poor nations.

Another important policy is to secure property rights and maintain political stability.

We can say that these policies can affect the amount of technological knowledge and the society, if the government introduces a patent or trademark system which protect developers of new ideas.

The government implicitly promotes technological advancement, and because of this policy the amount of stock of the available technological knowledge might increase in that in the economy as well as worldwide.

If the government protects natural resources or physical capital better, you can think that the available environment resources and the available capital stock that companies can be used more effectively.

Companies do not have to be afraid to invest in natural resources and capital, they don't have to be afraid that somebody would steal it from them in the future.

So, affectively all resources can be used better and affectively more natural and physical resources enter the production process.

Another policy is to promote re-trade with other countries.

Now remember that were talking about output or the amount of goods per worker in the economy.

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And let's think back to chapter three and chapter nine in the textbook when we discussed the effect of free trade on the amount of consumption by members of two trading economies.

We discovered that by trading, both participants in the trade can increase their consumption level.

So with the same amount of resources if the two countries start trading each others, they can produce more outputs.

So you tan think that free trade serves as a technological advancement which lets two economies put the available resources in more productive uses
And as a result, to achieve greater output level and greater output level per capital

Finally, the government can promote research and development recently by funding universities, funding research institutes, or even supporting research at private institutions.

The final thought from chapter 25 is that the amount of labor in the economy has a special position in this discussion.

We said that clearly if the amount of technological knowledge, physical capital, human capital, and natural resource increases, that increases both aggregate output level and productivity.

But what happens if the number of workers or number of the size of population increases, what happens to productivity of an average worker?

There are some conflicting views on this topic.

First of all, we might think that as the number of people in the economy increase, that simply stretches the amount of natural resources, capital stock in the economy.

So we would think that the effective amount of natural resources and capital per worker decreases, and that should decrease productivity.

On the other hand, the stock of technological progress can increase because they are more minds and more sharing in the society and technology can advance at a faster face.

Furthermore, the effect on the amount of human capital per worker is unclear.

It depends on how, let's say, immigration or population growth affects the average education level, average quality of nutrition, average training an experience of workers in the economy.

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So here we can see that through some ways population growth decreases productivity

Through some other ways population growth increases productivity and you may think that this is an empirical issue.

In some economies, population growth can be beneficial in others if may not.

It depends on the exact technology used, maybe the level of development in the economy

We cannot make a general statement across different economies.

So, in this chapter we said that there are several factors that influence output level of

the economy and even productivity of each worker

And one finding was that the amount of physical capital and the amount of investment in the economy can help us increase output level, on the aggregate level as well as per worker.

So in chapter 26, we will discuss saving an investment in more detail.