MITOCW | 5. Measurement in Development

ROBERT TOWNSEND: Today is-- it's not exactly a midpoint of the course, but it is a transition lecture between these macro financial models with micro underpinnings. Today we're going to go through the measurement, and then in subsequent lectures, focus on testing for the micro underpinnings. I mean, everything is connected to everything else.

There's a quote-- I don't know, many of you may be familiar with it. It's really quite good. Lord Kelvin. In physical science, the first essential step in the direction of learning any subject is define the principles of numerical reckoning and practicable methods for measuring some quality connected with it. I often say that you can measure-- when you can measure what you're speaking about and express it in numbers, you know something about it, but when you cannot measure it, you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind. It may be the beginning of knowledge, but you have scarcely in your thoughts advanced to the stage of science, whatever that matter may be.

So of course, today we're going to talk about measurement, and this is not an economics quote. This is a little more related to both economics and impact evaluation. It's Bill Gates. He's talking about the steam engine. In his book I think he must have read on the most powerful idea in the world, which is about measuring the energy output of engines with this my micrometer.

The point-- he's quoting Mr. Rosen-- is to see incremental design changes that led to improvement-- mainly what you want, higher power and less consumption of the coal. And it was this interaction between experimenting, trying things, measuring precisely given the goal and then innovating some more that led to this high-powered steam engine which revolutionized the world, essentially.

So he's saying he's struck how important it is to measure-- to improve the human condition and how incredible the progress could be if you set a goal and measure it. But then he goes on to say that he is also amazed how little this is actually done and how hard it is to do it to get it right. He gives an example of foreign aid, just measuring the dollars, say, that flow rather than the underlying impact that it may or may not have on household business or country welfare.

So the type of measurements that are needed or those that allow us to assess performance and gauge impact. So this is the end of what Bill Gates was saying and the rest is something I want to say. Measurement is tricky in the sense that he's really not saying just go out and measure anything you want to consistent with the goal. For a while the Gates Foundation was promoting savings accounts, having poor people have access to savings account as a kind of panacea, and indeed, wanted to measure the number of households out there now who have them and track improvement. And there's a new world survey done by the Gallup Foundation-- Gallup people who do the polls, actually, have survey techniques worldwide.

But of course, from our perspective, just having a savings account may not accomplish much. It's not a kind of measurement that's really assessing the impact on people. You'd like to know what impact it's having on welfare-- that is to say on actually using it or better ability to smooth consumption or finance investments and so on. Well fortunately in economics, we have one set of measurement tools that are common, and they're also consistent with the theme of the lectures-- namely there is measurement at the individual household level that's also consistent with measurement of the flow of funds across countries and everything in between.

And what I'm going to try to go through today but here's a quick summary of it is what these tools are. Basically you start with the financial accounts for a household or a firm. So that would be the balance sheet, the income statement, and the statement of cash flow. You may associate that language with corporate financial accounting and wonder perhaps about its relevance, but they are the benchmark standards and they can be applied to households and especially to households running businesses, which is the typical enterprise in developing countries.

So I'll show you in a moment exactly how this can be done. What use can you make of these things? Again, I'm going to try to buttress my case that it's not just measurement for the sake of measurement, but actually that you can use these measurements. So in this case, we'll draw a distinction between productivity and the return on assets versus liquidity, some distinction you could not make if you were not clear-headed as in applying these financial accounts-- or at least it would be quite easy to make mistakes.

And show how-- where wealth is coming from and how wealth changes over time. At the household level that gets you into poverty dynamics, you can start thinking about the mechanics that underlie changes in inequality. And again, in an application, take a look at how households are making a distinction, apparently, between savings rates and productivity in terms of what they do in their own investment. I think you've seen in the recitation section sort of a precursor of this in terms of the Thai data and some case studies. So in some sense, we're going to go back to the basics and talk about the financial accounts, but at least you have a motivation already for what households are doing.

Then we can aggregate up from households-- say all households in a village and create something like the national income accounts, except they're not at the national level, they're village income accounts. But we have the standard savings and investment, GDP numbers, and indeed, we get balance of payments at the village level or regional level just so you can see what's going on within the country, not just of the country relative to other-- and again, you've seen this come up in the lectures-- China, provincial-level China, at the national level relative to the rest of the world, flows across sectors that differ in obstacles to trade.

And finally, we'll get to the flow of funds accounting, which I like to think of as the nuts and bolts of the financial system actually measured. So you don't just have to imagine what's going on in the country over time in response to shocks, you can actually see it in the measurement.

So first paper up. Not going to work? Let's not cut off too much, maybe it's all right. Is to create-- well, I'm just not fast enough. Create the balance sheet, income statement, and statement of cash flow for these households in order to make the distinction between productivity and liquidity.

So this is a quote from Deaton that I ask often show. The only way to obtain these measures is by imposing an accounting framework on the data, painstakingly construct estimates from myriad responses to questions about the specific components that contribute to the total. So actually, there's a computer code that's you know 18 to 20 pages single-line code, and it operates on the Thai data.

It, of course, searches over all the questions in the questionnaire in order to be able to extract the key variables that are needed line by line to create these financial accounts. We didn't begin with the financial accounts. I wish we had, because then certain instances, it would have helped us measure better. This was something we came to afterwards when we were just struggling with a simple idea of what do we really mean by income? Something very basic.

AUDIENCE: [INAUDIBLE] more like 100 page, you think.

ROBERT TOWNSEND: That's a lot.

AUDIENCE: And the way that you look at it is initial.

ROBERT TOWNSEND: Yeah. Version 1, version 2. OK. So what are the problems when you have these high frequency monthly data or to some degree even annual data? There is a difference in timing between, say, when inputs are purchased and when their outputs are sold. If you think about farmers, they only sell at harvest time and they're using inputs along the way. It's true for businesses, too, who don't sell instantaneously. They have to acquire inputs to produce something or buy goods for inventory to stock, and then subsequently sell.

We are worried about liquidity, on the other hand. So since smoothing of consumption, protection of investment from cash flow, financing a budget deficits. So we want to make distinction between cash flow in terms of liquidity and kind of the overall performance. The key idea with performance is an accrual notion of accounting, which is simple to say-- mainly do not book or subtract expenses until the output is sold. It's the idea of corporate finance-- you have projects, not occupations. You buy assets. You have an idea, you need to fund it, you buy equipment, and you don't expect a return right away. So for the short-run, you have lots of negative profits, but it's just a cash outflow, so you wait till you can get the big picture, which is when you get the revenue then you subtract off the inputs.

But financing the inputs along the way, that's a liquidity issue. And indeed, if you're running out, you may as not invest even though your underlying project or idea is quite successful. So we go to the financial accounts. Now viewing households as firms, we have to draw some parallels. Assets are kind of easy to think about both on the household side and on the firm side. Households have debt just like firms have liabilities, so those are straightforward parallel concepts.

When you think about wealth, wealth is really net worth on the household side. The language for firms is something like equity. It's the amount of the owners' investment in the enterprise that's built up over time that is not as different from the fact that some of the equipment gets owned by outsiders who financed the project by lending.

What is the sources of this wealth? Well basically savings, like retained earnings. Savings for households, retained earnings for businesses. That part of the profits that you put back into the business. But also potentially contributed capital which I'll come to in a minute. This is this may strike you as odd at first, I'm not sure. Consumption on the household side is the same as dividends on the firm side. So the consumption we think we know, but dividends is like a firm paying either the inside owners or outside investors part of the return stream. So that stuff isn't going into the firm anymore, it's not retained earnings. It's kind of the fruit that you get to enjoy.

This is also a bit of a stretch and can be problematic. Incoming gifts on the household side, what do we do with them in the financial accounts? Gifts aren't really income in some sense-- in the corporate financial sense. Because income is a return stream of projects, but gifts, that's just something somebody gave you.

Well, so we ended up thinking about gifts as financing. So the idea is, someone gives you a gift, you have some implicit idea of reciprocity. So they're in effect helping your enterprise, they're investing in your enterprise even though the contract may not be nearly as formal as, say, an equity arrangement. And finally, the household budget constraint is like the firm cash flow constraint.

So again, we can therefore distinguish assets versus wealth. Note how easy it would be to make a mistake there. Isn't that the same thing? No. Remember, the liabilities get subtracted from assets to create, quote, wealth or net worth. Accrual versus cash flow I've said often enough. Savings as a budget surplus as in cash flow-- so you had more coming in in revenue than you had outflows in terms of expenses versus a different notion of savings, and that's savings as in wealth accumulation, that's where do you put the increasing wealth that you're acquiring? That's more like a portfolio problem. And therefore, we need to distinguish liquidity management from asset management.

So quick review. By the way, I'm really going to struggle today to make sure you don't just sort of pass out on me. Because accounting has a reputation as being really boring, and it is true that it gets more and more tedious. And so you kind of like tune out, like OK, I'll tolerate today. But no, you'll discover that when you start doing your research, whether it's looking at data from surveys or gathering data or trying to do-- and then you'll come back and you'll be much more interested in these things.

So the spirit with which I give the lecture today is not the bore you with the details, even though at times it will be tempting, because once you've invested in this stuff, you want to share that knowledge. But rather, to give you a reader's guide or viewer's guide of what the key concepts are and how things fit together. So that latter thing is what I want you to take away.

So here is a typical balance sheet. You've got assets and you've got liabilities. The bottom line has to be the same. Now how does that happen? Well, you really subtract liabilities off from the assets, and hopefully assets are larger, so the residual is basically equity or net worth, OK? And then this is just an enumeration of different kinds of assets, which include financial and trade credit and so on as well as if-- lending as well as your real physical fixed assets, and liabilities are kind of obvious, and so on.

So now let's get into some cases here. The Living Standards Measurement Survey makes a mistake if you want to think of it that way. They ask about inputs used over a specified cropping season and the amount spent. And implicitly they're equating them, but they don't have to be equal to each other. For one thing, you could be using inputs in your farm that you acquired previously-- especially with monthly data, it's likely you have some kind of input inventory. And for that matter, you could spend money and buy inputs but not actually put them on the field.

And the same thing happens on the output side, essentially. What do we do? Fortunately in the Thai survey, we actually keep track of both inputs required since the previous interview as well as the actual use, both value and quantity of inputs. So we have this input inventory account. And revenues I say here, but don't dwell on it. So what do you do when you have the output? Well, you could store it or you could sell it or you could eat it. So you kind of have to create an output account.

We act as if output is sold at the time of harvest just to put an accurate value on it, but when, in fact, they don't sell all of it or they eat some and store some, then we create another sort of output inventory account. So in high frequency data, this sort of inventory that your mind might glaze over when you look at a financial statement, inventory may be a really key smoothing device. And at the risk of getting carried away, there's something called work-in-progress inventory, and that happens when you're using this accrual notion of accounting where you don't want to subtract something off as an expense yet. If you don't subtract it off as an expense, then it's not on the income statement. Well where the heck is it?

Well basically, you act like you've created an inventory of something, like buying an asset. So all the fertilizer that you've put on the land and all of that stuff in the accrual notion is work-in-progress inventory, it's producing the crop. Yep?

AUDIENCE: So how do you-- literally-- so how do you kind of-- so I'm assuming that in your survey you ask kind of a simpler question, like just count assets and name--

ROBERT TOWNSEND: Yeah.

AUDIENCE: --expenses and what--

ROBERT TOWNSEND: Exactly.

AUDIENCE: --like that. How can you be sure that your classification kind of is what it is and it's in the mind of the households? So like I understand sort of the asset versus wealth thing and so on, but when you go into this like inventories and stuff like that, how--

ROBERT TOWNSEND: We create that. We don't ask the household what they're a work-in-progress inventory is. We have that as a conceptual category as measured from other variables, like what did they buy, not yet put on the land.

AUDIENCE: Would you think it's interesting to go see whether that maps in into some sort of--

ROBERT TOWNSEND: Yeah.

AUDIENCE: --way--

ROBERT TOWNSEND: So Chris Woodruff had done-- the inventory thing is the hardest thing to get right. And in fact, when you think about it, you buy maybe inputs at one price and you sell them in another. So you can have-- or-- so you can have capital gains and losses on the inventory account.

AUDIENCE: Yeah--

ROBERT TOWNSEND: And-- and so yeah. So what Chris has done is actually-- he wrote a paper called-- and we take the opposite point of view, but his is, how is the sausage made? Or don't ask what's in the sausage. So he just asks households basically what their income is, and the view there is that somehow they're going to do better than asking all these detailed questions. We think it's better to ask the detailed questions and then construct the income, but you can certainly-- and we didn't do enough of this.

So yes. You should compare the answers of the households to so-- and do the households have in mind some liquidity notion of income or do they have in mind some sort of rate of return calculation when you ask them what their income is in a given year?

AUDIENCE: Maybe even like at an earlier stage. So I think that in the whole boredom of accounting, there is some-- what I remember as more interesting stuff. It's like, everything that goes on those statements you can-- it's either market value, cost value. So there's all sorts of-- and you can get all sorts of numbers depending on how you value things.

So my question would be in those in these settings where I would assume there's even measurement error in prices and everything else, like how does that all come together? And how do you think noise--

ROBERT TOWNSEND: So I'm going to take you-- yeah. So I'll take you through a paper we wrote. I'm going to formalize the notion of rate of return on assets, and then I'll show you one slide where we did a lot of what-- the great virtue of having all the data is we could do these experiments, say, what if we didn't count something we actually measured, or what if we know change categories and put it in one place and the other?

So actually rank-ordered the three things that matter most to measuring productivity so that we and especially other researchers might be able to do better. Or not have to worry about all the details on everything, that's more to the point. Yes?

AUDIENCE: So what do you do with households that also are running a business? Do you ask them only about household inventories or the equivalent?

ROBERT TOWNSEND: No, we don't separate it at all.

AUDIENCE: OK.

ROBERT TOWNSEND: So we treat it as an integrated unit. And again, my view of it is, households don't necessarily make that separation. So we asked them what is the profit from running the business? You're asking them mentally to to separate out all these things, to have some money from wage earning and so on. So we prefer to measure everything--

AUDIENCE: Sorry.

ROBERT TOWNSEND: Yes?

AUDIENCE: --quick follow-up on [INAUDIBLE] question. In this sense in which households that are also a business or just treated as a business and consumption decisions are treated as a unitary things-- really this notion of some sort of corporate thing going on, how do you then go into-- have you thought of-- do you think it would be interesting to like integrate that with household decision-making modeling that also treats the household as a corporate firm? So the idea of transaction costs within the households, how like-- or the household then is still a unitary thing which maybe doesn't make much sense because there should be-- there could be like the woman is a manager of the--

ROBERT TOWNSEND: Yeah. So there are two things going on here. One is household non-business activities and the other is business activities, and we prefer to try to measure all of that and have an integrated account. Now in terms of-- a household is collection of individuals, could we do the accounting at the individual level?

In some instances, we're painfully aware that this notion we have that this group of people is a household and is a unit is stretching things, and yet that was our starting point, to have a household-level survey. For one thing, the demands even in the measurement of interviewing everybody individually is horrendous. Also, you know some assets are held jointly or people may disagree about who's got the real claims on them.

I mean, that said, there are instances clearly where the husband may be hiding some of his income or the young teenager still living at home actually have some earnings in his or her bank account and that's kind of not commingled with the rest of the family budget, and those are real, real problems for us. Yes?

AUDIENCE: I mean, I think to be fair to some extent, you can make that criticism of corporate accounting as well, that maybe they're like-- they're not acting as a unit or there are people doing things that you can't see in the accounts and that just looking at a firm statement would be different if you would like to sit down with every member of a corporate firm and ask, what did you spend money on this month? Where did you-- all this sort of stuff.

So I feel like to some extent, the criticisms here are criticisms that apply to the general framework of accounting and not to the household problem specifically.

ROBERT TOWNSEND: Yeah, there's is some stuff I took out, otherwise the lecture would be even longer, which is, do these problems-- you have a conglomerate which consists of different firms, and there are issues there about the flows from one to the other. Here, you could treat a marriage, for example, as a merger of two firms, and there is development literature like that. Mark Rosenzweig has written I think quite convincingly on the marriage of daughters as basically insurance and business transactions and so on. So there are-- a divorce is like a breakup and so on.

We try to measure liquidity, and so it's tempting to just have everything in cash, but actually here and in India, grain, rice here, and sorghum in India is people borrow and lend in it, they make commitments to pay in it. So we actually have in kind barter transactions. Now here again, you could imagine-- and when I teach monetary economics, we get into this for sure. The notion of liquidity is how quickly one could sell an asset or is there a deep market for it.

So this is, again, both a judgment call here because we aggregate it up, but also opens up a really interesting sort of line of research where you can study liquidity and transactions in these village economies. What to do with livestock? What does a cow-- a cash cow-- well, so we just separate the asset from the income and expense part. So the cow is the asset.

The cow, if it's young, actually appreciates in value over time. You get a capital gain out of it. Cattle can die prematurely, you'll get a capital loss. We actually try to book all those things. Meanwhile, the cow-- the dairy cattle up in Lopburi are delivering milk. So that's the revenue stream off the asset, actually. It's a great analogy, like fruit off the tree. They're not Lucas trees, they're, I don't know, Lopburi animals.

And gifts, as I've said-- so I don't think I'll belabor that. I spared you a lot. Just want to introduce the concept. In the underlying data, you'll see a transaction, like received wage income in cash. Now what to do with the answer to that? 50 baht. Well, it enters in all three incomes, all three statements. Basically the cash enters an increase in the balance sheet as an increase in a kind of asset, it's revenue on the income statement, and it's incoming cash flow on the statement of cash flow.

Not every transaction in the data enter on all three accounts. The struggle was deciding indeed where to put all of these things, although the accounting standards double-entry bookkeeping does provide a discipline-- and yes, we made mistakes initially and things didn't add up. So then we realized we hadn't entered things appropriately. That's what double-entry bookkeeping is, some clerk having all the transactions and then doing the books, quote-unquote, consists of entering all those daily transactions into ledgers and creating statements.

So these happened to all be cash transactions, that's kind of an accident, it's just the first page of about eight or 10 of them in the book, and I'll skip the rest. Now let's talk about liquidity management. Here's a statement of cash flow, D for deficit. So you run a deficit. The deficit, say, is the difference between your income in a month-- cash revenue, I should say-- and, say, consumption-- minus consumption, minus investment, OK? So it's a deficit, you had more demands for cash than you received in cash.

Well, again, by the construction of the accounts, everything has to balance. So we know exactly how a deficit is financed. We even try to measure the currency. So we have F1 through Fn are these financing devices, and then you can do a little math, basically, multiply both sides by D, but D is the sum of the F, so basically you get this, and then you square it, and then you divide by the different squared, and all of a sudden you're looking at a variance-- covariance decomposition, which is exactly true.

So if you want to know the role that a particular financing device like F1 is playing in terms of smoothing the deficits, it's basically like running a regression of the deficit onto the financing device and getting a regression coefficient. It's really cute. That you could do it one financing device at a time and the sum of those coefficients has to add up to 1.

So this isn't the only way to talk about-- this is variance/covariance, not order of magnitude. If you have two devices that track each other perfectly but there's always a gap, this thing will say, it's the perfect smoother, that's the thing that's used, but in fact, the gap remains. So you have to be a little cautious about the interpretation sometimes.

So how do you finance? Well you could decrease your deposits if you have them in a financial institution, you could-- this is an odd way to put it-- decrease in your net ROSCA position, which means basically you don't want to pay in, you want to get paid out. You want to be a recipient. You could call in your loans, you could borrow, you could get gifts or decrease your cash holdings.

And for two case study households, we actually measure-- and you probably unfortunately can't see it very well, but this cash is close to 100 or 1, basically, 100%. These numbers, though, are the quartiles of the province in which this case study household A lives. So the median is 76%, this guy's actually on the high side, but still, in this variance/covariance sense, 3/4 of the deficits is households in Lopburi are financing their deficits with cash. Cash. They're holding great gobs of it. Unbelievable amounts of it in the house. And when they get these adverse shocks or they have more expenses than inputs, it outcomes to cash.

You want to say, well why isn't-- is it in a savings account? Not much. Negligible. Now I was a little critical of this sort of measuring savings accounts. This is a measure of savings account. I guess at the end of the day, the issue is, are they managing their cash well? This is the starting point. We have the measurement, maybe they should be putting more of it in the bank and taking it out when they need it. They don't do it much, so that is a bit of a puzzle.

Gifts and loans are-- I think this is not-- this is out of the book and not the latest version.

AUDIENCE: This is the latest.

ROBERT TOWNSEND: Is it? So OK. So you can see these upper quartiles are getting up to 15%, 20%, 25%. So gifts are used by some households substantially as well. It's not just a pure cash economy. And like-- well that's cash management. We can talk about asset management. It's really the same concept, except instead of operating on the cash flow, you do this accrual notion of accounting and look at sort of net savings. And I'll come back to that later, essentially. And the portfolio management.

So here, in answer to the question that was raised earlier, is looking at something like profits over assets, which is a return on assets, and then creating 10 different measurements of it. Do you want to exclude household consumption of their own output and not count it into income? We counted total utility expenses as a business expense, maybe we shouldn't have done that. Maybe it was a household expense for, quote, consumption purposes.

So service flow from fixed assets, which would be very natural to do for durable goods, we tried that. We could take income but then add gifts and transfers even though it's really not associated with a project, and especially this sort of cash. So it turned out that this distinction of cash versus accrual was very important. The treatment of gifts was very important.

And up here, which where I didn't start, but I could, is in trying to get at the cost of household labor-- own household labor used in production, that is a monster difficulty, because you don't see for many of them what they would have earned as wages in someone else's farm and so on, yet it's clear that's very important and it makes a very big difference. So hopefully knowing that, one can bend over backwards to try to get a better sense of the opportunity cost of labor.

So as I said, let's look at some uses of these. This is a paper with Anan on the wealth distribution, and let's look at that 1%. Let's go get 'em. Let's get the top 1%. How much wealth does the top 1% have? It's huge. They start out in 1999 with about 35% of the total wealth. Now it's actually diminished. This is the-- frankly, a wonderful thing to have all these many, many years of data. It's diminished to 26%.

What's going on is this stuff at the bottom end where the bottom 50% have 5% of the wealth. By the way, this is typical of the US and European history, and it's very skewed wealth distributions. But this thing actually doubles over the space of about 12 years here.

AUDIENCE: Is this including cash?

ROBERT TOWNSEND: Yeah.

AUDIENCE: So it could be like cash.

ROBERT TOWNSEND: It could be. There was a question.

AUDIENCE: Oh yes. Not related to this, but what household characteristics does [INAUDIBLE] economic ones like [INAUDIBLE] household members--

ROBERT TOWNSEND: Yeah, we have all of that, all the demography. Age, education. Yeah. So in answer to your question, we'll see what the-- that among some of these poor people, they have a very high return on assets, real physical assets, and we'll see where they're putting their money. So inequalities going down in some sense, right?

So anyway, this is not the story of a poverty trap. Now I'm not claiming this is universal truth, I'm not claiming there aren't poverty traps, really, and models and in the real world. Many countries still have-- like India-- vast populations of poor people, but maybe be a little leery that at least in the case of Thailand, you think about starting at a low level-- and some of these guys remain in poverty, but there is a huge growth dynamic going on. Yes?

AUDIENCE: And how much is the very-- in terms of the actual distribution of income, how much of the very rich got surveyed? How much-- of this-- the people who got surveyed, were they like a top truncated distribution, like their very interested and you know, the ones who answered this survey. It's usual--

ROBERT TOWNSEND: Yeah, it's-- well, it's a stratified random sample. In some cases we actually ended up with everybody in the village, but maybe only two out of the 16 or so villages did that happen. I think it's more typical that we're worried the rich guys are hiding some of their assets rather than them not responding at all. I could not run these surveys on my own, I have built up close friendships and collaborators in Thailand who are amazingly good at getting households to participate, and there are occasional scares where they think the government's going to start taxing them, the chicken farmers were making great gobs of money in profits, and rumors circulated that they better conceal their wealth. They dropped out, but we got almost all of them back in after a while.

AUDIENCE: So I told them that attrition is very low, but what about the initial response rate? What is that? Close to 100%? Like when you actually went in and--

ROBERT TOWNSEND: Yeah. It was very high.

AUDIENCE: What do they get for answering the survey?

ROBERT TOWNSEND: Hmm?

AUDIENCE: I think Harry mentioned that people get gifts for--

AUDIENCE: No, it's not substantial. It's just like you get a new year's gift. So it's not worth the time. So they don't like look at it from a financial--

ROBERT TOWNSEND: We give them a bottle of fish sauce or a blanket, or something, and that's a Thai sort of cultural thing to establish goodwill and that you care about a person. We just did not and we deliberately avoided getting into the business of paying people. Because for one thing, then other households in the village feel like they're getting cheated and it's just-- it's--

So this is all voluntary participation. 13 years of households answering questions monthly with only, whatever it is, 2% per year dropping. So here is-- there's a movie called *Falling Down*-- I don't even remember that guy went berserko with a machine gun. I always think of that. So not everybody's wealth is going up, and in fact, some people actually find their wealth is falling.

So we can track their net position in the distribution of wealth, and here, you can see these people climbing up, and other people, quote, falling down. This is the histogram of sort of in percentiles. By the way, the average has to be 0 because it's-- the net change is 0 over all the households, but you can see some substantial-- 1 standard deviation is like 14 percentage points.

AUDIENCE: So do you have any [INAUDIBLE] falling down?

ROBERT TOWNSEND: Yeah. So I guess one thing that sort of got lost in the shuffle because we didn't decide clearly whether it would show within the TA session or I would show it here is kind of a life cycle picture. So we've created by cohorts, by age. And you can see, especially in the areas near Bangkok, a classic life cycle.

So as these households are young, they start to accumulate wealth, but after a while, especially as their income falls off, they start running down their assets. So this does not distinguish by age. So it's a bit misleading, it's not like there's some-- necessarily some young household that's just consistently eating more than their income.

There are households like that, and that raises this issue before of what's going on. I mean, if the husband isn't there, for example, and the wife is running some hair salon, she's consistently eating more than then the household income, but you kind of wonder if there isn't something going on, and we just don't have the husband there who chooses either for personal or occupation reasons to be in Bangkok the whole time. So then we get a misleading picture that she may be in trouble or she may know more the future than we do.

So let's do a simple decomposition. Here's savings. Savings on both sides in absolute amount. And then divide and multiply by profits from the household and businesses, all of them summed up, and divide and multiply by assets. So that has to be true. It's an identity. But savings over basically profits is a savings rate out of income, and profits over assets is the return on assets post-multiplied by the level of assets.

So basically you can look at-- you can look at the change in wealth or the percentage change in wealth, and wealth comes-- where is a change in wealth coming from? It's coming from savings plus income and gifts. The savings thing is decomposed up here. So part of the mechanical accounting drivers of increasing wealth has to do with savings rates and rates of return on assets. And maybe gifts if they're important.

So here is the correlation of the growth of net worth with savings rates, and depending on whether the unit of observation is household month or household year or households averaged up over all of the months and years of the data, you do see some positive significant correlations. So in fact, not too surprisingly, some of the increase in net worth is coming from households who have high savings rates.

But the bigger part of the story is the correlation with the return on assets. And there, it's consistent pretty much at all levels. So household by household with our measurement, we look at their productivity in terms of rate of return, and then see whether their net wealth is going up or down, and it's the households who have high rates of return who have the high-- highest rates of increase in their net worth.

And it's quite persistent. Here, we look at return on assets in the first half and second half of the sample at the time that we did it. So if they were identical, they would lie on a 45-degree line, and these scatter points are close with one exception, which is Buriram. Oh, you should be thinking models at this point. Remember the productivity, the TFP thing?

That's the thing sitting outside multiplicatively in front of the production function? These are household-specific TFP numbers sort of. It's not a very sophisticated-- production function is just linear. So it's not really just-- you'd rather have like the marginal product of capital and pre-multiply, this is a linear production function. The marginal product is just the average.

But it's very persistent. So in these models, the issue is, are those TFP shocks IID over households, are they the same unless you get blasted with some shock? And this suggests that the household level it's really quite persistent. Buriram is an interesting exception, and I'll just say it in words, there are many more occupations shifts in Buriram than in the other three provinces.

It turns out these villages aren't really villages anymore, they've paved over our soil moisture readers and they become part of the town. There's a big construction boom going on. Part of that is pararubber, part of it is Scandinavian tourists coming in marrying Thai women and staying. The place is just like a construction boom.

So people shifted from rice-growing or money-lending or other things to laying tile and all these things, and they had a higher return on their assets as a result on average of those switches. So that's kind of reassuring. It's another sense in which households are aware of their success.

And here, coming back to Witt's question, if you partition into low, medium, and high return on assets and looked at what they did with their increasing wealth, these high ROA guys are putting money back in the business. They're buying equipment, they're investing and putting it into their business. And that's not true of the medium or low guys. These guys are doing the financial assets.

So more of their increasing financial wealth is potentially in cash, but to the extent that we measured ROA accurately, which we have tried very hard to do in all kinds of different ways, we're getting the reinforcing message here that we've measured it accurately because they seem to do what you would think, which is, you're not going to put your money in a savings account when you've got a really high return. And later in another lecture will try to adjust for risk.

So now we'll aggregate it up to villages and use those same financial accounts. We do have to struggle again with this dual role that households play as consumers and producers. So much of economics is driven by here is firms maximizing profits, here is households maximizing utility-- these are households running businesses, so what are we going to do? And in particular, what are we going to do with the labor?

Well, we made a decision, although here, we do check and do robustness checks. And what I'm going to show you today is treating even the labor income as something like consulting income, like they're providing a service-- their business is to provide a labor service to other households, and they get profits from that.

Now if you think about a production sector and aggregate up, to the extent that inputs from one business are-- the outputs from one business are an input to the other, the net is zero and it doesn't count. But in these villages, the output of one business could be someone else's consumption, and it doesn't net out. Both get measured. As it would if you're distinguishing households from firms.

We can actually measure and ask about the transactions. So we know the transaction partners almost. We did screw up with consumption because we forgot to ask consistently where they buy stuff, which has to do with the price thing also mentioned earlier. But fortunately, and I'm sure you'll be more than happy to take my word for it, there is an accounting identity, so you can kind of back up as a residual how much of that output is basically sold and consumed in the village because we measured everything else.

In other words, on the buying side, we don't see it, but-- because we don't know where they bought it, but we actually figured out on the selling side that it came from somebody who produced it in the village.

Measurement error, you asked-- somebody asked about the rich guys not participating. If a moneylender were like the central node and the money lender refused to answer our questions, we're going to get really screwed up in terms of the flow of funds and the balance of payments and everything else. Because we are going to act like the average overall-- the households in the village is the representation of what's going on in the village itself as a whole.

To the extent that there's measurement error but there is IID over households, and to the extent that we have a lot of households, then hopefully that helps make the case that we've got a reasonably good measure.

So how do you create these accounts? What is GNP anyway? GDP? Everyone seems to be obsessed about it. OK, it just comes from the income statement. So basically, here's a statement of income, it's what you would expect. You've got revenues come from production, or for that matter, if you're a lender or saver from interest, you've got capital gains. You subtract off capital losses, maybe you have sort of a paid payment from an insurance indemnity.

So those are revenues, here is basically expenses, production expenses, interest expenses on loans, depreciation, insurance premia, taxes, et cetera. So net income before tax-- before income tax but after property tax is what makes these things balance because this is basically the profit-- it's basically revenues less expenses. So that should be comfortable, sound sort of reassuringly familiar.

All that we do is basically take this stuff and subtract it off from both sides. That cancels it out on the right-hand side and puts it on the left-hand side. So basically you have production revenue less production expenses, and that's basically the rest is equal to the payments to factors of production.

So you're paying stuff out in interest, you're paying out in taxes, depreciation is over here, and you're paying out to the owners of the enterprise namely profits. So you may remember vaguely that there's two ways to measure income on the output side and on the factor payment side, and they add up to each other.

So this is value-added, basically. The only catch here is the way we treated labor, you don't see a labor expense over here, because normally value-added, you're only subtracting off intermediate inputs and other purchased inputs, but here, we actually subtract off the labor because of the way we conceptualize that problem or that issue.

So you want to see what's happening over time in the four provinces, four villages per province, Chachoengsao GDP or really village product is going down pretty consistently. Now what happened is the shrimp ponds, basically, people had converted-- yeah, that stuff you're buying in Costco or Walmart, those are typically Thai shrimp. But the ponds-- so there's some disease.

And so-- and household, some of them switched. And the fish and others now are actually, with the world grain prices being relatively high, they're refilling in the ponds and planting rice again.

AUDIENCE: Rob?

ROBERT TOWNSEND: Yes?

AUDIENCE: What are the different colored lines [INAUDIBLE]

ROBERT TOWNSEND: Each of four villages. So--

AUDIENCE: Oh, I see. [INAUDIBLE].

ROBERT TOWNSEND: So you can see, is every village like every other village? Well, to some degree, yes, but the levels are different, and sometimes even the movements over time are a bit different. Another thing to watch out for is the scale here, because in order to clearly display each village-- each of the four villages in a province, where changing the scale of a province.

Sisaket is a lot poorer than-- even in their worst days, Chachoengsao villages are better off substantially than Sisaket. So the income levels are maybe on average three times higher in Chachoengsao. They're almost ordered by their distance to Bangkok.

I won't bore you with this. This is just to what do households do with their profits? And then the story is mostly in the northeast. they eat it. And in central region, they're more likely to put it back in the business or their farm as retained earnings. Savings investment account, that's probably worth looking at. Here's the balance sheet. So remember, we had assets and liabilities and net worth. This is the change over time in the balance sheet. So it's like a first-time difference.

So changes in liabilities and changes in net worth must equal to the change in all the assets, especially if you include change in net worth over there. These could be financial or real. Well hopefully this is comfortable and familiar. Just the notion of having assets and liabilities and net worth and taking a time difference.

What is the savings investment account? Well, you just basically take the change in liabilities and put it on the left-hand side. That leaves the change in net worth on the right-hand side, and then what you do with it on the left-hand side. Yes?

AUDIENCE: So before we were talking about household gifts equity.

ROBERT TOWNSEND: Yep.

AUDIENCE: So does that mean that they get counted as financial assets? Where would gifts in a village enter?

ROBERT TOWNSEND: Contributed capital.

AUDIENCE: Contributed capital.

ROBERT TOWNSEND: Yeah. That's what we called it.

AUDIENCE: All right. Cool. Thanks. I'm sorry, it just occurred to--

ROBERT TOWNSEND: No, no, it's fine.

AUDIENCE: --no idea where they're going.

ROBERT TOWNSEND: Yeah, yeah. It's there, because if they're getting gifts and not eating too much, it should increase their wealth, and therefore, it should show up somewhere as either reduced debt or increased assets. And that phenomenon depends a lot on where you are.

AUDIENCE: But entered both sides, right? It entered as increased cash, and then also increased--

ROBERT TOWNSEND: Well--

AUDIENCE: --contributed capital.

ROBERT TOWNSEND: The concept is here. So basically say this is positive, and your change in net worth is positive because either retained earnings or contributed capital. And then the issue is portfolio management, it's what did you do with it? And you could put it in cash, that's in financial assets, but you could also have it in inventory as I was alluding to, or have livestock assets or other fixed assets. So it's worthy of study to figure out what they're doing with it.

AUDIENCE: And sometimes the idea is there's a reciprocity, and the gift that I give to my buddy in the next village is in some sense a residual--

ROBERT TOWNSEND: Yeah.

AUDIENCE: So yeah.

ROBERT TOWNSEND: Yeah.

AUDIENCE: So yea, I guess that's what--

ROBERT TOWNSEND: I mean, the extreme versions of that would be the kids that go off to Bangkok and they send money back. Now can you distinguish they're just caring about their parents? And there's a very strong Thai tradition there. But then eventually they come back and run the farm. But it is-- it's a real incoming flow, so we have to do something with it. We could just not call it equity or something, and in effect, that's what we're doing here, is just keeping track of it separately as a line item.

OK. So I guess I said this before. Oh, by the way, on the lifecycle diagrams, it's really dramatic that in the northeast, wealth isn't dropping as these guys get older, and likewise, they're not accumulating a lot of financial or real assets as they're young and getting older either. There doesn't seem to be this life cycle, and the gifts just get bigger and bigger.

You don't have to get older to get those gifts. It's the huge-- I think it's overlapping generations, essentially. It's really quite different between the northeast and the central area, and that's related, because it's kind of showing up here. So then we get to the balance of payments.

So basically, villages trade. They produce stuff and sell it and they buy stuff as inputs and by consumption. So we got sort of a trade balance that we measure. You could add in interest earnings from, quote, abroad, but it's really mostly from the same country. They're getting interest on savings accounts that they held outside the village or in those gifts again.

So you may or may not have seen this, this gets really kind of confusing the way the standard accounting is done. Trade balance plus this other earnings on gifts and interest is called the current account, and then you have the current account balanced with the financial count and the capital account.

But they didn't write current account equal financial account, so this stuff has to be-- if you're trading a lot, like China, and you have a big sort of current account, this stuff has to be negative. A negative in the financial account is actually, quote, a good thing in the sense that you're accumulating assets. But believe me, it'll throw you every time when you start thinking about it.

And then I won't drive this for you, but it turns out that if you take this sort of Keynesian-looking thing, which is really just an accounting statement, income less consumption less investment plus transfers-- that's not taxes-- has to be identically equal to the trade balance plus sort of capital account balance, which we keep track of separately, plus the change in inventories.

So largely, if they run an export surplus, they're going to save it, but not quite. Because they have other ways of saving, you have to adjust for changes in the capital, buying and selling with foreigners, so to speak, and the changes in inventory.

AUDIENCE: So the left-hand side is a financial account in this case?

ROBERT TOWNSEND: It's not obvious how you get from this to this. And I decided not to try to derive it today. But it is an identity. One follows from the other. And here, the balance of payments accounts for these villages, mostly this story is they're running surpluses. The trade or trade and current account is this blue or blue-red stuff, and-- although here you see a difference. Chachoengsao's getting in trouble, its balance of payments is going down in the sense that it's running less and less of a surplus. Whereas Lopburi is the other story. It's always increasing.

The difference between red and blue is basically the gifts that play a big role in the northeast. And here's an instance of Buriram coming off the financial crisis, which was 1997-98, but anyway, they actually ran a balance of payments deficit. So this opens up the whole vista of international economics and what's going on using those kinds of ways of conceptualizing the problem.

And just to remind you, because I promised an application for each section, we've had tons of models of the role of financing constraints or other obstacles in growth and TFP and so on and so forth. So here's just some model with arch where we do the following.

We take these villages to be small open economies, we see a drop in the interest rate-- it's actually true worldwide-- and we see the number of new loans increasing this has to do in part with this village fund stuff that we'll talk about later the Million Baht Fund in Thailand. This is the collateral constraint-- this is a model thing.

So we're going to act as if that innovation associated with more loans was like a weakening of the borrowing constraint and feed it into a model, and it's a trade model with financial underpinnings, and it predicts things like the relative price of agriculture relative to manufactured goods. In the model and in the data, we're kind of close. And a real goal was to try to get the wages right, and here is the actual and model-driven real wages. Why is this a struggle?

If you think about Heckscher-Ohlin, that has to do with the area around Bangkok being very capital-intensive and not having so much labor, so interest rates are lower and wages are higher; in the northeast, it's the other way around because capital and wealth is relatively low. So you think that over time you're going to get convergence, which means wages ought to be dropping in the central area, and they're not. So then you introduce this financial constraint, and you get the dynamics that have to do with choosing occupations and so on.

So that hopefully you remember enough from the other papers that we covered to kind of imagine how one would fill this out, and we're actually at these calibrated values-- we're actually matching quite well all the income shares for wages, manufacturing, and agriculture. Yep?

AUDIENCE: I might remember wrong, but just-- yeah, it's very likely, but in your paper with Kaboski on the Million--

ROBERT TOWNSEND: Baht Fund, yes.

AUDIENCE: Is it the interest rate wasn't going to be with the intervention, was it? Now you just said that the interest rate drop has to do with the Million Baht--

ROBERT TOWNSEND: Remember, what we're doing is kind of a variation in the cross-section as a function of the percentage of households in the village. So the per-capita treatment is we're seeing whether that has any impact on the interest rate. What I showed you was the time variation in the interest rate, so it's a very different object.

AUDIENCE: OK.

ROBERT TOWNSEND: Yeah. So that's kind of like differenced out, basically. It's the relative difference from the trend and whether the Million Baht Fund had something to do with it. OK. The last thing is flow of funds. These are the flow of funds accounts for Thailand, basically. A quick introduction to flow of funds, you've got non-financial corporations, financial corporations, government, households, and not-for-profit corporations, and the rest of the world. Those are the sectors.

And then you have acquisition of assets, and they're actually in detailed financial accounts. When the flow of funds accounts-- when they exist, you've got money and gold and currency, securities, loans, and so on. So acquiring a loan means basically you're a lender. On the other hand, you've got sort of liabilities down here, and so that you can have a loan which represents an increase in borrowing.

It takes a lot of concentration to constantly remember uses means putting money-- so the idea is you run-- you have positive savings, where do you put your money? And you could put it here or you could reduce your deficits, or if you-- reduce your liabilities. If you run it the other way and you have negative savings or something, and then you've got to increase your liabilities or run down and sell off some assets that you own.

These are the traditional labor labels in the flow of funds by sector. Is there a relationship between flow of funds and the national income accounts? Yes. Actually, in principle, they should all be consistent with one another. But they're often not. The thing that is most consistent is flow of funds into and out of the financial institutions because commercial banks and other financial corporations are required to report to regulators, and the central bank keeps track of things.

So we see most accurately deposits coming in, loans going out for financial corporations. We often see little or anything of the transactions between the other sectors. There are national income and product account for those sectors, and we see, therefore, savings for those, but those savings numbers are often radically different from the savings we would impute from just seeing transactions with the measured formal financial sector.

Another way to say this, if you read Deaton and so on, the savings you see coming from household surveys gives you very, very different numbers than the savings you'll see at the level of the national income accounts, and that's because the measurement is missing, so households get treated as the residual in the national income accounts.

But flow of funds data do exist, and to some extent, they can be created, and Thailand is, for example-- and Mexico-- creating improved financial flow of funds accounts. I'd like to think we had something to do with that. We can also do it at the village level. I've shown you a lot, but let me just jump here.

At the national aggregate level, these are the traditional sectors, and here's a diamond, and basically you can see from the standpoint of banks, households are interior-- basically households are investing in banks, but that's a liability for the banking sector. Savings accounts are to be paid back. On the other hand, in this period between '08 and-- '04 and '08, you know the banking sector was investing in the rest of the world and that had to do with Thailand running a balance of payments surplus.

But this is at the village level. And here, you can distinguish financial corporations, transactions with businesses outside the village, transactions of the village funds we just talked about, and you can see them using currency, running surpluses or deficits with these other entities in terms of the objects.

So the point here is that it's a common way of measuring and it doesn't just have to be applied as it is conventionally at the national level. Flow of funds can zoom in and zoom out by region and tell you which object's moving around over time. And in fact, you can read it in a little more leisure style on your own, there's papers of Guerrieri and Guido Lorenzoni and Monika Piazzesi and Martin Schneider, and these are, granted, about the US, but it's basically looking at the household sector and going to the flow of funds data in the US to measure changes in savings and borrowing.

And this same language that they use to try to understand what happens in a financial crisis when all of a sudden you can't borrow as much because the banks are tight, or in Monika's case, what happens when there are many, many more young people entering and they have certain expectations about inflation, and each one of these pairs of authors is doing this kind of experiment in the context of a model.

So these very same models that rely on a sort of macro-aggregate looking, though, at sectors in the US also apply to developing countries. In fact Guido's model is eerily similar, although none of us recognized it at the time, to the model that Joe and I used to analyze the village fund in in Thailand.