PROFESSOR: I think at the beginning of the semester we have kind of sketched out the broad plan. And the broad plan was to move kind of progressively from what are fundamentally individual decision making problems to thinking about more problems of the market. And we're going to try and do insurance, which is obviously something to do with markets.

So here is by way of background. You probably remember a few years ago the world economy was in crisis. It may still be in one. But now we're told it's not.

So this is a quote from the president of the World Bank. He's trying to make the case that the crisis in 2008, 2009 was going to be a particular crisis for the world's poor. And that's not implausible. You might imagine that if you are that much closer to survival, you have fewer resources, then anything that goes wrong is likely to hurt you more. So that's not an implausible idea.

I spent a couple of days with a *New York Times* reporter, the *New York Times* bureau chief in India, in the pursuit of this story. So I was going for something else, and she came along with me. And she was looking for people who had-- this was a part of rural India, a very poor part of rural India.

And her whole idea was that she's going to go there and, like Zoellick, she was wondering how these people in the villages who go to the city to work as maybe laborers, how they would be affected by this global crisis. This is the *New York Times.* So she wanted to link up what's happening in poor parts in rural India with what's happening in New York. So that made perfect sense.

And the problem was that nobody seemed to know there was a crisis. So she would go and ask people, so have you heard about this? There's a crisis in the world. Is

that affecting your job prospects?

And one striking fact was this was in a part of rural India that's pretty backward. The areas we were were mostly conservative, mostly families. A lot of the migrants had come home for a bustling religious festival.

So a lot of the migrants were there. We could talk to them. And to the man, literally to the man, they said, no. What crisis? There are jobs for anybody who wants a job.

So we went to the train station for migrants coming back from having lost their jobs in the cities. In fact, we found tons of migrants who were leaving for the city on the train. So basically the story never got written, and *New York Times* never had this story because there was never anything to be found. And it was kind of striking how disjointed these two world views were.

Now, that doesn't mean-- I think it was clear that if you looked at the data, there were people who were losing jobs. Some construction projects had been shut down. There were certainly some jobs being lost.

I think the real reason why this didn't show up in people's kind of intellectual map as a very big deal is not because some bad things were not happening. But it's more that they're used to having jobs being lost and having to find jobs and things like that as a normal part of their life. In other words, the amount of risk that they normally bear is so large relative to our perception of risk-- I'll show you some numbers in a bit-- our perception of risk that this was seen as, you know, normal turnover.

Certainly some jobs were being-- but you find another the job. And the basic difference came from, I think, their calibration or what is unreasonable amount of risk. Our colleague, Rob Townsend who is an expert on Thailand, studied the Thai economic crisis of 1998. So this was a big deal in Thailand. I mean, there was like the Thai baht I think halved or more than half. I mean, it just grew. And the whole economy-- several banks came close to failing and had to be bailed out. All kinds of bad things happened.

Rob Howard doesn't study the banks. He studies the people who live in poorer parts of northern Thailand. And he has a panel of people now for more than, I think, 12 years. But he had a long time he had been following these people, 15 years something. He's been following the people for a very long time, families, and looking at the economic outcomes.

So every few months, they go back to the same families and measure a bunch of stuff. And the same families are maintained for a very long time. It's a unique data set that he has.

Now, one advantage of that data set is you can look at what happens in the crisis year relative to what happens in other years. You have a data set of the same families for a very long time. Just descriptively you may just ask what changed in the crisis year?

And I think his number, which he presented this at a conference before he came to MIT-- and I had to be the commentator-- the number, in a sense, it was almost unbelievable to think about it. So he found that 2% of the variation in their income was attributable to the crises. The 2% of the variation of income in these families-- so if you look at a family, his income varies every year, every six months.

So you can just look at the total variation in income. And then you can attribute a particular part of that to the crisis. What was extra in a crisis? And I think his calculation was about 2% more for the crisis.

The reason I make that point is not to say that the poor are very, very well off, but the opposite, that their normal exposure to risk is so high that this additional piece that come from global crises is an extremely small part of it. I think the way to think about it is that there's a ton of risk that any poor person bears all the time. And then there's some stuff that happens which we think are important like what's happening in New York and the important for MIT.

MIT, as soon as the crisis hit, the first thing that happened is that we used to get free lunch on Mondays and Tuesdays and that was shut down. So it was very

important. We got some risk from that.

But if you think of these people, they're not getting any free lunches in any case. And so the amount of uncertainty that they deal with on a day to day basis dwarfs any uncertainty that might come from specific episodes like the Thai banking crisis of 1998. Do you have question? Somebody had their hand up for a moment.

AUDIENCE: Do we have evidence from other places besides Thailand? Because, I guess, popularly speaking, a lot of people talk about the loss decades in Latin America and how bad that was, you know, for people's ability to generate livelihoods. So I'm just wondering if we really have a lot of evidence that this is really a broad phenomenon.

PROFESSOR: So I think there are two parts to what you're saying. Both are important. One is do we have evidence from other countries? Second is part of the reason why this population is different is that Thailand is a lot less urbanized than Mexico. So many more people in Thailand operate in the traditional underdeveloped economic mode, which is that they are self employed, they have a farm, something like that. So let me give you a different example, which is maybe even more revealing.

This is taking me a little further [INAUDIBLE], but it's interesting. So there's a study by one of our ex students of what happened in the Indonesian crisis of 1998, which happened for the same reason. And there the Indonesian rupiah devalued by a factor of three, which is a huge amount of devaluation.

So something really big happened to the Indonesian economy. So turns out that the real incomes of anybody in Indonesia who was mainly a rice farmer went up during this crisis. The reason is that suddenly the currency devalued massively.

What happens when the currency devalues and you're in rice? Well, rice is a trade-in good. Its price goes up relative to non trade-in goods. So your hair cut prices don't go up, but rice prices go up because rice is traded. So these rice farmers actually were better off in the Indonesian crisis than they were before.

He then looks at, well, how do they react? And the thing he's looking at is people attending Koranic reading classes as well as the outcomes. And the basic reason

he's interested in them is he thinks that this is a social support mechanism.

Who start attending Koranic reading classes? It's the people who are not rice farmers. It's the government employees, teachers, anybody who has a fixed income. They are the ones who lost.

And then the people who were farmers, they actually were better off. And they were actually less likely to attend Koranic classes during the crisis. So in other words, again, a lot of people in a country like Thailand or Indonesia are basically farming dependent. And those people have very different risk patterns from the urban employees.

Latin America is very different. Latin America is massively richer also then Indonesia, for example. Peru is three times richer than Indonesia, per capita income, at least in dollar terms. It's also much more urbanized with a labor force.

So I'm sure the lost decade happened. I'm sure that a lot of urban workers in each of these countries gets hurt. The main point I'm trying to make here is that there's also a whole bunch of people in these countries who bear a huge amount of risk even when there is nothing happening in the world economy.

And those are people who are farmers, who are laborers in construction, people who sometimes get a job helping out in farms, these kind of people, landless laborers or different kinds. These people have a very different risk pattern than the urban workers who tend to be the people who are directly hurt by big global shocks. So there was not that there were people not hurt, it's just there were, for many of the people that [INAUDIBLE] Rob Townsend was studying, all kinds of stuff were happening in their lives.

These were all farmers. And lots of them were-- all kinds of stuff were happening in their life, many of them very bad. And this was just a small piece of that big story. That's the point that I think is worth emphasizing is that there's just much diversity, and there's so much risk.

So basically what are the sources of risk? I think the biggest single risk is just being

a farmer. If you're a farmer, you'll face huge amount of risk. What do you face risk from? What's a main source of risk?

AUDIENCE: Bad harvests.

PROFESSOR: Bad harvests. How do you get bad harvests?

AUDIENCE: [INAUDIBLE] rainfall.

PROFESSOR: Rainfall, bugs, you know, locusts. If you're a farmer, you're used to dealing with a huge amount of risk. I mean, by our standards of the kind of risk that tenures professors face-- of course, maybe that's an extreme example. They have a huge amount of year to year variation in income.

Even those who don't have a farm, most of them are casual labours. The poor in most countries, in poor countries, are casual laborers. Casual laborers meaning they don't have a contract.

They have a daily job. The typical way you get a job is in a city you stand at a street corner and somebody who needs someone to move boxes comes and picks up 50 people and takes them somewhere. So it's extraordinarily casual, meaning at a given day, you may not get a job.

And many of these people are not employed more than 15, 16 days a month. So this is a very, very common fact. And there's lots of uncertainty there.

Some days, some months you maybe get unlucky and you just got there late or something, and then you missed your chance. So the amount of uncertainty that you have if you are kind of a casual laborer in a developing country is huge because its the uncertainty of in any given day you have a probability of, let's say, three out of four of getting a job. And the other days you don't.

And so if you look at daily income, daily income is extraordinarily variable for most of these people. And it's just mechanically almost. Somebody shows up at that street corner and, you know, they ask you to get on the truck and go with him, and he

needs 10 people today rather than 15. You don't get a job.

So this is just a core level of risk in this life, which is very different from thinking about the kind of risk we think about most of the time in a more developed country context. There's no social protection. The other side of that is there's no social protection or almost no social protection.

So one way to think about this is-- this is wage volatility. This is how much your wages vary. And this is not day to day variation. This is year to year variation across a set of countries. This is real wages.

So the poorest country is Myanmar. And basically you can plot a line and that line has essentially-- if you increase raw GDP by one, you halve the risk, something like that. So this is conditional on getting a job.

I said the big part of the uncertainty is you just don't get a job. But then the real wages are extremely unstable as well. Part of the reason they're unstable comes from this other fact, which is this.

This is food prices. And if you spend 60% of your income on food, food prices matter a huge amount. One big piece of risk that people have been facing is just what's happening to food prices.

So food prices have gone-- as you can see, 2007, they peaked. The dollar food index went up to 200. It came down to 140 then went up, bounced around, and has been climbing since.

So that's a 60% change in the food price in a year-- not 60. Sorry. It's a change from 140 to 200. So that's a change of 30%.

And if you spend 60% of your income on food then that's of the order of, like, losing 20% of your income in a given year. So just food price variation will itself have consequence. Now, wages probably adjust, so that's probably an overestimate of that. But still, you can see one major source of uncertainty comes from just the fact the food prices go up massively sometimes and come down.

With up and down it's risk that you see. There's also a trend which is worrying in general is the food prices seem to be going up systematically over the last some years. What is a bit misleading about that trend is that food prices had fallen for the previous 35 years or something. Food prices had fallen.

So since 1970 to 2005, food prices had basically systematically fallen slightly, and then it's been going up. So this is a bit misleading, this picture. But still, there's lots of uncertainty.

The thing I want to emphasize here is not levels but uncertainty. Food prices bounce around a lot. If you're poor, that's a very big piece of your income.

So just to think about this analytically, risk also matters very much depending on where you are, for example, in your production cycle. So a reason why risk is amplified is when-- the fact that you get hit by a shock then effects your ability to productive, which then affects your income, which then affects your ability to be productive, et cetera. So there is potentially a vicious cycle that can be set off by a shock. When would that happen? Well, we have introduced this idea of an S-shape production function. Have we read [? Ebutina's ?] story? What's the story?

AUDIENCE: It's about a woman who used to own a small business with her husband in which they had a kind of garment manufacturing company, which they had a bad contract which caused them to go bankrupt. And that led to a divorce. They tried to restart the company before divorcing.

They restarted the company with limited funds and bought a bunch of shorts that they packaged and were going to sell. But that fell through, led to a divorce. The woman has the children living with her parents, and they're just in absolute poverty now.

PROFESSOR: Yeah. So the thing to emphasize there in that story is that this particular kind of shock she faced was a contract enforcement shock. She had two shocks, both of which where basically-- so the first one was someone she had basically sold on credit defaulted and therefore didn't pay back the money. And she had taken a loan

to finance that. So that kind of put her into trouble.

Then she got an order to supply shorts to, I think, a retail store. And then they defaulted on that. They refused to take the shorts.

So when we met her, she had a huge pile of shorts. They were sitting inside her house surrounded by a pile of shorts, like, a lot of shorts, 12,000 shorts or something. So she lost a whole bunch of money on that as well.

The point is that what is also striking about her story is this dynamic. So what this picture does-- so it's like that S-shaped curve. S is maybe an exaggeration. That's a mapping from your wealth today to your wealth tomorrow. So that tells you given today's wealth what tomorrow's wealth would be.

So let's take that as given. And now the main point of drawing it that way is that if you think of what's happening around the point, P-- look around the point, P. Think of a part that starts just above P. Where's that part going?

AUDIENCE: [INAUDIBLE].

PROFESSOR: Explain.

AUDIENCE: To the second intersection up there.

PROFESSOR: Right. Any part that start to the right of P, you can see that-- like the one example that's drawn, the way to analyze this is to think you start with a particular wealth. That generates that wealth tomorrow. That wealth is the same. So tomorrow's wealth then becomes today's wealth.

The way you do that is you map that to the 45 degree line, and you look at wealth that will be. And that sequence is just going up to the point where the second intersection is. Who doesn't understand this picture? I'll explain again because we'll come back to this picture.

OK. I'll assume that you're comfortable with this picture. I'm not surprised, but just in case.

And then what's key is that if you're the other side of P, you're going the other way. So if you're close to P and you get hit by a shock, your wealth goes down by a small amount. That's not where it stops.

Your wealth goes up by a small amount, you go up a long way. Your wealth goes down by a small amount, you go down a long way. So there's a natural amplification.

If the production technology looks like that, then there's a natural amplification of a shock. A small shock turns into a big shock here. That's the point of that picture.

So now it's very difficult for her to get out because basically she's never generating enough surplus to make the investment she needs to get the next period's output to be high enough. So she's always, like, cutting back and cutting back and cutting back. So, in other words, not only is there a lot of risk, there's a lot of technologies in the world which amplify that risk.

So we already talked about another aspect of it last time. What was that? Another aspect of risk, kind of an amplification of risk. What happens? It's not quite an amplification. We talked about what happens during drought. Who was here?

AUDIENCE: During droughts the girl's more likely to be [INAUDIBLE].

PROFESSOR: Allowed to die.

AUDIENCE: [INAUDIBLE].

PROFESSOR: You were going to say allowed to die? Are you looking for that word?

AUDIENCE: Yeah.

PROFESSOR: It's an awkward word. Yeah, exactly. So another aspect of this risk is that you sometimes respond to it in drastic ways.

So one of the drastic ways you might respond is by-- why are you trying to do that? Because you know that essentially if you have two children, you can't feed either of

them, both of them are going to starve and be hurt, the long run, health will be hurt. So you kind of switch your money to one of them.

And that's another way in which you sort of maybe create a long term problem. Maybe one of those children doesn't die, but she starves and grows up as someone who has a handicap all her life. So you amplify lots of shocks by taking these extreme decisions under these conditions. So this is just saying that when you think that you can't really-- so balancing risk is difficult if you don't have a lot of money. It's not surprising.

Moreover, here's an interesting fact. So this means stress, right? It doesn't just mean that something happens to me. I also worry about it.

It would be amazing if you didn't worry about the fact that, you know, tomorrow you might have to starve one of your children. So risk means worry.

Now, it turns out that when you worry, your body actually acts in a particular way. It generates cortisols. Cortisols are a body's kind of defense mechanism to keep it going under situations of stress. They are actually a natural response of the body to a situation of risk. It's probably, in a sense, a good reaction from the point of view of certain types of survival.

But there's a lot of lab experiments where basically what they do is they stress people out. So I think the one that-- there's a bunch of them with Princeton students, who are not exactly the world's poorest. But the way these experiments go is they give you an endowment. And then they take away some of that endowment.

And somehow people get stressed out when you do that. Even if, obviously, you're a Princeton student. It's not that you're going to run out of food. There's plenty of food in the dining halls. And your lifetime income is unlikely to be affected by the fact that you lost $5 in this experiment. But people get stressed out when you put them into these situations.

And then the experiment is to make them play games, sort of, like, problem solving games. And you get a massive reduction in their problem solving ability. Maybe

they're not MIT students. Maybe they're just not as good at it.

But still you see that they do really badly when you put them under stress, so, like, little bit of stress, some fake stress, basically. They were going to get $10 and instead they end up with $2 or something. And that kind of stress already makes them take really bad decisions.

You might imagine if you had real stress. Your child could starve. Your mother could die. You could lose your job. You're not going to be taking a lot of good decisions under that. Yep?

AUDIENCE: In the experiment was the endowment or money related at all to the outcome of the games? Or was it just like they were [INAUDIBLE]?

PROFESSOR: No. These are separate. So the games were the games. But before the games, you created some general unpleasantness for them. They thought they would get A but they get B or something.

One of the rules of experiments is you can't make people worse off. So these people were not made-- they were first given some money, and then some of that money was somehow taken away from them. So this was like somehow even that got them so stressed out that they started playing games badly. Melissa.

AUDIENCE: How do you know that it's not just that they're like, oh, this is a stupid experiment? If I do well, they're just going to take it away from me again. So I'm not going to make any effort.

PROFESSOR: How do I know? Because I think they believed the experimenters. I don't think that they thought that-- so they were told from the beginning that when you join this experiment there will be some uncertainty that's going to be created for you.

So the experiment was done relatively carefully to avoid the possibility that they think this is just a mad world. I think most experimenters worry about that, which is you come and tell me first that we'll do this to you, and then I'm going to do that to you. You start worrying.

But then there's a nice field experiment actually in Kenya which is measuring cortisol levels across people when they receive, I think, some microcredit or some other program. I haven't seen the results from it yet. But I've heard the results are again very similar, that you're going to get people under stress take bad decisions.

So the advantage of doing it in the field is that they're getting real help with their stress. And when they get the real help with their risk, they actually take better decisions. It's less artificial.

But I think this fact is quite crucial in understanding a lot of decision making among poor people because they are under a huge amount of stress. And then we're expecting them to maximize utility over, you know, the rest of their lives and figure out which financial investment to make and, you know, how to educate their children and all of these decisions and get all of them right. You might imagine that one of the things that happens when you're under a lot of stress is you get these decisions wrong. And if you get the decisions wrong that obviously has long term consequences for your life-- so one other sense in which risk affects you is by making you take bad decisions. Yeah.

AUDIENCE: But isn't it often the case that for the poor the options are in many cases very limited and, for example, if plant harvest fails, a lot of people will just move to other areas or do labor? And they also have few sources of credits. So if the crop fails, then this will at least give people [INAUDIBLE] credit. So does decision making actually understress actual figure very highly in decision [INAUDIBLE]?

PROFESSOR: I think the answer is yes. I mean, I think at the beginning of the semester we looked at, for example, just consumption decisions of the poor. What we saw there was that they were spending large amounts of money on things that they didn't need to buy. So that's a very simple example.

Taking their child to be immunized. Should I take him today or take him in a month? And if I don't do it today, if I'm fully forward looking, rational, I might decide, look, I might as will do it today because I'll never do it in the future.

But if I'm subject to making bad decisions, I might easily make a decision on that. Should I spend the effort and the money to purify my water or not? I can miscalculate on that. I could think the risk is smaller than it is, for example.

Actually, I would almost put it the other way around. I think we who live in-- rich people have most of the decisions taken out of their hands. For example, I don't remember taking any savings decision.

Mostly my saving decisions are taken by MIT. And then there's some plan which I'm supposed to join. I joined that plan when I joined MIT, and I've not changed anything. I don't have to plan my retirement.

I don't have any risk mostly. Unless I do something really awful, I don't lose my job. So I never take many decisions on, like, should I go look for a job there or there? I just come to my office and I'm done.

I don't have the choice of not immunizing my children because to the extent that I want them to go to school, the school basically enforces that. You can't get your children to school without immunizing them. Most decisions of this class are taken out.

I don't know [INAUDIBLE] water supply. I turn on the water, it's clean. I absolutely don't have to take that decision on. Should I purify this water before I give it to my son or not? It's a decision I don't have to take.

Why? Because the water's infrastructure cleans before it reaches me. I get clean water, so I don't have to worry about that.

I don't have to worry about whether or not my house can be made out of things which can catch fire because before the house can be built an, inspector comes and checks it out. And I'm not allowed to build a house that can catch fire. So there's so many respects in which I don't have any choices given to me.

But if you're poor, you actually have a thousand choices. I mean, I actually think there are too many choices you have to make if you are poor. I mean, think of

water. Every day you have to decide should I clean the water or not? That's a difficult choice to make on any given day. Yes, someone else had a-- yeah.

AUDIENCE: So how much of that, though, can you attribute to bad decision making affected by cortisol? And how much of it is because of a basic misunderstanding of economics and utility and the future return on something like that?

PROFESSOR: We don't know the answer to that. It's a very good question. One day we'll know the answer to that.

Like, this whole cortisol stuff, we've only figured this out in the last two or three years. We're just beginning to get into these kinds of questions in a scientific way. Maybe in 15 years we'll know the answer to that question.

Right now this is one thing that I think is very, very, very recent, this understanding, this connection with cortisol and decision making and then the fact that cortisol is related to risk. This whole thing is very recent. So I don't know the answer to it. It's a perfectly good question. I just don't know.

AUDIENCE: OK.

PROFESSOR: Now, obviously people don't take risks sitting down. They do stuff about it. So one thing you can do is you can borrow. You can go and say, look, I don't have any money today. The truck didn't pick me up. Why don't you give me some money?

And certainly people do that. We'll see that it's pretty limited and very expensive. So the alternative is to save. So you can borrow. You can save. We'll come to insurance later. But mostly most people, they do one of a fairly limited number of things.

Now, savings is a pretty good way to deal with-- so imagine that you face a lot of risk and you can't borrow. Your decision rule more or less should be the following. The optimal decision rule-- whether people can figure this out. It took a Princeton economist and a computer to figure this one out. So maybe people can't figure it out.

But let's say they can. Then their decision rule should be to consume everything when your income is low, everything you have. And then as soon as your income crosses a certain threshold you should save the rest and you should build up a stock for those days when things go wrong.

Problem is that if you get two or three bad years in a row, this doesn't protect you at all. And the next picture kind of shows that a little bit. So this is a simulation. This is nobody real. This is a simulation of what happens when you have income, consumption, and assets.

So income is bouncing around. When income is high, you're accumulating assets. Then at some point, when income is low for a few years, your assets keep getting run down. Some point it hits zero. Then if you're lucky and income goes up right then, then you keep going up. Then your assets go up and you keep saving. You're fine.

But sometimes you can see that, like in the middle, there is this place where income goes down sharply, and it goes down like there's several periods for which it's gone down, that sharp kind of knife, you know, right in the middle. And you can see that what's happened there is your assets have hit zero.

And because your assets have hit zero, there's no way you can just pull down your assets and protect your consumption. There's nothing you can do about it. And that's when you see consumption really dropping.

So most of the time you see consumption is a lot flatter than income. And that's what people find in the data. Consumption, in general, is very flat relative to income. But there are periods when it plunges.

So if you get two or three bad shocks then it really hurts. One bad shock you can deal with but two or three and you run out of all assets. And then suddenly your consumption drops massively.

So you protect your consumption for a few periods. But then if your shock continues

then suddenly you get into starvation. So that picture is actually roughly what you find in the data, that people, at least two years in a row, maybe they just make it. Their consumption doesn't fall.

The third year, if the rain again falls then they go into starvation. So that's a pattern that you see a lot, and that's exactly what you'd expect. People should try to protect their consumption until they can by, you know, running down assets and expect that next time income will recover.

But income doesn't recover after several times then you get hit very badly. And that's sort of what we find also in the data. This is a pattern we also see in the data.

Another thing you can do is try to work more. And everybody does that. You know, let's say there's a drought and you can't farm. You go and start to sell labor. Problem is when it's a drought, it's a drought for everybody else. Everybody's selling labor. What happens to wages?

AUDIENCE: Well, they're much cheaper.

PROFESSOR: So wages keep going down. So in particular it could very well be that in a drought everybody ends up trying to work so much and wages go down so much that that amplifies rather than reduces the risk because everybody tries to work. So I'm going to try and go and try and get work assuming that everybody else is not working.

But when I try to go to get work, everybody else does as well. That drives down wages to the point where it could even be that it does nothing to protect me. I just end up working more and earning the same amount I would have earned otherwise.

So this is something that is this real? So there's a paper by [INAUDIBLE] who basically looks at this. And what she does is she adds another wrinkle to it.

So she says, well, how much you're going to do go out and look for a job versus sort of [? desave ?]? Depends on whether you have a bank account or not. So if you have money in your bank account, you're less likely to go out and find an extra job and more likely to live off your bank account or at least partly live off your bank

account. So you're going to be less desperate to find work. That's going to drive wages down less.

So what she does is she looks at what happens to wages in drought years versus non drought years in areas which have good banking services versus areas which don't have good banking services. So this is data from India. And she's comparing areas which have good banking services versus areas that don't have such good banking services and looking at the effect of that on wages in drought years versus non drought years.

So in drought years wages are going to be lower. She's asking are wages that much lower in areas where the banking services are worse? Or alternately, are wages relatively less likely to fall in a drought year where banking services are better? Do you see the motivation for that? So that's the next table.

So when crop yield goes up, which is basically rainfall-- so this is always with district fixed effect. So we're comparing the same district over time, the wage in the same district over time over this period 1956 to '87. Over these 31 years we are comparing the same district in a drought year and a non drought year.

Banking is something that improved over time. So, in particular, if you look in the last column, banking is also something that's changing over time. And she's controlling for that.

And then she's asking is it the case that where the banking is better, the effect of a good yield in increasing wages is smaller? That's the same question as the affect of bad yield in decreasing wages is also going to be smaller. The effect of yield on wages, is it smaller in districts which have better banking services?

And that negative in crop yield interactive with banking, that negative role in the middle says that, yes, the effect of yield on wages is smaller where banking is better, as you'd expect. People are less desperate. They can go to the bank instead of, you know, working. And, therefore, the fallen wages is smaller in those places.

We talked about saving. We talked about borrowing. There's a third thing you could

do. Or we talked about saving. We talked about borrowing. We talked about working. There's a fourth thing we could do.

Oops. That was dangerous. The fourth thing you could do is you could try to do things to avoid risk. So what's an example of doing something to avoid risk?

AUDIENCE: Maybe diversify where you're investing.

PROFESSOR: Diversify where you're investing. Give me an example. That sounds right but general principle. Give me an example of what you mean by diversify.

AUDIENCE: Maybe, for example, if you're a farmer, you have to [INAUDIBLE] of crops maybe. So that if some fail--

PROFESSOR: Right. So one example would be imagine there's two crops, sugar cane and wheat. Sugar cane is much more profitable. But wheat and sugar cane are subject to independent risk.

So when sugar cane dries up, that doesn't affect wheat. And when wheat dries up, that doesn't affect sugar cane. Different things affect them.

Then by having a little bit of sugar cane and a little bit of wheat, you have less risk. But, of course, you're paying in income. You'll be taking less income because sugar cane is more productive. So one thing people do is they diversify.

Like a very interesting paper from many years ago showing they diversified in many, many complex ways. One thing that was very interesting is you'll find that in many countries, actually, you'll find that the plots people crop are not adjacent. And that seems to make no sense.

Why would I farm over here for the morning, walk three kilometers over there and farm in the afternoon? That doesn't seem to make any sense unless you think that there are something like micro climates. So it might rain here when it's not raining there. Maybe when a bug attacks here, it doesn't attack over there.

So even though you're growing the same crop, you grow it over several plots and

the plots are not contiguous. You walk from plot to plot to avoid having exactly being in the same place. Because if you're in the same place then the same rainfall patterns, the same bugs, you're subject to them.

If you had multiple plots in different places, you can avoid that. Now, that's of course wasteful because you're spending a lot of time walking, and you should have been spending that time farming. But at least you reduce risk.

So the general principle is that you do many, many things to, like, diversify, have many crops, many plots, many jobs. There's a study of how many professions a family can have. And I think the maximum number in the study was 27.

They were doing 27 different things. They were small things like going to the pond and harvesting muscles. You do that in the morning. Then you go and collect the firewood for sale. Then your son goes and takes the cow to the field, and your daughter feeds the chicken.

So you had to add up all those little things. But they were doing 27 different professions. I think was the number if I remember right. But that's basically sort of an extreme version of this, avoiding risk by doing a little bit of many, many, many, many, many things.

That's good. It allows you to avoid risk. But it's bad because you end up doing things which are not particularly productive. You don't do the sugar cane even though sugar cane is much more productive than wheat. So you lose money, and that keeps you poor.

So it's estimated that it does not weather risk. And so if you didn't change your crop mix to deal with the risk, you would make 30% more money. So that's big. Basically the stuff that you're doing to protect against the risk is reducing your income by 30%.

Another thing that it does is that because you're doing so many things, you don't-- we [? are not ?] good at any one of them. One way to get good at a profession is by working very hard at it, learning the job. So a lot of these people, for example, they

don't want to go to the city and become a full time worker in the city.

Why? Because they think they'll lose their job. And when they lose their job, if they still have the farm at home, they can come back to the farm and get a living from that.

But if that means that your job in the city is a temporary job. If I'm hiring someone temporary, I have no incentive to give that person any skills. I know he's going to be gone in a month.

So nobody gets start any skills. Why? Because they're all temporary laborers. But why are they temporary laborers? Because they don't want to put all their money into this one basket, all the eggs into this one basket because they think that suppose I lose that job, what's going to happen? I might as will keep my foot in farming.

And so they keep their foot in farming. They keep their foot in the city. They keep their foot in farming sugar cane. They keep their foot in farming wheat. They do many, many different things. That means they don't get good at anything, and they don't take advantage of what they're good at.

So one other thing you could do is actually offer insurance. To all of these strategies the logical alternative is insurance. What is insurance? What would be weather insurance? What's an insurance? Yeah?

AUDIENCE: The idea for the insurance is to gather up a large group of people with different specific exposures to a certain risk and then to pool that risk. So you pay marginally in the event that something happens, and then you get a reimbursement.

PROFESSOR: What does the contract look like? I am asking a simple question. You're right.

AUDIENCE: You pay an annual premium. And then if something happens, you get reimbursed for it.

PROFESSOR: Right. So if the weather is really bad, you give me $1,000, and I pay $50 in a normal

year or something. You want to say something?

AUDIENCE: I mean, another alternative to private insurance would be to have some form of government insurance. So I was thinking when you were talking about this that are a lot of historically sort of much more seemingly primitive societies who did a better job of sort of dealing with these issues, like, say, like, the Incas or even, like, the Mycenaeans or something. And what seems to be different is that they had kind of somewhat strong functioning central states that redistributed across. People like the Incas didn't even have money or sort of markets in the modern sense that we've talked about, yet they had this sort of sophisticated system of redistribution and, like, collection of agricultural products to, I guess, feed the military but also to smooth risk.

PROFESSOR: Yes. So we'll talk a little bit about that in the end, which is you're talking about, I think, something very important which is what would public policy look like here? You would want some way to insure people. But right now I'm asking a narrow question.

If I was facing risk and there was an insurance market, I could buy insurance, right? If I'm worried about risk and I'm doing all kinds of inefficient things to avoid risk, I could deal with it by just saying, look, you know, I'm going to buy insurance on the weather. And when the weather's bad, I'm going to get money.

So here's a weather insurance product in Ghana. This was offered at different prices to different people. And the striking fact here is when you offer at a price of zero, people are willing to take it, not entirely surprisingly. However, as the price goes up to an actually fair price-- what is an actually fair price, if I can say the word correctly? Yeah?

AUDIENCE: It's the amount it actually costs, like, aggregate to get to an expected value of zero.

PROFESSOR: Right. So the amount I pay you in expectation is equal to the amount you pay. That's actually fair price. You can see that some people buy above the actually fair price. Why is that?

AUDIENCE: [INAUDIBLE].

PROFESSOR: Sorry?

AUDIENCE: [INAUDIBLE].

PROFESSOR: Because they're risk adverse. So you're really willing to pay the market. Economic theory would say you should be willing to pay more than the actually fair price. Why?

Because the actually fair price says on average you break even. But risk hurts you a lot. So you don't want to break even on average. You're willing to pay extra money to get rid of the bad things that happen when-- risk hurts you more than just-- it's not just that sometimes you get more, sometimes you get less.

The fact that sometimes you get less is worrying you, is making you do bad things that are inefficient. So you should be willing to pay more than the actually fair price to get insurance because that's the whole idea of insurance. Car insurance is almost hugely not fair if you look at the car insurance we have the US.

Why do we have that? Because we want to be covered against the possibility that sometimes people will sue us for a million dollars in damages. And so we are willing to pay a lot more than what's fair.

So these people, they're not willing to pay. At the fair price, 30% willing to take it. And you have to really go down to about the price of one, that's 1/9 of the fair price, to get people to take it. So people don't seem to want insurance.

So if everything I said so far was true, why don't they want insurance? I said they did all these inefficient things to deal with risk. Isn't that immediately telling us that they should want insurance? Yes? No?

And, in fact, when they take insurance, good things happen. So this picture, what it shows, this is spending on-- total chemical spending is an odd title. I didn't put it there. But it's total spending on chemical fertilizer.

So how much fertilizer do you buy? Well, when you get insurance, you buy about, you know, a little bit more than in control. So some people were offered insurance. Some people were offered credit. Some people were offered both.

And you see the sum gains in investment. People under invest when they get-- so relative to getting just the loan, insurance really helps. So when you get a loan, you don't want the loan if it doesn't come with insurance because you worry that you can't repay the loan. So you don't actually gain much.

So if you're offered the loan, you gain nothing. But when you're offered loan and insurance then your investment goes up by about almost 50%. So you really invest a lot more in fertilizer when you get insurance and credit together relative to getting just credit.

So that says that that affects your income. This says that this affects your welfare. When you get insurance and credit, you are actually about half as likely to have somebody in your family miss a meal. That's an extreme form of risk.

You're just starving because you don't have money. That halves when you offer insurance. So insurance is very good for these people, whether or not they want it. Insurance seems to be increasing output and reducing risk.

AUDIENCE: Wait. Can you go back to that slide?

PROFESSOR: Yeah.

AUDIENCE: I don't understand. So the both is if they get insurance and the loan?

[? PROFESSOR: Bought ?] and credit.

AUDIENCE: And so then the percentage of people missing meals of that goes down dramatically?

PROFESSOR: Dramatically, yeah.

AUDIENCE: But what is it that if they have just insurance or just capital, it looks like it increases

over the control?

PROFESSOR: It doesn't really increase. Like, as you can see, you need both for it to work. So why aren't they insured? And there are two versions of this question.

One is why aren't they buying insurance in the market? And the other is why aren't they buying-- if they don't buy insurance, they can still do something else, which is one way to get insurance is for all of us to just pool together. The government doesn't have to do anything. The market doesn't have to do anything.

We all live in the same village. We can all get together, and we can all adopt the rule which says that if any of us loses 50% of their income, we'll all pay them 1% of our income. We could adopt that rule, right?

And that would insure everybody because there's, like, 50 of us in this room. If I lose 50% of income, all of you give me 1% of your incomes and I'm OK. So you can ensure me. We don't need a market to do it. We can just do it at the community level.

AUDIENCE: [INAUDIBLE] limitation of that is the fact that you're diversifying across a larger geographical area or presumable, like, a bad weather condition.

PROFESSOR: Absolutely. But we should at least do that. The fact is that people seem to have limited insurance even from their friends.

AUDIENCE: But couldn't that potentially open you up to huge exposure as an individual?

PROFESSOR: Why?

AUDIENCE: I mean, I guess if everybody gets equally then even if you have a really bad year-- but if everybody has a bad year then you wouldn't require it.

PROFESSOR: You can adopt a rule which basically says let's take an average income of everybody and then those who get more than average in that given year give a little bit to the ones who get less than average. You can always do that. So in substance it's a puzzle. Why don't they buy it from the market? Why don't they buy it from each

other?

And there's been a lot of hype in this area. Like, *Forbes Magazine* had this issue where they said the "insurance for the poor is an unpenetrated natural market." And a lot of microfinance institutions have been talking about the next microcredit revolution is micro insurance. So they're going to provide insurance to people.

But in fact we don't see very much insurance being supplied or demanded. Now, insurance is difficult for a variety of reasons. Does anybody know what moral hazard is?

AUDIENCE: Yeah. Moral hazard is just the concept that-- I guess it could be best illustrated through the example. There was a huge [INAUDIBLE] about moral hazard about bailing out the banks because it could encourage banking institutions in the future to act more recklessly because there's this implicit guarantee it could backstop because it happened once before.

PROFESSOR: Right. So one problem with insurance-- but this doesn't explain why people don't want it. It just explains why it could be expensive. You know, if I offer insurance to you and I say that I'll take care of you whenever your income falls, your incentive to stay home goes up a lot. That's moral hazard. What's adverse selection?

AUDIENCE: You're only drawing those with high risk.

PROFESSOR: Yeah. The other worry is that you tend to draw in the people. So if I offer people the option of, you know, whenever your income falls, I'll take care of you. I might only get the people who they know their income is going to fall come and join that scheme. That's adverse selection. So we have both of those.

And there's outright fraud because people might claim their income has fallen but in fact their income hasn't fallen. How do I measure that? So it's expensive to deliver. That's a given.

But nevertheless, the reason why-- but you would imagine that at least some forms of insurance should exist. One is catastrophic health insurance. Like, you were in a

traffic accident. Nobody gets into a traffic accident on purpose, very little moral hazard. Why isn't there insurance for that at least?

Another one is weather insurance. I don't control the weather. So there's no moral hazard or adverse selection. I don't control the weather. The weather is what it is.

So if you say that, why don't we get lots of market for rainfall insurance? When the rainfall is below some cut off, I pay you money otherwise you pay me money. So we would at least expect to see these kinds of insurances.

It's difficult to have, like, more complex insurance. Maybe there's some fraud or something. But this kind of insurance, why don't we see more of it in the world?

So this is a sort of where we're beginning to understand. So there was this huge hype, like, five years ago, everybody in the world was talking about how the next revolution in micro insurance. And then that revolution kind of never happened. In fact, it was kind of, if you like-- we worked with a micro finance organization to offer insurance. And after about a year, they basically said, look, you guys, we can't do this.

We're losing clients every day because they were forcing their clients to buy insurance. The way you avoid adverse selection is by forcing people to buy it. You don't want people to have choice otherwise only the sick people will buy health insurance.

They're forcing all their clients to buy health insurance. As a result, all their clients were deserting them. So they basically canceled the program. So nobody seems to want insurance.

Now, I don't think people have fully understood what's going on there. I certainly don't. I mean, I think part of it is people don't understand insurance.

So part of the problem is that people think, well, I'm giving you money. And if I don't use this service, you should give me the money back. So the idea that I'm giving you something-- see, for most of us, the bizarre thing about insurance is it's a

product that you really don't want to use, right?

Insurance is one thing. But you want to buy it but not use it. I'm happy when I don't get sick and, therefore, I'm really happy when I paid for it and I didn't get anything.

Psychologically, it's an odd product in that sense. It's a product that you're happiest when you don't use it. So that's one problem clearly. It's a bizarre product. It's one unique kind of product.

Usually we're happy when we get what we paid for. Here, you're happy when you don't get what you paid for. And that makes it difficult.

Second thing, I think, is they don't trust the insurance company. And there's some evidence that when the insurance company has come through an NGO which people know and like, they're more willing to buy it. So there's some trust element there.

But I think there's something else that I think is difficult. So think of catastrophic health insurance. And if I was offering catastrophic health insurance, our theory was very simple. Nobody gets a heart attack on purpose. Nobody gets cancer on purpose. So let's just insure those things.

That was OK. The theory seemed to work. The problem is people also die from other things. Like, the stomach hurts and then they probably got an infection and died. That's not covered by the insurance because, you know, in general it's only particular conditions that are covered.

People don't understand why one thing that is covered and another thing isn't. And if you explain that, well, there's more moral hazard in this one than that one then that's too hard to explain. So, basically, insurance products, out of the necessity of protecting the insurance organization from adverse selection and moral hazard, tend to be incomplete. They cover only a few conditions. People don't understand those conditions.

So there was this big fight with this [INAUDIBLE] we worked with. They got into this

big fight with a group of women who were very upset because one of their friend's husband died. He died at home. He suddenly got sick and died.

When he got sick, she went to the local doctor. And the local doctor recommended a whole bunch of medication, expensive medication which was useless because the doctor, I think, was bad. The insurance company said this was not a covered condition. We can't pay for it because it was not covered in fact.

The insurance company in this particular case said we will only cover conditions that require hospitalization, and we'll only pay if you have been hospitalized. That's a very good way to check whether people are making up conditions or not. So they had imposed this hospitalization condition, which was to protect them.

But then these people said, look, her husband died. How could it be worse? You have to pay. So it was a big fight. The insurance company refused to pay. As a result, all of them quit [INAUDIBLE].

So just the nature of the product is difficult. That's one final psychological element which I think is also difficult, which is catastrophic insurance is particularly a product that makes you-- you value it when you think about your own death or something or something really bad.

People don't like thinking about those things. So it's very hard to get people to be rational about buying a product that involves contemplating really awful things happening to you. So a lot of people are both, I think, maybe they are a little bit superstitious about it.

So they don't really like taking on this risk, thinking about these states of awful things happening. So if you're going to insure us to insure awful things like when the crop completely dries up, that's not what people want to think about. So that's another reason why.

But in general, we don't fully understand why people aren't buying these products. But they aren't buying them. So if there's no question, I'll stop here. [INAUDIBLE].