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Partisan Politics, Agricultural Interests and Effects on State-Level Ethanol Subsidies

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PARTISAN POLITICS, AGRICULTURAL INTERESTS AND EFFECTS ON STATE-LEVEL ETHANOL SUBSIDIES

By

Lance Odum

B.A., Southern Illinois University, 2008

A Research Paper

Submitted in Partial Fulfillment of the Requirements for the

Master of Public Administration

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TITLE: PARTISAN POLITICS, AGRICULTURAL INTERESTS AND EFFECTS ON STATE-LEVEL ETHANOL SUBSIDIES

MAJOR PROFESSOR: Dr. John Foster

This paper examines factors leading to state-level fuel ethanol subsidies. The federal Renewable Fuels Standard (RFS2) mandates a certain volume of ethanol production through 2022. However, the $6 Billion federal ethanol subsidy expired at the end of 2011. Because the mandated amount of ethanol production from corn continues to increase until 2015, there is evidence that ethanol producers may look to the individual states to ensure that higher levels of ethanol production remain profitable. This paper examines factors that have led to state-level policies favoring ethanol in order to predict which states will be more likely to increase subsidies in the absence of the federal program. Using a multiple regression model with data from 1996 through 2010, this project finds that states with larger agricultural sectors and with higher degrees of party competition are more likely to subsidize ethanol while party control has no significant effect.

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Introduction

Over the past decade, US fuel ethanol production has exploded from less than two billion gallons in 2001 to nearly fourteen billion gallons in 2011 (US Department of Energy-Biomass Program, 2011; Renewable Fuels Association, 2012). That amounts to nearly ten percent of total gasoline production by volume (Energy Information Administration, 2012). This has occurred largely as a consequence of government interventions in the marketplace that initially gave incentives to ethanol producers and eventually mandated its use. However, Congress allowed the Volumetric Ethanol Excise Tax Credit (VEETC), amounting to nearly $6 billion in 2011, to expire on the first day of 2012.

In the wake of VEETC (colloquially known as the "blenders' credit"), ethanol blenders are left with a quantity of use mandated by the federal Renewable Fuels Standard (RFS) but no price support to ensure profitability. Additionally, a 54 cent per gallon tariff on imported ethanol expired along with VEETC so domestic producers no longer have the benefit of protection from imported Brazilian ethanol. However, while direct payments from the federal government to blenders accounted for the bulk of ethanol subsidies, there are myriad other policies at both the federal and state levels that create incentives for ethanol production and consumption.

Because the RFS mandates an increase in corn ethanol production through 2015, it is likely that more subsidies will be needed to meet the demand (DOE-Biomass Program, 2010). As the federal government becomes less of a player in the ethanol market, producers may look to state governments to fill the funding gap. This paper examines the effects of political and agro-economic variables on state-level ethanol policies to determine which states are likely to legislate more subsidies for ethanol production.

History of Ethanol in the US

It is important to understand the role that public policy has played in shaping the ethanol market. Ethanol has been distilled from corn in the United States for hundreds of years for the purpose of human consumption. And, the earliest experiments with internal combustion engine design in the early 1800s called for high-proof ethanol as the fuel. The use of ethanol as a motor fuel was short-lived though, as a $2 per gallon excise tax on alcohol, created in 1862 to help fund the Civil War, made it too expensive (Green Plains, 2012, Gustafson, 2010). Additionally, the original patents of the four stroke engine were coincident with the US oil boom. Before the perfection of the electric light bulb and widespread electrification efforts, gasoline was a bi-product of lamp oil or kerosene production and was priced accordingly. With the exception of limited use due to wartime fuel shortages, ethanol was dismissed as a motor fuel until the 1970s (Kovarick, 1998; Green Plains, 2012; Gustafson, 2010).

The oil embargo of 1973 renewed interest in ethanol as a supplement for foreign petroleum but it was the federal ban of lead fuel additives, beginning in 1975, that provided the initial catalyst for large-scale ethanol production (Green Plains, 2012; Gustafson, 2010). In addition to the ban on lead additives, new machining processes, as well as advancements in metallurgical sciences, eliminated the need for lead in modern engines but there was still a need for octane boosters or anti-knock agents. Because the octane rating of pure ethanol is about 113, it was a viable option (Kovarick, 1998; Gustafson, 2010). As a fuel source, ethanol was cost prohibitive, but as an octane booster it was competitive with other non-lead options. However, it was still used only on a limited basis.

The Carter administration ushered in the modern era of federal ethanol support in 1978 with the creation of a 40 cent tax credit for every gallon of ethanol blended with gasoline

(Glozer, 2011; Gustafson, 2010). The Energy Security Act of 1980, the Gasohol Competition Act of 1980 and the Crude Windfall Tax Act of 1980 offered various new incentives such as construction loans for ethanol plants, imposed a tariff on imported ethanol and extended the per gallon subsidy. In 1983, the subsidy was increased to 50 cents and then 60 cents in 1984 by the Surface Transportation Assistance Act and Tax Reform Acts, respectively (Green Plains, 2012).

By 1985, the ethanol market had peaked at 595 million gallons of production, up from just 50 million in 1980. Additionally, over the same time period, production facilities skyrocketed from less than 10 to 163. This saturated the market and even with the 60 cent per gallon subsidy, less than half of those plants were still operating at the end of 1985. In spite of the federal government's best efforts, ethanol production increased only marginally over the next 15 years. The Omnibus Budget Reconciliation Act of 1990 reduced the subsidy to 54 cents and in 1998 it was extended yet again but with a scheduled reduction to 51 cents by 2005. Still, by 2000 production had reached over 1.6 billion gallons. The continued growth may partially be attributed to the first state-level subsidies passed in 1995-96, as well as limited production of flex-fuel vehicles capable of operating on 85% ethanol blends (Glozer, 2011; Green Plains, 2012).

An amendment to the Clean Air Act (CAA) in 1990 piqued new interest in ethanol. Smog problems in larger metropolitan areas (primarily Los Angeles) provoked mandatory fuel oxygenate additives to reduce airborne pollutants (EPA, 2012). As the name implies, oxygenates increase the amount of oxygen present in gasoline in order to make it burn more thoroughly. Ethanol is an excellent oxygenate but due to the price, Methyl Tertiary Butyl Ether (MTBE) was the additive of choice throughout the 1990s. However, MTBE did not break down when leaked from gasoline storage tanks and created massive ground water contamination problems.

Consequently, states started banning the additive in 2000 and only a few still allow it. Following the widespread ban on MTBE, ethanol became the most cost-effective oxygenate and its production subsequently increased dramatically (Kovarick, 1998; Green Plains, 2012; Gustafson, 2010).

The American Jobs Creation Act of 2004 reauthorized the federal subsidy as the VEETC with an immediate reduction to 51 cents and it was again reduced to 45 cents by the 2008 Farm Bill (DOE-Energy Information Administration, 2012). More importantly, the Energy Policy Act of 2005 introduced the Renewable Fuels Standard (RFS) which mandated the use of certain quantities of different types of renewable fuels. Then, the Energy Independence and Security Act of 2007 amended the RFS (now called RFS2) to require even more renewable fuels (Green Plains, 2012; Gustafson, 2010).

Following the Energy Policy Act of 2005, federal ethanol policies expanded. Accordingly, only the most substantive current policies are mentioned here. All flex fuel vehicles (FFVs) in the federal fleet are now required to burn E85 when available. As an incentive for automotive manufacturers to build FFVs, credits are given for each FFV produced to effectively increase the company's Corporate Average Fuel Economy (CAFE). In other words, FFVs have an artificially high fuel economy rating for the purposes of reporting CAFE figures (DOE-Energy Efficiency and Renewable Energy, 2011). The alternative fuel Infrastructure tax credit covers 30% of the costs (up to $30,000) of adding ethanol-related infrastructure at fueling stations. The Rural Energy for America Program (REAP) provides loan guarantees for 25% of the cost (up to $25 million) of building ethanol plants. The small ethanol producer tax credit returns 10 cents on every gallon of ethanol produced, up to 15 million gallons, for plants that produce less than 60 million gallons annually. Finally, in August, 2011

the EPA began granting waivers to increase the allowable amount of ethanol blended into gasoline from 10 percent (E10) to 15 percent (E15) but the effects of that have yet to be seen (EPA, 2011; RFA, 2012; DOE-Alternative Fuel and Advanced Vehicle Data Center, 2012a).

Ethanol's Dependence on the Government

It should be evident at this point that the current ethanol market is largely the product of government intervention. Consequently, it is a market that is now very much dependent on public policy. By and large, this is due to ethanol production volumes mandated by the RFS. But, as the following section discusses, the story is more complex.

When the production of a good is mandated by public policy, there is no guarantee that it will be a profitable endeavor for those who aim to produce it. It should not be surprising then, that governments would ensure that the production target is met either by use of the proverbial carrot or stick. However, ethanol subsidies essentially function as farm price supports and when agricultural interests are on the receiving end of public policy, the stick has typically been discarded in favor of the carrot (Gardner,2007). Moreover, with VEETC the role of the "blender" is played almost exclusively by major oil companies. It is difficult to determine which one of these interests currently holds the most political clout but it is fair to say that they are both contenders for the top spot.

Since the initial introduction of the RFS in 2005, researchers have studied the continued need for a per-gallon ethanol subsidy. However, the extant literature emanates mostly from fields closely related to economics. The price of the ethanol subsidy has been calculated as a function of the price of ethanol and other commodities as well as the production volume mandated by RFS2.

To understand this relationship, a quick note on the implementation mechanism of the RFS is warranted. A 38-character Renewable Identification Number (RIN) is attached to each gallon of every batch of ethanol produced. The RINs denote when the ethanol was produced, who made it and where it was produced, along with various other information. When that ethanol is blended with gasoline, the RINs are separated from the fuel and allocated to the blender. Obligated parties (blenders) may then trade the RINs on an electronic market moderated by the EPA, forfeit them to the EPA for RFS compliance or allow them to "rollover" to meet up to 20% of a future year's RIN requirement. RINs provide proof to the EPA that each party has met its blending quota for each fiscal year. If a party actually blends the required volume of ethanol then it can use its own RINs for compliance. But if a party blends less than its mandated volume of ethanol it can purchase RINs from other parties who have blended in excess. The RIN market thus ensures that the marginal cost of blending for each party is equal, and therefore, the burden of the RFS is spread evenly across the entire market. In essence, the RIN market is the opposite of a cap-and-trade program.

The price of RINs varies based on a number of factors including tax credits, the price of crude oil and corn, and because speculators may register with the EPA, there is a speculative component in the RIN price (USDA –Economic Research Service, 2011). Tyner (2010) suggests that the relationship between these variables is rather simple. At a given price of corn, ethanol will be profitable only if the price of oil is high enough that gasoline becomes more expensive than ethanol. At this point, the demand for ethanol will drive production levels above the RFS mandate and the price of RINs will go down. Conversely, if oil is cheap relative to ethanol, ethanol production will be very low and the RFS will be binding. Accordingly, high-priced RINs indicate a binding RFS and low-priced RINs indicate a non-binding RFS. Though

different model parameters have been used, this basic relationship has been examined extensively (Babcock, 2012; Cui et al., 2011; de Gorter et al., 2008; de Gorter et al., 2009; Gardner, 2007; Tyner et al., 2011).

Based on the price of RINs, Tyner (2010) suggests that either the RFS was binding in the last quarter of 2008, or projected production levels were low enough that obligated parties feared that it soon would be. This is important because it is the only time since the inception of the RFS that production has been in danger of falling below the mandate. In other words, virtually no ethanol has ever been produced from corn as a result of the RFS. This may be surprising to some but ethanol has actually been very profitable, especially in light of VEETC. However, two factors suggest that overproduction of ethanol will soon be a thing of the past. Shortly after the federal subsidy dried up, so did most cropland in the US corn belt.

On August 10th, the USDA lowered the estimated US corn harvest to 10.8 billion bushels. This is a 13% reduction from 2011 and a 17% reduction from the July estimate (NASS, 2012). Because of this, Babcock (2012) predicts that 2.4 billion of the estimated 2.6 billion carryover RINs will be used to meet the RFS for FY2013. As a result, ethanol prices will increase by over 6% and the price of corn will increase by 8% compared to what they would be in the absence of the RFS. While this reflects a modest increase, if it were not for carryover RINs, the price of ethanol would increase by 25% and corn prices would increase by 26%, according to Babcock's model. Fortunately, carryover RINs create a substantial degree of flexibility in the RFS, but because there will be only about 200 million carryover RINs for FY2014, the model is a strong indicator of what might be expected if the 2013 corn harvest does not rebound.

State Involvement in Ethanol Subsidies

Based on Babcock's predictions, another small corn harvest in 2013 could send RIN prices soaring to well over a dollar, compared to the current price of less than 5 cents. Obligated parties are already asking for an emergency RFS waiver and if the corn harvest fails to recover in 2013, pressure from oil interests will only increase. However, because a waiver would supress corn prices (as Babcock's model reflects) it will not be welcomed by agricultural interests. A direct subsidy such as VEETC though, makes both the oil and agricultural interests happy. However, congress let the VEETC expire, partially due to the current budget crunch, and it is unlikely that it will be politically feasible to allocate the $6 Billion necessary to reinstate it. The oil and agricultural lobbies know this and they may be forced to look to the individual states for ethanol subsidies.

It is hardly worth mentioning the profound effects of interest group politics in the US. While the term often carries a negative connotation, the edited volumes of *Interest Group Politics in America* and *Interest Group Politics* represent only a small sample of the research suggesting that interest groups are the *de facto* means through which citizen preferences gain legislative consideration (Hrebener & Scott; Cigler & Loomis). Specifically relevant to this topic, Gilbert and Oladi (2012) , and Gawande and Hoekman (2006) have documented the direct effects of the agricultural and oil lobbies on US trade policy. Similarly, Holloway et al. (2008) and Stratmann (1995) have indicated the power of the agricultural lobby on US farm bills.

Most of the studies aiming to quantify the power of interest groups have looked directly at total or net (difference between contributions to each candidate) campaign contributions. While this measurement is one indicator of interest group strength, the data it requires becomes very elusive at the state level and is beyond the scope of this project. Instead, it is assumed that

the power of agricultural interests may be indicated by the relative size of the agricultural sector in each state. Therefore:

H1: States with larger agricultural sectors are more likely to subsidize ethanol.

Additionally, countless studies have reported the effects of partisanship on policy outcomes. In fact, V.O. Key (1967, pp.432) suggested that "parties are the basic institutions for the translation of mass preference into public policy." Partisanship has been linked to policy outcomes such as welfare and redistribution, gerrymandering and even public budget outcomes (Brown, 1995; Cox & Katz, 2002; Phillips, 2008; Plotnick & Winters, 1990). However, previous research suggests that US agricultural policies typically occur across partisan boundaries (Gilbert & Oladi, 2012; Mercier, 2011). Because of this, it is likely that partisan competition will have a greater effect on agricultural policy outcomes than partisanship. That is, states with closely divided partisan control should be more likely to cater to the agricultural interests. Most of the studies examining the causes and effects of partisanship have considered both of these variables. A gross simplification of these studies is that outcomes that are not typically linked to a particular party are often correlated with high levels of interparty competition. The simplest explanation of this phenomenon is that supporting the American farmer is almost a universal value in the US. Similar examples might be tax breaks for the middle class, balancing the budget or getting tougher on crime. When it comes to these issues, political feasibility often outweighs logic and candidates may wind up in a race to give more and more in order to steal votes from the opposing party without alienating their core constituencies. Therefore:

H2: State partisanship does not affect ethanol subsidies.

H3: States with high levels of party competition are more likely to subsidize ethanol

Data

Dependent Variable

As should be evident in the preceding discussion, the ethanol market has been shaped by policies with unintended consequences. However, the goal of this study is to determine factors that have shaped state-level ethanol policies in the US. Consequently, defining and measuring ethanol subsidies is an important part of this project.

The World Trade Organization suggests that subsidies should have a direct intentional effect on a particular market (WTO, 1979). Additionally, the WTO's official definition of a subsidy states that there must either be a direct transfer of funds from the government, foregone government revenue that would have otherwise been due (such as tax credits and exemptions) or government provided goods or services (WTO, 1994). While the WTO's definition provides a good starting point for measuring ethanol subsidies, it is not all-inclusive.

The International Institute for Sustainable Development describes a dozen different methods for subsidizing a market (Koplow, 2007). Most importantly, regulations, mandates and import tariffs make up a notable portion of the US ethanol policy menu. Incorporating those policies into the WTO's definition gets closer to meeting the needs of this project.

Steenblik (2003) points out that "there is no universally accepted definition of a subsidy" and that it would be "pointless and fruitless to argue for a conceptually perfect definition." (pp 102). But he goes on to warn that the criteria used for measuring the subsidy certainly matter. Bruce (2003) recommends, quite simply, that the definition should be in accordance with the available data and should serve the purpose for which it was intended. An amalgam of different sections of each of these definitions might fit Bruce's criteria but it would be unnecessarily complex. For the purpose of operationalizing the concept of subsidies as a dependent variable,

the term refers simply to any government policies intended to artificially increase the supply of or demand for ethanol in the US.

Past researchers have experimented with a variety of methods for measuring subsidies. The price-gap approach has been the most common measurement among researchers studying energy subsidies (Koplow, 2007). This method aims to determine the difference in the current price of a good in a particular market and the price that it would be in the absence of subsidies. This method is unsuitable here for many reasons. Most importantly, it is very complex and data intensive. Additionally, the method relies on a global reference price and, because the US dominates the world ethanol market, this number is nearly impossible to discern. Finally, as Koplow (2007) points out, this method does little to capture the effects of non-monetary subsidies.

Another method that is frequently used to quantify subsidies is simply to account for the monetary transfers associated with each program. This is the most obvious method but it is also data intensive and it does not even consider non-monetary subsidies (International Energy Agency, 1999; Koplow, 2007).

Finally, Harry de Gorter of Cornell University has made a career of measuring and describing subsidies in different global markets. He has even devoted a paper specifically to the measurement of global biofuels subsidies (de Gorter, 2008). But again, his work does not account for *all* biofuel incentives. Moreover, he is measuring subsidies in a global context and data that is available and works at the national level is either not available or is not useful at the state level. Ultimately, his measurement is no better suited for this project than any of the others.

It is clear that part of the problem with previous measurements is that they aim to convert all subsidies into dollars. Any such method will have difficulty capturing the effects of laws and

regulations such as the RFS. Part of the problem here is that this project is concerned more with the policy than the subsidy. Unfortunately, those who have attempted to quantify policies on a broad scale have had even less success than those measuring subsidies.

Reisman et al. (2007) suggest that measuring policy outcomes has become increasingly important in the field of non-profit grant writing. Accordingly, non-profits have turned to program evaluation and policy analysis techniques to defend their work and prove their effectiveness. Though the context of their work is different, they make a point that is equally important for this project. Essentially, measuring policy outputs (what policies have been enacted) is not the same as measuring the outcomes of policies (what have those policies done). Most studies fall in line with that of Reisman et al. in that they seek to determine the latter. One reason for this is that it is often not difficult to draw a straight line from a policy to a result but it can be very difficult to draw the line from an action to the enactment of a policy.

Guthrie et al. (2005) state that there are no standard practices or commonly used methods or tools for measuring policy. Yet Guthrie et al. and Reisman et al. (2007) both suggest that knowing *what* to measure is at least as important as *how* it is measured. Reisman et al. go on to say that it is important to describe a set of policy outcome categories. While none of these authors has offered a measurement scheme that fits neatly into this project, they have provided enough information to develop one.

The first attempt at a measurement was simply to add up the number of ethanol subsidies in each state. This method quickly illustrated the need to develop outcome categories as suggested by Reisman et al. (2007). The reason was that some states have one policy that offers a number of incentives which may be separated into two or three different policies in another

state. Using the simple count method would have given the latter state credit for three subsidies while the former was credited for only one.

Creating a set of categories simplified the process so that each policy was counted equally across states. Additionally, in the many instances where a state had more than one policy that fit into the same category, it was given credit for only one. Initially, this would appear to undercount a large number of policies. However, it is quite clear that states with multiple policies in a single category tend to dilute the overall effect across multiple separate policies. And again, just because there are two or more policies does not mean that another state might not offer all of the same benefits with a single policy.

Finally, as previously mentioned, it is both futile and unnecessary to try to quantify the individual effects of each subsidy category. Still, it is quite clear that different categories have varying impacts on supply and demand in the ethanol market. Accordingly, not all categories were counted the same. The following section describes each of the subsidy categories and how they were counted.

The list of state-level ethanol subsidies used for this project comes primarily from the US Department of Energy's Energy Efficiency and Renewable Energy-Alternative Fuels Data Center (AFDC). The AFDC information on state incentives and laws was checked against compilations of subsidy information available from the American Coalition for Ethanol (ACE) and the Renewable Fuels Association (RFA). ACE and RFA are private associations (essentially lobby groups) and their standard for an ethanol incentive appears to be marginally higher than that of the AFDC. In cases where there was a discrepancy, the subsidy was included in this measurement only if it fit into one of the categories listed below. Finally, in the cases of conflicting information between these three sources, state legislative websites were consulted for

resolution. Accordingly, it is not likely that any substantive subsidies were left out of the measurement. Policies were included in this measure if they were in effect in January of 2012.

By far, the most common policy across all states was a requirement that state agencies make some effort to purchase flex fuel vehicles (FFVs) for their fleets. The exact means of applying preference to FFVs over non-FFVs varies, but the intent is generally the same. In addition to the FFV acquisition requirement, most states require that those vehicles actually use E85 when it is available. States with both the acquisition and usage requirement were given a score of 1. States with one or the other were given half credit (.5). Across the US, 34 states have some type of FFV acquisition requirement while 30 have an E85 usage mandate.

The second most common category included some type of state-sponsored ethanol promotion or education program, or a state ethanol commission. Promotion and education programs vary greatly across states but commissions are typically set up to study the state of the ethanol industry and advise the state legislature at prescribed time intervals. The effect of each of these programs was perceived to be small and this category was scored as .5 accordingly. Policies fitting this category were found in 24 states.

Monetary incentives for ethanol infrastructure made up the next category and these policies exist in 22 states. Incentives in this category range from tax credits/exemptions to grants and loan guarantees. States with an incentive for E10 blends were given full credit of 1. Additionally, there are six states with separate incentives for E85 infrastructure. These states were given an additional score of .5 because E85 accounts for a very small portion of the total ethanol consumed in the US.

Monetary incentives for ethanol production were divided into two categories. Incentives for the construction of ethanol production facilities are similar to the incentives provided for

infrastructure but often take the form of property tax exemptions. Sixteen states received a score of 1 for policies in this category. The other category of production incentives is a per-gallon subsidy. These incentives take the form of direct payments or tax credits and range from 5 to 20 cents. Fifteen states were scored 1 for having policies in this category.

Retail incentives account for the next category. These are provided as excise, sales or use tax exemptions, a VAT exemption (Michigan has a VAT on retail gasoline) that is passed on to the consumer by law, flat-rate alternative fuel taxes, tax rebates and various other forms. These incentives are relatively small however, and rarely amount to more than a few cents. Incentives for E10 were scored 1 while E85 incentives were scored .5 for the same reasons discussed above. In total, 18 states offer some type of E10 incentive and 10 offer one for E85.

Another category was policies encouraging ethanol research and development. While many states promote research and development for advanced biofuels (not made from corn), only 17 have some type of incentive that applies to ethanol made from corn. Again, these policies vary significantly but most provide research grants in some form. While some policies, such as Illinois' National Corn-to-Ethanol Research Center (NCERC), channel tens of millions of dollars into ethanol research, most are modest investments and any effect is likely to be very long-term. For these reasons, the category received a score of .5.

Many states offer an incentive for the production or purchase of FFVs. These come in the form of tax credits or rebates and even payroll tax deductions based on the number of jobs created by the production of FFVs. However, over 10 percent of light-duty vehicles produced in the US are already FFVs (largely because of the reduced federal CAFE standard mentioned above) so these policies probably have little effect (AFDC, 2012c; d). For this reason, and because of the marginal levels of E85 consumption, this category received a score of .5.

The final category of ethanol subsidies is a usage mandate. These mandates look similar to the federal RFS but often have complex schedules depending on a number of variables and ethanol usage benchmarks. California and Oregon have adopted low-carbon fuel standards (LCFS) which essentially act as an ethanol mandate. Even though the California LCFS has been challenged in federal courts, the intent of the policy remains and the state received the full score of 1. In addition to California and Oregon, 10 other states mandate some quantity of ethanol consumption.

Table 1. Ethanol Subsidy Index Components

Policy	Score
Preference for flex-fuel vehicles in government fleet	0.5
E85 usage mandate for government fleet vehicles	0.5
Promotion, education or commission on ethanol	0.5
Ethanol research and development incentive	0.5
Incentive for production or purchase of flex-fuel vehicles	0.5
Incentive for ethanol infrastructure	1
Incentive for E85 infrastructure	0.5
Ethanol production incentive per gallon	1
Ethanol production incentive per facility	1
At-the-pump retail incentive for E10	1
At-the-pump retail incentive for E85	0.5
Renewable fuels standard or low carbon fuels standard	1
Possible score	**8.5**

Source: Data from USDOE Alternative Fuels Data Center, American Coalition for Ethanol and Renewable Fuels Association. Index created by author.

When added together, these scores yield the ethanol subsidy index for each state. Possible index scores range from 0 to 8.5. Actual scores range from 0 (West Virginia, Wyoming and Utah) to 7 (Iowa). The index scores roughly follow a standard distribution with the exception of the Midwestern states with scores over 6 (Figure 1).

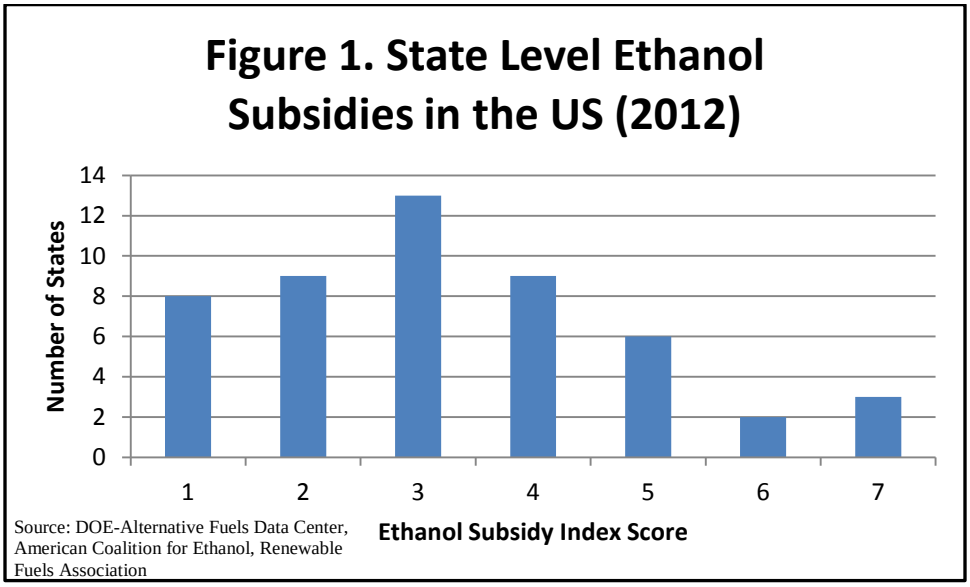
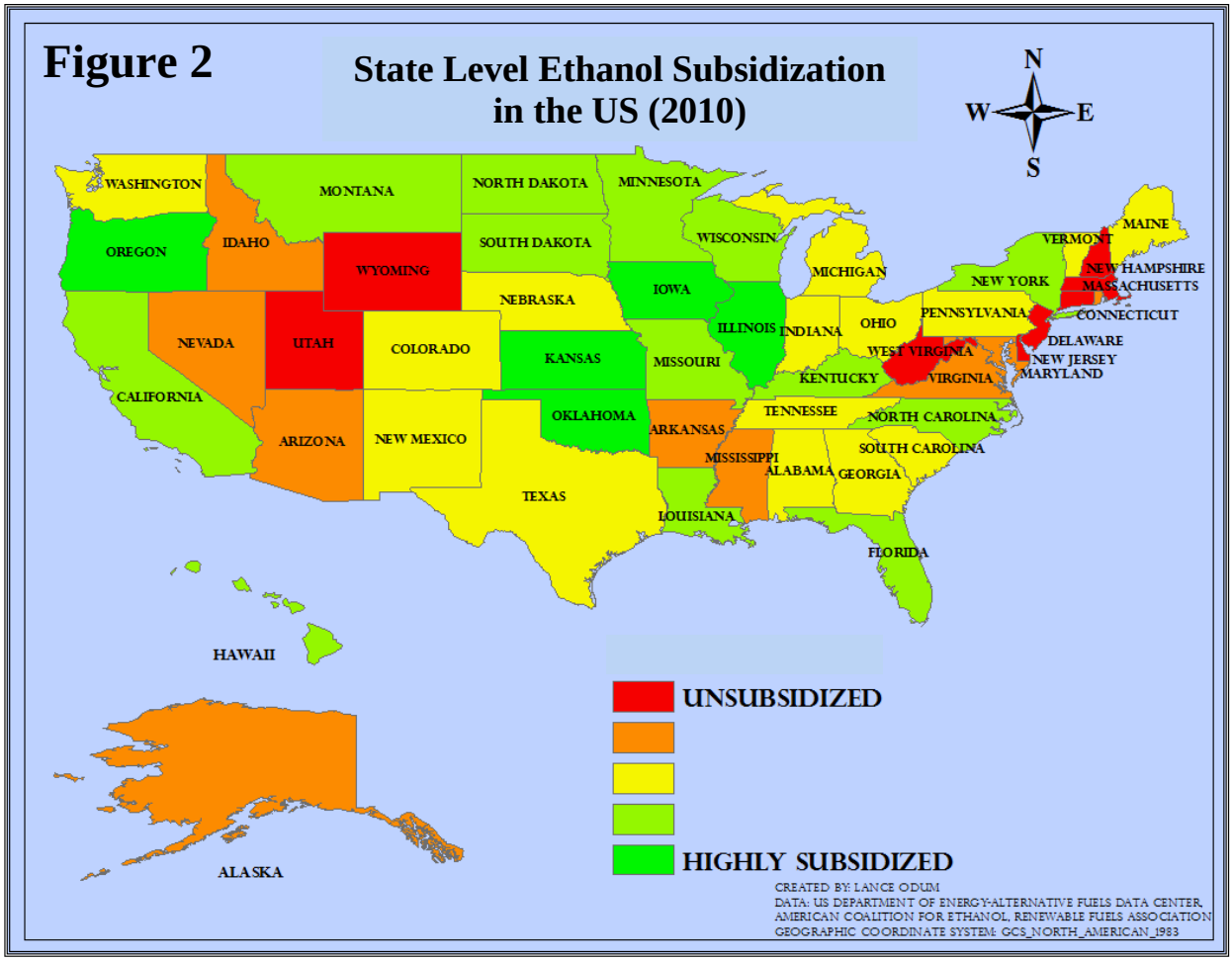


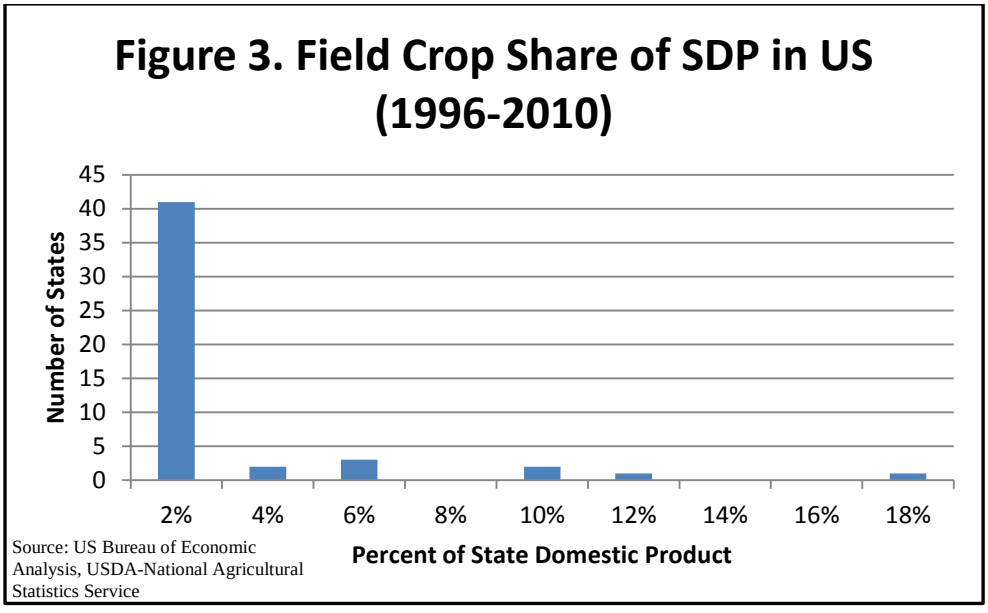
Figure 2 reflects the geographical distribution of state-level ethanol subsidies. It is clear that ethanol subsidies are high in the Midwestern states. States that subsidize ethanol very little are concentrated in the West and Northeast. A notable exception is West Virginia where a law actually bans any ethanol subsidies by any political subdivision of the state.



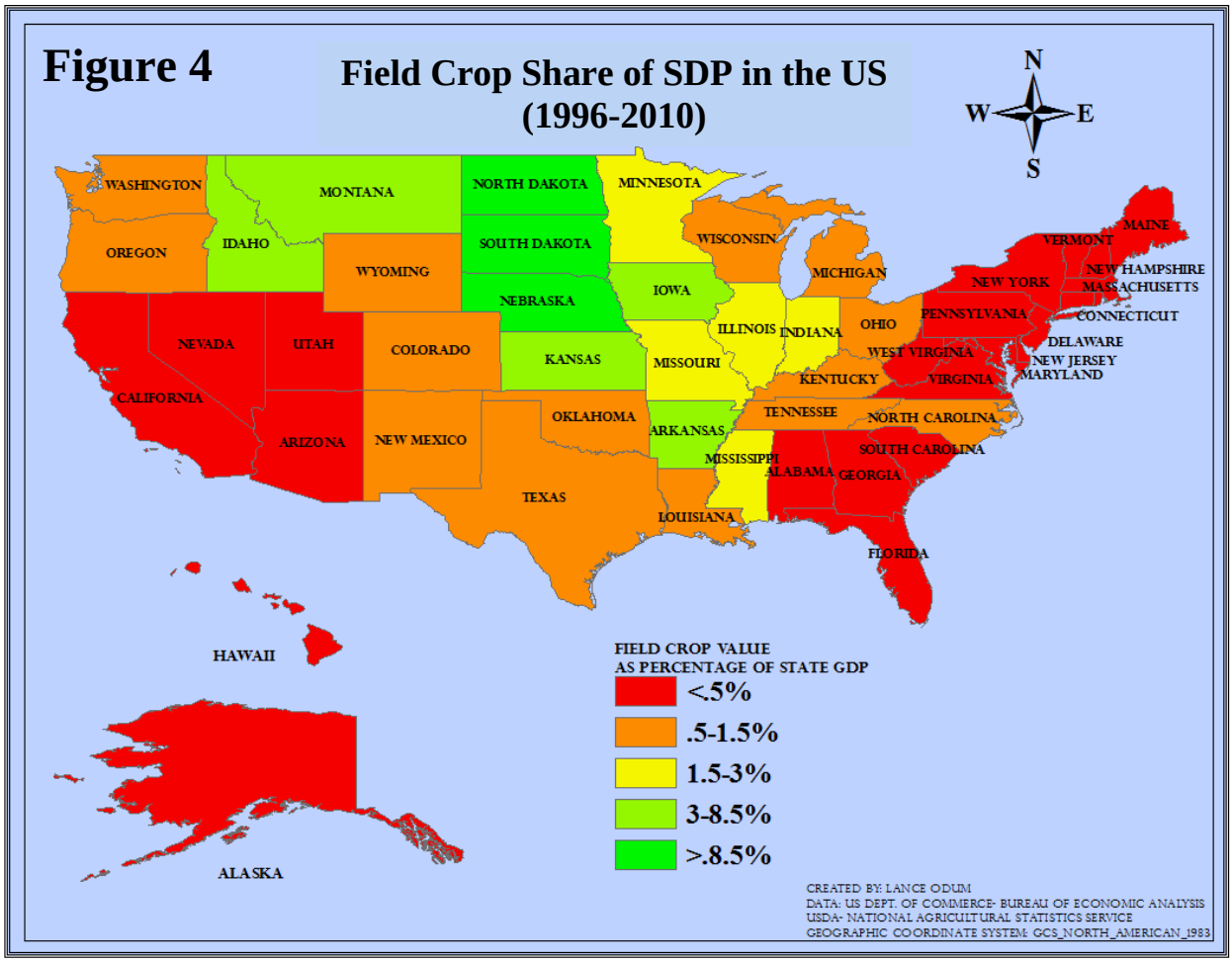
I acknowledge that this index is a low-resolution indicator of ethanol subsidies in US states. However, anyone looking at the measurement and the data is likely to conclude that the index has face validity, and that the relative hierarchy of state ethanol subsidies is an accurate reflection of reality. Additionally, based on the previous definitions of a subsidy outlined above, the index has content validity. That is, there should be no policies included in this measure that are not part of the subsidy concept and everything that should be included is accounted for. Finally, using the description of the index detailed above, the same measurement should be easily reproduced for studies of other time periods or locations. Ultimately, the measurement is as reliable and valid as is necessary for this project.

Independent Variables

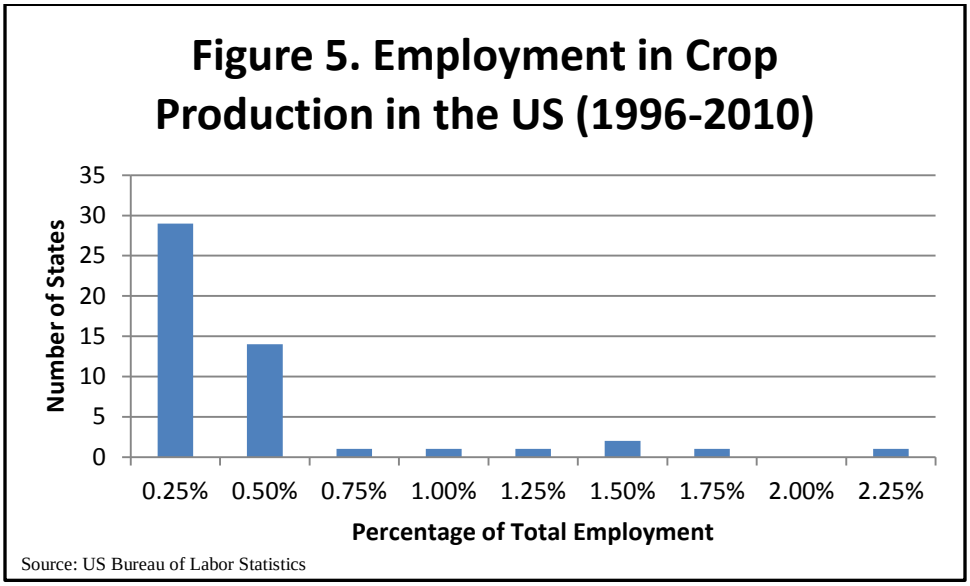
Size of the agricultural sector. Measurements of the independent variables are in accordance with a well-worn path in the academic literature. Consequently, they require less explanation. The size of the agricultural sector in each state was operationalized through two measurements. The share of field crop production as a share of Gross State Product (GSP) was the first measurement. Field crop production was used as opposed to total agricultural production because it excludes livestock farming, and fruit and vegetable farms, neither of which should be expected to be an indicator of ethanol subsidies. Data for GSP was retrieved from the US Department of Commerce's Bureau of Economic Analysis (BEA). There is a small discrepancy in the data however, as the BEA switched from the Standard Industrial Code (SIC) to the North American Industry Classification System (NAICS) in 1997. The data is available for both systems in 1997 though, and the differences between the values from each classification system average .5 percent, with a range of .08 to 4.9%. Field crop production data comes from the USDA National Agricultural Statistics Service (NASS). The final measure is a 15 year average percentage for each state spanning 1996 to 2010.



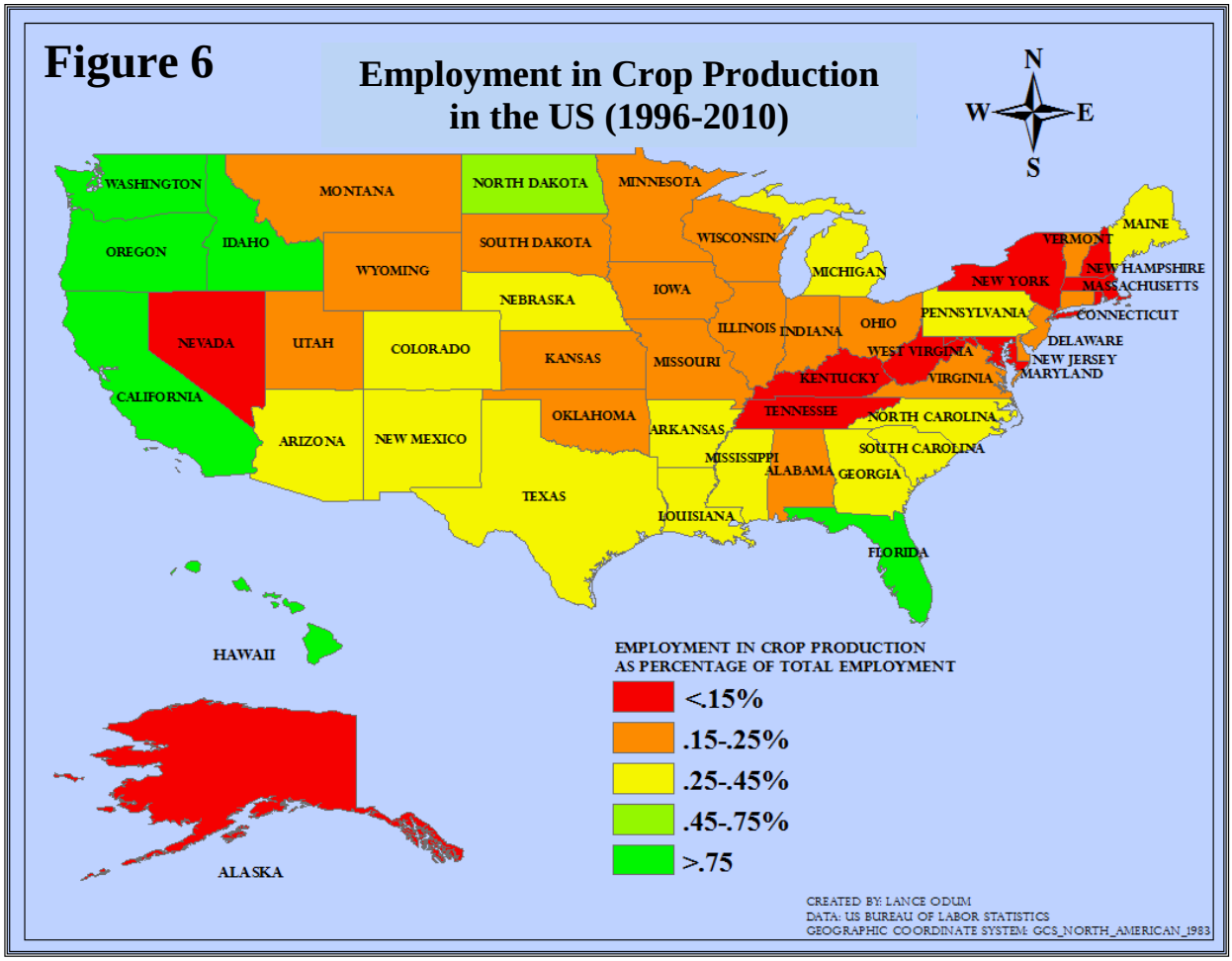
Actual values for this measure range from .01% in Rhode Island to 16.2% in North Dakota with an average of 1.9%. Figure 3 reveals that values of this variable are highly skewed to the right as field crop production accounts for less than 2% of the GSP in 41 states. More interesting is the geographic distribution of this variable shown in Figure 4. Though Iowa and Illinois produce the most corn, field crops account for a smaller percentage of GSP in those states than in Nebraska and the Dakotas.



The agricultural sector was also measured by state employment in crop production as a percentage of total employment. The US Department of Labor's Bureau of Labor Statistics (BLS) provided data for total employment and employment in crop production. Note that the BLS does not aggregate data for field crops. Consequently, this measure does exclude livestock production but it includes most fruit and vegetable farms. Even though this measure is not as ideal as one including only field crops, it is the best available and it may even offer some insight regarding the effects of the agricultural lobby in a broader sense. Again, this variable is the average share of employment in the crop production sector over a 15 year period from 1996 to 2010.



The percentage of employment in crop production ranged from .05% in Alaska to a little over 2% in Washington, with an average of .35%. As expected, the frequency distribution of this variable looks very similar to that of the previous measure (Figure 5). However, the geographic distribution in Figure 6 reveals an entirely different pattern. This likely reflects the high percentage of labor-intensive fruit and vegetable farms on the west coast and in Florida.



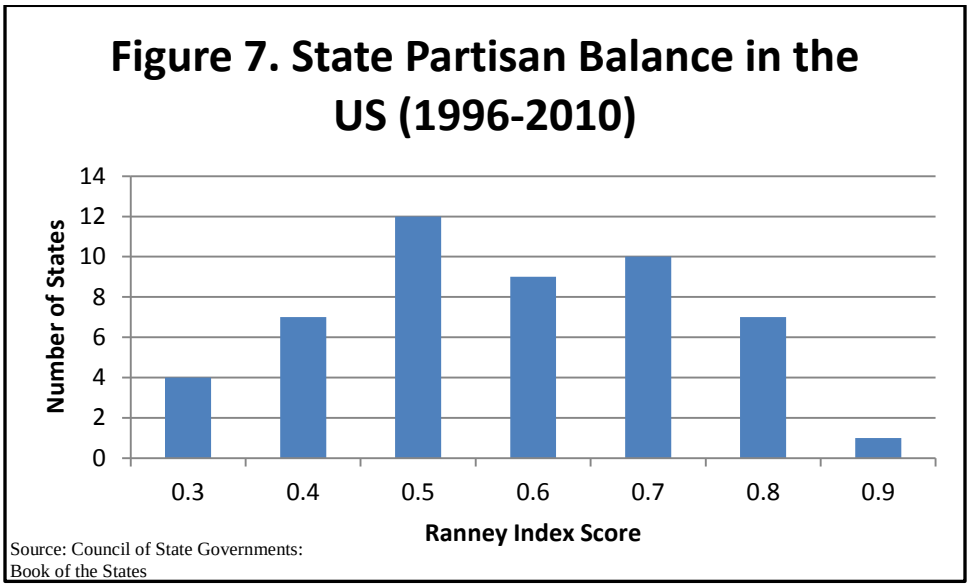
State partisan balance. The other independent variable was state partisan balance. King (1989, pp.83) suggests that "The literature on American state politics is replete with measures of party competition." However, the Ranney Index is by far the most frequently cited measure of partisan balance (Ranney, 1965; Tucker, 1982). This measure incorporates the percentage of seats in the state legislature held by Democrats, the percentage of Democratic votes in gubernatorial elections, and the percentage of years that Democrats controlled each house of the legislature over a given period of time. These percentages are then averaged

together to yield the Ranney Index for each state. Possible scores range from 0 (meaning complete Republican control) to 1 (meaning complete Democratic control). Ranney labels possible categories as one-party Republican (.0-.09), modified one-party Republican (.1-.29), two-party (.3-.69), modified one-party Democratic (.7-.89) and one-party Democratic (.9 or higher). Based on these categories, the Ranney index is more accurately a measure of partisanship or party control than of party competition. Because the Index was intended to give a running average of partisanship, it is well suited to the current study period of 1996-2010. However, the Ranney Index has some flaws and nearly every author referencing it has modified it to fit their needs. Such is the case here.

One problem with the Ranney Index is that it assumes there are truly only two parties. Consequently, seats and votes not counted as Democratic are allocated to the Republican Party by default. Due to the increase in independent and third-party candidates, seats and votes were counted as a percentage of the two-party total. Accordingly, third-party and independent votes and seats were summarily omitted from the measure. While this modification is effective for the measures of partisanship in the legislature, it is not as well-suited to the few cases where non-major party candidates were actually elected to the governorship. Finally, because Nebraska has a non-partisan, unicameral legislature, only the measure of gubernatorial votes was used.

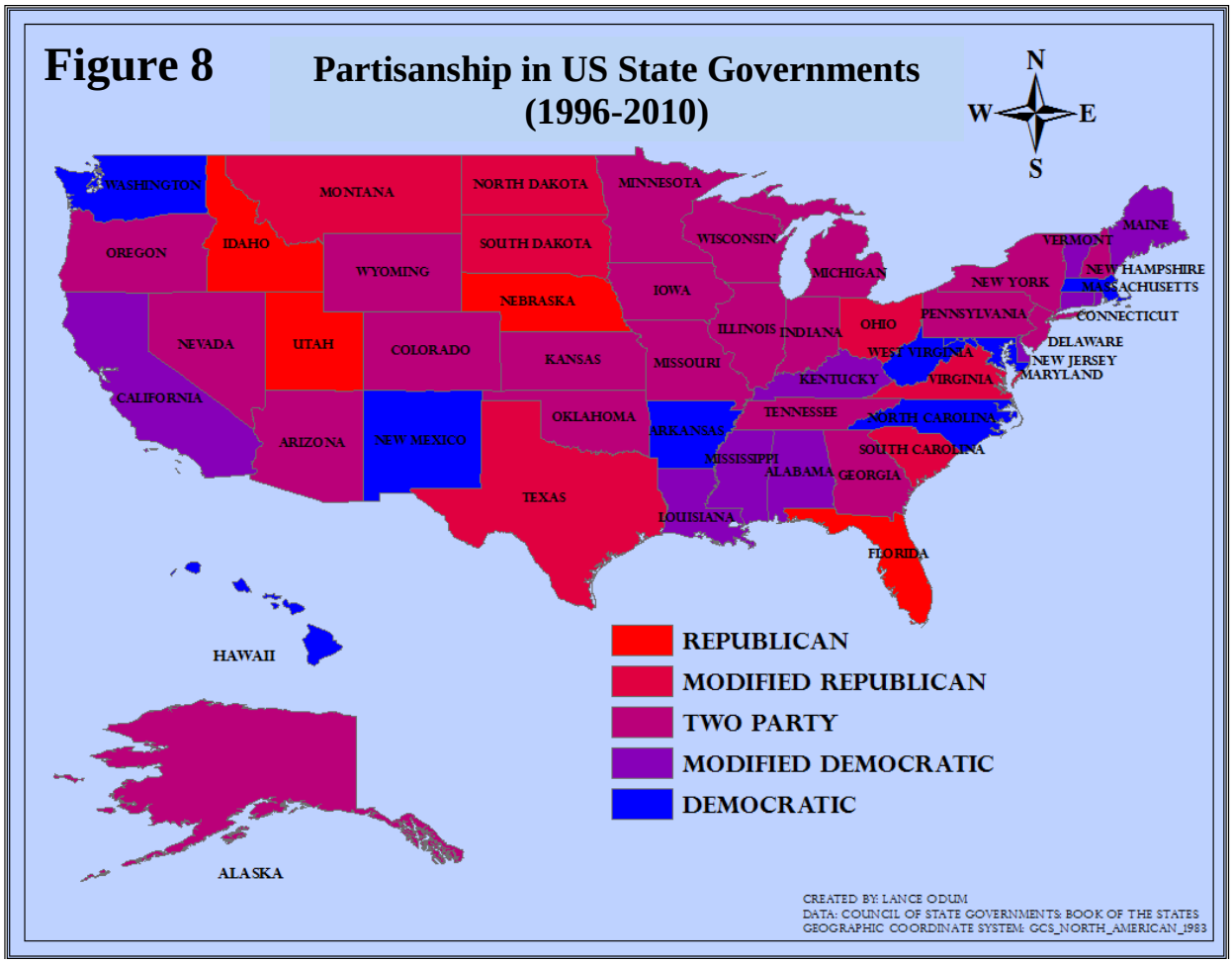
Data for all political party variables was aggregated from two sources. Most data is available from the various editions of The Council of State Governments' *The Book of the States*. While this data is correct most of the time, there are numerous issues such as special elections that are not reported, seats vacated or filled in the middle of a term, and even mis-transcribed entries. To ensure the accuracy of the data used here, it was verified against a dataset provided by Karl Klarner of Indiana State University. Klarner has built a career on accurately recording

and measuring the partisan balance of US states and his dataset accounts for every imaginable anomaly in measures of state partisan balance (Klarner, 2003; 2011). The only reason Klarner's dataset was not used in its entirety is that *The Book of the States* aggregates the data in a fashion that was more easily formatted for this analysis.



Calculated scores for the Ranney Index from 1996 to 2010 ranged from .26 in Nebraska to .8131 in Maryland with an average of .52. The data for this measure roughly follows a normal distribution but the scores are clustered closer to the mean than they were when Ranney calculated them in 1965, 1973 and 1976 (Figure 7). Consequently, the categories are adjusted slightly as shown in Figure 8. Values at the extremes were labelled simply as Republican and Democratic because they are not really one-party systems in the sense that Ranney originally suggested. Also, to account for the lack of such extreme scores, the categorical divisions are now, .0-.29, .3-.39, .4-.59, .6-.69 and 7 or higher. Each time Ranney revisited this measure, he suggested that these scores are likely to be surprising to most viewers (Ranney, 1965; 1973; 1976). This is because people tend to have an idea of each state's partisan affiliation at the national level rather than the state level. Looking at the geographic distribution of this variable

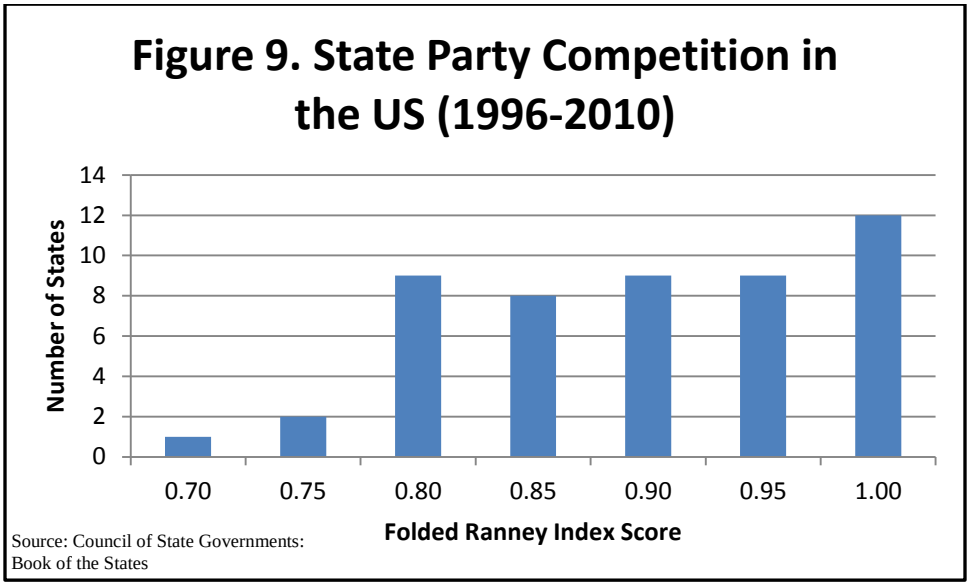
reveals that this still holds true (Figure 8). He attributes this to the long time period covered by the index and the fact that it is based wholly on state offices.



The Ranney Index was further modified in order to yield the second measure of partisan balance. The folded Ranney Index is a direct measure of party competition without regards to the actual party in control (Ranney, 1965). This is necessary because the Ranney Index is a measure of partisanship rather than party competition. The Ranney Index is folded by taking the absolute value of the difference between each score and .5, and subtracting that number from 1.

The result is a score with a possible range of .5 to 1, where higher scores indicate higher levels of competition.

Again, scores for the folded Ranney Index were calculated for the 1996 – 2010 period. They averaged .87 with a range of .69 in Maryland to .99 in New York. The frequency distribution shown in Figure 9 is a relic of the folding method and essentially reflects half of the distribution curve for the Ranney Index.



The geographic distribution of this measure looks similar to that of the Ranney Index, where two-party states are the most competitive, followed by modified states (Figure 10). The minor differences between the map of the Ranney Index and the folded Ranney index are results of different symbology. In order to show more detail here, the range of data was broken up into five equal categories. Again, this data may be surprising as some of the traditional "swing states" in Presidential elections reflect very low levels of competition at the state level and vice versa.

For the sake of clarification, the Ranney Index is a direct measure of partisanship or party control, and any of these terms may be used with the same meaning. The folded Ranney Index measures party competition without regard to the majority party, and again, these terms may be used interchangeably. Both of these variables measure the concept of partisan balance.

Methods and Results

In order to gauge the effect of these agro-economic and political variables on ethanol subsidies, a method is required which will account for any relationship between the independent variables. Specifically, the political landscape of each state may be dependent, to some degree,

on the agricultural sector. A multiple regression model was used in order to control for this and similar effects.

Any time more than one measure is used to quantify the same concept, there is a potential for collinearity. This was an initial cause for concern here and was dealt with accordingly. Most obviously, the folded Ranney Index is a mathematical derivative of the Ranney index. However, because the transformation is non-linear, variance inflation factors were below 1.4 for both variables. Moreover, the two measures have been used together extensively in previous projects (Tucker, 1982). Any relationship between the agricultural variables is likely to be linear, but again, variance inflation factors were less than 1.3. As discussed above, the incorporation of labor-intensive fruit and vegetable farms into the crop employment variable probably accounts for low levels of collinearity that might have otherwise been present.

The results of the regression are presented in Table 1. While the overall fit of the model is low (R^2=.264), it is significant at the .01 level. More importantly, employment in crop production, the field crop share of GSP and party competition (Folded Ranney Index) all have statistically significant positive effects on state-level ethanol subsidies just as expected. The fact that partisanship (Ranney Index) shows no effect is also consistent with previous research.

Table 2 Estimated Effect on Ethanol Subsidies

	Estimate	(Std. Error)	Beta
Employment in Crop Prod.	107.273*	(56.13)	.251
Field Crop Production/GSP	23.560**	(7.87)	.429
Partisanship	2.554	(1.75)	.219
Party Competition	8.101**	(2.99)	.381

* $p < .05$, one-tailed test

** p < .01, one-tailed test

The standardized coefficients reveal the first unexpected result. The significant effect of party competition was expected but the relative magnitude of that effect is far stronger than the

theory would have suggested. An upper-bound estimate would have been that party competition has half the effect of either agricultural variable. But the effect was only 11% lower than the field crop share of GSP and 52% higher than that of employment in crop production. Because Beta is strictly relative, it is still not clear whether the effect of party competition was really that strong or if the effects of the agriculture sector measurements were much weaker than expected.

Because the Beta coefficient compares the effects of increasing each independent variable by one standard deviation, it inflates the effects of those with values less clustered around the mean. The standard deviation of the folded Ranney Index is relatively small (less than 10% of the mean) while the standard deviations of the field crop share of GSP and employment in crop production are relatively large (174% and 114% of the mean, respectively). Furthermore, the standard deviation of the folded Ranney Index is half of what it should be in light of the fact that it has been cut in half and the true zero point is .5 (Tucker, 1982). Taking this into consideration would lead to a Beta that is substantially higher than that of any other variable. The problem with comparing Beta values here is that the partisan balance variables actually vary temporally more than the standard deviations would suggest. That is, the 15 year averaged value of these variables used here masks a considerable amount of variability from one year to the next. The converse is true for the agricultural variables. There is great variance geographically but no single state changes that much from one year to the next. Accordingly, a different method of comparison is used to see the relative effects of increasing each independent variable by 10% of its mean value. The effects shown by this method are far different than the Beta coefficients indicated.

A 10% increase over the average percentage of employment in crop production results in an estimated 1.2% increase of the average ethanol subsidy index value. That is, if employment

in crop production increases from .35% (the average value across states) to .385% we would predict the ethanol subsidy index will increase from 2.99 (again, the average value) to 3.02. Using the same convention, a 10% increase in the average field crop share of GSP will yield a 1.4% increase in the average ethanol subsidy index. Finally, a 10% increase in the average folded Ranney Index will result in a 20.3% increase in the average ethanol subsidy index. This measure suggests that the effect of party competition is greater than either agricultural variable by a magnitude of nearly 20. This analysis strays from standard convention but the effect of party competition is higher than expected by any measure.

Though the effects of party competition have been well documented in other contexts, it is not clear why the effect is so strong in comparison to measures of the agricultural sector. The most likely cause is measurement error. The folded Ranney Index has been proven to be a reliable and direct measure of party competition. Conversely, the measures of the agricultural sector are merely supposed proxies for the size and strength of the agricultural lobby in each state. It may actually be more accurate to suggest that the agricultural lobby is the mechanism through which the agro-economic variables affect policy outputs. In either case, a more direct measure may have been more appropriate. Another possible cause is that employment in crop production is skewed because fruit and vegetable farms are more labor intensive. Consequently, states such as Florida and California have relatively high percentages of employment in this sector even though there is no reason to believe that they would be particularly likely to subsidize ethanol. Finally, policy decisions are made by politicians and when they don't need anything from the agricultural lobby (i.e. times of low competition) they are much less likely to cater to their needs. However, when competition is high, politicians will do much to gain

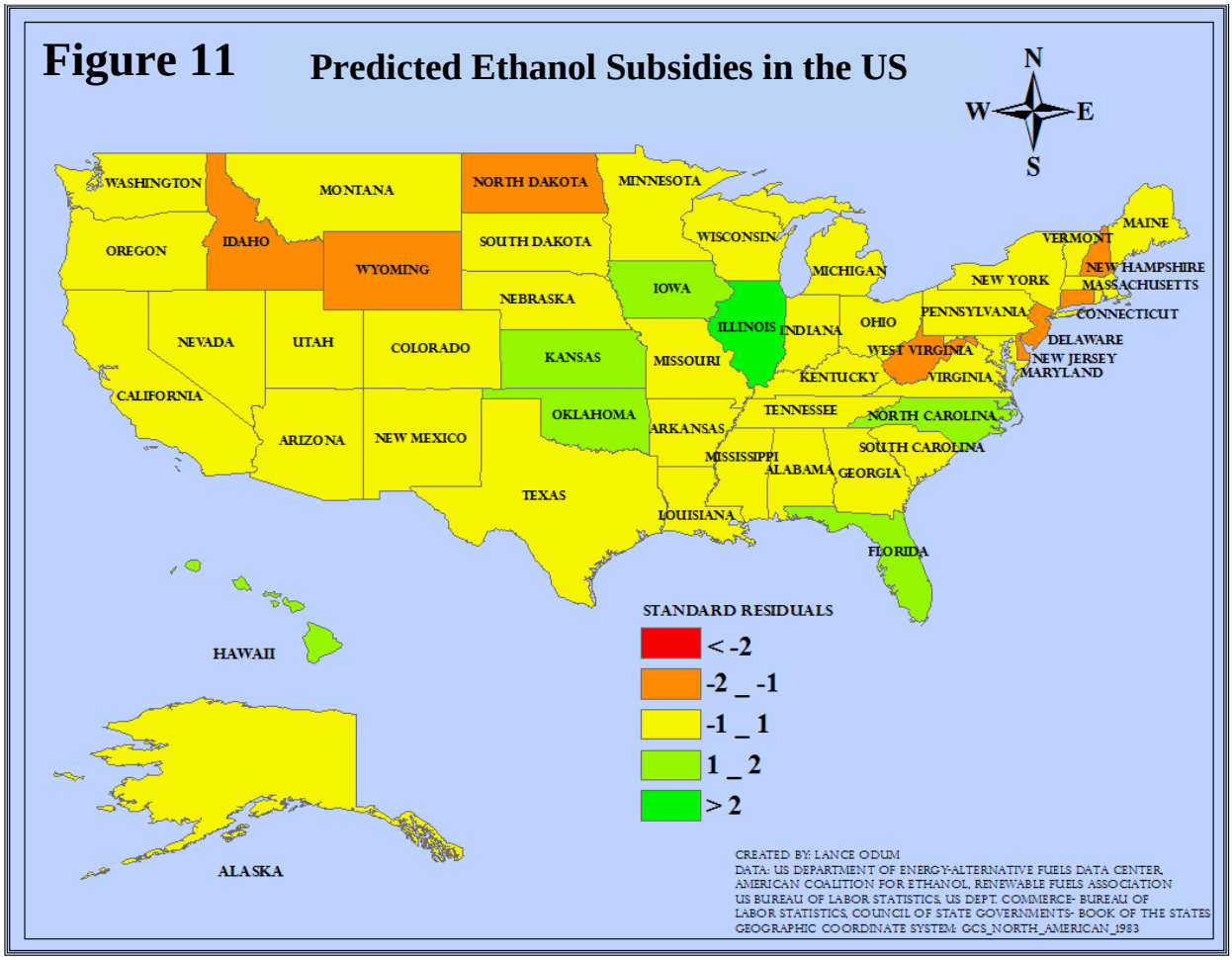
support of the lobby. In other words, the size of the agricultural sector only matters when there is high competition and competition only matters when there is a large agricultural sector.

The reason that party competition matters when partisanship does not is fairly obvious. Subsidies for American farmers enjoy bipartisan support. When parties (or individual candidates) face tough competition, they will both offer more legislation that will appeal to voters of all political ideologies. Therefore, high levels of competition lead to high levels of ethanol subsidies. For the same reason, there is not likely to be a change in ethanol subsidization when either party enjoys a comfortable margin of control because both parties are equally as likely (or unlikely) to subsidize ethanol.

With an R^2 of only .264, it is important to suggest some other variables that might account for the almost 74% of variance in ethanol subsidies not explained by the model. As discussed previously, the measurements of the agricultural sector may not have accurately represented the underlying cause of subsidies. Other measures of interest group power maylead to a model with more predictive power. Furthermore, the averaged values of the independent variables probably conceal some of the effects that might otherwise have been apparent. A model that accounted for the political and agro-economic landscape at the time each ethanol subsidy was passed would probably yield different results. But most importantly, this model does nothing to account for the fiscal situation in each state. I have suggested that the federal government is not likely to increase subsidies due to the budget crunch at that level. However, each state has a different economic situation and those who are operating in the red may be just as unlikely to subsidize ethanol as the federal government is. Simply averaging each state's deficit or debt as a percentage of GSP over the study period may have increased the strength of the model.

Where did the Model Perform Well?

The map in Figure 11 shows the standard residuals for each state. Because there are 50 states, we already know that about 35 of them fall within plus or minus one standard deviation of the predicted subsidy index scores. However, knowing the states that do not may be of as much value as any of the previous analysis. The states falling above one standard deviation have subsidized ethanol more than the model would have predicted while those below one standard deviation have subsidized it less. Because the predictive power of the overall model was low, a closer look at these states may lead to a better understanding of the causes of ethanol subsidies.



Conclusion

The US ethanol market is clearly a product of government intervention in one form or another. It has been shaped by public policy dating back to the tax on alcohol used to fund the Civil War. Because the federal government has mandated the consumption of ethanol while eliminating price supports, firms that are obligated to comply with the RFS will be forced to either leave the market or look to ways of making it profitable. Because technologies leading to more efficient production of corn ethanol have plateaued, few options are available. The discussion of ethanol subsidies over the last three decades leaves no reason to believe that they will not continue. And because state subsidies are a more recent phenomenon, growth in this sector is at least as likely as it is at the federal level.

One implication of this analysis is that the agricultural lobby in states with fewer ethanol subsidies may look to states where there has been more success for new tactics. Perhaps more importantly, the analysis suggests that timing can be critical when attempting to get new ethanol subsidies through the legislature. While the size of the agricultural sector varies geographically, there is very little temporal variation. The converse is true for party competition. The partisan composition of each state changes every two years, and though partisan control changes infrequently, the level of competition varies from one election year to the next. When competition gets tight, elected officials will scramble to satisfy the agricultural interests.

Overall, the results of this study lead to a better understanding of which states are more likely to subsidize ethanol and why they are likely to do so. To say that ethanol will be subsidized by states that grow corn is common sense at best and tautological at worst. But this study actually suggests that this relationship is not as strong as what might have been expected.

Harold Lasswell's (1936) classic definition of politics suggests that it is the study of "Who gets what, when, and how" (pp.3). When the "what" is ethanol subsidies, this project answers the "who," "when" and "how." Essentially, farmers get ethanol subsidies when there are a lot of them who can put pressure on the legislature at a time of high competition because neither party can afford to lose the agricultural vote.

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