How Biofuel Legislation and The Subsidization of Corn for Ethanol Product Impacted Agricultural Communities

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

Agricultural communities have been foundational to the development of the United States, providing food and energy security for hundreds of years. Until the twentieth century, these communities worked in a relatively laissez-faire environment (Angelo, 2010). Farms succeeded or failed based on their individual merits, without economic interference from government sources. However, the environmental and economic disasters of the 1920's and 1930's, namely the Dust Bowl and the Great Depression, led to the implementation of government policy that shaped the agricultural frontier moving forward. The mindset of policymakers had changed with the belief that agricultural communities were in a constant state of emergency, and without permanent help would result in a "collapse of the farming system" (Angelo, 2010, p. 30). One such emergency involved federal legislators responding to the oil crisis of the 1970s. According to Duffield et al., (2008), "[p]olicymakers began to look at the U.S. agricultural sector as a source of energy supply, which had the ability to turn corn…into renewable fuels", facilitating the creation of "a new market for farmers who suffered from persistently low commodity prices caused by crop surpluses" (p. 426).

In response to the oil crisis, legislators instituted laws creating and necessitating the use of ethanol-based gasoline additives. Lawmakers also designed mandates requiring that up to 15 billion gallons of bioethanol must come from corn, more than one-third of nationwide corn use (McPhail & Babcock, 2012). To achieve this large scale technological and environmental objective, legislators wrote many policies and subsidies into law. Subsidies allowed the federal government to aid farmers via various methods including direct payments to farmers to bolster or suppress crop production (Angelo, 2010), or support programs that acted as crop insurance based on crop yield and market price (Orden & Zulauf, 2015). Angelo (2010) states that "[f]rom 1995-

2006, the United States government paid out 177.6 billion dollars in agricultural subsidies", where the largest percentage of "commodity subsidies were for corn, with 1,568,095 recipients receiving $56,170,875,257 dollars" (p. 5). This large share of assistance given to corn farmers appears at first glance to be a financial boon, distributed equally amongst farmers. However, according to Bruckner (2016), "only three out of 10 farms with less than $100,000 in sales, but seven out of 10 farms with $500,000 or more in sales received government subsidies" (p. 632). Subsequently, Bruckner (2016) claims that "[g]iven this artificial competitive disadvantage, smaller and more diversified farms and beginning farmers are unable to compete with the largest farms for highly coveted cropland to rent or purchase" (p. 633). These authors seem to bring two opposing viewpoints on the impact of subsidization, therefore demonstrating the importance of understanding the effect that government policy has on agricultural communities.

The aim of this research is to explore how biofuel policy and the subsidization of corn for ethanol product facilitated an infrastructural paradigm shift in agricultural communities from the 1970s to today. I provide an overview of previous literature regarding the rise of ethanol in gasoline and its transition into a predominantly corn-based biofuel, and how agricultural communities struggled with economic and financial problems during the 1980s, sparking the biofuel revolution. However, this literature review fails to recognize the seemingly irreversible implications of government biofuel policy on the financial and systemic health of agricultural communities, thus making my research imperative. I primarily analyze secondary source data from the USDA Economic Research Service, along with overviews of legislation from the Department of Energy (DOE) and the Environmental Protection Energy (EPA), to perform a policy analysis to better understand the effects of biofuel policy from the 1980s to current day.

Throughout this analysis, I utilize the idea of the sociotechnical imaginary from Jasonoff's & Kim's "Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power" (2015). Jasonoff & Kim (2015) claim that analyzing policy can be especially helpful in understanding the response of institutions and social actors to "events that might disrupt order", and the subsequent sociotechnical imaginaries that are created (p. 26). I examine multiple pieces of legislation focused on biofuels and promoting corn production to understand how biofuel policy reflects the U.S. government's sociotechnical imaginary of the agricultural sector. I conclude my research by utilizing an idea posed by Jasonoff & Kim (2015); the government's sociotechnical imaginary was "transformative", and "recalibrate[ed] human futures", but I argue that with a reevaluation of what drives the farming sector, the imaginary itself can be "reenvisioned" to create an infrastructurally healthier agricultural industry (p. 27).

Literature Review

Government messaging about ethanol transitioned throughout the years, increasingly becoming tied to domestic corn farming. Spurred by the domestic effects of the 1973 OPEC oil embargo, United States government officials searched for a way to reduce American reliance on imported oil (*Ethanol - A Primer*). Ethanol, initially created as an alcohol-based fuel additive to internal combustion engines, was suggested as a solution. Engines could handle as much as 10% ethanol by volume, reducing the total national amount of gasoline required. Ethanol could also be produced domestically in industrially-sized quantities; Corn is the primary feedstock for ethanol production, with the United States growing about three quarters of the global supply around this time (*Data Page: Maize production*). Recognizing ethanol as a solution to the U.S.'s foreign oil problem, legislators created the Energy Security Act of 1980. This Act cemented ethanol as a permanent, albeit initially small, fixture in the U.S. economy providing loans and tax benefits to ethanol producers and blenders (*Ethanol Timeline*).

Ethanol blending into gasoline began as a way to reduce foreign reliance on oil, but quickly morphed into a way to reduce emissions from internal combustion engines in the United States. In 1995, an addition to the Clean Air Act allowed the EPA to require oxygenates to be added to gasoline to reduce pollutants in car emissions (*Gasoline: MTBE in Fuels*). Ethanol is one of a few known oxygenates, but specifically "drew political support from farm groups who sought to create value-added enterprises that could reduce crop surpluses and raise corn prices" (Tiffany, p. 43, 2009). While the 1995 addition was to primarily mitigate environmental harm from pollutants, government officials realized that encouraging ethanol production could secondarily provide financial support for farmers.

With previous legislation acting as facilitator, government messaging about ethanol transitioned from a clean, domestic fuel additive to a renewably sourced "biofuel". Biofuels are traditionally derived from living matter, produced in a cyclically regenerative, or "renewable", manner. Renewable fuel sources do not take up new carbon from the Earth, but instead recycle carbon already released into the atmosphere. Renewable fuels inflict less damage on the environment, gaining popularity with legislators at the turn of the twenty-first century and siplayed in acts like The Energy Policy Act of 2005. This Act was built upon the original Energy Policy Act of 1992, but was updated and expanded to include grants, initiatives, and tax incentives for alternative fuels and vehicles (*Energy Policy Act of 2005*). According to Wang & Ortiz-Bobea, (2019), "[t]he Energy Policy Act of 2005 was a major federal law encouraging the use of biofuels and had an important impact on corn production" (p. 275). While this piece of legislation primarily addressed domestic energy production, it also initiated a wave of additional corn production.

Finally, ethanol as a biofuel became genericized with renewable fuels, as reflected in legislative messaging like the 2007 Energy Independence and Security Act. This Act created the Renewable Fuel Standard, requiring up to 36 billion gallons of renewable fuel to be blended with gasoline by 2022, and mandating that up to 15 billion gallons of bioethanol must come from corn, greater than one-third of nationwide corn use (*Renewable fuel standard; Renewable Fuel Standard Program;* McPhail & Babcock, 2012). The Renewable Fuel Standard not only necessitates that almost 50% of ethanol must be made from corn through 2022, but over 25% of ethanol must be made from cellulosic sources like corn waste by 2023 (*New renewable fuel standard volume*). This Standard made ethanol the dominating renewable fuel choice in the United States, subsequently embedding corn and the farming sector as vital contributors to the booming renewable fuels industry. What began as a way to reduce reliance on foreign oil, became a way for governmental action to support many groups, including a struggling farming industry.

Agricultural communities in the United States have continuously struggled with economic and financial problems, especially felt since the 1970s and 1980s. According to Carlisle et al., (2019), "farmer incomes have become highly volatile because of trade liberalization and financial speculation. In general, crop prices are too low for farmers to make a living, due to structural overproduction, globalized competition, and externalized costs of production" (p. 4). Income from farming is typically unreliable, with environmental, economic, and even societal factors contributing to inconsistent pay. Government assistance has been necessary since the early twentieth century to aid in stabilizing the farming industry, but "social and economic safety net programs…available in this country [have] not [met] the needs of these [farming] families" (Heffernan & Heffernan, p. 90, 1986). Farming influences many sectors besides the people working the land, making it imperative for agricultural communities to be supported in times of need. D'Antoni et al., (2009), stated that "[d]uring the farm crisis period of 1982-1989 higher interest rates caused many farms financial stress", around the time that ethanol as a gasoline additive came onto the scene in American culture (p. 1). Government policy found a way to subtly change the idea and messaging of ethanol to financially aid farmers, conceptually stabilizing the agricultural community via legislation for years.

The STS analytical framework of the "sociotechnical imaginary" in the reading "Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power" by Sheila Jasonoff & Sang-Hyun Kim (2015), is used throughout the analysis portion of my research to better understand the government's purpose behind biofuel policy and the legislative implications on the farming industry. The foundation of my research is based upon Jasonoff's & Kim's (2015) definition of sociotechnical imaginaries "as collectively held, institutionally stabilized, and publicly performed visons of desirable futures, animated by shared understandings of forms of social life and social order attainable through, and supportive of, advances in science and technology" (p. 4). The United States government has created its own sociotechnical imaginary around the domestic agricultural sector, where government actors have understood the farming industry as an entity responsible for economic prosperity and fortifying national independence. As a consequence of this imaginary, biofuel policy was instituted as a continuation of the industry's purpose. However, I argue that the government's perception of the agricultural sociotechnical imaginary is misconceived. The government's imaginary understands the effects of the farming industry, but not the cause, or the being of it. The basic relationships that farming has with the soil has spider-webbed effects on the respective technologies, culture, and sociological makeup of the farming industry, far before the industry begins to impact the U.S. economy or national security.

Methods

I have collected several primary sources dating from the 1970s to today to perform a policy analysis using data including government statistics, and overviews of legislation from the DOE and the EPA. Specifically, pieces of legislation like the 1990 Farm Bill, Renewable Fuel Standard (2005), Energy Policy Act (1992), Clean Air Act (1970), Energy Independence and Security Act (2007) were reviewed. Some secondary sources, including academic journals, books, and law reviews, were gathered to give some context on how government policy affects farmers. Most of the secondary source information came from the USDA Economic Research Service, a government program that provides economic analyses through research, with most sources being from the 1980s-2020s. While reviewing the literature, I analyzed and evaluated these sources to understand whether the data provided described how legislative acts have affected the financial and social success of farmers.

Analysis

Upon the implementation of biofuel policy, increasing corn production is the ultimate deciding factor in farming decisions. Federal policy requiring the addition of ethanol in gasoline product created a purposeful deficit in corn supply. To remedy this, farmers prioritize corn production because higher corn prices from corn-ethanol legislation leads to potentially higher incomes when corn product is sold (Foreman, 2014). According to Wallander et al., (2011), specific areas in the United States, including the Corn Belt and Lake State regions, demonstrated strong trends of converting soybean and hay acreage to cropland deemed only for corn. Crop variation is traditionally necessary to ensure that farms make money no matter the scenario- blight, drought, or low commodity price of a particular crop. However, federal and state legislation like the federal Energy Security Act of 2005 "assur[ing] increased ethanol demand for several years", and state requirements for specific oxygenates in gasoline blends or reduced state taxes on those blends, incentivize increased corn-ethanol production and use (Taylor et al., p. 5, 2006; Tiffany, 2009). Realizing the potential financial gain, many farms decide to convert non-corn crops to corn.

Another way farms have capitalized on these government-led financial incentives is to convert non-cropland to plantable acres for increased corn production. From 2008 to 2012 "Gross land conversion was nearly [12 million acres]" where "grasslands were the source for 77% of all new croplands, with 5.7 million acres converted (Lark et al., p. 3, 2015). 1.6 million of those grassland acres were considered "long-term unimproved grasslands", meaning that these acres had been considered wild, non-producing acres for more than 20 years (Lark et al., p. 5, 2015). Although converting wild grasslands to plantable acres can meet current corn demand, land is a finite commodity and can be completely consumed and nutritionally exhausted if current conversion levels continue. The need for additional corn production has created a land imbalance not found in pre-corn-for-ethanol legislation farming operations. This trend of converting not-in-production acres to corn-producing ones shows that farmers believe that current financial gain is more beneficial than the long-term financial farm health that comes with sustained production.

Traditional farming methodologies and technologies tied to the health of the soil and surrounding environment have been abandoned as a result of government biofuel policy. To keep up with increasing ethanol production quotas, farmers have attempted to supply enough corn via modernized methods like monoculture farming. Wang & Ortiz-Bobea (2019) claim that biofuel policy like the 2005 Energy Policy Act created “higher expected market returns for corn” … “significantly associated with higher proportions of corn monocropping” (p. 286). Since the 1800s, farmers have practiced rotational planting to maintain the long-term quality of the soil (Gebremedhin & Schwab, 1998). However, farmers seem to have deviated from this sustainable practice, with this new monocropping method becoming especially prevalent around the same time as early twenty-first century government biofuel policy. While a financial gain in the short term, the method of monoculture farming poses a significant economic threat to farmers because of dependency on a single market and specific set of economic conditions, with crops at risk of succumbing to severe weather or blight (Power & Follett, 1987). Financially prudent farming requires repeatable, sustainable practices to successfully grow crops. If farmers are taking advantage of biofuel policy and deviating from traditional farming methods to make more money in the near future, the long-term success of the farm may be put in jeopardy.

Agricultural communities have demonstrated both a technological and methodological shift with the implementation of a new type of corn- the corn hybrid. Fausti (2015) claims that “[t]o meet the ethanol-driven increased demand for corn, many farmers abandoned traditional crop rotation practices” …made “feasible with the adoption of…corn hybrids” (p. 44). Corn hybrids allowed farmers to skip beneficial soil and non-hybrid crop techniques like rotating crop fields to augment short term profits. Farms maximize profitability by using hybridized corn because of its lesser labor requirement, and its projected higher yields. With waiting for land to regenerate becoming a method of the past, a new methodology for farming prioritizing different behaviors has begun to form.

Biofuel policy impacted the way land was valued, subsequently changing the demographics and culture inherent to traditional farming communities. Katchova & Ahearn (2015) claim that "[a]side from the increasing number and share of older farmers, there has been an absolute decline in the number of young farmers" (pg. 336). This could be attributed to farm size increasing with increasing farmer age, with farming operations owned by younger farmers containing the fewest number of acres (Katchova & Ahearn, 2015). Larger farms enjoy lower unit costs of production, higher equity returns, and lower labor and capital per acre costs, creating a significant financial advantage. This financial advantage could potentially pressure smaller, less profitable farms to cease operation, inhibiting the number of young people wanting to farm.

When considering farm size, from 1982 to 2007 "the midpoint farm size…almost doubled from 589 to 1105 acres" (Key, p. 186, 2019). Around the time of the institution of the federal and state corn-ethanol polices, farms began to consolidate and grow in acreage. Henderson (2008), stated that, "[i]n 2000, the U.S. Department of Agriculture (USDA) reported that government payments accounted for 30 percent of national farmland values- and in some regions up to 70 percent" (p. 86). Artificially inflated land value was a driving force for land acquisition. Larger farms were worth more and could afford to buy more land compared to smaller ones, creating a positive feedback loop to garner additional government subsidies.

Along with farm makeup and size, the sheer number of farmers has steadily decreased from 32.5 million people to 4.5 million in 2017, which could be attributed to farms getting larger (Pardey & Alston, 2021). Larger farms are able to enjoy benefits that come with increased production and lower labor requirements per acre of land, dramatically reducing the total number of farmers needed. Typically, farming operations with large tracts of land are able to make more money in sales per year. Farmland makes up 85% of total farm sector assets, with larger farms enjoying the financial and monetary benefits associated with increasing assets (Henderson, 2008). Government has inadvertently instituted policy deeming total acreage as a deciding factor on whether a farm is successful or not. The financial and subsequent competitive advantage that larger farms receive could exacerbate potentially irreversible infrastructural changes induced by government policy.

As I have argued, biofuel policy has inflated land values, impeding the viability of smaller farms and success of younger farmers. Some might think that farmer age may be the main contributor to the decrease in average farm size and number of farmers. The average farmer age has steadily increased throughout the years, with a typical American farmer being 58 years old in 2012 (Fried & Tauer, 2016). This could be a factor in explaining why the number of farmers decreased while the size of farms increased. There is a notion that older people want to slow and settle down, stereotypically depicted by selling off property to other farms or ceasing to operate altogether. However, this view fails to consider that young people may see the costs associated with farming non-large farms as a barrier to entry. As previously discussed, larger farms earn more money and more subsidies, which may entice people to change their operating habits by buying more land and operating longer, while smaller, less successful farming operations get pushed out.

STS Framework

Using Jasonoff's & Kim's (2015) definition of sociotechnical imaginaries, it can be argued that the United States government developed its own imaginary of what they thought the agricultural industry to be. Government actors wanted to design a sustainable agricultural sector that was protected from financial turmoil, so that the industry could bolster the greater U.S. economy and nation security. This desire was reflected in the evolution of the Farm Bill, a continuously adapted bill known as "the primary piece of agricultural legislation in the USA" for close to one hundred years (Lehrer, 2018, p. 358). As of 2018 there have been 17 Farm Bills, with Lehrer (2018), claiming that "the concept of *national interest*…surface[d] in almost all 17" versions (p. 361). The 1990 Farm Bill illustrated the government's sociotechnical imaginary of farming communities in the context of improving domestic trade. In this bill Congress justified additional subsidies for corn farmers and funds for biofuel research by stating "the economic well-being of rural America is vital to our national growth and prosperity" (Pollack & Lynch, 1991; Lehrer, 2018, p. 362). While securing national interests transitioned to international security and bioenergy, the 2008 and 2014 Farm Bills sustained the government's imaginary, with the incorporation of crop-insurance programs (Lehrer, 2018). The United States government understood the social life and order of agricultural communities in a specific way to use them as a mechanism for advancing domestic and international interests.

Conclusion

Government aid via biofuel policy attempted to assist ailing agricultural communities. The farming sector was prone to financial flux, and promoting corn for domestic ethanol production was thought to be ingenious way for the government to stabilize this community. However, as shown in my research, what started as seemingly well-intentioned policy to keep farmers afloat for many years has systemically changed the ideas, methodology, and sociology of the typical United States farmer. Through the STS framework provided by Jasonoff & Kim (2015), I argue that these infrastructural changes were inadvertent. The U.S. government's imaginary of agricultural communities does not account for symbiotic relationships between farmers and the soil, technologies, and other farmers. Government believed it could fulfill its own economic and security directives by creating biofuel policy and subsidizing farming communities, but this limited imaginary facilitated a shift in the inherent properties of the agricultural sector.

However, not all hope should be abandoned. The idea of sociotechnical imaginaries defined the problem between government and agricultural communities, and may also provide the solution. Jasonoff & Kim (2015) claim that imaginaries are created by understanding how science and technology impact social infrastructures, and how these understandings help progress the imaginary. If funds were allocated toward government partnerships with farmers, qualitative and quantitative relationships including crop type, land quality, and farmer demographics demonstrated in my research could be examined. By using a more scientific analytical approach to these relationships, data can be operationalized and easily evaluated, allowing the government to modify their imaginary and tailor legislation to better suit these communities.

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