Analysis of a More Restricted Antimicrobial Access Policy in Pork: An Update.

Dermot Hayes, Professor of Economics, Professor of Finance, Pioneer Chair in Agribusiness

Iowa State University

Introduction

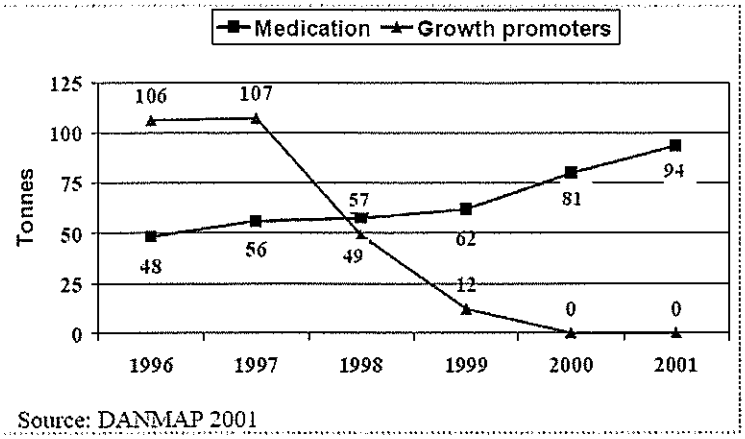
In the early late 1990s and early 2000's I was involved in a series of research projects designed to evaluate the impact of restricting antimicrobial access in the US pork production system, (Hayes et. al. 2001, 2002 and 2004). The reasoning behind these studies was that one could best evaluate the impact in the U.S. by close examination of the farm level impacts in other countries that have followed this policy. The two countries we chose for our case studies were Sweden and Denmark.

At the time we did our analysis, the Swedish policy had been in place for several years and the impact of the restriction on the pork system was well underway. However, Sweden had also implemented a series of animal welfare regulations at that time and it was difficult to tease out all of the impacts of the restriction from the impacts of the animal welfare regulations. In particular, Sweden had mandated a much later weaning period at that time. As we discovered, the negative impacts of an antimicrobial restriction was greatest when these products are withdrawn from young, weaned pigs. The logic here is that the stomach of young pig is simply not ready for a grain based diet. Sweden sidestepped this problem by making it illegal to wean pigs early. At that time the Swedish pork market was highly controlled and the Swedish consumer federation had agreed to accept the costs involved in the simultaneous implementation of animal welfare and antimicrobial policies. These costs could be passed on to consumers because Sweden was a closed pork market.

The Danish experiment was a much more useful one for us because the Danish production system and weaning age were similar to the US and because the Danish pork industry was and is an export orientated, market driven industry. Unfortunately for us it pig farmers were in the process of responding to the antimicrobial restriction when we did our study and this mean that our results were very tentative.

When faced with the impacts of the restriction on the health, mortality and welfare of young pigs, the Danish pork industry simply replaced prophylactic antibiotic use with veterinary prescribed antibiotics. These antibiotics were typically much stronger and much more likely to be products that were used in human medicine than the products that they were replacing. These veterinary prescribed products ameliorated, but did not eliminate the impact of the policy.They had the unintended consequence of increasing total antibiotic use on production agriculture. See Figure 1 below which is taken from our earlier work.

Figure 1. Total consumption of antibiotics in production agriculture in Denmark



The reason that the additional antibiotics did not eliminate the problem is that farmers and veterinarians had to wait until the pigs became sick before they could treat them. Pigs that were untreated often left the nurseries on a poor state of health and as a result this increased disease problems in the finishing barns. The Danish experts we had consulted said that they planned to eliminate this problem by tracking individual antibiotic prescriptions by veterinarians (with a program called Vetstat), and by punishing those veterinarians who were prescribing more antibiotics than average. We published our earlier studies before the outcome of this veterinary monitoring program were known.

The two purposes of this report are, to update the results regarding total antibiotic use in Denmark and, to use productivity data we collected earlier to updates the estimate the likely economic impact of a Danish style antibiotic restriction on the current U.S. pork system.

Impact of the Danish Restriction on Danish Antibiotic Use

The following indented paragraphs are an unedited excerpt from the most recent results from the Danish antibiotic use tracking system (DAN MAP 2007) [1]. The data in this report

[1] See http://www.danmap.org/pdffiles/Danmap_2007.pdf

show that antibiotic use in swine production has continued to increase in the period since we finished our report. The problems that were encountered with increased use of human medicines have also trended up. This is true even if one measures antibiotic use based on average daily gain per pig. The key result from the new publication is the following.

"From 2001 to 2007, the overall antimicrobial consumption in pigs measured in ADDkg per pig produced increased by 19% (Figure 6)."

The average daily gain normally improves over time as the pig breeders increase animal performance, so when one sees a 19% increase in antibiotic use per kg of pork produced, it indicates that a serious problem continues to exist in the Danish pork system.

Excerpt from the 2007 Report

"In 2007, the total antimicrobial consumption in pigs increased by 6.3% from 91 tonnes in 2006 to 97 tonnes, in 2007. In the same period, the production of pork increased by 4.5%, while the production of pigs (heads) increased by 2.1%. In 2007, the consumption amounted to 3.9 ADDkg/ kg-pork-produced, representing a 3.9% increase per kg pork and a 6.9% increase per pig (head) produced.

In 2007, tetracycline, macrolides and pleuromutilins remained the most commonly used antimicrobials in pigs. Compared to 2006, tetracycline and macrolide consumption increased by 26% and 6.5%, respectively, per pig produced In 2006 and 2007, tetracycline became the most commonly used drug in pigs, probably due to new treatment guidelines launched by the veterinary authorities in 2005, as an attempt to reduce the use of macrolides. The relative macrolide consumption in pigs decreased in 2005 and 2006, but an increase was observed again in 2007. In 2007, the most commonly used amino glycoside compound was taken off the market, which resulted in a 46% decrease in aminoglycoside consumption in 2007. The aminoglycosides are used for local intestinal treatment and was substituted mainly by tetracyclines and macrolides; this may explain up to one third of the increase in tetracycline consumption. From 2001 to 2007, the overall antimicrobial consumption in pigs measured in ADDkg per pig produced increased by 19%.

Table 5. Trends in the estimated total consumption (kg active compound) of prescribed antimicrobials for production animals, Denmark

DANMAP 2007

ATC_{vet} group a)	Therapeutic group	1990	1992	1994	1996	1998	2000	2002	2004	2006	2007
QJ01AA	Tetracyclines	9,300 b)	22,000	36,500	12,900	12,100	24,000	24,500	29,500	32,650	38,200
QJ01CE	Penicillins, β-lactamase sensitive	5,000	6,700	9,400	7,200	14,300	15,100	17,400	20,900	22,600	23,850
QJ01C/QJ01D	Other penicillins, cephalosporins	1,200	2,500	4,400	5,800	6,700	7,300	9,000	12,900	11,550	11,500
QJ01EW	Sulfonamides + trimethoprim c)	3,800	7,900	9,500	4,800	7,700	7,000	10,600	11,500	13,800	13,850
QJ01EQ	Sulfonamides	8,700	5,900	5,600	2,100	1,000	1,000	900	850	750	750
QJ01F/QJ01XQ	Macrolides, lincosamides, pleuromutilins	10,900	12,900	11,400	7,600	7,100	15,000	19,200	24,200	22,050	23,800
QJ01G/QA07AA	Aminoglycosides	7,700	8,500	8,600	7,100	7,800	10,400	11,700	11,600	10,500	8,150
	Others c)	6,700	6,800	4,400	600	650	300	1,600	1,900	1,250	1,100
Total		53,400	73,200	89,900	48,000	57,300	80,700	95,900	112,500	115,150	121,100

1990-2000: Data based on reports from the pharmaceutical industry of total annual sales. (Data 1990-1994: Use of antibiotics in the pig production. Federation of Danish pig producers and slaughterhouses. N. E. Rønn (Ed.). 1996-2000: Danish Medicines Agency). Data 2001-2007: VetStat. For comparability between VetStat data and previous data, see DANMAP 2000. Only veterinary drugs are included. Veterinary drugs almost exclusively used in pets (tablets, capsules, ointment, eye/ear drops) are excluded. Dermal spray with tetracycline, used in production animals, is the only topical drug included

a) Only the major contributing ATCvet groups are mentioned

b) Kg active compound rounded to nearest 50 or 100

c) Consumption in aquaculture was not included before 2001

Updated Impact of a Restrictive Antimicrobial Policy on the US Pork Industry

As mentioned earlier, it is likely that a policy designed to reduce antibiotic use in US pork production would likely increase antibiotic use in the US pork industry. This would occur for the same reasons this trend occurred in Denmark.

It is possible to estimate the impact of a restriction in the U.S. in the event that the U.S. Government ignores the Danish evidence on total antibiotic use and proceeds with such a restriction. To do this I have used the productivity measures we calculated in our earlier work and as input into an updated economic that accounts account for the differences in feed costs and the size of the US pork industry since the earlier work was completed.

Technical assumptions made based on the evidence gathered in our earlier reports were as follows

1. Age at weaning + 1 week
2. Days from weaning to reach 25 kg + 5 days
3. Feed efficiency from 50 to 250 lbs - 1.5%
4. Piglet mortality + 1.5% pts
5. Fattening-finish mortality + 0.04%
6. Piglets per sow - 4.82% %
7. Veterinary and therapeutic costs + $0.25 (per pig) net of costs for feed grade antibiotics

8. Lawsonia vaccine $0.75

The technical assumptions include an increase in the age of weaning of one week, an increase in the days from weaning to reach 25 kg, a decrease in feed efficiency during the feeding stage, an increase of piglet mortality of 1.5 percentage points, a small increase in mortality during the fattening-finishing stage, a decrease in sow efficiency, and an increase in veterinary and therapeutic costs of $0.25 per pig net of costs for the feed-grade antibiotics. All of these productivity measures are explained and referenced in our earlier work.

We had also included the sort loss of $0.64 in the costs expected in the United States because of increased variability of weights and the penalty packers place on the lightweight pigs. I have retained this assumption.

We had included additional capital costs of $63 million for additional space needed for the additional five days post-weaning and $166 million for the additional sow space.I retained these calculations.

Since the report was written U.S. feed prices have increased by approximately 50%.Tthis means that the economic impact of the reduced feed efficiency in the finishing barns is approximately 50% greater than in our earlier work. In addition the U.S. pork industry is approximately 10% larger than it was in 2000. I have updated the economic results to account for these changes.

Results from the Updated Economic Model:

The results from the updated economic analysis are presented in Table 2 below. Adding the effects from estimated changes in productivity to the sort loss and initial construction costs suggests a first-year impact of $6.00. This cost increases slightly as more buildings are required in subsequent years and there are fewer animals but the same fixed costs

Table 2. Most likely scenario, impact from baseline

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Sow stock	-0.08	-0.44	-0.51	-0.56	-0.63	-0.68	-0.74	-0.80	-0.84	-0.86
Farm price	2.90	6.25	6.30	6.13	6.00	5.89	5.81	5.77	5.75	5.72
Consumption	-1.57	-3.10	-3.29	-3.34	-3.39	-3.43	-3.47	-3.50	-3.52	-3.54
Production	-1.57	-3.11	-3.30	-3.36	-3.40	-3.43	-3.48	-3.51	-3.53	-3.55
Retail price	1.29	2.59	2.73	2.73	2.71	2.71	2.71	2.72	2.75	2.77
Pigs/sow	-1.36	-1.27	-1.27	-1.27	-1.27	-1.26	-1.25	-1.24	-1.23	-1.23
Cost per head	6.00	6.53	6.55	6.49	6.44	6.41	6.37	6.35	6.31	6.28
Net profit Per Head ($)	-3.56	-0.75	-0.43	-0.48	-0.60	-0.71	-0.76	-0.79	-0.77	-0.75
Net profit per pound	-2.51	-0.53	-0.31	-0.35	-0.44	-0.52	-0.57	-0.60	-0.60	-0.59
Industry	-403	-87	-51	-59	-73	-88	-95	-98	-98	-95

As costs increase, some producers are forced out of business and production declines. A lower level of production increases wholesale and retail prices, and higher prices help offset some of the cost increases. The profit impact is greatest in year one, and producers make $3.56 per animal less than they otherwise would have. By year two, the consumer is paying for most of the cost increase, and producer profits fall by only $0.75 per animal. The end result is a slightly smaller U.S. pork industry as slightly higher retail prices result in lower consumption. Adding up the lower profits per animal for all ten years and summing across the entire industry, the total cost of a ban to U.S. pork producers is $1.1 billion.

References

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