

12-16-15 ERS Transcription

Good afternoon everyone and welcome to our webinar The Economics of Antibiotic Use in US Livestock Production my name is Nancy McNiff and I will be your host. Our speaker today is Stacy Sneeringer. Stacy is an economist in the Structure Technology and Productivity Branch of the Economic Research Service US Department of Agriculture. Stacy has a PhD in Economics from the University of California at Berkeley. Her research predominantly uses econometric methods to evaluate environmental and public health aspects of livestock agriculture in the United States. I think we're ready to start so Stacy you can now begin your presentation.

Hello, thank you Nancy, welcome everyone you'll have to pardon me this is Stacy. I have a little bit of a cold so if at some point you hear me cough I'm just having a sip of tea. The title of the talk today is The Economics of Antibiotic Use in US Livestock Production. It's, the title of the talk is the same as that of the report which is available on the ERS website. It was released on November 24th so you are welcome to access that. I'm going to go over... So farmers use antibiotics for four main purposes the first is to treat disease. That would be the case if an animal became ill you would treat it with antibiotics usually in a, a syringe format. The second reason would be to control disease. This would be the metaphylactic purposes. This would be the case if you had a barn full of animals and one animal or two animals became sick and then you treated the rest of the animals that were not yet showing signs of disease for the disease to control the disease. The third use is to prevent disease. This would be the case where none of your animals in the barn are sick but you have a high risk or high likelihood of seeing disease in that barn and therefore you would administer antibiotics for prevention and the fourth is to increase productivity. These are things like increasing growth or increasing feed efficiency these are termed to production purpose uses in the policy sphere so I'll be using that terminology quite a bit in this talk. So there have been a number of public health concerns raised about antibiotic use. Antibiotic use in humans and livestock can contribute to the emergence of organisms that are resistant to most or all antibiotics. This leads to difficult to treat illnesses or deaths in humans and animals and therefore it's become a topic of policy concern. Currently there are a number of policies on the table either proposed or being put, currently put in practice. The most talked about recently is the US FDA policy efforts, that's the Food and Drug Administration to restrict use of medically important antibiotics for production purposes. Medically important refers to antibiotics that are used in human medicine. The White House has also released a report in 2014 on combating antibiotic resistance and also there have been a number of European Union policies restricting production purpose uses of antibiotics. This varies by countries. The European Union in 2006 universally adopted this practice or this restriction but their restrictions in individual countries started as early as 1986 in Sweden. So the major research questions addressed today in this talk there's much more in the report that I invite you to look at but just to keep it a little bit succinct today we're just looking at what are the, what's the current extent of antibiotic use for production purposes and disease prevention in hogs and broilers. We look at dairy and beef in the report more but I'm just going to focus today on hogs and broilers.

The second research question is what would be the effects of restricting production purpose antibiotic uses on both animals and farms. This is going

to rely on largely on past research performed by others as well as ERS researchers and the third major research question addressed today is what are the effects of production purpose restrictions on prices and quantities produced of pork and chicken. So if all farms have to restrict their uses what happens to prices and overall amounts that are produced in the market and what we're worried about is what effects that's going to have on the consumer. I mostly make use today of data from the Agricultural Resource Management Survey. This is the only national representative data with information on both antibiotic use and financial features of farms. The ARMS Surveys are conducted by specific commodity every five or six years. The data that I'm mostly using today is from the 2011 Broiler Survey and the 2009 Hog Survey. These are the most recent surveys for these two commodities. There's a Hog Survey that's going to be in the field I believe now or shortly so that will be updated and then in I think 2015 or 16 is the next Broiler Survey. An important thing to note about the ARMS Survey is that farmers or otherwise known as producers are surveyed but the presence of contracting is going to affect the farmer responses. What contracting is, is when you have a major producer or major company like Tyson they would provide young animals and feeds to a farmer, they would leave the young animals and the feed with the farmer for a period of time, the farmer would raise the animals and provide the feed and provide other management services and other caretaking aspects for the animals but the farmer may not know what is in the feed because it's been provided by the contractor. This is going to show up in how the farmers answer questions about whether there is antibiotics in their feed. And we are missing, there we go, this is showing you the extent of antibiotic use in the broiler industry in 2011. What we're seeing is this is a percent on the Y axis on the vertical axis, this is just showing you the number of birds. So on the bottom of the bar that's 20 percent, 20 percent of producers are, 20 percent of birds are raised by producers that report using antibiotics for purposes other than disease treatment.

Now because in the ARMS we only ask whether antibiotics were provided for purposes of disease treatment or other reasons we don't know whether these other reasons are growth promotion or disease prevention so we can only separate into those two categories. But we see that another 32 percent report that they don't know if antibiotics were used only for disease treatment. So what we can conclude is that between 20 and 52 percent of broilers were provided antibiotics for purposes other than disease treatment. This would be inclusive of production purposes it would also be inclusive disease of treatment. The important point here is that not all broilers receive antibiotics for these purposes that are other than disease treatment and this is from 2011 again. When we turn to hogs this is the extent of antibiotic use in the hog industry from 2009. This is the most recent data that you're going to see for a national perspective. What we see here is this is divided by growth promotion and disease prevention between nursery hogs and finishing hogs. Now growth promoting antibiotics are thought to have a bigger effect in nursery hogs than in finishing hogs so when we originally made this chart we were expecting to see some difference in the percentages fed to nursery hogs versus finishing hogs. So what we see here on the first bar to your, the farthest to your left is that 23 percent of producers report that they fed hogs to, excuse me, that 23 percent of hog, nursery hogs are at producers who report that they used antibiotics for growth promotion. Now that number could be up to 49 percent because as you see 26 percent were at farms that say they don't know whether there was antibiotics in the feed for use for growth promotion. Moving to the next bar you see between 59 and 79 percent of nursery hogs received antibiotics

for disease prevention. Looking at finishing hogs you see between 40 percent and 62 percent received antibiotics for growth promotion and between 51 and 71 percent received antibiotics for disease prevention, this is via feed or water. Again what you see is that there is a percentage, a high percentage in our perspective that did not receive antibiotics for growth promotion. Now what would be the potential economic effects of these production purposes use restriction? Well these are going to have effects at three levels of aggregation the first being at the animal level. If you restrict use for production purposes the animals might have lower feed efficiencies, they might require more feed per unit of weight gain for example but at the farm level you might have different effects. If you could substitute away from growth promoting antibiotics into something else that might have a different effect on the farms overall productivity when you're looking at all inputs versus all outputs and then if all farms have to do something, if all farms have to change their cost structures then what kind of effect does that have at the market level?

So let's just go over each of these in a little bit more detail. These are potential animal level effects of production purpose use restrictions and I say potential these are the things that have been talked about either in policy spheres or in the academic literature or in producer literature. The concern is that if your restrictions on production purpose uses that the growth to market weight is going to be slower, that the feed required per unit of weight gain will be more, that the death rate of young animals will increase. This is because, the idea is that the growth promoting levels of antibiotic use actually have a disease preventative effect even though they're not indicated to do that but therefore they might have, you might see a higher death rate of young animals. The illness rates again among all animals might increase, reproduction might decrease. The concern here is that you have a, a greater illness in pregnancy or greater illness in birthing and therefore the number of animals per birth are fewer and then the worry is that animals at higher, that you would receive animals at higher and lower ends of the weigh spectrum. This is a problem for mechanized processing. I'll go into it a little bit more in a moment. So what has the prior research shown about these? You don't have research on all of these individual level effects because that's not what everybody looks at but what you do see when you do a careful reading of the literature is that the effect of the production purpose antibiotic uses decline over time in studies. So I can divide this into experimental research versus observational research. Experimental research would be that if you had a research station that had two barns for example and each barn had the exact same characteristics, an exact same number of animals, exact same management except one barn of animals received antibiotics for production purposes and the other barn did not and so then you could compare after a period of time the difference in feed efficiency or the difference in growth between the animals in the two barns. What you see from that type of research that was published about before the 1980s is you see very high effects of production purpose antibiotic use and this shows single digit or high double digit percent changes in growth or in feed efficiency so you have market increases in those impacts when you look at research that was most, largely from even the 50s, 60s 70s and 80s. But since the 2000s we see low single digit or even less than one percent changes from production purpose antibiotic use when you look at this experimental literature. When you look at observational research it shows a similar pattern from the 2000s. So observational research would be when you are looking at farmers in the wild so the farmers can, they don't have, you wouldn't have two barns that have to be the exact same in every way. You would have one farm that was using antibiotics

for growth promotion and one farm that isn't but they, the farm that isn't might do a number of other things in place of feeding antibiotics for growth promotion. They might have more biosecurity measures or they might have different management practices so you have other things that aren't controlled for in an experiment. So this is kind of observational research and you can kind of control for those other features using statistical methods. So what you see from that observational research in the 2000s and onward is again you see these single digits in even those statistically significant effects of the growth promoting antibiotics.

So why has this happened? The theories in the literature is largely that the industry has evolved. There's been rapid improvements in housing equipment and practices, you have better design of facilities, better management practices, better biosecurity, better ability to keep disease out so in that way you have fewer bacteria in the barn and therefore to the extent that the growth promoting antibiotics had a disease preventive effect it's no longer having those effects because you're correcting for that, the other lines. So that's the theory and the literature is very hard to test definitively but that's what people believe is happening. So moving on to the farm level effects again I said that if an ani, you have individual animals that might change in terms of their feed efficiency or growth but at the farm level the farm make, makes substitutes out of growth promoting antibiotics into other things. So what are the potential farm level effects of production purpose use restrictions and these are again these are potential, these are what's possible that could be happening. First, well the cost is antibiotic use for production purposes. That will decline if you are no longer able to use them but this might mean that the veterinarian antibiotic costs for disease treatment might go up to the extent that the growth promoting antibiotics had a disease preventive effect despite not being labeled for that purpose. If you are substituting as a farmer into alternatives for antibiotics then you might have increased cost for those alternatives. For example if your animals take, require more feed per unit of weight gain then you're going to have to buy more feed so the cost of feed is going to increase. You might need more young animals purchased if you have a lower reproduction rate. The biosecurity measures might be more expensive. This might include making sure that your barns are contained and that they exclude wildlife for example, even just birds. You might have adjustments in housing to create space more animal, per animal or space per animal. So to the extent that an animal under less stress is going to grow better that creating more space for it might enable it to achieve the same growth as it would have had with growth promoting antibiotics and then the labor costs of alternative practices might require more management and that might be costly both in terms of the per unit cost of the labor as well as more labor itself. You might have and I've mentioned before that you might have animals that are and need higher and lower weight brackets. The mechanism for this is not quite clear but the problem is that if you have, you have mechanized processing so if you're going to bring your animals to the slaughter facility then what you might have is that if animals are either too heavy or too light that you receive penalties at market because those animals don't fit into the mechanized processing well. And then finally a proposal is that you might have declining economies of scale.

So what has the research shown? Well we draw a lot on the prior research done by ERS and what this does is observational research that uses the ARMS data from the years mentioned and it looks at farms that use antibiotics for production purposes compared to those that don't correcting for through

statistical methods through the other factors that the farms could be adopting in replacement of the antibiotics. What we see there is that farms using antibiotics for production purposes see a one to three percent increase in the productivity on average but the high variance in these estimates make it impossible to distinguish these statistically from actually no effect. Now if all farms have to change their practices or rather the farms using antibiotics for growth promotion have to change their practices what effect is this going to have at the market level? Well economic theory, this is showing you a supply and demand graph that's a standard staple of economic theory. What you're seeing is supply before and after the restrictions so what you see is that for every quantity produced, for every Q which is on the horizontal axis the P required for that quantity is higher. So that's showing you the shift in the supply curve to the left. What that is that's the one to three percent decline in productivity from restricting antibiotic use for production purposes. Economic theory predicts that this would lead to a decrease in quantity of animals produced. On the graph or on the figure it's showing from Q1 to Q2 and is also predicting an increase in the price of animals from P1 to P2, now revenues which I'm just going to refer to as just revenues as price times quantity that could go up or down overall.

How could it go up? Well if quantity declines but price increases a great deal then your price times quantity might actually increase but if your quantity goes down and your price increases only a slight bit then your revenues might actually decrease. Another concern at the market level is that this restriction on use might make the US less competitive in global markets if they have higher costs for production. On the demand side which we don't really go in to it hasn't been very widely researched but on the demand side is the consumers might demand more meat and this is going to be highly dependent on knowledge and perception as well as preferences for meat. The idea being proposed is that consumers may decide, oh I'm, I'm much more comfortable not having antibiotics for growth promotion in my meat so therefore I'm going to eat more chicken. This is not widely supported in the literature but it's been proposed. What has been proposed it's a little more supportable is that foreign buyers that might have previously rejected US products due to the production purpose antibiotic you may now permit them. When you look at the prior research on the market level effects you see a wide range of outcomes and you see a wide range of things being studied, a wide range of time spans covered the results are strongly dependent on the assumed extent of the animal level effects of the production purpose antibiotic use so these studies come from and they're, they're well, we look at them to some extent in the report so I welcome you again to look at the report but what you see is that they're highly dependent on their assumptions about the extent of the productivity effect on the animals. So a lot of them use, so some, they'll use a study from the 1950s for example that says if you restrict antibiotic use for growth promotion you're going to see this 15 percent decline in feed efficiency, we are going to see this 15 percent decline in growth. Now that's highly dependent on a different period of time and a different period of time's production in the US at any rate. So it's important when you look at that literature when you see some of these things in the policies here that you are paying attention to that kinds of, those kinds of assumptions. So I'm not going to go into any more detail about those prior research but you can look at those in the report. I am however going to show you the results of our own market model about the effects of the restrictions. So what we do is we model the at market level effects and what I mean by that is price, quantity and revenue.

The outcomes that we examine are price, quantity and revenue and the main parameters of interest that are important for this are the percentage of animals that are using production purpose antibiotics or that are administered production purpose antibiotics.

So as we've seen in the, in earlier slides only a portion of animals are using, are being administered production purpose antibiotics. So if have only a portion of animals that are, that are having to change based on these restrictions then the market level effect is actually going to be muted because of that and we've also seen that the farm level productivity effects of the restrictions are of an order of magnitude of only about one to three percent. This again is going to mute any effects at the market level on prices and quantities. So a little bit of foreshadowing of what we find is that if you see that only a portion of farmers use antibiotics for production purposes and the effects are in the one to three percent at the farm level then the overall effects on prices and quantities are going to be modest. Looking at this in a little more detail what we see is this is the estimated effects of production purpose use restrictions on prices and quantities and the first three sets of bars are showing you all producers, the second two sets of bars are showing you for users versus non-users and the last set of bars again is showing you non-users versus users. So non-users are producers that don't use antibiotics before the restrictions and we'll go into this in a second. So what you see for all producers is that the quantity produced actually declines by less than one percent. So take note of the X axis this is a percent change this is not ranging from up to a hundred percent this is ranging between a negative 1.75 percent to a one percent so these effects are all quite muted.

Do you see as the quantity produced is declining for hogs and broilers by less than half a percent? The wholesale price is predicted to increase by about three quarters of a percent and then we see because the price effect is larger than the quantity effect that the total revenues are actually increasing by a, between a third and a half of a percent. Now the negative effects are largely concentrated in the current users before the restrictions of the, and before the restrictions. So you see is that the non-users those not using antibiotics already before the restrictions well their quantity of produce is going to increase. This is because they actually just see a higher price in the market. So if they're seeing a higher price but they don't have to make any changes to their production methods because they already aren't using antibiotics for production purposes well they're going to start producing more, they're going to respond to those higher prices by producing a bit more. So they produce a little bit more but the users have to actually make changes to their production practices, substituted to other production practices and they're going to see a decline in their quantity produced but it's still less than two percent, it's about a percentage and a half, percentage point and a half. The revenues for non-users increased because both their quantity and their prices increased but for users again their revenues do decrease but again by less than a percentage point.

So in conclusion I invite you to look at the report. There's much more detail there but what we see is that a significant portion of livestock producers do not use antibiotics for production purposes already. Those producers that don't use antibiotics currently are going to be made better off from their restrictions on the use of antibiotics for production purposes but overall even for everybody the effects on prices and quantities are quite muted of less than one percentage point... and now I'm happy to answer questions.

The report with my co-authors, my co-authors are James MacDonald, Nigel Key, William McBride and Ken Mathews and that is available online and you're welcome to contact me via my email address which is right there and I believe we're taking questions through Nancy.

Yes so if you have questions please submit them through the chat feature and I will ask them to Stacy and we'll get to as many questions as we can. We did have a question a while back about whether production purpose use included preventing disease?

No, no, it's separate from a disease prevention use. I mean are you referring if a specific slide for the broilers, I can, I'm going to scroll back to this slide I'm sorry if this give everyone a headache but looking at the broilers here we can't distinguish between growth promoting and disease prevention uses here if that's what the slide is refer, if that's what the question is referring to but in general a production purpose does not include label uses for disease prevention.

So it's just growth, growth and increase in production basically is what you mean by production purpose.

Yes, yes.

Okay, we have another question about why, why didn't you look at beef? Why did you just look at poultry and hogs?

The issues with beef are numerous. The, the main issue from our standpoint from a research standpoint is that the structure of the industry does not in, lend itself well to using data collection. So there's, beef is, there's many, many, many, many cow-calf producers all over the country and those are shipped through to stock room facilities and then to feed lots and it's the problem of trying to survey each of these units together and separately and so that's why there's not a lot of data on antibiotic use as, in the beef industry as a whole. There's information on portions of the beef industry that we look at in the report but we don't do analysis of the entire beef industry just because of the data collection issues.

Okay thanks, we have another question. I think some of these questions that are coming in are, you just sort of answered but here's one about how do, how do bi, antibiotics help animal growth?

How?

Yes.

The thought is that you have, the thought is and I don't think, I mean like I'm an economist so I'm going to say this in a way that is likely going to offend any scientist on the phone but the idea is that you have bacteria in the gut and that the, that bacteria in the gut of the animal is competing with resources with the animal. So if you're having feed, if you feed the animal, the animal, part of that feed goes to servicing the bacteria in the gut and part of it goes to servicing the animal and what you're doing is with these very low levels of antibiotics is that you're suppressing that bacteria in the gut and therefore you have more of the feed going to the animal.

Okay, we have another question about dairy. Do you look at the impact

in the dairy industry at all?

No, we don't look at the impact on dairy. Dairy, growth promoting antibiotics are used a little bit in the dairy industry but they're not widely used and I'm talking about production purpose antibiotics. Dairy uses antibiotics for other purposes for, you know disease control and disease prevention and disease treatment certainly but because the focus of this report is largely on, on the production purpose uses we don't look at it for dairy. And again we don't because the ARMS data does not collect data on the antibiotic use in dairy. We do have some information in the report about the dairies and that's largely drawing on data from the APHIS which is the Animal Plant Health Inspection Service's data, the National Animal Health Monitoring system.

Okay, we have another question on the impact on the market. Does it, do you take into account the size of the producers that are currently using production purpose antibiotics and do you have any data on how large they are?

We, we, the, the, the overall market level effects are just looking at the market so it's basically that if you have all producers CSA one to three effect are going to have this kind of effect on prices and quantities so it doesn't have any differential effects by size. We, we don't look at this in the report but you can find this in other re, ERS research which is that there is some information specifically from the hog surveys about the size of the producer and whether or not they use antibiotics for different purposes. But then you have, there is some disparities there but it's difficult to characterize with one sentence.

Okay, do you know how much of the production purpose antibiotics include medically important drugs?

In the data that we're using?

Yes.

In that data that we're using we don't ask about medically, I mean I think the question is referring to ionophores and so the ARMS data doesn't make a distinction between ionophores or not and it's certainly something that is possibly contributing to those don't know answers. So for example some producers particularly in broilers will not call ionophores antibiotics and the FSIS, the Food Safety Inspection Service is for purposes of labeling does call ionophores antibiotics so if a producer is feeding their broilers ionophores which are antibiotics that are not used in human medicine and they don't know whether to call them antibiotics or not then they might answer I don't know. So we don't know in the ARMS Survey whether they're referring to antibi, ionophores or not. In some of the other and specifically the National Animal Health Monitoring System data that we access in the report they do make distinctions between ionophores and other kinds of antibiotics.

Okay, we have another question, how did you determine the slopes of supply and demand curves used in your analysis of the impacts?

Right we, so we use prior research that has been published and, you know, peer reviewed about those effects and then we do, getting a little technical but we do a Monte Carlo Simulation so we vary those, those supply and



demand slopes according to certain assumptions about the distribution around them just to see if there is a big change based on those supply and demands but there, I mean we, you can find the references in the report if you'd like but that's, they come from prior literature.

Okay, we have another question about this, so for example a less than one percent economic effect is that significant to producers and although it's a small amount would this effect smaller producers proportionately more?

We don't look at, right, this is one of the issues, we don't look at the effects ranging across producers so whether some, I mean there's obviously going to be some producer that's going to see a price change of one percent be something that, you know, is a make or break moment for them but to the extent that what you're talking about wholesale prices and to the extent that prices vary much more than one percent in the market due to other reasons it, it, it, just putting it in that kind of perspective it doesn't seem to be a very large effect. It's certainly not something I think that consumers will even notice because wholesale prices are a small percentage of retail prices.

Okay, you mentioned foreign markets possibly opening up if we restricted antibiotic or production purpose antibiotic use. Is there an estimate for what added trade value this would, you know, do?

No, we have looked into that a little bit the issue is there, when you look at trade agreements there's a lot going on besides just the purported reason for restricting trade. So it's difficult to pinpoint whether the, the trade agreement restriction or lack thereof is based on the use of growth promoting antibiotics or based on some other reason. So we've thought about it but it's very difficult to characterize.

Okay, we have a question about the, I guess the antibiotic use. Do you have informa, or is there information in the report about the poundage or the total amount of antibiotics used in broiler and hog production?

No.

Does it have amounts in it, okay.

No, I think if you're referring, a lot of people are referring probably to the ADUFA data which is the Animal Drug User Fee and then the data which is published by the FDA and that is published and there was a recent outcome from that report publishes the pounds of drugs sold but they don't characterize by broilers or hogs for it and it's just the amount sold by kilograms and so it's very difficult to characterize by what they were used for an whether they were even used.

Okay, there's another question, how much, how much can different management systems potentially decrease the need for production purpose antibiotic use? Do you look at that at all?

We, we look at that in terms of the prior research that's been done. Certainly you see when we look at, usually for example the ARMS data for the broilers in 2011 comparing broiler producers that use production purpose antibiotics or rather antibiotics for purposes other than disease treatment compared to producers that have a host of other biosecurity

options for example, they have HAPA plans which are, they do a lot of things to keep diseases and bacteria out. So comparing those two types of producers you really don't see a statistically significant difference between their productivity.

So to the extent that you can...

I think in broilers you see this a lot more at least in the industry you have a larger percentage of the industry moving towards full antibiotic free, they're not giving antibiotics for any purpose not just for production purposes but in the broiler industry it's, it seems that they're are figuring out ways of doing this without great losses in productivity.

Okay, we have one last question on the farm level productivity. They are asking how you calculated that the farm level productivity?

The farm level productivity is again it's based on prior research using the ARMS data and what you're doing is, this can be very complicated, it's from some published journal articles. What you're doing it's observational research so you're comparing farms that use production purpose antibiotics with those that don't but then you're making a series of statistical adjustments for the fact that they might do a host of other things, they have a host of other inputs instead of the production purpose antibiotics and you're also making statistical adjustments, econometric adjustments for the fact that you have certain producers choosing to use antibiotics versus those that don't so you might have a selection effect into those kinds of production practice styles and the, the, the specific journal articles are referenced in the report or if you want to email me I can easily send them to you and it's, if you're an economist asking these questions it's using a production frontier style analysis.

One last question, is there any plan to gather new data from this, about this topic?

It, it seems that a lot has changed since 2011 it'd be interesting to see more updated data, is there a plan to look at this again? Yes I mean the, the, the next hog survey is almost in the field now or shortly will be and that'll be collecting updated data for hogs and I believe the next broiler survey... we, the ARMS data collects surveys by commodity every five or six years by animal so we don't collect data annually just because funds do not permit us to do that and we also don't want to put a burden on the producers for answering your questions over and over again. So we, but yes there is data forthcoming in at least those two sectors. I know that there's other nationally represented data that's coming down the pike from Animal Plant Health Inspection Service and they do, they do periodic surveys as well. Their surveys are much more focused on individual treatment regimes with antibiotics, the reasons for antibiotics, the specific diseases so they're really looking at more management and veterinary perspectives and we're more collecting data for financial purposes.

Thank you Stacy and I just wanted to let everyone know that this webinar is being recorded and it will be posted on our website about a week after it's closed captioned and it will be available at [www.ers.usda.gov/multimedia](http://www.ers.usda.gov/multimedia). Thank you very much Stacy I think we are, that's all we have time for and thank you all for joining.

Thank you.

Have a great day everybody.