Factors Affecting Genetic Engineering Policy Outcomes

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A Capstone project presented in partial fulfillment of the
requirements for the degree of
Master of Arts in Policy Studies
Interdisciplinary Arts and Sciences

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Abstract
The safety and sustainability of genetically engineered (GE) crops is an ardently debated topic. Serious concerns have surfaced regarding environmental impacts and health implications (VanHosen, 2015; Diamanti-Kandarakis et al., 2009; Gasnier et al., 2009), as well as many other controversial issues discussed in this study. Although these concerns have been dismissed by industry and scientists as the result of consumer inexperience and lack of understanding of genetic engineering (Sarich, 2014), there have been many restrictive GE legislation attempts, such as mandatory labeling of products that contain GE ingredients so consumers can make informed choices when making purchases, cultivation bans to protect non-GE farmers from cross contamination, and a range of other proposals, such as no GE food in vending machines (Oregon Secretary of State, 2014; Illinois General Assembly, 2015; Sarich, 2014). All of these efforts are similar in seeking some form of restriction of GE products in our food systems. At the close of this study, 36 states (5 passed), 13 counties (11 passed) and a handful of cities have proposed GE restrictive legislation. The purpose of this study is to understand which socio-economic, political, or industry factors are correlated with states having considered or passed GE restrictive legislation, as well as the percent of vote in favor of proposed GE restrictive legislation at the county level for states that have proposed such legislation through ballot initiatives. This is a mixed methods, comparative cross-sectional design with data gathered from publically available sources utilizing cross-tabs, bi-variate correlation, and multiple linear regression to determine if any relationships exist that correlate to either the formal proposal of GE legislation or the passage or failure of such legislation once proposed. Generally, the most powerful explanatory variable was the outcome of the 2012 Presidential election: States or Counties with higher percentage vote for President Obama were most likely to have proposed or passed GE restrictive legislation. In addition, states in the northeast of the US all have considered such legislation and some have passed such legislation, while states in the southeast are the least likely to have considered such legislation and none have passed. A comparison of those states that have considered GE restrictive legislation showed no difference between those states that passed and those that did not pass the proposed legislation in any of the variables considered apart from their vote in the 2012 Presidential election. The only states to pass GE restrictive legislation are those in which the proposal came from within the legislature, while those states that have held ballot initiative processes have all failed. However, a county-level examination of the ballot states showed that counties in which a greater proportion of the electorate voted for President Obama, also had a greater proportion that supported GE restriction.

Chapter 1: Introduction to the Controversies Surrounding GE Agriculture

In recent years there has been a growing debate over GE food. There have been many areas of concern as the use of GE techniques in agriculture has progressed. In particular, debates have emerged regarding environmental and health impacts of expanded pesticide and herbicide use, insignificant yield increases, economic impacts on the ability to export crops, concerns about the level of agribusiness influence, reduction in regulation and safety of our food systems, and proposed solutions and legislation. Many of these issues are intertwined, and critiques of GE technology often cite multiple concerns. This section will review these issues and explain the motivation for pursuing this research, but will first begin with some definitions of core concepts.

Definitions

What is GE (GMO)?
Genetic Engineering (GE) sometimes commonly referred to as Genetically Modified (GM) is defined by the Union of Concerned Scientists (n.d.) as a set of technologies that are qualitatively different from existing breeding technologies because it alters the genetic makeup of cells within and across species boundaries through sophisticated manipulations of genes. Monsanto defines it as the insertion of another organism, such as bacterium, other microbe, or plant species to produce a beneficial characteristic in the modified plant (Monsanto FAQs, n.d). These breeding technologies were brought into the market as a means to enhance agricultural sustainability by increasing yield under weed and insect pressure, decrease tillage to conserve water and soil, and reduce pesticide applications and decreasing the use of fossil fuels (Monsanto, 2014). Monsanto has used genetic engineering to modify several crop varieties, including alfalfa, canola, corn, cotton, sorghum, soybeans, sugarbeets, and wheat. One example of the expected benefits is with, GM sweet corn also known as Bt/Roundup Ready Sweet Corn which provides protection from damaging lepidopteran larva (caterpillars) through incorporating a protein from the *Bacillus thuringiensis* (Bt) bacterium (a natural pesticide) and built in resistance to the herbicide Roundup (Monsanto, n.d). Advocates of GE technology claim that the technology provides a reduction in the amount of chemicals used for both pest and weed control in the field.

What is Sustainable Agriculture?
Sustainable agriculture integrates environmental health, economic profitability, social and economic equity to meet the needs of the present without compromising future needs (Feenstra et al., 2014). It is possible to farm sustainably without sacrificing yield (DeLonge, 2014) (Gurian-Sherman, 2009) (Patil, et. al, 2011) or undermining the natural building blocks (soil, water) of the system and resources attempting to work with the natural processes rather than struggling against them, using techniques such as crop rotation, cover crops, natural pest predators, soil enrichment, and numerous others (UCS, n.d) (Feenstra, et al., 2014). Sustainable agriculture draws from and learns from organic and/or traditional farming, and renewing the best practices of the past (SARE, 2012).

What is GE Restrictive Legislation?
This study defines restrictive legislation as any attempt at a local, state, or federal law with the sole purpose of restricting the use of GE materials in any manner. This can include, but is not limited to mandatory GE labeling, cultivation bans, pesticide applications in conjunction with GE, or designation of GE as an invasive species, etc. It is used as a broad term to discuss GE restrictions as a whole and when necessary specific information for the type of restriction will be provided.

Controversies Surrounding GE Agriculture (GMO)

Crop Yield
Initially, the use of *Bacillus thuringiensis* (Bt) a bacterium that provides pest resistance to the plant, reduced crop damage from the target pests, causing a reduction in pesticide use and an increase in crop yield. Currently, the targeted pests have evolved and become more tolerant of Bt (Benbrook, 2009) which has triggered new research to find other means to confer pest resistance (Mortensen et al., 2015). Additionally, GE crop yields have not been dramatically higher as originally expected. Corn yields, for example, have seen a 28% increase since Bt corn came on the market, with only 3-4% of that increase being attributable to Bt (Gurian-Sherman et. al., 2009). The majority of the increase is attributable to other farming methods such as organic, low-external-input methods, conventional and modern breeding without inserting new genes (Union of Concerned Science, 2009).

Farmers in India changed agricultural practices that had been in place for around 4000 years to include new advancements in science and technology which later included GE seeds and required adding extensive irrigation, electricity, petroleum-based agro-chemicals, and plant protection and storage (Patil et al, 2014). India saw an initial increase in yields, but they have now become stagnant, earnings have fallen due to the increased input costs for chemical fertilizers, herbicides, and pesticides causing these farms to suffer from ground water depletion, soil degradation, loss of bio-diversity, increased pesticide concentrations in food, and increased indebtedness of the farmers (Patil et al, 2014).

Environmental Concern
Before commercial introduction of GE technology agriculture was already affected by herbicide resistant weeds and contamination of ground and surface water making industrial agricultural practices unsustainable (Goldburg, et. al, 1990) (FAO, 2015). Recent studies have found negative effects associated with glyphosate (the active ingredient in Roundup and used in conjunction with GE Roundup Ready seeds) on the environment, specifically with weed resistance (Benbrook, 2009) (Gurian-Sherman, 2009; 2012) (Sammons, 2012), water contamination (USGS 2014) (Jergentz, et. al, 2005), and soil erosion/degradation (Romina, et. al, 2007) (Pablo et. al, 2008) (Lane, et. al, 2012).

In the US pesticide and herbicide levels are regulated by the Environmental Protection Agency (EPA) to prevent application levels that would cause health concerns (EPA, 2014) including the impacts from concurrent and accumulated levels in the human body (EPA, 2002). To control pest outbreaks higher doses of pesticide application are needed, however these contribute to

further pest resistance (Benbrook, 2009). This has led to increased levels of pesticide and herbicide application which can continue the cycle of pest resistance and increased risk to human health. However, the EPA has repeatedly increased the maximum levels allowable (Cuhra et. al, 2015) at the agribusiness industry's request (USGPO, 2013).

Health Implications

Recently, several studies have found adverse health implications resulting from the use of GE technology (glyphosate applications to Roundup Ready crops), which have resulted in an announcement from the World Health Organization stating glyphosate is a possible carcinogen (Van Hosen, 2015). The EPA has named agricultural herbicide runoff as the major source of pesticide contamination in drinking water, and cautioned that exposure could potentially cause kidney problems and/or reproductive issues (EPA, 2014). In at least two studies glyphosate was found to be an endocrine disruptor at dosage levels lower than what is commonly used on a farm (Gasnier et al., 2009; Seralini et al., 2014). These studies also found that it caused DNA damage to human cells, inhibited the conversion of androgen to estrogen (Gasnier et al., 2009), and can induce hepatic, kidney and hormone disruptions (Seralini et al., 2014). According to a Scientific Statement by The Endocrine Society endocrine disruption has effects on reproduction, neuroendocrinology, thyroid, cardiovascular endocrinology, breast development and cancer, prostate cancer, metabolism, and obesity, all of which represent significant concern to public health (Diamanti-Kandarakis et al., 2009). The toxicity studies performed by the agribusiness industry for market approval are typically short, running only 90 days (Seralini, 2014). Many of the aforementioned studies have been of longer duration, suggesting that the industry studies fail to pick up health impacts that may exist. Further, independent scientists found that some industry studies used to gain approval were conducted with soy material produced in non-representative agricultural conditions because the Roundup-Ready soy was not exposed to Roundup in the field (Cuhra et al., 2015). However, duplicating industry studies has proven difficult due to the limitations on access to the research materials provided by intellectual property rights and patent laws (Cuhra et al., 2015).

Economic Concerns

The United States (US) has a very high adoption rate of GE varieties among commodity crops such as corn, soy, cotton, canola, and sugar beets that are being grown for domestic and international trade, however some other countries have implemented restrictions and labeling requirements. The extensive use of GE varieties has recently caused a few trade agreements to be canceled and crops rejected. Exports of hay rose to 1.25 billion in 2012 with Washington State being one of the largest producers of alfalfa (Gillam, 2013). However, one farmer from Washington had his non-GE alfalfa rejected because it tested positive for a GE trait and there are other recent halts in exports such as the wheat from Oregon that Japan and South Korea temporarily stopped purchasing (Gillam, 2013). China began enforcing a policy regarding the presence of some GE corn leading to delays, deferrals, and rejections of US shipments of corn which left US corn farmers out of the market at an estimated $1-$2.9 billion dollar loss which could continue to grow (Fisher, 2014). This is a huge impact to the farmers involved, but these market forces might also demand they use different means to sell their products or choose to grow different crops.

Solutions Proposed

World-Wide

The World Health Organization (WHO) and the Food Agriculture Organization (FAO) created the Codex Alimentarius Commission (Codex) to promote food standards internationally to ensure fair trade and protect consumer health. When GE food was in the development stage Codex began working on suggestions for labeling, however the countries with the largest investment in GE strongly opposed labeling GE products. In May 2011, after 18 years, Codex adopted guidelines that did not endorse labeling, but would allow countries to utilize labeling if they desired (Chang, n.d). The World Trade Organization (WTO) adopted the Cartagena Protocol on Biosafety which reinforces the right of an importing nation to reject GMO products and also establishes international rules of trade for GMO products by strengthening the precautionary principal (Faulkner, 2000). "The precautionary principle states that in the case of serious or irreversible threats to the health of humans or the ecosystem, acknowledged scientific uncertainty should not be used as a reason to postpone preventive measures" (WHO, 2004). Dr. George Amofah the General Secretary for the Ghana Public Health Association (2014) reports that a scientific seminar was organized to discuss the possible introduction of GMO health impacts and public use. Many issues were discussed at this seminar including the potential for a correlation between organ disease and the use of GMO/glyphosate, and concerns regarding several other diseases with weaker correlations, and a concern that short term studies are insufficient to detect the true impacts. These concerns drove a recommendation that Ghana proceed with caution in adopting any GE crops. It was recommended that they monitor the disease and illnesses mentioned and perform epidemiological studies. It was also suggested that they require further independent testing, labeling of the products in place so that further monitoring of their impact can be attempted, and that they institute a regulatory agency before approving GMO and releasing to the market (Amofah, 2014).

United States

The Federal Drug Administration (FDA) is tasked with regulating the health aspects of GE foods. However, historically, the FDA has relied primarily on safety assessments provided by the developers of GE plants (FDA, 2013). Given the array of potential environmental, economic, and health impacts mentioned above and the minimal oversight currently provided many individuals, companies, organizations, and governments are asking for regulation.

Due to the lack of federal regulation in the US, many states and counties have opted to proceed in a way they see fit. The Center for Food Safety (Oct, 2014) reports that, over 30 states have introduced bills requiring GE labeling or prohibition. The state attempts have proceeded either by a direct democracy approach and proposing ballot initiatives to the people for a vote on restrictive GE legislation, or the representative democracy approach and introducing bills directly to the legislature.

Since 2012, four states, California, Washington, and most recently Colorado and Oregon have allowed a vote on GMO labeling as ballot initiatives, all of which failed. Colorado's initiative was strongly defeated with only 34.53% of yes votes on the ballot (Colorado Secretary of State,

2014) and Washington's was also defeated by a substantial margin with yes votes at 41.5 % (Washington Secretary of State, 2013). California's ballot measure was defeated by a narrow margin, with 48.6% of yes votes (California Secretary of State, 2012). Oregon's vote was too close to call forcing a mandatory recount, which ultimately ended in defeat by less than 1000 votes and 49.97% of yes votes (Oregon Secretary of State, 2014). With the exception of Colorado, all of these ballot initiative states have had at least one county that also attempted legislation.

Hawaii is a special case in that the state has not passed any restrictive legislation, but Hawaii, Kauai (Cocke, 2013), and Maui (Ballotpedia, 2014) counties have been successful in passage. However, their restrictive legislation is being challenged in court and in January 2015 a preemptive bill was introduced to the state legislature and is still pending (Hawaii State Legislature, 2015). Preemptive legislation makes restrictive GE legislation a state only option and removes the power of lower levels of government to adopt such legislation (Duhaime's Law Dictionary (n.d.). In some cases this preemption has not stopped the attempts or the passage of restrictions, and some counties have proceeded, managed to have their ballot allowed, and some have even passed restrictions. However, the preemption allows for county or city level restrictions to be negated or challenged in court unless they were expressly exempted.

Maine, Connecticut, Florida, Michigan, and Vermont have successfully passed restrictive laws through their legislature. The laws for Connecticut and Maine require that other states in the area with a specified minimum population also pass the labeling laws before theirs will go into effect (Center for Food Safety, 2014), but Vermont was the first state to pass GE labeling legislation without any caveats. Vermont Governor Peter Shumlin (2013) announced that he is proud that Vermont can lead the way for other states to require GE labeling because they believe in the right to know what is in their food. Maine has since brought, in 2015 an amendment has been brought forward that would allow immediate implementation, but is still currently pending.

Industry Influence

Vermont's legislation has been challenged by the Grocery Manufacturers Association (GMA), Snack Food Association (SFA), International Dairy Foods Association (IDFA), and the National Association of Manufacturers (NAM) through a lawsuit against the state. This lawsuit cites many reasons including stifling their First Amendment Right by compelling the labeling. The state has already requested that the lawsuit be dismissed because the industry claims are invalid (Sorrell, 2014). On April 27, 2015, almost a year after the passage of Vermont's legislation, the US District Court Judge ruled and has denied the GMA's request to block the law from going into effect, and the GMA filed an appeal to this decision (Wheeler, 2015). In addition, to these lawsuits the agribusiness industry has done many things to protect their interest. Some on the anti-GE side believe that the industry has been trying to discredit scientists whose research promotes conflicting views and have purposely hidden their secret agendas and conflicts of interest in doing so (Seralini, 2014). What is more certain is that the agribusiness industry has invested heavily in lobbying and campaign financing. In the first half of 2014 the agribusiness industry, had already spent 3 times as much against GE labeling as they spent in 2013 (Foley, 2014). If you include the lobbying money of $36.8 million the industry spent in 2013/14 they have spent a total of $67.9 million to defeat ballot initiatives in

California and Washington while the anti-GE advocates have spent a total of $1.9 million for the first half of 2014 (Foley, 2014). Many consumers now want to know why the agribusiness industry is fighting so hard against labeling if they believe in the product.

Purpose of this Study

This study will not provide a determination on whether GE is a desirable choice or method, but rather seeks to understand what leads to the introduction and possible success of restrictive GE legislation by exploring the impacts of public initiative and legislative efforts to introduce and pass such laws. In my research I seek to understand which socio-economic, political, or industry factors can explain which states have considered GE legislation, as well as which states have passed their proposed GE restrictive legislation at the county and state level.

Chapter 2: Methodology

In this study, I seek to understand what factors are correlated to the attempt of and/or success of restrictive GE policy. I used a comparative cross-sectional study design because the data does not occur on any time continuum, but rather could be captured at a specific point in time with data gathered from publically available sources. The data analysis uses a mixed methods approach that first examines bi-variate correlations among the dependent and independent variables, and then seeks a multivariate regression model that best explains the relationships among all the independent variables and the dependent variables.

Based on the discourse surrounding Anti-GE vs pro-GE campaigns I developed several hypotheses about what variables would be correlated with the proposal or passing of GE restrictive legislation, as well as the converse of those correlated with failure to propose or pass such legislation. Discussions regarding which groups favor GE restrictions show a number of hypotheses, many contradictory to one another. One is that consumers who are white women with a higher disposable income prefer organic food (Astyk, 2010) to GE food. Explanations for this preference could stem from concern with environmental and health rick of industrial agriculture, while some have argued this stems from a mistrust of GE technology (Sarich, 2014). Those who prefer organic foods are more likely to be in support of restrictive legislation. In contrast to the correlation between white, and relatively affluent women preferring organic food, there are also reasons to predict that minorities might favor GE restrictions. Minorities tend to favor environmental legislation at higher rates than whites (Lavelle and Coyle, 1992), and thus states or counties with higher minority populations (or lower percent non-Hispanic white populations) might be predicted to support GE restrictive legislation at higher rates. People with more education tend to show higher concern with environmental contamination and interest in healthy lifestyles (Baum, 2013), and this interest particularly to avoid GE foods as a "healthy choice" (IRT, 2014), we could expect to see higher education correlated with higher support for GE restrictive legislation. Anti-GE sentiment is also seen as liberal ideology, and thus could be correlated with support of Democratic candidates for public office (Shermer, 2013). Finally, working in the agricultural industry should strongly influence opinions on GE legislation, with the majority of farms of commodity crops using GE varieties,

while organic farms explicitly do not use GE technologies. Thus, the proportion or market share of organic agriculture might predict anti-GE sentiment, while states with large agribusiness presence would be unlikely to support GE restrictive legislation. Further, large agribusinesses make substantial campaign contributions and lobby legislatures (Foley, 2014), and thus where agribusiness political contributions can be measured, it is likely that these efforts could sway the decisions on proposed GE legislation.

H1-The proposal or passing GE restrictive legislation is related to political values, with those who vote Democratic being more likely to favor GE restrictions, higher levels of organic agricultural activity, in terms of number of farms and profits, and socioeconomic characteristics, such as high levels of education and income, which is also associated with a higher proportion of white people.

H2- Failure of GE restrictive legislation, or the lack of attempts at such legislation is related to political values that favor Republicans, higher levels of agribusiness spending, higher proportions of industrial farms or farm profits, and socioeconomic characteristics include lower income due to the need for cheaper food, and lower education levels.

While there is data available at the county and city level, investigating and locating this data is difficult and time consuming. Data was not collected for cities in this study due to the excessive number of cities and little research that has aggregated the number of attempts made at this level. County data was collected, but due to the relatively few (13 counties) that have attempted legislation compared to the number of counties (>3000) nationwide, statistical analysis is invalid in determining the factors affecting their attempt at legislation. However, for states that had ballot initiatives in favor of GE labeling, I was able to perform analyses of the influence of these factors on the percent vote in favor of such initiatives among counties, although similar investigation at the level of legislative districts I states in which GE restrictions have been proposed and voted on in the state legislature was not possible as farm data are not aggregated on this level.

I used a mixed method data analysis approach in this study, measuring state level data, and compare those states that have attempted legislation, the status of their legislation, and the type of restriction pursued, and counties percent of yes votes for ballot initiatives in ballot states only (dependent variables) with those that fall into one of three categories, political, socioeconomic, or industry related (independent variables). The variables that were considered for the political category include the percent of Democratic vote during the 2012 presidential election (both state and county level data), the vote for both of the US Congressional Senators for each state on the Amendment 965 requiring GE labeling as part of the Federal Farm Bill (state level data that was combined and analyzed as Senators Vote Together), also whether the Senators were members of the same political party, and the amount of time combined the Senators have been in office. For the socioeconomic category region, education level, specifically those individuals age 25 and older that have received their high school education and/or a bachelor's degree or higher, percent of the population living at or below poverty, median household income, and the percent of non-Hispanic White only. All of the socioeconomic data was available at the state and county level. The industry related variables consider both farm activity and agribusiness political influence (in the form of political

donations). The farm variables included the number of all farms and all organic farms, the number of acres for all farms and organic farms, and the amount of total sales for all farms and organic farms. All of the farm data was available at the state and county level except for the organic farm acres which were only available at the state level. In addition, there was a substantial amount of missing data for the organic farm sales. The agribusiness industry data was collected on total donations given to each states two US Congressional Senators in the 2013-2014 elections cycle, total money received for the same senators for all elections cycles since 1990, and the money given in opposition to ballot initiatives. All of the agribusiness data was only available at a state level.

Dependent Variables

Dependent Variable data was collected for all 50 states and at the county level when available. The data was found on the corresponding state/county websites. The variable "percent of yes votes for ballot initiative" is only available for the states and counties within each state that attempted ballot legislation. Some of the legislation that has been passed has/was also challenged in court. However, court proceedings or determinations will not be evaluated due to time restrictions and a greater interest in the question of the factors associated with legislation to be successful, rather than the responses to its success.

Legislation status- Each state/county was classified into one of 4 categories (passed, failed/died in committee, pending, none) based on information from the corresponding state or county websites when available. The "passed" category included any state/county that has passed restrictive GE legislation regardless of any further action after acceptance. The "failed/died in committee" category includes any state/county that has attempted legislation and were unable to pass it. The "pending" category includes any state/county that has initiated restrictive GE legislation, but has yet to make a ruling. The "none" category contains all the remaining states where no legislation has been attempted or was not verifiable.

Legislation attempt- Each state/county was classified into one of 2 categories (attempted, not attempted) to allow them to be further examined. For the attempted category, all states that have attempted regardless of the status and those that have done nothing.

Type of restriction pursued- Restrictions were categorized as either none, cultivation, labeling, other, and multiple considered at one time. The other category contains any legislation or policy that was not cultivation or labeling. The multiple considered at one time category included those that might have been attempting any combination of legislation including something in the other category. This was done because it was difficult to determine if one policy/legislation was taking more precedence over the other.

Percent of yes votes for ballot initiatives (in ballot states only) - This is a continuous variable that was not categorized in any way. Each state/county either voted yes or no for the initiative, but the percent of yes in each state /county was recorded and used for analysis. The data for both state and county was specifically found at the Secretary of State Website.

Political Characteristics

Percent of democrats vote during the 2012 presidential election- Data was collected from politico.com for each of the state/county percentages. Initially utilizing either a Republican or Democrat vote for each was thought to suffice. However, a continuous variable, such as the specific percent of democrat votes in each state/county would provide for a more detailed view of any relationships.

US Congressional Senators vote the same on Farm Bill amendment- Originally each senator was given a number and assigned as either Senator 1 or 2 randomly. However, upon attempt to analyze the data the statistics program treated them as separate variables with one showing a correlation and the other not. It was decided that it would be easier to evaluate them if they were combined into one category so each state was categorized as either voting the same (YY, NN) or not.

Senators were members of the same political party- Originally each senator was given a number and assigned as either Senator 1 or 2 randomly. However, upon attempt to analyze the data the statistics program treated them as separate variables. It was decided that it would be easier to evaluate them if they were combined into one category so each state was categorized as either part of the same political party (RR, DD) or not.

Senators amount of time in office - The United States Senate website provided data on the Amendment to the Farm Bill addressing the mandatory labeling of GE food and the way each senator voted on it. Originally each senator was given a number and assigned as either Senator 1 or 2 randomly. However, upon attempt to analyze the data the statistics program treated them as separate variables. It was decided that it would be easier to evaluate them if they were combined into one category so the amount of time each senator had spent in office from their start date until 2013 when the vote on the amendment occurred. The sum of the two senator's time was then used as a continuous variable in the analysis. In this research this variable may also be referred to as state senator's experience.

Socioeconomic

The data for all of the socioeconomic data was provided by the United States Census quick facts page for state and county level.

Region of the United States- The census provides a map of the United States categorized into regions. These regions are West (1), Midwest (2), South (3), and North East (4).

Education level- Specifically those individuals age 25 and older that have received their high school education and/or a bachelor's degree or higher from 2009-2013.

Median household income and the poverty level- The reporting years for this variable were 2009-2013 and is shown as a percent.

Percent of non-Hispanic White- The reporting years of this data was from 2013. This was chosen to determine a difference between white and all other minorities in an area. This will allow for further investigation into other races if there is a correlation to less whites in an area.

Industry Related

Industry related variables could include monetary gain or expenses, but should also take into consideration the size and types of operations involved. The difference in the types and amounts of farms in the state and the money those operations brought in as revenue are likely to be affected differently and thus possibly play a role in passage. According to the documentation that accompanies the Agricultural Census they define a farm as any place that produces or sells a $1000 or more during the census year. For the farm data there were abbreviations and symbols used to specify further information and was located where a number should have been. A hash (-) represented zero, (D) was data that was withheld to avoid providing individual farm data, and (Z) meant data could not be provided because there was less than half of the rounding unit. These codes were entered into the data set as (-) =0, (D) =2, and (Z) =1. This allowed the data to be distinguished between true zeros and those data that were unreportable.

Number of all/organic farms- These data were collected from the United States Department of Agriculture's (USDA) National Agricultural Statistics Service's (NASS) Agricultural Census for 2012 (NASS Table 8) for the number for all farms and (NASS Table 42) the number of organic farms in each state and county. The data for all farms was an aggregated number that didn't need transforming. The data for the number of organic farms was categorized as those farms that were USDA National Organic Program certified, those that were exempt from certification, and the number of farms that were transitioning an unspecified number of acres into organic agriculture. The assumption was made that even though the transitioning farms were not currently organic they were abiding by organic practices to achieve certification. Therefore the sum of all three of these categories was used for the total number of organic farms in the state and county.

Number of all farm/organic acres- The data was collected from the USDA's (NASS) Agricultural Census for 2012 (NASS Table 8) for the number of acres for all farms in each state and county. The number of organic farm acres was not found at the same website and was the only data that was from a different reporting year. Data for organic acres was collected from the USDA's, Economic Research Service (ERS) Organic Production Report for 2011 (ERS Table 4) and was only available at the state level. The data for organic farm acres was broken out into crops, pasture & rangeland. The total category was used in this study because the all farm data was reported as a total and not individually.

Amount of total sales for all/organic farms- The data was collected from the USDA's (NASS) Agricultural Census for 2012 (NASS Table 2) for the number of acres for all farms and (NASS Table 42) for the organic farm sales in each state and county. Both of the tables reported their data in $1000, therefore the number provided was multiplied by a thousand and the product of that was then used as the total sales for all/organic farm sales.

Total Senator donations- The list of senators (previously mentioned) was used as a checklist to ensure data was collected on each of the senators that voted on the Farm Bill amendment. Locating data for money donated by any industry can be difficult to assess and data varies depending on the sources of information, the aggregation of the data and the presentation of

the data. Some sources may only report specific companies which can make comparison difficult if all of the same companies didn't donate in all states. Opensecrets.org reports money by industry without specific corporations being pinpointed. Specifically for this study the agribusiness industry was selected as the most potentially influential in the amendment vote. This reporting style was considered to be the most appropriate in allowing total influence in each state to be seen and also provide a glimpse at the amounts of money in question. Monetary influence could be measured in several ways but specifically this study wanted to determine if a specific year or many years of monetary donations made a difference. It was assumed that influence could be achieved as a reward/response for a vote in favor of the industry or could have been an ongoing attempt over years. To determine if one had more clout than the other data was gathered specifically for the elections cycle 2013-2014 to represent a reward status and all of the money donated for all election cycles since 1990 through the current cycle to represent the ongoing status.

Agribusiness industry money opposing ballot initiatives- The four ballot initiative states (California, Colorado, Oregon, and Washington) all received donations from both sides of the issue from many sources. While the opposition could have received money from individuals the majority of the donations in amount and number came from the agribusiness industry. While Ballotpedia did provide some minimal breakdown of each side deciphering only the agribusiness industry contribution was impossible and the total amount was assumed as agribusiness contribution. This assumption was considered fair in that even if there were individuals or smaller donors that the agribusiness industry stood the most to gain from the ballot failing.

Chapter 3: Results and Discussion

State Level

Influences on Proposing GE Restrictive Legislation among All 50 States

Bi-variate correlations were performed with all 50 states as an exploratory analysis to determine if there were any interesting relationships worth investigating further (Table 1). The only variables associated with an attempt at legislation were agribusiness donations during the 2013-2014 election cycle (Chart 1) and the percent of Democratic votes in the 2012 presidential election (Chart 2). The analysis showed a significant negative correlation ($r2=-.288$, $p=.042$, $n=50$) to agribusiness donations and a highly significant positive correlation to the percent of the Democratic votes ($r2=.416$, $p=.003$, $n=50$).

Twenty- four states voted Republican ® and 26 voted (D) in the 2012 Presidential Election (Chart 1b). Additionally, there were 36 states that had attempted GE restrictive legislation and 14 that have not (Chart 1c). Of the 36 states that had attempted legislation 5 passed (D), and 5 failed (D), 15 are still pending (D=8), and 11 (D=5) have died in committee. As you can see all of the Republican states that are attempting legislation are either pending or have died in committee (Table 2).

Influences on Passage of GE Restrictive Legislation

A simple regression analysis was performed on the 10 states that had attempted legislation and either passed or failed (Connecticut, Florida, Maine, Michigan, Vermont, California, Colorado, Oregon, Washington, and Wisconsin) to determine any factors that might be associated with their ability to make a decision on proposed GE restrictive legislation. The only correlation (besides all being Democrat states) that surfaced was the total acreage of farm in the state ($p=.004$, $r2=.812$, $n=10$). Surprisingly though there was no correlation to an increase in the percent of Democratic votes in the 2012 Presidential Election.

States that Passed GE Restrictive Legislation

The five states that passed legislation are Connecticut, Florida, Maine, Michigan, and Vermont. In each case, the legislation was developed and voted on within the states legislature. A comparison of political, socioeconomic and agribusiness influence among these states shows often great variability, but few patterns that might unite these states (Table 3). Among factors that were in common, all of states voted Democrat in the 2012 Presidential Election with the percent of Democrat vote ranging between 50-67%. The percent of females didn't vary at all across states but was about 1% on average higher than those states that failed to pass legislation. Education level in these states were somewhat close with the percent of the population that achieved a high school education being 86.1-91.4 % and bachelor's degree or higher being 25.9-36.5%. The level of poverty was 10.2-16.8% and the median household income ranged from $46,956-$69,461. Beyond these variables, the states differed more substantially. These states had different population levels with Vermont being significantly lower than the others. The states had varying amounts of farm acreage, number of farms, and farm sales with Connecticut being substantially less than the others. The organic farm sales range from $1.9 million-$83.3 million with Florida having the greatest amount of sales. The percent of white people in each state was widely different ranging from 56-94%. All of the Both US Congressional State Senators in all of the states, with the exception of Maine, voted together on the amendment to the Farm Bill with 2 states Connecticut and Vermont voting yes and Florida and Michigan voting no. The combined total of both senators received agribusiness donations for the 2013-2014 election cycle varied drastically.

Examining the state characteristics for these 5 states yielded no commonalities that might explain why GE restrictive legislation passed. The only common variable they share is the vote in the 2012 presidential election, but the percentages varied substantially with Florida being marginally Democratic. In the 1996 and 2008 presidential elections all of the states that passed legislation voted Democrat, with Florida flipping in 2000 and 2004 and voting Republican (US Election Atlas, 2012). This variable may also not be a common denominator in the outcome of GE restrictive legislation either.

States that Failed GE Restrictive Legislation

The five states where legislation failed are California, Colorado, Oregon, Washington, and Wisconsin (Table 4). All of these states attempted restrictive legislation through ballot initiative except Wisconsin which utilized the legislature. When comparing the political, socioeconomic, and industry related variables there was a high degree of variability across all of the states with few similar trends. All of the states voted Democrat in the 2012 Presidential

Election with the percent of Democrat vote ranging between 51.2-59.3% and all of the state's anti-labeling campaigns received millions of additional money from the agribusiness industry. Education level in these states were somewhat close with the percent of the population that achieved a high school education being 81.2-90.4% and bachelor's degree or higher being 26.8-37%. The level of poverty was 13-16.2% and the median household income ranged from $50,229-$61,094. These states had similar population levels, with the exception of California, which was significantly higher. All of these states had over 14 million acres of farm land, but Colorado and California had almost double the amount of farm acres than the others. Beyond these variables the states differed more substantially. The percent of white people in each state was widely different ranging from 39-83%. Farm sales varied drastically, but all had over $4 billion in sales. Colorado, Oregon and Washington had approximately half as many number of farms as the other states. California had more than triple the number of organic farm acres than the next largest amount for the other states. All of these 5 states had substantial organic sales, but varying substantially with California being significantly higher than the others as was the case with number of organic farms. Both US Congressional State Senators in all of the states are Democrats, with the exception of Wisconsin where they are from opposite parties. Most of these senators' votes also aligned for the GE labeling amendment to the Farm Bill, with California, Oregon, and Washington all voting yes on the amendment, Wisconsin voted no, and Colorado had a split vote.

A subsequent analysis was performed omitting Wisconsin as an outlier and using the percent of yes votes on the ballot as the dependent variable. The only relationship that surfaced was a negatively significant correlation with the percent of population with a bachelor's degree ($p=.027$, $n=4$, $r2= -.973$).

There were few commonalities in the socioeconomic and industry variables examined among the states where proposed GE restrictive legislations has failed, except they all voted Democratic in the 2012 Presidential Election and they all received millions of dollars of agribusiness money directed to the anti-labeling campaign. Education, poverty and household income were all close in range, but the remainder of the variables were substantially different across the states. The direct influence of the agribusiness industry lobbying against GE restrictive legislation may have affect the outcome of proposed legislation in states where the legislation was approached through ballot initiative. However, it is difficult to account for the direct agribusiness influence in the states in which the legislation was proposed and decided by elected officials.

Additionally, all of the ballot initiative states have attempted legislation through their legislature as well. California attempted their ballot initiative in 2012 and introduced a bill to the legislature in the 2013-2014 legislative session which also failed to pass the Senate (California Legislature, 2014). Colorado attempted both the ballot initiative and legislative bill in 2014 with their legislative bill failing to pass committee (Colorado Legislature, 2014). Oregon's ballot initiative was in late 2014 and the legislature bill was introduced in the 2015 regular legislative session and is still pending (Oregon Legislature, 2015). Washington introduced a legislative bill in 2011-2012 legislative session which died in committee (Washington State Legislature, 2012) and attempted the ballot initiative in 2013 (Washington Secretary of State, 2013). This is yet another variance in the analysis that does not provide any

clear indication as to why they have not been successful. All of the ballot initiative states also had at least one county that has attempted legislation and because each county within the state had voting outcomes for the ballot initiatives further analysis was performed on the counties of these 4 states to determine if there were local factors that were not being captured at the state level.

County Level

Ballot Initiative Counties

For this section all of the counties for the four ballot initiative states (California, Colorado, Oregon, and Washington) were analyzed utilizing a simple regression (Table 5) to determine any important relationships for the multiple regression. The dependent variable in this portion of the analysis was the percent of vote (county level) in support of the GE labeling ballot initiative and was run against all of the socioeconomic, political, and industry associated variables. The results of the simple regression showed a positive significant correlation ($p=.014$, $n=197$, $r2=.174$) with the total number of organic farms, a negative significant correlation ($p=.015$, $n=197$, $r2=-.173$) with total acreage of all farms, and no correlation to the number of all farms or all farm sales. There was also a positive highly significant correlation with the percent of population with a bachelor's degree ($p=.000$, $n=197$, $r2=.259$), median household income ($p=.000$, $n=197$, $r2=.259$), and percent of Democrat vote in the 2012 presidential election ($p=.000$, $n=197$, $r2=.419$). There were no correlations with the percent of population that had achieved a high school education, percent of population living below poverty, or race.

The variables used for the multiple regression model were total number of organic farms, total farm acreage, percent of population with a bachelor's degree or higher, median household income, and the percent of democrat vote in the 2012 presidential election. When running the analysis with the dependent variable county vote for GE labeling (yes or no) the only correlation with the dependent variable was the percent of Democrat vote in the 2012 Presidential Election ($p=.000$; $df=5$, $n=196$, $t=4.221$). The multiple regression was then run with the dependent variable as the percent of vote in favor of GE labeling with the same independent variables as above. There were highly significant positive correlations with the number of organic farms ($p=.004$, $df=5$, $n=196$, $t= 2.943$), and the percent of Democrat vote in the 2012 Presidential Election ($p=.000$; $df=5$, $n=196$, $t=7.462$). There was also a highly significant negative correlation to the total farm acreage ($p=.000$, $df=5$, $n=196$, $t= -3.592$).

Even at the local level the only relationship that could be determined is the excess agribusiness money against labeling and the percent of Democratic votes. Although, as the percentage of yes votes increased not only did the percent of Democratic vote in the 2012 Presidential election increase, but so did the number of organic farms, while the total farm acreage decreased.

The association with percent of Democratic votes for the 2012 Presidential Election could be inaccurate/more accurate due to a number of things including, the voter turnout for the particular election chosen, the election chosen, or number of elections analyzed. The results may have been different if any of these had been different or included, especially when considering how each of these states voted in previous elections. In the 1996, 2000, and 2004

presidential elections 3 of the 4 ballot states voted Democrat, with only Colorado voting Republican, but in the 2008 presidential election Colorado voted Democrat along with the other 3 ballot states (US Election Atlas, 2012).

Counties for Individual Ballot States

The counties for each individual ballot state were also analyzed by conducting a simple regression to determine any relationship within the state only (Table 6). The dependent variable was the percent of vote in favor of GE labeling on the ballot initiative for each state and was run against all of the socioeconomic, political, and industry variables to evaluate local nuances that may be occurring.

Oregon showed no correlation with any of the variables. There were several significant correlations, for the other three states, that surfaced with Agricultural sales, acreage of farms, percent of population with higher education, income, poverty level, and again the percent of democratic votes. The analysis for California counties showed a significant positive correlation to the percent of population that had reached high school achievement ($r2=.287$, $p=.029$, $n=58$) and those with a Bachelor's degree or higher ($r2= .607 p=.000$, $n=58$), median household income ($r2= .372$, $p=.004$, $n=58$), and the percent of democrat vote ($r2= .795$, $p=.000$, $n=58$). Washington counties analysis showed a highly significant positive correlation to the percent of democrat vote in the 2012 presidential election ($r2=.663$, $p=.000$, $n=39$) and the percent of population with a Bachelor's degree ($r2=.589$, $p=.000$, $n=39$). There was also a positive correlation with high school education ($r2= .346$, $p=.031$, $n=39$), and median household income ($r2= .509$, $p=.001$, $n=39$). In addition, there were significant negative correlations with the percent of population below poverty ($r2= -.431$, $p=.006$, $n=39$) and total farm acreage ($r2= -.377$, $p=.018$, $n=39$). The analysis for Colorado counties showed a significant positive correlation to college level education ($r2=.368$, $p=.003$, $n=64$) and the percent of democrat vote in the presidential election ($r2=.306$, $p=.014$, $n=64$).

It was important to remove any relationships between the socioeconomic variables for the multiple regression model to reduce the likelihood of their relationship being the only outcome (Table 7). Therefore the variables used for the regression model were all farm acreage, and percent of population with a bachelor's degree or higher, median household income, and the percent of democrat vote in the 2012 presidential election. The result of the multiple regression showed that the counties in Oregon again had no correlations. California had a significant negative correlation to median household income ($t= -2.611$, $p=.012$, $n=57$, $df=5$) and a highly significant correlation to the percent of Democrat votes for the 2012 Presidential Election ($t=7.008$, $p=.000$, $n=57$, $df=5$). Colorado had highly significant positive correlations with the percent of population with a bachelor's degree ($t=3.762$, $p=.000$, $n=63$, $df=4$) and the percent of Democrat votes for the 2012 Presidential Election ($t=6.149$, $p=.000$, $n=63$, $df=4$). Washington counties had a negatively significant correlation to the total farm acreage ($t= -2.071$, $p=.046$, $n=38$, $df=4$) and a highly significant correlation to the percent of Democrat votes for the 2012 Presidential Election ($t=6.80$, $p=.000$, $n=38$, $df=4$).

The only common association among these variables for each of the states, at the county level, is the percent of Democrat votes for the 2012 Presidential Election with the exception of Oregon. It is surprising that there were no relationships that surfaced especially given that

they came the closest to passing the ballot with less than a 1000 vote difference (Oregon Secretary of State, 2014).

Chapter 4: Conclusions

While more decisions are being made in Democrat states and the data showed a correlation to the percent of democrat votes in the 2012 presidential election, it still could be inconclusive. The vote for this one election may be skewed because a few of the states analyzed voted Republican in other election years. To confirm the relationship further analysis should be performed with other elections to include other presidential elections, gubernatorial election, and congressional elections.

While this study found that the data is inconclusive to the factors affecting GE restriction it did point to some areas where a relationship could potentially exist and room for further research to continue. The overarching theme appears to be political in nature and possible intertwined with agribusiness monetary influence. Therefore, further study should be done in these specific categories.

In this study it was difficult to use the senator's data without combining them together to perform the analysis. However, there may be a relationship that was left unrevealed because of this. Further research should address the senators time in office (possibly ranking them by seniority), monetary donations received, and voting patterns to determine if any true relationship exists. Additionally one could extended this to include all of congress, and if looking at a county level, district representatives. A study performed that could analyze how often our representatives vote in favor of constituents versus party lines when they are not one in the same, could be very beneficial in determining influential behaviors.

This study did not determine that farm characteristics had any correlation to passage or failure of legislation it is possible that is due to the difficulty in acquiring the data necessary to perform analysis. The data was not only difficult to acquire, but also difficult to interpret, and compare across data sets especially when data for the same year is not available. Additionally, some data is not reported if it will reveal a specific farms information, this leaves areas that can't be assessed or analyzed. To further complicate matters there was more than one government agency reporting similar data where numbers did not match. The presentation of agricultural data can sometimes feel like it is purposely transposed to make it difficult to analyze.

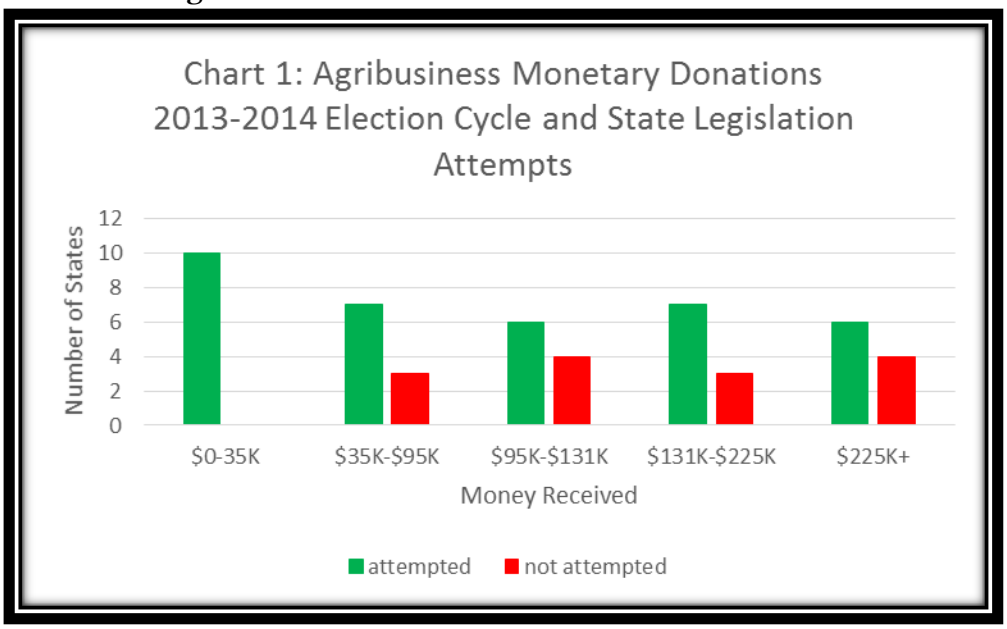
For the purpose of this study it was necessary to compare GE crops to non GE crops. The only way to attempt this was to utilize data for certified organic farms and all farms. However, there are many farms that utilize organic or other non-GE techniques that may not ever pursue certification and would therefore not be considered and skewing the data. Improved and consistent reporting would allow for improved evaluation of the agriculture industry. This is an extremely important area as it could provide insight into relationships that may exist with other industries, including agribusiness, and the politics involved or influencing decisions.

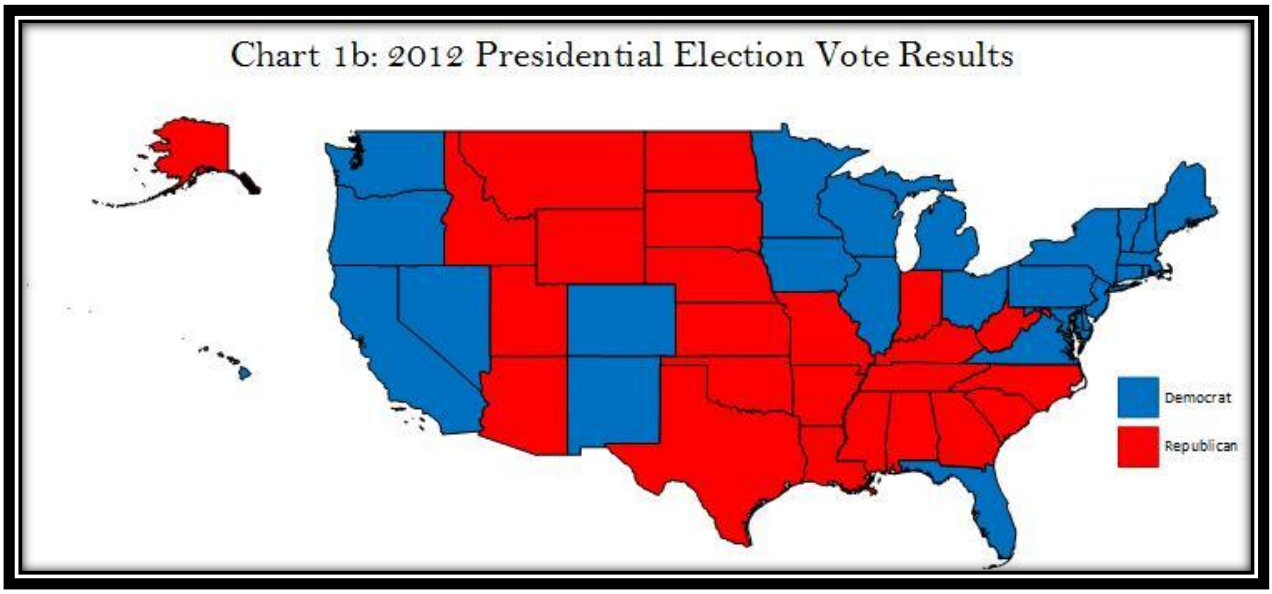
Agribusiness monetary donations, specifically those above and beyond what is given to a state's congressional leaders appears to be the most influential. This could be because the data in this study was skewed by combining the senators received donations, but the donations to the state initiatives by the agribusiness industry is definitely the only thing that is an obvious difference between legislation passing and failing. Without having an equal measure to verify against the states that passed their legislation it is impossible to prove correlation or causation.

Validity Concerns

There are a few validity concerns with this study. Foremost, while every attempt was made to find legislation for every state and county, it was time consuming and difficult to locate, so it is possible for some missing data in regards to legislation attempts, status, and type pursued. Voter turnout and political party could have some variability from election to election and the 2012 Presidential Election may not have been the best to adequately determine correlation. The agriculture data is difficult to collect and interpret. Currently, the only way to distinguish between GE and non-GE agriculture is to use Certified Organic farms to represent the latter. This unfortunately is a small percentage of overall agriculture and eliminates many farms that may practice organic or sustainable farming methods not including GE inputs, but it is impossible to measure or find that data. The agriculture data for farms in respect to number, acres, and money is a self-reporting system and many times in the data available there was no data or was unable to be disclosed due to only one farm reporting in an area. Furthermore, this study does not take language of the policy or legislative documents into consideration and assumes that they are created as equal. Additionally, as with any study, there could be variables that are so embedded in a community, county, and/or state that are overlooked that are not currently measured or available, or that could not be measured, or that would have potentially highlighted an important correlation.

Tables and Figures





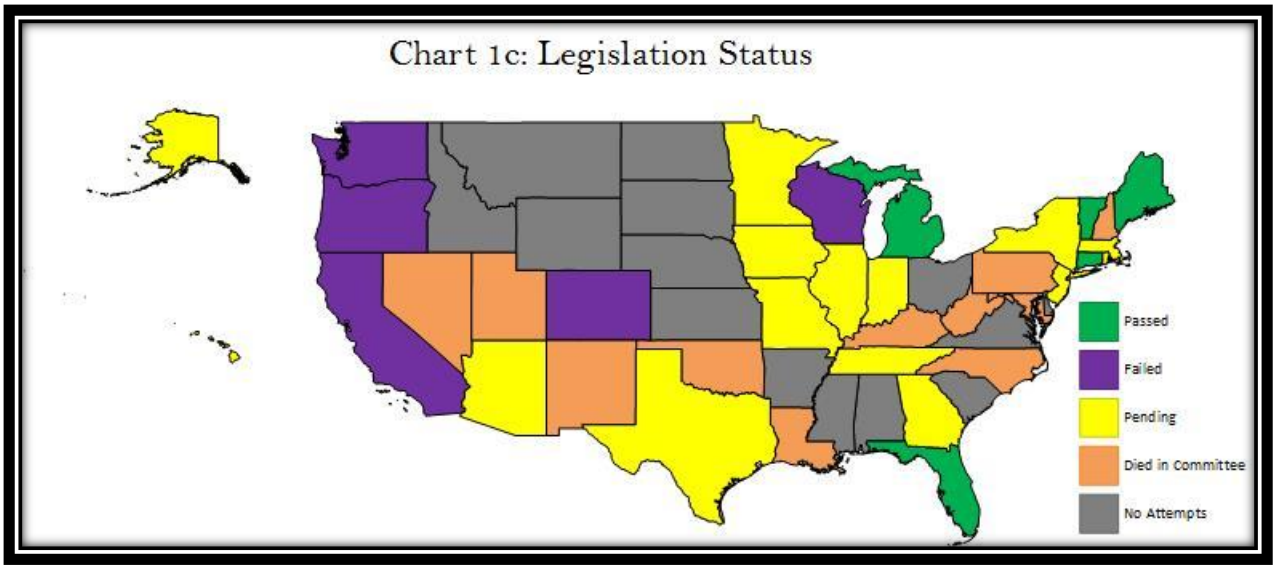


Chart 1c: Legislation Status
Passed
Failed
Pending
Died in Committee
No Attempts

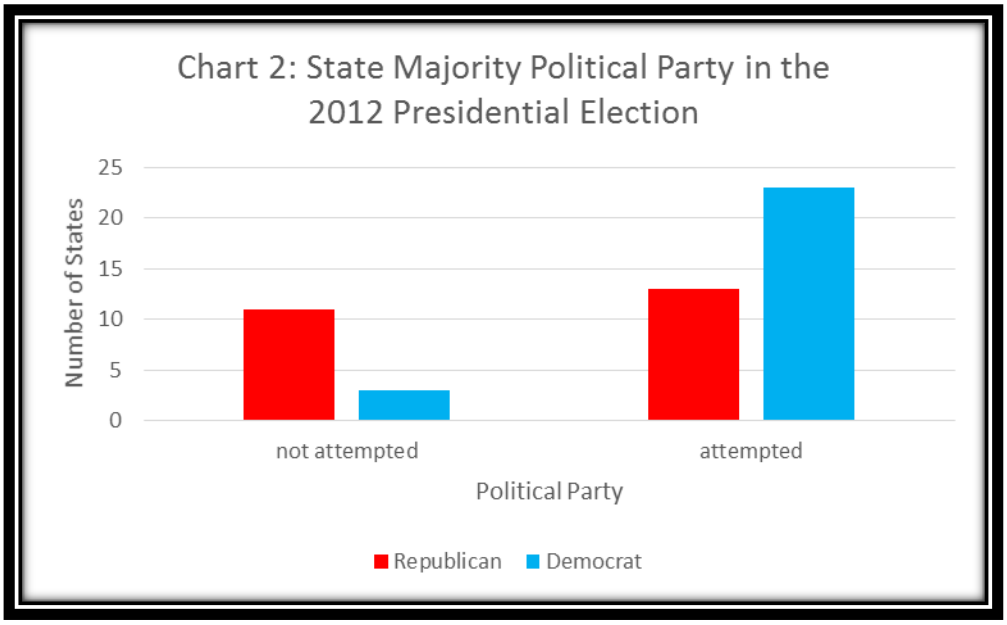


Chart 2: State Majority Political Party in the 2012 Presidential Election
Number of States
25
20
15
10
5
0
not attempted
attempted
Political Party
Republican
Democrat

Table 1: All 50 States-Simple Regression/Correlation

	Legislation Attempt	All Ag $	Organic Ag $	# of Farms	# of Organic Farms	Acreage All Farms	% of pop with Bachelors +	% of pop with HS	Income	% of pop below poverty level	% of white people	% of democrat vote	Agribusiness $ 2013
Legislation Attempt	1											.416**	(-).288 *
All Ag $		1	.613**	.656**	0.633**								
Organic Ag $		.613**	1		.912**								
# of Farms		.656**		1				(-).330*	(-).289*	.315*			.338 *
# of Organic Farms		.633**	.912**		1							.348*	
Acreage All Farms						1							
% of pop with Bachelors +							1	.470**	.812**	(-).712**		.609**	(-).405 **
% of pop with HS				(-)0.33*			.470**	1	.466**	(-).781**	.507**		(-).418 **
Income				(-).289*			.812**	.466**	1	(-).851**		.518**	(-).468 ***
% of pop below poverty level				.315*			(-).712**	(-).781**	(-).851**	1		(-).363**	.534 ***
% of white people								.507**			1	(-).319*	
% of democrat vote	.416 **				.348*		.609**		.518**	(-).363**	(-).319*	1	(-).341 *
Agribusiness $ 2013	(-).288 *			.338*			(-).405	(-).418**	(-).468**	.534**		(-).341*	

t= a trend present at <.1

*=significant at <.05

**=significant at <.01

***=significant at <.001

Table 2: All 50 States-Vote and Status of Legislation

	Republican	Democrat	Total
Passed	0	5	5
Failed	0	5	5
Pending	7	8	15
Died in Committee	6	5	11
None	11	3	14
Total	24	26	50

Table 3: States that Passed Legislation

	Connecticut	Florida	Maine	Michigan	Vermont
population	3,574,097	18,801,310	1,328,361	9,883,640	625,741
Farm Acres	436,539	9,548,342	1,454,104	10,031,807	1,251,713
Farm Sales	$550,620,000.00	$7,701,532,000.00	$763,062,000.00	$8,678,050,000.00	$776,105,000.00
# of Farms	5,977	47,740	8,173	52,194	7,338
Organic Farm Acres	69,549	No Data	39,227	69,861	105,060
Organic Farm Sales	$1,984,000.00	$83,373,000.00	$36,401,000.00	$53,503,000.00	$62,634,000.00
# of Organic Farms	134	300	676	640	663
Percent of Bachelors Degree	36.5	26.4	27.9	25.9	34.8
Percent of High School Achievement	89.2	86.1	91	88.9	91.4
Percent of Poverty	10.2	16.3	13.6	16.8	11.8
Percent of White People	70	56	94	76	94
Median Household Income	$69,461	$46,956	$48,453	$48,411	$54,267
Vote in 2012 Presidential Election	Dem	Dem	Dem	Dem	Dem
Percent of Dem Vote in Presidential Election	58.4	50	56	54.3	67
Are Both State Senators in the Same Party	Yes	No	No	Yes	No
Sen Shared Party	Dem	N/A	N/A	Dem	N/A
Did Both State Senators Vote the Same for Amendment	Yes	Yes	No	Yes	Yes
Agribusiness Monetary Donations 2013-2014	$9,100.00	$150,940.00	$149,790.00	$129,882.00	$18,500.00

Table 4: States that Failed Legislation

	California	Colorado	Oregon	Washington	Wisconsin
Process	Ballot	Ballot	Ballot	Ballot	Legislature
Population	37,253,956	5,029,196	3,831,074	6,724,540	5,686,986
Farm Acres	25,569,001	31,886,676	16,301,578	14,748,107	14,568,926
Farm Sales	$42,627,472,000.00	$7,780,874,000.00	$4,883,674,000.00	$9,120,749,000.00	$11,744,476,000.00
# of Farms	77,857	36,180	35,439	37,249	69,754
Organic Farm Acres	951,356	164,007	358,779	92,083	208,081
Organic Farm Sales	$1,355,207,000.00	$68,188,000.00	$194,356,000.00	$291,410,000.00	$121,527,000.00
# of Organic Farms	3,886	265	727	962	1,582
Percent of Bachelors Degree	30.7	37	29.7	31.9	26.8
Percent of High School Achievement	81.2	90.2	89.4	90	90.4
Percent of Poverty	15.9	13.2	16.2	13.4	13
Percent of White People	39	69.4	77.5	71	83
Median Household Income	$61,094	$58,433	$50,229	$59,478	$52,413
Vote in 2012 Presidential Election	Dem	Dem	Dem	Dem	Dem
Percent of Dem Vote in Presidential Election	59.3	51.2	54.5	55.8	52.8
Are Both State Senators in the Same Party	Yes	Yes	Yes	Yes	No
Sen Shared Party	Dem	Dem	Dem	Dem	N/A
Did Both State Senators Vote the Same for Amendment	Yes	No	Yes	Yes	Yes
Agribusiness Monetary Donations 2013-2014	$12,500.00	$257,669.00	$170,646.00	$63,750.00	$90,750.00
States Initiative Opponents Campaign Money	$45,600,000.00	$12,677,389.00	$20,881,102.00	$22,009,926.00	$0.00

Table 5: Ballot Initiative Counties-Simple Regression/Correlation

	County Voted Yes on Ballot	Farm Sales	# of Farms	# of Organic Farms	Farm Acres	Percent of Bachelors Degree	Percent of High School Achievement	Median Household Income	Percent of Poverty	Percent of White People	Vote in 2012 Presidential Election
County Voted Yes on Ballot	1			.174*	(-).173*	0.259***		0.250***			.419***
Farm Sales		1	.642***	.445***	.514***	(-).223**	(-).616***		.329***		
# of Farms		.642***	1	.699***	.330***		(-).303***		.179*		
# of Organic Farms	0.174*	.445***	.699***	1			(-).255***	.158*			.260***
Farm Acres	(-).173*	.514***	.330***		1	(-).399***	(-).423***	(-).276***	.336***		(-).411***
Percent of Bachelors Degree	0.259***	(-).223**			(-).399***	1	.568***	.683***	(-).507***		.573***
Percent of High School Achievement		(-).616***	(-).303***	(-).255***	(-).423***	.568***	1	.272***	(-).536***		
Median Household Income	0.250***			.158*	(-).276***	.683***	.272***	1	(-).696***		.432***
Percent of Poverty		.329***	.179*		.336***	(-).507***	(-).536***	(-).696***	1		
Percent of White People		(-).574***	(-).338***	(-).351***	(-).232**		.788***	(-).140*	(-).312***	1	(-).374***
Vote in 2012 Presidential Election	.419***			.260***	(-).411***	.573***		.432***		(-).374***	1

*=significant at <.05

**=significant at <.01

***=significant at <.001

Table 6: Counties for each Individual State-Simple Regression/Correlation

	California	Colorado	Oregon	Washington
Farm Sales				
# of Farms				
# of Organic Farms				
Farm Acres				(-).377*
Percent of Bachelors Degree	.607***	.368**		.589***
Percent of High School Achievement	.287*			.346*
Median Household Income	.372**			.509**
Percent of Poverty				(-).431*
Percent of White People				
Vote in 2012 Presidential Election	.795***	.306*		.663***

This table shows the r2 value and the following p values. DF and N are reported in text.

*=significant at p <.05

**=significant at p <.01

***=significant at p <.001

Table 7: Counties for each Individual State-Multiple Regression				
	California	Colorado	Oregon	Washington
Farm Acreage				(-)2.071*
Percent of Bachelors Degree		3.762***		
Median Household Income	(-)2.611*			
Vote in 2012 Presidential Election	7.008***	6.149***		6.80***
This table shows t values for the multiple regression and the following p values. DF and N are reported in text.				
*=significant at p <.05				
**=significant at p <.01				
***=significant at p <.001				

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