Impact of the Food Modernization Act on Market Structure: Evidence from the Corn Industry

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Abstract

The Food Safety Modernization Act was the most extensive measure ever enacted by the Food and Drug Administration at the time of its implementation in 2011. Aimed at curbing foodborne illness at its root, the FSMA increased regulation and therefore increased fixed costs for farms. This paper analyzes whether the act's exceptions for small farms succeeded in protecting them to mixed findings. Employing seven difference-in-differences models using the intensity of corn farming in a state as a proxy for the amount of large farms in a state, the paper finds that the number of corn for grain farms decreased significantly in corn states, while the total acreage of corn for grain farming in corn states increased immensely, indicating that the FSMA may have pushed small farms out of corn for grain farming and may have accelerated the process of industrialized monoculture agriculture of the commodity corn crop. The paper finds that corn for silage farms, as well as the overall agricultural industry in corn state appears unaffected. In total, this paper speaks to the importance of protecting small firms for the health of competition in an industry, as well as the health of a society in the case of farming, and of carefully considering legislation's impacts on small firms before implementation.

JEL Codes: L11, Q18, L51, Q13.
Keywords: FSMA, regulation, small business, farming.

1 Introduction

On January 4, 2011, Congress enacted the Food and Drug Administration Food Safety Modernization Act, and President Barack Obama signed it into law. The FSMA was the first comprehensive regulation imposed on food suppliers by the FDA since its founding in 1938. The main goal of the act was to take sweeping preventative measures against foodborne illness throughout the food supply chain. The FSMA imposed regulations on produce, water, food traceability measures, foreign supplier verification, laboratory accreditation for analyses of foods, mitigation strategies to protect food against intentional adulteration, preventive controls for human foods, preventive controls for animal food, sanitary transportation of human and animal food, as well as various other highly specified ruling on niche subcategories of food safety (FDA, 2024). The Act has been put into place in stages from 2016 to 2022, making it a pertinent time to question the preliminary effects that the FMSA has had on agriculture. One issue that is particularly relevant to the act is the differential effects that the FSMA will have on farms of different sizes. The FSMA takes into account firm size when imposing regulation as follows: generally, large firms have more than 500 employees, and small firms are all other firms. However, under some rulings of the FSMA, firm size is based on revenue, with firms making greater than $500,000 in revenue being specified as large firms, and similar classifications following. The larger the firm, the greater their burden of regulation, and therefore their costs at implementing this regulation.

The question this paper aims to answer is: How did the passing of the FDA's Food Safety Modernization Act (FSMA) affect market structure in corn agribusiness? The main focus of the institutions that this paper will focus on is the Food and Drug Administration (FDA), which is a federally funded part of the Department of Health and Human Services, and the entity boasts that, "FDA-regulated products account for 20 cents of every dollar spent by U.S. consumers" (FDA, 2025). The FDA enforces its regulations through inspections, seizures, injunctions, and criminal prosecution. The FSMA was one of more than 200 laws that the FDA has put forth and enforced over the last 100 years of its existence, but was the first comprehensive regulation imposed on food suppliers by the FDA since its founding in 1938. At the time of the passing of the FSMA, the Centers for Disease Control and Prevention cited figures that "each year roughly one out of six Americans (or 48 million people) gets sick, 128,000 are hospitalized and 3,000 die of foodborne illnesses" (CDC, 2011). The FSMA worked to directly minimize these numbers by regulating food at its source and throughout its supply chain. But at what cost to the sources, or rather, the farms? Despite the limitations relating to a firm's size that were placed on mandates, it is very possible that large firms were still advantaged in taking on the additional costs imposed by FSMA.

This paper aims to analyze whether the FSMA's differential treatment of large farms and small farms was successful specifically in the corn agricultural industry. The final ruling for the corn farming industry of the FSMA, the Final Ruling on Produce Safety, went into effect in 2016. Using data from the United States Department of Agriculture National Agricultural Statistics Service, this paper analyzes how the FSMA affects corn states and non-corn states' market structures using a difference-in-differences modeling approach. The result of this work is mixed. While it appears that the FSMA has thus far had no statistically significant or economically significant impact on the average acreage of all farms, the median acreage of all farms, the total number of farms, the number of corn for silage farms, or the average acreage of corn for silage farms, there is an economically and statistically significant[1] decrease in the number of corn for grain farms and an increase in the total acreage of corn for grain land in a state. These findings indicate that the FSMA may have pushed smaller farms to exit the market, and that the FSMA may have accelerated the process of industrializing monoculture agriculture with respect to corn.

Protecting small farms is vital to the health of competition in agricultural industries. As we see increases in the sizes of farms, we also know that this process leads to degraded soil, increased susceptibility to pests and diseases, and reduced biodiversity within the biome of agriculture. In the specific context of farming commodity crops like corn, the rapidly increasing rates of corn production also point to a sociological and physiological health risk: the over-reliance of corn in the diet of Americans. This makes corn a particularly important crop to study.

This paper contributes to the literature on regulation's effect on market structure. It also specifically adds to the growing conversation on monocrop agriculture and commodity market structure. In addition, this paper focuses on the Food Safety Modernization Act, which introduced specifications within its implementation to attempt to mitigate the presumed costs associated with regulation for small firms. Using an empirical modeling strategy, this paper finds that the FSMA may have failed at protecting small farms in the corn for grain industry.

The paper is organized as follows: Section 2 reviews the current literature, Section 3 introduces the data in detail and the empirical model that this paper utilizes as well as a brief theoretical section, Section 3 presents the empirical results, and Section 5 discusses the findings and concludes.

[1]The argument for statistical significance of the decrease in the number of corn for grain farms within a state is discussed in Section 4.

2 Literature Review

To begin, there have been very few empirical studies exploring the economic implications of the FSMA after its implementation. There have been no studies exploring the entry-exit decisions of farms pre- and post-FSMA, nor anything relating to market structure of agribusiness pre- and post-FSMA.[2] This paper aims to fill this gap in the literature. As is seen through the descriptive and analytic papers that follow, the importance of small farms to the United States' wellbeing both economically and wellbeing-relatedly cannot be overstated. Small farms are vital to the diversity of agribusiness and provide most of the produce supplied to American citizens. This motivates the importance of the question of how the FSMA impacted the market share structure of agribusiness.

2.1 FSMA's Economic Impact

Bovay and Sumner (2014) provide the most important background literature for this paper. Bovay and Sumner utilize economic forecasting and compliance cost estimation strategy to simulate different outcomes on market structure after the FSMA. Noting that this paper was published before the Final Ruling of Produce Safety went into effect in 2016, it is useful in characterizing the possible impacts that the Act had on market structure to compare to the empirical results that this paper finds. According with the economic theory on increased regulation, this paper predicts in whole that the FSMA will impose disproportionately large fixed costs for small farms and postulates that regulation such as the FSMA could harm competitiveness in farming in the future and further push the changes towards industrialized agriculture.

Strauss (2011) wrote a detailed analysis of the history FMSA's passage, the vital components of the FSMA, future hurdles and limitations of the FSMA, the significance and breadth of the FSMA, and areas for reassessment for the FDA. In total, this paper deeply informs the institutional context and identifies areas of study relevant to economists. Of singular importance to the research objective of this paper, in a specific section regarding the exemption of small firms from regulation, Strauss touches on the opposition that the law faced from grassroots small-farm organizations, with some fearing the costs of compliance and increased paperwork while others postulated that the act could eradicate small farms entirely. However, the paper notes that the Tester Amendment, the amendment that exempts small farms from regulation, was politically vital to the passage of the bill. Strauss adds that food safety on small-scale firms is thus still a concern moving forward, which introduces

[2]Bovay and Sumner (2018) forecast theoretical entry and exit decisions of small and large firms using cost of compliance estimates as is disucssed later in Section 2.

an important consideration to the theoretical considerations of this paper. In all, Strauss (2011) adds rich context to the political and social environment of farming and the impact the FSMA could have on farms, which is vital to understand for this paper.

2.2 Small Farms and the FSMA

Boys, Ollinger, and Geyer (2015) provides rich understandings of the theoretical costs faced by small farms in light of the FSMA's rulings. The authors explore the theoretical impacts of the FSMA on the costs and choices of small scale farms, delve into the private sector response to the new regulation, and address the foodborne illness liability introduced by leaving small-scale firms unregulated by the FSMA. In particular, Boys, Ollinger, and Geyer (2015), begin by noting that large-scale farm operations impressively account for only 9.9% of all farming establishments in the United States, but are the producers of 79% of the country's agricultural production. In contract, small-scale farming operations account for 91% of all farms in the United States while only producing 23% of agricultural output. Pushing deeper into this divide, the authors argue that most large scale firms were already in compliance with the regulation proposed by the FSMA, but that small scale firms faced huge fixed costs were they to have to implement the FSMA's regulations. Furthermore, despite the limitations that the law places on requirements for small scale farms, the article discusses the introduction of private-side regulation mimicking behavior from intermediary parties (between farms and consumers, i.e. supermarkets, etc). After the introduction of the FSMA, many intermediary parties began requiring their own levels of food safety guarantees from farms, or requiring food product liability insurance to hedge against increased liability risk by small firms remaining unregulated by the FDA. This introduced liability risk is an important point on the weaknesses of the FSMA. There is reason to believe that foodborne illness could be more present at small scale farms and harder to track when originating from small scale farms, therefore to alleviate the regulations on these firms is a huge risk to the goal of limiting foodborne illness. Importantly, the paper outlines the immense costs faced by small scale farms that are the outcome of the FSMA, either directly or indirectly. Whether by private sector imposed regulation, FSMA regulation, or higher insurance costs, small farms will increase their costs, which they will have to make up for in their sales prices. In markets in which large and small farms are competing, small firms will then lose their price competitiveness. This paper concludes with a conversation about the importance of small-scale firms on the health and wellness of the United State's population and economy.

Similarly to Boys, Ollinger, and Geyer (2015), Ribera and Knutson (2011) discuss the potential fallout of the implementation of the FSMA. Published just after the passing of the

act, the authors explore the key points of the FSMA and hypothesize that the introduced budget constraints and costs of compliance could have sizable market structure impacts and cause many small firms to exit the industry. This article does not include a conversation surrounding the introducing foodborne illness liability by leaving small farms unregulated as Boys, Ollinger, and Geyer (2015) does, but overall highlights the importance of exploring the question of market structure changes after the implementation of the FSMA.

2.3 Institutional Context: FDA Regulation

Pivoting now to the literature on regulation on the part of the FDA, Law (2006) explores the historical and pragmatic question of FDA regulation. How powerful and effective is the FDA? Law argues that the FDA's past informs their current regulatory strategy. Previously, the FDA focused on legal actions against companies as their main form of power, but found that this was resource intensive and ineffectual at many preventative goals. The FDA then leveraged a more cooperative regulatory strategy with the parties that they sought to regulate and combined this with public pressure, which in tandem proved to be powerful means of enforcement. This paper thus propels the conversation surrounding the FDA's power to regulate and enlightens some of the methodology that the FDA uses to help enforce the FSMA at present.

2.4 Regulation's Impact on Small Firms

Finally, we conclude with a seminal paper that further motivates the theoretical approach that this paper takes: Djankov (2002). This paper was extraordinarily influential in its finding that increased costs of regulation are associated with higher levels of corruption across industries with evidence from multiple countries; the paper was part of the larger neoliberal movement towards deregulation in the 1990s and early 2000s. The paper's conclusion that higher entry costs reduce the number of small firms in a market was very impactful. Using regression models and correlation models, Djankov showed empirically that increased regulation reduced the number of small firms within a given industry within a given country. This evidently relates to the FSMA's increased regulation because even as existing small firms were exempted from regulation, there could be strong evidence that firms lose incentives to grow into larger firms for fear of the barrier of entry that is increased regulating costs, an anticompetitive outcome.

In summary, the existing literature is highly descriptive and useful in its analytical approach towards the FSMA, but is lacking in empirical work surrounding this influential piece of legislation after the final ruling have actually been implemented. This paper seeks

to incorporate the vital knowledge that the literature provides and apply it to an empirical analysis of the firm size in agribusiness before and after the FSMA was enacted.

3 Empirical Model

3.1 Theory

The FSMA was a major regulatory bill, and it imposed significant costs on all farmers, even though many were already self-regulating since there were strong private incentives to produce food that would not make its buyers sick. The FSMA also included caveats for small farms that have less than 500 full-time employees and less than $500,000 in sales in the three-year period before. Though regulation increases the fixed costs of all firms, it theoretically hits smaller firms harder because they are operating on slimmer margins. However, incorporating this caveat that aims to protect small farms may serve to incentive small firms to stay in the market. These outcomes could also exist in tandem, resulting in an individual small firm being burdened by regulatory costs but not enough to force them out of the market. Bovay and Sumner (2014) explore simulations of the outcomes of the FSMA on the supply and demand of the farming market on small and large firms, showing examples where small or large firms may exit, examples where large firms buy out small firms, and examples where small firms are able to stay in the market. In this paper, the real-world outcomes of the FSMA in the corn industry are compared to the simulations of the Bovay & Sumner paper.

3.2 The Model

This paper uses a difference-in-differences quasi-experimental methodology to explore how the Food Safety Modernization Act Impacted exposure to a certain sector of agriculture impacted average firm size in a state before and after the FSMA was implemented. Below, the equation for the average acreage of farms is displayed, with the Corn State being defined as described in Subsection 3.3. This is just one example of the seven models employed as it would be redundant to include equations for all seven.

$$\text{Average Acreage of Farms}_{i,t} = \beta_0 + \beta_1 \text{Corn State}_i + \beta_2 \text{After FSMA}_t + \beta_3 \text{Corn State x After FSMA}_{i,t} + \gamma_i + \alpha_t + \epsilon_{i,t}$$

A differences-on-differences model must meet four conditions in order to claim causality: that there existed parallel trends between groups before the event took place, that there are no

switching groups around the cutoff threshold, that there are no anticipatory effects, and that nothing else changed across the threshold. To address the parallel trends assumption, observe the Parallel Trends plot in the Section **??**, displaying the trends of our various dependent variables in a state between corn states and non corn states over time. To address the second assumption, that there is no switching between groups, the corn states were defined based on their average corn proportion over all years, so they remain in the same group over time. Also, there is not evidence suggesting that there was any intentional upscaling or downscaling of corn production on the state level through subsidies or taxes from state governments in this period. To address the third assumption, that there are no anticipatory effects, it must be acknowledged that this is the most worrying of the difference-in-difference assumptions for this model given the context of the FSMA. The FMSA was introduced in 2011, but was not imposed until 2016, so it is possible that some firms anticipated the imposition of the FSMA and therefore there could have been anticipatory effects. However, it seems that small firms would not have exited the corn industry simply in anticipation of the FMSA's regulations, so the model most likely meets this assumption. Finally, the last assumption of the model is that nothing else changed at the threshold, another troubling assumption for this model since the FSMA was imposed in 2016, a time when many farmers were seeing harsh economic conditions, with lower net income for the third year in a row, along with many other immense macroeconomic changes that have followed 2016, such as the global pandemic, trade wars, and decreased/increased government spending during different periods. It is entirely possible that the macroeconomic conditions are such that they are pushing small suppliers out of the market.

3.3 Data

This paper utilizes data from the United States Department of Agriculture National Agricultural Statistics Service Censuses from 2007, 2012, 2017, and 2022. The final ruling for produce from the FSMA went into effect in 2016, so the data has two censuses before the FSMA and two censuses after the FSMA/ NASS censuses are taken every five years and include rich data at the state level on size, market value, products, and other key demographic information of farms. The data were taken from its PDF format and translated into usable files by Google Gemini. Since the FSMA definition of a large farm in the Final Ruling on Produce Safety was firms that produce more than $500,000 in sales over a three-year period and farms that have more than 500 employees, and the NASS datasets only reported farms that made more than $100,000 in a year, the data was not able to be used to analyze which firms were subject to identify the share of farms that were subject to the Large Firm

regulations of the FSMA.

Instead, the proportion of land used for corn farming was used as a proxy for the number of large farms within a state because corn agriculture is particularly prone to industrialized monoculture farming. The outcome variables of interest were then the average farm acreage in a state, median farm acreage in a state, number of farms in a state, number of corn for grain farms in a state, number of corn for silage farms in a state, total acreage dedicated to corn for grain farms in a state, and total acreage of corn dedicated to corn for silage farms in a state were used to characterize the FSMA's impact on corn states. To designate a state as a corn state, the share of total acreage dedicated to agriculture in a state was divided by the total corn acreage in a state (both corn for grain and corn for silage). If more than 30% of a state's designated farm land was used for corn, then this state was considered a corn state. The use of the 30% of farmland being used for corn is justified by the 90th percentile of states' corn proportions being 30%. This process yielded five corn states, now also referred to as our treatment states: Delaware, Illinois, Indiana, Iowa, and Minnesota. Observations from 2007 and 2012 were categorized as "Pre-FSMA" observations, and, similarly, observations from 2017 and 2022 were categorized as "Post-FSMA".

Table 3.3 displays the average acreage of farms, the total number of farms, and the average market value per farms on the state level. In referencing the bottom of the table, one can see that the standard deviations on each variable of very large relative to the means of the variables. This variation indicates the importance of the eventual inclusion of state-level fixed effects.

Figure 1 displays the trends by states of the average farm size over time. Axes are varying in this figure in order to view trends within a state. One can again observe a great deal of variation across states, with many seeing increased size over time and others seeing decreased average farm size over time. This figure is particularly informative for motivating a more granulated analysis.

Figure 2 Displays the number of corn grain farms over time within corn states. The overall trend is evidently a decrease in the number of corn for grain farms. This figure is particularly motivating for the analysis since decreasing numbers of farms over time indicate that farms are getting bigger (since the amount of output of corn is growing).

The final descriptive figure, Figure 3 displays the granulated breakdown of farm size across the United States. Without the context of Figure 1, it would appear that the market structure has remained quite stable, but considering the varied trends across states, one may conclude that though the total number across the country of firms of different sizes is relatively stable, within states, it varies greatly.

Summary Statistics by State

State	Ave. Acreage	Number of Farms	Market Value per Farm
Alabama	208.25	42482.5	611991.5
Alaska	994.75	902.75	643348.3
Arizona	1469.75	17859.5	1138206
Arkansas	319	43699.5	980636.3
California	343	73136.25	3087835
Colorado	847.5	37045.75	1336935
Connecticut	74.75	5368	935378.8
Delaware	219.5	2364.25	1998544
Florida	204	46874	1233045
Georgia	232	42951.5	816858.8
Hawaii	156.25	7104.5	1470608
Idaho	475.25	24509.5	1353260
Illinois	362.25	73930.25	2350160
Indiana	257.25	57470.25	1549845
Iowa	344	88627	2256894
Kansas	759.75	60401.75	1293585
Kentucky	170.75	76928.75	619471
Louisiana	290.25	27647.75	827807.5
Maine	172.5	7736.25	467820.8
Maryland	161	12517.25	1247817
Massachusetts	67.25	7442.5	794953
Michigan	195.75	50357.5	903520.3
Minnesota	360	72471.75	1624558
Mississippi	296.5	36578.25	770939.3
Missouri	288.25	97550.75	946694.5
Montana	2184	27211.5	2083266
Nebraska	955	47123	2333990
Nevada	1745.25	3453.25	1555655
New Hampshire	107.5	4157.25	576060.8
New Jersey	73.75	9819.75	1059199
New Mexico	1825.75	22917.75	965223.3
New York	204	33994.25	626972.5

North Carolina	175	48091.5	816731.5
North Dakota	1384.5	28590.75	2150110
Ohio	182	76284.25	1025349
Oklahoma	433.75	78929.75	705381
Oregon	434.75	36788.75	1072863
Pennsylvania	133.75	56170.5	836530.3
Rhode Island	55.75	1139.75	992155
South Carolina	194.5	24639.25	671714
South Dakota	1422.75	30356.25	2599026
Tennessee	155.75	70104.5	630645.5
Texas	526.25	243831	971406.5
United States	439	2064201	1239930
Utah	616	17630.5	1155854
Vermont	175.75	6916.75	605412.5
Virginia	179.5	43908.25	831401.8
Washington	404.75	36100.5	1116302
West Virginia	159	22879	428185.8
Wisconsin	215	67882.75	992092
Wyoming	2618	11321.75	2122888
Total (mean)	**515.11**	**80949.04**	**1204413**
Total (sd)	**582.92**	**285912.2**	**610110.6**
Total (min)	**55.75**	**902.75**	**428185.8**
Total (max)	**2618**	**2064201**	**3087835**

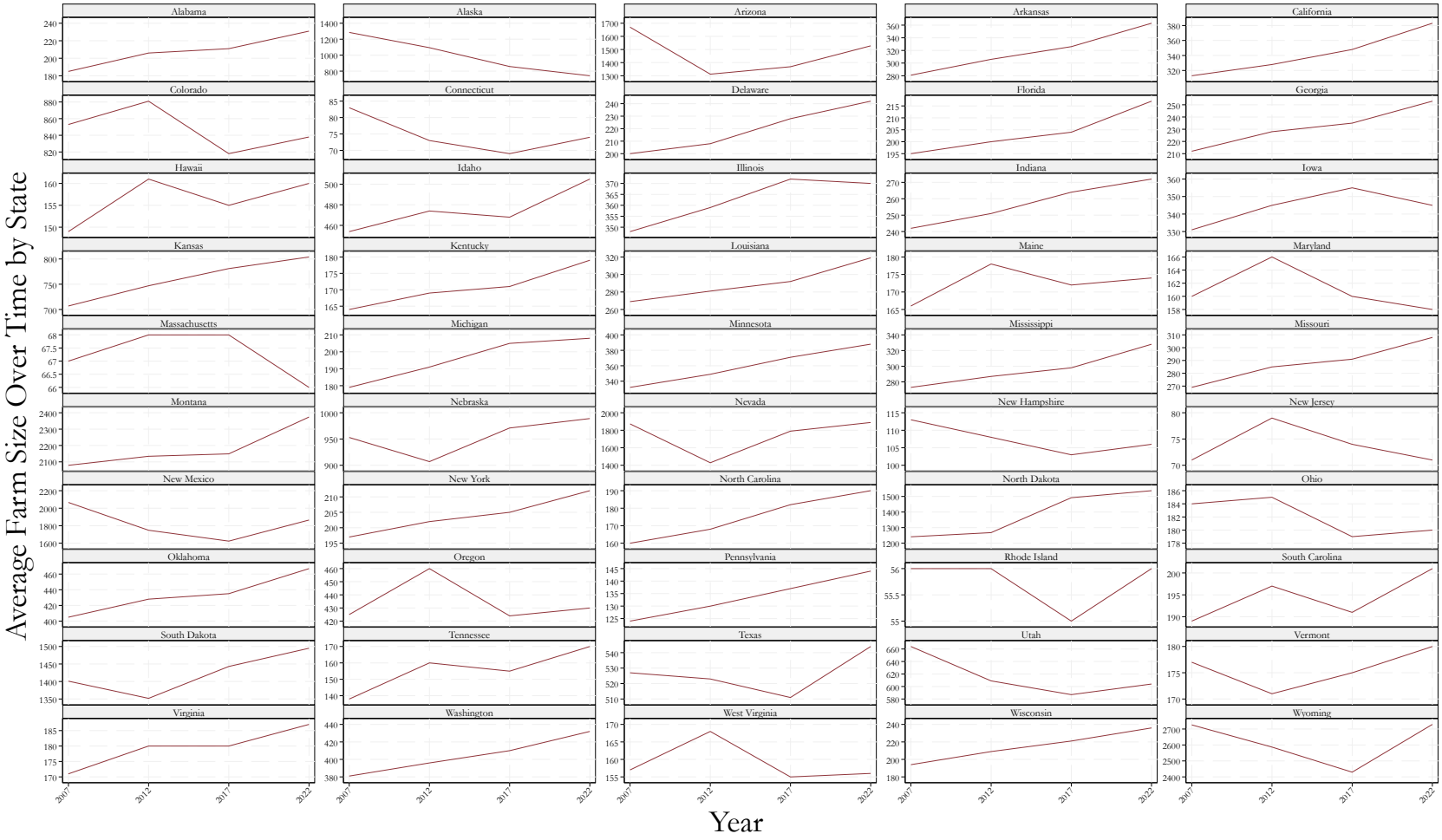

Figure 1: Farm Size by State Over Time

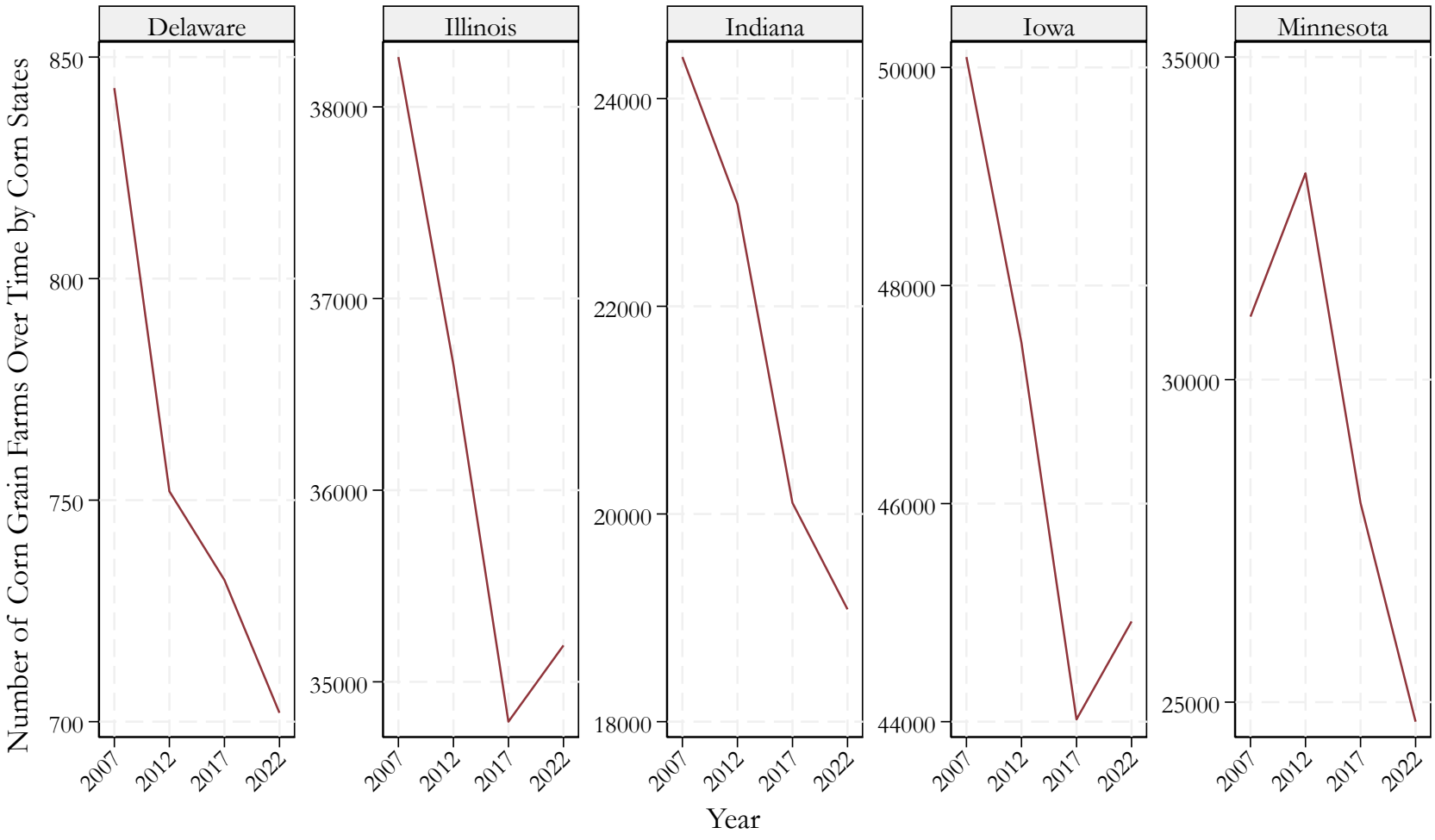

Figure 2: Number of Corn Farms Within Corn States Over Time

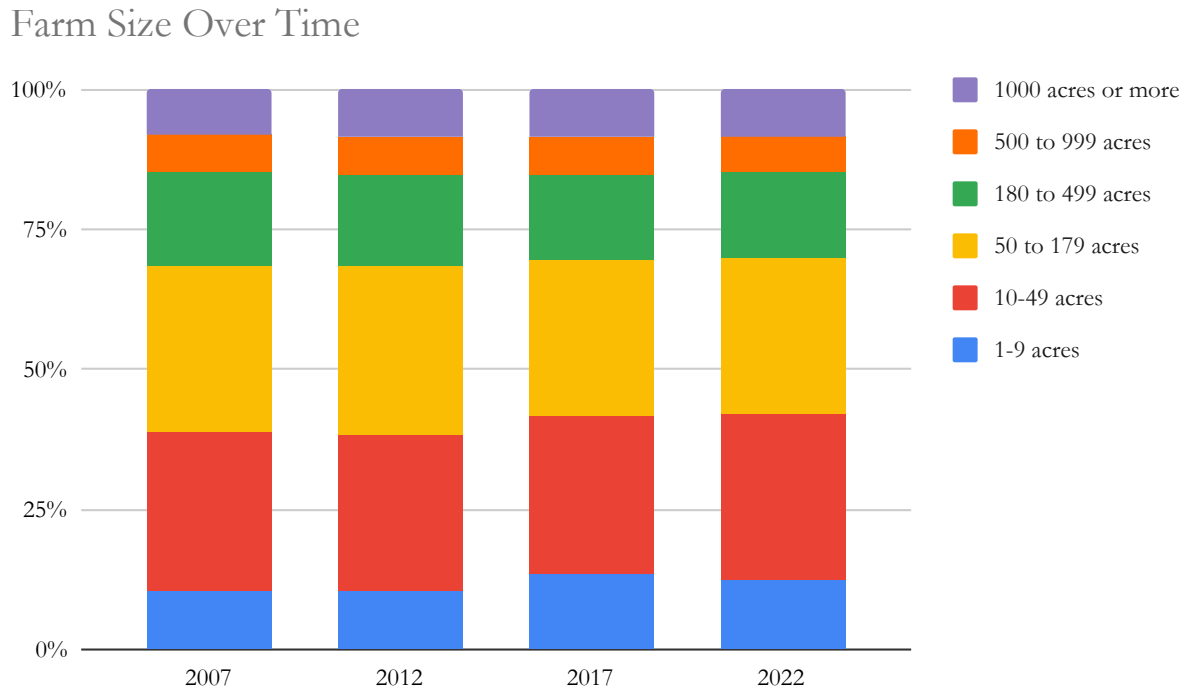

Figure 3: Farm Size Over Time

4 Results

The results of the seven difference-in-differences models are displayed in Table 4. As can be seen in the table, the coefficient estimates on After X Corn State for average farm acreage, median farm acreage, number of farms, number of corn for grain farms, the number of corn for silage farms, and the total acreage within a state dedicated to corn for silage farms have neither economically nor statistically significant results. These zero results are productive in light of the FSMA's intended outcomes. The fact that one does not observe a statistically significant decrease in the number of farms, nor the average (or median) acreage of farms suggests that entry and exit decisions of farms were not affected. However, this does not necessarily inform the consideration of firm size on entry and exit positions. It is possible that after FSMA, more large firms entered the market, and even though small firms exited the market, the influx of large firms was enough to offset the exits of small firms. Nonetheless, these results characterize the market overall, and give hopeful indications that the policy was successful in its protection of small farmers.

To this point, it is also noteworthy to observe the economically and statistically significant coefficient on total acreage within a state dedicated to corn for grain farming variable. The magnitude and sign of this coefficient suggest that among corn states, after FSMA, total corn

grain acreage increased by about 4,052,458 million acres more than it did in non-corn states. This suggests that FSMA may have accelerated industrial farming trends in the corn industry. This result is very consequential when situated within the aforementioned repercussions of agricultural monoculture. Not only does monoculture farming reduce the diversity of foods available to consumers, it also leads to soil degradation, reduce biodiversity, and lead to an increased threat of pests and disease. While this figure suggests that corn farming remained resilient to the increased regulations imposed by the FSMA, which is arguably very positive for food security, it is also indicative of a large trend toward an over-reliance on corn within the agricultural economy.

Furthermore, there was one coefficient that would have been statistically significant if the level of the test had been very slightly altered: the number of corn for grain farms within a state. This estimate had an associated p-value of 0.124, which, with a marginally larger-leveled test, would be significant. This is important to consider, because the number of corn for grain farms coefficient is negative, and its magnitude, 859, is arguably quite economically significant. This figure suggests a nuanced story regarding corn farming in the context of the FSMA. Were we to combine the two significant results, or almost significant in the case of the number of corn for grain farms, the decrease in number of farms but increase in total acreage of farms suggests that the farms remaining in the market are growing in size, therefore confirming the hypothesis of this paper, that small farms exited and even that large farms actually grew.

It is also worth discussing the statistically significant coefficients on the controls variable(s). Though none of the figures are economically significant due to their magnitude being relatively close to zero, the fact that these coefficients are positive indicates that subsidies from the government are, if anything, helping ease the burdens around entry and exit decisions for farms.

Table 2: Difference-in-Differences Estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Ave. farm (acres)	Med. farm (acres)	Farms (number)	Corn (grain: farms)	Corn (silage: farms)	Corn (grain: acres)	Corn (silage: acres)
After X Corn State	29.971	6.149	3129.392	-859.097	163.009	4052458.326***	-15382.058
	(32.489)	(5.987)	(2560.922)	(555.670)	(495.208)	(583962.518)	(40829.570)
Subsidies (farms)	0.001*	-0.000*	0.626***	0.181***	0.137***	59.809***	1.660***
	(0.000)	(0.000)	(0.037)	(0.008)	(0.007)	(3.964)	(0.582)
Subsidies ($1,000)	0.000**	-0.000**	-0.017***	0.000	-0.000	4.941***	-0.001
	(0.000)	(0.000)	(0.005)	(0.001)	(0.001)	(0.315)	(0.077)
Constant	439.766***	100.805***	69666.254***	7799.667***	-1116.700**	-222581.778*	214120.093***
	(33.576)	(6.187)	(2646.603)	(584.958)	(526.158)	(131858.396)	(44125.863)
Observations	204	204	204	200	198	200	194

Standard errors in parentheses; There are fewer observations in columns (4) - (7) due to missing data within states.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5 Summary and Concluding Remarks

This paper uses a difference-in-differences empirical strategy to characterize how the Food Safety Modernization Act impacted the market structure of corn agriculture. Its findings were mixed. In finding non-statistically significant results on the estimates for average farm acreage, median farm acreage, number of farms, the number of corn for silage farms, and the total acreage within a state dedicated to corn for silage farms, there is some promising evidence that the FSMA did not increase the strain on farms' entry-exit decisions. However, the combination of the two significant results, or almost significant in the case of the number of corn for grain farms, the decrease in number of farms but increase in total acreage of farms suggests that the farms remaining in the market are growing in size.

There are notable limitations to this paper's results that must be addressed. Due to imperfect information on reporting of farm size with respect to employees and revenue, the data is misaligned with the rulings of the FSMA. The treatment used in the difference-in-differences models is also imperfect because it is simply an exposure dummy variable rather than denoting true control and treatment groups. It is also important to note that the results from this paper are not generalizable to other industries since corn is a unique food in that it is a commodity and farmers of corn are prone to industrialized monocrop agriculture. Finally, the largest limitation of all is the limited time horizon. There has not been adequate time to evaluate the long-term effects of the FSMA on corn agriculture market structure.

This topic is particularly important to the conversation surrounding industrialized agriculture and monoculture farming. In characterizing the market structure of corn after the FSMA, this paper provides vital evidence about the resilience of this commodity crop to increased regulations and therefore fixed costs for firms, but also worryingly indicates that the FSMA may have accelerated the industrialization of corn farming. As a possible mechanism to this acceleration of corn farming is the exiting of small farms, whereby small farms face larger fixed costs, sell their land, and large farms buy it. This is consistent with our results, particularly in the corn for grain industry, since this would cause an increase in the acreage of corn farming and a decrease in the number of corn farms.

Furthermore, this paper informs future policy decisions that wish to impose increase regulation without harming small farms. While this paper provides confounding information with respect to how FSMA influenced exit and entry decisions of farms, the results highlight the importance of fully considering the impact that legislation has on small firms, who are vital to the health of any industry. Losing small firms due to strained exit decisions from increased regulation can harm future competition within any industry, and our results point to the harm that this could cause.

Future research on the FSMA's impact on market structure would be fruitful. Focusing on industries that generally have smaller farms would yield particularly interesting results to put in conversation with the results of this paper. Future research could also seek to characterized more specifically who is entering and exiting a market to achieve a more granulated analysis of market structure.

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7 Appendix

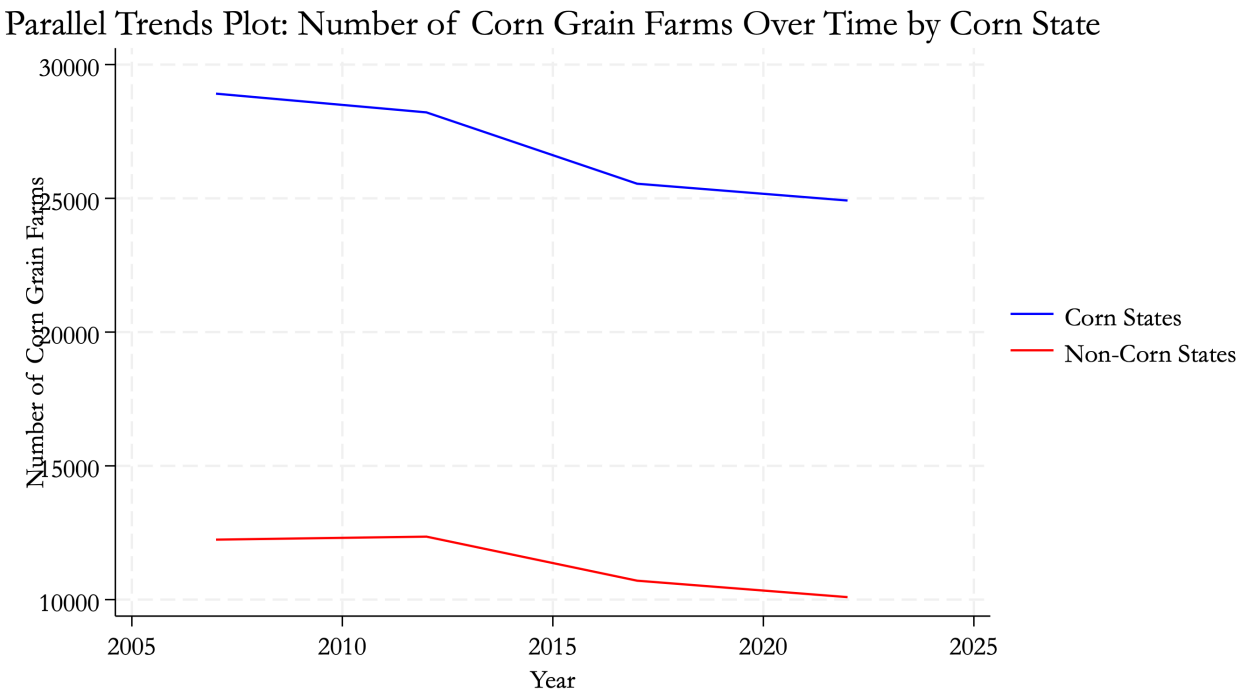

Figure 4: Parallel Trends Plot: Number of Corn Grain Farms

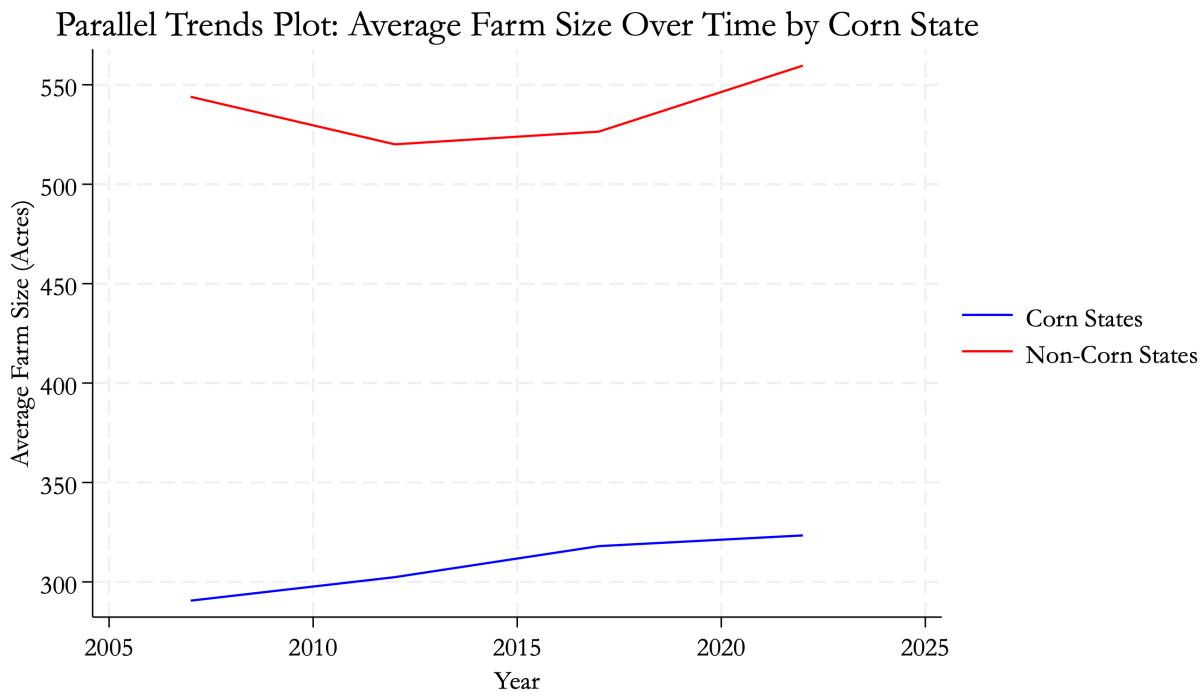

Figure 5: Parallel Trends Plot: Average Acreage of Farms

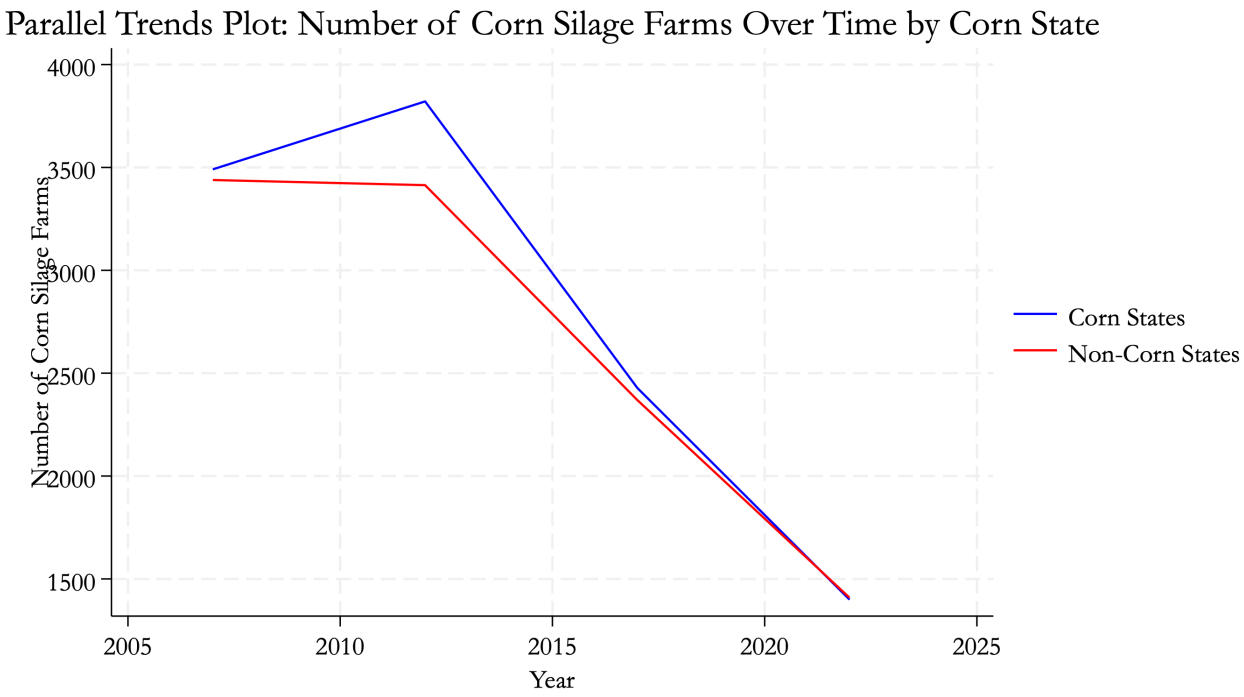

Figure 6: Parallel Trends Plot: Number of Corn Silage Farms

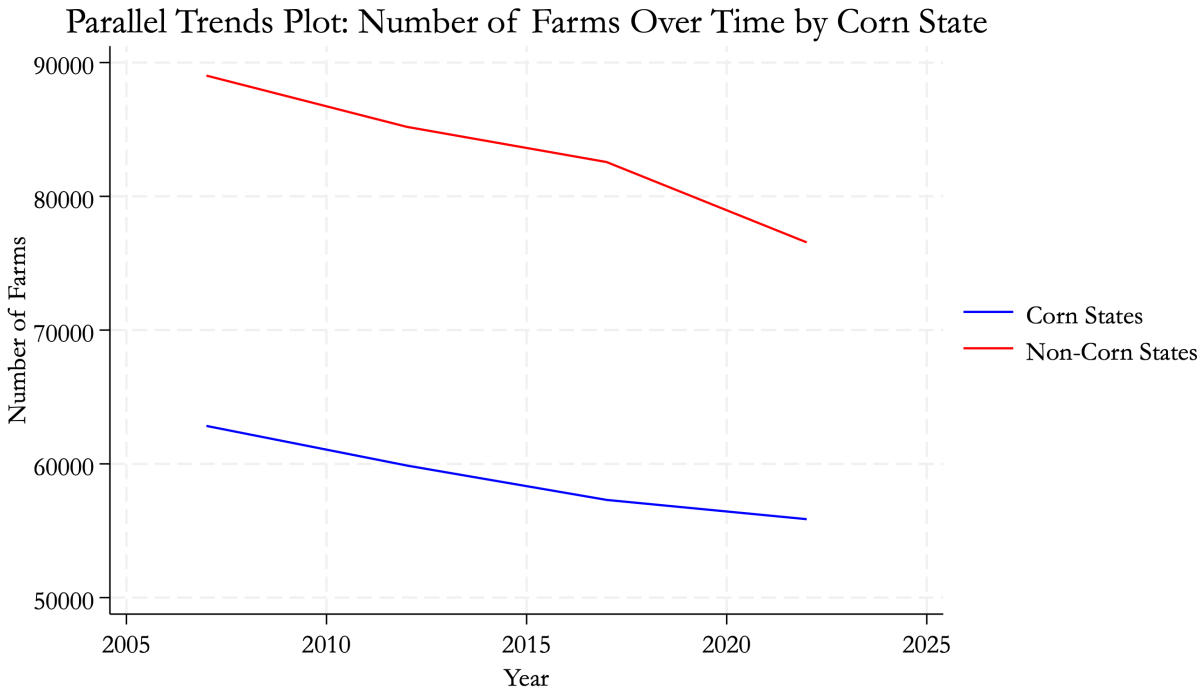

Figure 7: Parallel Trends Plot: Total Number of Farms

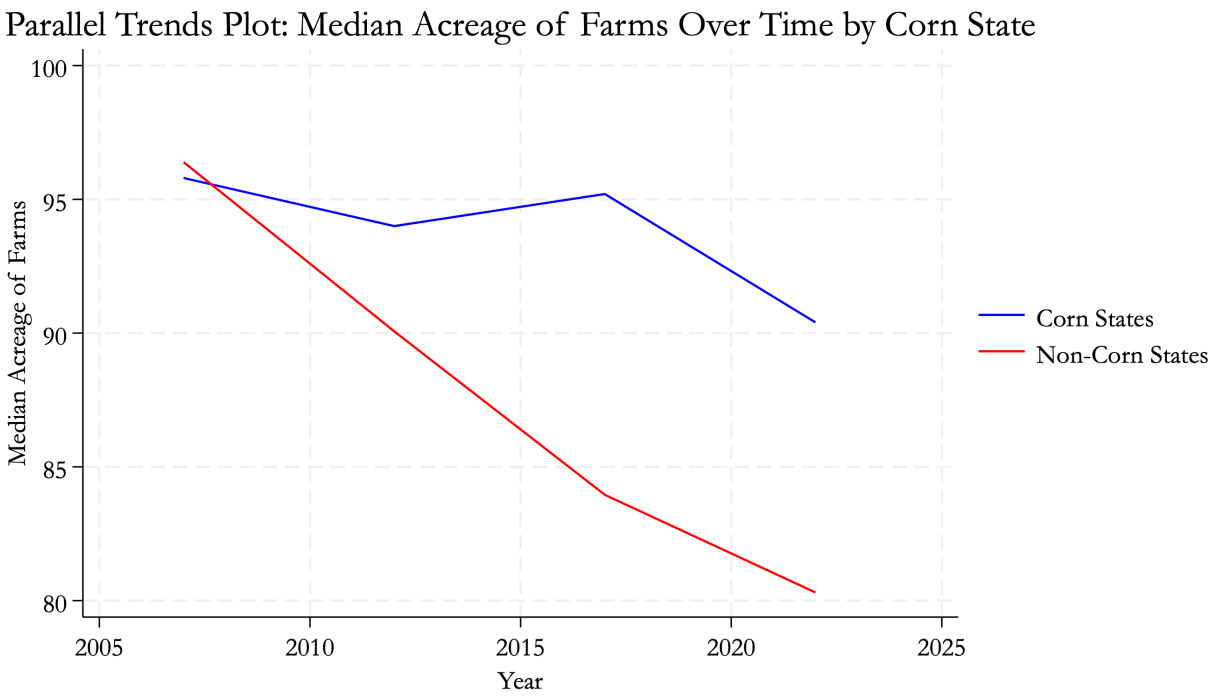

Figure 8: Parallel Trends Plot: Median Acreage of Farms