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The 1997 Moratorium on Construction or Expansion of Swine Farms: A Tale of Unintended Consequences

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In this edition of the *NC State Economist*, Dr. Tomislav Vukina describes how the state of North Carolina, determined to curb the negative environmental impacts of the rapidly expanding hog industry, passed new regulations that generated several unintended consequences. First, these regulations created substantial wealth gains for hog farmers who were grandfathered valuable production quotas for swine. Second, the quota system accelerated the industry's concentration in North Carolina. Third, the quota system stifled competition among swine-producing companies that eroded some of the initial windfall gains to hog farmers in later years.

The Evolution – and Regulation – of North Carolina's Swine Industry

An emerging development in North Carolina agriculture during the final decades of the 20th century was the rapid expansion of the swine industry. In the ten-year period from 1988 to 1997, the hog population in the state grew from around 2.6 million to over 9 million, and North Carolina rose from seventh to second in U.S. pork production, trailing only Iowa. The primary engine of this dramatic growth was the swine industry's transition to a market structure defined by production contracts between integrators/processors and independent farmers. These contractual relationships bind farmers (growers) to specific husbandry practices in exchange for monetary compensation that is insulated from market price volatility. Growers provide land, housing facilities, utilities, labor, and manure management, while integrators own the animals and provide feed and veterinary services. Moreover, integrators typically own and operate feed mills and provide transportation for feed and live animals. Some integrators are completely vertically integrated from breeding and growing into slaughter and processing, whereas others specialize only in live production and will typically sell finished hogs to pork processors using marketing agreements.

The scale of modern swine operations creates a significant on-farm waste management challenge for growers. The standard mode of operation involves storing animal waste in man-made lagoons, allowing natural processes to decompose the waste into sludge, and then spraying the sludge onto adjacent fields. In June 1995 during a particularly severe storm, an 8-acre lagoon in Onslow County was breached and over 20 million gallons of hog waste spilled into the New River. Within a month, the North Carolina Senate passed the Swine Farm Siting Act restricting the location of new swine houses and lagoons.¹ In March 1997, the General Assembly enacted the Clean Water Responsibility and Environmentally Sound Policy Act establishing a two-year moratorium on the construction or

¹ Chapter 106, Article 67 of the North Carolina General Statutes Available at:
https://www.ncleg.gov/EnactedLegislation/Statutes/PDF/ByArticle/Chapter_106/Article_67.pdf

expansion of hog farms, lagoons, and swine waste management systems.² The moratorium was originally established to give counties a window to adapt to the 1995 zoning ordinances, as well as to allow time for researchers to complete ongoing studies, and for the General Assembly to act on these findings and recommendations. This moratorium was renewed for two years prior to the 1999 hurricane season and extended two more times before finally becoming permanent in 2007.

Today, each swine production facility requires a North Carolina Swine Waste Management System (NCSWMS) general permit, which must be renewed every five years. These permits establish performance standards, annual inspection guidelines, production restrictions, and penalties for noncompliance. Each permit specifies the type of swine production operation (weaned-to-feeder pigs, feeder pigs-to-finished hogs, or farrow-to-finishing) and the maximum annual average number



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of animals that can be produced at the facility. The average weight of pigs produced and, consequently, the amount of waste generated, is dependent on the type of swine production operation. The maximum annual number of pigs allowed is multiplied by its respective average weight to compute a facility's permitted steady state live weight (Harden, 2015). The North Carolina Department of Environmental Quality maintains a database of permitted facilities in the state. There are currently 2,189 permitted swine facilities located in 61 of North Carolina's 100 counties. These permits regulate 9.6 million swine and

3,694 associated lagoons.³ The moratorium has been effective in the sense that the number, location, and size of swine farms in North Carolina have remained unchanged since 1997.

The moratorium and permitting system regulations were motivated by well-meaning environmental considerations, yet their implementation created unintended economic consequences that were not fully appreciated by the General Assembly at the time of their implementation. By establishing a firm cap on industry expansion through a production quota system, the moratorium effectively created a barrier to entry into swine production. This accelerated industry concentration in North Carolina, which was already well underway in the rest of the country. Moreover, the design of the manure-based production permit system led to the creation of windfall gains in the form of future rents to a scarce production factor – the required permit. The fact that the permits needed to grow hogs are fixed in supply makes them valuable. Because the hog farmers at the time this bill was passed were grandfathered into the permit system free of charge, this created a one-time wealth effect for them. In what follows, I will explain the significance of these effects.

² N.C. House Bill 515, S.L. 1997-458, 1997.

Available at: <https://www.ncleg.net/EnactedLegislation/SessionLaws/PDF/1997-1998/SL1997-458.pdf>

³ Program Summary: Facts about North Carolina's Animal Feeding Operations Program.

<https://deq.nc.gov/about/divisions/water-resources/water-quality-permitting/animal-feeding-operations/program-summary>

Market Consolidation

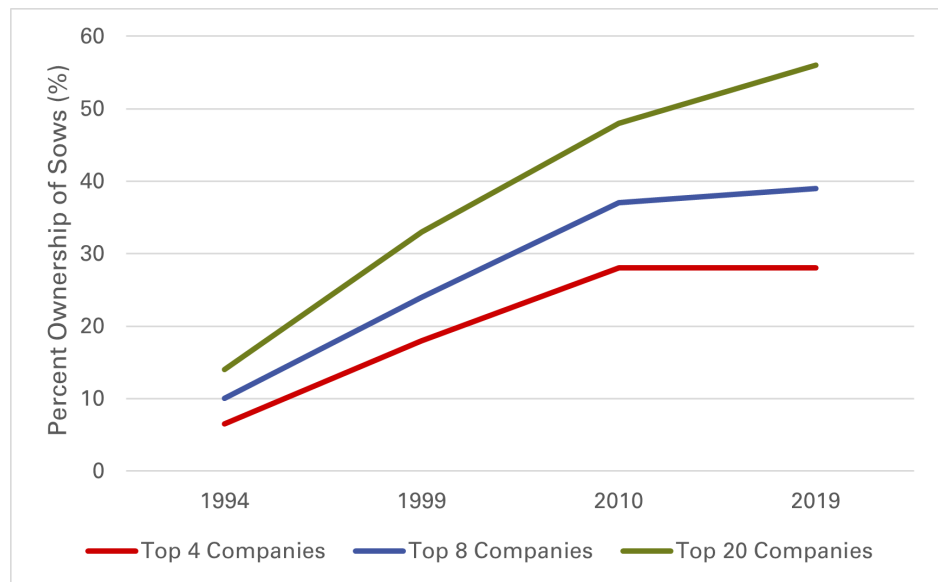
The early 1990s mark the beginning of the rise of Smithfield Foods as the swine industry's most dominant player. Smithfield opened the world's largest processing plant in Tar Heel, North Carolina in 1992, formed long-term contractual relationships with three North Carolina hog producers (Murphy, Carroll's, and Prestage), and produced its own hogs through Brown's of Carolina and the Smithfield-Carroll joint venture. At that point, the swine industry was not highly concentrated. Measured by the number of sows in 1994, the largest 4 firms accounted for 6.5% of the market, while the top-8 and top-20 firms accounted for 10.3% and 13.7% of the market, respectively.⁴ In 1999, Smithfield acquired Murphy Family Farms and its 325,000 sows, J&K Farms (15,000 sows), and Carroll's Foods (180,000 sows), all three based in North Carolina. Relative to 1994 when it had only 65,000 sows, Smithfield

grew to become the largest vertically-integrated U.S. pork packer-producer with 675,000 sows. In this 5-year period, the industry's top-4 firms grew to control 17.7% of the U.S. breeding stock, while the top-8 and top-20 firms accounted for 23.9% and 33.5%, respectively (see Figure 1). In the first decade of the 21st century, concentration in the national hog industry continued, albeit at a slower clip. In September 2006, Smithfield announced plans to buy its main rival, Premium Standard Farms. After that purchase, Smithfield's breeding stock in 2007 climbed to 1.23 million sows and its individual market share grew to almost 20%

of the national breeding stock. By the end of the decade, the swine industry breeding stock fell by about 7% relative to its peak in 2007. Smithfield also reduced its breeding stock both in absolute terms and as a percentage of the national total such that its market share dropped to about 15%.

The most momentous event in North Carolina's swine industry history occurred in May 2013, when WH Group, then known as Shuanghui Group, the largest meat producer in China, announced the purchase of Smithfield Foods. When WH Group took over Smithfield, its U.S. market share in sows still stood at 15% and has remained largely unchanged up to the present. However, the swine industry continued its trend towards higher concentration: in 2019, the top-4 firms captured 28.1% of the U.S. market, while the top-8 and top-20 were responsible for 39.2% and 56%, respectively.

Figure 1. The US Swine Industry Concentration Measures, 1994-2019



Industry concentration is a significant predictor of competitiveness. The higher the industry concentration, that is, the smaller the number of firms controlling the market, the weaker the within industry competition and the larger the individual firms' market power, i.e., the ability to price above the marginal cost of production. For example, the top-4, or C(4) concentration ratio measures the aggregate share of the leading 4 companies in the industry total.

⁴ Firm level data for the number of sows were obtained from Successful Farming Magazine's Pork Powerhouses rankings. Total industry sows were obtained from the USDA December issue of Quarterly Hogs and Pigs report (various years).

Prior to the moratorium, the competitive landscape in North Carolina generally mirrored national trends. But the 21st century ushered in a dramatically different competitive environment. As the national swine industry continued its path toward higher concentration, industry consolidation in North Carolina was even more pronounced. The U.S. Pork Powerhouses 2010 survey showed the presence of only four companies with a production base in the state, down from 16 a decade prior.⁵ It is difficult to identify an alternative explanation for this amplified industrial concentration in North Carolina relative to the national trend other than the 1997 moratorium on the construction of new hog facilities. While restricting growth in the construction or expansion of swine farms and lagoons (thus restricting growth in the number of pigs) in the State was the aim of the new regulations, the stifled competition in the hog industry was surely an unintended and undesirable consequence of the imposed moratorium.

The NCSWMS Permitting System

The second leg of the policy to control growth of the swine industry is the NCSWMS permit or the quota system. Production quotas have been and still are very popular policy instruments to control supply. They are ubiquitous and serve different purposes: from fisheries where they control harvest (individual transferable quotas or total allowable catch), to tobacco and peanuts where they were designed to limit market access (abolished by now), to taxi medallions required to operate a vehicle



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for hire (for example in New York City), to import quotas imposed to limit purchases from overseas (e.g., steel or cars). Quotas have two primary effects. First, they reduce output and increase prices. Second, higher prices increase the profitability of firms that remain in the industry. These profits are captured by quota owners (farmers) who are, by the restricted entry, insulated from competitive forces that would otherwise erode their profits. The quota value amounts to the expected stream of discounted future profits from growing hogs.

The creation of the NCSWMS permit system, in tandem with the moratorium on new hog farms, generated overnight windfall gains for those farmers who were lucky enough to be grandfathered permits at no cost. Essentially, swine farmers who operated when the NCSWMS permit program began received the equivalent of winning lottery tickets in the form of permits, free of charge. Of course, nothing would be per se wrong with winning a lottery, other than the fact that, in this case, the winning tickets were not randomly distributed among all citizens of North Carolina. This is another unintended consequence of the moratorium, and its troublesome aspect is the fact that the government de facto picked winners from the pool of citizens of the State. The story, however, does not end here. As I will show next, the aforementioned unintended effects of the moratorium to some degree canceled each other out in the

⁵ Because Pork Powerhouses' ranking in the 1990s did not capture companies involved in contracting with less than 10 thousand sows and due to ambiguities in the definitions of the headquarters and the production base, the data for North Carolina is not entirely reliable. Personal communication with Dr. Todd Sea, Professor and Head, Department of Animal Science, NCSU, revealed that 22 firms were involved in swine contracting in North Carolina in 1994, nine in 2010 and only five firms today.

intervening years.

Who Captures the Value of NCSWMS Permits?

With the increased market concentration of the swine industry in recent decades, North Carolina farmers now have fewer buyers for their hogs or fewer integrators to contract with. When negotiating over a contract's terms and, importantly, the price per delivered hog, their bargaining power has declined because their ability to walk away from a negotiation and find another buyer (i.e., integrator) to contract with is less feasible when fewer potential buyers exist. In the extreme case where there is only one swine buyer, economic theory predicts that the value of the production quota (permits) can be entirely captured by that single buyer. Such an outcome would imply that farmers would have been better off had the permit system never been introduced. In the less extreme case where there are a small number of swine buyers (as we see currently in North Carolina), the farmer's bargaining position is surely stronger than in the single-buyer case, but relative to a world where there were lots of potential buyers, the swine farmer's ability to capture the value of the quota is still diminished.

These insights have important implications for North Carolina's swine industry. As shown in a recent study by Rozowski and Vukina (2022), the increased market concentration of the swine industry has resulted in a gradual erosion of the value of swine permits to farmers. The authors observe that because state-issued NCSWMS permits cannot be sold separately from farms, the permit values are capitalized into farm values, and, other things being equal, the difference in farm sale prices for two farms, one with the manure permits to produce hogs and the other without, should reflect the market value of NCSWMS permits. Using a sample of farm transaction prices from the Cape Fear Farm Credit database and controlling for other factors that drive farm values within a hedonic regression framework,⁶ Rozowski and Vukina find that the presence of integrator market power on the market for live hogs (or the market for contract grower services) diminished farm values in North Carolina during the study period between 1994 and 2010. Their empirical results suggested that NCSWMS permits accounted for 32% of the total hog farm sales prices in 1994 but that the value of these production permits fell to 29% in 2010, costing the average farmer roughly \$38 thousand on a farm worth approximately \$1.27 million.⁷ Extrapolating these results to more recent farm sales, their results imply that the losses due to the lack of competition in the swine industry continue to be substantial. As an example, for an individually owned large swine farm with a permitted steady state live weight of 3.17 million pounds in Duplin County which sold for \$2.84 million in 2019, the value of the quota (permits) would amount to \$718 thousand but has declined in real value by about 11%, or about \$88 thousand, since 1994.⁸

Concluding Thoughts

This tale of unintended consequences has considerable policy implications for the North Carolina swine industry which is continuously facing significant challenges from regulators and various environmental groups. First, given current public sentiment, it seems likely that any enduring solution

6 The hedonic regression method is an econometric technique used to determine the value of some non-tradeable characteristic of an asset by considering it as a bundle of attributes (e.g., features) with an objective to determine how much the value of each individual attribute contributes to the total value of the asset.

7 High values of government programs created rents are commonplace. For example, under the corporate tax bill passed by Congress in 2004, owners of tobacco quotas and farmers who produced the crop in the U. S. received cash payments totaling \$10.1 billion as compensation for accepting an end to the tobacco price-support program. Under the buyout bill, quota owners received \$7 per pound of quota owned and active producers \$3 per pound of quota on tobacco produced. Most active producers also owned quota, and they received both payments (Pasour, 2005).

8 Because of the continuous deterioration of industry competitiveness (i.e., increase in market concentration), the implicit price of the permit decreased from 25.4 cents per pound of steady-state live weight in 1994 to 22.8 cents in 2010 and to 22.7 cents in 2019. Therefore, 3.17 million pounds of quota is worth \$718,332 in 2019 dollars but would have been worth \$806,702 if 1994 concentration levels had persisted, hence the drop in real value by \$88,370.

to hog manure problems in North Carolina will involve replacing the traditional lagoon and spray-field technology with a more environmentally friendly approach. Public and industry acceptance of any solution will depend crucially on the magnitude and incidence (i.e., who bears) of the adoption costs. Second, given that North Carolina hog farmers already lost significant equity in their farms due to diminished competition among swine integrators, the financial responsibility to address the swine waste problem should not be borne by hog farmers alone. It is important to recognize that the hog farm moratorium and NCSWMS permits came into existence via government regulation. These policies initially created a windfall gain for farmers but later served as a barrier to entry into the swine industry that led to market consolidation. With fewer competitors, integrators could then exploit their market power and earn larger profits by capturing part of the quota value from the farmers. All of this points to the important role of government regulations in the swine industry over the past 30 years. Going forward, developing new regulations to equitably share the cost burden of changing the industry's waste management practices will likely require new actions by lawmakers in Raleigh. Along with new hog waste regulations, it seems more likely than not that government assistance to farmers in the form of equipment grants, tax breaks, and subsidized loans will be necessary.

References

Harden, S. L. (2015). "Surface-water quality in agricultural watersheds of the North Carolina coastal plain associated with concentrated animal feeding operations." Technical report, US Geological Survey.

Pasour, E.C. (1995): "The Tobacco-Quota Buyout: More Legal Plunder." FEE, Foundation for Economic Education, February 1, 2005. <https://fee.org/articles/the-tobacco-quota-buyout-more-legal-plunder/>

Rozowski, C. and T. Vukina (2022): "Production Quotas, Competition and Farm Values: A Chronicle of the Swine Industry in North Carolina." Department of Agricultural and Resource Economics, North Carolina State University, working paper, mimeo.

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