

Week 3 Transcript

Yeah.

You.

Oh.

No.

Yes.

This.

Okay.

Good afternoon everybody.

Hello.

Please take a seat.

Uh, we're going to get started.

Please sit down.

Okay.

Welcome back.

Um, this is going to be the last, um, well, one of the last two, uh, lectures about growth.

Uh, just to remind everybody what we have covered so far.

And what we're aiming to do is, you know, we looked at a lot of data, right, as to why there are some poor countries, some richer countries, and the gap is big.

Now, if you looked at country pairs that started out with the same level of income, let's say in the 1960s, like Singapore and, um, you know, some of the African countries started out exactly the same income, a massive divergence into rich country for Singapore, Southeast Asian countries like South Korea, Taiwan, um economies, um, Hong Kong, etc..

Uh, whereas some other countries remain poor into poverty trap.

Right.

And from all of our experiences were richer than our grandparents and great grandparents.

So again, that cross-sectional cross-country comparison and over time growth.

Now, today we're going to really get into how countries grow and why countries are poor.

And Richard, we've already made some suggestions, right?

We've said, look, you know, if you just look at the production function, there's inputs, things like technology, capital, labour, human capital.

And that should explain everything.

Now if we have time, we're going to do this exercise and potentially next lecture, as well as to what you think are the reasons why some countries are poorer than others and why some countries grow faster than others.

And we can try that exercise and see if it can map onto the three factors that we talked about, right?

Labour, capital and technology and etc..

In principle, that should.

But that's not a theory of growth.

Okay.

Now today we're going to study two, but really one theory of growth as to why some countries grow faster than others and why some countries stagnate.

Now the point here, which I hope that will come across from the mini model, we're going to look at a mini model.

Not a lot of math, to be honest, but math makes it very easy to understand that your growth rate and your income level depends on where you are today versus where you can be in the future, or where your potential is.

Now that's crucial because that's a new idea.

Right.
Lots of countries are poor, have remained poor.
You don't see a way out of their poverty or
their, um, their, their income levels.
Why?
Maybe it's that their potential income level is low for
a variety of reasons that we're going to look at.
Some countries you can see has amazing growth.
Potentially the East Asian countries.
We talked about East Asian economies, China.
Why?
Because it started out far from where it should be,
the potential income.
So the gap is really what matters, right?
Some countries might never make it to the rich income
status for the reasons that we're going to explore.
Some countries might very well make it to the rich
income status for the reasons that we'll explore.
And that underlying is a theory.
And that's called the solo model.
And Robert Solo and MIT professor won the Nobel Prize
for this very monumental discovery.
Now, before we talk about solo, there's another monumental economist
called Malthus.
I'm sure many of you have heard.
Um, that had another theory of growth and that was
very, very relevant for the time period leading to his
lifetime, which ended before the Industrial Revolution.
And he had a population growth theory that we're going
to just examine and see where where that falls short
of explaining modern growth.
And by the way, these monumental economist David Ricardo Malthus
were doing economics in their spare time.
This wasn't even their day job.
So you can imagine the kind of intellectual achievements they
achieved with just pure curiosity.
Okay, so.
This was Malthus before.
Okay.
And we alluded to this fact last time when I
polled people in the class.
A third of you answered at all.
But most of you said, most of you who answer
said there was no growth compared to 2% growth and,
um, and a 5% growth.
And that was pretty much the millennia.
Okay.
Very, very little growth.
Yes, there were ups and downs.
You can map onto the history classes that you've taken,
the Roman period, the Renaissance or whatever it is.
Right.
And we've seen also with different countries, India, China, uh,
accounting for a huge part of global GDP at certain
times in history.
Right.
But that was pre-industrial revolution.
Look at what happened during and after the Industrial Revolution.
Now, mind you, this is interesting.
I mean, not something that we're not going to dwell
on.
But when the technologies were discovered, innovation, the, um, the
mechanisms, the cotton spinning machines and automation, all that was
discovered, it really took time before that actually fed into
real productivity and higher living standards.
Right?

It wasn't immediate.

And it's that kind of technology discovery which we call general purpose technology, general purpose being it's kind of broad. It spills onto various different sectors, the kind we can describe about electricity, about machines, about AI, about renewables. This is general purpose.

Technology takes time before it actually shows into productivity and growth.

And this is potentially something we're experiencing currently with AI. We've had lots of investment.

We've certainly had lots of excitement recently, but when is it actually going to show up in the GDP numbers or productivity numbers?

For those of you who are interested in why the productivity growth isn't that spectacular?

Although we sense that there's been a lot of discoveries, and especially in the US, you can read up in the textbook, there's some, you know, boxes about the productivity and why we don't see it in the numbers, but we really do see it here.

Right?

There's been just an absolute phenomenal growth in living standards.

And I think I mentioned something like 75% increase in living standards within a human lifetime during the Industrial Revolution. Um, or right around there.

But also the Great Divergence happened in the sense that the Western economies really speared ahead at that point on, uh, the, the empires that accounted for a large share of GDP growth, they really fell short of the of the GDP.

I think we have a graph of that from the last lecture.

Now it's picked up again.

Developing countries are accounting for a greater share of world GDP.

China I think is now 16% of global GDP share, um, compared to less than 10%, you know, 20 years ago or so forth.

And it's similar with India.

But the great divergence is really, really happened at that point.

So Malthus was, you know, didn't see this.

Right.

So he had a theory that basically there's no growth in the long run, that income per capita.

So income per capita, the thing we care about is per person income.

Right.

That's you know, you divide a big number with a lot of people.

That's a small number.

So we care about per capita income.

And that's ultimately what's going to determine welfare.

Um is steady.

And so what was his theory?

Um.

His theory.

It ensured this is not, you know, something we're really going to look at closely.

You can read up about it in the textbook, is that there's some equilibrium that suggests that people's wages are really going to be at the subsistence level.

Subsistence level is basically the level that keeps you alive, okay.

Just enough to eat.

And he had a particularly pessimistic view of the world

in that sense.

And it basically goes like this.

When income standards of income or sorry, standards of living goes up because your income is higher, you tend to have more kids, right?

That could be because, well, you live better, you have more time.

Your kids can live better because you're a better off.

Whatever the reason, you tend to have more kids.

But after a while, um, a population grows, right?

So there's a lot of population because because people are having more kids and um, then, um, because remember, that mouth is at that time did not think about technology.

Okay.

Didn't see the kind of innovation that we saw in the Industrial revolution.

So his view was that at some point there wasn't going to be enough food in the sense that food production per capita was declining as people grew.

Right.

He also did not think about agricultural productivity.

If you think about it today, you know, we really have do have a limited supply of land and things like that.

But agricultural productivity has been really amazing to keep on feeding that many people.

Right?

So productivity was really absent in his thinking.

So basically he thought of this very, um, uh, catastrophic world where there would be just too many people going after a limited supply of resources, and there would be things like wars and famines, and that would reduce the population.

And then somehow that once your population goes down, your income per capita goes up.

And so we're back in an equilibrium, and it kind of swings back and forth if you if you understand what I'm saying.

Um, so.

So that was kind of his view, uh, that there was some cyclical equilibrium fertility rate and that, you know, after a while, having lots of kids, people will have fewer children and then things will get better and again and things like that, that kind of cycle.

Um, his view of technology is that it's just going to increase the population, right again.

Indeed.

It hasn't been, you know, the idea that arrival of things like idea, scientific discovery, you know, machines, all that it wasn't really it wasn't really there yet.

And his view of technological advance is that there were just increased people.

Maybe, um, people will live longer, but no long run changes in the standards of living, um, which we saw was pretty much true right before the Industrial Revolution.

Now that was a good prediction or a good explanation of pre 1800 growth.

Uh, GDP per capita as we saw, is roughly constant.

Even stagnation population growth is increasing.

And living standards.

We saw that production.

And this is this is definitely true.

Right.

If we look at the broad spectrum of history.

Right.

If you do read books like guns, germs and steel

and think about geography and really take back growth, really a long, long back in history, um, population was really, really important for growth, right?

You needed people, the hunter gatherers, the ones that you know, or the nomadic tribes, they did not have organised societies.

So everybody had to work.

The women had to work.

If the women had to work, they were not able to bear as many children.

Um, if you want to do agriculture, obviously you need a density of people, right, to divide the labour.

So population growth was really fundamental, uh, to growth back then.

You'll see that it's no longer the case.

Right.

We're going to we're going to look at a model where population growth is not what drives overall income levels or income per capita.

But back then, certainly if you need a density of people to create an economy, and which is why, you know, guns, germs and steel argued that certain geographical locations was more prone to having agricultural societies, and that led to division of labour, steady population growth and good nutrition and higher productivity and so forth.

Right.

So population was important back in the time.

And Malthus actually had quite an impact on people like Darwin because he had a really, um, kind of very stark theory of, you know, the relationship between fertility and growth.

But that was true, uh, roughly before the 1800s.

Now modern growth, of course, industrial revolution took place.

And what did we see?

We saw sustained growth in GDP per capita.

Now, which country do we see in the data?

Last lecture that has sustained growth over the long period of time.

Remember.

Which one?

Singapore is one of them.

What about the big ones?

Obviously us right, us growing at 2% constant rate for since the 1800s that sustained growth.

UK is also doing okay a little bit less than than the US, but sustained growth.

Um we did we do see that that's not true for all countries.

We saw negative growth in a lot of African countries, poorer nations as well.

Right.

So sustained growth is again growth that takes place and can hold up over longer periods of time, not just spurts of growth.

Five years here, ten years there and then back to stagnation, but constant growth rates.

We do see that after the after the industrial revolution in certain countries.

Um, we also saw one thing that Malthus missed, right, was obviously technology.

Second was the demographic transition.

What is the demographic transition?

Someone wants to answer that.

Yeah.

So how do fertility changes?

How do fertility rates change not only over time, but

as a country gets wealthier, right?

Richer?

Right.

So demographic transition, as you're alluding to is the fact that as countries get richer.

You're going to change fertility rates and hence you're going to change the population structure.

So let's just start with fertility rates, right.

Do richer countries have more children or fewer children?

Fewer.

Right.

We see that, um.

Uh, why, uh, does anybody want to venture a guess?

Women are more educated, women are more educated or and or they have a higher wage, right.

If they're higher wage, that's the opportunity cost of having kids.

You know, that's the truth, truth of the matter.

So they're less willing to have many, many kids given that they're earning a higher wage and they're obviously more educated.

So education also reduces the desired fertility of women.

Right.

So mostly it is just that, um, it's true that when you live better, you want to have more kids, right?

That's what we see.

But also when you have higher income, your opportunity cost of raising kids and the cost, not only the opportunity cost, but the cost of raising kids also goes up because the relative price of education goes up and things like that.

That's what we observe, right?

And so once you have a lower fertility rate, when you were referring to the pyramid of people, then what that means are you're going to have fewer younger people compared to older people over time.

Right?

So you're an ageing society.

And that's what we see with countries like Japan, with European economies.

The reason that US doesn't have a demographic ageing issue is.

Or as as severe is what?

Illegal immigration.

Excellent, right.

It's immigration.

A lot of these countries have less.

Immigration.

But that demographic transition is very clear.

The fact that as you get, you get richer, you're going to have fewer kids.

So mouth has missed that.

Right.

Mouth is always thinks thought.

So mouth has missed that in the sense that as countries got richer, they were going to reduce their fertility rates anyways.

His view was that there were going to be too many people around and not enough food supply.

So then lots of them have to die off, right?

But in fact, as countries got richer, people got richer, they had fewer children.

But crucially, he really missed the technological change because as we saw a scene in The Last lecture and we're going to really hone this in today, technology expands

the frontier continuously.

Okay, expands the capabilities, the capacity, and you don't run into the diminishing marginal returns with technological improvements, which is why you can continue to increase your income per capita based on technological growth.

His view was long run growth was zero.

Okay.

So that's what he was missing these two things.

So this is why we're going to look at a modern theory of growth.

And that's the solo growth model Robert Solo MIT um, a professor who won the Nobel Prize in 1987 based on a growth paper that he published in the 50s.

So the solo model is different because it allows for capital accumulation and technical progress.

Okay.

So we're going to examine this today.

There are lots of variations of the solo model.

You know obviously I'm going to give you the bare bones of the solo model.

And um, you're going to go back and practice it with the quizzes and think about it.

Right.

Play with a model, think about it, let it sink in.

Um.

So assumptions number one.

This is a real economy.

There's nothing like money.

There's no government.

There's no taxes.

Like the real bare bones of an economy.

Okay.

Second assumption.

We're going to assume that there's no population growth.

And human capital growth is constant.

No.

In a more sophisticated, complicated version, you can have population growth in that.

Leads to a series of other, more complex issues.

But basic guideline basic principles are exactly the same.

But for the purpose of this course, let's just hold this constant.

Okay, so they're not things like education increases and skill and things like that.

So population let's hold that as constant.

Okay.

So we remember this production function.

Correct.

Um, remember that these two factors are subject to diminishing marginal returns.

Okay.

An A is not by the fact that this is linearly a relation linear relationship with Y.

So 1% increase in output leads to a direct 1% increase in income.

That's not true for Kaplan H because it has diminishing returns marginal returns.

Okay?

So just just be up there.

Just.

It's a little distracting to hear you.

So can you just, um, uh, just be a little bit quieter?

Sorry.

Sorry about that.

Okay.

So this is very crucial here.

We're going to introduce.

A function of capital stock that tells you exactly why countries tend to grow or not to grow.

So let's focus on this for a second.

How does capital accumulate?

We talked about capital accumulation for a while now.

First of all, is capital a stock variable or flow variable?

Stop right.

By the end of period, you've accumulated all this capital.

So the machines, the computers, the factory that whatever it is, the trucks that you have.

Right?

Now, this capital stock, as we said, is subject to depreciation.

We said the depreciation is not accounted for in the GDP.

But the truth is, trucks tend to wear down.

Your computers tend to get old to keep that level of capital stock even fixed.

Constant.

What do we do?

We need to put in new investment.

Okay.

We need to put a new investment to keep the capital stock constant.

Okay.

So this is the depreciated capital stock.

And what is left that's not depreciated is your total value of capital stock today.

Okay.

So let's say depreciation is 10% right.

So 90% of the current capital stock is still.

Around today.

We add in the investment.

Remember that in our national accounting, investment is, uh, the kind of money that's spent on purchasing new capital.

Right.

New physical capital.

So new investment this year.

And this is a what is this a flow variable or stock variable.

Flow variable because it happens over this period of time.

So within this year you spend this amount of money on accumulating capital stock okay.

So you add this investment onto what's under appreciated.

The old capital stock to get next period's capital stock.

Okay.

Understood.

So again, the idea is, look, you have lots of trucks, but they wear down, so you have to fix the brakes or get some new trucks.

And that's how capital accumulates over time.

So that's the capital accumulation function.

Now how do we link this to growth?

What is investment?

Where does it come from?

Remember that we had a national accounting equation which says $y = c + I$ plus.

You know G right.

Plus net exports right.

We don't have G .

We don't have net exports.

Okay.

So y equals c plus I .
Okay.
What is y minus c ?
Let's just make sure that we get this.
Okay, so originally we had the counting.
 C plus I plus G plus net exports.
Right.
So we said we don't have this in the simple model.
And so we have y minus c is equal to I .
What is y minus c .
Saving.
Okay, so saving is exactly equal to investment in a closed economy.
We're in a closed economy.
We don't have open economy.
We can't send money abroad.
It's a closed economy okay.
So that's where this equation first equation comes from.
Now.
What is saving what, we're going to assume that you're going to save a constant fraction s of your total income.
Remember that from the GDP accounting your income includes capital income and labour income.
Right.
We're just going to call that income.
Well this y includes all of the income.
So we're going to save s percent of that income.
That could be 30%.
That could be 50%.
That could be 10%.
Now, mind you that this is an assumption.
Okay, we're assuming that you're going to save constantly 20% of your income.
That's not actually real economics.
It's just hand-waving.
Why?
Because how much you consume or save should be an optimal decision, right?
I mean, again, this is not in the lecture, not in the model, but just for you to understand, if we see income forever rising.
Okay.
You're young, you just got a Goldman job, you're going to steadily become partner and MD and blah, blah, blah.
And you know that your income is rising very sharply.
What do you do?
Do you base your consumption decisions on how much you make today as an analyst or on your future income?
Well, if you're rational, you base it on your future income, right?
So that's an optimal decision.
You're not going to spend 10% of your income every year as sorry, say, 10% every year.
You're actually going to adjust that saving rate.
So that's based on an optimal decision, which we're going to leave out here.
And instead for simplicity, we're going to assume that you're only going to save 10% or 20%, whatever it is.
That fraction of your income.
So plugging Y which is equal to h times f of k and h gets you that right.
So investment equal saving.
That's the crucial link here right.

We're talking about how does capital accumulate.
 Well it's through investment.
 Well where does the investment comes from.
 Investment comes from saving.
 Saving comes from saving a portion of your income okay.
 So if we were to graph this.
 Um, this is a graphical representation that we have already seen, right?
 Uh, on the x axis is capital stock.
 Total capital stock.
 Remember, labour is constant here.
 And on the x axis is whatever the y sorry,
 the y axis, whatever the variable, what we care about,
 whether it's GDP, consumption or saving, we'll come back to that.
 So first of all, we've seen this graph already right.
 It's increasing okay.
 Because more capital leads to more income but increasing at a slower and slower rate.
 As you increase capital stock, the marginal impact on income is going to be smaller and smaller, right?
 Um.
 That is because of the diminishing returns to capital.
 Now saving.
 If it's a constant share of the income, that's just a shift downward of the same curve, right?
 Okay, again, if you get confused, just hold something constant.
 Right.
 Hold k constant.
 Okay.
 And then why is the red line a fraction of the red line is gets you the green line.
 The point at the green line.
 Okay.
 So it's a it's a shift downward of.
 Of the of the curve.
 And so for every K , let's say we're here.
 This is your total income.
 This is your total saving.
 Okay.
 This point on this green curve.
 What is this in between?
 The vertical distance is just y minus s which is your consumption.
 Okay.
 So remember that what we talk about move along the curve and shifts of the curve.
 Moving along the curve is anything that happens to changes to the x variable.
 Okay.
 So when k increases you're moving along the curve.
 Anything that's not changing it's a shift of the curve.
 Okay.
 So this is saving and investment sorry saving and consumption.
 So this is your total investment.
 Now, before we look at exactly how the economy works with this solo model, what have we learned so far about the solo model?
 Solo model is simply that savings is equal to investment, and investment is what keeps capital growing.
 Okay, let's introduce one important concept which is called a steady state a steady state equilibrium.
 It's an equilibrium is where this variable is not changing anymore.
 It's constant.
 Okay.

It's forever constant.
Um.
And that.
So so I'm trying to think about steady states in the world.
Um, but there's probably a steady state population growth rate somewhere in along along the lines.
Right.
Um, there's a steady state saving rate, right in the long run.
So steady state, just for the purposes here is just where something is constant.
So that means k_t plus one next period is equal to k_t which is equal to some constant number k^* .
Okay.
That's the definition of a steady state.
Okay.
So coming back to our equation, our capital accumulation equation which is very important, we know that k is constant.
So this k and this k .
Is equal.
Okay.
So if k is equal these two things cancel out.
And we get that Δk is equal to I .
Right.
So when k is equal so this one cancels Δk .
You swing over here is equal to I .
And that's equal to saving and that's equal to s small s times the output.
What is the idea here?
Idea here is.
Because there is depreciation of capital.
You need investment every single period.
Just to keep up with the stock of capital, you need to replenish what is depreciated, right?
So when I equals Δk or DK , that's when exactly when capital stock can be remained as constant.
Maintained as constant.
Okay.
Every year, every year you need to put an investment to keep capital stock constant and to get capital stock to be constant.
Your investment equals exactly what's depreciated.
That's what this means.
And obviously investment equals savings.
So that equals small s times y which is a times f of KL .
Okay.
Any questions here.
Okay.
So we're going to add that depreciation line onto the graph.
Okay.
So.
How do you graph d times k ?
What d times k is linear.
Right because Δk it's a linear function of k .
So when you increase k you proportionately increase your decay.
So that's why it's a line.
The others are curves y because there's diminishing returns okay.
So increase k there's diminishing impact on y .
But $d k$ is linear.
Now, we said the steady state happens exactly when DK

is equal to investment, and investment is equal to saving.
 So decay crosses the green curve, which is the saving curve exactly at this point.
 And that's the steady state capital stock.
 Okay, again, just to make sure we get this.
 This is you have a constant capital stock.
 Exactly.
 When your investment.
 Incremental investment.
 Is able to compensate for the depreciated capital.
 And then you can.
 You can maintain capital stock to be very to be constant.
 So that means that is your long run income level.
 Okay.
 Onto y star.
 That's your long run capital stock and long run.
 Um income level.
 Okay.
 So that's where your potential income is.
 Again, you grow grow grow grow.
 I mean, just think about it this way.
 You start out from a low capital stock, let's say here.
 Okay.
 You're on this income.
 What happens.
 You're growing, right?
 You're growing, you're moving, you're moving, you're moving, you're moving, you're moving, you're moving until you reach here.
 Which is this capital stock?
 What happens to the right of this capital stock level?
 What happens if you're here?
 Well, we're already clear right here.
 We just grow, okay?
 We're capital stock increasing.
 You're on this y line, and you get here.
 And what happens here when you're here?
 Here.
 Your depreciated capital is greater than your savings.
 So your investment is not able to keep up with that capital stock.
 What's depreciated, which means is capital stock falling or increasing or staying constant.
 Capital stock is falling.
 Right.
 Because it's more more of it is depreciate over time than you can possibly replenish with the saving increment.
 So when capital stock is falling, you're going back until you reach this point at which capital stock exactly constant.
 Okay, so we'll come back to that.
 Just.
 I'm sure that you're a little confused, but here capital stock is constant, so output is constant.
 Why we assume that constant population.
 So with constant technology everything is constant.
 So let's look at the dynamic equilibrium which I already alluded to.
 This is your initial starting point.
 Okay.
 How do we map on this?
 Map this onto the real world that we talked about last time?
 Well let's look at initial income levels right.
 Let's take Singapore in the 1960s.
 Where are we?

We're here.
 Poor.
 Right.
 Where is the.
 Long run level of income?
 Well, K star, that's the point where you're exactly keeping
 up your capital stock and it's constant.
 What happens.
 You are on this saving curve.
 You're increasing your capital stock.
 Until you reach the steady state.
 Remember that we can't.
 Once we go over here, capital stock is falling because
 you're not investing enough to keep the plant is the
 capital can come back.
 Okay, so that's the dynamic equilibrium.
 But guess what.
 Look at your growth rate here.
 When you start out here compared to if you're here,
 let's say.
 Where where are you growing fast?
 Where are you growing faster?
 You're initially right.
 Why?
 Because you're on the steep end of the curve.
 Okay.
 You're growing very fast because you're diminishing returns have not
 set in as strongly as if you're right here.
 So that is a very, very crucial insight telling us
 why there should be some kind of convergence for poor
 countries and why poor countries should be growing faster.
 If we don't look at the data, we just look
 at the model.
 That's what you say, see?
 Right.
 Poor countries that start out with a lower capital stock
 is is growing faster.
 Why?
 Because they save a constant fraction of their capital of
 their income and it doesn't hit the diminishing returns.
 So you're increasing output at a faster rate and you're
 growing faster.
 So this graph already tells you if you're poor, start
 out poor, you're going to grow fast.
 Okay.
 So I think that's kind of neat.
 So that's why there's a convergence theory that when you're
 far below the steady state, you tend to grow further
 than if you're closer to the steady state.
 And this convergence theory is driven by capital accumulation.
 Now, it also tells you that if every country had
 the same saving rate, same technology level, no matter where
 you started.
 You can end up in exactly the same place.
 Right.
 If everybody had the same saving rate and same technology
 level, everybody should be equally rich or poor.
 That's what this theory tells you.
 So when we talk about capital accumulation growth.
 This is called catch up growth.
 Why?
 You're just catching up.
 Right.
 You don't need to do anything other than just save.
 You're saving and constant.
 You don't need to invent things.

You don't need to come up with better productivity.
 You just catching up because you started out poor.
 And a lot of this was attributed, or this theory
 was attributed to how the East Asian economies grew, saying
 they were mostly catching up right with good savings rate.
 They had high savings rate.
 It wasn't that they were particularly productive or innovative, at
 least one theory goes.
 But these East Asian economies were simply catching up because
 they finally had a stable macro environment, good government in
 place, and the right strategies led them to catch up.
 Okay, so something actually very powerful.
 Now let's look at a different thing, which is the
 impact of technology.
 Now when we have technological growth, what we see is
 that this production function keeps on pushing out.
 Right again.
 How do we know it's a shift of the curve,
 rather than shift along the curve or movement along the
 curve?
 Well, it's because A is not k .
 So for every single k a higher A will get
 you get you a higher income.
 Right.
 So that means it's a shift of the curve and
 you push it out.
 So this is the highest technology level A_3 .
 Now let's look at what happens a few observations.
 Technological progress.
 This shift curve shifts out.
 First of all, our steady state with the first level
 of lowest level of technology was here K_1 .
 Let's say that that's the constant capital stock right.
 That's where we're going to go.
 That's where we're going to stay except.
 If there's technological progress to A_2 .
 Where's our steady state now?
 Well, again DQ hasn't changed.
 Delta K hasn't changed because delta hasn't changed.
 But this curve has shifted out.
 And so K_2 is now a higher steady state income
 or capital stock associated with a higher level of technology.
 Now if you are already at a steady state.
 And suddenly we had this invention, industrial revolution, AI, whatever
 electricity, what happens?
 You're going to grow.
 You're going to continue to grow onto this level and
 again, so forth.
 A_3 you're going to go to higher level.
 So this tells you that there's no limits to how
 much your income can grow when there technological progress.
 Right?
 You keep on pushing out the curve and you keep
 on raising reaching a higher capital stock.
 And this is what we called sustained growth.
 Right.
 Because when you catch up to your steady state, that's
 simply catching up.
 But when you can have sustained growth higher and higher
 because of technological changes, this is the long run growth
 that we we talked about that we see in the
 countries like the US or even this country.
 Okay.
 It's not meeting the it doesn't.
 It's not subject to the diminishing returns.
 So in summary, capital accumulation generates growth in the short

run because you're catching up, but not in the long run because you reach a steady state.

The point of the steady state is that at that point you have no growth, zero growth.

You're no longer growing.

Growth only comes when you have technological changes.

Okay.

And so in the long run, sustainable growth comes from changes in a .

Now, let's now, now that you have the set up and hopefully it's clear how this model works, we can do a lot of things like comparative statics.

We can change things.

And then you're asked to understand what happens to the economy.

Right.

That's the kind of exercises that that you should be familiar, um, should be able to do.

Let's just think about the impact of saving rate.

So Latin American countries didn't say much.

Okay?

They tend to consume what they earn.

Maybe because of cultural differences, maybe because of other things.

East Asian economies saved a lot.

Does that have an impact?

On your income both today and in the future.

Well, let's take a look.

First of all, the one that has a lower steady state saving rate has a steady state capital, steady state capital, and hence income that is lower than a higher saving rate country.

Right.

So one thing that you really ought to think about and make the distinction is what are levels and what is growth?

Okay.

Here we're talking about levels.

We say that level of capital stock or income is going to be lower for the country with a lower saving rate.

In other words, whoever says less is going to be poor than the one saving more.

But here's the question once they get to their steady state capital stock, respectively.

What's their growth rate?

Growth rate.

Is it higher for rich countries?

It's both zero.

Okay.

At this point, both are growing at zero, but one is obviously richer than the other.

Right.

So levels this is higher.

But growth rate it's the same.

Okay.

So you want to distinguish between growth versus levels.

It's the same idea.

You know we looked at a lot of this you know looked at the data and we didn't see that.

Poor countries necessarily had higher growth rates than, say, the US, right.

Even though they were poorer and, um, even the US at 2% per capita growth, per capita growth rate because of technology.

Um, you know, other countries were also growing at 2%, potentially even poorer.

Right.
 So one thing doesn't imply the other.
 So the point here is that if you if you
 say more, your potential level of income is going to
 be higher, you could be starting from anywhere.
 But where you're reaching is high.
 And why I say this is, is interesting.
 Also in the real world, right.
 There are lots of countries that, you know, the economist's
 feet are calling out, you know, the potential, the potential,
 right.
 The potential income.
 This is the potential.
 This is what we're talking about.
 So when we talk about potential, we're talking about a
 country's ability to safe ability to, you know, increase their
 human capital or technology.
 Where you are at will only, and the gap between
 where you are at and your potential will determine what
 your actual growth capacity is today or your growth rate.
 Right.
 Like we said.
 I mean, look at these two countries, these two economies,
 right.
 Let's say that one one economy starts out at this
 point, okay.
 And the other economy with a higher savings rate starts
 out at this point.
 Which which is going to grow faster.
 Well, you don't know.
 That's not necessarily because here you are at a much
 lower income level, but you're also much closer to your
 potential long run capital stock.
 Right here you are at higher income level, but if
 you're further away from your own potential income, you're actually
 growing faster, potentially, right?
 It depends on exactly where we are.
 So doesn't mean that.
 So this tells you that the fact that you're richer
 doesn't mean that you're going to grow faster, necessarily.
 It only means that you're going to grow faster if
 you have the same saving rate.
 Right.
 So conditional on the same saving rate or technology, the
 further you are away from your long run, the faster
 you're going to grow.
 But if you actually have different potential long run capital
 stock, it depends on how far you are away from
 your respective income level.
 Is that clear?
 Because it is a little bit of a subtle.
 Point, right.
 And this is important.
 If we map again that back on to the real
 world, because this tells you that it's not that poor
 countries necessarily will catch up and poor countries will necessarily
 grow faster than rich countries.
 It's exactly where you are compared to where you should
 be.
 And this is why East Asian economies potentially aren't worth
 growing very fast, because they had a high, long run
 potential income because their savings rate was potentially even higher
 than the US or the UK.
 But they were further off.
 Right.
 So that's the subtle point that we want to talk

about conditional conversions versus absolute conversions.

We'll get to this in the next lecture.

But this is very much apparent on this graph.

Okay.

Any questions?

So let's look at the data.

Um, if we're saying savings rate is really important for income for your level of income, if not for your growth rate necessarily.

Um, this is a relationship between per capita income, real income.

And investment rates, and your per capita income is relative to the US.

So it's normalised.

Okay.

So this is your investment rate as a share of output.

Remember that we said savings as a share of output or share of income like 10% 20%.

Well obviously if you're closed economy your investment is exactly that share of output.

Right.

So we see, you know, somewhat of a positive relationship, right.

That the countries that had a higher share of investment going in, sorry, higher share of their income that's not consumed but invested, they also had a higher real income per capita, but it's not clear at the lower end.

If you just look at this sample sample of countries, you know, this country invested a lot.

Sorry this invested this country did not invest a lot, but it has higher per capita income.

Whereas some countries that invested a lot like these countries do not necessarily see that as a per capita income, but over cross-sectional, we um, over a bigger cross country set of countries.

You do see a little bit of that, um, um, uh, relationship.

Um, now.

Here's a test question.

Can we keep on increasing our saving rate to get sustained growth?

You see that we got the sustained growth by pushing out the curves right outward with a it's a possible with savings.

We know that it's possible with a.

They can keep on rising over time.

Is it possible with saving?

No.

Because the maximum of your income that you can save is 100% of your income.

Right.

So you can't go beyond that.

So it's limited by 100% and nobody's saved 100%.

Here I want to pause for a second and grapple with one real issue here about growth.

Obviously from the solo growth model, we saw that the more you save, the higher per capita income you will have in the long run.

Correct.

So saving is good.

But why don't we.

Want to then save 100% of it at the other extreme?

Is this really necessarily good if we are, you know, first year economics students learning about micro macro?

Is it good?
 Is it a good thing to save?
 No.
 Why?
 Yes, please.
 It means lower consumption, right?
 The more you save the more, you have lower consumption.
 And we all derive our utility by consuming.
 Right?
 That's at least the assumption.
 I'm sure there are more things in life than just consuming, but that's usually embedded in not baked in our models.
 So here is the tension.
 You save less, you consume less today.
 That's bad for you today.
 But it's better for you in the long run because savings mean more income in the future.
 So there's a trade off between consuming today and consuming tomorrow.
 More tomorrow.
 And this again comes back to optimisation.
 Right.
 How patient are you.
 Right.
 Some people are really, really impatient.
 So they really, really want to consume today.
 Well then it's a big loss for them to cut down their consumption and save a lot for the future.
 Right.
 Another determinant factors.
 Even if you save today, does that mean that you're going to get higher income tomorrow?
 That's a very crucial question for a lot of developing countries.
 Maybe they don't want to save because they don't really see that saving becoming more consumption over time.
 Because maybe the institutions is not good.
 Education is not good.
 If you actually see prospects, good prospects in the future, you might actually want to save more.
 So there's two tension going on sacrificing consumption today and how much actual gains you have if you save over time.
 So this is kind of the tension.
 So again this doesn't tell you optimality of our utility.
 It doesn't mean that we're happiest.
 Right.
 Because we actually sacrifice a lot of consumption.
 But it does tell us that by saving we will be richer in the long run.
 Okay, so finally it's a different theory.
 Malthusian theory.
 Increase in consumption output first.
 But then this leads to population adjustment.
 That's going to leave us stagnant with zero growth in the long run.
 And the Solow model, it tells us exactly that technological changes, diffusion of ideas, excess, you know, microchips and all that will keep on keep our incomes rising over time.
 But that is sustained growth compared to catch up growth, which is just about catching up to where you actually your potential level of income.
 Okay.
 Thank you.

And see you on Thursday.
Thank you for that.
I just had.
This surgery thing on the student hub, so.
Oh, yeah.
Yeah, yeah.
You can drop in my office hours.
It's, uh, tomorrow, 1030.
Yes.
Yeah.
Oh, yes.
Oh.
The.
It's.
Uh.

I can.
They don't.
I'm.
It is.
Bom bom.
I don't know of any sort.
Will you let?
Him know.
Till.
Okay.
Good afternoon everyone.
Welcome back.
Hello.
Okay, so last lecture.
Uh, we really thoroughly looked into a solo growth model.
Right?
Solo growth model.
Told you told us exactly why countries grow because of capital accumulation.
And capital accumulation comes from saving.
And it also tells us two really important predictions.
Number one, the poorer you are or the lower the capital start stock with which you start, the faster you're going to grow.
But there's a caveat here.
The caveat is that it's not just about where you start, right.
It's about the distance between where you start and where you're going to end up.
And we saw that two countries with two different savings rate or two different technology levels can have very different growth rates, even if they started out in the same place or if one started out further ahead of the other.
So that is the notion of conditional convergence, right?
Conditional on some fundamentals like technology, like savings, like education, you grow faster.
The poor you are, the further you are from your own distance.
So the first thing we want to look at is
is there some evidence of conditional convergence.
Now this I think is a very fascinating, uh, graph of the United States.
Okay.
These are different states in the US.
Now, when we talk about conditional convergence, why are we selecting a group of places, economies where, you know, they are roughly similar otherwise?
Right.

That's the notion of conditional.
And and to look at US states is interesting because
us all Americans are more alike with each other than
with another, right?
Whether it's savings or technology or whatever it is.
So conditional.
That word conditional is based on this notion that you
have to take constant some things.
And then American states are as a very good thing
to look at.
If you compare just across countries, there are lots of
differences, right?
It's hard to compare human capital.
It's hard to compare technology.
It's hard to compare lots of other factors that might
influence your growth rate and your fundamental or where your
potential income is.
So this strongly suggests there is conditional convergence for a
group of United US States, um, between 1880 and 1990.
So it really gave it time to converge.
Right.
So we're seeing, uh, on the uh, x axis is
the income per capita in 1880.
And, uh, what we're graphing is the annual growth rate.
Okay.
Um, annual average growth rate between 1880 and 1990, depending
on where they started.
So x axis is the initial level of income and
y axis is the average growth rate.
What do we find.
Well, we find that countries that started out relatively richer
grew slower than countries that started out with relatively, um,
poor.
I don't know.
Florida.
Virginia.
Right.
Um, and it grew faster.
So that is a strong evidence for some notion of
conditional convergence.
Now, if we look at a broader spectrum of countries,
and if you just group all countries together, it's harder
to detect such a strong negative relationship for the reasons
that we discussed.
You know, countries are very difficult to cross compare.
Right.
There are lots of other things that are going on
that might affect your growth rate.
That has nothing to do with, um, or that's correlated
with this, you know, initial level of income.
So we need to find that relationship.
We look at US states, which is again more similar
than others.
Now, we do find a broad level of conditional convergence
evidence among a group of similar countries.
If we look at European economies, for instance, OECD countries,
we do see conditional convergence.
I think about the ones that I've caught up.
The Spain and Greece is of the world, um, in
the European economies, the further they started out from, the
faster they grew.
Okay.
But again, conditional convergence is what this powerful implication that
the solo model tells us.
Because again, it's not about absolute convergence, which is about,
you know, the poor you are, the faster you grow.

But it's about conditional on where you're going to get to right your steady state.

Now, one word about steady state.

Um, just because I sense a little bit of confusion.

A steady state is not an optimality, okay?

There's no optimal things going on in determining with studies.

How do we define the steady state?

We define the steady state as a variable that is constant over time.

There's no optimality going on, just that it's constant.

Okay.

And how was capital able to be constant?

Well, when the additional investment is just enough to replenish the depreciated capital, you can keep capital stock constant.

And again I want to, you know, drill this in.

The concept of solar model is based on this concept of diminishing returns.

Right.

So the poorer you are the more you generate an income or the easier it was easier because you have low capital stock and the higher the saving because your savings rate was a proportion of your income, and the more saving compared to your depreciated capital or investment, then you can grow capital stock.

But when you're at a very rich level, your savings is not enough to keep up with your depreciated capital.

Then capital stock will tend to fall until it reaches a steady state equilibrium.

Again, no optimality going on.

The optimality here that we're leaving out of the model is when you choose to decide between consumption and saving.

That is based on optimality that we discussed last time.

Right.

We're leaving out that problem in this course.

Maybe you'll encounter it in your second year or third year of courses or leaving that out.

So there's it's just a steady state.

Okay.

So we do see conditional conversions.

Now we want to really evaluate some of the theories that we discussed okay.

Or some growth theories now.

We want to make a distinction between what we call proximate versus fundamental causes of growth.

Okay.

Proximate means kind of immediate factors, right, that determine growth.

What are proximate factors in the way that we've studied.

Well capital accumulation.

So savings technology and human capital right.

That's the proximate, uh factors.

Now the question is that's all fine.

But what's driving the differences in savings behaviour, the differences in human capital accumulation, the differences in technology.

There are some fundamental factors.

And today, the last course on the last class, on growth, um, is going to surround what are some of the fundamental causes of differences.

Now before we go into this, and I know that we weren't able to upload the lecture beforehand, there was some error.

But this is also good because I can now let you think a bit more before we tell you what are some plausible explanations.

But I think that from your own experience, your observations, your, you know, your your your your knowledge about history, you can think about ways to map your theory of

growth onto what we learned and then see, you know, what are the fundamental causes as we will explore, um, shortly.

So this is one of the few courses that we're going to have a chance to have a little bit of discussion, uh, having been equipped with the tools that we learned from last time.

So now does anybody want to give me a theory of growth?

I mean, it doesn't have to be a sophisticated theory.

Just why do you think some countries are poorer than others, or some countries grow faster than others?

And then let's see if we can map out your explanation onto the things that we have learned.

Okay.

Any any takers?

Yes.

Natural resources.

Okay.

Very interesting.

So, um, how does that map onto what we have learned?

That's a that's a very interesting problem.

So natural resources, we see that countries like Norway, countries in the Middle East.

Right.

By the way, Norway is extremely rich, not necessarily because there's the greatest technology and innovations in the world, but because it has very, very as oil, right?

Oil has made everybody very rich per capita wise.

Middle East, obviously.

You know, if we look at the 19th century deserts everywhere now, some of the richest economies in the world and a few other examples.

Okay, so first of all, let's think about the proximate factors, okay.

We know that y equals a and then k and h .

Right.

So how does natural resources um fitted.

Any any any ideas.

What they call me versus economy.

Open economy versus okay.

So so that's that's an interesting hypothesis.

On top of natural resources you can export.

Right.

So you can export the natural resources.

But how does that map onto.

That's correct.

So what's the next step on mapping onto our a equals sorry y equals $a f h k h$.

What does it turn into.

Well, first thing it turns into a saving, right?

Once you export it, you earn a lot of income.

Okay.

That's saving.

So that goes into our K capital accumulation right.

So that's an immediate mapping of your theory onto our our our formula.

Now of course you can go one step further saying with the saving I can invest in education I can invest in technology.

A lot of these Middle Eastern economies are using the wealth that they have to invest in future technology.

So that could increase a in the future.

Okay.

So there we go.
 We have one theory and you can connect it to
 um but but here's the follow up question.
 Is natural resources sustainable growth.
 No right.
 It's not sustainable growth.
 Because or not necessarily because the immediate factor is that
 increases saving and capital accumulation.
 But it doesn't necessarily increase productivity unless it's invested in
 productivity.
 And we see results.
 Right.
 That's the secondary effect.
 Okay.
 So good good theory natural resources.
 What else.
 What else?
 It can be anything.
 As long as it's reasonable, we can map it onto
 our theory.
 It can't be just capital accumulation and saving, can it?
 Yes, please.
 Up there.
 Geographical location.
 So can you be more specific?
 That is.
 Great.
 Excellent.
 So what he was saying was landlocked countries, you know,
 um, are further away from ports and it's harder to
 export and trade and import potentially.
 It's harder to to.
 It's the exchange not only of goods but also of
 technology, the spreading of technology.
 Right.
 Okay.
 So how does that map onto our our formula.
 Right.
 So um, I'd say the media thing again is coming
 back to this exports and imports, the ease with which
 you can export.
 And although it is a little bit different from natural
 resources, natural resources, you can just export a lot.
 Landlocked is just a disadvantage, right?
 It's a disadvantage so that maybe it's harder to export
 and trade.
 And it could be it could impact aid, right.
 Technology because technology comes from diffusion.
 It comes from a knowledge.
 And it could also impact K because, you know, there's
 less savings because you can't gain as much from exports.
 Okay.
 That's very interesting.
 And especially in a world where trade we haven't gotten
 to that yet, but where trade is very much related
 to growth, that could be a disadvantage.
 Anything else?
 Anything to do with politics?
 Yes, please.
 If.
 Some of these things are useful, for some others are
 extracted.
 Okay.
 So institutions, institutions institution.
 We're going to talk a lot about institutions.
 So very good.

That's you know, the rule of law right.
How you know how well your property rights protected institution.
We're going to come back to this.
It's a complex big thing, okay, that we're going to talk about what?
About political systems.
Do we think that there's a relationship between there and growth?
Not necessarily.
Okay.
All right.
So let's leave it there.
Think about why.
Through your observations about why you think countries are poorer richer.
And then again map it onto the a k h framework.
But again those are proximate factors.
So now we're going to come to the fundamental factors right.
Proxy ones.
You can map it onto the education saving and technology.
But what are some of the fundamental causes.
Now there's been a huge debate since history of why some countries are more developed than others at a fundamental level, or in other words, fundamental causes are what actually makes countries save more than others, or more educated in another or or have higher technology.
So what are the deeper layers?
So this is, you know, if you will, a map of what we said, the proximate causes, as it's kind of illustrated by our formula, which is basic inputs and output and fundamental causes.
So there are three leading hypotheses, but I don't think it's conclusive just to say I don't think we have a conclusive idea about exactly why countries grow fast and others are poorer than others or richer than others.
But here are some hypotheses.
One is about geography and others about culture.
Another third is about institutions.
And what I want to try to get you to think about is, how do we try to falsify some of these theories, or how do we try to test some of these theories by thinking about real world examples that can tell me are.
But here's this example, which means that this can't possibly be true.
So again, there's no fundamental final answer on these things, but it would be interesting to, um, to, to to debate about it.
Okay.
So the geography, uh, hypothesis is that, um, things like climate ecology, also your location, whether you're landlocked or you're close to a port, I mean, we do see as generally, you know, if you look at cities that are closer to rivers, they tend to do better.
But here's a snapshot.
Maybe some cities try to locate themselves next to rivers or ports.
And so it's not ports that lead to cities doing better, but the fact that there's some endogenous selection of wanting to be close to rivers with good institutions, good governments that made it very successful.
Right.
So the correlation versus causation, I hope that we're clear

on that.
This is something I want to want to, um, drone
in here.
There's a difference between correlation and causation.
Right.
So far.
I think you must have heard of that many times.
But I just want to say when we think, think
about these things, this is very important distinction.
Correlation is where you see some relationship between variables.
Let's say we see geography and growth.
Okay.
Uh, we, we, you know, we see some other correlations.
Uh, uh, if you, if you go on YouTube, uh,
you know, this is this is really absolutely ridiculous.
But you see, you know, cats standing next to pianos,
okay.
That's a correlation.
There's no causation going on.
Right?
It's not that cat causes, you know, or the piano
causes the cat to be next to it or the
other way around.
It's just a simple correlation.
So that ridiculous example is precisely why we want to
be careful as to what is the causal effect or
what is just a simple correlation.
So for instance, if you see cities do better, cities
that are located next to rivers or ports that do
better, again, the question begs us to, is it the
fact that there are next to the river that's make
the city successful?
Or do empires and emperors select themselves to be next
to rivers and with good governance and capital?
And because it's a, you know, it's a central, um,
it's a, it's a, it's a, it's a thriving city
that you see that correlation.
Right.
So that that might not be the best example, but
we want to be very careful as to correlation causation
differences.
So in that sense if you look at the geography
hypothesis here's an interesting map.
Right.
This is the lighter areas are the poorer regions.
So you can see this um red orange much poorer
than the blue shades I don't know why they selected
the colours.
Maybe it's the heat map.
So hotter areas are are more in red.
But you see that there's a correlation between the fact
that if you're in the tropics, you tend to be,
on average poorer than if you were in the northern,
actually not even the northern hemisphere, but just outside of
the equator area.
Okay.
So with that observation, you got economists thinking, okay, is
there some kind of causation or is it just a
simple correlation?
Right.
If it's a simple correlation then we need to dig
further and understand.
So what is then the underlying cause to, to to
have this kind of correlation that we observe.
Now the people who believe in the geography hypothesis are
invariably the ones who believe that geography causes differences in

growth.

Right.

So we have, um, in history.

Montesquieu, uh, Alfred Marshall argued all kinds of things like tropical climates, decreased efforts.

Okay, maybe, you know, this is slightly getting into very borderline political correctness, um, issues.

But, you know, you look up and you see coconut trees and they fall off and you don't have to work that much.

Right?

Lots of these things are being kind of, um, uh, written off.

Um, because first of all, it's not correct.

And second, obviously there are overtones about these hypotheses that is just simply, uh, you know, with, with.

Biases.

But there are some other more modern economists, such as Jeffrey Sachs, who talked about Jared Diamond, that argue that tropical climates are sometimes more prone to infectious diseases, such as malaria, dengue fever, and this okay causes low growth.

Why?

How does it map onto.

So these are the fundamental if this is the fundamental factor, how does a map onto our proximate factor.

Well for one thing, if there are lots of diseases that makes the people less productive, right.

So our human capital factor is lower.

This could also work less and therefore savings is less.

Okay.

So that maps into capital stock.

What do we think about this theory now?

I think, um, Jared Diamond has a more sophisticated argue than simply just infectious diseases, although his book is called guns, Germs and steel.

Um, guns, germs and steel actually being the proximate factors, not the fundamental factors behind his theory of growth.

His theory of growth was okay, first of all, why did we have guns and steel in certain places and, you know, and not in others?

Well, he goes back to really the beginning of geography and talks about how the axis has tilted in a way that sun shines through a certain area that's more conducive to doing agriculture, or why there are horses in some regions and not others.

You know, if you think about the zebra, African zebra, that's the closest thing that you can find to a horse on the continent.

But it's totally non-domestic, all right, because of its temper.

And so these are some examples.

Right.

And then he talks about how the East west axis is, uh, easier to spread things like plants and, you know, things like seeds blow right in the wind and somehow they blow this way rather than this way.

But, you know, more generally, um, uh, kind of the, the spreading of writing and technology on the east west axis is stronger than north west, north south.

So there's a much more complete analysis of geography.

And in some ways it could be compelling to look at the starting point.

Right.

And he argues that places that are more prone to developing agriculture led to more, you know, more sophisticated societies that had organisations.

And then coming back to the institutions point because it

necessitated the building of institutions.

Okay.

So that's that's definitely, you know, one, one theory that is very interesting, but not without its flaws.

So let's just look at a test of the geography hypothesis in the sense of infectious diseases.

Right.

Um, if you look at this graph and, you know, one part of being part of this course is to how to read these graphs and understand the implications. Um, what do we see on the x axis?

Is the percentage of population exposed to malaria in 1966. And then the real income in 2010 is on the vertical axis.

Okay, so what are the what?

What do we see?

First of all, we see that there are lots of zeros.

Okay.

See lots of zeros.

Because these places are not all not exposed to malaria. And that has you.

We need to take out those data.

But it doesn't tell us that much.

Right.

And then there's lots of places also with a 100% exposure percent of the population exposed to malaria.

But we do see generally a negative, if not as strong as some of the other negative relationships that we see.

Right.

So this suggests that first of all, all we can say is infectious disease is really bad for growth.

But can we really conclude this is the fundamental cause of growth differences?

Not necessarily.

But it gives a bit of justice to an idea that, um, that that disease is very, very important and therefore it affects people's productivity.

Now the second hypothesis is based on culture.

I'm sure that from your daily observations and the fact that you're a very international group and you look at behavioural differences, family differences, preferences, differences, there is quite a bit of cultural difference, right?

Um, now, some people think that culture is one really important reason determining differences in income.

So for instance, coming back to our proximate factors, there's things like safety saving differences.

Some people believe it is a cultural thing.

Why do East Asian countries economies save a lot.

Right.

And other economies like in Africa or Latin America, even the United States, save so little US household saving rate is right now about 2%.

If you look at a country like China, the household saving rate is about 35%.

Massive differences.

So there seems to be something there, right?

According to what we observe.

And actually leading even back to earlier times before the divergence and started before the really rapid growth of East Asia.

Uh, in the past there was some, some hypothesis about religion, okay.

And the fact that, you know, this is the strongest proponent of that was Max Weber, who argued that Protestant,

as opposed to Catholics or others, uh, more emphasised on hard work, higher savings and, um, I don't know if education was part of it, but certainly it could be.

And so that increased income and that's the work ethic hypothesis.

And they said that part of the industrial revolution leading up to that was this kind of Protestant led efforts.

So that originally came from this idea.

And then we had important political scientists like Samuel Huntington, Samuel Huntington, who talked about clash of civilisations.

Okay, I'm not sure this is exactly related to growth, but the idea that culture values are very, very different, certainly at the proximate level, we can understand, you know, cultures that emphasise education emphasises hard work.

Discipline and saving will map onto higher levels of K and H, at the very least, even if not at technology.

And by the way, innovation.

There's also an argument for culture and innovation.

They actually say East Asian economies tend to have this very rigorous, um, rote, memory based education systems that did not create this level of entrepreneurship or innovation or creativity.

Right?

So that's something to argue against why East Asian countries will grow faster.

So you can see some of this is starting to, again, bordering very politically incorrect.

Um, a line's a very thin border, but it's still something that we can at least roughly think about.

Now, if I were to ask you, how do we either confirm or falsify this hypothesis based on culture?

How do we think about a way to see if culture really matters?

Just give me an example.

Right where a culture matters or it doesn't matter, or is one of the most, I'm sure that culture matters.

Let's be clear.

But is it a first order degree of of importance?

Any ideas?

Well, first of all, let me give a.

Give you a hint, okay.

Does culture change fast or slow?

Slow.

Now.

But what do we observe about growth?

It can change very fast, right?

Lots of countries have very rapid growth in a period of ten years.

And you can't say that culture fundamentally changed vastly.

So there's a time mismatch thing that you can argue, well, maybe it's not the first order thing because culture really changes slowly.

But why did we see this.

Huge cycles and lots of countries right.

What's another way to falsify it?

Can somebody think of.

So.

So here I gave you a cross time okay.

Hint.

Right.

Things that didn't match on the time dimension.

What about at the cross-sectional dimension.

Meaning same time across two different places.

Who can think of an example where culture was very similar but very, very different.

Outcomes.
Yes.
North Korea and South Korea.
Same culture, actually.
Same people.
Right.
So excellent.
Anything else?
That's exactly right.
If this is called a cross-sectional comparison.
So culture is pretty constant.
But you have very, very different outcomes.
The first one I gave you the head was over
time culture changes slowly but growth changes very quickly.
Right.
So it can't be due to culture at the.
At the at the at the first order.
However, having said that, it doesn't mean that culture doesn't
matter now.
My own view is that culture does matter a lot,
but where it could matter is to determine not the
growth rate, but the potential level of income.
Remember where when we talked about in the solo model,
it's all about the distance between where you are now
and where you are in the future.
Or you can think about this as the long run
levels, levels versus growth.
Now, my own view is that levels of income are
inherently determined by things like culture because of the savings,
education, discipline, etc. but where you are and your growth
rate is not first order dependent on culture.
Right.
That's my that's my perspective.
But again, coming to these examples, we see that in
terms of growth culture might there might be a challenge
for this to really take place and take hold.
Now this is um, a graph of Weber's or a
test of Weber's Protestant work ethic hypothesis.
This is the percentage of population that is Protestant in
1900.
And, um, this is a real GDP per capita in
2010.
What do we see?
Well, we see a slight correlation.
Right.
Again, not very, very, very strong but a slight correlation.
We know that in Norway you know a lot of
resources and Iceland etc..
So there's some somewhat of a of a of a
um of a relationship there.
Again here this is a levels comparison, not a growth
comparison but a levels comparison.
Okay.
Now let's look at the last hypothesis which is institutions.
So what is institutions.
What is institutions.
What do we think are important?
I mean you're getting at people told me about natural
resources, geography.
But look around us.
Look at the societies that we're now.
Where are you now?
And look at some of the, you know, warzones and
other places and, you know, other countries.
What what's the fundamental difference?
That we haven't talked about.

For one thing, there's stability, right?
 Political stability, macroeconomic stability.
 Lots of places in war zone areas.
 How do you imagine that entrepreneurs will want to invest
 now broadly what is institutions?
 Institutions is the way that societies organise themselves and create
 these entities, in my understanding is, you know, it's not
 just entities, but a set of rules, laws, entities that
 shape human behaviour and put binding or put constraints around
 what's good behaviour.
 Right.
 So for instance, rule of law could be one set
 of institutions.
 Let's see.
 Um, do I have it here?
 Okay.
 Anyway, it's at the end of the end of the
 lecture slides, but it could be the rule of law,
 private property protection.
 Now imagine that if you are in, um, in a
 place where you're septic to being expropriated of your property
 or your, you know, whatever it is that you own,
 you're less likely going to want to invest there, build
 factories, educate your workers, and so forth.
 Right now, there are some very interesting, you know, if
 you look back and interesting episodes in African economies, right?
 A lot of these governments had bad institutions and they
 couldn't protect the private property of the businessmen.
 Or not only did they not protect, they stole.
 Right.
 They see this business making money.
 And either they say, you know, give me 50% of
 your profits or we're going to tear down your factory,
 that kind of thing.
 So if you think about an incentive problem, why would
 you want to invest there?
 Right.
 Not only just in factories but also in technology.
 There's no way that you would want to do that.
 And so one African government said, um, you know, we
 can't be extractive because we can't kill the golden goose
 or the goose that lays the golden eggs, right?
 The golden eggs being the factories and the productivity.
 If you kill the goose, then you know, you don't
 have anything that lays the eggs.
 So that kind of idea that institutions is important, um,
 led to this idea that this is the main fundamental
 cause of prosperity observed around the world.
 Now, if you just look at a simple.
 Um.
 Index of War.
 Of war.
 Okay.
 This is coming probably from the world Bank and the
 real GDP per capita.
 Rule of law is minus two to plus two.
 So some kind of scale, uh, some kind of, uh,
 index of rule of law.
 You see that?
 Well, there's a pretty.
 Pretty solid relationship between rules of law and real GDP
 per capita in 2010 ten.
 You see countries like Zimbabwe or Burundi obviously far off.
 Now, what's the problem with this graph?
 It does show you a positive correlation, right?
 But what's the problem with our interpretation?

Does this tell you that rule of law causes higher income?

No.

Why?

It's a correlation, but it could be a reverse causation.

In what sense?

Well, I'm richer and I put more emphasis on things like rules of law.

And so I'm gonna have a better rule of law, right?

This at this point does not tell you causation.

It tells you a correlation.

You can totally tell the other story from the reverse correlation, that it's not rule of law that causes high income, but rather high income.

That makes it more likely for you to have a good rule of law.

Same thing with all kinds of other things like the corruption index.

By the way, there's a problem with these corruption indexes and rule of law indexes how you measure them.

The going joke was that some countries bribed these data sets to have a higher ranking on the corruption index, then, then a lower ranking.

So obviously these measures are also problematic.

Right?

But again, the point here is that there's some relationship.

We don't know if it's causation or correlation.

So institutions have three important features that are determined by individuals.

They place constraints on behaviour and they shape human behaviour by determining incentives.

Incentives is the key here.

Right.

What kind of institutions induces good incentives okay.

Um so talking about incentives and here's some examples in history.

Right.

Of what means what are incentives.

Now incentives are really, really important.

Think about the let me give you an example.

Right.

Let's take um China.

China was extremely poor in the 1960s and 1970s, one of the poorest countries in the world.

Okay, maybe \$500 per capita income, uh, per year.

Now, obviously, it's a very important economy and much richer than in the past.

Obviously, culture didn't change that much, right?

Geography.

Right.

There's no relocation of China.

But what changed was that people were incentivised suddenly right before they had communism or communist planning, planning economy.

Everybody was tied to their land, and everybody worked a few extra few hours a day, and they all went to some canteen and shared food.

Okay.

Then the reforms happened in the 1970s, and all these people were given a piece of land, right, that you can kind of own.

Not entirely the kind of at least your work efforts was proportional to what you got in return, rather than just being equally distributed.

And then people had different kinds of equipments and machines coming from savings and all of that.

You could keep part of your profits.
Entrepreneurs could keep part of their profits rather than just handing it to the state every single time.

Right.

What did that change?

That change incentives.

And that alone was strong enough for poor, backward country to become one of the most powerful economies in the world today, with one of the best innovation systems and technology and so forth.

Right.

So incentives here is crucial the desire to want to work, number one, and the desire to want to innovate is the second.

Right?

Working and innovating is not the same thing, but you need to have both because we need innovation to have sustained growth.

So incentives is really important.

Um, if you looked at ancient Rome and mentor turn to the emperor, but not rather to an investor here, let's look at the US as an example.

Right.

Incentives you can.

The going saying is that you can raise your first 100 million in the United States as a young person, before you can be rich enough to own a suit.

Right.

What's the incentive there?

Well, you go out, you build a company, and you become a millionaire billionaire.

And that strong incentive for you to have good ideas, right?

And hard work is what pushes the American innovation frontier.

And rather than if you had to turn to an emperor, very, very unpredictable, etc., then you might not be so incentivised.

And other kinds of, uh, examples here.

Okay, so we talked about North Korea and South Korea, right?

A classic example.

Another example is western eastern Germany.

Another example is Eastern Europe compared to Western Europe.

Right.

Of course there you can say that culturally is also different.

Geographically it's different.

But at least for Germany, this is very, very much the case now.

North and South Korea in the 1940s, um, North and South Korea were a single country with a unified language, cultural geography.

So what do we call these?

We call these natural experiments.

Right.

Something that is exogenous, that happened because of not economic reasons, but outside the economic reasons, because it was split into two countries by an agreement between the US and Soviet Union.

As we know, North Korea today is extremely closed.

South Korea today, on the other hand.

Well, you guys are listening to South Korean pop, right?

So a vast difference between the two countries in terms of openness.

And this is actually what happened.

Obviously very similar income per capita and then 50s, 60s,

70s until they diverged.

South Korea being one of the richer countries today compared to North Korea, really, you know, falling behind even in absolute values, in absolute numbers.

Right.

So by 2010.

North Korea was an economic disaster with GDP per capita of \$1,500, while South Korea was in a miracle.

Um, and many times that was a geography.

No.

Was it culture?

No, it was an institutions.

So that lends some credibility to good institutions, good rule of law, you know.

But apart from institutions, something we did not talk about is openness.

And this is not part of the solo model.

Right?

The solo model is one theory.

Now, um, admittedly the most prominent theory among growth, which is about capital accumulation and saving, but openness is not featured there.

But if we look at around the world, we see that open economies tend to do well because of trade.

Right?

Um, if you look at even the European economies, very small but extremely open, if you look at countries like Singapore, um, like South Korea, they were export oriented economies. Even the East Asian Tigers, including Hong Kong and Taiwan, these economies, they were all export driven.

But none of that is featured in the solo model.

It's neither institutions nor geography nor culture.

Now it could you could say that as part of institutions, you need to have good institutions to promote trade.

But that's not necessarily the same thing.

Right?

So globalisation obviously being an extremely big and important topic is not part of what we're studying here, but very important in terms of thinking about how globalisation shapes growth.

And I don't know if you remember, but in the first two lectures I did allude to one fact, which is that despite the fact that income inequality, as we hear it, is increasing within countries, income inequality between countries is shrinking.

Right.

And how do we see that?

We also saw because of convergence of lots of countries, right, in terms of shrinking that gap.

And a lot of it is mainly because of globalisation.

Now, how do we map that onto our formulas?

Well, again, trade right.

We already talked about this.

Trade promotes exports.

If you can export you have higher income, higher income, you have higher savings.

That leads to capital accumulation.

Another idea is through a right a technology.

So trade helps diffuse ideas.

Now think about you guys importing a country, importing stuff that you couldn't make before right.

High tech chips.

You know, intermediate goods, electronics.

You import them.

You learn you learn from these products.

Or because these other companies are exporting to your country, you establish contact with them.

They're kind of transfers of knowledge.
That's the idea of diffusion of ideas through trade.
And when ideas and ideas being captured by a is also that it can impact a.
And then of course you can argue about human capital, right.
The fact that when you have trade, you need to skill up your workers in order to keep up exports and the quality of exports.
And then you invest in human capital.
So again, you know, this is just some ways to think about it.
Another another idea is that somehow globalisation can help you attract.
So if you're a small country, initially you had very, very little domestic consumption capacity.
Remember we said y is equal to C plus I plus g right.
Plus net exports.
But when you're a small country and you're poor you don't have much consumption.
And that means you're not going to manage income.
But by being able to sell to the rest of the world, your C is really, you know, the whole world.
 C you can sell to a whole world that has much greater capacity to consume, even if you have low domestic capacity to consume.
So the idea that somehow you can produce for the world doesn't mean that you're doomed to a very small demand, and hence income in the beginning.
Right.
So South Korea also was, um, an exporter.
So the South Korean autocratic government, um, of these people adopted a market based economy providing incentives for investment in human and physical capital.
Right.
The North Korean dictatorship adopted a strict communist system that outlawed private property and banned markets.
And I think, again, coming back to the China example or the Soviet Union example or the planned economy is a problem because there are no incentives to really work hard, nor to invest in technology.
So economic institutions in sum, is the protection of private property rights, ownership, impartiality of the justice system, finance, financial system finance is about reallocating capital across borrowers and savers and regulations.
This is not an exhaustive list, and you can also see that there are lots of countries that don't have great institutions that also grow a lot, right?
So it's not like you have to have perfect institutions, but that over time you create better and better institutions.
Now again, there is a causality.
Okay.
So let me tell you how to, you know, how do we test this.
Right.
There's a reverse causality issue here as well.
Right.
We see correlation between good institutions and good high income.
But it could also be because as you get richer over time you tend to want to build good institutions.
Right.
So how do they test this theory.
Well, one interesting study Acemoglu, Simon Robinson said look at the colonial past in Africa.

European colonialist.

Right.

So the European colonialists set up very different institutional features in various colonies when they were there.

Okay.

You can say you can distinguish between the French and the British and Dutch and all that Portuguese, but that maybe doesn't tell you enough.

But the fact of the matter is that, um, they tended to set up, um, a think about Congo, right?

Or some of these African colonies as opposed to as opposed to Australia, New Zealand, the United States, which were also also a colony.

Right.

So what they showed was that in a lot of these colonies where it was very difficult to make settlement, whether it's disease or the aggressiveness of the local population, whatever it is, they tended to set up extractive institutions because they couldn't settle.

If they couldn't settle there, they weren't that friendly.

They were taking away a lot of stuff, whereas in other places, maybe more milder temperature, maybe a better geography, maybe, you know, all these factors, they set up different kinds of institutions.

So using that as a proxy you can test because that's exalting us.

Right.

That's not a reverse causality problem because that was based on some random factors like infectious diseases or geography.

And they showed that European colonies that set up better institutions because they could settle there, actually perform much better.

And this is we're talking about the, you know, the colonies that we just talked about.

So that's actually the right kind of test of a hypothesis.

Right.

Rather than just looking at correlations and just to say, look, you know, there are lots of countries that have not so great institutions.

Again, I'm coming back to China because China has lots of problems in institutions, but it's managed to grow very well.

Right.

So again, it's not a complete explanation.

You need a pretty good incentive system, but it doesn't mean that institutions have to be perfect for these things to work out.

So, um, Darren Asamoah blew and all of these people wanted to push for this idea of what's called extractive versus inclusive economic institutions.

We talked about inclusive ones and inclusive ones gradually.

Now, uh, stretch the scope of inequality, right?

Bring people together.

Extractive economic institutions, as we said, don't enforce private contracts and private property.

And also there's a sense of political attractiveness, which means that and again, I think this is subject to debate.

So I'm not completely convinced by this argument.

But the idea is that politicians don't like to see change because that threatens their own stability.

And hence some extractive, politically extractive states don't encourage innovation and technology because that tend to unseat their stability in power.

I think it is fair, you know, in a number of countries, but if not in all countries.

And so they're just arguing that in these kind of

states, there's no encouragement to invest in things like innovation and technology.

Um, there are lots of counterexamples where you don't have.

And this leads to the last final point, which is what about democracy of growth?

Right.

Does democracy usually lead to growth?

Or is it the reverse?

That growth tends to lead to democracy.

Right.

So again you need a very clean test to be able to tease out the causal effects.

It's very, very difficult to tease out which way it goes.

But what they say is that outside of the East Asian economies, you did see that countries that had democracy, that became global democracies were growing faster than countries that were non democracies.

But let me remind you that lots of countries where do I list here today Chile, uh, South Korea, um, Taiwan, uh, what are some others Singapore, Hong Kong, South Korea.

All of them were only recent democracies okay.

And they grew despite being not a democracy.

So I'm going to leave you with this one thought, right?

Is it really democracy that causes growth or the other way around?

Or is it the concept of free markets?

And free markets can still hold in non democracies right.

It's not a necessary condition or sufficient condition or is a free markets that encourage people to innovate.

Uh, to work hard.

That is really crucial here.

Okay, so lots of open ended questions because there are no final conclusions.

But this is way for you to kind of grapple with some of these prevailing theories and your own thoughts.

Okay.

See you next week.

Thank you.

They'll talk.

About.

Do you like it?

Yeah.

Us.

Oh, yeah.

By not.

Wishing they.

Awesome.

This is.

She's.

That.

Indian Super League.

And what if you told me that, you know, I would have watched.

Just look.

I love to dance.

I think my best.

And I lost interest in Syria.

I think they want it for 90.

It's good.

I haven't spoken since.

I've been born.

That's.

Because I don't want that.

What are you doing?