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Thinking About Future Food Security By Examining The Last 35 Years In World Grain and Oil Seed Markets - September 7th, 2018

[Introductory music]

Brady Deaton: Today is September 7th 2018 and my guest today on FARE-Talk is Patrick Westhoff. Dr. Patrick Westhoff is a professor of agricultural and applied economics and director of the Food Agricultural Policy Research Institute at the University of Missouri. Welcome to FARE-Talk, Pat.

Patrick Westhoff: Nice to be with you today. Thank you for the opportunity.

Brady Deaton: Pat, in today's podcast, I want to explore the general question of is the world agrifood system up to the task of feeding the future? In many ways, this is an ancient and always an important question. In your article that you've written with your colleague, Wyatt Thompson, titled Four Indicators That Explain World Grain and Oilseed Market Developments, you suggest that it might be helpful to look back at the last 35 years, that is from 1980 to 2015, to better understand the capacity of the system to meet the needs over the next 35 years to the year 2050. In this article, there's a number of zingers and I want to start off by having you comment about one of the lines that you write that I think is thought-provoking. And that line is, and I quote, "Chinese demand in biofuel production account for the entire net increase in world per capita grain and oilseed consumption since 1980." Let's start there.

Patrick Westhoff: Yeah. What we did was we added up all of the 14 major grains and oilseeds that are in the USDA's data set of data going back to 1980, divided by the world's population, and when you do that just all by itself, you find that there's been a big increase in per capita consumption since about the year 2002. But when you dig in a little bit further, you find out if you take China out of the mix and take U.S. ethanol production out of the mix, now what's left is basically a picture that's very different and, in fact, there's almost no increase whatsoever over that period from 1980 to 2015 in the overall consumption per capita of grains and oilseeds by the world as a whole.

Brady Deaton: For those of you listening, a link to this paper is provided on the website and I would note that there's a very interesting figure that develops the points that Pat's just raised. Figure two and figure three, there's a graph with and without China and U.S. corn ethanol use and the first graph shows a relatively flat per capita consumption until around 2002, and then it starts to increase. But when you take China and U.S. corn ethanol out of that picture, basically it looks relatively flat since from 1980 to 2015. With these two major forces of demand in mind, China and U.S. corn ethanol, talk to me a little bit about the reasons, or what's been going on in those two areas.

Patrick Westhoff: In the case of China, of course, I think most people know the story there, that we've had this massive change in dietary patterns in China. As incomes have increased, people are consuming a lot more meat and dairy products. To produce that meat and dairy products, there are a lot more animals out there, a lot more chickens out there and that means a lot more feed going to those animals and to fish of course, as well. So that's really, really caused an explosion of overall grain and oilseed consumption in China. On the grain side, for the most part, China's been able to supply that with domestic production. But on the oilseed side, especially in the case of soybeans, they have not taken that track, and instead have become not only the largest import in the world, but the dominant import in the world of soybeans, accounting for typically more than 60% of all the soybeans that are imported in a given year by all the countries of the world put together.

Brady Deaton: Looking back over the last 35 years, China has clearly played an important role in explaining per capita use of grains and oilseed. Now let's look forward over the next 35 years to the year 2050. Do you expect the trend to continue with respect to China?

Patrick Westhoff: I think there's lots of reasons to expect it's going to slow at least eventually. China's per capita consumption, meat and fish, have obviously been expanding rapidly and can't keep expanding at the current pace forever, unless we think people in China just like to eat meat and fish more than anybody else in the world. We would expect eventually we're going to see a slowdown in the growth of meat and fish consumption, and therefore probably a slowdown in the consumption of grains and oilseeds to produce those animal products. One big question mark that I confess is a really, really important one is whether or not we can trust the data that we're looking at.

The data from the USDA, the data from Chinese sources suggests that per capita availabilities of meat and fish are not horribly different in China today than they are in many of the rich countries of the world. Many people are skeptical of that and think that probably the true levels of consumption aren't quite that high just yet, so there's probably still some further room for growth. But that growth potentially, even in that case, is not infinite and at some point we're going to have to have a slowdown in the growth pattern there.

Brady Deaton: Okay, now I want to turn to the other very important driver of demand that you mentioned, U.S. corn ethanol use. In previous conversations in this context, you and I have talked about the important role of policy and oil prices. Let's start again with a look back at what's happened over the last 35 years, or in your paper from 1980 to 2015, and think about what might happen between now and 2050.

Patrick Westhoff: Sure. We saw incredibly rapid growth in US consumption of maize corn to make ethanol between 2005 and 2010. Part of it was just the explosion of ethanol plants that went up during that period of time, renewable fuel standard that required the use of more biofuels in the nation's fuel supply and then again,

very supportive prices on the oil side of the picture as well, where high petroleum prices translated to high gasoline prices and a strong incentive for people to blend more ethanol into the fuel mix in this country. That has largely come to an end now. We've had relatively little growth in domestic consumption of ethanol in the United States the last several years now. Currently policies, at least as I've talked to you today, are not as supportive as they were a couple years ago to that domestic consumption of ethanol and so unless there's a policy change or unless oil prices change dramatically, we wouldn't expect there to be a huge increase in domestic consumption of ethanol in the United States going forward.

There is, obviously, continued growth in biofuel consumption in many other countries. The growth in biodiesel in Europe was dramatic and important for world vegetable oil markets. We've also seen mandates in Canada and mandates in some Southeast Asian countries and a number of other places around the world, Argentina, to use biodiesel and ethanol and fuel mixes in those countries as well. So, I wouldn't say we won't have any further growth in biofuel production, but at least as we look kind of around the world right now, certainly the U.S. is no longer a major source of growth in that category and it doesn't appear to me there's many other countries where we're seeing really massive growth happening overnight.

Here again, China is yet another question mark. China announced a couple years ago intentions that they wanted to move to 10% ethanol blends nationwide. If they really had been serious about that and if they proved to be very serious about that, that would be a very important development because that would mean tens of millions of tons of additional grain or other beef stocks being used to produce ethanol and China or elsewhere. Many folks were skeptical whether that's really going to happen. The actual actions on the ground so far, as we speak at least, have not been consistent with that type of expansion.

As we think about the longer run, I suppose there's lots of question marks. One is what is the future of oil prices and we see how much markets can change from day to day, let alone from year to year and decade to decade on petroleum markets. The kind of petroleum markets we have in early September of 2018, prices are now high enough in those global markets to justify a lot of discretionary blending of ethanol into fuel supplies so, for the most part, it takes mandates to get that use to occur. If we were to have much higher oil prices than we have at this time, then that kind of discretionary blending becomes much more possible, but if we're really talking about 2050, probably the real question mark for the long run is are we still going to continue to use internal combustion and is there run on petroleum-based fuels or are we going to shift to other types of vehicles, be it the electric vehicles or whatever that are not as reliant on petroleum-based fuels?

Brady Deaton: And do you have any thoughts on that?

Patrick Westhoff: I think the direction is probably clearly that, yes, we are probably going to move in that direction, but just how fast is a very big question mark and it's going to depend on relative prices of petroleum and other products, other types of energies, sources and of course it's going to depend on policy.

Brady Deaton: Okay, I know that you and your coauthor are careful in your paper not to suggest that you have a crystal ball, but would it be a fair assessment of what we've just discussed to suggest that you do not expect the growth in demand that we attribute to China and U.S. ethanol that has occurred over the last 35 years, will you expect it to be somewhat lower over the next 35 years going to the year 2050?

Patrick Westhoff: Yeah, I think that's right. Again, there needs to be some growth both in Chinese consumption and in biofuel production, but I don't expect it to be as the kind of pace that we've experienced for the last 15 years, in particular.

Brady Deaton: One of the really interesting discussion points in your article is about population growths. So, again, we'll start off by looking back. If we look back from 1980 to 2015, what have you noted about population growth over that period of time?

Patrick Westhoff: Over the last 35 ... between '80 and 2015, the world's population increased by 63%, so the rate of population growth has been declining for a long time in terms of percentage growth per year, but we've had a relatively linear growth if you just talk about how many additional people we're adding to the world's population each year. It's been roughly 80 million people out of the world's population each year for about the last 20 years now. As we go forward, most of the projections that I've seen from the United Nations, from the U.S. Census Bureau and from a variety of other sources, suggests that the rate of population growth will definitely continue to decline in proportional terms and it will probably surely start to decline even in absolute terms.

So that while we're not going to be declining in world population in total, we are going to have fewer new people being added to the world's population each year. By the time we get to 2050, expectations are that at the current rate of growth of 1.1% roughly will have declined to roughly half a percent per year, for example.

Brady Deaton: One of the really interesting things that comes out in your paper is that your estimates of population growth rates are essentially the same as your estimates of the growth rate in yield. Is that right?

Patrick Westhoff: Yeah, it is pretty remarkable if you look back over again the 35-year period, the overall increase in population over that period and the overall increase in yields over that period for all the grains and oilseeds combined, turns out to be almost identical. So, if we had just been simply trying to maintain per capita calorie availability at the same level we had in 1980, we could've done so with roughly the same amount of area that was devoted to crop production back in 1980 and

it was only because of increased per capita consumption we've talked about already that we've had to have had an increase in the total area used for crop production.

Brady Deaton: Yes, I think that's an important point and I'd like to hit it again. So, population growth rates and yield increases have roughly been the same, so they've essentially offset each other. So, we've seen per capita use of grains and oilseeds increase since 2002. Where has that come from? How has that been achieved?

Patrick Westhoff: We did have a big increase in the area harvested and it's frankly very remarkable how big the increase was since 2002. We added more than 100 million hectares of land [inaudible 00:12:41] to the world's grain and oilseed production over that period of time. [inaudible 00:12:46] physical land, it's also counting additional double cropping and triple cropping that occurs in some parts of the world, so when you harvest the same field twice in a year, it counts twice in these data. But even if you were to correct for that, you'd find that we have, indeed, expanded the overall use of land globally and agriculture by quite a bit over the last 15 years, in particular.

Brady Deaton: Okay, so in quick summary, we've identified the four indicators that you discuss in your paper, growth in crop yields, growth in population and those have essentially offset each other with respect to consumption of grain and oilseeds. The two major drivers, particularly since 2002, have been Chinese demand and biofuel production and you suggest that the next 35 years may not increase at the same rate as the previous 35 years. So, bringing that all together, at least from my perspective, it's a rosier picture than sometimes you hear about the world's grain and oilseed markets capacity to address the needs of the population that we will encounter in 2050. But, of course, there are other concerns, so let's discuss that.

Patrick Westhoff: There are many things to be concerned about, but certainly it's not difficult to tell a story where meeting the future global food demands may not be quite as hard as some people have suggested. Again, I don't want to pretend ever that this is not an important and difficult challenge. Of course it is, but if we were able to continue past trends on yield growth, and that's a very important if, just linear growth in yields across time and have the population slow as is currently anticipated so that over the next 35 years, instead of adding 63% to the world's population as we did over the last 35 years, over the next 35 maybe only about 29 or 30% to the world's population. Now it doesn't look like quite such an impossible task. Global production of grains and oilseeds increased by 86% between 1980 and 2015. If the world's population increases by 29%, let's say, and if per capita consumption were to increase by another 14% on top of the 14% by which it increased between 1980 and 2015, that would mean that we need roughly a 47% increase in grain and oilseed production to satisfy that level of world consumption.

Now, obviously, the true growth in per capita consumption is unknown, as is the growth in the world's population, but it does seem very likely, to me at least, that the amount of growth we need in front of us is less than the amount of growth that we've already gone through over the last 30 to 40 years. It doesn't mean it's easy, but it probably means it's not quite as impossible as some people might have feared. Now this is, of course, assuming we can continue the growth in yields that we have seen. There are many severe concerns about that. Some very good scientists have suggested that we're closing the yield gaps in many parts of the world that the potential for increasing yields isn't what it once was and to the extent that is true, it may make it more difficult for yields to grow as rapidly in the future as they have in the recent past.

But as a counter to that, I would note that from the period from 2013 through 2017, we appear to have had five straight years worth of the global average yield for grains and oilseeds was at or above the long-term trend, a string that we haven't had, frankly, is for the entire period I've looked at over the previous 35 years so that's one note that at least in the near-term that we seem to be doing as well or better than we might have thought. So, again, there's lots of questions about what the future might hold and I wouldn't want to pretend that this is going to be easy, but it's also not an impossible task, either, provided we don't have unpleasant surprises in front of us.

Brady Deaton: What is your sense about the potential effect of climate change on these yield projections?

Patrick Westhoff: Yeah, and that's certainly one of the very important wild cards here. We, so far, have been talking strictly at the global level about things and that's probably appropriate for a big picture view, but maybe it's worth saying a few words about one particular region in the world where food security is obviously still a very major concern today and that's the Sub-Saharan Africa. Sub-Saharan Africa has multiple challenges, one of which is that its population growth is not slowing as much as some other regions of the world have been slowing. In fact, that's the one region of the world that is probably going to see larger absolute increases year over year in population growth in the next several years as they had in the recent past. So, more mouths to feed there is always a challenge. Yields have been below the global average by quite a bit and we haven't seen the sort of dynamic on yield growth at least in some countries in Africa that would make it possible for African countries to supply their domestic consumption needs through internal production.

So, as we look forward, there's a lot that can be done to boost our rate of productivity in African countries, but climate change, by many models' expectations is it may hit Sub-Saharan African countries harder than many other parts of the world and so what is already a challenging situation could be even a bigger challenge when climate change comes to bear. Again, different climate models say different things about other parts of the world. You know, some would suggest that parts of Canada might actually fare reasonably well with climate change in terms of agricultural productivity, but there's certainly some

other parts of the world like Sub-Saharan Africa that appear to be in very serious danger going forward.

Brady Deaton: Are there any ... when you think about the areas that might be hit the hardest or the most challenged in terms of matching population growth with yield growth, do you see any important policies or ways of addressing ... what are the points of leverage for policy makers?

Patrick Westhoff: Well, you know, again from some of these countries, it will obviously be very difficult to see how they can possibly satisfy local consumption needs just with local production only. If you think of a country like Nigeria that has, already, a very large population, but that is also growing very, very rapidly, by some estimates from the United Nations I've seen, could become perhaps the second or third largest country in the world by population [inaudible 00:19:34] but just in future, if current growth rates continue. Nigeria is a big country, but not that big and to expect that even if they were to have some major policy developments in productivity if they're going to be able to satisfy local consumption needs just with local production, it could be very difficult.

So, for a country like Nigeria, you probably want to think in terms of what can they do to make sure they have an economy that is generating enough income for people that the country can actually afford to do the sort of food imports that might prove to be necessary at some point in the future. Food security obviously does depend on both supply and demand, but a country doesn't have to have its own supply necessarily to meet the domestic demand. The obvious case would be cities like Singapore, for example, where one would not think of food security being a major problem in Singapore, even though it has very, very little production that occurs within that small country.

Brady Deaton: I think that's such an important point and it emphasized in your paper over and over again, that particularly in the short-term, variations in crop production are very dependent on the weather and, in a sense, so is food security for any country that depends largely on own production and so trust trade relationships between countries are so important for providing food security.

Patrick Westhoff: Yeah, that's certainly true. We have a project that we've been working on for some time now in South Africa that now includes partners in a number of other countries in the region as well and one thing we had been looking at has been the trade in Southern Africa and Eastern Africa in maize, corn, which is the basic staple food in many of these countries. There's been some recent weather events, for example, that have resulted in short supplies in particular countries and the region as a whole that has resulted in big gyrations in maize prices across that part of the continent and with very different experiences in different countries. Keeping a more open trading regime has benefits to the region as a whole, even though there can sometimes be incentives for particular countries to want to restrict trade when a problem strikes.

Zambia has been a prime example of that, where Zambia has now become a maize exporter in most years, but if there was something that causes prices to run up within Zambia they have, at times, imposed export controls that may help restrain domestic maize prices in Zambia, but with the effect of raising prices in Zimbabwe, the Congo and other countries in the region. So, just a reminder that things are very intertwined and dealing with the weather shock is a lot easier if you don't think you have to deal only with domestic supplies to do so.

Brady Deaton: I'd like to end this podcast with the discussion of prices and you note in your paper that this is a very important dimension to consider when thinking about the dynamic questions that we've been asking about with respect to food supply and food demand. I'll just quote your paper and let you speak to this issue and it's quote, you write, "People sometimes ask if agriculture can meet future demand. This question is misguided. The quantity that consumers buy will have to be no more than the quantity that the sector produces. Over time, there's no way to sustain consumption above production. Weather and other shocks will cause annual volatility in crop prices and stocks can mitigate these impacts. Focusing on the long-term, however, attention is better focused on the price level necessary to ration demand and to coax additional supplies."

Patrick Westhoff: Yeah, and I think it's an important point to make that we don't trade much with Mars or Venus, you know? So, pretty much our food has to be produced on this planet and sure, in a given year, you can draw down stocks or you can do things like that to smooth things out a bit from one year to the next, but in the long run, you've got to produce it to be able to consume it and so the real question is whether or not it's going to be available to people at a price that they can afford. If food prices are constant or declining, it's a lot easier to help even the poorest part of the world's population get the food they need to survive and to thrive, but if food prices are rising in real terms, it's a heck of a lot more of a challenge.

So, while this has mixed effects on different parts of the population, if you're a relatively low income farmer, but who sells at least some of your surplus in a given year, you don't like low food prices because low food prices probably mean lower income for you. Before the growing share of the world's population lives in urban areas, a lower food price in retail markets is going to make it easier for families to achieve the kind of food security they want.

Brady Deaton: So, with respect to food prices, what did you observe over the past 35 years and what are your thoughts about food prices for the next 35 years?

Patrick Westhoff: Yeah, prices obviously matter and so when we had the kind of high prices we've had between 2007 to about 2013 or so, that is one of the many reasons why we have expanded global areas for crop production as much as we have and provided incentive for people to make investments in land that might otherwise have been judged not to be worth trying to produce crops on. It resulted in major investments by seed companies, by other people involved in agribusiness

to try to increase the possible level of yields that were possible out there and those investments are still paying dividends even today. But now with the lower prices we've had since about 2014, you can probably expect there's less investment that has been occurring than would have otherwise occurred in those sorts of activities.

Not surprisingly, if you look at the global area chart that we mentioned earlier, again much of that growth occurred between about 2002 and about 2013 or so. Since about 2013 we have seen much less change in the global areas for crop production. So, again, some assign that there is, indeed, some price responsiveness out there and it's not just a matter of supplies fall from the heavens, it's rather that people making investments that have a lot to do with the supplies beyond the effects of weather and other things we can't control might have. So, as we think about the future again, if you have regimes that allow prices to give signals to both producers and consumers so they can act appropriately, you know, that makes it easier to keep things going on an even keel. One of the many reasons why we have the kind of volatility we have in many agricultural markets is precisely because policies and other things sometimes may get in the way and make it tough for markets to fully respond to the sorts of incentives that are supposed to be out there.

Brady Deaton: Well, I'm hopeful in 2050 when we look back at the last 35 years, we'll look back at a system that's been able to enhance food security around the world and that's going to require the continual effort of people like yourself, so thank you for your efforts and thanks for taking the time to speak to us today.

Patrick Westhoff: Thank you very much. Appreciate the opportunity.