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AGRICULTURAL MARKETS AND NUTRITION

OPENING REMARKS

Eeshani Kandpal: I will be your emcee for what remains of this conference, which is two very interesting panels and a concluding fireside chat. Let's get going with today's agenda. The first session, which I'm delighted to be moderating, is called Agricultural Markets and Nutrition. This session asks a question that is deceptively simple, perhaps, which is, how do agricultural systems interact to shape nutritional outcomes? Where do markets succeed or fail in delivering not just calories, but health and opportunity? And importantly, how can public policy bridge the gaps? Look, I'm not going to chair a session today of all days, this week, of all weeks, on nutrition and not talk about the situation in Gaza. We're not going to address it. The research that's going to be presented today is not really going to address these questions of political economy and of moral correctness and ethics and humanity. But I did just want to acknowledge that is underway, and that is very directly related to, at least some of the research we'll be talking about in terms of the outcomes, but the processes that are leading us to where we are in Gaza are very different from what we're going to be talking about, what the panelists are going to be talking about today. Just to acknowledge that.

These questions are technical. They're also moral, obviously, not only in the humanitarian crises that I just talked about in Gaza, in Ethiopia, and elsewhere. In fact, some of the research today that will be presented is about a similar situation in moral dimensions, to some extent, in Ethiopia. But this is a world where nearly, I think, one in ten people are undernourished, and the vast majority of them live in low- and middle-income countries. Healthy diets remain unaffordable to many in low- and middle-income countries. Understanding how agriculture markets shape food access, how they shape nutritional outcomes is essential, even if it is, as I just acknowledge, part of the picture. This isn't just about the yield in supply chains. It is fundamentally about who eats, what they eat, and what the impacts are on not only them, but the future generations as well, as research will show on this panel. And we know that these dynamics are shifting, that climate change, the conflict, of course, that global price shocks are disrupting supply chains in ways that amplify existing inequalities. At the same time, we don't have to be all gloom and doom, I suppose. New data sources, innovations and measurements, and really rigorous smart empirical work of the type that we're going to see today are opening the door to better policy making, and that should give some hope.

This panel reflects some of the urgency that I talked about, but also the possibility of opportunity. We have four outstanding presenters. We're going to present work that spans theory, data, and policy, each presenting a different piece of that interlocking pathway that goes from agricultural systems to nutritional outcomes, including succeeding generations. First up is Chris Barrett, who is the Stephen B. and Janice G. Ashley Professor of Applied Economics and Management at Cornell University. He will provide a broad overview of agriculture markets in Sub-Saharan Africa. He is going to build a whole body of his work, which really highlights how persistent structural challenges coexist with areas of real promise in a region where agriculture remains central to livelihoods, and this is something we touched on yesterday, as well as [unintelligible] security. Next up will be William A. Masters, who is a Professor of Food and Nutrition Policy and Programs as well as of Economics at Tufts University. William will explore how we measure poverty or how we might measure poverty through the lens of diet costs and diet affordability, but not just calories, but also diet quality, crucially. Offering a nutrition-sensitive perspective that I think is really important to inform, again, the conversations we were having about poverty and poverty measurement earlier in this conference.

Then, Kibrom Tafere, who is an economist in the World Bank's Research Group, will present his work on early childhood shocks and their intergenerational impacts. This work shows that early life adversity leaves a lasting imprint, not only on those who directly experience that adversity, but on their offspring as well. And last but not the least, Kathy Baylis is a Professor in the Department of

Geography at the University of California, Santa Barbara. She will present work on the impacts of food subsidies for both producers and consumers. This is really interesting, cool work that links the two parts of that puzzle, focusing on child nutritional outcomes as the key indicator. Each speaker will have time to present their work, and then that will be followed by some Q&A. I really encourage you to engage actively and thoughtfully when we get to the Q&A. So, with that, Chris, over to you.

OVERVIEW OF AGRICULTURAL MARKETS IN SUB-SAHARAN AFRICA

Chris Barrett: Thank you very much, Eeshani, for the generous introduction. It's a pleasure to get to lead off because coffee hasn't kicked in, so you can't attribute whatever feeling of sleepiness you might have to my slides. Eeshani asked me to give a broad overview, so I will do that. The big changes in low- and middle-income countries come from a range of different things, some of them horrific—climate change, conflict, etc. But much of it is the natural process of economic development. I will try to walk you through a very broad overview of what are the mechanisms through which the transformation of markets, agrifood markets, I'm going to refer to them this way because I want to talk not just about the commodities produced on the farm, but equally the foods people eat and the transformations that happen in between. I'm going to talk how the transformation of markets, agrifood markets, ultimately affects nutritional transitions and nutritional outcomes, with an emphasis on what's the research agenda going forward. I'm trying to position this, hopefully to inform some of the younger participants in the conference on a research agenda. I'll start with rather familiar, indeed, fairly old ideas that are nonetheless very salient today, and transition towards newer things where I really think the possibilities for policy-impactful research are quite significant.

It helps if I turn on the remote…

The first thing to keep in mind by way of broad framing is these structural transformations are very broad. This goes back at least to Lewis, Rosenthal, Rodin, lots of early thinkers as the post-World War II era of independence. Decolonization began to liberate countries from the yokes of colonialism and opened up new opportunities for independent economic development. The narrative here is very familiar. Most people think of this in terms of a very heavily agrarian population, where transformation in the form of improved agricultural technologies begins to free up labor, investible capital, promote demand for non-food, non-agricultural products, which ignites the familiar Lewis process of structural transformation. And with that comes rural to urban migration, and importantly, a very big dietary transition. I'm going to be focusing on how the market transformation is associated with, potentially causally, the dietary transformation and the manifestation of nutritional outcomes. A key part here is to recognize that structural transformation and markets development, the shorthand I'll use, are highly correlated. They are bidirectionally causal. It's very hard to separate that out. Frankly, I'm not sure that's an especially productive project.

But the key things behind it are the improved physical and institutional infrastructure. And that will matter because, as I'll talk about, you're going to see the transformation of farmers becoming consumers. But that requires evacuating products that you grow and being able to have low-cost import of processed products that farmers are buying in rural areas. But the institutional environment matters a lot, in particular product standards, as I'll come to a little later. All of this goes hand in hand with increased spatial and intertemporal market integration, which matters a lot because one of the disturbing features of nutrition is that our bodies actually require key trace elements with high regularity. The annual average or what you get over a period of five years in a panel dataset, your body doesn't really care. It cares about if you are getting essential nutrients roughly each week. It depends a lot on the nutrient. So that's the big picture setting. I'm going to talk about four specific mechanisms involved in market-mediated nutritional impacts. And by market-mediated, I mean the transformation of agrifood markets. The first and most familiar and obvious is income. We'll then talk about prices, both overall real food prices. If we create a composite, what happens as real food prices change? But then in particular about relative food prices

because nutrition doesn't come equally from all food groups. We will then talk about product variety and composition and risk management. If you want a quick, really nice summary of this, Will has a really outstanding handbook of Agricultural Economics chapter with some co-authors just a couple of years ago that walks through many, not all of these topics. That provides much more detail that I'm able to give you in a few minutes.

The first mechanism by which improved market integration, improved market infrastructure, the promotion of engagement, the transition from semi-subsistence to fully market-engaged production by a largely growing population, the first mechanism by which that impacts nutrition is income effects on the farm. Farmers, net sellers, at least, are making more money because they are able to sell more at higher prices as the transactions and search costs of market exchange fall, but also the pass-through effects on labor demand and farm workers, both employment volumes and real wages commonly go up, and we see urban-rural wage convergence. This is a big effect because obviously, starting from low income, the higher people's income given angle curves, you see a significant increase in food intake with generally improved nutritional outtakes. And I emphasize generally, because we'll come to some refinement, some nuance shortly. You see this in lots of places. Ethiopia, I have a picture of the Ethiopian Commodities Exchange, pricing board in a distant, dusty town in Southern Ethiopia, Yabelo, that I took years ago, tea pickers who demand for whose labor is increasing, and you can see evidence of improvements in their nutrition, advancements in the infrastructure for small dairy farmers in Madagascar that enables them to evacuate product, lots of different mechanisms. Bottom line is income for farmers and farm workers grow, their nutrition improves, especially when it starts from a low base. One of the reasons for this is, as their incomes grow, people want a more diverse diet. One of the defining empirical regularities of low-income smallholder agriculture is a relatively monotonous diet. So that diversification, which is commonly referred to as Bennett's law, is surprisingly understudied. Eeshani has a nice working paper on this, by the way, that those interested in Bennett's law might want to check out. But that diversification doesn't imply farmers have to diversify. Indeed, one of, I think, the under-recognized empirical regularities of structural transformation is how fast smallholder farmers become food buyers. We see here data from the nationally representative household surveys in Vietnam from '92 to 2016 in a paper Yanyan Liu from IFPRI led. The striking thing here is that in 1992, Vietnam was essentially the equivalent of Liberia today. It was a very low-income country, a very rural agrarian country. Roughly half of the food expenditures by farming household, so this is just farm producers in Vietnam, roughly half, even at that very low level, were purchased. So, 50% auto consumed, 50% or 49 % purchased, 51% auto-consumed, meaning self-provision. But by 2016, one generation later, 80% almost of the food that these farming households, averaging about a hectare in rural Vietnam, the vast majority of their food was purchased. Markets are becoming salient at a very early stage to the nutritional status of even small farmers in low-income and lower middle-income countries. And we forget that at our peril because markets matter a lot. The channels through which people access their food matter a lot, not just to the income they earn from farming. One of the implications of that is there are a lot of people who need to get products, get food, to people where they buy it. Very few people interact directly with farmers to purchase products, whether it's transport, storage, especially transformation, food service. The employment, the income effects that come out of the post-farmgate value chain are huge. A group of us published some estimates globally, roughly 73% of the value-added in consumer food expenditures globally comes post-farmgate. We'll put differently, roughly a quarter of the value of what the average consumer in the world is spending is flowing back to the farm. And that is shown on the left in this graphic. That's true even in middle-income countries. That's true in India. It's true in China. So, it's obviously true in the US. And this share falls steadily with economic development. What is perhaps less obvious, a group of us have a paper, we are just doing proofs today or tomorrow for nature of food, where we've built a global dataset on employment and average compensation by industry, country, and year around the world, showing how jobs transition in the agrifood value chain. Those who are interested, the datasets are available through the IFPRI data verse. But what you see here is the rapid decline in employment in

primary production and how quickly people begin moving towards food service and retailing in particular, but equally the convergence in compensation across sectors, which you see on the right. The key thing here is off-farm jobs pay better. They're safer and they pay better. So, this transformation, people leaving the farm and moving into the downstream processing and transport and food service and retail sectors leads to income growth, which also has nutritional implications, one that we haven't yet really studied very well.

There's a real food price channel, and I'll skip through this because I think this is pretty familiar. But as agricultural productivity grows, you typically have—because of our natural satiation, our bodies can only absorb so much food intake, we are typically quite price inelastic in demand. The result of that is that as the supply curve shifts, prices typically fall fairly steeply. Most of the gains that accrue from agricultural technological change in food commodities accrue to consumers as consumer surplus, much of it in nutritional form. Robert Evenson and Douglas Gollin established this long ago for the Green Revolution, and there is lot of other evidence behind this. But the key here is this is a real food price effect that enables consumers to just buy more given their income. And coupled with higher income, allows for a choice of a more diverse diet.

One thing we have spent less time looking at is technological change is not equal across commodities, and income and price elasticities of demand and cross-price elasticities of demand are not uniform across food products. We are just starting to appreciate how differential investment in R&D, for example, in staple tubers and cereals, has probably preferentially advantaged starchy sources of calories, with the effect that the cost of vegetables, fruits, nuts, and legumes for the average consumer has gone up appreciably compared to cereals-based products, which induces change in diet. We know from, for example, David Atkins' work, that exposure to low-cost diets creates a cultural cuisine effect. And people take that with them. As they migrate, they remain wedded to diets that were affordable and familiar and preferred by their population with significant consumer welfare costs. This habit formation effect helps to lock in the differential advantages. An implication here is the need to reprioritize our R&D. And we have some natural obstacles to perishables in general because of added cost in the value chain. But one implication here is continued pure focus on staple cereals may not be adding much more are at the margin to nutritional advances.

Now, let me just wrap up with the things where I think we really need to learn more. One of these is, as people diversify their diets, product quality matters a lot. But product quality is largely a credence attribute. Very few people have any idea what the nutrient content of their food is. And part of that is because very few people read the labeling, and the labeling is often not particularly informative. One thing we know is that you have a series of trace minerals that are really important to human health and nutrition, iodine chief amongst them. Many people don't know that the leading cause of preventable intellectual disability in the world is iodine deficiency still. It costs roughly a penny per day per person to iodize salt. It's incredibly cheap and very effective. Yet most countries in the world, including the United States, by the way, do not have mandatory iodine fortification of salt. This is at some level crazy. The public policy implications of thinking carefully about where in the value chain is it best to improve micronutrients, mineral vitamin content? Is it biofortification of germ plasm so people grow crops that naturally have adequate zinc content, for example? Or is it industrial fortification? Or is it dissolving iodine in irrigation water? Because the iodine comes mainly from marine sources.

I really encourage more work on thinking about these questions of where, especially post-harvest, it is most cost-effective for us to improve nutrition. And part of that then turns on the incentives for processors. Right now, some processing is hugely helpful to nutrition, like iodine in salt or folic acid and zinc and iron in vegetable oils or flowers. Some is literally lifesaving. If we could get ready to use therapeutic foods into Gaza, you would see a lot more Gaza young children surviving this current crisis. We can't, for political economy reasons, but this is literally lifesaving food manufacturing. But an awful lot of it is not lifesaving. It's adding things that appeal to our sensory receptors, make

things smell good, look good, and particularly taste good, or it helps preservation. And many of those have very adverse health effects, adverse nutritional effects. Product standards help, but they have to be enforced. Industry standards commonly long predate government standards. [Unintelligible name] has some nice work showing this over the years. This is an area where economists could usefully focus on: What does it take to induce firms to do the right thing? To do the right thing in terms of nutritional quality of food rather adverse quality.

The last two brief topics, one is public procurement. Governments are big buyers of food. Governments typically have statutory provisions to buy from the lowest priced qualified bidder. I'm doing some work with the State of New York, which buys about $1.3 billion of food every year for schools, prisons, hospitals, etcetera. How do you get them to consider the spillover effects of the foods that they are purchasing? We developed a tool that we think does this for economic multiplier effects, environmental spillovers, where there is a good scientific basis, a little bit on prison labor for some social justice and subsidization issues. It is much harder to do this for health and nutrition because a single food item doesn't tell us much about overall diet. And overall diet is what drives nutrition and health. But this is an area where we need to make progress because we need to leverage the power of large buyers to set standards that manufacturers then need to meet to get a big market because the standards they meet in the processing for supplying a huge contract to the state of New York wind up being the standards they are using in the product that they sell through the retail value distribution system. We can crowd in better behavior as the hypothesis. But frankly, we have no idea if this actually works. This is an area where I think there are a lot of possibilities, especially in the developing world.

And finally, risk management. We know that the frequency of intake of key micronutrients is really important to health and nutrition. We know there is a lot of seasonality in diets, although that's become appreciably less in the high-income world as panseasonal availability of fruits and vegetables becomes pretty universal. A woman in a winter coat shopping for fresh citrus is pretty clearly not local citrus. These marketing channels enable us to access key sources of micronutrients year-round. That is not universally true in the low- and middle-income world yet, obviously. But it is also important to recognize the important role that markets play in helping to smooth out the fluctuations people have in access to key nutrients. Part of this comes by just stabilizing incomes because financial markets don't develop as fast as commodity markets do. People turn to commodity markets in place of credit and insurance oftentimes. They sell when they need cash. And that enables people to smooth fluctuations. [Digvijay Negi] at Ashoka University is doing some work on this in India right now. This, too, is an area where I think as high frequency data are emerging, the Bank is really leading much of this, drawing out more on what are the nutritional implications of the intra-annual variation in incomes and occupational transitions will be very important. To summarize, market shifts have lots of implications through multiple channels: income channels, price channels, product composition/quality channels, as well as risk transfer channels. There's a lot of scope for policy-relevant research there, especially in those latter topics I was raising. I really encourage, especially earlier career folks, this is an exciting agenda, and it's one where you have a natural audience of policymakers. They really do care about these health and nutrition implications of markets development. Thank you. I look forward to hearing from the other speakers.

Eeshani Kandpal: Next up is William A. Masters, but just a quick reminder to our virtual audiences that you can submit your questions. There's a Slido link. Sorry, I keep calling it Sligo because there's a creek around here called Sligo Creek. There's a Slido link, and we will be monitoring those just like yesterday. Feel free to contribute your questions that way. Will, please.

POVERTY MEASUREMENT AND THE COST OF HEALTHY DIETS

William A. Masters: Thank you, Eeshani. This has been a treat of a conference, really. Eeshani asked me to follow up on Chris's overview and lead into Kathy and Kibrom's descriptions of social

protection interventions and how those matter for people. By thinking about how this work on the cost of healthy diets informs poverty measurement and the social protection response to that, as well as the agricultural nutrition kinds of changes that Chris talked about.

So this comes from what's been, for me, 15 years of work, having moved from agriculture and development economics into a school of nutrition at Tufts University on the Health Science campus, surrounded by people who do nutritional biochemistry, who do clinical practice and dietetics, international nutrition, developing those ready to use therapeutic foods, things that Chris described, as well as people doing public health policy and messaging. In 2010, I moved to this school of nutrition, surrounded by these nutrition scientists, and began to do the work that is in the book that Chris—the literature review that Chris mentioned, we produced this book called *Food Economics: Agriculture, Nutrition and Health* linking food supplies to the health outcomes that we see in high income countries and low income countries. Thanks to being part of a project funded by the Gates Foundation called the Global Agriculture, Nutrition & Health Academy, it is now the world's smallest book. It's open access. On the book table over there, there's business cards with a QR code. If you are curious about this agenda, about thinking about agriculture and development economics, food systems in terms of health, that might be a helpful resource for you. One aspect of this agenda began nine years ago when Yan Bai, who's now here in the room and at the Bank, came from a career in banking and economics to think about food and nutrition and health outcomes, working with me and a number of colleagues, initially in Ghana and Tanzania, and then across East Africa—colleagues in Malawi, in Ethiopia, and then West Africa, Nigeria, work in South Asia as well, Pakistan, Bangladesh, and elsewhere in India—to think about this project that we now call Food Prices for Nutrition that matches the retail cost of the items at the end of the value chain that Chris described in terms of their nutritional composition and the health requirements for an active life over the lifespan. So, development *in utero*, infancy, as Kibrom will talk about, intergenerational effects, and think about how those can be measured in this cost of healthy diet's agenda. By a coincidence, next week at this short URL, worldbank.org/foodpricesfornutrition, that redirects to the Development Data Group's effort to take the available prices and construct an indicator of food security that correctly, as best this health science community can tell, reflects the requirements of a human being for an active and healthy life. So, food systems and agroecological environments are drastically different around the world, but once people chew and swallow food, inside we are pretty similar and have a set of health requirements that we now cost in this way.

This new data has changed the conversation. This is Google ngrams data in which Google has violated copyright and scanned and digitized vast amount of English language—both professional documents, the gray literature, as well as books and journal articles—taking the frequency of these four or five-word phrases compared to all other four or five-word phrases. You can see on the left axis, these are very small shares of the total English language literature says cost of healthy diet, it's not very much. But from 2010s, early 2010s, people were talking about this a little bit. But once we could measure it, people can really use it for the policy-making agenda that Marcus talked about in terms of the relevance of work to these stakeholders in government regarding social protection, agriculture, and health.

So, what do we do? The slide is a bit dense. I'll walk you through it. This new data is called the Cost of Healthy Diets—because in the UN system agencies, they love acronyms. You might have noticed that. In this political process of developing a metric that would reflect policymakers' desires, we ended up with this acronym—Cost of Healthy Diet, CoHD—focusing on access, whether the food system was making it even possible for people to meet their health needs, measuring access to a healthy diet in contrast to the actual foods that people consume. Prior price indexes, consumer price indexes, world trade, world food prices that measure commodity prices, those use very different weighting systems. You understand consumer price indexes is shared by actual expenditure, so there's sugar-sweetened beverages and chips and all those foods. Food price indexes, producer price indexes, those are about bulk commodities.

Then food security metrics do very different things. Since 1974, the FAO and UN agencies measured hunger through this prevalence of undernourishment metric that is based on a method introduced by great Indian statistician, P. V. Sukhatme, in the year I was born, 1961. Talk about influence of these great Indian economist statisticians, developing a metric to take these early food balance sheets and all the foods have actually produced and consumed—whatever they might be—, and just add up, if they were distributed abnormally, would you meet the daily energy requirements? And that's now about 9% of the world's population—according to that method, developed by Sukhatme in 1961, then implemented in the 70s. Since 1995, USDA and then UN agencies, the FAO, have used this experience of food insecurity metric that asks people, did you go to bed hungry? Did you skip a meal? Did you eat less or other foods due to lack of resources to either grow or buy your own food? That's about 25% of the world's population. What we do now is using economics in the context of a nutrition knowledge to use economics to say, well, what is the least expensive that would allow people to meet their other goals, saving money for education, health, all their other goals as a household, if they were to meet their nutritional requirements—what would be the least cost item by food group, as I'll show you, in dollars per day? It's a price index calibrated to the heights and weights of people and how much you need of food per day. Since 2020, the World Bank Group and FAO began to develop these metrics. Since 2022, the current method is used. That's about a third of the world population cannot meet these needs. You can see how we're moving towards a higher bar, defining food security closer to the aspirations of society as poverty reduction occurs around the world, and you can hope for something better into the future. In particular, this is a metric developed in a health science context. It's a diagnostic metric. It's doing differential diagnosis to identify what are the causes of the poor diet qualities we observe. Is it high prices for these essential foods that you would need for health? Is it that prices are what they are, but incomes are too low to afford those? Or is it that these healthy items are available, but they are being displaced by other reasons, as Chris suggested, by the marketing of very attractive foods with convenience, with taste attributes, with the perishability, the package-processed foods that are convenient, and so forth—what's going on to cause the poor diet quality?

So what do we do? We tie the available data on locally available items being sold, we match them to the composition of that item in terms of food group requirements as specified in dietary guidelines. On the right of this, you see the food guide, the pictures from the official government documents defining what a healthy diet is in a country from each of the UN regions, assembled to represent the concerns of policymakers and define a healthy diet as done by national governments in each UN region. For the SOFI 2020 document—the State of Food Security and Nutrition in the World, formerly State of Food Insecurity, hence the acronym SOFI—we use the median cost of these 10 quantified guidelines, the ones you see on the right. For 2022—working closely with the Development Data Group of the World Bank Group to ensure that it was reflecting accurately what the international comparison program individual item prices were showing—we introduced this healthy diet basket developed by my colleague, Anna Herforth—a nutrition researcher, very close contact with the nutrition communities across the UN agencies, World Health Organization, UNICEF, as well as World Food Program and IFAD—to have consensus around a way to think about affordability that would work.

National governments doing this monthly in each region of the country—Nigeria was the first, I'll show you those results. Malawi also uses this international standard, the healthy diet basket. Ethiopia, Ghana, Pakistan use their own dietary guidelines. You can see this method is flexible in responding to the needs of policymakers. This table shows you what this healthy diet basket consists of. There are six food groups, nutritionally defined. In the category starchy staples, for example, in many country datasets, you would find potatoes as a vegetable, but we classify that as a starchy staple. Similarly, in fruits, you might find tree nuts as a fruit, but we classify that as nuts and seeds. There is a classification agenda here. There is a food composition agenda to make sure you are tracking the actual caloric value of these foods and the result. Our discovery is that the red dots

here, from low to high income, the cost of these least expensive items to meet a healthy diet is between $3 and $4 a day. The total range is roughly a two-fold variance, whereas the actual food consumption in the blue dots is much lower than that in the low-income countries. They could not possibly afford this healthy diet cost. But in high-income countries, middle-income countries, and higher-income countries, you see China and India, the large dots in the middle, at that inflection point where actual expenditure begins to exceed this minimum threshold, this minimum floor. To track affordability, this negotiated process of coming up with a metric of what would people need starts with these World Bank Group poverty lines for each income group. The UN agencies wanted to have that as their standard for what then non-food spending would be. So, working with the poverty inequality platform to get income distribution and ask what are the low income, the second quintile or the first quintile in some countries of people are spending on non-food shares, and that leads to the required non-food spending. You add that to the $3 to $4 a day, and you get, could people afford a healthy diet? So, what does this show us? Comparing the new to the old metrics of food security. What we find is unaffordability is just a much tighter metric from a development economics perspective. It's more closely aligned with what we expect to see. It's a metric that is founded in fundamental biology and track some—it's based on some economic principles that turn out to give you a better metric.

I'll jump over some of that comparison to show how it plays out in practice in Nigeria. What you see is that Nigeria, the National Bureau of Statistics doing this with data from 2016—you get a very different picture when you look at these least expensive items for an overall healthy diet. Pre-Covid, these items in the Nigerian context—Nigeria was growing. These items stayed low cost. Then during the Covid period, you see the cost of a healthy diet rising at the same rate. And then during Nigeria's crisis period, when it's banking crisis, its exchange rate crisis, drove the price of these low-cost basic commodities through the roof—that led to just a huge political crisis. And the statistician general of Nigeria, Prince Adeyemi, as a new statistician general in the new government, was very keen to publish the best available information about Nigerian economy for a variety of reasons. You see them doing this cost of a healthy diet. And this publication, a monthly bulletin about these low-cost basic items, you see the list there, was just enormously interesting for civil society to think about. In the bottom right, you see how this informed how trade unions were talking about what a living wage is. What does it mean to have a dignified life in the Nigerian context? You should be able to buy enough of these items on the left side of this picture in these quantities to feed a household. I want to just end by turning to sustainability. This economics approach of the least expensive items in these food groups to give you a benchmark access to a dignified diet turns out to be the least emitting items as well. Less land use, less feed for livestock and so forth, but not necessarily the least nutritious. Using these benchmark least cost diets does provide a very interesting new idea about what the food system is doing. Just to conclude, about a third of people in the world cannot afford this basket of items. That's because they are just more costly to grow and ship than basics. But even if healthy items are available, that doesn't mean people eat them. Many factors beyond health drive food choice, you can't tell. Even without the food system transformation, people overshoot on basically fried meat. I don't know if you ever tried it, but it's really good. And then, of course, switching to food service package foods. That's another huge agenda of harms that Chris talked about. So, calculating this new indicator from the underlying prices that you get in the international comparison program or national consumer price indexes, it reveals something very profound that's new, that's relevant, that's interesting. And having done this in close collaboration with the colleagues in the countries that I mentioned has made a big difference in thinking about how innovation can work in these countries. What are the firms doing this work? What are the regulatory environments that might matter? I'll just conclude by saying this is funded by the Bill and Melinda Gates Foundation in collaboration with the UK government. And I hope you pick up a card about the book to see how this, in the context of other work, helps to think about how agriculture works for human nutrition, as you'll hear from Kibrom at the end, inter-generationally, and from Kathy now. Thanks.

INTERGENERATIONAL EFFECTS OF EARLY CHILDHOOD SHOCKS

Kibrom Tafere: Hi, everyone. Thanks for the invitation, Eeshani. I'm honored to share this stage with my mentors and friends and collaborators. So, today… Perfect. Today I'll talk to you about intergenerational effects of shocks focused specifically on the early childhood stage.

My presentation will have two parts. The first part gives you a broad overview of the literature, and then I'll spend a few minutes talking about my own work, which is on the 1983-1985 Ethiopian famine.

Okay, so I have a very busy slide for you here. To get us started… Oh, this is an old… Yes.

Eeshani Kandpal: No good conference without some technological glitches. I'm not going to stand here and tell jokes the entire time. But I did want to tell one, which is just as a segue to Kibrom's intergenerational transmission. P. V. Sukhatme reminded me, I was actually taught Development Economics as an undergrad by his nephew, Vasant Sukhatme. There you go. That's my joke. They're still looking for slides, but he'll be back.

Audience: You have only one minute left.

Kibrom Tafere: Oh. Okay, so these are the updated slides I wanted to talk about today. Let me quickly move through. Again, another busy slide. By way of motivation, I'll start by saying that shocks experienced by individuals during the *in utero* period in early childhood can have significant consequences to themselves and their children. This is especially the case in developing countries where we have market failures of all sorts, credit markets, insurance markets, and households lack resources for self-insurance. You can review Chris's several papers on credit failures and insurance failures in developing countries. The effects of shocks are transmitted through a variety of mechanisms, including biological, which covers the health and educational aspects of exposure to early shocks or behavioral elements in which parents or individuals who experience the shock invest less on education and last epigenetics, which covers the genetic expression of heritable genetic features.

Why does this matter? Exposures to adverse conditions in early childhood can impair health and economic outcomes throughout one's life, and it affects human capital accumulation and earnings in later life. When early life shocks affect, especially the next generation, we are dealing with structural problems that persist across the generational line and lead to intergenerational poverty and inequality. It's important to understand how early shocks affect generations within the generation and across the generational line.

Let me first walk you through some of the canonical literature in this area. Doug Almond's 2006 Journal of Political Economy paper is foundational in a sense that it led to a wave of research in economics, public health, and demography on the importance of the fetal origins hypothesis. It also sublimes that exposure in early childhood, especially in the *in utero* period, can have long lasting implications decades later. Case and co-authors link socioeconomic status to later life health and labor market outcomes. Almond & Curie's 2011 Journal of Economic Literature paper provides a comprehensive review of the literature on the fetal origin's hypothesis, and more importantly, starts a new discussion on possible pathways, importance of stages in the developmental cycles that are critical for the impacts of this shocks, as well as potential social policy interventions that could mediate the long-term impacts of early exposure. And a more recent paper by the same set of authors and their co-author, Valentina Duque, updates this entire literature on the early life origins of adult outcomes of human capital. Tom Vogl is probably here. I forgot to cite your paper here.

The evidence from the low-middle income countries, for the most part, is primarily focused on generational impacts. For example, the very famous work by Maccini and Yang shows that rainfall in early life affects adult outcomes in Indonesia. And an important work by John Hoddinott and co-authors shows that nutritional interventions in Guatemala improved adult wages. A work by

Sonia Bhalotra and Venkataramani shows that this is burden in India as it affects learning outcomes later in life. Our own work, actually, we have listened to Chris's suggestion earlier, and Will and I put together a quick paper a few minutes ago, and that's the last paper you see here. The Alemu and co-authors' paper looks at the effects of iodine deprivation in early childhood on later life, schooling, and health outcomes. I'll briefly talk about this paper. In this paper, what we do is we use the Eritrean-Ethiopian war in late 1990s as exogenous source of variation to try to understand how deprivation of iodine in the early developmental stage affect later life outcomes. Basically, we combine a university entrance exam with soil iodine content. To give you an idea of what this is, just a brief idea of what this is about, I want to go back to Chris's earlier point that iodine fortification is the cheapest way of getting iodine in human body. During the war, Ethiopia lost its access to its single and only iodine fortification plant because of the war. For a few period of years, much of the soil that's available on the market was not iodized. As a result, humans, at least during that period, would have to rely on access to iodine through their food, which for the most part comes from the soil. We collected a sample of soil iodine content throughout the country, and we use that as exogenous source of variation to try and see how iodine in early stage affects later life outcomes. And we show in this paper that it affects the performance on high-stakes university in entrance exam. It reduces performance at that stage between 0.3 to 0.08 standard deviations, which is at the margin really, really important. As mentioned earlier, these studies are more generational long-term effects. These are different from intergenerational. Now, there is growing evidence on intergenerational effects of shocks.

The first paper I refer to here is the paper by Cheng and co-authors in China. They used the Chinese great famine from the 1959 and 1961 period to try and see how that affects later life outcomes. They show that exposure to the farm during early development affects cognitive and school achievement of children generations later. A couple of papers by Caruso, who is here at the Bank, and co-authors show that early exposure to natural disasters in Latin America lead to long-lasting effects. The biggest challenge in the developing country context is lack of data. There isn't really a lot of work on intergenerational effects of shocks. That's related to the lack of access to data, especially in Sub-Saharan Africa. I have a bullet point that probably will make Talib a bit happy a little later.

What do we know about the intergenerational effects of shocks? We know intergenerational transmission is most likely in the *in utero* period as well as the first, roughly—we usually refer to the first 1,000 days, which is the early childhood stage. Cognitive and educational outcomes are more sensitive than health outcomes such as height, vertical height. We know there is now growing evidence that there are gender-specific pathways with effects on girls having greater impact across the generation line than boys. And I should say here, the evidence on males is relatively limited. But we have now a significant body of evidence showing that the effect is primarily passes through women, because of genetic expression at that stage. Timing and severity of the shocks matter, and social protection programs can play social policy broadly defined, can play an important role in reducing the intergenerational transmission of shocks.

As you will see in my own work next, intergenerational impacts are often muted because we're trying to measure effects across the generation of the line, and these tend to be generally very muted compared to direct and long-term effects. But the effects are bigger among marginalized populations who lack access to infrastructure, for example, or groups that face repeated exposure to severe events.

I've briefly walked you through this throughout my discussion, but just to make it a bit more concrete. The mechanisms for the intergenerational transmission of shocks include malnutrition or illness during the mother's early life. From now on, I'll focus on the mother because there is strong evidence on intergenerational shocks passes on through mothers more than fathers. And this affects physical stature and cognitive ability, impacting their children. The effect on physical stature is

relatively lower compared to cognitive effects. Lower educational attainment and non-cognitive outcomes, socioemotional outcomes, such as aspirations are among those affected by exposure to early shocks. Early research points to biological mechanisms such as epigenetic. The evidence is not solid yet, but there is now growing evidence that epigenetic change influences later life's outcomes. There is also evidence that mothers who experience trauma, transversal psychological stress—this is a new study from Scandinavia that shows that stress gets passed on to the kid.

Now, let me move on to my study. This is a case study of the 1983-1985 Ethiopia famine. Ethiopia suffered a catastrophic famine during that time, which is generally considered to be one of the worst farmers' crises in the 20th century, and the peak of the famine was 1984. It primarily affected the northern provinces of Tigray and Wello. It had a broad geographic variation. I used the geographic variation in the distribution of the famine and birth cohorts of parents to see if exposure to the famine affects the human capital outcome of children.

For this study, I use the Young Lives data, which tracks children who were between six months and 18 months at baseline in 2002, over six rounds. The last round is a phone survey, the fifth round in the process of integrating. So today's presentation uses the first four rounds. Our outcome variables are health outcomes measured by height-for-age z score, standardized test scores, outcomes, schooling achievement, and emotional measures such as locus of control and self-esteem. For the transmission channel, we look at maternal height, education, aspirations, and expenditures. This slide summarizes my findings in that paper. I find significant intergenerational effects: a 1 standard deviation increase in the severity of the famine leads to a 0.08 drop in, standard deviation drop in height-for-age. At the sample mean, this translates to a 5% drop in height-for-age for children born to mothers who experience the famine *in utero* or early childhood. Similarly, we find statistically significant effect, in material may not be as big, but statistically significant effect on children's years of schooling by approximately 0.05 grades. We find negative effects on locus of control, self-esteem, and test scores, standardized test scores, but these results are statistically insignificant. Because the nature of the data is panel, we're able to establish that the effect persists across rounds, from infancy to adolescence.

The transmission channel. Basically, we find that mothers who experience the famine are shorter, and they are less educated, and they have low aspirations for themselves and their children. They have lower self-esteem and locus of control, but the latter outcomes are statistically insignificant. We don't find anything along the parental investment channel. Maybe our explanation is probably in the context we studied, women are not primary income earners or marriage market outcomes may have mediated the effects of the shock.

Policy implication. I want to start with the big picture. The big picture is that data is a big problem in developing countries. There has to be a concerted effort to invest in data infrastructure such as the LSMS data that Taleb and his team lead here at the Bank. It's just data that tracks individuals across generations, like in developing countries, and that has limited our ability to see much in terms of policy-informing research. Specifically related to this study, we find prevention is more and more effective than post-shock remediation. Thank you. Thank you so much.

Kathy Baylis: So hi, everybody. My name is Kathy Baylis. I strategically went after Kibrom, who teed up a lot of the motivation for what I want to talk about today, which are various interventions to try and mitigate the effect of sometimes some of these shocks that children are susceptible to in terms of malnutrition. So anyway, it allows me to skip over a lot of the background discussion in my first slide. So thanks, Kibrom.

So I think I don’t need to tell anybody in the room this. We’ve got a crisis in terms of malnutrition, undernutrition, emphasized by Will’s point that if a third of the population can’t afford healthy diets, this is not something that’s going to be solved overnight. So we got, again, I’m going to particularly look at the manifestation of undernutrition in terms of stunting. And I think everybody in the room here knows the definition of stunting, below two standard deviations of the median height for age.

So about 23% of kids globally are stunted, and that's a lot of people. And just to, again, riff off of Kibrom's presentation, this can have long run effects. It can have long run effects on health, it can have long run effects on terms of income, and it can have intergenerational effects. So again, this is not a short run problem. And so, in that yellow line there that I don't know if you can see very well, but it's a percent of people that are stunted in the world. We've seen this, by the way, if we track food security, it looks very similar. We had this dip up until about 2015. We thought we were making good progress. I remember teaching world food security around that time and thinking, oh, pointing to this is a big success story in terms of reducing, stunting, reducing food insecurity. But since then, we've seen an increase again, which is very disturbing.

So what can be done? Lots of stuff. Obviously, malnutrition has been quite often the argument for a lot of policy interventions on the part of agriculture. I'm going to talk very briefly about that at the end. Happy to discuss that more during the Q&A. But we've also seen a bunch of interventions in terms of social transfer. So Rema [Hanna] talked a bunch about this yesterday. Prenatal and early child support, including work by Eeshani, and improved access to nutrient dense foods. This has been a lot, particularly dealt within the nutrition literature, so less in terms of evaluating programs on that front, but although there is some work there, too. But a lot of work showing that, again, nutrient dense foods can improve nutrition, can reduce stunting. But I want to talk about food transfers, partially because they tend to get less attention, but they're widely used globally. So this is all work from the World Bank highlighting that more than three quarters of low and middle-income countries have some form of food transfer program, and this covers more than 1.5 billion people globally. So again, these are big programs, and we think they deserve to get some attention too.

So we're going to look at India, which is the biggest of these. And so, it also is facing some of the biggest problems in terms of malnutrition. So the latest data is from 2020, where we saw, I think 35.5% of kids in India are stunted. That's been decreasing, but it's still quite high. And we're going to look particularly at India's public distribution system, which is, again, the world's largest food transfer program. It accounts for over 60% of the social assistance budget of India. There's been lots and lots of work done in NREGA, and I remember when we were first sending this paper out to places, people kept saying, "Why don't you look at NREGA?" It's like, "Well, a lot of other people have." And besides, it's much smaller. This is a much bigger program. It's, once again, the most important safety net in the very recent COVID. And what it does for folks, I know a lot of people in this room know the PDS program very, very well. But for those of you who don't, it basically gives a ration of staple cereals, rice and wheat, that are sold below market price to ration card holders. And these are sold through a network of basically half a million fair-price shops. So we're going to look at that in particular. We're going to try to ask a simple question, whether this form of food transfer program reduced stunting in India. And I'm going to try to convince you by the end of this that it did. So that it, PDS, improved nutrition, that it actually also had a knock-on effect of improving income, very similar to what we've seen with a lot of other social transfers and also some conditional cash transfers, and that also was reducing risk. So thinking of Chris's four points about things that affect nutrition. We've got income, we've got prices. I can talk about that, too. So there's some evidence it might have lowered food prices, particularly during bad weather shocks. Risk, right? As well as... Now, this is the one that might be surprising. It's access to more nutrient dense foods.

So PDS has come under a lot of criticism, both in terms of whether it's been particularly effective. There's always concerns about corruption. There are concerns about quality of grains that are distributed through PDS. We heard from a lot of people said, "Oh, no, we use that for our chicken feed, basically, we wouldn't eat that," da, da, da. The high-quality grains falling off the back of a truck, that kind of problem. There's also been a lot of concerns on the nutrition side saying, "Well, what you're doing is subsidizing basically empty calories." We wanted to dig into that a little bit. What do we do? We're going to use this big expansion of the PDS program under the National Food Security Act in 2013 in India. What this did essentially was set national standards for what should be distributed, which in the program itself up until then had really been... The specific mandates had

been determined at the state level. So in 2013, national level mandates now were put in place, and the money was put behind that to try and encourage all states to come up to a minimum standard of amount of grains. And particularly, some of the things they were doing was they changed the rules so that the amount of grains should be considered per person as opposed to per family. And again, it was specifically targeting certain amounts of rice and wheat at certain prices. For identification purposes, this was in a geeky econ way, was helpful for us because what that meant is that some states were already meeting these, but some states weren't. And those states had to come up to these guidelines. However, you also saw some states overshooting. You saw some states implementing this a little later. And you might worry that that might introduce some endogeneity. There might be a reason why some states did more than what was mandated.

So what we're going to do is we're going to use an instrument where we basically say, what if all states had just complied with the national standards at exactly the time that they were supposed to comply? We're going to use that to instrument for the variation in state compliance, if you like. And what we're going to also do is we're going to use the VDSA data that Chris showed a graph of earlier, where we've got monthly level consumption data. We also have got specific household level ration card data, which is useful. So we know exactly what each household was due, was supposed to be getting. All right, let's go to the timeline. One thing to note is because these VDSA villages are rural and relatively remote, we're dealing primarily with the impact of PDS on stunting in rural households. And also, this means that our baseline levels of stunting were pretty high, so around 38%, 40%. So jump right to the punchline. Apologies, too many tables. But if you look at the top line there. So that's saying that for a hundred Rupee increase in PDS transfer, you'd be looking at a reduction in stunting of about 22%. The average increase came because of this rule change in 2013 was about 30 to 35 Rupees. So for a 30 Rupee increase, we're reducing stunting by basically 0.087 points, which amounts to about an 18% reduction in stunting. Pre-trends, because we have to show pre-trends, look pretty reasonable. We mostly found this effect in young kids. So to Kibrom's point, when you're talking about the first thousand days of life, this is when we were seeing the effect largely. Our results are in line with other work that had looked at various interventions to reduce stunting. One thing to notice, a bunch of the other work was really only finding effects when you looked at behavioral change. So we're talking about food transfers, but also behavioral change, and they saw the behavioral changes being some of the big effects. We're not looking at behavioral change. We're just looking at food transfers. Other results, we're not finding any effects on adult men. We don't find any effects on obesity. It's partially, again, we're working in a rural setting where obesity rates were very low. We do find some evidence of increased body mass index for adult women, particularly women of childbearing age, which, again, may suggest something in terms of birth weights. We were hoping to try and get into that.

So I want to spend the last few handful of minutes talking about why. So one thing is that we're actually seeing crowding in of other nutrient dense food. So basically what it seems to be happening is that people are taking the money they're saving on grains, and they're using that largely on other foods. It's not going to stock time. I mean, it's a little bit, but not as much as you would expect if you just gave people cash. So in particular, we see a big increase in terms of proteins, both in terms of lentils so it's like pulses, but also in terms of animal-based foods. And we also see some increases in vegetable and oil, etc., consumption. So just to the highlight there. So basically what we're seeing, so this is again for a 30 Rupee increase, which was consistent with about the average level of increase that we saw due to the NFSA. We're seeing an increase in consumption of about 167 calories. Notably, only a third of that is coming from PDS grain. Most of that is coming from other foods. So we are seeing evidence of this budgeting fly paper effect in terms of money that's allocated to the food budget is large actually staying in the food budget, but getting reallocated to more nutrient dense foods.

The other thing we noticed was that we were seeing pretty large effects, and we were trying to scratch our heads and say, what the heck is going on? And so, we started to look at what was

happening to people's wages, and we actually saw a notable increase in wages. We also see a slight decrease in labor supply, but that was more than made up for by the increases in wages. These are largely... Now, notably, so we dug into where this increase in wages is coming from. It wasn't coming from salaried workers, as you'd expect. It was coming largely from basically short-term manual labor, particularly during climate shocks. So we also looked at this effect during rainfall shocks, and we saw basically a more protective effect of PDS during rainfall shock. So this is consistent with what Seema Jayachandran's paper in terms of selling labor low during bad rainfall events. We're seeing that, and we're seeing this increase in PDS helping mitigate negate that. Okay.

So conclusions. I think overall, I think the implications are good, which is a little bit of good news in a period of not-so-great news. So we're finding the expansion did reduce stunting. The biggest effect on young kids did improve dietary diversity, and it had this sort of big second-ground effects in terms of wages and labor income. So that was what we were finding there. Now, we know, this is important, again, just to recap, because stunting can have these long run effects, intergenerational effects. And so, finding policies that can help mitigate that is very important. We also know that stunting is expected to increase with climate change because of the increased amount of severity of weather shocks, increased temperature, heat, and humidity. Recent work from a grad student of mine was showing five-fold implications in terms of when you take into consideration heat and humidity projections because of climate change versus just heat. So again, this is not a problem that's going away quickly. So we need to find interventions. Interventions are wide-ranging, right? And I'm just focusing in on one here in terms of food transfers, but we also know that improving public health, improving sanitation, women's empowerment, access to nutrient-dense foods, there's lots of other interventions that are useful here. So I don't want to say food transfers is the only answer. I also want to note that food transfers aren't a panacea because they can have... You worry about implications in terms of long-run agricultural production, etcetera. But in general, because we're seeing these knock-on effects, or not only, but particularly because we're seeing these knock-on effects in terms of labor income, I think these social protection programs can be really important in this context. And there's a nice piece done by McGovern et al that went and actually looked at the cost effectiveness of some of these interventions in terms of stunting and found that the cost-benefit ratios were huge. So long story short, I think this deserves attention, work on the policy front, and happy to entertain questions. Thanks so much.

Eeshani Kandpal: As the panelists get settled in, can I just see a show of hands for questions in the audience? Okay. All right. Let's get a mic over to Tom.

Tom: I wanted to ask Will about implications for this index, for this new food cost index, for thinking about nutritional poverty traps. I guess I was taught in graduate school that we used to think short term nutritional poverty traps could be an important thing. And then we figured out that calories were really cheap, and so they couldn't possibly be a real thing. And I wonder if incorporating more aspects of than just calories can lead us to think more richly about the problem.

Eeshani Kandpal: In the interest of time, we'll go a little bit over, given the slightly delayed start and the technical glitches, but no more than five to six minutes into the coffee break. Shannon, I promise. So let's do a question here. And then were there any others at this time? Okay.

Christopher: These seem such important results I was wondering how you marketed them down to the people who most need them. I noticed one of you said that Google had started searching your acronym, but was it doing that to distribute the knowledge from that to the people who need it, or maybe to big food manufacturers who may not actually use it the way you want it used?

Eeshani Kandpal: And then in the back, Christina had a question as well.

Christina: Sorry, another question for Will. In terms of, you talked a lot about the different nutritional requirements. How does this factor into in terms of total caloric demands? And does that

vary at all by modal job requirements? Does it vary at all by expectation of how much exercise will be needed on the job?

Eeshani Kandpal: Thank you. Okay. We'll come back for more. Will, why don't you start us off? The question in the middle about reaching policy audiences, I think I'd love to hear from all of you briefly.

William A. Masters: Yeah, so quickly, Tom's question about nutritional poverty traps, one really fascinating thing is that we do find pretty continuous response to improved circumstances, whether it's magnitudes of social protection, cash transfers, product transfers like the PDS, rainfall shocks, other kinds of metrics, we find pretty continuous response, actually. So we don't see those threshold effects that you would think of as a trap, really.

In terms of the question about data flowing to decision makers, we do have a pretty robust pipeline to governments now, I think, in terms of engaging with governments on these kinds of data. Of course, underlying data flows are pretty limited. But one thing we're trying to open up is the dialog with food enterprises. So what Chris described as the agenda with respect to economics of firms about incentives to improve nutritional quality.

And then Christina's point about total caloric demand. So that's mostly heights and weights. Physical activity is very important. And as far as we can tell, there are individuals and households who are doing these 5,000, 6,000 calorie days like that athlete in your college cafeteria with the two forks eating two plates of food because they've just been doing four hours of football practice. There are individuals and households doing that, but most individuals, even in low-income agrarian settings, are not actually doing that. And so, most of the variants in total caloric need is just heights and weights. It's a really striking phenomenon about the world. And there's a new paper showing that using energy expenditure from what's called doubly labeled water, that even in agrarian households, that total metabolic activity, for on average for people, at least who were studied, there's not that many of those 5,000, 6,000 calorie a day. There are, of course, some people do need to do that. The famous Heather Schofield work on rickshaw drivers and other professions, but for most people, it's heights and weights that drives total energy means.

Eeshani Kandpal: Kathy, did you want to go next on reaching policy audiences?

Kathy Baylis: Yeah, just very briefly. So we, by we I really mean my co-author colleague, Aditya Shrinivas, who's at IIM Bangalore right now. Anyway, he's been chatting a fair bit with some of the folks in the Indian government to try and highlight this. We've also done a number of local popular press things in India to try to bring this forward, but yeah, it's a very good point.

Eeshani Kandpal: Actually, if I can just jump in on that. Yesterday, after the conversation moderated by Indermit, there was an online question that came in a little too late, but that asked about budget allocation, NREGA, for instance, in the PDS, which have, at least in real terms, taken quite a sizable hit. So it's really important to reach the government with that work. Kibrom.

Kibrom Tafere: Okay, the mic is on. So in terms of policy, what comes out of our work relates to the importance of social protection programs. So prevention is the best way of avoiding intergenerational transmission of shocks. And given the instruments we have, social protection programs or social safety nets are ideal in terms of being able to mitigate the effects of early exposure, but social safety nets are expensive. So there has to be serious engagement with government counterparts, and probably the World Bank can have a significant role. Finance is a big issue for developing countries, so the World Bank can come in and maybe help institutionally set up social safety net programs, which I should mention, have been growing in much of the developing world following the COVID-19 crisis and the impacts that social countries with social protection programs experienced from having them in place before the crisis hit. So that's the direction we would take.

Chris Barrett: Yeah. So I guess two different points. One, I like to have a friendly disagreement with Will on Tom's great question about, are there nutritional poverty traps? I think the evidence on calorie-based poverty traps is pretty compelling, and you explained the narrative quite well. We don't really know much about micronutrient-based poverty traps. What we know from the public health literature is there are really important irreversibilities. Xerophthalmia, night blindness due to insufficient vitamin A intake, isn't reversible. Children who suffer xerophthalmia will have permanent night blindness. It's one of the reasons why the public health community invests a lot in vitamin A drops. We know that cretinism, the old language for severe iodine deficiency, causes irreversible loss of cognitive function. That's why the public health community invested so much in the 1930s and '40s in this country to identify the etiology of cretinism in the US population and to push hard for salt iodization. These threshold effects are one thing one looks for in poverty traps, but another is an irreversibility of state. And we do know from the public health literature that there are irreversibilities of state associated with some micronutrients. What we have no idea of is what is the right interval of time and the right level of intake. So we haven't found these thresholds yet, but we know from the health literature that they exist. So I think that's a really important question to probe, and it gets at a whole host of issues, including nutrient composition tables.

We actually know surprisingly little about the true composition of people's diets because nutrient composition tables are means from old samples in very specific places. And nutrient composition, especially of trace minerals, varies a lot based off of weather conditions and soil conditions. So we are using quite poor data to try to get at these hard defined effects in small elements and diets. But the gateway for policy engagement on this, I think, is twofold. One is safety nets, where government obviously plays a lead role. But we can't forget that the vast majority of the food people consume is coming through the commercial distribution system. No matter how poor you are, with a few exceptions, people in refugee and IDP camps, etcetera, poor people are primarily getting their diet supplied through the commercial food distribution system in their own production. If we don't figure out how to productively engage the commercial food processing and distribution and food service sectors to provide healthier food that is affordable, we will not make much progress on nutritional outcomes. They can be a force for good, they can be a force for bad. We can get salt ionization or we can get Big Macs. And I really think a big task for the economists oriented towards policy is how do we induce more of the former type of intervention from firms that are thinking about profits, not the good nutrition of poor people.

Eeshani Kandpal: Thank you. Bummer about your thoughts on the nutrient composition tables because we have been... The Venice Law paper that you mentioned, we've just drawn it thematically using nutrient composition tables, but we do what we can with the data we have. Okay, so we have time for two very quick questions. One was over here. Okay. And then across the aisle. And please be very quick or I will cut you off. And I have shown that I will cut people off.

Audience Member 1: Thank you. Great panel. The incidence of stunting is just increasing with the COVID crisis, and that's something that we need to pay more attention to. Kathy and Chris, I would like to hear your thoughts in terms of when a COVID crisis happens, particularly, the market's availability of foods goes down. From some of my own work in Afghanistan, we see households that are agricultural livestock. They're better safe. Obviously, nutrition-wise, it's low, but they have something to eat. So thinking in terms of accessibility to the market in a COVID crisis situation, how can we better think moving forward in addressing stunting across different—

Eeshani Kandpal: Got it. Thank you. And if you could just pass it across the.

Audience Member 2: Actually, my question is pretty short. I just want to hear the panel is talking about a little bit of an overnutrition issue, because today we're talking about nutrition, but the overnutrition, obviously, is one of the most important, and also very quickly increasing problems in the world, especially in the low-income countries. So just on the comments. I think especially for Kathy, Kathy, this question about interventions in overnutrition. Thank you.

Eeshani Kandpal: Just on that very quickly to note that there is also a well-documented link between early life malnutrition and later life predisposition to diseases that are often labeled overnutrition-related. Maybe let's go in. Why don't you start?

Kathy Baylis: No, great question. I admit, we've, given the nature of the data that we're looking at, which is primarily in rural areas, we punted on the... And we will look briefly at effects in terms of obesity and overweight, and just we're finding nothing. I think there is... Other than Eeshani's point that we do know this relationship between early childhood malnutrition and longer run issues in terms of overnutrition, I guess. Long story short, I don't have too much to say.

Let's see. And your question was about stunting and market access stuff. So I mean, one thing we do see evidence for is that if you've got places that are very disconnected from markets, and you see local weather shocks, and therefore, you see relatively high local price shocks, that that can precipitate stunting. And so, I've done a little bit of work in that area, but many other people have done a lot more. So that would be certainly suggestive that helping improve market integration would be useful also in terms of just getting farmers access to things like early maturing seed varieties, etcetera. So I think there is suggestive work there around that, but I'm curious to hear Chris's response.

Eeshani Kandpal: Market integration. Love that. Chris, 30 seconds, Will, 30, and then Kibrom.

Chris Barrett: Yes, so I have very little to add to what Kathy said, other than in conflict settings, really, the crucial thing is the political economy of humanitarian response. Markets work. There are traders who will always find their way into even active conflict zones, but people are increasingly dependent upon social safety nets and humanitarian response. And as we see today, that's driven much more by politics than economic analysis of where are their high returns to spending from the public purse.

William A. Masters: Yeah. So first on stunting. So stunting has been a tremendously valuable indicator of the degree to which people have been able to attain their genetic potential, largely thanks to the demographic and health surveys that, sadly, are under threat, perhaps ending now. But we now have metrics of actual dietary intake. We have metrics of biomarkers whose cost of data collection has come way down through these low burden surveys to see what people ate in the past 24 hours, in the last seven days. So that's giving us even more granular information about ongoing nutritional status. So in collaboration with dietetics and understanding food intake, we're getting a more nuanced picture. It turns out that stunting is partially, of course, affected by dietary intake, but also by many other things.

Then on overconsumption, it's this idea of a balanced diet, a Goldilocks diet, in which we're identifying these different food categories, nutritional food groups, where people overshoot in some; and therefore, under-consume in others, and where there are entire categories that you should moderate to less than 10% or so of your dietary intake in order to have an overall balanced diet. Those are two really important things about data collection and these metrics that in the past five years, I would say, have changed quite dramatically, thanks to the understanding that's generated by this nutrition science community. Thank you.

Kibrom Tafere: So I'll just add a couple of points on Eeshani's earlier point to your overconsumption issue. So basically, we know from the literature that because of metabolic adaptation to early undernutrition, this overconsumption is a later life consequence. So it's just a reflection of basically having the need to intervene early. So during a lack of nutritious food, if you intervene, you avoid this later life overconsumption issue.

Eeshani Kandpal: Thank you. All right. That was a very rich discussion. These folks are all giants in the field of agriculture and nutrition economics. Kibrom is one in the making. So thank you very much for making the time to be here. I really appreciate it. It's a real pleasure and honor to share

this stage with you. We're going to take our one coffee break until we break for lunch. So be sure to fuel up, and we'll be back in 20 minutes. Thank you.

[END OF TRANSCRIPT]