

A Theory for Why Large Farms need Small Farms

John M. Crespi, Stéphan Marette

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Iowa State University
Ames, Iowa 50011-1070
www.card.iastate.edu**

John M. Crespi is Professor, Department of Economics, Iowa State University, Ames, IA 50010. E-mail: jcrespi@iastate.edu.

Stéphan Marette is Researcher, Institut National de la Recherche Agronomique (INRA), Thiverval-Grignon, FR 78850. E-mail: stephan.marette@agroparistech.fr.

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For questions or comments about the contents of this paper, please contact John M. Crespi, jcrespi@iastate.edu

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A Theory for Why Large Farms need Small Farms

Abstract: The political economy literature related to agricultural policy provides a number of conjectures corresponding to farm size, but provides no theoretical model of the political utility of small farms. Framed in the context of regulation, we demonstrate how large farms may use small farms to influence their regulatory burden. Producing in the presence of externalities, farms can be regulated to eliminate the damage. We compare a socially optimal regulation with the choice that would be taken by a large farm if it could influence the regulatory decision using the small farm as political cover. Compared to the socially optimal choice, there are cases where the large farm would choose regulation and reduced competition while in others would choose to fight the regulation to save its smaller rival. If the externality and the regulatory burden are very large, the large farm prefers more competition if that leads to less regulation. In this case, lobbying to “save small farms” is in the best interest of the large farm.

Keywords: farm policy, farm size, concentration, regulation, lobbying

JEL Classification: L5, Q15, Q18

1. Introduction

Small farms are politically important. Politicians and lobbyists regularly defend rural lifestyles and rail against rural exodus.¹ The evolution of the farming sector has taken different paths around the world, but despite talk of the industrialization of agriculture, small farms have proven unconventionally resilient. Why small farms remain viable and of special political status in the face of scale economies where the majority of agricultural production comes from ever-larger farms and a shrinking mid-size producer has fostered much discussion (Tweeten 1984, Tweeten and Amponsah 1996, Gardner 2002, Sumner 2014, MacDonald, Hoppe and Newton 2018).

What has not been discussed is whether small farms' political support factors into the objective function that influences market structure. U.S. farmers through most of the early 20th century until just after World War I saw generally good returns but beginning in 1921 and especially from 1929 to 1932 the farm-commodities price index fell by 56 percent and net farm income fell by 70 percent (Ezekial and Bean 1933; Hoffman and Libecap 1991; Breimeyer 1983). It was at this time that Congress began the precursors to the farm bills with the Agricultural Marketing Act (1929) and the Agricultural Adjustment Acts (1933, 1936). These farm bills helped farmers deal with market forces generally referred to as "The Farm Problem."² Approximately every five years, Congress passes another farm bill. Over the same time, especially since World War II, large farms have been growing larger (MacDonald, Hoppe and Newton 2018). By the end

¹ Although we focus primarily on issues in the United States, this is not a first-world issue only. In Africa and Asia, capping a vast rural exodus is important to all governments as cities grow extremely quickly leading to congestion, urban sprawl, pollution, urban overcrowding (<https://www.worldbank.org/en/programs/africa-regional-studies/publication/african-cities-opening-doors-to-the-world>).

² Gardner (1992) summarized the basic features of the supply and demand model of the farm problem as arising from the presumption that in agriculture: "(1) the demand is very inelastic, (2) the supply is very inelastic, (3) the demand increases slowly over time, and (4) the supply increases more rapidly. An implication is that farm product prices decline over time. Moreover, it requires technological progress sufficient to generate only a slightly larger rate of increase of supply compared to demand to cause prices to fall a lot, and relatively small transitory output or demand shocks to cause substantial price fluctuations."

of the 20th Century, as farming became more industrialized and farm sectors appeared more and more concentrated, questions arose as to the need for policies that seemingly make farmers a protected population and correlated over time with larger and larger businesses. Blank (1999) summarizes the thinking behind a rather dismal future for American farming, dismissing the need for taxpayer-funded answers to the farm problem: “The U.S. economy no longer needs agriculture and is rapidly outgrowing it. Voters support urban positions over rural interests. Taxpayers are tired of paying subsidies to farmers...No one is buying the farmer’s sob story anymore.” However, two decades later those tired taxpayers’ representatives passed a farm bill just short of one trillion dollars. The 2018-19 trade war between China and the US, the subsequent aid package to American farmers, and the “Phase One” trade agreement of 2020 with its generous treatment of the U.S. farming sector, only reinforce a special political relationship.

One argument as to why the protected status exists is that farm policy simply helps large corporate farms who likewise are influential donors. It is easy to point to correlations between larger farm aid packages and increased concentration and claim this is evidence of “payoffs” to a powerful farm lobby that represents its constituents in the same way the oil, energy and pharmaceutical lobbies represent their industries’ constituents. Politicians regularly make such connections. Democratic presidential candidate Bernie Sanders writes, “Storefronts are empty and farmers have been forced to sell their land that has been kept in families for generations to massive corporations” (Sanders 2019). Many might be surprised to learn, however, that the number of small family farms is about the same as it was in the 1980s and the average size of farms (about 400 acres) has not changed much in the last fifty years. Although small farms accounted for only 26 percent of the value of farm production in the U.S, they account for almost half of all land and make up 90 percent of all U.S. farms. Adding in medium and large family farms brings the total

share of farmland owned by families to 99 percent (USDA 2018). In other words, Sanders’ “massive corporations” are either family farms with large acreages who choose to incorporate for tax and liability purposes or the 1 percent of farm businesses that are not owned by families. But if large farms are getting larger and small farms are not disappearing, from where does the land come? The growth in large farms has come at the expense of mid-size farms, creating a great hollowing out of the industrial distribution with large family and non-family farms providing most of the farm value and small family farms providing most of the farming population.

The existence of numerous small farms raises many questions regarding the implementation of regulatory decisions. On the cost side, regulators must be aware that regulations on production can be disproportionate to farming scale, creating an undue burden on smaller farms. But perhaps even more importantly, each farmer represents one vote in an ever-declining rural population that nonetheless has greater than proportionate voter power in state legislatures, the U.S. Senate and the U.S. electoral college.³

Politicians and farm lobbyists regularly bemoan the decline of small farms and rural towns to attack “farm-killing” regulations and taxes. The outsize influence of the rural vote may explain the moderation or outright elimination of regulatory policies, but, obviously, the absence of a regulation also benefits large farms that might easily bear the cost of that regulation.

It seems almost too obvious that large farms could use the politics of small farm and rural-lifestyle issues as a shield. Surprisingly, we find little to no discussion of this connection in studies

³ 1920 was the first year that the U.S. Census showed more urban Americans than rural ones and that shift has only increased. But not so the political power of rural areas. In 1800, it took at least 30 percent of the U.S. population to elect a party majority to the U.S. Senate. Today, the share is just 17 percent, slightly less than the 20 percent share of Americans living in rural areas. Because state shares change as the population changes, the U.S. House of Representatives is less influenced, but still has an outsize share of elections turning on rural votes, especially in elections between the decennial census years. Researchers who have studied legislation from state houses and Congress have found significant rural biases, with more money flowing to rural areas than the population would suggest (Badger 2016).

of the political economy of farm policy and no explicit models of it. If rapid and unfaltering farm concentration is occurring because of economies of scale and scope, we ought to see small farms selling their lands to larger farms, as Senator Sanders and other politicians assert. This paper provides a theory to answer the following question: Why do small farms exist if large, powerful farms would benefit from their absence? The implication in the literature is that politicians are protecting small farms, but might large farms be protecting them as well?

In this paper, a simple theoretical model shows how large farms may use small farms to influence regulation. We present the theory in the context of some nameless negative externality that is a by-product of farming and an equally nameless regulation tied to a sunk cost to remove the problem. By maximizing social welfare in the presence of a simple entry decision, a policymaker chooses whether or not to eliminate the externalities, regardless of farm size. By comparing the policy maker's socially-optimal choice with the choice that would be taken by a large farm, we show that the large farm in some cases prefers competition from small farms while in other cases would choose to eliminate its rivals even if this leads to more regulation. It is when the externality would lead to (relatively) large regulatory sunk costs to eliminate it that the large farm would prefer to keep small farms (and their political clout) around.⁴ The next section tells the general political economy story concerning our thesis. The third section presents the theoretical model. The fourth section discusses extensions and concludes.

2. Small farms in the United States and agricultural policy

Swinnen (2019) reviews much of the recent literature on the political economy of agriculture. A consistent story in that literature is that the political clout of farming can actually grow even when

⁴ For lobbying, we follow a Downsian framework (Downs 1957) that politicians are motivated by the interests of their constituents, but a Besley-Coate (1997) framework where the politician is a member of the constituency is also amenable to the thesis as many politicians who support rural areas and farming are themselves from this background.

its economic clout declines.⁵ While much of the literature models the impacts to voting from the farm sector, we find no studies modeling the possibility that small-scale agricultural voters might be a tool to support large-scale agricultural producers. In 1989, Bruce Gardner provided a framework to think about “Economic Theory and Farm Politics.” Like Swinnen thirty years later, Gardner’s goal was to provide background in the form of reviewing the research and providing his own observations to help economists model the political economy questions of why, how and which farmers are supported through government policies? His reflections could just as easily have been titled, “How Do We Model Government Support for Small Farms?” Gardner (pp. 1166-1169) suggests six possible starting points for a theory including, *i.* “The existence of many picturesque farmsteads in the countryside appeals to many”; *ii.* “the belief that a healthy agriculture is a necessary condition for a healthy economy”; *iii.* a high political weight is put on farm income in Washington; *iv.* interest group action in the form of an “iron triangle” of lobbyists, staffers and specialists to whom Washington has ceded complicated policy; *v.* government is “owned and operated by a ruling elite” who sets all policy and, more particularly, *vi.* a theory “held by some rural populists, with the particular feature that the ruling interests are opposed to the interest of farmers, except perhaps very large-scale or corporate farmers.”

This last conjecture, the “rural populist theory,” Gardner rejects.⁶ However, we feel it is worth examining a little more because it is consistent with the rhetoric of politicians who rail against large farms and the negative impact on small farms and rural lifestyles. Why should “rural

⁵ Reasons given by Swinnen (pp. 36-37) are that “consumers do not notice farm policy expenditures as much while the share of their food budget declines so politicians reward rural voters more than urban ones; as farm numbers decline, the political cost of protecting farmers also declines; and farmers can collectivize when their numbers are smaller.” Swinnen (pp. 42-46) also discusses much of the literature concerning voting implications of the farming sector in democratic countries in more detail.

⁶“Because this theory predicts that ordinary farmers are heavily taxed and not subsidized, whereas in reality they are lightly taxed and heavily subsidized, this is one of the few instances in which political theory can be fairly decisively rejected” (Gardner, pp. 1169-70).

populists” posit such a theory? Empirically, there do seem to be reasons. The concentration of farming into ever-larger corporate entities concomitant with a decline in rural population growth relative to metropolitan areas are data. These patterns are seen not only in the U.S. but in many developed areas of the world and have a well-established literature (Cohen, 2003; Brown, Johnson, Loveland and Theobald 2005; Dimitri, Effland and Concklin 2005; Sumner 1985, 2014; MacDonald, Hoppe and Newton 2018).⁷ The literature cites economies of scale and scope as the primary mover of concentration (Tweeten 1984; Gardner 2002, pp. 73-87; Dimitri, Effland and Concklin 2005; Key and Roberts 2006; Roberts and Key 2008; MacDonald, Hoppe and Newton 2018); with farm policies moving the needle sometimes toward and sometimes away from concentration.⁸ Hence the rural populist theory might in some cases hold (e.g. when policy or regulation encourage specialization leading to support for large-scale agriculture) while in other cases, farm policy goes against the rural populist theory (e.g. price support that is capped at low sales revenue levels would not help extremely large operations).

Sumner (2014, p. 153) directly and simply asks: “Why are there very few large farms?” Sumner (2014) underlines the role of the economies of scale hypothesis but notes that “evidence suggests that these economies of scale seem to almost level out at some medium level of input” (p. 155) and the role of economies of scope (e.g. crop rotations, adding different enterprises),

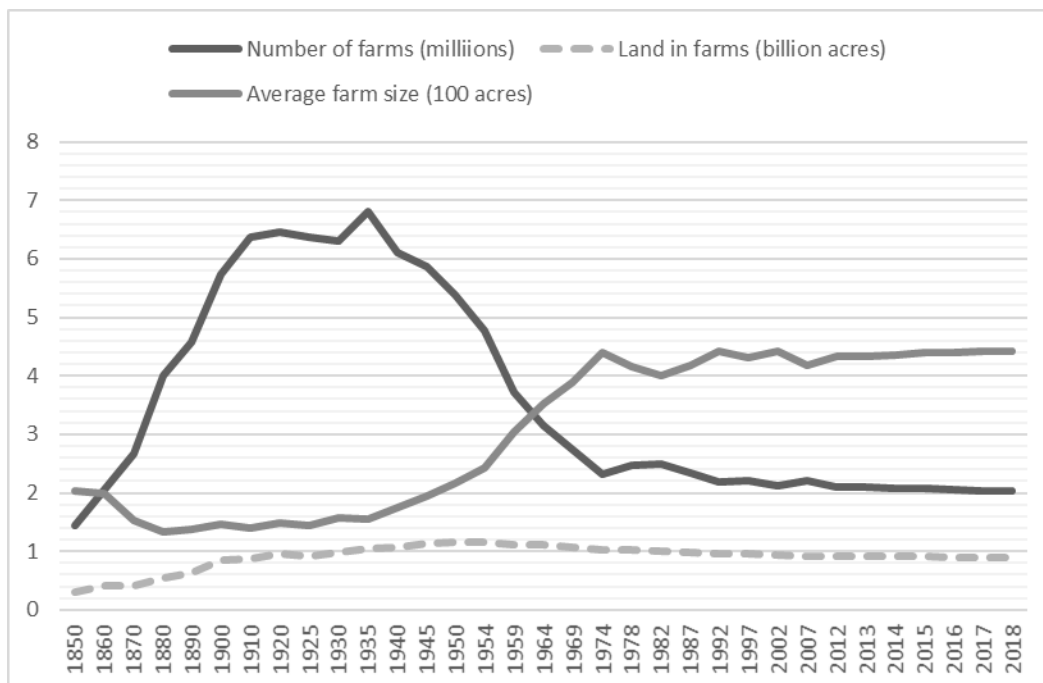
⁷ Interestingly, Olson (1985) forecasted that large-scale farming would never bear much fruit. From his standpoint in 1985 less than 30 percent of the value of U.S. farm output came from farms grossing more than \$1 million in sales and only 15 percent of all crops were grown on farms of greater than 2,000 acres. He felt scale had reached its optimal level. Today, more than half of the sales value and 36 percent of the cropland are on such farms (MacDonald, Hoppe, Newton 2018). And while Olson would be correct in pointing out that there are still many small farms, he would be hard pressed to explain why competitive pressures have bifurcated farmlands into small farms averaging slightly less than 100 acres making most of their income from off-farm activities and extremely large farms who actually produce most of the value.

⁸ “Overall, farmers found ways to adapt to the changes of the last century. Those who remained in agriculture increased their efficiency by expanding and specializing their operations to take advantage of economies of scale, or by identifying niche markets to maintain profitability....Farm policies have never fundamentally altered the trajectory of change, but they have in some cases affected its pace.” (Dimitri, Effland and Concklin 2015, p. 12).

lumpy physical assets, and managerial capability may limit scale economies. A “medium level of input” does not suggest the image of the bi-modal distribution one sees (unless one simply ignores counting small farms in the production function). Sumner nonetheless argues that whatever is the answer to the question of why there are few large farms, farm policy is “inevitably connected” to the reason (p. 160).

It is well established that concentration has increased in farming, it is likewise well known that the number of very small farms has remained mostly unchanged since the late-seventies. Much has been written about how the U.S. Department of Agriculture (USDA) defines a farm and that based upon this definition, the number of farms in the U.S. has remained more or less constant at about 2 million since the 1980s (O’Donoghue et al. 2009 and figure 1). Remaining unchanged since 1975, the USDA defines a farm as “any place from which \$1,000 or more of agricultural goods (crops or livestock) were sold or normally would have been sold during the year under consideration” (O’Donoghue, p. 4). Sumner (2014, p. 147) puts the issue bluntly. “In fact, most of these ‘farms’ contribute approximately nothing or less than nothing” to U.S. agricultural production instead existing for their “public relations *and political rationales*” (emphasis ours) whereby “elected representatives laud the efforts of ‘two million American farms’ to feed the world or support the rural economy” (p. 147).⁹

⁹ Koerth-Baker (2016) writes of this in a recent popular press article titled “Big Farms are Getting Bigger and Most Small Farms Aren’t Really Farms At All.” In a similar popular press article titled “Many Small Farms Squeezed Out of Family Farm Designation” Hunter (2018) argues the USDA definition overcounts small farms because it includes definitions of ownership practices that include incorporation and partnerships.



Source: National Agricultural Statistics Service, Census of Agriculture, various years.¹⁰

Figure 1. US farms, land in farms, and average acres per farm, 1850-2017.

We do not dispute that the definition of small farms can be in the eye of the beholder. However, while the cutoff for farming used by USDA might be the reason why so many farms exist, replace the word “farm” with any other industry and ask what is the cutoff in terms of output, value, square footage, etc. in the definition for any other trade or business in U.S. law? The Internal Revenue Service (IRS) merely defines a business as “any activity carried on for the production of income from selling goods or performing services” (IRS 2020). In other words, the definition of a business, any business, is fluid. In farming, what determines a farm business has been precisely defined. Politically, that can reap benefits.¹¹

¹⁰ The authors are thankful to Kathleen Kassel at ERS, USDA.

¹¹ Interestingly, as Sumner 2014, p. 153, notes, the definition for “small business” by the U.S. Small Business Administration is arguably liberal in many industries, but especially so when it comes to farming. This is important because the Small Business Administration’s definition impacts special loans for small businesses. This observation, in fact, bolsters the thesis of this paper. The dismissal of small farmers as not really farmers also plays into a belief

Prager, Tulman and Durst (2018) find that in any given year, roughly half of the 2 million farms in the United States have negative net incomes. Resident farm households, defined as farms with less than \$350,000 in annual gross cash farm income (and a principal operator with a nonfarm occupation) had an average *loss* in 2015 of \$2,241 while commercial farms with greater than \$350,000 in gross cash farm income earned \$232,780 on average. If this is the case every year (as it was again in 2016-2018; NASS Table 9-39, 2019), then what keeps these smaller farmers in business? One answer might be government payments, but Key and Roberts (2006), find that such transfers have only a small (albeit significant) impact on farm business survival, and such payments “increase business survival rates proportionally more for larger farms” (p. 391). Perhaps it is simply that off-farm income and the tax and farmland value advantages keep small farms in business. Prager, Tulman and Durst (2018) found that adjusting income to account for tax-loss benefits from farming against the non-farm earnings and asset appraisal (mostly from farmland), raised the net *farming* income of small farms to an average of \$13,619. However, using the same adjustments, commercial farms increased average net farming income to \$308,084. Whatever is benefiting small farms, seems to benefit large farms as much or even more.

Taking into account that many farms benefit from policies that help them mitigate risk (especially in the form of taxpayer subsidized insurance), and one must conclude that it is not simply the definition that keeps small farmers in business. The fact that the low threshold in the farming definition has never been updated, not even for inflation, in the several farm bills since the definition was adopted underlines the political calculation to keep that cutoff low, as Sumner

that urbanites and academics are out of touch with rural communities thus fostering a need for a stronger farm lobby. When economists raise the sales threshold to something claiming “economic meaning” they are jettisoning the political part of the equation that may be just as important as the economic portion. For example, Qu et al (2019) surveyed Midwestern farmers to assess their support of President Trump’s trade war with China but excluded farmers with fewer than 250 operating acres of corn or soybeans.

(2014) has written. Unlike other industries, a definition of a farm is necessary because Congress creates regular farm bills that specifically target farm businesses. Such a low cutoff helps small farms remain in business by providing aid to them, which might seem anathema to the large producers who actually create most of the production value. From either a market-structure standpoint, an economy-of-scales standpoint, or a rural populist standpoint, why would large farms who have political clout of their own, put up with even a slight loss in market share from a competitive fringe especially when “buying the farm next door” attracts no great regulatory oversight? If large farms are running the show, in the populist theorem, why would they allow even a small amount of profit to go to a competitive fringe? Why would they allow, for example, that, “It is new farmers, just starting out, who receive most of the low-interest loan money available each year from the United States Department of Agriculture” (Vilsack 2018)? Likewise, there are income ceilings to the so-called subsidies received from many farm programs that hit large farms but not small farms (Vilsack 2018).

Farmers benefit from being a large voting bloc and representatives from states with large farm sectors would be served by having more voters in their districts. The farm definition would seem to create a political feedback: more small farmers benefit from farm policy and in turn support their local representative. But, what about large farms? Is the political benefit of being part of a large bloc worth the economic loss from a competitive fringe? The answer is informative because the structure of farming is different than the structure of other industries. The automotive, aviation, pharmaceutical, and computer industries, like agriculture, have very few large firms, but unlike agriculture no long-run, stable competitive fringe for whom both politicians and the larger firms support.

In 2017, politicians railed against the “death tax.” The estate tax was greatly reduced with

the passage of the 2017 Tax Cuts and Jobs Act (TCJA), which raised the estate tax exemption to \$5.43 million per individual (\$11 million per couple) from \$675,000 (\$1.34 million per couple), which had been in place since 2000. But even this decline is misleading. Under the previous estate tax a marginal rate of 55% was encumbered only on the estate above the exemption. Today, under the TCJA, the rate above the exempted portion fell to 40%. Such exemptions must have had significant consequences given the rhetoric, but Williamson and Bawa (2018) estimated that along with these exemptions and other tax credits, had the TCJA been in effect in 2016, only 0.86% of all farm estates would have paid the tax. After the TCJA, only 0.11% of all farm estates, a mere 43 estates, would pay anything. Yet, to listen to politicians discuss the “death tax” prior to the TCJA, one would think thousands of farms were affected.¹² So, who did benefit? Williamson and Bawa (2018) find that large farms were the biggest beneficiaries of the reductions. Likewise, other changes to the TCJA, such as new capital cost recovery provisions, benefited mostly large farms (Williamson and Bawa, 2018, p. 9).¹³

Small farms have also been used recently as the frontlines of trade policy. As the United States and China resort to tit-for-tat tariffs that certainly impact more than farmers (Balisteri et al. 2018), farmers do bear a bigger than proportionate impact. When the Trump administration announced compensation to U.S. farmers, the National Farmers Union was quick to thank USDA and its “work to mitigate family farmers’ losses as a result of these trade disputes” (Doran 2019)

¹² John Thune, Republican Senator from South Dakota, claimed in the *Rapid City Journal* on April 13, 2015 that “one-third of South Dakota farms [are] vulnerable to the death tax.” Paul Ryan, then House majority leader and Republican congressman from Wisconsin, said in a hearing of the House Ways and Means Committee on March 25, 2015 that the estate tax “doesn’t just hit the big guy. It hits the little guy—like the small business and the family farm.” Democratic congressman Sanford Bishop of Georgia, in a press release March 27, 2015, echoed these sentiments saying the estate tax “undermines the life work and the life savings of farmers and small- and medium-sized businesses.”

¹³ In 2016, the effective tax rate on pass-through businesses in the U.S. was around 24 percent (U.S. Department of the Treasury 2017, p. 7). By comparison, the effective tax rate for farms was around 17 percent (Williamson and Bawa, 2018, p. 22).

although as the Environmental Working Group pointed out, more than half of the \$8.4 billion dollars from the first round of trade-related bailouts went to the largest 10 percent of U.S. farms (Pamuk 2019).

Farm policy and taxes are not the only place where small farms' political clout might be used to insulate larger companies from scrutiny. Smithfield (owned by China's Shuanghui International) is the largest pork and hog producer in the world. In April 2018, a North Carolina jury ruled that a hog farm contracting through Smithfield's subsidiary Murphy-Brown was liable for pollution. Smithfield and its subsidiaries both contract with farmers but also maintain their own hog production operations. In a news release Smithfield Senior V.P. Keira Lombardo (2018) did not claim Smithfield itself was under attack but that the lawsuit was "an outrageous attack" on "thousands of independent family farmers who own and operate contract farms."¹⁴

Examples of changes to regulations that benefit large farms much more than small farms are numerous. Although the 1972 "Clean Water Act" defines agricultural waste discharged into water as a "pollutant," the Act exempts agricultural return flow runoff from necessitating a permit and exempts agricultural stormwater discharges (Federal Water Pollution Control Act Secs. 402 and 502). This makes small farms off limits to regulatory scrutiny of its runoff, but clearly helps even larger acreages. Likewise, the recent rollback of the Waters of the United States EPA rules helps very large farms but it was thousands of farmers and ranchers who lobbied to overturn the rule (Friedman and Davenport 2019). Could a large farm or CAFO have successfully lobbied for a rollback? It is also hard to imagine a very large food manufacturer arguing it should not be

¹⁴ In August 2018, Smithfield was found guilty by a federal jury and ordered to pay \$473.5 million in damages from three of its hog farms. North Carolina legislators reacted by passing new laws against "nuisance lawsuits." U.S. Representative David Rouzer is considering federal legislation saying, "nuisance lawsuits that are destroying livelihoods and communities in North Carolina are the tip of the iceberg for what is to come...This is a very slippery slope that threatens the very existence of every form of agriculture nationwide" (CBS News 2018).

inspected following a food-safety event. However, only the United States and India have no mandatory national identification and traceability systems (Smith et al. 2005; Schroeder and Tonsor 2012). In the summer of 2015, almost 200 people in the state of Washington became ill from drug-resistant salmonella poisoning from pork. Overuse of antibiotics in livestock, especially pigs, is widely blamed for the emergence of drug-resistant bacteria. Yet while inspections could be made at restaurants, supermarkets and pork processing facilities, USDA, FDA and CDC investigators are stopped by law from collecting farm data without farmers' permission (Richtel 2019).¹⁵

It is hard to imagine very large farms (or any large companies, for that matter) arguing publically for lower taxes; that runoff should not be monitored; that they should be off limits to inspection; that property values should appraise at lower values, or that water should be half the price of water sold to non-farms. It is easier to imagine millions of small farms, struggling with consistently negative net farm incomes, making these arguments. When might large farms benefit?

3. A simple model

We present an extremely simple model to provide a basic theory which we feel is overlooked in the literature. We provide numerous extensions afterward.

3.1. The assumptions

For simplicity only, trade occurs in a single period with two farms $i=\{1,2\}$ deciding whether or not to exit the market. Farm 1 represents a large farm (or a group of large farms) with an output q_1

¹⁵ These are just a few examples. The history of farm policy has many. The Metropolitan Water District (MWD) gets its water from the California Aqueduct, the same source as many California farmers who buy water from Westlands Water District. Urban users of MWD water pay about \$1200 per acre foot. Farmers pay less than half that amount from Westlands (Cline 2007). In Kansas, a farmer pays real estate taxes based upon her land's use value while her non-farming business neighbor pays taxes based on his property's market appraised value (Kansas Constitution). Both of these examples benefit larger farms more than small ones in the presence of cost economies.

and a cost function $\frac{q_1^2}{2} + IF$, with F a sunk cost incurred to eliminate the externality. I is an indicator variable equal to 1 if the effort is chosen and zero otherwise. Farm 2 represents a small farm (or a group of small farms) with an output q_2 and a cost function $cq_2 + q_2^2/2 + IF$, with $c > 0$, so that the smaller farm is less efficient. IF is identical to that incurred by farm 1.¹⁶

Farmers are price takers facing a linear demand $Q(p) = a - p$, where $Q(p)$ is the quantity, p is the price and $a > 0$. For each farm, its output generates damage $(1 - I)D$ that is not directly proportional to the output of the farm. When a farm makes no effort to control the externality, namely with $I = 0$, society (or a third party) incurs the damage D . This damage is not directly taken into account by consumers through demand $Q(p) = a - p$. When damage-control effort is undertaken, $I = 1$, and there is no externality. With the assumptions of (i) a third party incurring the damage and (ii) no impact from the damage on demand, farms have no incentive to mitigate the damage without regulation. In this way, we avoid introducing nuances that complicate the model without enhancing it.

The timing of the game is as follows. In stage 1, the regulator may impose the regulation. This regulation requires damage-control while maximizing welfare, defined as the sum of farms' profits and consumers' surplus less the damage. In stage 2, farmers decide whether or not to produce. In stage 3, consumers buy the output.

3.2 Market mechanisms

The game is solved by backward induction (i.e., subgame Nash equilibrium). When consumers make purchases in stage 3, we determine profits and consumers' surplus. We assume that, with

¹⁶ Sunk costs can play an important role in models of political economy. Becker (1983, p. 383) opines that sunk costs are not sunk in the political realm because firm decisions on undertaking or not undertaking them can alter their political protection.

one or two farms, there is a unique equilibrium in stage 3. If two farms produce (in stage 2), profit is lower than if one farm produces (otherwise one farm could split itself into two to maximize profit).

We now turn to the farms' profit-maximizing decisions. In stage 3, farm 1 maximizes its profit $pq_1 - q_1^2/2 - IF$. For a given price p , the maximization of this profit leads to a supply $q_1(p) = p$. Farm 2 maximizes its profit $pq_2 - cq_2 - q_2^2/2 - IF$. For a given price p , the maximization of this profit leads to a supply $q_2(p) = p - c$.

When 2 farms enter the market, the price equalizes demand $Q(p)=a-p$ and overall supply $q_1(p) + q_2(p)$. The equilibrium price is

$$p^* = (a + c)/3 . \tag{1}$$

Consumers' surplus with two farms is equal to

$$CS^* = \int_{p^*}^a Q(p)dp = (2a - c)^2/18 \tag{2}$$

By replacing p^* and supplies in the profit functions, the equilibrium profit for farm 1 is

$$\Pi_1(I) = (a + c)^2/18 - IF . \tag{3}$$

In order to examine the case where farm 2 would have positive output, we assert $a > 2c$. In this case, equilibrium profit for farm 2 is

$$\Pi_2(I) = (a - 2c)^2/18 - IF . \tag{4}$$

When no effort is imposed ($I=0$) the profit in equation (4) is positive and the small farm always exists in the market. Conversely, the small farm's profit $\Pi_2(1)$ when effort is imposed (with $I=1$) is crucial to determine the number of farms in the market. The constraint $\Pi_2(1) = 0$ is satisfied when $F = F_1$ with

$$F_1 = (a - 2c)^2/18. \tag{5}$$

When $F \leq F_1$, both farms produce in stage 2 with positive profits. When $F > F_1$, the small farm does not exist on the market in stage 2 because its profit, $\Pi_2(1)$, is negative. When only the most efficient (large) farm exists, price equalizes demand $Q=a-p$ and the supply $q_1(p)$ in stage 3. The equilibrium price is

$$p^{**} = a/2 . \quad (6)$$

Consumers' surplus with one farm is equal to

$$CS^{**} = \int_{p^{**}}^a Q(p)dp = a^2/8, \quad (7)$$

and equilibrium profit for farm 1 is

$$\hat{\Pi}_1(I) = a^2/8 - IF . \quad (8)$$

For simplicity, we restrict our attention to cases for which profit $\hat{\Pi}_1(1)$ is always positive, namely for $F < a^2/8$.

3.3. The socially-optimal choice of effort

In stage 1, the socially-optimal choice of effort maximizes welfare taking into account farm profits, consumers' surplus and damage from the externality. When both farms profitably exist, welfare is

$$W_2(I) = CS^* + \Pi_1(I) + \Pi_2(I) - 2(1-I)D = (a^2 - ac + c^2)/3 - 2[IF + (1-I)D]. \quad (9)$$

When both farms ignore the damage, $I = 0$, no sunk cost is incurred, and welfare is equal to $W_2(0)$.

Conversely, when effort is imposed by the regulator and sunk cost is *affordable* for both farms, welfare is equal to $W_2(1)$.

What happens when the small farm cannot afford the sunk cost? When a regulatory imposition ($I=1$) leads to a negative profit (equation 4), the small farm exits (or does not enter). Some legitimate “distortions” may appear if the effort is used to limit entry because it also leads to the absence of damage. When only the large farm exists on the market, welfare is

$$W_1(1) = CS^{**} + \hat{\Pi}_1(I) = a^2/4 - F. \quad (10)$$

The maximization of welfare relies on comparing $W_2(0)$, $W_2(1)$ and $W_1(1)$. The policymaker maximizes welfare by considering and controlling farm entry due to the regulation. The *optimal* policy is described in both figure 2 and proposition 1, with the sunk cost F represented on the x -axis, and the damage D represented on the y -axis. In different areas of this figure, the level of effort and the entry of farms are indicated.

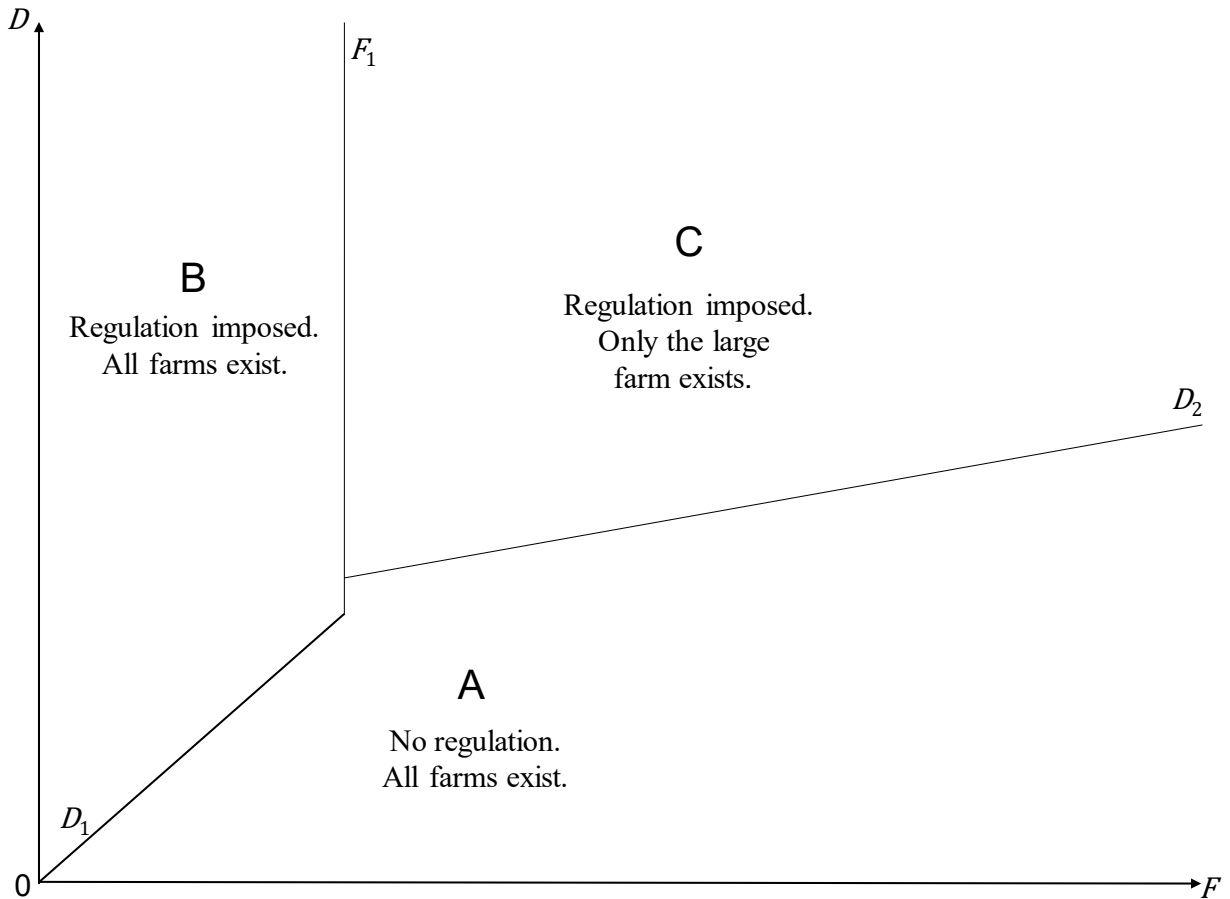


Figure 2. The socially optimal choices to maximize welfare

Proposition 1: *When welfare is considered, the regulator chooses:*

In area A, no regulation is imposed and both farms coexist in the market.

In area B, the regulation is imposed and both farms coexist in the market.

In area C, the regulation is imposed and only the large farm exists in the market.

Proof in Appendix.

Proposition 1 and figure 2 show that the regulatory imposition of effort and the number of farms depends on the relative sizes of the damage D and the sunk cost F . When the damage is relatively low (in area A), the absence of regulation is optimal and both farms exist in the market. When the damage D is relatively high and the sunk cost F is relatively low (in area B), requiring the elimination of the damage is compatible with all farms co-existing in the market. In area C, when the damage D is relatively high (above D_2) and the sunk cost F is relatively high (to the right of F_1), the regulation is not compatible with all farms coexisting, since the increased competition does not generate enough profits to cover the regulatory sunk cost. In area C, regulation excludes small farms.

3.4. The preferences of the large farm toward lobbying on behalf of the small farm

The large farm (or its lobby) may contest the socially-optimal choices presented in figure 2. What if the large farm could make the regulatory choice? Profit maximization would reveal its preference. In this scenario, we compare $\Pi_1(0)$, $\Pi_1(1)$ and $\hat{\Pi}_1(1)$ (see equations (3) and (8)). Comparing $\Pi_1(0)$ and $\hat{\Pi}_1(1)$ provides clues regarding the preference of the large farm to support small farms even if it competitively disadvantages the large farm. The constraint $\Pi_1(0) = \hat{\Pi}_1(1)$ is satisfied when $F = F_2$ with

$$F_2 = (5a^2 - 8ac - 4c^2)/72. \quad (11)$$

When $F \leq F_2$ ($\Pi_1(0) < \hat{\Pi}_1(1)$) the large farm would prefer to have regulation even though it is costly, because its profit in the face of the regulation is higher than its profit in the face of competition. Conversely, when $F > F_2$, the large farm would prefer no regulation even though it means competing with the small farm because $\Pi_1(0) > \hat{\Pi}_1(1)$.

Figure 3 represents the private choices of the large farm that could lobby on behalf of small farmers (with notes in italic showing how the regulator would choose in a given region from figure 2). Areas A and C of figure 2 are now split in figure 3 into several sub-areas (A_1 , A_2 , A_3 , C_1 , and C_2) depending on the differences between private and social choices. Only area B remains unchanged.

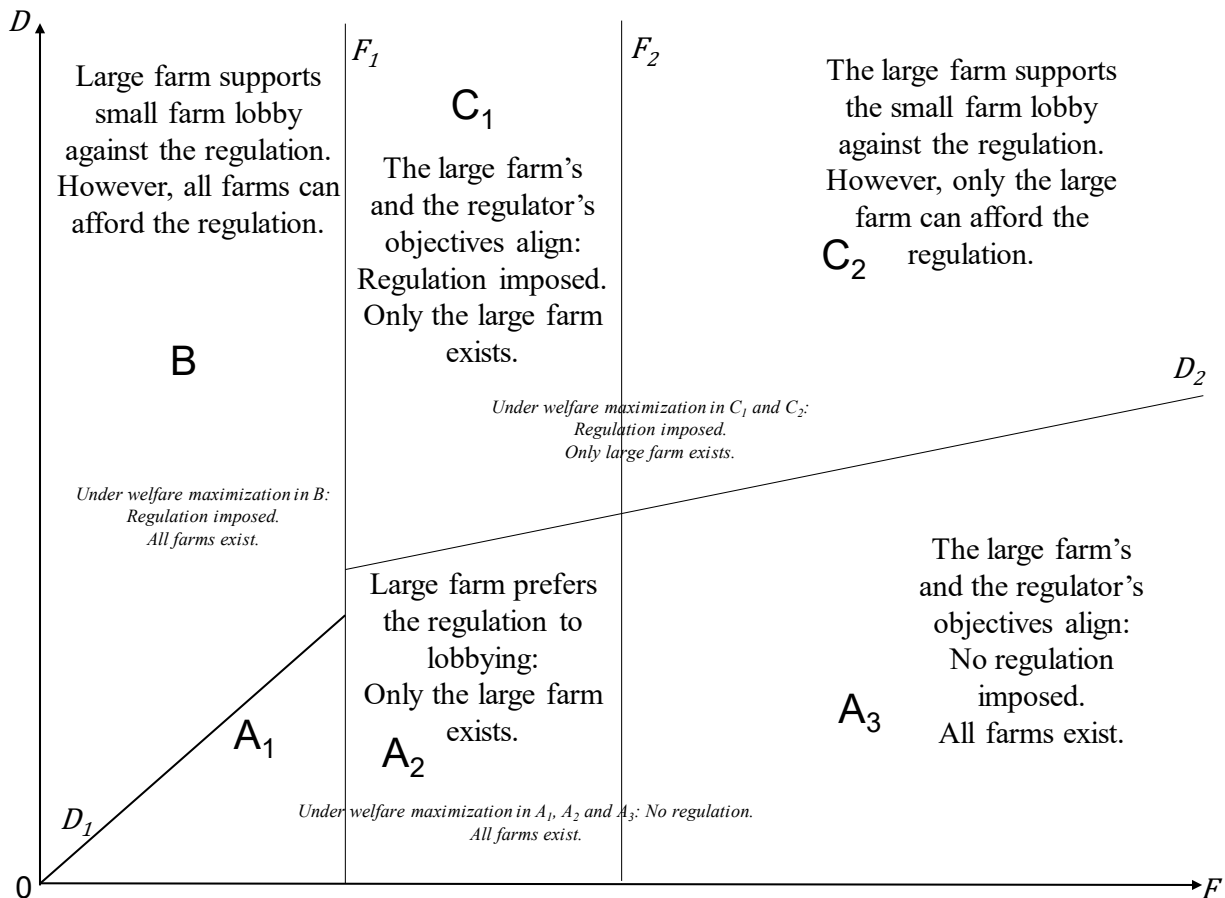


Figure 3. Large Farms Support for Small Farms Depends on the Tradeoff between More Competition and Less Regulation.

Proposition 2: *Lobbying on behalf of the small farm will not exist in areas A_2 and C_1 . Here, the large farm would prefer the regulation, which keeps small farms out of the market.*

In areas B and C_2 , the large farm would prefer no regulation. In area B, both farms can afford the regulation. Only in area C_2 is lobbying to protect the small farm honest in that the

absence of the regulation really would keep the small farm in business. In the presence of the regulation, the small farm cannot exist in area C_2 (see figure 2).

Proof in Appendix.

Figure 3 shows that the large farm and the regulator have different objectives, but not always. For “medium” values of sunk cost and relatively low values of damages, in area A_2 , the large farm would prefer costly regulation because it leads to the exclusion of small farms with which it competes. As the sunk cost is not very high, the large farm prefers excluding rivals. In area A_2 , if the large farm imposed its view, there could actually be an overinvestment to reduce the damage compared to the socially optimal decision by the regulator. Doing even more toward eliminating the damage in this case maintains its dominant position and excludes rivals. When the damage is potentially large but the sunk cost is small (area B), the large farm may engage in lobbying on behalf of the small farm. However, lobbying on behalf of the small farm in this case is disingenuous as both farms can afford the regulation. As costs of mitigating the externality increase, however, something interesting happens. Initially, the large farm would accept the regulation and watch its rival go bankrupt in areas A_2 and C_1 . Interestingly, in area C_1 the large farm and the regulator will be in agreement: both social welfare and the large farm’s profit are maximized in the absence of the small farm. From a rural populist’s perspective, it may appear in area C_1 that the regulator is in the pocket of the large farm, although in reality this is not coordination. On the other hand, if a regulation were imposed in area A_2 , one could rightly make that argument because in this case social welfare is lower in the presence of the regulation but the large farm’s profit is higher.

As sunk costs and damage increase as we move into area C_2 , the large farm can afford the regulation, but would prefer no regulation even though this means it will have rivals. It is in this

last area where the large farm would support lobbying activities that truly will “Save the Small Farm” but, it supports these efforts because the large farm would be better off in a competitive market without the regulation. Note that area C_2 increases when F_2 decreases (or moves towards the left in figure 3), which is the case when the parameter c increases, namely when the small farm’s efficiency declines.

The comparison between $\Pi_1(0)$ and $\hat{\Pi}_1(1)$ determines the lobbying decision of the large farm. The attitude of the large farm depends on the comparison between its profits when 2 farms enter the market and its profits when it is alone in the market. The use of the economic impact on small farms by large farms to avoid regulation (as in area C_2) is not systematic. The radical difference between strategies in areas A_2 and C_2 underlines the ambiguity of the farms’ attitude. Regulation can be used as a tool to either exclude or protect small farms, thus while there are cases where large farms benefit along with small farms from the absence of regulation there are also cases where large farms prefer the regulation because the benefit of getting rid of competition is higher than the cost of the regulation. Lobbying to save the small farm can at times help both large and small farms, but from the large farm’s perspective, there are also times when silence is golden. We now have a model that gives insight into when those times occur.

3.5. Extensions to the model

Focusing on the main economic mechanisms at work, we kept the mathematical aspects as sparse as possible. From the previous, simple model, our analysis could accommodate various contexts using the following extensions.

We only consider 2 farms, but we could obviously consider n farms entering the market. Figures 2 and 3 could be extended to the case with n farms. Among them, it is possible to enrich

the model using heterogeneous farms with various sizes or various levels of efficiency. Further extensions could exhibit a socially optimal number of farms, influencing the socially optimal policy and the policy that a group of large farmers could decide.

We could also study acquisition of the small farm's assets by the remaining farm. We believe that results would be similar but much more complicated to demonstrate graphically. An exit model raises the question of fixed costs incurred by farmers that become sunk when farmers leave because of a new and unexpected regulation. Future work should consider such exit conditions as they may be more realistic, however.

Other regulations, such as mandatory labels, minimum-quality standards or a Pigouvian tax could be also considered. Even if the market distortions differ between these instruments, they generally impose some costs on farmers that penalize small farmers. Larger farmers would voice these difficulties to avoid mandatory regulations (as in area C_2 of figure 3).

We asserted the process of lobbying by large farms but this could be detailed. We could take into account the cost of lobbying and the probability of its success. The marginal benefit coming from lobbying could include the difference between the expected profit from successful lobbying minus the profit without lobbying. One could then compare the marginal benefit to the cost of lobbying.

Finally, only two types of farms were considered. However, there is a huge diversity of farms, and it is well understood that mid-size farms in the U.S. are on the decline. The model does not directly capture this effect, but the effect of preserving small farms via lax regulations (as in area C_2 of figure 3) could coexist with predatory actions of very large farms interested in buying medium-size farms with similar assets. The very small farms are not as capital intensive and survive with other sources of household income, which makes the small farms not as appealing for

predation from large farms. In such a context, small farms are useful because of their political clout, whereas medium sized farms are just a competitive threat.

Nevertheless, all of these additions bring with them complications that do not necessarily better explain our initial question: Why do small farms exist? Political cover, as demonstrated in the many anecdotes and discussion of the political economy literature does fit the model presented in figures 2 and 3 in a context of an impending regulatory burden. If the large farm wants to avoid it, it will put up with competitive pressures sometimes, but not always. The model explains when it will and when it will not: it is the trade-off between a large farm's profit under regulatory burden and under lobbying on behalf of its competitors.

4. Conclusions

The existence of a long-run, economically stable, competitive fringe of barely profitable small farms in the presence of large farms that could easily assimilate them is an empirical regularity that has no simple theory to support it. Simple accounting factors, scale economies and competitive cost pressures should have eliminated small farms long before the elimination of mid-size farms, for example, and yet the reverse is happening. Politicians regularly treat small farms as a protected class as if it were in decline when, as far as farm numbers go, it remains at approximately 2 million in number as it has for nearly forty years. The answer that this is because of rural politics and rural votes is believable, and yet, does not coincide with a rural populist argument that small farms are at the mercy of large farms who are getting larger at their expense. Large farms are getting larger, but small farms are not really going anywhere and both large and small farms lobby for the same political messages of less regulation, lower taxes, and special treatment due to the hardships of farming. But even here, large farms benefit from some, but by no means all, of the policies that

help small farms. Large farms are not without political influence, so why lobby on behalf of smaller farms? General Motors bought Chevrolet, they did not ask Congress to make it easier for Chevrolet to sell cars. What is missing is a model that ties all of these pieces together. In this paper we present one.

How does this relate to the rural populist theory that large farms are in control of the political process? By using the political clout of the small-farm voting bloc, a large farm can advocate for policies that protect small farms in order to get around regulations that it could afford to pay but would prefer avoiding. The existence of the competitive fringe, although it reduces a large farm's profits, is a price worth paying if the regulation is more costly to the large farm than the loss in profits. While this seems simple enough, showing that there are other cases in which the large farm would be "happy" to see its smaller competitor eliminated by the regulation, generalizes the theory to show that the small farm is as much dependent on the large farm as vice versa. Politically, the two entities benefit from each other.

The empirical validation of our theoretical model is an open question, but future research should contrast market structure and lobbying messaging in both the presence and absence of actual or proposed regulations imposing large sunk costs (e.g. acreage removal, testing machinery, housing specifications, traceability) to overcome potentially large externalities (e.g. runoff, humane farming practices, ambient noise, air pollution). Differing state regulations, for example, contrasted with heterogeneous operation sizes and numbers of farms across states or industries while controlling for other factors that influence the size of operations, would provide a test of the model. We leave that to future researchers but hope that we have now provided the theoretical framework from which to test such hypotheses.

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Appendix

Proof of Proposition 1:

The maximization of welfare relies on comparing $W_2(0)$, $W_2(1)$ and $W_1(1)$. (see equations (9) and (10)).

The constraint $\Pi_2(1) > 0$ is satisfied when $F < F_1$ with F_1 given by (5) and welfare is defined by (9) with 2 farms, regardless the existence of regulation. In this case, the equality $W_2(0) = W_2(1)$ is satisfied for $D = D_1$ with $D_1 = F$. In area A, $W_2(0) > W_2(1)$ is satisfied for $D < D_1$, no regulation is imposed, and both farms enter the market. In area B, $W_2(0) < W_2(1)$ is satisfied for $D > D_1$, the regulation is imposed, and both farms exist on the market.

The constraint $\Pi_2(1) < 0$ is satisfied when $F > F_1$ with F_1 given by (5) and welfare defined by (9) with 2 farms in the absence of the regulation and by (10) with one farm when the regulation exists. In this case, the equality constraint $W_2(0) = W_1(1)$ is satisfied for $D = D_2$ with

$$D_2 = [(a^2 - ac + c^2)/3 - a^2/4 + F]. \quad (A1)$$

In area A, $W_2(0) > W_1(1)$ is satisfied for $D < D_1$, no regulation is imposed, and both farms enter the market. In area C, $W_2(0) < W_1(1)$ is satisfied for $D > D_2$, the regulation is imposed, and the large farm exists. QED

Proof of Proposition 2:

Maximizing the large farm's profit relies on a comparison between $\Pi_1(0)$, $\Pi_1(1)$ and $\widehat{\Pi}_1(1)$ (see equations (3) and (8)). Specifically, the comparison between $\Pi_1(0)$ and $\widehat{\Pi}_1(1)$ shows when the large farm chooses to support the small farm. The constraint $\Pi_1(0) = \widehat{\Pi}_1(1)$ is satisfied when $F = F_2$ with F_2 given by (11) (the value F_2 is greater than F_1).

In area B, the large farm would prefer not to have the regulation because $\Pi_1(0) > \Pi_1(1)$, however, the small farm can also afford the regulation, so in area B, the small farm cannot be excluded ($\Pi_2(1) > 0$).

When $F_1 < F \leq F_2$, the large farm would prefer to see the regulation and eliminate the small farm, because $\Pi_1(0) < \widehat{\Pi}_1(1)$. In particular, in area A₂, the large farm would prefer the regulation because it removes competition. In area C₂, the large farm would prefer not to face the regulation because $\Pi_1(0) > \widehat{\Pi}_1(1)$. QED