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**JONATHAN
GRUBER:**

Today, we're going to finish our discussion of savings, continue my nagging on you guys about how you should be saving money. And then we're going to move on and talk about international trade. So let's finish our discussion of savings.

Now, savings turns out to be a critically important element of growth in the economy. And we've now traced through why that happens. Our basic story is as savings goes up, that means that the capital supply shifts out.

So the capital supply curve shifts outward as people save more. That's an increase in the capital supply curve in the capital markets. That means that interest rates fall.

Because there's more supply for given demand, the price is going to fall. The price of capital is the interest rate. So as people save more, that's more supply into capital markets. It's increasing the pool from which firms have to borrow.

For a given pool, firms have to pay less money to borrow from that. If the interest rate goes down, that means the NPV of investment goes up, because remember, the net present value of investments is a negative function of the interest rate. The lower the interest rate, the more firms will say I might as well buy a new machine, because the bank's not paying anything. That means that NPV investment goes up, which means investment goes up.

So the bottom line is, the way we get firms to invest more and grow the economy is by saving more. We save more. We increase capital supply.

That lowers the interest rate. That raises the NPV of investment, which leads to more investment. So that's the link by which savings lead economic growth, is that savings leads firms to invest more.

Is that clear from the sort of structure we built in the last couple lectures? If it's not,

just go back through and work through the math. But you'll see we talked about the capital market.

The interest rates, the price, and the capital market-- last time we talked about the lower the interest rate, the higher the net present value of any given investment. That means firms will invest more. So that means a critical public policy concern is getting people to save enough.

Now, obviously, that varies with economic conditions. In a deep recession, we don't naturally want as much savings as when we're not in recession. But in general, in the long run, we will grow more as an economy if we save more as a society. And the US has an incredible low savings rate.

Our savings rate in the US, depending how you define it, is maybe 3% to 5%. In Europe, in Japan, it's like 15-plus percent. So we have a very low savings rate. And as a result, that has led public policymakers to try to think about tools they can use to encourage savings.

And the major tool we use in public policy to encourage savings is the tax subsidy to retirement savings. The tax subsidy to retirement savings is the major tool that we use to increase savings in the US. Now, how does this work?

The basic logic is the following-- When I put my money in the bank and I earn interest, that interest gets taxed. Just like my labor supply gets taxed, my capital income gets taxed. So when I put money in the bank, I don't just earn the interest rate. We'll use our-- we don't care about real interest rate. [INAUDIBLE] earn interest rate.

I earn r times 1 minus τ , where τ is the tax rate. That's all I take home. So the bank pays me 10%. Say inflation is zero, so nominal interest rates are the same. If the bank pays me 10% and my tax rate's 50%, I only take home 5% on that.

If we assume substitution effects dominate-- which is a big assumption, but typically one we make-- this means the taxation, by lowering the return to savings, will lead to less savings. So by taxing people's savings, we lead to less of it, because we sort of assume substitution effects dominate. To offset this, we say, well, I'll tell you what-- if you save for retirement, we won't tax it. So if you save it, and you pull it out next

year, we're going to tax it, but if you put it in special accounts which we've labeled as retirement savings, we won't tax it.

So these have a number of forms. One form is employer sponsored pensions. These are things where your employer takes some of your pay, puts it aside in an account. And when he does that, you're not taxed on that pay.

So if MIT is going to pay me \$100,000, and they pull \$10,000 aside and put it in a pension, I'm only taxed on \$90,000. That \$10,000 isn't taxed. And likewise, the interest that's earned on that isn't taxed.

There's also 401(k)s. A 401(k) is like a pension, but where you control the money. So when you get a job, you might get offered a 401(k).

That's something where some of your money gets pulled out of your salary. It doesn't get taxed, and it gets saved instead, and you control where it goes. And then we also have individual retirement accounts, with the unfortunate name IRA. It's not the Irish Republican Army, but individual retirement accounts, which are similar features, where you could take your money and save it on a tax-free basis.

Now here's the trick about how all these things work, is they're not actually tax free. They are tax deferred. And what do I mean by that?

What I mean by that is that when you take the money out eventually, it does get taxed. So the way, say, your 401(k) would work-- you get a job at whatever, Google. Google offers you a 401(k). You put money in it.

That money then accumulates. And when you take it out-- you put money in. That money is not taxed when you put it in, but when you take it out, it is taxed. So it is eventually taxed.

So what good does that do you? What good does that do you if it's going to get taxed eventually anyway? Yeah.

AUDIENCE: If you don't get taxed right now, you get more money now, which will then accumulate more money through compound interest.

JONATHAN Right. It takes advantage of present value. Remember, we talked about this last

GRUBER:

time. With present value, money in the future is worth less than money today. By that same logic, paying taxes in the future costs you less than paying taxes today, because you have the money. You can earn all this interest on it, and you have to pay taxes on it off in the future.

So let's see an example of that. Let's look at figure 18.1. Let's say you have two types of accounts, a regular account, or an IRA account, which is a tax-deferred account.

And let's say the tax rate is 25% and the interest rate is 10%. And let's say you're just going to put the money in-- to make life easy, imagine put the money in for one year. Imagine you're retiring next year.

This is a super easy example. You're retiring next year. The question is, for this last year of work, should you put your money in a tax-deferred account or in a regular account?

If you put it in a regular account, you will take your \$100 of earnings to pay \$25 of taxes right away. You only get to put \$75 in. On that \$75, you'll earn \$7.50. And when you take the \$7.50 out, you'll pay \$1.88 in taxes.

So you pay \$25 on your earnings. You pay another \$1.88 on the interest you earned. And you end up with \$80.62.

Now let's say instead, you set up an IRA. There, you get to put the whole \$100 in. That \$100 earns \$10. And when you take out \$110, then you pay tax on it, so you pay \$27.50, then, in the end. But if you put it all together, you end up with more money-- \$82.50 rather than \$80.62.

Why is that? It's because you delayed paying taxes by a year. By paying taxes one year later, you got to earn the interest on that money during the year. Think of it this way-- if you pay taxes now, the government gets the money and they get to earn interest on it.

If you pay taxes next year, you keep the money and you earn interest on it. So it's much better to pay taxes later, and that's why these accounts matter. It's a simple example. It's a simple example.

If you have a 30-year account, if we kept the interest rate at 10% and the tax rate at 25%, and did a 30-year calculation, you would have twice as much money after 30 years, if you put it in an IRA rather than putting it in a regular bank account. So even though it eventually gets taxed, it's a big advantage. It's a big advantage.

And that's why public policy introduced these tools-- 401(k)s, pensions, IRAs-- because they're trying to encourage saving by raising the return to saving. And they hope that by encouraging saving, they'll get all this good stuff coming out of it. So that's why these things come up.

So the first lesson is, just like my continued nag on you, is save early and save often. Things like 401(k)s, by putting your money away, not only do you get the compounding I talked about before, but you also get the tax benefit of paying taxes later rather than sooner. You get the compounding on the money and the compounding on the taxes.

So these kinds of retirement accounts, when you get your job and you're thinking about why would I worry about retirement, worry about retirement. There's a big advantage.

Then you ask, that's fine, John, but when I get my 401(k) paperwork, I've got like a million things I could invest in. What I do with the money? So let's talk for a couple of minutes about investment strategy, about what you do with the money.

So let's think about three different ways you can invest your retirement money, three class of options a 401(k) will typically have. They'll typically be a money market fund, a bond fund, and a stock fund. And there will be various combinations of these, but these are the categories.

What do these mean? Money market means the money is invested in government bonds. The money is invested in what are called "Treasury securities," government bonds. These are things which are ultra safe, as long as the US doesn't default on its debt, which we've never done in our history and, the good Lord willing, won't do in the near term.

Because the US doesn't default on its debt, you get paid back. These are super safe, the safest place you can put your money. But they pay a very low interest rate.

Right now, they're paying interest rates, a typical government bond fund right now would be paying interest rate of around maybe 2%, maybe 1% to 2%-- very low interest rate, maybe up to 3% now, but very, very low single digits, but totally safe.

A bond fund invests your money in corporate bonds. Basically, this is making loans to corporations. Instead of loaning money to the government, you loan the money to a corporation. You're not actually buying a bond in GM. That's too hard.

So what these 401(k) accounts do is they say, we're going to buy a bunch of bonds. We're going to put them together, and let you own a small piece of that entire set of bonds. That's what a bond fund is. So you own a small piece of bunch of corporate bonds.

The difference is, unlike the government, corporations do go out of business all the time. So these are riskier. These are riskier, but they pay a higher interest rate. Bond funds typically paying 4% to 5% right now.

Then finally, the last thing you can do with the money is you can put in stocks. You could literally own corporate equity. You could own a piece of companies. You could own a piece of the companies, and then what you get is you get something, it doesn't really matter.

With these two, it only matters-- you get paid as long as the government or the company doesn't go out of business. Here you get paid in proportion to how well the company does. If it does really well, you make a lot of money. Stock prices go up.

If it goes badly, you lose money. It goes bankrupt, you lose everything. So similar to these, in the bankruptcy, it costs you everything. The difference is these, either you get paid or you go bankrupt.

Here, it's much more variable. Things do well, you get more. Things go badly, you get less. So this is the riskiest option of all, but it also pays the highest rate of return. Traditionally, stock investments pay a long rate of return about 7% a year.

So what we see here when we compare these is what economists call the "risk-return trade-off." The riskier things are, the higher you earn by investing in them, but the riskier that earnings is. The more [INAUDIBLE] invest in them, but the riskier

that earnings is.

That in other words, people are willing to accept a lower interest rate for a safe investment than they want for a risky investment. And we'll talk about, in two lectures from now, why that is, why people's preferences are that way. It's because people are what we call "risk averse." People don't like risk, and we'll talk about why that's a natural way to be.

So basically, that is your set of choices. And what economists recommend is that the key in all of these investments is to diversify. The key recommendation of economists is diversification, that you spread your money across these options to get the right balance of risk and return.

So that basically, if you're someone who-- now, how you balance depends on your taste for risk. For someone who really hates risk, you put most of your money here. But it's silly to put all your money in money markets, because you're losing a lot of return.

If you're someone who's risk loving, you might want to put most of your money in stocks. But still don't put all your money in stocks, because you have a much higher risk. You want some safety behind you as well. So an economist would say you should diversify.

Now, that's a general. I can't tell you what percentage is the right percentages. I can tell you to diversify. But I can give you one specific piece of advice-- that when you go work for Company X, the one thing you do not want to do is put your money in the stock of Company X.

Why is that? Why is the last thing you want to do when you go to work for Company X to put a bunch of your money in the stock of Company X? Yeah.

AUDIENCE: [INAUDIBLE]

JONATHAN GRUBER: No, this would be through a 401(k) [INAUDIBLE]. It wouldn't be like that. Yeah.

AUDIENCE: If you lose your job, or if the company shuts down, you can lose both your job and the money.

JONATHAN

GRUBER:

That is the maximally risky strategy, because you are tying your risk of your investments to your risk of your salary. That's the most risky thing you can do. So absolutely what you would not want to do is go work for Google and say, good, I'm going to put all my retirement in Google stock.

You might think Google's safe, but safer companies than Google-- companies thought to be safer than Google at some point have gone bankrupt. Google is bankrupt, you're totally screwed. You've lost all your savings and your job, so the last thing you want to do is that. Yeah.

AUDIENCE:

If you're in a more corporate position, and they gave you bonds as promises.

JONATHAN

GRUBER:

Well, I mean, certainly a lot of companies give you stock options, where you're sort of stuck in the stock of that company. And my lesson there would be, that's part of the conversation, but as soon as it's best, sell it and get out. That doesn't mean you shouldn't-- you should value-- it's not saying stock options in the company are worthless. They're worth something. It's just they're worth less than if they just gave you the cash, because if you got the cash, you'd go invest it in somewhere that wouldn't be tied to your job.

And this came to a head with the example of Enron, which is sort of before your time. That's sort of when you were young. But basically, Enron was an energy company that got into some really shady dealings to try to essentially prop up its stock price.

To make itself look valuable it essentially created shell companies that were the same company it sold to them. So it looked like it was generating a lot of sales, but it was just selling to itself. It was illegal activity.

But it caused their stock price to go through the roof. And Enron, in order to have enough money in the company, encouraged their employees to invest all their retirement savings at Enron. Indeed, the Enron 401(k) said, we'll give you extra money in your account if you invest your money in Enron.

So most people at Enron had their retirement savings invested in Enron. When the whole thing-- and Enron was a very successful company, in the Fortune 500, doing

quite well. When the whole thing collapsed, these people not only lost their jobs, they lost their entire savings.

That's the problem with non-diversification. And the ultimate form of non-diversification is to invest in the company you're working for. Have I scared you enough? Any questions about that?

Now, let's move on. That finishes our discussion of savings. Let's move on to a totally new topic, which we'll talk about this lecture and the rest of next lecture, which is international trade.

And let's start with what is international trade and why the ruckus? This is the great time to be teaching on international trade, probably the best, most exciting time of any year I've ever taught this topic. It's front and center in a way it hasn't been, probably, in decades. So what's the big deal?

Let's talk about a simple example. How many people have ever given someone roses for Valentine's Day? Raise your hands. MIT, man-- that's OK, when I was your age, I hadn't either.

Now, here's the interesting problem with Valentine's Day-- Valentine's Day falls in the winter. Roses don't grow outside in the cold in the winter. So what do you do?

For many years, what we did was we had hot houses where we grew-- basically were dedicated, their reason for existing, was essentially to grow Valentine's Day roses. So it's an industry around growing these indoor roses in the winter so that you could have them available. But what happened over time is we realized it was a lot cheaper to actually buy the roses in Colombia or countries like that, and fly them up, than to actually have them grown here.

So what happened was all the roses we get now in the winter come from South America. And we don't grow roses in America anymore in the winter. So is that a good thing or a bad thing?

Well, on the one hand, roses are a ton cheaper now than when I was a kid. So that's a good thing for the romantics among us. You can get a dozen roses for 25 bucks. It was like 80 bucks when I was a kid or something. It was crazy.

On the other hand, a bunch of guys who used to grow these roses are out of jobs. There was an industry devoted to growing these roses and these people now have no job, because they're grown somewhere else. So how do we think about-- this trade-off is sort of a microcosm of the larger debate around international trade. The larger debate about whether trade is good or bad comes down to this rose example. It sort of summarizes that issue.

So now, when we think about international trade, we think about three concepts. We think about exports, which are the amount of goods that we sell to other countries, and imports, which are the amount of goods that we buy from other countries. So a country exports to other countries. It imports from other countries.

Currently, the US exports about \$1.6 trillion of goods a year. That's trillion with a T. It imports about \$2.4 trillion of goods a year, leaving us with an \$800 billion trade deficit. You may have heard the President mention this once or twice-- an \$800 billion trade deficit.

So the question you want to ask is, how big a problem is this that we have a trade deficit? And the answer economists give is none problem. No? No Spinal Tap fans here? OK, whatever.

So basically, let's explain this in a simple example. Imagine that you have two Pichachus and your friend has two Jigglypuffs. And you want to have a more diverse set of Pokemon, so you go to your friend and you say, I will trade you one Pichachu for one Jigglypuff.

So you send your friend a Pichachu. He sends you a Jigglypuff. You've just created a massive Pichachu deficit.

Think about it-- you used to have two Pichachus. You sent one away. You sent one away. You didn't get any Pichachus back, did you? So you've created a huge deficit of one Pichachu.

Is that bad? No, you got a Jigglypuff. You're happy. You wanted to make the trade. You made the trade. Calling the trade deficit, define trade deficit in terms of-- if you define trade deficit, instead, in terms of Jigglypuffs, you've got a huge trade surplus. You used to get no Jigglypuffs, now you get one.

So basically, a trade deficit, trade surplus, is all about an arbitrary definition. The bottom line is America then spends \$800 billion more. You're sending money to other countries, but we get \$800 billion year more stuff for it.

There's no bad or good. It's just the way trade works. So any time you've had a trade in your life of anything, with a friend or whatever, you've created a deficit and a surplus. But that doesn't mean anyone is worse off or better off. Whether you're worse off or better off depends on the indicators of the trade, depends on how much each party values what's going on.

So basically, if I said, oh, good Lord, if I had a headline like, "Good Lord, Gruber Trades Pikachu Deficit, Must End Trade with Jigglypuff Land," we must shut down trade, because good Lord, we're creating this huge Pikachu deficit, that would be bad. Because I wanted to trade my Pikachu for a Jigglypuff I was happier. That would be a bad thing to shut that off.

And that, in a stupid example, is why economists like international trade. It's the same reason we like trade in general. Think about this whole course-- the whole course is a bit about trade. It's about trading our money for cookies and pizza, about trading a firm's money for workers and machines, about trading my time for a wage.

Life is all about trades. International trade is just another example of that. Just because it's got this bizarre label of a trade deficit, we think about it differently. So that's sort of basically, if you think about-- now let's replace Pikachus and Jigglypuffs with the US and a poor country.

Instead of US having two Pikachus, the US has tons of money. Instead of the poor country having two Jigglypuffs, the poor country has really underpaid workers who can make stuff really cheaply. So I, in the US, say, wait-- I have a lot of money. You've got a lot of sweaters. I'm going to send you my money and get your sweaters.

I'm better off because I was happy to buy those sweaters cheaply. You're better off because you can't eat sweaters. You need money, so you get some of my money. We're both better off, but I've created a trade deficit. That is not inherently a problem.

Now of course, the reality is more complicated. The reality is that when I send the money to those countries to buy the sweaters, and I bring the sweaters in, my consumers of sweaters are much happier. And I keep focusing on sweaters because it's just amazing. This sweater I just got at Old Navy, \$15. Pretty nice, decent, it's not cotton, whatever. \$15.

This would have been a fortune when I was your age. In those day's dollars, it would've been \$30, and that would be like \$70 today. Why? China. Because we used these to make these in North Carolina, now we make them in China.

So the good news is, I went to Old Navy, I got two pairs of pants, and like four sweaters, like \$100. That's the good news. The bad news is the guys in North Carolina lost their jobs. That's the bad news.

So there's a trade-off. Now, I'm going to argue over the next lecture and a half that that trade-off is worth it in aggregate, but we can't ignore the fact there's a trade-off. Because that's what leads to the very intense debates around international trade, is the fundamental tension between the consumers of goods that are made cheaper by international trade and the producers of goods that get wiped out by international trade.

So that's our setup. That's our big picture. Now I'm going to dive in, and I'm going to teach you the nitty gritty of how we think about this with models, but that's the big picture I wanted you to have in mind.

So let's dive into the models. And to do the models, I need to introduce a new tool to you, which is the Production Possibility Frontier, the PPF, the Production Possibility Frontier. What the PPF shows you is the maximum combination of outputs you can produce for any given set of inputs.

So basically, let's think about that. Let's go to figure 18.2, because it's easy to see this graphically. Let's go to figure 18.2.

Let's think of you as a firm. And you as a firm produce two things-- problem set points and exam points. Sorry, it's all you're good for at MIT here. You produce problem set points and exam points, but you can produce either. Those are the two things you produce.

And to make life easy, let's say given your innate intelligence, the points are produced as a function of time. Literally the more time you put in studying for an exam, the better you do, the more time you spend on the problem set, the better you do. And you have one scarce input, which is time.

This production possibility frontier tells you if you devote your scarce input across different activities, what will the result be in terms of what's produced. So what's this line saying on the left-hand side? It's saying, if I put all my time into studying for exams, I'll get 200 points on exams and 0 on problem sets.

If I spend all my time doing problem sets, I'll get 200 points of problem sets and 0 on exams, and some combinations in between. That is a production possibility frontier. It shows the combination of output you get for any given fixed level of inputs.

Now, what is wrong with the graph on the left? And why is the graph on the right a probably more realistic description of what your actual production possibility frontier looks like? Yeah.

AUDIENCE: You know, if you can get more points on the problem set, and you know more, you're probably more well prepared for the exam.

JONATHAN GRUBER: Yeah. It's wrong because in fact, what this system features is something we call "economies of scope." We talked about economies of scale a number of lectures ago, the notion that if you double inputs, you double output. This is economies of scope, which is that by producing more than one thing at once, you may get better at both.

By studying for an exam, you get better at problem sets. And by doing problem sets, you do better on the exam. So what that means is, doing some of both leads to a better outcome than doing all of one or all the other. You get a concave to the origin production possibility frontier.

A concave to the origin production possibility frontier demonstrates economies of scope. Doing some of both is better than doing all of just one and all the other. And that makes sense for you when doing problem sets and exams. It makes sense you'd be better off doing some of both than devoting all your attention to just one

and just the other.

So that is a production possibility frontier. Now, there can also be dis-economies of scope. Another great example for MIT is that when I was here as an undergrad, I came in as a tennis player. And I was on the tennis team.

Now tennis was only in the fall and spring. In the winter, they had squash. So I thought I'd play squash.

Well, it turns out that the key with tennis is keeping your wrist firm, and the key with squash is keeping your wrist flexible. And by playing squash, I screwed up my tennis game, and by playing tennis, I screwed up my squash game. So I had a dis-economy of scope. I was worse off at both things by playing both, rather than just playing one or the other. So there can be economies of scope, which is when doing both things make you better at both, and dis-economies of scope when doing both things make you worse at both.

And that's the nature of the shape of production possibilities frontier. An economy of scope is when doing both makes you better off. A dis-economy of scope is when doing both makes you worse off. Questions about that?

Now, I just introduced that tool because that tool is going to be the fundamental modeling feature that allows us to demonstrate why international trade is beneficial. So now, we're going to take that tool and we're going to go and talk about the concept of comparative advantage, which is the core concept in international trade economics. This is the core of how it all works.

Let's think of a particular example to understand this. Let's take the US and Colombia and the rose market. And as I said before, let's say it's expensive for the US-- and the Valentine's Day rose market. It's expensive for the US to grow Valentine's Day roses. It's cheap in Colombia.

On the other hand, let's compare roses to computers. Roses are cheap to produce in Colombia and expensive in America. Computers are the opposite.

We have giant factories, and skilled labor, and giant machines that can quickly crank out computers. In Colombia, they'd have to like assemble the computer by

hand. So it's a lot cheaper to produce a computer in the US than it is in Colombia. It's a lot cheaper to produce a rose in Colombia than it is in the US.

The way to think about this is through the lens of opportunity cost. What we're saying is the opportunity cost of making a rose in terms of computers is higher in the US. In other words, the amount of computers you have to give up to make a rose is high in the US, because computers are cheap and roses are expensive. The amount of roses you have to give up to make a computer in Colombia is higher, because roses are cheap and computers are expensive.

So we say that Colombia has a comparative advantage in roses. It is relatively cheap-- in a world of computers and roses, it is relatively cheap for them to produce roses compared to computers. The opportunity costs in terms of forgone computers is lower.

Whereas the US has a comparative advantage in computers. It is comparatively cheaper for us to produce computers. So international trade is all about what you're relatively better at.

Now, let me emphasize "relative" for a second. This is an important concept. The reason we don't just say "advantage" and we say "comparative advantage" is it doesn't actually matter if you're better. It matters if you're relatively better.

Let me explain. This is hard. I would say of the main economics concepts in the world that we need people to understand, this is one of the top three least understood concepts in all the world in economics. [INAUDIBLE] it's like in our blood, and we can't understand why regular people can't understand it. It's because it's hard.

Let me give you an example. Take me and LeBron James, and imagine there's two activities in life, mowing the lawn and playing basketball. That's all life consists of.

Now, LeBron James is better than me at both playing basketball and mowing the lawn. But he's much, much, much, much, much, much better than me at basketball and only much better than me at mowing the lawn. So LeBron James has an advantage in everything, both activities, but he only has a comparative advantage in basketball.

He only has a comparative advantage in basketball. The comparative advantage is about opportunity costs. In other words, if LeBron James mows his lawn, the amount of basketball he's giving up is ungodly. It's crazy to have to mow his lawn, given how much basketball he could've played.

If I mow my lawn, I'm not giving up much basketball, because I suck at basketball. So I have a comparative advantage in lawn mowing. You say, you're not at lawn mowing than LeBron James. I'm not.

But I have a comparative advantage in lawn mowing, because the opportunity cost to me is much lower. The opportunity cost to LeBron James of mowing his lawn is high, because he could be playing basketball. The opportunity cost to me is low, because I can't play basketball. Yeah.

AUDIENCE: [INAUDIBLE] the only one in the world that can mow lawns.

JONATHAN GRUBER: That's a weird edge case. I won't do that. Then there'd be no reason for-- that makes trade things hard. We can come back to that.

Now of course, the example doesn't stop there. Should I mow my lawn? No, I should not mow my lawn, because there is someone who doesn't have as much education as I, who can't earn as much money than I at work. And they have a comparative advantage in lawn mowing. I have a comparative advantage in office work.

So in fact, not only should I mow-- do I have comparative advantage over LeBron in lawn mowing, but some less-educated guy has a competitive edge over me in lawn mowing. So just as LeBron would be better off letting me mow his lawn and I'm better off letting him play basketball, I'm better off letting some less-educated guy mow my lawn, and letting me go sit in front of my computer all day.

Comparative advantage is all about what you're relatively better at. And the key insight of international trade is that in a world of comparative advantage, people should always specialize. In a world of comparative advantage, people should always specialize. You should do what you're best at.

You should do what you're best at because otherwise, it's simply silly for LeBron to spend any time mowing his lawn. As much as my wife thinks I'm just trying to get

out of it, it's simply silly for me to spend any time mowing my lawn. I have a comparative advantage sitting on my computer and doing that stuff, so I should hire someone else to mow my lawn.

So to actually see that, let's go to figure 18.3. This is a confusing figure, so I'm going to go through it slowly. On the top, we have the US production possibilities frontier.

And to make life easy, let's assume that there's no economies of scope between roses and computers. Makes sense there wouldn't be. Let's assume there's no economies or dis-economies between roses and computers. It's a linear production possibility frontier.

So we're showing each graph as a production possibility frontier between roses and computers. And we're assuming it's just linear, which makes sense. You don't make better computers by making roses and vice versa.

On the top, we have the US. Let's say that the US's production possibility frontier is the following-- given the resources we have in the US, we can produce 2,000 computers or 1,000 boxes of roses, given our resources, our skill level, our capital intensity, et cetera. Now go to Colombia. Say that Colombia, given their skill level, resources, the sunshine, the beautiful weather-- any Colombians here?

Sounds perfect. It's like 75 all the time. They can make 2,000 roses and 1,000 computers, or 1,000 computers, or some combination in between.

So the first thing I want to make you guys understand is why these are sensible production possibility frontiers for each country. They're sensible production possibility frontiers because they basically show the US has a comparative advantage in computers. That is, the trade-off in terms of roses foregone to make a computer is lower in the US than Colombia.

And Colombia has a comparative advantage in roses. The trade-off in terms of foregone computers to make a rose is much lower in Colombia than in the US. So comparative advantage is about opportunity cost. Let me say it again-- the US has a comparative advantage in computers because to make a computer, we have to give up less roses than Colombia does.

To make one computer, we give up half a box of roses. That's the slope of this line.

Colombia, to make one computer, has to give up two boxes of roses. So we have a comparative advantage in computers. Yeah.

AUDIENCE: Would it be possible to have comparative advantage in both?

JONATHAN GRUBER: You cannot. That's the term "comparative." You can have an absolute-- in this simple two by two model. You can have comparative advantage in multiple things in life.

From the simple model, you can have the absolute advantage of both, but you can't have a comparative advantage in both. That's absolutely right. In this model, with two goods and two countries, each country has a comparative advantage in one thing or the other. Or there could be weird edge cases, but generally that's right.

So now, I did computers. Now let's flip and do roses. In roses, for the US to produce a box of roses, they have to give up two computers. For Colombia to produce a box of roses, they only give up half a computer, so they have a comparative advantage in roses.

People understand the setup here, these graphs on the left? Yeah.

AUDIENCE: Does the price of what you can sell each unit for factor into what you actually produce? Because I can imagine that yes, maybe you can produce more roses--

JONATHAN GRUBER: But they're worth less.

GRUBER:

AUDIENCE: --more easily, but they-- you can't sell a rose as much as you can [INAUDIBLE]

JONATHAN GRUBER: Right. So for right now, we're ignoring prices. We'll come back to prices later, but for right now, we're ignoring the prices. Right now, we're just sort of-- we're going to basically have prices come in later, but for right now, we're doing prices.

So now, let's imagine that tastes are such that consumers in the US want 1,000 computers and 500 boxes of roses. That's point C US. And consumers in Colombia want 500 computers and 1,000 box of roses. I just made this up. C US and C CO, I just made up tastes. I just said, let's just make it a case where people in Colombia like roses better, people in America like computers better.

And imagine we do not allow international trade. This is the best case. Actually,

international trade would be even more valuable with a different assumption. I've made assumptions which make trade less valuable than it would otherwise be.

I said look, Colombia produces roses and people there like roses. American produce computers and people there like computers, but not totally. Some US guy still wants some roses. Some Colombian guy still wants some computers.

Now imagine we don't allow trade. What's the outcome? Well, in the US, we will produce-- like I said, we want 1,000 computers and 500 roses, so we'll produce 1,000 computers and we'll consume 1,000 computers.

So on the chart on the right, you've got production and consumption. For the US, we'll produce 1,000 computers, consume 1,000 computers. We have to consume what we produce. There is no trade.

And same with roses-- we'll produce 500, consume 500. Colombia's the flip. So you end up in the world with 1,500 computers being produced and consumed, and 1,500 roses being produced and consumed.

Now, you might say that's silly, computers cost more than roses. We'll come back to prices. For now, we're leaving prices out of it.

The point is, given the tastes I've suggested with C US and C CO-- I just made those up-- given those tastes, we'll end up in a situation where every country just consumes what they produce, because there's no trade, and the world as a whole will produce 1,500 boxes of roses, 1,500 computers. Now let's say that we allow trade. What trade does is introduce economies of scope. Why? Because trade allows specialization.

Flip to the next figure. The next figure is the figure for the world. Imagine the world only wanted computers. That's the point on the y-axis. Then the US would produce 2,000, and Colombia would produce 1,000. We'd have 3,000.

Imagine the world only wanted roses, the flip side. We have 3,000. But if the world wants both, you get more. Why? Why is it outward bending when you allow trade?

This is not a technological change, change in technology. All we've done is take these two PPS and combine them and allow trade. Why does that suddenly

introduce economies of scope? Because what do countries get to do compared to what they were doing before when they couldn't trade? What do they get to do now?

AUDIENCE: Specialize.

JONATHAN GRUBER: Specialize the US specializes in-- and Colombia specializes in roses. By specializing, we can make more, because that's what we're good at. So by trading, we allow specialization.

Without trading, we can't specialize, because some guys in the US want roses. We've got to make some roses. But that's stupid. We shouldn't make roses. We should let Colombia make roses.

If LeBron can't hire anyone to mow his lawn, he's going to mow his lawn. That's stupid. LeBron should hire someone to mow his lawn and play basketball all the time.

By allowing trade, we allow people to specialize and take advantage of their comparative advantages. Without trade, you can't take advantage of comparative advantage. Without trade, it doesn't matter if the US is better at producing computers or roses. What's produced is just determined by people's tastes.

But with trade, you can specialize. And that yields the outcome we discussed in figure 18.5. Figure 18.5 takes the previous figure, 18.3, and adds trade. So let me go through this.

The basic, the blue, the PPFs are the same on the left, same PPFs as before. And if you look at point CO and C US [INAUDIBLE] before, we could have 1,000 computers and 500 roses in the US or 1,000 roses and 500 computers in Colombia. But now suppose we allow trade.

What happens now? Well, what happens now is the US goes to producing only computers and Colombia goes to producing only roses. Now let's assume, just to make life easy, let's just assume that people's tastes are proportional.

So if there's more computers and more roses, they just want proportionately more of each. So the US, as there's more of both, wants two computers for every rose.

And Colombia wants two roses for every computer. That's just their tastes.

What happens now is we shift out to these new levels, C prime US and C prime Colombia. At the new levels, the US produces 2,000 computers. All they do is computers. Colombia produces 2,000 roses.

The world as a whole ends up with more. Flip back two pages and look at the table on the right. The world as a whole ended up with 1,500 roses and 1,500 computers. Now the world as a whole ends up with 2,000 roses and 2,000 computers.

What happened? Nothing changed technologically, same PPS here as before. All the change is by trading. We allowed people to exploit their comparative advantage through specialization.

Without trading, the US was inefficiently producing roses and Colombia was inefficiently producing computers. With trading, we've now opened up the possibility that they can specialize in what they're good at. And the world as a whole ends up better off.

And look at both countries. Both countries end up with more consumption. The US gets more computers, so flip back and forth between 18.3 and 18.5. The US goes from 500 roses and 1,000 computers to 750 roses and 1,250 computers. Colombia goes from 1,000 roses and 500 computers to 1,250 roses and 750 computers.

Now, the split between roses and computers here is not determinate. That's just made up. I made up what tastes look like. The point C and C prime, that's just made up.

What you care about is the bottom panel. What you care about is fact that the world as a whole now has more roses and more computers in it. And that is the mechanics of why international trade expands our production possibility frontier.

We have more goods in the world once we can trade, not because-- I mean, you still have the same, where Pikachu and-- when I allow trade between you and your friend, that doesn't create any more goods. You each have two cards. But in the real world, it creates trade, because the production allows people to specialize. And that's the beauty of trade.

We'll come back next time and do a welfare analysis, talking about why international trade makes people better off.