Iowa's Tax Incentive Programs Used by Biofuel Producers Tax Credits Program Evaluation Study

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The Iowa Department of Revenue

31 March 2009

IOWA Department of REVENUE

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Preface

During the 2005 Legislative Session the Iowa Department of Revenue received an appropriation to establish the Tax Credits Tracking and Analysis Program to track tax credit awards and claims. In addition, the Department was directed to perform periodic evaluations of tax credit programs. The evaluation of the State's Tax Incentive Programs Used by Biofuel Producers represents the fourth of these studies.

As part of the evaluation, an advisory committee was convened to provide input and advice on the study's scope and analysis. We wish to thank the members of the panel: Dr. Dan Otto of Iowa State University, Lihong Lu McPhail of Iowa State University, Monte Shaw of the Iowa Renewable Fuels Association, Dawn Carlson of the Petroleum Marketers and Convenience Stores of Iowa, Tim Johnson of the Iowa Farm Bureau Federation, Lane Palmer and Amy Johnson from the Iowa Department of Economic Development, and Dale Thede of the Iowa Department of Revenue. The assistance of an advisory committee implies no responsibility on members for the final product. The Department would also like to thank Dr. Chad Hart of Iowa State University for helpful comments on the economic analysis section of the study.

This study and other evaluations of Iowa tax credits can be found on the Tax Credits Tracking and Analysis Program Web page on the Iowa Department of Revenue Web site located at:

http://www.state.ia.us/tax/taxlaw/creditstudy.html.

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Executive Summary

Iowa offers several tax incentive programs that have been utilized by biofuel producers. The tax credit programs include the Enterprise Zone Program (EZ), the New Jobs and Income Program (NJIP), the New Capital Investment Program (NCIP), and the High Quality Job Creation Program (HQJCP). The NJIP and NCIP were replaced by HQJCP on July 1, 2005, but claims under NJIP and NCIP contracts can still be made. The EZ, NJIP, and HQJCP allow biofuel producers to claim a ten percent Investment Tax Credit. The NCIP provides a five percent Investment Tax Credit. All four programs offer a sales and use tax refund and a supplemental Research Activities Tax Credit. The EZ and NJIP also provide a supplemental Iowa Industrial New Job Training Program (260E) withholding tax credit. All four programs were not established specifically to support the biofuel industry but rather to help the State of Iowa promote general business investments.

The major findings of the study are:

Tax Incentives for Biofuel Producers Across the United States

- Most states, including Iowa, have general Investment Tax Credits aimed at promoting business investments, including investment in the biofuels industry.
- Twelve states, including South Dakota and Nebraska, have specific investment programs to promote investments in biofuel plants in their states. Iowa does not have such programs.
- Twenty-three states, including South Dakota, Minnesota, Nebraska, and Missouri, provide programs to biofuel producers based on their actual output of ethanol or biodiesel. Iowa does not have such programs.

Biofuel Production in Iowa and Neighboring States

- Ethanol production is heavily concentrated in the Midwest. Iowa is the leading ethanol producer in the nation in terms of production capacity accounting for nearly 3 billion gallons per year or 24.9 percent of U.S. nameplate capacity[1].
- Iowa is second to Texas in terms of biodiesel production capacity with 245 million gallons per year (MGY), or 10.1 percent of U.S. production capacity.

Biofuel Producers' Tax Credit Awards and Claims

- More than $405 million in tax credits have been awarded to 55 ethanol projects through December 2008. The majority of the tax credits, $274 million, have been awarded under the EZ and HQJCP programs. Ethanol projects account for 54.8 percent of all tax credits awarded through the Iowa Department of Economic Development Business Job Creation programs.
- More than $43 million in tax credits have been awarded to 16 biodiesel projects through December 2008. Likewise, the majority of the tax credits have been awarded under EZ and HQJCP. Biodiesel projects account for 5.8 percent of all tax credits awarded through the Iowa Department of Economic Development Business Job Creation programs.
- The amount of credits claimed thus far is less than the amount awarded. In 2006, nearly $4 million in Investment Tax Credits were claimed by biofuel producers, mostly through NJIP.

[1] Nameplate capacity refers to the minimum production rate an owner or operator should expect. Many plants are capable of exceeding nameplate capacity.

- For sales and use tax refunds, $3.8 million was claimed by ethanol producers between 2003 and 2008. Biodiesel producers claimed $1.7 million in sales and use tax refunds between 2006 and 2008.

Ownership Structure

- Sixty-one companies have invested in 71 biofuel production projects that have been awarded State tax credits in Iowa through July 1, 2008. 51 of the 71 projects are owned by pass-through entities.

- Of the 28 biofuel project owners set up as pass-through entities, for which data is available, nearly 90 percent of the investors are Iowa residents. More than 80 percent of the shares are owned by individual Iowa investors. Iowans with farm income own approximately one-third of all shares.

Evaluating Beneficiaries of Biofuel Producers' Tax Incentives

- A 50 MGY ethanol plant employs an average of 38 workers while a 100 MGY plant employs an average of 52 workers. Employees earn an average annual salary of approximately $52,000.

- State tax credits may have induced as much as 25 percent of Iowa's ethanol production capacity.

- A portion of the increase in corn prices experienced in recent years (3 cents in 2005, 9 cents in 2006, and 17 cents in 2007) can be attributed to increased ethanol production capacity induced by tax credits. This increase in the price of corn led to an increase in farm income at the state level of $64.9 million in 2005, $184.5 million in 2006, and $402.4 million in 2007, while the value of corn produced in Iowa was $6.8 billion in 2006 and $10.7 billion in 2007.

- It is estimated that increased ethanol production capacity increased the average farmland prices by $66.57 (2.3 percent) in 2005, $136.73 (4.3 percent) in 2006, and $253.4 (6.5 percent) in 2007. This translates into total agricultural land value increases of $2.1 billion, $4.3 billion, and $8.0 billion over the same periods.

- At the same time, increased corn demand has led to increased farming input costs. The average farmland rent increase due to the tax credits was $2.37 per acre in 2005, $7.11 per acre in 2006, and $13.43 per acre in 2007.

- It is estimated that the operation of an ethanol plant in a town increases the average real household income of its residents by $822. There does not appear to be a very strong correlation between counties that had an ethanol plant constructed between 2003 and 2006 and change in retail sales.

Future of Biofuels

- Second generation feedstocks are expected to supplement grain in the future. However, commercial scale production facilities have been slow to develop and the latest forecasts project that the U.S. will not meet the renewable fuel standards target for advanced biofuels in the coming years. Specifically, the Energy Information Administration (EIA) predicts that the U.S. will only produce 30 billion gallons of biofuels, traditional and second-generation, by 2022 which is short of the 36 billion gallon mandate for that year.

Comments from the Tax Credits Evaluation Study Advisory Committee Meeting
Monday, March 16, 2009, 10:00-11:30 am

The following is a summary of several issues raised by advisory committee members regarding the final draft of the Iowa's Tax Incentive Programs Used by Biofuel Producers Tax Credits Evaluation Study.

Committee members offered additional insight into the current situation of the biofuels industry. Due to unfavorable economic and market conditions several plants across the U.S. and a few plants in Iowa have been forced to shut down while many others are producing well below potential output capacity. The Iowa Renewable Fuels Association (IRFA) estimates that 400 million of Iowa's 3 billion gallons of ethanol production capacity, 13.3 percent, is currently off-line. The situation is worse in the biodiesel industry with 200 million gallons of Iowa's 315 million gallons of biodiesel capacity, 63.5 percent, estimated to be off-line. However, the IRFA notes that some plants will produce biodiesel intermittently based on orders. IRFA does not know of any biofuel projects that plan to begin construction this year. Further, some projects have suspended construction due to market conditions. The IRFA believes that the current troubles in the industry are only temporary and recalls that in 1995 a drought forced many plants to shut-down but the industry continued to grow and prosper in subsequent years.

The future of the biofuels industry was also discussed at the meeting. IRFA projects that new feedstocks, such as corn stover, switchgrass and algae, will become economically feasible within eight to ten years. However, IRFA notes that these feedstocks will be an addition, as opposed to a replacement, to traditional feedstocks. Traditional feedstocks will remain prominent in the industry due to continual technological advances that make producing biofuels from these sources more efficient.

The Iowa Farm Bureau was represented at this meeting and agreed with the current situation and future outlook outlined by the IRFA.

Technical remarks were received by Dr. Dan Otto and Lihong McPhail and their edits have been incorporated into the paper.

I. Introduction

The objectives of this study are to evaluate the impact of tax incentive programs encouraging business investment on the development of the biofuels industry in Iowa, to identify the cost of tax credits provided to biofuels producers, to identify those beneficiaries, both direct and indirect, of the tax incentives, and to examine the economic impacts to the beneficiaries. The study begins with a brief look at the history of the biofuels industry and its resource needs. The study then describes the tax incentive programs available to biofuel producers in Iowa and compares these to credits and other incentives available across the country. Next, the analysis moves to award and claim data, presenting details on the amount of credits awarded and claimed by year and program. The analysis then turns to a discussion of the beneficiaries and economic impacts of biofuel production in Iowa. Finally, there is an evaluation of tax credits and a look ahead to the future of the biofuels industry.

A. Ethanol Industry Background

The U.S. ethanol industry has evolved since its start in the 1970s. The industry was originally dominated by many small, farmer-owned plants peaking at 163 in 1984 (Morris, 2005). Ethanol plants served as a way for farmers to add value to their crops. Oil prices increased sharply from 1978 to 1979, creating demand for ethanol and allowing the product to be competitive in the motor fuel market. By the mid 1980s oil prices had fallen back and in 1990 only 50 ethanol plants remained (RFA, 2008).

During the 1990s and 2000s, demand for ethanol recovered helped by a sustained rise in gasoline prices and the federal renewable fuels mandate.[2] The number of operating ethanol plants also increased dramatically from 54 in January 2000 to 182 in January 2009. In response to the high profitability of ethanol plants in 2006, the number of plants under construction and/or expansion more than doubled from 31 in January 2006 to 76 in January 2007 (RFA, 2008).

Ethanol plants have increased in size over the past decade. In 1999 the average ethanol biorefinery across the U.S. had a nameplate capacity of approximately 35 MGY. This number steadily climbed to 55 MGY by mid 2008 (RFA, 2008). Newly constructed ethanol plants are likely to be 100 MGY biorefineries. Additionally, the average size of new plants constructed in Iowa has increased since 2002 reflecting the national trend.

Ethanol biorefineries are clustered in the corn producing states. Raw corn weighs more than ethanol and its co-products. Consequently, the location of ethanol plants is supply-oriented to reduce transportation costs. Iowa, as the top corn producing state for the last 14 years, is also the top ethanol producing state. The Iowa ethanol industry experienced a similar explosion in number of plants and in production capacity (see Table 1). As of January 2009, of the 182 producing plants in the U.S., 33 (18.1 percent) are located in Iowa, accounting for 2,814 (24.9 percent) of the 11,273 million gallons per year (MGY) of nameplate capacity (see Figure 1).

In January 2009, four Iowa ethanol plants, with a total capacity of 238 MGY, are currently not producing (Ethanol Producer Magazine, 2008). Pine Lake Processors in Steamboat Rock was forced to shut down in December to avoid operating losses which the plant attributed to high corn prices on futures contracts written during the summer and a decrease in ethanol prices mirroring the recent decline in gasoline prices (Chicago Tribune, 2008). Due to shrinking profit margins, high corn and energy prices, and the tight credit market, firms are canceling planned projects.

The increased use of ethanol within Iowa mirrors the increase in production. In 1979, 650 Iowa retail gas stations sold gasohol, a gasoline mixed with a minimum of ten percent ethanol, compared with

[2] The federal Renewable Fuel Standards mandate that the amount of renewable fuel blended into gasoline increase from 9 billion gallons in 2008 to 36 billion gallons by 2022. (EPA)

2,052 in May 2008 (Iowa Corn Promotion Board, 2008; IDR, 2008). Following Governor Branstad's 1988 mandate that all State vehicles use ethanol blended fuel, 31 percent of fuel sales contained ethanol. Ethanol blended fuel's market share surpassed 50 percent in August 2000. As of December 2008, gasohol sales accounted for 75.2 percent of all gasoline sales. The share of gasohol sales in Iowa has been between 70 and 75 percent for the past two years. Despite the substantial demand for ethanol in Iowa, the state exports most of the ethanol it produces.

B. Biodiesel Industry Background

Iowa's current operating production capacity is 245 MGY (10.1 percent) of the nations' 2,423 MGY of biodiesel (Biodiesel Producer Magazine, 2008). It is important to note that actual production can substantially differ from the maximum production capacity which is referred to above. In fact, due to unfavorable economic conditions the capacity utilized currently by producers is very low. In the 12 month period beginning October 1, 2006 only 450 million gallons were produced nationally which is less than 20 percent of the total production capacity over these twelve months (National Biodiesel Board, 2008).

As of January 2009, eleven of the 139 (7.9 percent) operating U.S. biodiesel plants are located within the State (see Table 2). Biodiesel plants are scattered throughout the nation as they can use various feedstocks such as oil derived from corn or soybean as well as animal fats and other wastes. The dramatic rise in U.S. biodiesel production mirrors that of U.S. ethanol production as the nation focuses on renewable fuels (see Figure 2).

The average size of biodiesel refineries is much smaller than ethanol refineries. The largest of the producing biodiesel facilities in Iowa is Cargill Inc. in Iowa Falls with a production capacity of 37 MGY (Biodiesel Producer Magazine, 2008). Thirty million gallon capacity plants are the most common size of biodiesel refineries in Iowa. Despite the ability to produce biodiesel from a variety of feedstocks, the majority of Iowa refineries use animal fats due to the high cost of soybean oil. However, plants adjacent to soybean crushing facilities use soybean oil.

The primary market for U.S. biodiesel is currently in Europe where a combination of mandates and primarily diesel fueled automobiles drive demand for the product. Of the 450 million gallons of biodiesel produced in the U.S. in 2007, an estimated 300 million gallons of U.S. biodiesel was exported to Europe (Brasher, 2008). The two-thirds of U.S. biodiesel production that is exported to Europe accounts for 15 to 20 percent of all European biodiesel sales (Brasher, 2008). The U.S. government has established increasing Federal biodiesel usage mandates that will help create domestic demand for biodiesel beginning with 500 million gallons in 2009 and reaching one billion gallons a year by 2012. Further, the European Union launched an investigation into the United States' "dumping" of biodiesel in Europe in the summer of 2008. As a result of the investigation it is likely that the European Union will impose duties on biodiesel imported from the U.S.

C. Ethanol Production Process

There are two primary ways to produce ethanol, either through a wet mill or dry grind process. There are a few major differences between the two processes. Wet-milling requires more capital and energy and yields more valuable co-products such as oil, corn gluten meal, and corn gluten feed (Bothast, 2004). Dry mill plants have lower capital costs and focus on making profits primarily through the sale of ethanol and the co-product distiller's dry grains (DDG) (Bothast, 2004). DDGs can be sold to farmers as animal feed, and in addition, captured carbon dioxide can be sold to the beverage industry (Iowa Corn Promotion Board, 2008).

Wet mill plants dominated the ethanol industry in the late 1980s and early 1990s as their valuable co-products were a primary source of revenue. In Iowa, Cargill Inc. and Archer Daniels Midland (ADM) continue to operate wet mill plants. The ethanol industry began to boom in the 2000s due to mandates that were favorable to biofuels, which assured producers there would be demand for their product. Virtually all of the new plants being constructed today are dry mill plants and subsequently the proportion of dry mill plants continues to increase, surpassing two-thirds of total plants in 2004 (Bothast, 2004). Dry mill plants produce 2.8 gallons of ethanol per bushel of corn compared to 2.6 gallons per bushel for wet mill plants (Bothast, 2004). In recent years, large (100 MGY) dry mill plants have been the dominant type for new construction. Although dry mill plants focus on the sale of ethanol for their revenue, the sale of co-products such as dry and wet distiller's grain is essential for firm profitability.

The USDA has published guidelines for a community when evaluating the resource requirements needed to operate an ethanol plant. These guidelines encourage potential communities to consider transportation, labor, land, financial resource availability, and the economic and environmental impact the plant will have on the local community before proceeding with the project. Typically, ethanol plants truck in local corn and then export ethanol by rail. Rail access is critical to an ethanol plant's operations and thus many ethanol plants have received grant money from the Iowa Department of Transportation (IDOT) to construct or improve existing railways (see Figure 3).

Key inputs into the production of corn ethanol include corn and labor. At a dry-mill plant, one bushel of corn can produce 2.8 gallons of ethanol and 18 pounds of DDGS. The amount of corn required per gallon of ethanol produced is invariant to the amount of ethanol being produced. A 100 million gallon a year ethanol plant uses 42.9 million bushels of corn annually (Tiffany and others, 2008). Thus, a producer's profit margin is highly sensitive to the price of corn. Specifically, if the price of corn increased by $1 from its June 2008 price of $6.45 per bushel, the breakeven price of ethanol (holding all other input costs constant) would increase 14.2 percent from $2.45 to $2.80 per gallon (Tiffany, 2008). The price of corn increased steadily from $1.75 per bushel in January 2005 to $6.45 per bushel in June 2008 and is expected to remain strong (Tiffany, 2008). In January 2009 with corn futures for March delivery just over four dollars a bushel, profit margins for ethanol plants were still tight (WSJ, 2009).

To put a plant's demand for corn into perspective consider the amount of corn produced per county in Iowa. In 2007, corn harvested in Iowa counties ranged from 4.2 to 59.3 million bushels with an average of 23.9 million bushels (see Figure 4). Therefore, on average, a 100 MGY plant will consume almost all of the corn harvested in a two county area. The total amount of corn produced in Iowa in 2007 was 2.37 billion bushels (NASS, 2008). In 2006, some estimates show that if all planned ethanol plants in Iowa were to begin production, in addition to those already producing in the State, Iowa would have to become a corn importer. However, these estimates used all planned projects of which some will never open because a region cannot sustain several plants.

Virtually all Iowa ethanol refineries are dry mill plants that use corn as their feedstock. Other sources of feedstock for ethanol production are being researched to produce advanced biofuels. Researchers hope to transition from grain based feedstocks to cellulosic. Potential sources include miscanthus, switch grass, sugarcane, corn stover, and microbes. Brazil, the world's second leading ethanol producer, after the United States, uses sugarcane as its feedstock. Second generation feedstocks promise to alleviate the food versus fuel debate as some of these new feedstocks can be grown on less fertile land that is not suitable for growing corn. Additionally, these feedstocks have demonstrated the ability to produce more ethanol per acre of land than corn. A critique of this argument is that these results are hypothetical yields and assume that the amount of ethanol produced per acre of corn does not increase. Also, commercial scale cellulosic plants have been slow to develop.

D. Biodiesel Production Process
Biodiesel can be produced from a variety of feedstocks with soy oil and animal fats being the most common. The single largest factor affecting soy biodiesel production costs is the feedstock which accounts for 88 percent of the cost (Haas, 2006). This strong dependence on the cost of soybeans has negatively affected many producers as soybean prices remain high. High soybean prices result in high variable costs, consequently many firms are operating below production capacity and others have reached or are nearing the point at which they cannot cover variable costs and must shut down. A 30 MGY biodiesel plant uses 58.5 million pounds of degummed soy per year and employs approximately 27 people at an average hourly wage of $16.70 (Haas, 2006; IDED).

The sellable co-product from the production of biodiesel is glycerol. Glycerol is an industrial chemical used as a preservative in foods, beverages, and in pharmaceutical formulations, such as cough syrup, tooth paste, and soaps. The market for glycerol has become saturated as biodiesel production continues to increase, further decreasing biodiesel producers' profits.

E. Transportation Implications
As previously mentioned, ethanol production is concentrated in the Midwest while strong demand for the product can be found on the coasts. Iowa produces nearly 25 percent of the nation's ethanol but only consumes 4 percent (Low and Isserman, 2009). California consumes the largest share of ethanol nationally at 21 percent. Thus the product must be shipped long distances with the three shipping options being train, truck and barge[3]. Rail is the most efficient way for the majority of producers to ship their product. Savings, compared to shipping by truck, are estimated to be $2.5 million per year for a 50 MGY plant (IDOT). Annually, a 50 million gallon a year ethanol plant estimates using 2,950 car loads each carrying 100 tons to ship its products, ethanol and DDGS; traveling 2.2 million miles by rail. As a result, rail access is essential to the operations of a biorefinery. Of the 143 million gallons of biodiesel produced in Iowa last year, 84 million gallons were shipped by rail and the remaining 58.6 million by truck.

The Iowa Department of Transportation has awarded grants and loans to biofuel producers through the Rail Revolving Loan and Grant Program for the construction or improvement of railway infrastructure. Awards have been announced on three occasions with the first occurring in June 2006 and the most recent awards being announced in October 2007. Grants through this program have totaled $1.2 million with an additional $1.2 million being awarded as loans (see Table 3). It should be noted however, that not all rail projects receiving funds have proceeded.

II. Iowa Tax Incentive Programs Used by Biofuel Producers
Iowa does not offer any tax credits specifically for the production of biofuels, but the State does offer tax incentive programs to induce investments by businesses that produce biofuels. These programs are administered by the Iowa Department of Economic Development (DED) with the goal of increasing investment in businesses, the number of high-quality jobs, and economic activity in the state. These include the Enterprise Zone Program (EZ), the New Jobs and Income Program (NJIP), the New Capital Investment Program (NCIP), and the High Quality Job Creation Program (HQJCP). The Enterprise Zone Program was created in 1997 to encourage investment in distressed areas around the state. The New Jobs and Income Program was created in 1994 to encourage capital investment and job creation within the state. The New Capital Investment Program was created in 2003 to encourage capital investment within the state. In 2005, the High Quality Job Creation Program was created to replace NJIP and NCIP as a tool for encouraging capital investment and job creation within the state. Requirements, benefits, and claim information for these programs are discussed below.

[3] The existing pipeline structure is not conducive for the shipment of ethanol and it is more feasible and efficient to ship ethanol by rail and truck.

A. Tax Incentive Program Requirements
The four major tax incentive programs, EZ, NJIP, NCIP, and HQJCP, have similar general requirements (see Table 4). The Enterprise Zone Program requires a minimum capital investment of $500,000, NJIP had a minimum capital investment requirement of $12.1 million in Calendar Year 2005, and NCIP had a minimum capital investment requirement of $1 million. HQJCP does not have a minimum capital investment requirement but the award a business is eligible to receive is dependent on the amount of qualifying capital investment. Qualifying capital investment refers to capital investment in real property including the purchase price of land, existing buildings and structures, site preparation, improvements to real property, building construction, and long-term lease costs, and investments in depreciable assets.

The number of jobs created by a business also affects its eligibility for tax incentives. Businesses in an Enterprise Zone must create at least ten full-time, project related jobs and maintain them for at least ten years. To be eligible for tax credits under NJIP a business must create 50 new jobs within five years. Neither NCIP nor HQJCP have minimum job creation numbers; however, for each, the amount of Investment Tax Credit awarded varies depending on the number of jobs created.

In addition to job creation numbers, all four programs have a minimum average wage requirement based on the county average wage. For EZ, a company must pay an average wage that meets or exceeds 90 percent of the average county or regional wage, whichever is lower. To qualify for awards under NJIP, a business must pay a median starting wage of 130 percent of the average county wage or an hourly wage of $13.35 in calendar year 2005, whichever is higher. Under NCIP, the starting wage must be at least the county average wage. For HQJCP, starting wages, including certain benefits, must be at least 130 percent of the average county wage. EZ, NJIP, and NCIP require a business to provide and pay at least 80 percent of the costs of a standard employee medical and dental insurance plan for all full-time employees. EZ, NJIP and NCIP also have additional restrictions[4].

The Enterprise Zone program has an additional geographic requirement; firms must locate in a designated Enterprise Zone (see Figure 5). NJIP and HQJCP also have additional criteria which a business must meet three of for NJIP and four of for HQJCP. The additional criteria under both programs are:

- Offer a pension or profit-sharing plan
- Produce and/or manufacture value-added goods or services or belong to one of the Iowa's "target" business segments which are: value added agricultural products; insurance, financial services or telecommunications; plastics; metals; printing, paper or packaging products; pharmaceuticals; software development; instruments, measuring devices and medical instruments; and recycling and waste management
- Make daycare services available
- Annually invest at least one percent of the Iowa facilities' pretax profits in research and development
- Annually invest at least one percent of the Iowa facilities' pretax profits in worker training and skills enhancement
- Have a productivity and safety improvement program in place
- Occupy an existing vacant facility of at least 20,000 square feet

[4] EZ, NJIP, and NCIP restrict award eligibility to non-retail establishments. Additionally, EZ does not award tax credits to businesses whose entrance is limited by a cover charge or membership fee. Further, a business cannot close or significantly reduce its operations elsewhere in Iowa in order to relocate the operation to the proposed community under EZ, NJIP, and NCIP.

In addition to the above criteria, HQJCP also has an additional criterion which is available to provide or pay at least 80 percent of the costs of a standard employee medical and dental insurance plan for all full-time employees.

B. Tax Incentive Program Benefits

The exact value of the award depends on the amount of capital investment and number of jobs proposed to be created as well as the business' needs. This is particularly true for HQJCP (for more specifics see Table 6). All four tax incentive programs offer a refund of sales and use taxes paid to contractors or subcontractors during construction, a supplemental Research Activities Tax Credit, and an Investment Tax Credit. EZ, NJIP and HQJCP also offer local property tax exemptions on the value added to the property. EZ and NJIP allow eligible businesses who already have a Iowa Industrial New Jobs (260E) agreement in place to claim a supplemental 260E Withholding Tax Credit for new employees.[5]

C. Tax Credit Claim Provisions

For the Investment Tax Credit and the supplemental Research Activities Tax Credit, credits awarded to pass-through entities must be claimed by the entity's owners based on the share of the entity's income distributed to each owner. Each award is given a unique tax credit certificate issued by the DED containing a certificate number, the taxpayer's name, address, tax identification number, and the amount of tax credits. The tax credit certificate must be attached to the taxpayer's tax return for the year in which it is used. In addition, taxpayers with claims to these credits must file, starting with tax year 2006, the IA 148 Tax Credits Schedule. Awarded credits may not be sold or traded.

In all cases where these tax credits are available the following refundability provisions apply. The local property tax exemption and the supplemental 260E are not refundable. The Investment Tax Credit is generally not refundable except for value-added agricultural or biotechnology projects, subject to the successful completion of the project and the aggregate cap of $4 million per fiscal year. Any nonrefundable credit in excess of tax liability may be carried forward for up to seven years. The sales tax refund and the supplemental Research Activities Tax Credit are refundable.

III. Biofuel Producers Tax Credits Across the U.S.

The federal government and 25 of the 50 states currently have some type of public funding program to support biofuel producers. Seventeen of these 25 states have established tax credit programs (see Table 7). Other incentives include grants, tax exemptions, tax deductions, rebates, and mandates. The federal government also has tax incentives to promote both fixed investment and production of biofuels.

There are two kinds of tax incentive programs for biofuels production: investment incentives and production incentives. The first category encourages investors to make capital investment in biofuel facilities, including production, storage, distribution, or delivery facilities and equipment. The tax credit programs in this category allow taxpayers to receive credits on their fixed asset investments and claim these credits against their income tax or property tax liabilities. Currently, there is no federal tax incentive to promote the fixed investment in biofuel production facilities. Thirteen states provide such financial incentives to biofuel production investment. Eight of the thirteen states offer tax credits for investment in infrastructure and equipment (see Table 8). Most states' tax credit rates are below 50 percent. Florida, as an outlier, offers a 75 percent credit for fixed investment in production and distribution facilities which can be claimed against sales and use tax.

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[5] 260E is a job training agreement between a business and a community college. The supplemental 260E can allow a business to double its credit.

One of Iowa’s six neighbors, Nebraska, currently provides a tax credit, the Biodiesel Production Investment Tax Credit, specifically for investment in biodiesel production facilities. The eligible facilities must produce B100 and be at least 51 percent owned by Nebraska individuals or entities. The tax credit rate is 30 percent of the investment in any eligible production facility and capped at $250,000 per facility. The average cost to construct a biodiesel facility is approximately $48 million (DED). South Dakota has a tax refund for contractors' excise taxes and sales and use taxes paid for the construction of a new agricultural processing facility with a project cost higher than $4.5 million.

The second category offers production tax credits directly related to output. The more biofuels produced, the more credits awarded, until any credit caps are reached. The federal program offers small ethanol and biodiesel producers a tax credit of $0.10 per gallon produced up to 15 million gallons (see Table 9). To be eligible, a producer must make less than 60 million gallons of biodiesel or ethanol per year. Before 2005, a small ethanol producer was defined as a producer making less than 30 million gallons per year.

Twenty-three states offer incentives to biofuel producers to increase their output. Fourteen of the 23 states also provide tax credit programs to support biofuel production, but Iowa is not among them. Credits are usually awarded on a per gallon basis, ranging from $0.01 per gallon in Virginia to $1.00 per gallon in Indiana and Kentucky. A majority of these programs are capped.

Of Iowa’s neighbors, Nebraska, Minnesota and South Dakota are the three states with production tax incentives. Minnesota and South Dakota offer a $0.20 per gallon tax credit to ethanol producers. Nebraska offers a $0.18 per gallon tax credit. Minnesota has an annual cap of $3 million for any individual producer. South Dakota has an annual cap of $7 million statewide. Although Missouri does not have a production tax credit, it has both ethanol and biodiesel production incentives supported by a state fund. Its ethanol production incentive pays $0.20 per gallon for the first 12.5 million gallons and $0.05 for the second 12.5 million gallons by a single producer. Its biodiesel production incentive pays $0.30 per gallon for the first 15 million gallons produced (by a single producer) and $0.10 per gallon for the next 15 million gallons produced.

As noted above, the tax credits received by Iowa biofuel producers are through tax incentive programs designed to support any qualified business investment and job creation in Iowa. Therefore, the business investment and job creation related tax incentives in other states need to be examined and compared with Iowa’s programs. To make the comparison more relevant to Iowa’s biofuel production, only the top seven ethanol producing states and Iowa’s neighbor states are considered. According to the *Ethanol Producer Magazine*, Iowa and five of its six neighboring states, (Nebraska, Illinois, South Dakota, Minnesota, and Wisconsin) are among the top seven ethanol producing states (see Table 10). Indiana is the only one in the top seven producing states not adjacent to Iowa.

Five of the top seven ethanol producing states have Investment Tax Credit programs. While each program is unique there are some similarities (see Table 11). All five states have some Enterprise Zone or special zone programs, which are aimed to direct investment to specific communities. The other similarity is that most states award tax credits based on the additional economic activity induced by the investors. The usual measurements for the additional economic activitiy include the minimum investment criteria, the number of new jobs, and the average wage of new jobs.

The Enterprise Zone Program in Iowa provides a basket of public incentives, such as a property tax exemption, a supplemental New Jobs Credit (260E), a sales and use tax refund to the biofuel companies, an Investment Tax Credit, and a supplemental Research Activities Tax Credit. Among other states, Illinois’s enterprise zone program offers an Investment Tax Credit equal to one half of one percent of the value of qualified property, a sales tax exemption, and an enterprise zone tax credit for new jobs created (Illinois Department of Commerce and Economic Opportunity). Indiana’s enterprise zone program only offers credits for increased wages of local employees in private companies in the enterprise zone. Nebraska has programs specially aimed to promote investments in rural areas. For Wisconsin, both investment and the new jobs are awarded with the tax credits.

IV. Literature Review

The economic literature on ethanol is broad, although little discusses the interaction of state tax incentives and the ethanol industry. Hofstrand (2008) outlined several beneficiaries of corn ethanol production. He found that ethanol producers, corn farmers, farming input suppliers, and farmland owners are among the major groups benefiting from the ethanol production boom. In this study, local communities are also considered as another beneficiary group because the communities benefit from the increased economic activity of the ethanol plants operating in their neighborhood.

The state tax incentive programs, such as EZ, NJIP, NCIP, and HQJCP used in Iowa to support biofuel producers include Investment Tax Credits. Little work has been done to directly measure the impacts of Investment Tax Credits, like those provided under EZ, NJIP, NCIP and HQJCP, on ethanol producers. However, there are numerous studies focusing on the effectiveness of Investment Tax Credits on general business activities. One group of papers estimated the Investment Tax Credit's impact on promoting capital investments using Tobin's q model. Tobin's q, widely used as a measure of capital investment, provides a ratio of a company's market value to the replacement value of its assets.[6, 7] The q ratio is related to the investment rate, which is the speed at which investors increase their investments. Using a tax-adjusted q ratio, researchers have focused on the impacts of taxes and depreciation allowances on the investment decision (Auerbach and Hassett (1992), Calomiris and Hubbard (1993), Cummins, Hasett and Hubbard (1994), Bond and Cummins (2000), Goolsbee (2000), and Desai and Goolsbee (2004)). The tax-adjusted q is the q ratio adjusted for depreciation allowances and Investment Tax Credits.[8] These works found that investment tax incentives promote more capital investment, but the magnitude varied across industries and periods. To examine the Investment Tax Credit's impact on Iowa ethanol producers, the Desai and Goolsbee (2004) model is applied to estimate tax-adjusted q ratios for ethanol projects built in Iowa. It is hypothesized that these Investment Tax Credits have had a significant impact on attracting more investment to the ethanol industry, which in turn has increased the nameplate capacity of ethanol production facilities in Iowa.

Economic benefit analysis of the ethanol industry on the agriculture sector has only been developed recently. For major suppliers like corn farmers and farmland owners, increased ethanol production capacity causes increased demand for corn and farmland. Some papers that address the long-term equilibrium in corn and ethanol markets include Elobeid and others (2007), Tokgoz and others (2007), and Baker and others (2008). For short-term market equilibrium, McPhail and Babcock (2008) provides a structural equation model that links the corn, gasoline, and ethanol markets. Their model is able to forecast the short-run impacts of energy policy changes or market shocks on the price of

[6] Tobin's q is a measure of firm performance. It equals the ratio of a firm's market value (as measured by the value of its outstanding stock and debt) to the replacement cost of the firm's assets. A ratio greater than one means the firm's profits exceed what is necessary to remain in business and generally indicates the firm benefits from some source of monopoly power, such as barriers to entry. Sometimes a ratio in excess of one denotes an inability to determine a replacement value for all assets, particularly intangibles. James Tobin (1969) first presented this measure.

[7] For a better understanding of the Tobin's q ratio, see Hayashi (1982), Fazzari, Hubbard, and Petersen (1988), Bernanke, Bohn, and Reiss (1988), Bernanke and Gertler (1989), Clark (1993), Oliner, Rudebusch, and Sichel (1995), Gilchrist and Himmelberg (1995), Erickson and Whited (2000), Erickson and Whited (2006), Cumins, Hasset, and Oliner (2006), and Philippon (2008)

[8] To estimate the tax impact using the q model, a tax-adjusted q is developed by adjusting for the dividend tax rate, corporate tax rate, capital gains tax rate, Investment Tax Credits, and the depreciation allowance. One important paper that discusses the tax-adjusted q model in detail is the work by Desai and Goolsbee (2004).

corn. They estimated that the three major federal ethanol policies which are the renewable fuels mandate, the blender tax credits, and the tariff on imported ethanol increase average corn prices by 14.5 percent. Du, Hennessy, and Edwards (2007) estimated that cash rents increase by $79 for a $1 increase in the corn price in the short-run. They also found that the ethanol plants impact the local farmland rental market mainly through the national commodity price.

There are a few papers estimating the spill-over effects that ethanol plants have on local communities. Swenson and Eathington (2006) found that local economic benefits are greater with a higher percentage of local ownership. A 2006 study conducted by the Missouri Department of Economic Development also supports the finding that local ownership of an ethanol plant results in greater regional benefits from the plant. Specifically, new personal income to Missouri residents was estimated to be sixty-five cents greater, per dollar invested, if the plants are exclusively owned by residents compared to plants solely owned by nonresidents. This same study by the Missouri Department of Economic Development also found that for every dollar invested in the biofuels industry, net general state revenues increase by forty-five cents, residents' personal income increases by $18.40, and economic activity within the state increases by $20.29.

Several papers have attempted to estimate the number of direct and indirect jobs created by the ethanol industry. There is a wide range of estimates for the number of indirect jobs created by the biofuels industry. On the high side, a 2008 report prepared by Urbanchuk for the Renewable Fuels Association (RFA) found that a 50 MGY plant creates 40 direct jobs and 578 indirect jobs and a 100 MGY plant creates 50 direct jobs and 1,087 indirect jobs. On the low end Swenson (2006) found that a 50 MGY plant creates 35 direct jobs and just 75 indirect jobs. The discrepancy is due to differences in assumptions made and consequently the estimated multiplier used. The actual number is likely modest and closer to Swenson's estimate.

Some studies have questioned the cost effectiveness of tax credits given to the biofuels industry to achieve the perceived goals of lowering greenhouse gas emissions and reducing the nation's dependence on foreign oil. A 2008 report by Metcalf concluded that, "the cost of reducing carbon dioxide emissions through this subsidy exceeded $1,700 per ton of carbon dioxide avoided in 2006 and the cost of reducing oil consumption over $85 per barrel" (Metcalf, 2008). Further, an update on U.S. biofuel subsidies by Earth Track Inc. in 2007 found that giving tax credits to the industry is an expensive way to achieve the above goals (Koplow, 2007).

V. Motivation for Public Support of Biofuel Production

There are numerous quantifiable direct and indirect benefits of biofuel production in Iowa. The potential of the plants to revitalize rural communities is among them. With many perceived benefits to plant location within a community, states must make substantial offers to attract investors to construct a biofuel plant in a specific area as other states are also competing for the plant. The construction of a plant stimulates economic activity in the area by bringing in outside contractors and creating jobs and demand for local goods and services. After the initial construction phase, communities benefit from the jobs required for operating the plant. These all lead to an increase in retail sales within the community. The local benefits of ethanol plants will be further analyzed in Section X.

Additionally, ethanol and biodiesel production creates strong demand for corn and soybeans, which increases the prices of the commodities, resulting in higher farm income. Also higher commodity prices result in higher land values and rental rates, which benefit land owners but not farm renters. These benefits transcend county lines and aid all corn and soybean farmers. This impact is also analyzed further in Section X.

Originally, an argument for subsidizing biofuel plants was to protect the infant industry. However, there is growing debate about when to consider the industry mature and thus cease public assistance.

Jim Nichols, a former Minnesota state agriculture commissioner said, “There was a time when these [subsidies] were needed, but I think that time has past.” (Star Tribune, 2006) Also, market saturation is increasingly an issue as demand is limited by such factors as a lack of flex-fuel vehicles and a limit of a 10% ethanol blend (E10).

Although beyond the scope of this paper, there has been public support of ethanol because of its presumed environmental benefits. Also, as world demand for oil continues to increase and global supply remains tight, the price of oil will remain high further warranting investment in alternative sources of fuel.

VI. Biofuel Production in Iowa and Neighboring States

Iowa is the top ethanol producing state in terms of both current operating production capacity and current plus under construction/planned capacity. The top five ethanol producing states, in terms of current operating production capacity and their share of U.S. ethanol production, are Iowa (24.9 percent), Nebraska (12.8 percent), Illinois (9.3 percent), South Dakota (8.7 percent) and Minnesota (7.4 percent) (see Table 10). There are 25 states currently producing ethanol (Ethanol Producer Magazine, 2009). The top five states produce 63.1 percent of U.S. ethanol. The total amount of ethanol produced by the top ten states is just short of 84.7 percent. The strong supply orientation of the industry can be seen as it is heavily concentrated in the corn producing states of the Midwest. Further, a linear relationship exists between a state’s total ethanol production capacity and the amount of corn produced in that state (see Figure 6).

Iowa is second to Texas in biodiesel in terms of current operating production capacity with 245 MGY, or 10.1 percent of U.S. production. Texas (14.5 percent), Illinois (7.8 percent), Missouri (6.3 percent) and Washington (5.8 percent) round out the top five states. The top five states produce 44.5 percent of U.S. biodiesel. This share grows to 67.7 percent when the top ten biodiesel producing states are included. There is a greater variety of less centrally located feedstocks available to produce biodiesel than there are for ethanol. Thus, 39 states are currently producing biodiesel and the national production capacity is not geographically clustered (see Table 12).

VII. Biofuel Producers Tax Credit Awards

Both DED and DOT offer financial support to the biofuels industry in Iowa. Both State agencies have provided the Department of Revenue (IDR) with public information on financial awards made to biofuel projects. The information includes the company name, location, production capacity, projected employment, capital structure, incentive program type, and the amount of award for each program. DED also provided IDR with some information on the type and amount of financial support offered by local governments. These local incentive programs include property tax abatements, local bonds and grants, local Tax Increment Financing (TIF), and city loans.

As of December 2008, there were 71 ethanol and biodiesel projects that had entered into contracts with the State of Iowa to receive tax credits. Regarding only tax credits, the State awarded $449 million in total and $6.3 million on average to each project (see Table 13). As a comparison, the average amount of private investment in a biofuel production facility is about $101 million. Therefore, for every public dollar committed, $15.50 of private money has been invested in Iowa.

Of the 71 biofuel production projects receiving public financial support, 55 are ethanol facilities and 16 are biodiesel facilities. In total the Iowa ethanol industry was awarded $411.9 million of public funding, including $405.8 million in State tax credits. The biodiesel industry has been offered $49.3 million of public money, including $43.2 million in State tax credits. The average capital investment in ethanol projects is $122 million compared to $29 million for biodiesel projects. Not surprisingly, ethanol projects are awarded more tax credits, an average of $7.4 million per project, compared to the $2.7 million received by the average biodiesel project.

Table 14 shows tax credit awards by program. EZ and HQJC are the two major programs used by the State to provide public financial support for the biofuel industries. EZ provided $104.2 million and HQJC provided $169.6 million in public support.

Among biofuel projects, ethanol projects on average received substantially larger awards across tax credit programs. For EZ, ethanol projects were offered $5.8 million on average and biodiesel projects received $3.9 million on average. For HQJCP, ethanol projects were awarded $8.1 million on average and biodiesel plants were awarded an average amount of $1.3 million.

Investment Tax Credits and sales and use tax refunds are the two largest components in the tax incentive programs supporting biofuel producers. The Investment Tax Credits can be claimed against corporate income, individual income, franchise and insurance tax liabilities. The sales and use tax refunds reduce state sales and use taxes and local option taxes paid by contractors or subcontractors during construction.

Also, it should be noted that, according to the Iowa Renewable Fuels Association, as many as 17 projects that have received awards may not proceed with their construction plans.

VIII. Biofuel Producers Tax Credit Claims

Biofuel producers are eligible for both sales and use tax refunds and Investment Tax Credits as benefits of the tax incentive programs previously described. Sales and use tax refund claims are made by the producer after the tax has already been paid. In contrast, Investment Tax Credits are claimed against income tax liability. When C-corp buisness structure, the business can claim the tax credit against its corporate income tax liability. Those tax credits that can passthrough to shareholders are claimed by the individual investors on individual income tax returns. The amount of tax credits that can be claimed by an individual shareholder is directly proportional to the fraction of the company that the taxpayer owns.

A. Sales and Use Tax Refund Claims

The first sales and use tax refund issued to an ethanol producer was in 2003 under NJIP. There have been a total of 29 claims by 15 unique ethanol producers amounting to $3.83 million (see Table 15). In 2006 the first sales and use tax refund was issued to a biodiesel producer under the Enterprise Zone Program. Since then, there have been a total of seven sales and use tax refunds issued to four unique producers for a total of $1.72 million (see Table 16).

B. Investment Tax Credit Claims

In 2006, the only year for which credit claim data is currently available, there were 1,823 credits claimed against awards made to biofuel producers (see Table 17). Investment Tax Credits are amortized over five years. Of the investors who claimed credits in 2006, 43 percent had farm income and 99 percent of claimants were Iowa residents. Nonrefundable and refundable credit claims totaled $3.74 million and $230,000, respectively. Investors claimed tax credits on behalf of 18 different producers. The amount and number of credits claimed varied greatly by program. There were 1,326 credits claimed against NJIP awards amounting to $3.1 million. 421 credits were claimed through the EZ program for an additional $637,000. Investors in biofuel producers claimed 62 and 14 credits against awards through NCIP and HQJCP, respectively, for $215,929 and $8,122. The majority of claims were made by investors in ethanol plants. In 2006, these investors accounted for 1,457 (79.2 percent) claims. The likely reason for the small number of HQJCP claims is this is a relatively new program and many of the projects that received tax credit awards under this program have just recently gone into production. Also, some credit claims do not have certificate numbers because either the taxpayer did not attached one to the return or the taxpayer was not issued a certificate number with the credit. In these cases, it is impossible to determine what credit the taxpayer is claiming.

IX. Ownership Structure of Biofuel Production Facilities

Based on the information available through July 1st, 2008, sixty-one companies have invested in 71 biofuel production projects that have been awarded State tax credits in Iowa. Eleven projects are owned by eight C-corporations. Fifty-one projects are owned by limited liability companies (LLCs). There is also one limited partnership (LP), two cooperatives, and two S-corporations[9].

Using IDR data, shareholder information for 28 of the 51 LLCs was collected including some pass-through entities. For a few biofuel producers, some of their pass-through entity shareholders (1st level) are owned by other pass-through entities (2nd level). In extreme cases, there are five 'levels' of pass-through entities in producers' shareholder structures (see Figure 7). Only underlying shareholders are included in the analysis after examining every ownership level. The individual income tax dataset was also used to identify investors with farm income.

Table 18 shows summary statistics of the ownership structure in these 28 LLC producers. The average number of underlying investors is 367. The median number of investors is 167, which implies that a small number of producers have an extraordinarily large number of investors. The company with the largest number of shareholders has 1,533 underlying owners. Furthermore, most shareholders are Iowans, including individuals and corporations, and Iowans also own the majority of the companies. On average, there are 316 Iowa resident shareholders in every company and they own 89 percent of the company. The median number of shareholders who are Iowans is 54, much lower than the average number, but the median percentage of the company owned by Iowans is higher, at 99 percent. Most of the investors are individuals. Of the 367 owners per producer on average, 346 are individual investors, and they own 81 percent of the company.

Because the biofuels industry is one of the most important markets for corn and soybeans, farmers' stakes in biofuel producers were also examined. On average, 169 of the 367 owners of a biofuel company have farm income and they have a 31 percent stake in the company. On median terms, 75 of the 167 owners of a biofuel company have farm income and they own 38 percent of the company.

Investors in biofuel plants are likely to live within a 100 mile radius of the plant. The geographic distribution of investors with and without farm income is indistinguishable as both types of investors are clustered around the plant. Likewise, the tendency of investors to live near the plant is independent of whether it is an ethanol or biodiesel facility (see Figure 8).

X. Beneficiaries of the Biofuel Industry in Iowa

The profits from investing in ethanol production filter through the various layers of beneficiaries starting with the ethanol producers and ending with the land owners. Initially ethanol producers, helped by strong demand for their product as a replacement for MTBE[10] and low corn prices, saw large profits. Until late 2006 there was a surplus of corn and limited ethanol production capacity. In late 2006 the supply of corn became limited due to ethanol production and the price was bid up. This shifted the profits to the corn producers. In response to the high price of their product, farmers expanded corn production which increased demand for inputs such as fertilizer, chemicals, and seed. This shifted profits to the agribusinesses supplying these inputs. Eventually, these companies will respond with higher prices for their products and produce key inputs until profits are zero. When this happens, the profits of the corn ethanol industry will shift to the final limiting resource, land and land

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[9] See appendix A for definition of business organization type and their respective tax treatment.

[10] Methyl Tertiary Butyl Ether (MTBE) was used as a fuel oxygenate that has been linked to water contamination.

owners. If technological advancements in other alternative fuels replace the need for ethanol a similar scenario will play out with producers being the first losers and so on (Hofstrand, 2008). This section provides an analysis of the beneficiaries of the corn ethanol industry in Iowa.

A. The Farm Sector

Part of the rationale for providing tax credits, and other forms of public assistance, to the Iowa ethanol industry is that the benefits derived from the development of this industry flow through to farmers and by extension to their suppliers and to their surrounding communities. Farmers have invested some of this increase in income in new equipment as seen by large increases in depreciation expenses. Between 2006 and 2007, depreciation expenses for corn and soybean farmers increased 45.3 percent. This has benefited firms who supply farm equipment as farmers purchase large farm equipment such as tractors.

Gross farm income for corn and soybean farmers increased 17 percent from 2006 to 2007, the previous five year high for year over year growth was 11 percent from both 2002 to 2003 and 2003 to 2004. Cattle (8 percent), dairy (13 percent) and hog farmers (9 percent) all experienced more modest increases in gross income from 2006 to 2007. High commodity prices increase land values. To this end, cash rental rates increased 9.1 percent (county average) from 2006 to 2007 nearly three times the pervious five year high of 3.5 percent from 2002 to 2003.

The direct impact on increased corn prices from the additional ethanol production induced by state tax credits provided to ethanol producers is analyzed using a two-stage model. The first stage uses an adaptation of Tobin's q to estimate the impact of tax credits on the amount of investment and the ethanol production capacity in Iowa. The second stage employs a model developed by McPhail and Babcock (2008) to estimate the impact of ethanol production capacity on corn prices and farmland value.

The technical details of the models are presented in Appendix B. Estimates from the first stage suggest that if there had not been any tax credits awarded to the ethanol producers, the capital investment would have been reduced by $2.11 billion, which is 38.4 percent of the $5.48 billion of the total investment made by producers in Iowa. More specifically, for 2005 and prior years, it is estimated that the tax credits increased the investment by $645.9 million, or 44.6 percent of the investment made during the period. The 2006 tax credit induced investment was $600.9 million (40.5 percent) of total 2006 investment. The 2007 tax credit induced investment was $858.5 million (37.7 percent) of total 2007 investment.

Without the tax credits, the nameplate capacity of the Iowa ethanol industry would be smaller. The increase in nameplate capacity would have been reduced by an estimated 307 million gallons in 2005, 300 million gallons in 2006, and 332 gallons in 2007. The cumulative capacity loss would have been 307 million gallons in 2005, 607 million gallons in 2006, and 939 million gallons in 2007. By comparison, the total capacity of ethanol production was 13,608 million gallons in the nation and 3,534 million gallons in Iowa by the spring of 2008, according to the Nebraska Energy Office (December, 2008). Therefore, the state tax credits may have induced as much as 25 percent of Iowa ethanol production capacity.

The demand for corn is positively correlated with ethanol production capacity and would thus be lower if production capacity were lower. Consequently, the corn price would have been reduced because of the lower demand. In the second stage, the impacts on corn prices are estimated.

It is shown in Table 19 that the baseline simulated corn prices, which are estimated using the model under the condition that tax credits were awarded, are very close to the actual average corn prices for calendar years 2005-2007. The reduction in ethanol production capacity is estimated in the first stage

Tobin's q model. The non-credit corn prices are the simulated corn prices using the reduced demand for corn from ethanol producers. Without the State tax credits, the corn price per bushel would have been 3 cents lower in 2005, 9 cents lower in 2006, and 17 cents lower in 2007. Assuming that Iowa farmers still produced the same amount of corn, the corn value difference measures the impacts on farmers' revenue from the demand for corn due to ethanol production. The State tax credits increased farm corn production revenue by $64.9 million in 2005, $184.5 million in 2006, and $402.4 million in 2007. By comparison, Iowa corn production revenue was $4.3 billion in 2005, $6.8 billion in 2006, and $11.4 billion in 2007.

Although farmers have seen an increase in income, a direct result of increased corn and soybean prices from the additional demand for the products attributable to biofuels, there has also been an increase in farm expenses, most notably farmland rents, seed, fertilizer and chemicals (see Figure 9). Using the estimated impacts on corn prices due to the State tax credits, the impacts on Iowa farmland cash rental rates and farmland prices are calculated. Du, Hennessy, and Edwards (2007) found that cash rents go up by $79 per acre of cropland for a $1 per bushel increase in corn price.

Using the annual three-month London Interbank Offered Rate (LIBOR) as the interest rate, the affected farmland prices due to the changed farmland rents are presented in Table 20. Land cash rents would have been reduced by $2.37 per acre in 2005, $7.11 per acre in 2006, and $13.43 per acre in 2007, because the lack of State tax credits to ethanol plants would have led to lower corn prices. The estimated Iowa land cash rents would have caused average farmland value per acre to fall by $66.57 (2.3 percent) in 2005, $136.73 (4.3 percent) in 2006, and $253.4 (6.5 percent) in 2007. Total agriculture land value in Iowa would have been reduced by $2.1 billion (2.3 percent), $4.3 billion (4.3 percent), and $8.0 billion (6.5 percent) from 2005 to 2007.

The United States Department of Agriculture (USDA) reported that in 2007 national farm production expenditures surpassed previous record highs due primarily to high fuel prices (USDA, 2008). Table 21 presents the U.S. corn farming production value and input costs from 2001 to 2007. It shows that the benefits of increased corn prices have been partially transferred to farm input suppliers. High fuel prices led to increased costs for transportation, fertilizer, chemicals, and fuel. From 2006 to 2007, the amount of farm expenses categorized as seed for corn and soybean farmers increased 31 percent; far higher than in any of the previous five years. Even more, fertilizer expenses grew 42 percent in the same time period; the previous high year over year change was 18 percent growth from 2004 to 2005. Chemical expenses increased 30 percent from 2006 to 2007, which is much higher than the high of 11 percent from 2002 to 2003. Likewise, livestock farmers have experienced a sharp increase in feed expenses as they use corn for animal feed (see Figure 10). Cattle and cattle feedlot farmers' profits have been squeezed by a 34 and 40 percent increase, respectively, in feed expenses from 2006 to 2007. Feed expenses for hog and pig farmers increased 21 percent over the same period.

B. Direct Employment

As the biofuels industry has grown in Iowa, direct employment by ethanol facilities has also increased (see Figure 11). Employment by Iowa dry mill ethanol producers peaked in December 2007 at 1,156 employees[11]. The largest increase in employment occurred between 2006 and 2007. This coincides with the ethanol explosion when many more plants went into production. Biorefineries also demonstrate increasing returns to labor. Doubling output from 50 MGY to 100 MGY requires increasing labor by approximately 37 percent, from an average of 38 employees to 52.
The average wage of employees in the ethanol industry in the first quarter of 2008 was $52,944.

[11] Note that this number only includes employees at dry mill ethanol plants and thus understates total employment by the ethanol industry in Iowa due to the existence of wet mill plants located within the state.

Direct employment in the Iowa biodiesel industry has also increased substantially since 2005 as more producers began operations (see Figure 12). Employment in the biodiesel industry peaked in July 2007 at 267 employees. In the first quarter of 2008, the average annual wage earned by employees at biodiesel plants was $51,965.

C. Local Communities: Impact on Household Income

Ethanol plants provide direct and indirect benefits to local communities through job creation and increased economic activity within the community. These factors could potentially raise household income for residents. Between 2003 and 2006, nine ethanol plants were constructed in Iowa. Over the same period real household income increased in those nine towns much more than all of Iowa (see Table 22). To determine if this increase is attributable to the construction and operation of ethanol plants, average household income before and after a plant was constructed can be compared. However, factors other than the construction of the plant, such as general economic growth in the state, may explain the increase in real household income. Thus, to determine if ethanol plants can explain income growth it is necessary to compare the change in household income of taxpayers in towns where an ethanol plant was constructed, referred to as the treatment group, to the change in household income of similar taxpayers who live in towns in which an ethanol plant was not constructed, referred to as the control group[12].

First, it is necessary to identify the two groups. Using data from individual tax returns in tax years 2003 and 2006, the treatment group is constructed with all taxpayers reporting the name of the nine towns with ethanol plants (see Table 23). Two methods were used to construct the control group of taxpayers. The first chose the control by matching on an individual basis, while the second matched on a town level.

Under the first approach, the treatment group and eligible control group were limited to residents who lived in the same town in both 2003 and 2006[13]. This was done to control for the possibility that people moved in and/or out of a town in response to an ethanol plant being constructed and also to control for unobserved differences between individuals within the same groups in both years. The demographics of the population is not homogenous throughout the state, conversely it varies by region. Thus, the state is divided into four geographic regions Northeast, Northwest, Southeast and Southwest (see Figure 13). Residents living in the southwest quadrant of the state were excluded from the potential control group because there were no ethanol plants constructed in this region between 2003 and 2006, thus no taxpayers in the treatment group live in that quadrant. Individual taxpayers living in towns categorized as the treatment group were matched to taxpayers in the potential control group (all taxpayers who did not move between 2003 and 2006 and excluding residents in the southwest quadrant of the state) using the propensity score matching method to form the control group[14].

Under the second approach, the control group was formed by matching each town in the treatment to a similar town without an ethanol plant, based on the following observable characteristics: population density, state quadrant, number of housing units, percent of taxpayers who itemize deductions,

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[12] This technique is referred to as a difference-in-difference model. See Card and Krueger 1994.

[13] This approach also resulted in the exclusion of taxpayers who were the primary earner in 2003 but the secondary earner in 2006 and vice versa as well as those residents who did not file a tax return in either 2003 or 2006.

[14] Propensity score matching is a statistical technique used in non-experimental situations to correct for selection bias. Matching is based on observable characteristics that vary between the treatment group and the potential control group. A probit model is used to calculate propensity scores and then taxpayers in towns in the treatment group are matched to taxpayers in the potential control group based on their propensity scores. See Rosenbaum and Rubin 1985.

percent of taxpayers who have farm income, percent of taxpayer households that are dual earners, and percent of taxpayers who are married (see Table 24).

Under both approaches, once the control group was constructed a difference-in-difference model was used to determine if there is a statistically significant effect on household income by having an ethanol plant in a community. Difference-in-difference models are used extensively to determine the effects of a treatment by measuring how a change that occurs only for the treatment group over time impacts the variable of interest differently compared to the change in that same variable for the control. Thus, the model tests if the increase in real household income for the treatment group between 2003 and 2006 is statistically different from any change in real household income observed in the control group over the same period.

Consistent with a difference-in-difference model a time indicator is included, where time equals one in 2006. This variable controls for any general changes in economic growth between the two periods that might affect the treatment and control groups equally. An ethanol production facility indicator, which is equal to one for all taxpayers living in towns that had an ethanol plant constructed between 2003 and 2006, is included to control for any fixed differences in average household income between the control and treatment groups. The interaction term, which is the product of the ethanol indicator and the 2006 indicator, is of most interest in the model as it shows the effect of an ethanol plant on average household income after controlling for other variables.

Other variables are necessary to explain variation in household income among taxpayers. Unfortunately, tax returns provide limited demographic information and lack desirable variables, such as education level and sex. Geographic region indicators are used, where one indicates a taxpayer resides in that region, to control for regional differences.[15] Marital status and number of members of the household that earn income are both correlated with real household income and thus included in the model as the indicator variables married and dual earner. Whether an individual itemizes deductions is positively correlated with household income and thus is included in the model where itemizer equals one indicates that a taxpayer itemized deductions in that tax year. An indicator for farmer is included in the model since farmers should benefit more directly from the operation of an ethanol plant.[16] As with any model on income or wages, age and age squared are included where it is expected that wages increase at a decreasing rate with age. There is large variation in real household income; These income-outliers significantly affected the results. Consequently, households with incomes in the first and ninety-ninth percentile are excluded from the sample. The summary statistics for the treatment and control groups under the two techniques for constructing the control are shown in Tables 24 and 25. The large difference in number of taxpayers in the control and treatment group using the matching by towns method is a result of a couple of large cities being included in the treatment group and a lack of similarly sized cities in the potential control group.

The results from these two methods differed. Matching individuals in the treatment group on an individual basis to form the control group yielded the following results (see Tables 26). The ethanol indicator is negative and statistically significant indicating that taxpayers in towns with ethanol plants have on average $3,716 less household income than taxpayers living in towns without an ethanol plant. The interaction term is not statistically significant which suggests that there is no measurable effect on local households' income when an ethanol plant is constructed in a particular community.

Different results are obtained when taxpayers within entire towns are selected to be in the control group based on observable town characteristics (see Table 27). The ethanol production facility indicator is less significant than in the previous method which suggests that taxpayers in towns in the

[15] In the model the northwest indicator is omitted to avoid model over identification.
[16] Based on reporting farm income on the Schedule F.

treatment and control group have on average a more similar real household income prior to the ethanol plants construction. The interaction term, which represents the effect of having an ethanol plant within a town on average household income, is positive and statistically significant.[17] The coefficient of 822 implies that an ethanol plant near a town increases the average real household income of its residents by $822.

One possible explanation for the difference in results is the effectiveness of the constructed control group to serve as a good control. The summary statistics presented in Tables 24 and 25 and the magnitude and statistical significance of the coefficient for the ethanol indicator suggest that the control group selected using the town matching method is better than the control group selected using the propensity score approach which matched individual taxpayers. Thus, noise in the individual matching method model may have influenced the results.

D. Local Communities: Impact on Retail Sales

A perceived local benefit of ethanol plants is an increase in general economic activity in the surrounding communities. This indirect benefit should be quantifiable by measuring retail sales. Retail sales data is available from the IDR sales tax database at the county and town level. For this purpose, the data are limited to businesses in the retail trade category, which includes furniture, clothing, grocery stores, and specialty retailers, and the accommodations and food service category, which includes hotels, motels, bars, and restaurants (see Table 28). Sales for stores within the retail trade category should increase if general economic activity increases. It is hypothesized that sales for businesses within the accommodations and food service category might increase during the construction phase since specialized construction workers travel around the country building ethanol plants.

A map showing the percentage change in retail sales from 2003 to 2007 does not indicate a very strong correlation between counties that had an ethanol plant constructed between 2003 and 2007 and growth in retail sales (see Figure 14). Two counties had changes in retail sales between negative five and negative fourteen percent, four counties had between a negative four and positive five percent change, two counties had between a six and fifteen percent increase and one county's real retail sales increased by more than fifteen percent. One possible explanation for this finding, is that ethanol plants are often located on the border of two counties thus the local benefits transcend county lines. Also, local benefits may be limited to communities located in close proximity to the plant hence not benefiting the county as a whole.

To investigate this hypothesis a difference-in-differences model is used in a manner similar to that in the section estimating the effect of the existence of an ethanol plant on local household income. Here the effect of the existence of an ethanol plant on retail sales is estimated. The same towns are selected to be in the control and treatment groups as before. It is found that the location of an ethanol plant does not significantly effect growth in retail sales at the town level (see Table 29). It is likely that retail sales for businesses within the accommodations and food service category experienced a boom during the construction phase but this increase was only temporary.

It is possible that although ethanol production does significantly increase corn and land prices much of the benefits are reduced by increased input prices and other expenses. Consequently, little of the increase in farm income flow through to local communities resulting in a minimal increase in real household income and no change in retail sales.

[17] To test the robustness of this result, the model was run with the "second best" control group and once again the interaction term was positive and statistically significant.

XI. Future of the Biofuel Industry in Iowa

To meet federal renewable fuel mandates the nation must move beyond corn based ethanol production. Broin, a leader in ethanol production, received a federal government grant of up to $80 million to build a plant in Emmetsburg that can produce ethanol in the traditional way, from the starch in the kernel, but also from the kernel hulls and corn cobs. However, additional funding is necessary including subsidies to compensate farmers for harvesting and storing the cobs (DSM Register, 2007). Capacity for this plant is estimated to be 125 MGY with up to one quarter of the ethanol being produced from second generation sources such as kernel hulls and cobs. The amount of ethanol that Iowa could produce using biomass is constrained by land and ranges from 420 MGY if only twenty-five percent of the State's corn stover is used to 2 billion gallons per year if a very significant amount of the state's land is planted with perennial crops such as switchgrass, which is native to Iowa[18] (DSM Register, 2007). Because the technology for commercial scale cellulosic ethanol plants has been slow to develop the U.S. is expected to fall short of the Renewable Fuels Standard mandate of 36 billion gallons of biofuels by 2022.

XII. Conclusion

Biofuel production capacity in Iowa has increased steadily in recent years, from about 500 million gallons in 2000 to more than 3 billion gallons in 2008. Iowa and most of its neighboring states have general Investment Tax Credits available to all qualifying industries including the biofuels industry. This study found evidence that the Investment Tax Credits offered through the Economic Development incentive programs used by biofuel producers in Iowa had a significant positive impact on the increase in production capacity.

Beneficiaries of the ethanol industry include investors, suppliers of the industry's key inputs, employees at the plants, farmers via higher crop prices, and local communities. Direct benefits include job creation and returns to investors, the majority of whom are Iowa residents. Local communities where the plants are located also benefit from the spill-over effects of ethanol production. It is found that the location of a plant within a community leads to a small increase in average household income. However, the existence of an ethanol plant does not have a significant effect on retail sales within a town or county. This is likely because the increase in household income is relatively small and thus there is not a substantial wealth effect that would induce additional consumer spending.

Evidence is also found that tax credits increase ethanol production capacity which leads to increased demand for corn. Corn prices and farm income rise due to the induced increase in demand. However, increased demand for corn also drives farm input costs higher, such as seed, fertilizer, heavy farm equipment, and farmland. The higher input costs and farmland cash rents take a large portion of increased farm income out of Iowa farmers' pockets. Some of this money stays in Iowa because some suppliers are Iowa based companies. Consequently, some of the benefits generated from the State tax credits awarded to biofuel industries have gone to Iowa based agricultural related companies which produce farming inputs. However, some benefits are transferred to companies outside of Iowa in the supply chain.

This evaluation study was limited by access to only one year (2006) of tax credit claim data. Furthermore, 2007 ownership data for all plants is not yet available. Future research should investigate potential changes in ownership after the 2006 boom and a predicted increase in tax credit claims as more plants came online and became profitable during 2007 providing income to claim the credits against.

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[18] Corn stover is the leaves, cobs and husks that remain in the field after the corn is harvested.

Given current economic conditions and high volatility in commodity markets, new investment in the corn ethanol industry is unlikely. Federal support of the biofuels industry is now largely focused on second generation fuels.

Finally, the Investment Tax Credit is one of the public incentives used to promote business investments and employment. Although this study only deals with the biofuel production industry, it provides a comprehensive framework to examine the economic impacts of other Investment Tax Credits in the future.

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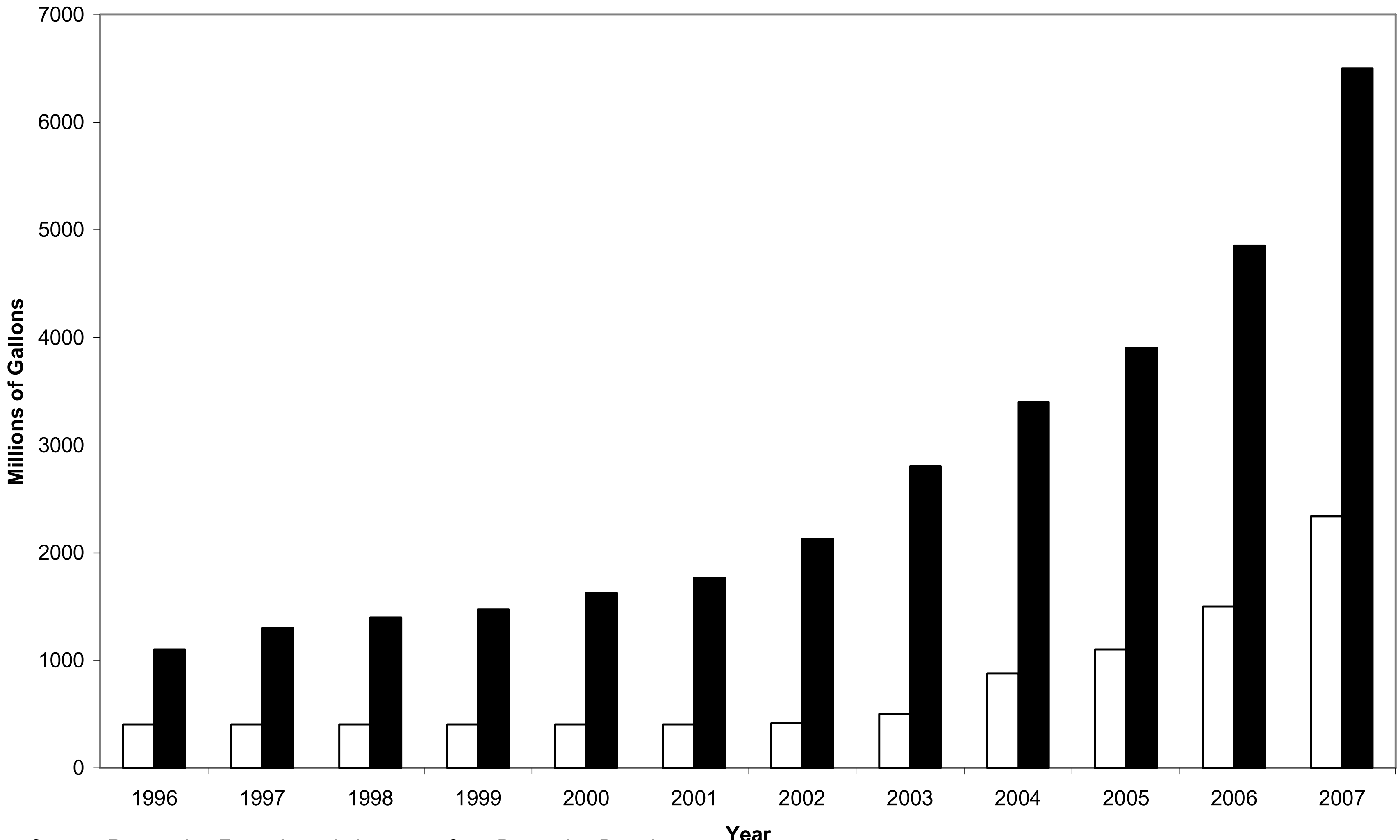
Iowa Department of Economic Development

Iowa Department of Transportation

Iowa’s Tax Incentive Programs Used by Biofuel Producers
Tax Credits Study

Tables and Figures

Figure 1. U.S. and Iowa Ethanol Production Capacity



Source: Renewable Fuels Association, Iowa Corn Promotion Board

Table 1. Iowa Ethanol Plants

Company	Location	Feedstock	MGY	Start Date
Status: Operational				
Quad County Corn Processors	Galva	Corn	30	February-02
Midwest Grain Processors LLC	Lakota	Corn	100	November-02
Little Sioux Corn Processors LP	Marcus	Corn	92	April-03
Poet Biorefining-Hanlontown	Hanlontown	Corn	55	February-04
Poet Biorefining-Ashton	Ashton	Corn	55	March-04
Big River Resources LLC	West Burlington	Corn	92	April-04
Hawkeye Renewables	Iowa Falls	Corn	100	November-04
Golden Grain Energy LLC	Mason City	Corn	80	December-04
Poet Biorefining-Emmetsburg	Emmetsburg	Corn	50	April-05
Poet Biorefining-Coon Rapids	Coon Rapids	Corn	54	June-05
Amaizing Energy LLC	Denison	Corn	55	September-05
VeraSun Fort Dodge LLC	Fort Dodge	Corn	110	October-05
Corn LP	Goldfield	Corn	50	December-05
Poet Biorefining-Jewell	Jewell	Corn	60	March-06
Poet Biorefining-Corning	Corning	Corn	60	May-06
Lincolnway Energy LLC	Nevada	Corn	50	May-06
Hawkeye Renewables	Fairbank	Corn	115	June-06
Poet Biorefining-Gowrie	Gowrie	Corn	60	summer 2006
VeraSun Charles City LLC	Charles City	Corn	110	April-07
Green Plains Renewable Energy Inc.	Shenandoah	Corn	50	June-07
Superior Ethanol LLC	Superior	Corn	50	November-07
Absolute Energy LLC	St. Ansgar	Corn	100	February-08
VeraSun Hartley LLC	Hartley	Corn	110	August-08
Penford Products Corp.	Cedar Rapids	Corn	37	October-08
Hawkeye Renewables	Menlo	Corn	110	October-08
Hawkeye Renewables	Shell Rock	Corn	110	October-08
Cargill Inc.	Eddyville	Corn	35	N/A
Platinum Ethanol LLC	Arthur	Corn	110	N/A
Grain Processing Corp.	Muscatine	Corn	10	N/A
Siouxland Energy & Livestock Co-op	Sioux Center	Corn	55	N/A
Permeate Refining Inc.	Hopkinton	Sugars & Starches	1.5	N/A
Archer Daniels Midland Co.	Clinton	Corn	237	N/A
Archer Daniels Midland Co.	Cedar Rapids	Corn	420	N/A
Subtotal:	Number of Plants: 33		Total Capacity: 2,813.5	
Status: Not Producing				
Manildra Ethanol Corp.	Hamburg	Corn / Wheat Starch	8	N/A
VeraSun Dyersville LLC	Dyersville	Corn	110	N/A
VeraSun Albert City LLC	Albert City	Corn	100	November-06
Pine Lake Corn Processors LP	Steamboat Rock	Corn	20	March-05
Subtotal:	Number of Plants: 4		Total Capacity: 238	
Status: Construction				
Homeland Energy Solutions LLC	Lawler	Corn	100	
Archer Daniels Midland Co.	Cedar Rapids	Corn	275	
Southwest Iowa Renewable Energy LLC	Council Bluffs	Corn	110	
Plymouth Energy LLC	Merrill	Corn	50	
Subtotal:	Number of Plants: 4		Total Capacity: 535	

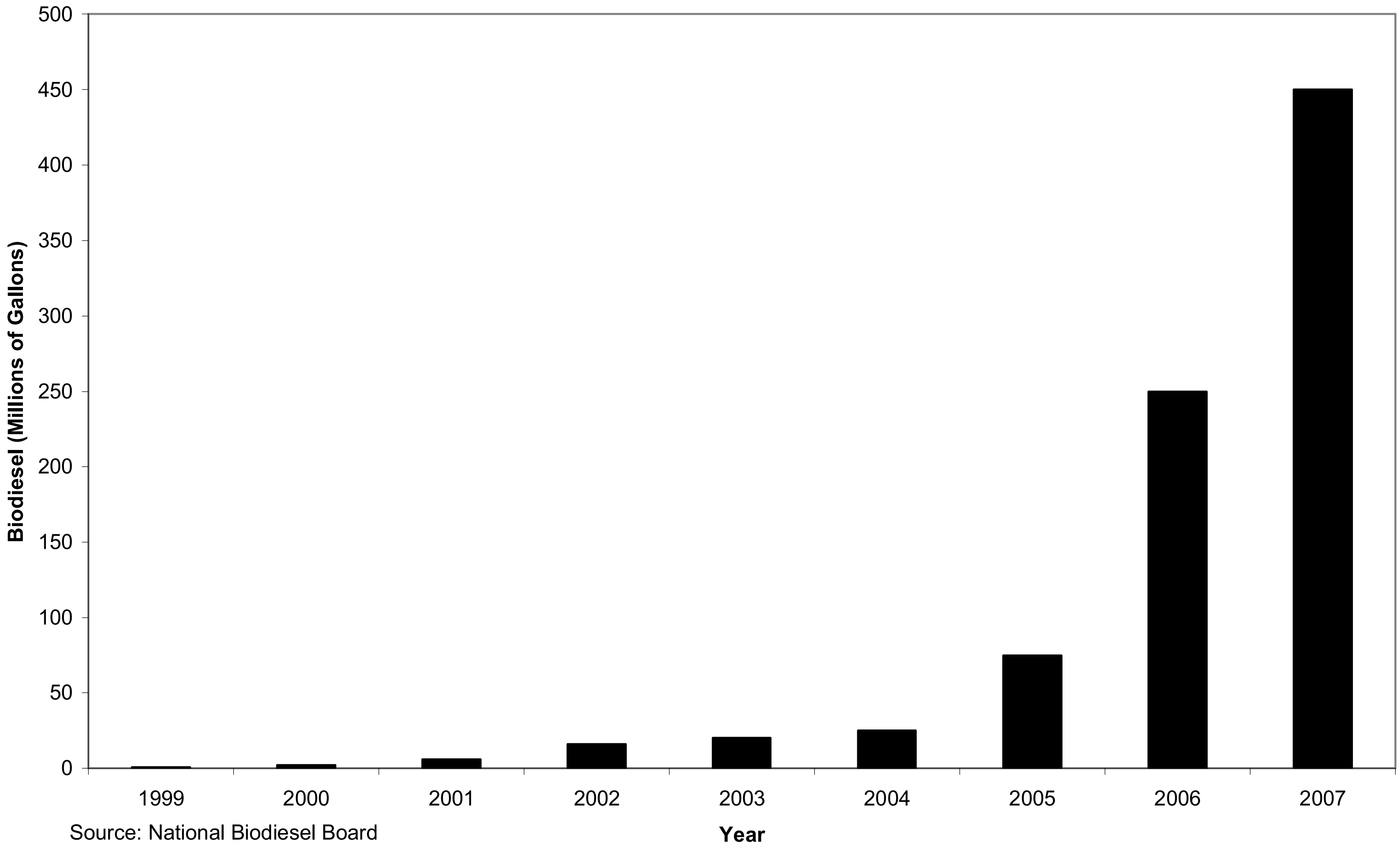
Source: Ethanol Producer Magazine
Updated: Jan. 5, 2009

Table 2. Iowa Biodiesel Plants

Company	Location	Feedstock	MGY	Start Date
Status: Operational				
Ag Processing Inc.	Sergeant Bluff	soy oil	30	September-96
Cargill Inc.	Iowa Falls	soy oil	37.5	May-06
Western Iowa Energy LLC	Wall Lake	multi-feedstock	30	June-06
Tri-City Energy	Keokuk	multi-feedstock	5	November-06
Riksch Biofuels	Crawfordsville	multi-feedstock	9	February-07
Sioux Biochemical Inc.	Sioux Center	corn oil	1.5	March-07
Freedom Fuels LLC	Mason City	soy oil	30	March-07
Central Iowa Energy LLC	Newton	multi-feedstock	30	April-07
Western Dubuque Biodiesel	Farley	Vegetable Oils	30	June-07
Iowa Renewable Energy LLC	Washington	animal fats/vegetable	30	July-07
REG Ralston LLC	Ralston	vegetable oils	12	N/A
Subtotal: Number of Plants: 11		Total Capacity: 245		
Status: Not Producing				
East Fork Biodiesel LLC	Algona	soy oil	60	November-07
Soy Energy LLC	Marcus	multi-feedstock	15	N/A
Nova Biofuels Clinton County	Clinton	multi-feedstock	10	September-06
Soy Solutions	Milford	soy oil	1.5	N/A
Subtotal: Number of Plants: 4		Total Capacity: 86.5		
Status: Under Construction				
Maple River Energy	Galva	corn oil/soy oil	5	
Subtotal: Number of Plants: 1		Total Capacity: 5		

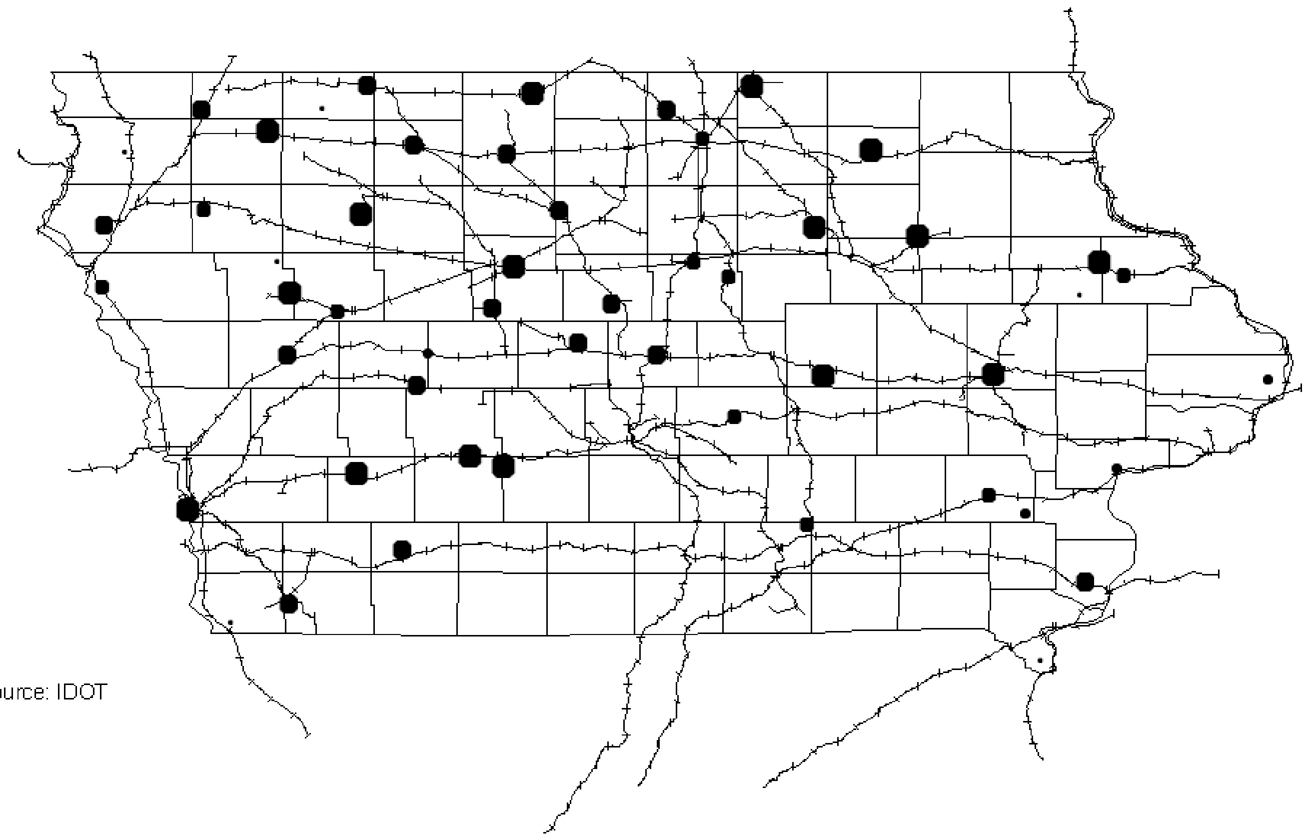
Source: Biodiesel Producer Magazine
Updated: Jan 2, 2009

Figure 2. U.S. Biodiesel Production Capacity



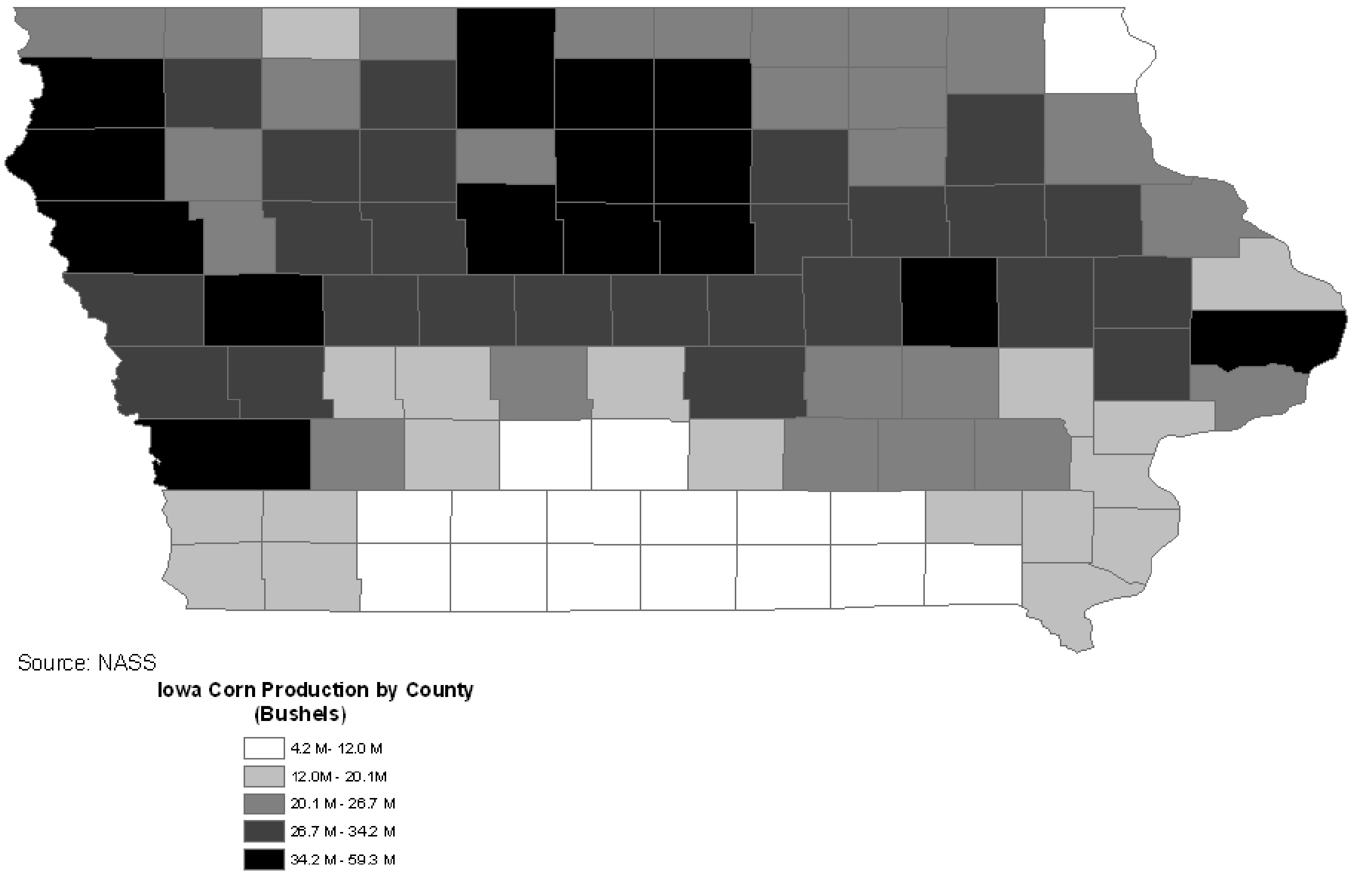
Source: National Biodiesel Board

Figure 3. Biofuel Production Facilities and Railroads in Iowa



Source: IDOT

Figure 4. Quintiles of 2007 Iowa Corn Production by County



Source: NASS

Table 3. Railroad Revolving Loan and Grant Program Awards to Biofuel Producers

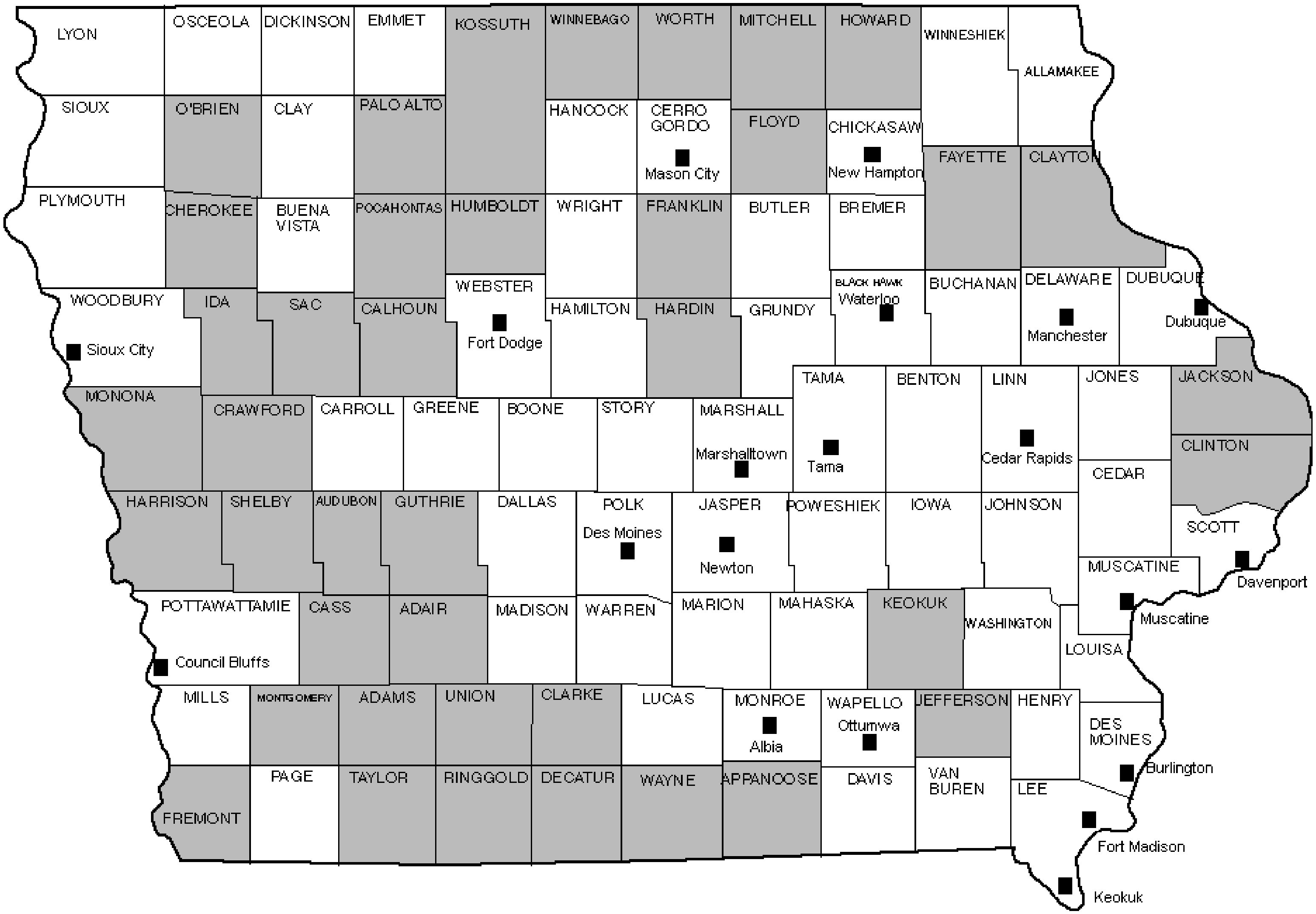
Applicant	Grant	Loan	Total	Date of Award
Absolute Energy	$246,000	$254,000	$500,000	Jun-2006
Alternate Energy Sources	$144,500	$94,500	$239,000	Dec-2006
Big River Resources	$75,000	$0	$75,000	Oct-2007
Green Plains Renewable	$126,000	$154,000	$280,000	Jun-2006
Homeland Energy	$0	$25,000	$25,000	Oct-2007
Iowa Renewable Energy	$168,000	$132,000	$300,000	Jun-2006
Oregon Trail Energy	$75,000	$0	$75,000	Oct-2007
Praire Creek Ethanol	$75,000	$0	$75,000	Oct-2007
Raccoon Valley Biodiesel	$50,000	$0	$50,000	Oct-2007
Southern Iowa Bio	$100,000	$150,000	$250,000	Dec-2006
Unity Ethanol-Cedar River	$0	$270,000	$270,000	Oct-2007
Unity Ethanol-Ottumwa	$159,000	$111,000	$270,000	Oct-2007
Total:	$1,218,500	$1,190,500	$2,409,000	

Source: Iowa Department of Transportation
Note: Not all projects receiving awards proceeded with construction

Table 4. Tax Incentive Program Requirements

	Program			
Requirements	**EZ**	**NJIP**	**NCIP**	**HQJCP**
Minimum Capital Investment	$500,000	$12,100,000	$1,000,000	None
Required Job Creation	At least 10 full-time, project related jobs maintained for at least 10 years.	At least 50 jobs within 5 years.	No set requirement, award depends on number of jobs.	No set requirement, award depends on number of jobs.
Required Employee Benefits	Provide and pay at least 80 percent of the costs of a standard employee medical and dental insurance plan for all full-time employees.	Provide and pay at least 80 percent of the costs of a standard employee medical and dental insurance plan for all full-time employees.	Provide and pay at least 80 percent of the costs of a standard employee medical and dental insurance plan for all full-time employees.	See additonal Criteria.
Required Wages	Average wage must meet or exceed 90 percent of the average county or regional wage, whichever is lower.	Median starting wage of 130 percent of the average county wage or an hourly wage of $13.35, in CY 2005, whichever is higher.	Starting wage must be at least the county average wage.	Starting wage, including certain benefits, must be at least 130 percent of the average county wage.
Business Type Restrictions	Business cannot be a retail establishment or a buisness whose entrance is limited by cover charge or membership fee.	Business cannot be a retail establishment.	Business cannot be a retail establishment.	No restrictions.
Other Restrictions	Business must not close or significantly reduce operations elsewhere in Iowa in order to relocate the operation to the propsed community.	Business must not close or significantly reduce operations elsewhere in Iowa in order to relocate the operation to the propsed community.	Business must not close or significantly reduce operations elsewhere in Iowa in order to relocate the operation to the propsed community.	No restrictions.
Additional Requirements	Must be located in a certified Enterprise Zone.	Company must meet at least three of the additioanl criteria listed below:	None	Company must meet at least four of the additional criteria listed below:
Additional Criteria		Offer a pension or profit-sharing plan.		Offer a pension or profit-sharing plan
		Produce/manufacture value-added goods or services or belong to one of Iowa's "target" business segments: value-added agricultural producets; insurance, financial services or telecommunications; plastics; metals; printing, paper or packaging products; pharmaceuticals; software development; instruments, measuring devices and medical instruments; and recycling and waste management.		Produce/manufacture value-added goods or services or belong to one of Iowa's "target" business segments: value-added agricultural producets; insurance, financial services or telecommunications; plastics; metals; printing, paper or packaging products; pharmaceuticals; software development; instruments, measuring devices and medical instruments; and recycling and waste management
		Make daycare services available.		Make daycare services available
		Annually invest no less than 1 percent of the Iowa facility's pretax profits in research and devlopment.		Annually invest no less than 1 percent of the Iowa facility's pretax profits in research and devlopment
		Have a productivity and safety improvement program in place.		Have a productivity and safety improvement program in place
		Annually invest no less than 1 percent of the Iowa facility's pretax profits in worker training and skills enhancement.		Annually invest no less than 1 percent of the Iowa facility's pretax profits in worker training and skills enhancement
		Occupy an exisiting vacant facility of at least 20,000 square feet.		Occupy an exisiting vacant facility of at least 20,000 square feet
				Provide and pay at least 80 percent of the cots or a standard employee medical and dental insurance plan for all full-time employees

Figure 5. Iowa Counties and Cities with Certified Enterprise Zones



Source: IDED (Updated April 14, 2008)
Note: This map identifies those Iowa cities and counties (shaded in gray) that have one or more certified EZ within their Jurisdictions.

Table 5. Tax Incentive Program Benefits

Benefits	Program			
	EZ	NJIP	NCIP	HQJCP
Property Tax Exemption	Yes, up to 10 years.	Yes, up to 20 years.	No	Yes, with a minimum $10,000,000 qualifying investment, up to 20 years.
Supplemental 260E	Yes	Yes	No	No
Housing Assistance Credit	Yes, but only if supplemental 260E not taken.	No	No	No
Sales and Use Tax Refund	Yes	Yes	Yes	Yes
Investment Tax Credit	Up to 10 percent of the qualifying capital investment, carry forward seven years or until depleted; for projects approved on or after July 1, 2005, must be amortized over a five year period	Up to 10 percent of qualifying capital investment, seven year carry forward.	Up to 5 percent of qualifying capital investment, dependent on number and type of new jobs created, seven year carry forward.	Up to 10 percent of qualifying capital investment, dependent on number of new jobs
Supplemental Research Activities Credit	Yes, up to 10 years.	Yes, up to 10 years.	Yes, up to 10 years.	Yes, with $500,000 qualifying investment, up to 10 years.

Source: IDED

Table 6. HQJCP Capital Investment and Job Creation Program Requirements and Benefits

Amount of Qualifying Investment	Number of Jobs Created with a Starting Wage Including Certain Employee Benefits Equal to 130% of the Average County Wage				
	No Jobs*	5-Jan	10-Jun	15-Nov	16+
Less than $100,000	Up to 1% ITC	Up to 2% ITC	Up to 3% ITC	Up to 4% ITC	Up to 5% ITC
$100,000 - $499,999	Up to 1% ITC Sales Tax Refund	Up to 2% ITC Sales Tax Refund	Up to 3% ITC Sales Tax Refund	Up to 4% ITC Sales Tax Refund	Up to 5% ITC Sales Tax Refund
$500,000 +	Up to 1% ITC Sales Tax Refund Supplemental Research Activities Tax Credit	Up to 2% ITC Sales Tax Refund Supplemental Research Activities Tax Credit	Up to 3% ITC Sales Tax Refund Supplemental Research Activities Tax Credit	Up to 4% ITC Sales Tax Refund Supplemental Research Activities Tax Credit	Up to 5% ITC Sales Tax Refund Supplemental Research Activities Tax Credit

* Modernization or Retention Projects Only

Amount of Qualifying Investment	Number of Jobs Created with a Starting Wage Including Certain Employee Benefits Equal to 160% of the Average County Wage				
	21-30	31-40	41-50	51-60	61+
$10,000,000 or More	Up to 6% ITC Sales Tax Refund Supplemental Research Activities Tax Credit Property Tax Exemption	Up to 7% ITC Sales Tax Refund Supplemental Research Activities Tax Credit Property Tax Exemption	Up to 8% ITC Sales Tax Refund Supplemental Research Activities Tax Credit Property Tax Exemption	Up to 9% ITC Sales Tax Refund Supplemental Research Activities Tax Credit Property Tax Exemption	Up to 10% ITC Sales Tax Refund Supplemental Research Activities Tax Credit Property Tax Exemption

Source: IDED

Table 7. Summary of Biofuel Production Tax Credits and Incentives by State

State	Tax Credit		Other Incentives	
	investment	output	investment	output
Federal		Yes		
Arkansas			Yes	Yes
Connecticut			Yes	Yes
Florida	Yes			Yes
Hawaii	Yes	Yes		
Indiana		Yes		
Kansas				Yes
Kentucky		Yes	Yes	
Louisiana			Yes	
Maryland		Yes		
Minnesota		Yes		
Missouri				Yes
Mississippi				Yes
Montana	Yes	Yes	Yes	
North Carolina	Yes	Yes		
North Dakota	Yes		Yes	Yes
Nebraska	Yes	Yes		
New Mexico				Yes
New York		Yes		
Oklahoma		Yes		
Oregon	Yes		Yes	
South Carolina	Yes	Yes		
South Dakota		Yes	Yes	
Texas				Yes
Virginia		Yes		Yes
Wyoming		Yes		

Source: U.S. Department of Energy

Table 8. State Comparison of Biofuel Investment Tax Credits

State	Program	Tax Type	Rate	Cap	Expiration Date
Florida	Hydrogen and Biofuels Investment Tax Credit	Sales and use tax credit for investment in the production, storage, and distribution of biodiesel and ethanol.	75%	$6.5 million in each fiscal year for all taxpayers	2010
Hawaii	Ethanol Facility Tax Credit	Income tax credit for investment in production facility	Lessor of 30% and a cap which ranges from $150,000 to $4.5 million	Ranges from $150,000 to $4.5 million depending on the capacity of the facility	2017
Montana	Biodiesel Production Facility Tax Credit	Income tax credit for the cost of the construction and equipping of a facility to be used for biodiesel or bio-lubricant production.	15%	None	2015
Nebraska	Biodiesel Production Investment Tax Credit	Income tax credit for amount invested in facility	30%	$250,000 per facility	2015
North Carolina	Renewable Energy Property Tax Credit	For the cost of the construction, purchase, or lease of renewable energy property.	35%	$2,500,000 per installation	2011
	Alternative Fuel Production Tax Credit	For the cost of the construction and equipping of a facility to be used for biodiesel production.	25%, 35% if any taxpayer invests at least $400,000,000 in three or more commercial facilities.	None	2011
North Dakota	Biodiesel Production Equipment Tax Credit	Income tax credit, for the cost of equipment.	10%	For any taxpayer, $250,000 cumulative amount of credits for all taxable years	No
Oregon	Alternative Fuel Production Facility and Fueling Infrastructure Tax Credit	Certified cost of production constructing facility and costs for constructing or installing fueling infrastructure	50%	$20 million per production project,	2015
South Carolina	Biofuels Production Facility Tax Credit	Cost of constructing or renovating.	25%	None	No

Source: US Department of Energy

Table 9. Federal and State Comparison of Biofuel Production Tax Credits

State	Program	Rate	Cap	Expiration Date
Federal	Small Agri-Biodiesel Producer Credit	$0.10 per gallon	15 million gallons	2009
	Small Ethanol Producer Credit	$0.10 per gallon	15 million gallons	2010
Hawaii	Ethanol Production Incentive	30% of nameplate capacity	40 million gallons per year	2017
Indiana	Ethanol Production Tax Credit	$0.125 per gallon	To a single taxpayer: $2 million between 40 and 60 MGY of grain ethanol, $3 million greater than 60 MGY of grain ethanol and $20 million atleast 20 MGY cellulosic ethanol	No
	Biodiesel Production Tax Credit	$1.00 per gallon	To a single taxpayer: $3 million for all taxable years, $5 million for some applicants	No
Kentucky	Biodiesel Production and Blending Tax Credit	$1.00 per gallon	$5 million per year before 2009, $10 million per year after 2009.	No
	Ethanol Production Tax Credit	$1.00 per gallon	$1,500,000 per year before 2008, $5 million per year after 2008.	No
Maryland	Biofuels Production Credits	$0.20 per gallon of ethanol produced from small grains, $0.05 per gallon of ethanol produced from other agricultural products.	15 million gallons per CY of ethanol, of which at least 10 million gallons must be produced from small grains.	2017
		$0.20 per gallon of biodiesel produced from soybean oil , $0.05 per gallon for biodiesel produced from other feedstocks.	5 million gallons per CY of biodiesel, of which at least 2 million gallons must be from soybean oil.	2017
Minnesota	Ethanol Production Incentive	$0.20 per gallon (0.13 for 2004-2007)	$3 million to any one producer annually	2010
Montana	Ethanol Production Incentive	$0.20 per gallon		2010
	Biodiesel Production Incentive	$0.10 per gallon		2010
Nebraska	Credit for the Production of Ethanol	18 cents per gallon of new production for 96 months	May not be claimed beyond 2012	2012
North Carolina	Biodiesel Production Tax Credit	equal to the per gallon excise tax the producer paid in accordance with the motor fuel excise tax rate.	$500,000 for single provider	2010
New York	Biofuel Production Tax Credit	$0.15 per gallon	$2.5 million per taxpayer per taxable year, and available for no more than four consecutive taxable years per production facility	No
Oklahoma	Ethanol Production Tax Credit	$0.20 per gallon before 2013, $0.075 per gallon after 2013	60 months before 2013, 36 consecutive months after 2013	2013
	Biodiesel Production Facility Tax Credit	$0.20 per gallon before 2013, $0.075 per gallon after 2013	60 months before 2013, 36 consecutive months after 2013	2013
South Carolina	Biofuels Production Tax Credit	$0.20 per gallon for Corn-based ethanol and soy-based biodiesel , $0.30 per gallon tax credit for other feedstocks	60 months	2014
South Dakota	Ethanol Production Incentive	$0.20 per gallon	Cumulative annual production incentives paid out may not exceed $7 million.	No
Virginia	Biodiesel Producers Tax Credit	$0.01 per gallon	$5,000 annually , nonrefundable, transferrable	No
Wyoming	Ethanol Motor Fuel Production Tax Credit	$0.40 per gallon	$4,000,000 per year for all, $2,000,000 per year for any individual	2009

Source: US Department of Energy

Table 10. Ethanol Production by State

Rank	State	Ethanol Production Capacity (MGY)	Percent of National Capacity	Number of Plants
1	Iowa	2813.5	24.95%	33
2	Nebraska	1438	12.75%	23
3	Illinois	1054	9.35%	11
4	South Dakota	977	8.66%	15
5	Minnesota	837	7.42%	18
6	Indiana	806	7.15%	11
7	Wisconsin	534	4.74%	9
8	Kansas	442.5	3.92%	12
9	Ohio	412	3.65%	6
10	Texas	240	2.13%	3
11	North Dakota	238	2.11%	4
12	California	226	2.00%	7
13	Michigan	212	1.88%	4
14	Missouri	191	1.69%	5
15	Tennessee	160	1.42%	2
16	New York	150	1.33%	2
17	Oregon	143	1.27%	2
18	Colorado	138	1.22%	5
19	Georgia	100	0.89%	1
20	Arizona	55	0.49%	1
21	Idaho	55	0.49%	2
22	Kentucky	37	0.33%	2
23	Wyoming	13.5	0.12%	2
24	Oklahoma	2	0.02%	1
25	Louisiana	1.4	0.01%	1
Totals:		11,276	100.00%	182

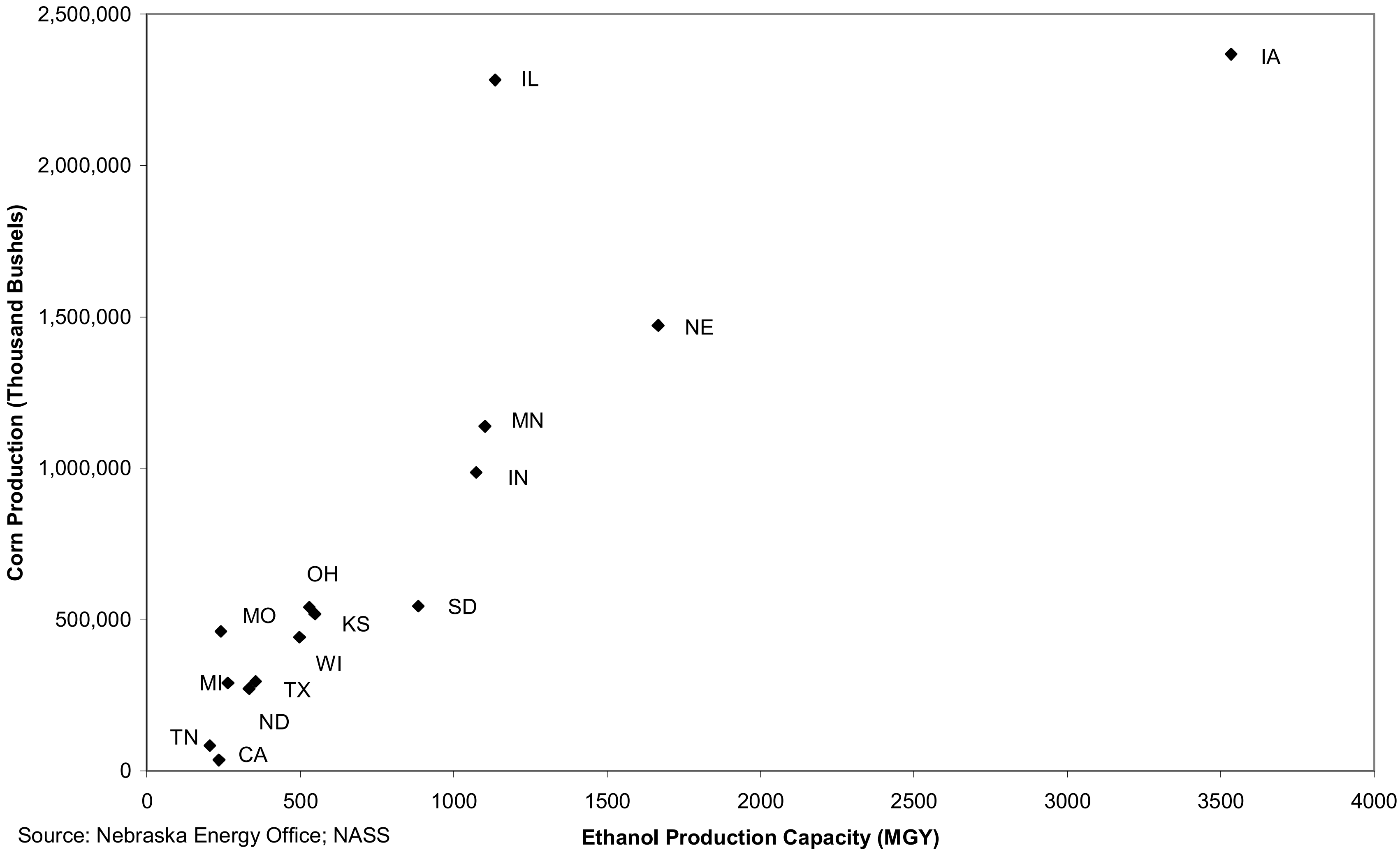
Source: Ethanol Producer Magazine
Updated January 6, 2009

Table 11. Description of General Investment Tax Credits by Top Ethanol Producing States

State	Programs	Key Minimum Requirements	Key Credit Benefits
Iowa	Enterprise Zone Program	At least $0.5 million investment and 10 jobs. Above county average wage. Located in a certified zone.	10% of investments and sales and use tax refund.
	New Jobs and Income Program	At least $1.21 million investment and 50 jobs. Above county average wage.	10% of investments and sales and use tax refund.
	New Capital Investment Program	At least $1 million investment. County average wage.	5% of investments and sales and use tax refund.
	High Quality Job Creation Program	Above county average wage.	10% of investments and sales and use tax refund.
Illinois	Economic Development for a Growing Economy	Only for headquarters. $25 billion Investment and 250 jobs.	Negotiable.
	Enterprise Zone or River Edge Redev. Investment	Located in a certified zone.	0.5% of qualified investment.
	High Impact Business Investment Credit	$12 million investment and creation of 500 jobs. Or $30 million investment and retention of 1500 jobs.	0.5% of qualified investment.
	Job Tax Credit	Awardees of High Impact Business Investment Credit or Enterprise Zone or River Edge Redev. Investment. Create at least 5 new jobs.	$500 per new jobs.
Indiana	Capital Investment Credit	Capital investment over $75 million in Shelby County.	14%
	Economic Development for a Growing Economy	Creating new jobs or retaining existing jobs.	Negotiable.
	Enterprise Zone Employment Expense Credit	Increase employment expense in an enterprise zone.	10% of increased wage until $1500
	Hoosier Business Investment Tax Credit	Certain capital investments.	10%
Nebraska	Nebraska Advantage Act	$1 million and 10 jobs.	3%-6% of wages. 3%-10% of the investment
	Nebraska Advantage Rural Development Act	Located in a county with a population of less than 15,000 or in an Enterprise Zone, must invest at least $125,000 in a business expansion and create at least 2 jobs; Or located in an area with less than 25,000 inhabitants, they must invest at least $250,000 and create at least 5 jobs	$3,000 per new job and $2,750 per $50,000 in investment.
Wisconsin	Development Zone Capital Investment Credit	Located in a development zone.	3%
	Development Zones Job Credit	Create new jobs in a development zone.	Up to $4,000 per job created or retained ($6,500 for jobs that are filled by members of a targeted group).

Source: TaxCreditResearch.com

Figure 6. Ethanol Production Capacity and Corn Production by State



Source: Nebraska Energy Office; NASS

Table 12. Biodiesel Production by State

Rank	State	MGY	Percent of National Total	Plants
1	Texas	353	14.54%	15
2	Iowa	245	10.09%	11
3	Illinois	190	7.83%	6
4	Missouri	152.5	6.28%	8
5	Washington	141	5.81%	6
6	Alabama	137	5.64%	4
7	Indiana	120	4.94%	5
8	Mississippi	108.5	4.47%	4
9	Ohio	106	4.37%	5
10	New Jersey	90	3.71%	2
11	North Dakota	88	3.62%	2
12	Pennsylvania	77.5	3.19%	6
13	Arkansas	74	3.05%	3
14	California	61	2.51%	8
15	Tennessee	61	2.51%	5
16	Kentucky	54	2.22%	3
17	Georgia	49.5	2.04%	5
18	Michigan	42.5	1.75%	3
19	Oklahoma	40	1.65%	2
20	South Carolin	36	1.48%	3
21	Minnesota	33	1.36%	2
22	Wisconsin	33	1.36%	3
23	New York	23	0.95%	2
24	Virginia	20	0.82%	4
25	Arizona	16	0.66%	2
26	North Carolina	15.8	0.65%	5
27	Idaho	12	0.49%	1
28	Colorado	10	0.41%	1
29	South Dakota	7	0.29%	1
30	Nebraska	6.2	0.26%	1
31	Maryland	6	0.25%	3
32	Oregon	5	0.21%	1
33	Vermont	4	0.16%	1
34	Florida	3	0.12%	1
35	West Virginia	3	0.12%	1
36	Kansas	1.2	0.05%	1
37	Rhode Island	1.2	0.05%	1
38	Hawaii	1	0.04%	1
39	Maine	1	0.04%	1
Totals:		2,427.9	100.00%	139

Source: Biodiesel Producer Magazine
Updated: Jan. 2, 2009

Table 13. Biofuel Producers Funding Sources

Ethanol Producers

Funding Sources	Count	Total	Average
Capital Investment	55	$6,721,806,889	$122,214,671
Total Awards:	55	$411,935,259	$7,489,732
State Tax Credits		$405,785,259	$7,377,914
Direct Awards		$615,000	$11,182

Biodiesel Producers

Funding Sources	Count	Total	Average
Capital Investment	16	$470,555,500	$29,409,719
Total Awards:	16	$49,342,421	$3,083,901
State Tax Credits		$43,192,421	$2,699,526
Direct Awards		$6,150,000	$384,375

All Producers

Funding Sources	Count	Total	Average
Capital Investment	71	$7,192,362,389	$101,300,879
Total Awards:	71	$461,277,680	$6,496,869
State Tax Credits		$448,977,680	$6,323,629
Direct Awards		$6,765,000	$95,282

Source: Iowa Department of Economic Development

Table 14. Biofuel Producers Tax Credit Awards by Program

Incentive Program	Count	Total Amount of Credits Awarded	Average Amount of Tax Credit Awarded
Ethanol			
Enterprise Zone Program	18	$104,225,116	$5,790,284
High Quality Job Creation Program	21	$169,604,351	$8,076,398
New Capital Investmetn Program	2	$5,675,000	$2,837,500
New Jobs and Income Program	3	$24,760,226	$8,253,409
Value Added Products	8	$73,625,029	$9,203,129
Community Economic Betterment Account	1	$17,162,000	$17,162,000
Biodiesel			
Enterprise Zone Program	6	$23,278,456	$3,879,743
High Quality Job Creation Program	5	$6,312,515	$1,262,503
New Jobs and Income Program	1	$3,128,125	$3,128,125

Source: Iowa Department of Economic Development

Table 15. Sales and Use Tax Refunds by Ethanol Producers, Tax Years 2003 to 2008

Year	Amount Claimed
2003	$128,694
2004	$353,109
2005	$308,197
2006	$924,519
2007	$1,515,271
2008	$599,530
Total:	$3,829,320

Program	Amount Claimed	Number of Claims
Enterprise Zone	$635,559	8
NJIP	$1,989,003	15
NCIP	$605,228	4
HQJCP	$599,530	2
Total:	$3,829,320	29

Source: Iowa Department of Revenue

Table 16. Sales and Use Tax Refunds by Biodiesel Producers, Tax Years 2006 to 2008

Year	Amount Claimed
2006	$36,041
2007	$1,686,869
2008	0
Total:	$1,722,910

Program	Amount Claimed	Number of Claims
Enterprise Zone	$596,420	5
NJIP	$443,535	1
HQJCP	$682,955	1
Total:	$1,722,910	7

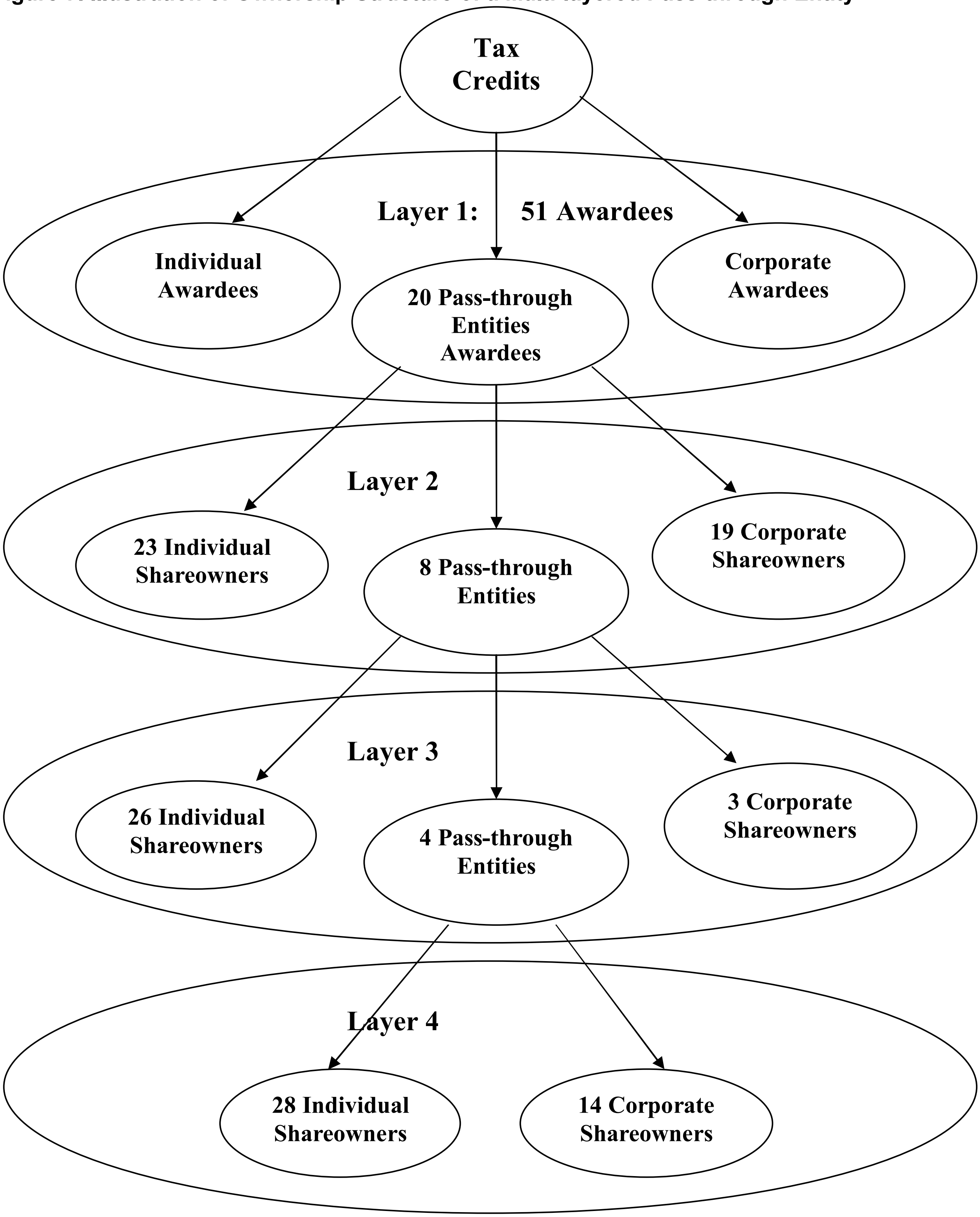
Source: Iowa Department of Revenue

Table 17. Biofuel Producers' Investment Tax Credit Claims by Program

Program	Number of Claims	Amount of Claims (Non Refundable)	Amount of Claims (Refundable)	Total Amount of Claims
EZ	421	$620,005	$16,578	$636,583
HQJCP	14	$7,352	$770	$8,122
NCIP	62	$183,054	$32,875	$215,929
NJIP	1326	$2,932,171	$180,424	$3,112,595
Total:	1823	$3,742,582	$230,647	$3,973,229

Source: Iowa Department of Revenue IA 148 Tax Credit Claim Data

Figure 7. Illustration of Ownership Structure of a Multi-layered Pass-through Entity



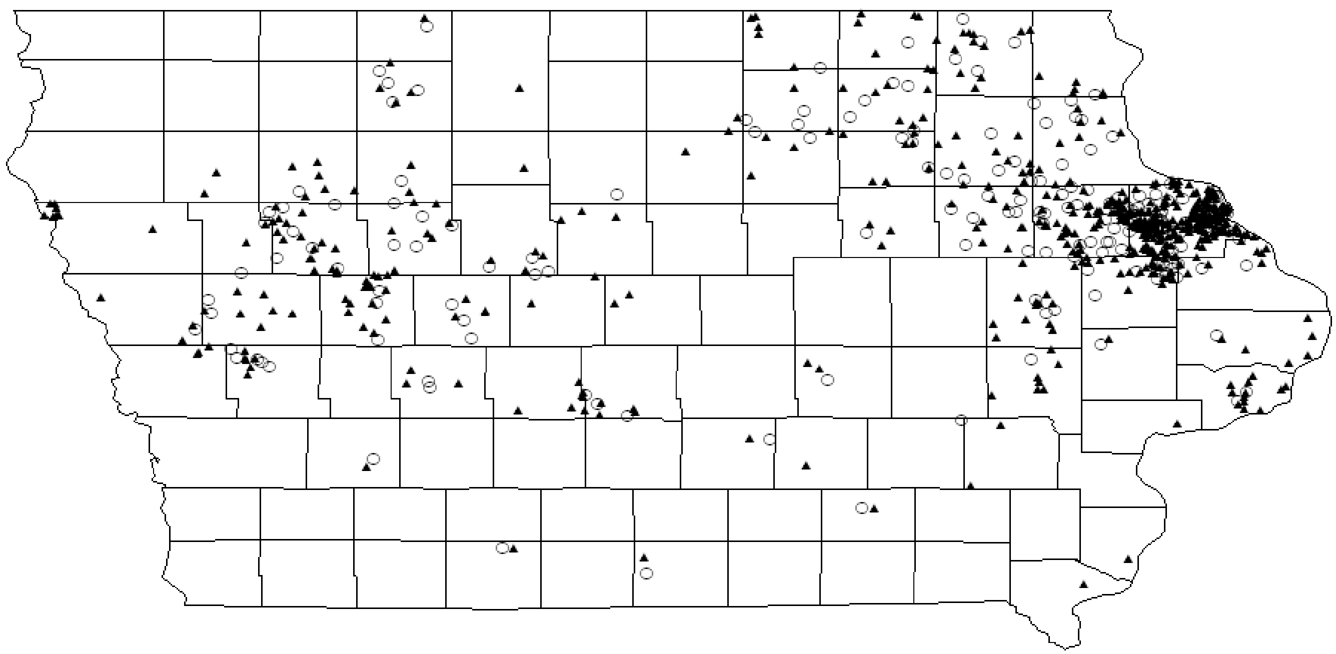
Note: This diagram is for illustrative purposes only and the numbers do not represent actual owners of biofuel production facilities.

Table 18. Ownership Statistics for Biofuel Producers Organized as a Limited Liability Company

Owners	Average	Median	Minimum	Maximum
Number of Owners	367	167	3	1,533
Number of Iowa Owners	316	54	3	1,584
Shares owned by Iowa Owners	0.89	0.99	0.01	1.00
Number of Individual Owners	346	161	3	1,533
Shares owned by Individual Owners	0.81	0.91	0.01	1.00
Number of Iowa Farmer Owners	169	75	0	745
Shares owned by Iowa Farmer Owners	0.31	0.38	0	0.62

Source: Iowa Department of Revenue, The data are available for 28 producers.

Figure 8. Location of Iowa Residential Investors in Western Dubuque Biodiesel



Source: IDR

▲ Investors with no Farm Income

○ Investors with Farm Income

Table 19. Estimate of the Reduced Ethanol Production Capacity's Impact on Corn Price

Variables	2005	2006	2007
Est. Reduction in Ethanol Capacity (million gallons)	307	607	939
Actual Corn Price ($)	2	3.33	4.79
Base Line Corn Price ($)	2	3.31	4.76
Non-Credit Corn Price ($)	1.97	3.22	4.59
Price Difference ($)	0.03	0.09	0.17
Iowa Corn Production (million bushel)	2,162.50	2,050.10	2,368.35
Corn Value Difference (million $)	64.9	184.5	402.4

Source: USDA and author's calculations

Table 20. Estimate of the Reduced Corn Price's Impact on Land Rents and Land Value

Variables	2005	2006	2007
Price Difference ($)	0.03	0.09	0.17
Land Cash Rents Difference ($/Acre)	2.37	7.11	13.43
LIBOR, 3 Month (%)	3.56	5.2	5.3
Actual Average Iowa Farmland Prices ($/Acre)	2,914	3,204	3,908
Estimated Land Price Difference ($/Acre)	66.57	136.73	253.4
Estimated Land Price Difference (Percentage)	2.28	4.27	6.48
Iowa Farmland Acreage (million acre)	31.6	31.5	31.5
Iowa Farmland Value Difference (million $)	2,103.61	4,307.00	7,982.10

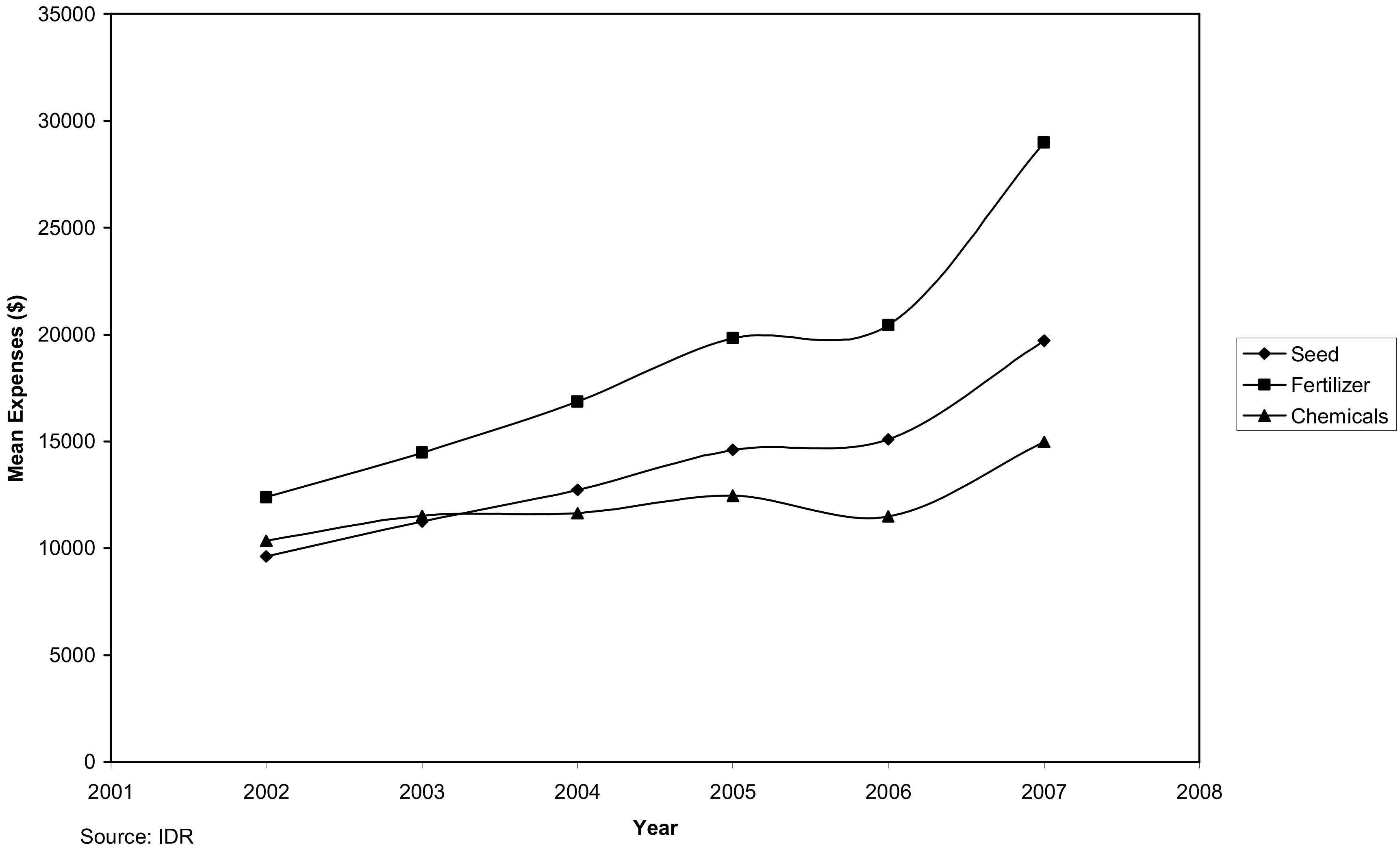
Sources: Iowa State University Farmland Value Survey, National Agricultural Statistics Service

Table 21. Corn Farming Output and Input Costs (in Dollars per Acre)

Year	2001	2002	2003	2004	2005	2006	2007
Gross Production Value	266.92	312.82	319.62	362.35	260.43	351.87	468.94
Seed Costs	32.34	31.84	34.83	36.82	40.47	43.55	49.04
Fertilizer Costs	55.12	42.51	50.64	54.62	69.35	80.17	93.13
Chemicals Costs	26.44	26.11	26.2	26.76	22.84	23.62	24.38
Other Costs	48.4	45.02	49.49	57.74	53.71	58.64	62.44
Land Rent	86.5	87.44	89.2	92.14	93.27	90.84	97.21
Total Cost	248.8	232.92	250.36	268.08	279.64	296.82	326.2
Net Corn Farming Income	18.12	79.9	69.26	94.27	-19.21	55.05	142.74

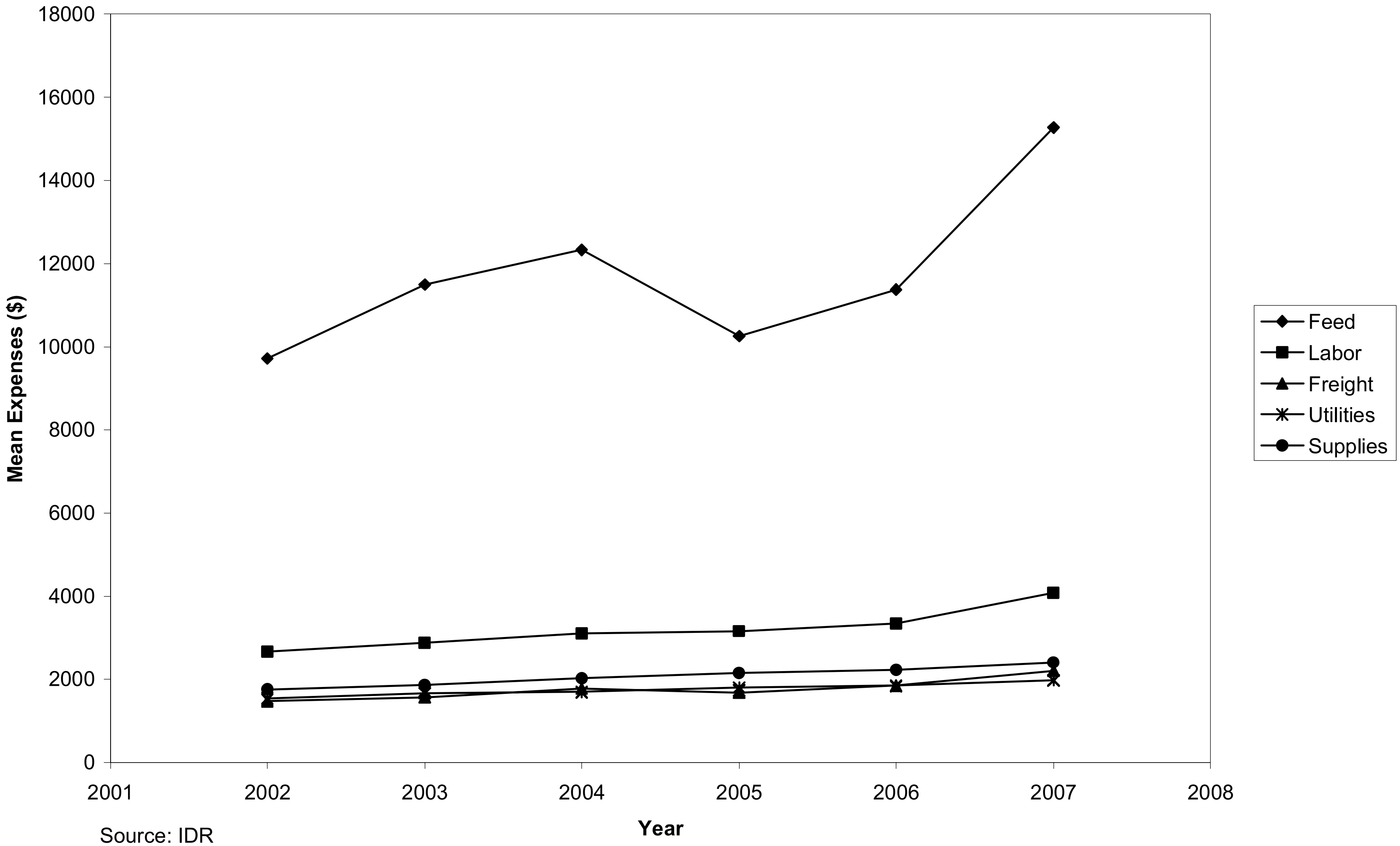
Source: United States Department of Agriculture (USDA)

Figure 9. Seed, Fertilizer, and Chemical Expenses for Corn and Soybean Farmers, 2002 to 2007



Source: IDR

Figure 10. Selected Expenses for Cattle Farmers, 2002 to 2007



Source: IDR

Figure 11. Dry Mill Ethanol Industry Direct Employment

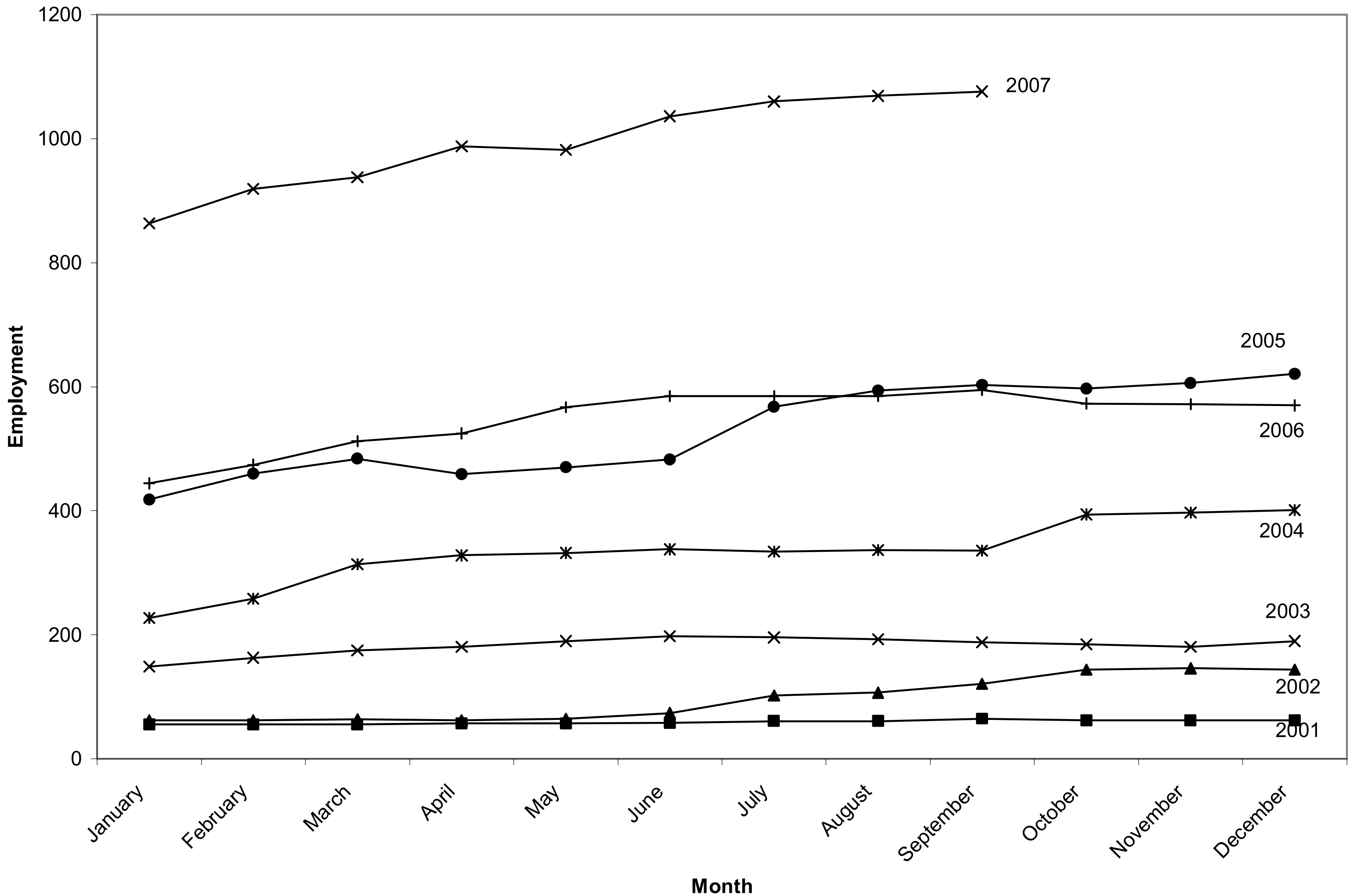


Figure 12. Biodiesel Industry Direct Employment

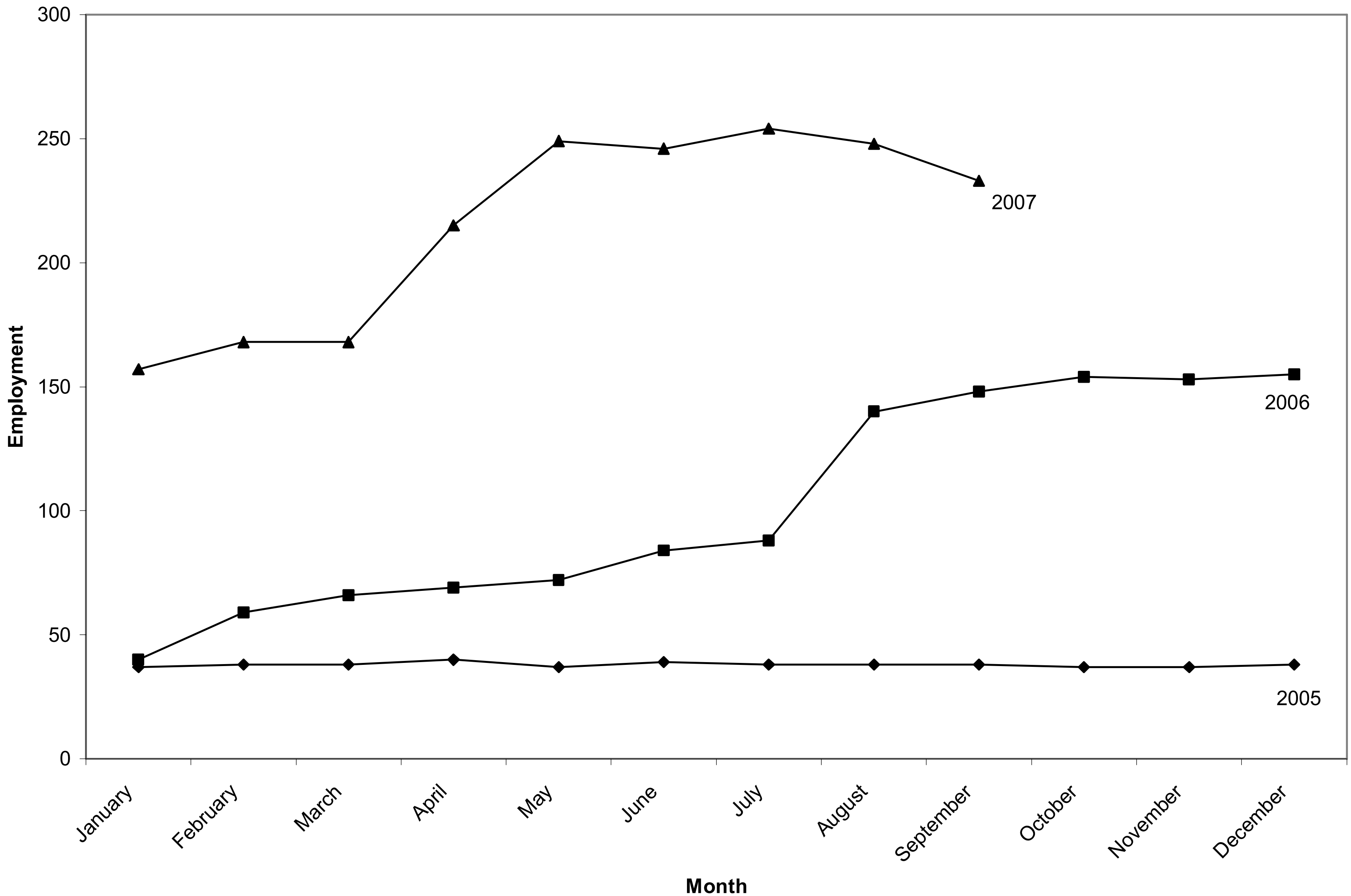


Table 22. Median Real Household Income in Iowa and Treatment Towns (2003 dollars)

	2003	2006
Iowa	$27,791	$28,280
Treatment Group	$27,068	$29,001

Source: Iowa Department of Revenue, individual tax returns, for tax years 2003 and 2006

Table 23. Treatment Towns and Selected Control Towns

Treatment Group	Control Group
Ashton	Gilmore City
Burlington	Keokuk
Denison	Harlan
Emmetsburg	Forest City
Fort Dodge	Spencer
Goldfield	Marcus
Hanlontown	Rake
Iowa Falls	Oelwein
Mason City	Algona

Source: Ethanol Producer Magazine, and authors calculations

Figure 13. Map of Selected Towns

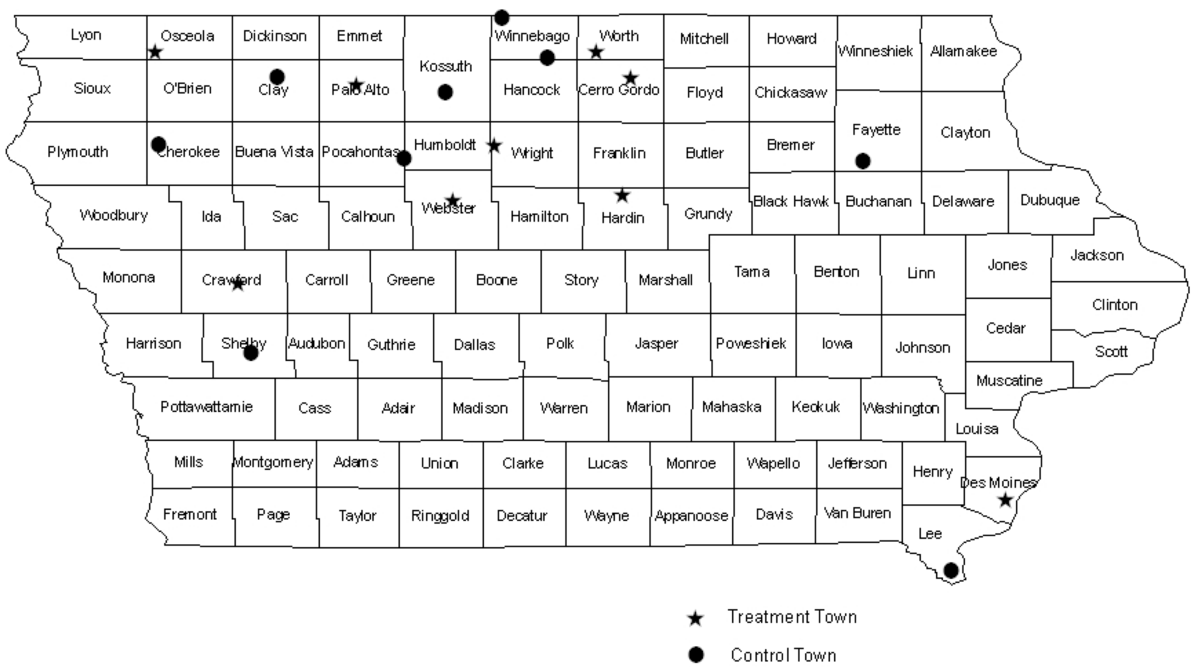


Table 24. Summary Statistics for Treatment and Control Groups at Individual Level in 2003

Variable	Treatment	Control
Median Household Income	$31,315	$35,148
Southeast Region	27%	27%
Southwest Region	0%	0%
Northeast Region	34%	37%
Percent Married	44%	55%
Percent Dual Earner	31%	41%
Percent with Farm Income	3%	5%
Percent Itemizer	49%	57%
Household Age	47.75	47.21
Count	25,084	25,084

Source: Iowa Department of Revenue Individual Income Tax Returns, tax year 2003

Table 25. Summary Statistics for Treatment and Control Groups at Town Level in 2003

After Matching on Town Level

Variable	Treatment	Control
Median Household Income	$27,100	$27,199
Southeast Region	27%	22%
Southwest Region	0%	12%
Northeast Region	34%	12%
Percent Married	44%	50%
Percent Dual Earner	33%	36%
Percent with Farm Income	3%	6%
Percent Itemizer	49%	48%
Household Age	47.51	48.43
Count	42,457	21,742

Source: Iowa Department of Revenue Individual Income Tax Returns, tax year 2003

Table 26. Explaining Variation in Real Household Income Between 2003 and 2006 Across Treatment and Control Groups (Individual Level Comparison)

Independent Variable	Coefficient	t-value
Intercept	-26080.00	-35.52
Ethanol Indicator	-3715.87	-13.92
2006 Indicator	2060.19	7.70
Southeast Region Indicator	3303.53	13.78
Northeast Region Indicator	-196.64	-0.89
Married Indicator	7002.84	23.09
Dual Earner Indicator	22962.00	74.67
Farmer Indicator	-1255.63	-2.71
Itemizer Indicator	18192.00	89.65
Household Age	2056.44	67.74
Household Age Squared	-20.57	-70.81
Interaction Term	127.53	0.34
Number of Obeservations	98,527	
Adjusted R-Squared	0.3592	

Source: Iowa Department of Revenue, individual income tax returns, tax years 2003 and 2006
Note: Using Propensity Score Matching and excluding observations where household income is in the 1st and 99th percentile
t-values with an absolute value greater than 2 indicate statistical significance.

Table 27. Explaining Variation In Real Household Income Between 2003 and 2006 Across Treatment and Control Groups (Town Level Comparison)

Independent Variable	Coefficient	t-value
Intercept	-12659.00	-18.75
Ethanol Indicator	810.24	3.24
2006 Indicator	907.26	3.28
Interaction Term	821.99	2.42
Southeast Region Indicator	-1091.82	-5.39
Southwest Region Indicator	-1241.81	-2.92
Northeast Region Indicator	-1187.35	-5.82
Married Indicator	5304.40	20.07
Dual Earner Indicator	22706.00	85.68
Farmer Indicator	2291.13	5.94
Itemizer Indicator	14104.00	81.65
Household Age	1455.94	54.67
Household Age Squared	-14.52	-58.66
Number of Obeservations	87,345	
Adjusted R-Squared	0.3889	

Source: Iowa Department of Revenue, individual tax returns for tax years 2003 and 2006; and 2000 Census Data

Note: Excluding observations where household income is in the 1st and 99th percentile, data set is limited to non-movers

t-values with an absolute value greater than 2 indicate statistical significance.

Table 28. Businesses by Category

RETAIL TRADE

All other General Merchandise Stores	Jewelry
Automotive Parts and Acessories	Lawn & Garden
Beauty & Health(Drug)	Liquefied Petroleum
Book and Stationary Stores	Liquor Stores
Camera & Photographic Store	Luggage and Other leather goods
Cigar stores	Miscellaneous Retailers
Clothing and Clothing Accessories stores	Mobile Homes Dealers
Department stores	Music Stores
Direct Sellers	New and Used Car Dealers
Electronic Shopping and mail order houses	News Dealers
Florists	Paint and Glass Stores
Fuel & Ice Dealers	Recreational and all other motorized vehicles
Fuel Oil Dealers	Sewing & Needlework
Furniture Stores	Shoes
Gas Stations/Convenience Stores with Gas	Specialized Groceries
Grocery stores and Convenience Stores	Sporting Goods
Hardware Stores	Stationary, Gift, Novelty
Hobby & Toy	Used Merchandise stores
Home Centers(Bldg. Mat)	Variety Stores
Home Furnishings Stores	Vending machine operators
Household Appliance Store	

ACCOMMODATIONS AND FOOD SERVICE

Hotels & All other Lodging Places
Rooming & Boarding Houses
Restaurants, Taverns, & Bars
RV parks and recreational camps

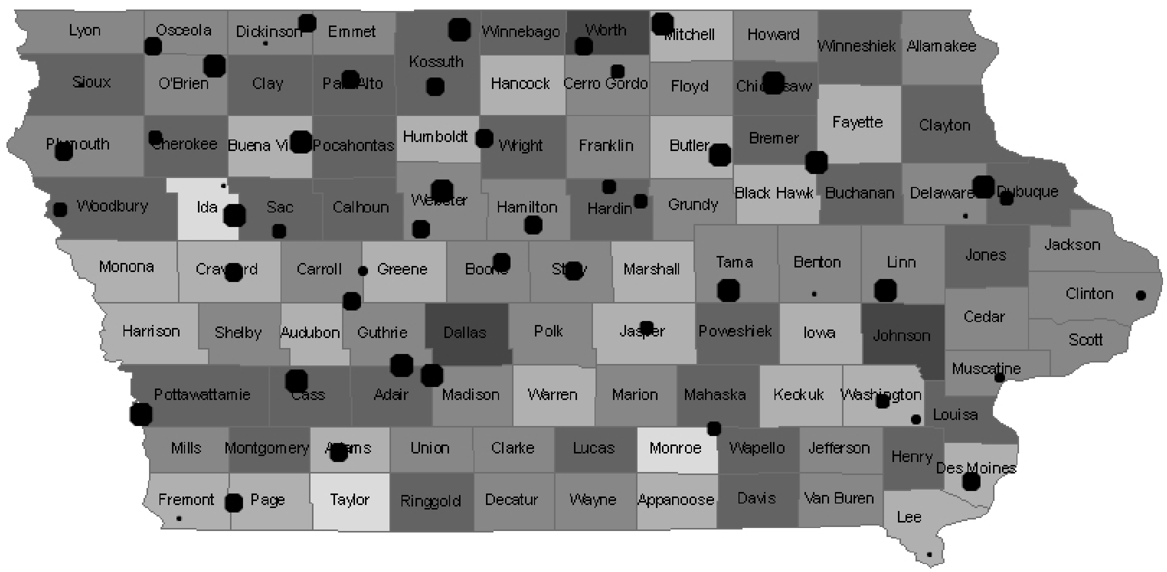
Source: Iowa Department of Revenue

Table 29. Explaining Variation in Retail Sales at the Town Level across Control and Treatment Groups between 2003 and 2006

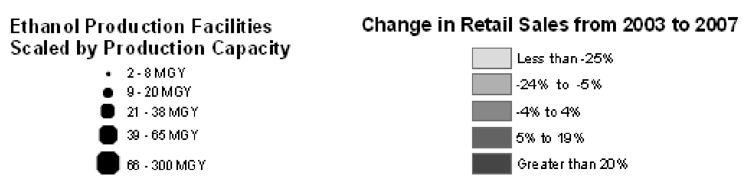
Independent Variable	Coefficient	t-value
Intercept	166154	3.54
Ethanol Indicator	-26747	-0.41
2006 Indicator	-24952	-0.39
Treatment Effect	-8578	-0.10
Population	21	8.04
Number of Obeservations	36	
R-Squared	0.69	

Source: Iowa Department of Revenue Sales Tax Returns, Tax Years 2003 and 2006
t-values with an absolute value greater than 2 indicate statistical significance.

Figure 14. Map of Change in Retail Sales by County



Source: Iowa Department of Revenue



Appendix A

A limited partnership is comprised of a general partner who manages the project and limited partners who invest money but have limited liability; hence they cannot lose more than their capital contribution. A partnership passes through any profits or losses to its partners who must report the profit or loss on their individual income tax return.

A limited liability company (LLC) allows owners to have limited personal liability for the debts and actions of the LLC similar to a corporation while allowing the owners to have management flexibility and pass-through taxation like a partnership. There are neither a maximum nor minimum number of owners allowed. Owners of an LLC must file tax form IA1065, unless filing as a corporation which requires tax form IA8832.

A C-corporation is comprised of shareholders who exchange money, property, or both for the corporation's capital stock. For federal and Iowa income tax purposes, a C-corporation is recognized as a separate taxpaying entity. A C-corporation conducts business, realizes net income or loss, pays taxes and distributes profits to shareholders.

An S-corporation is a corporation with 75 or fewer shareholders that can elect to be taxed as if it were a partnership. An S-corporation is exempt from federal income tax other than tax on certain capital gains and passive income. On their individual income tax return, shareholders in an S-corporation include their share of the corporation's separately stated items of income, deduction, loss, and credit and their share of non-separately stated income or loss.

Appendix B
Technical Report: Economic Analysis of the Impact of Tax Credits on Corn Prices

In the two-stage model, the first stage hypothesizes that the total nameplate capacity of ethanol production facilities in Iowa would be lower without the availability of State tax credits. An adaptation of Tobin's q is employed to estimate the amount of additional ethanol production capacity that has been constructed in Iowa as a result of the tax credits.

In the second stage of the analysis, the predicted reduction in ethanol production capacity is used to estimate impacts on the price of corn.

First Stage: Estimate the Tax Credits' Impacts on Investments and Nameplate Capacity
The tax-adjusted q model is used to estimate the Iowa tax credits' impacts on investment decisions of ethanol producers, in particular the corporate finance approach described in Desai and Goolsbee (2004). Their equation is the following:

$$(I_t / K_t) = \alpha_0 + y_t + \beta_1 q + \beta_2 T + \varepsilon_t$$

where I_t is the investment in the current period, K_t is the capital stock in the current period, α_0 is the industry fixed effect, y_t is the time fixed effect, T is a measure of tax incentives and depreciation allowances, and ε_t is the error term. β_1 and β_2 are estimated coefficients. The measurement of q used in the equation is constructed as 1+[(MV Equity - BV Equity)/BV Assets], where MV stands for market value and BV for book value.

There are several difficulties in applying the Desai and Goolsbee model. First, data on the existing capital stock of ethanol producers with facilities in Iowa are not readily available. This is because most ethanol producers are private companies, so their balance sheets are not readily available. In addition, the ethanol industry is relatively new, so there is little existing capital stock for most producers. Therefore, only investment in each year is used as the dependent variable instead of the investment rate.

The other issue is the calculation of q. Data on the BV equity and the BV assets of ethanol plants were collected from the Iowa Department of Economic Development (IDED). IDED maintains copies of the application forms and supporting documents from ethanol producers that seek State tax credits. These documents include information on the ethanol producers' funding sources. The market values of these ethanol producers are difficult to determine because the majority of them are private companies. However, the corn based ethanol production industry is a fairly homogenous industry: the products, the inputs, and the production technology are mostly standard across the industry. Therefore, the industry average price-to-book ratio should provide a reliable estimate for the q-ratio for all plants. It is assumed that all producers have the same price-to-book ratio, which is the average price-to-book ratio for the publicly traded ethanol producers.

To compute the industry average price-to-book ratio, the price and balance sheet information of all the publicly-listed ethanol producers was collected.[19] Some large farm products companies (i.e., ADM and Cargill) also have ethanol production operations. However, the revenue from their ethanol production only accounts for a minor share of these companies' total earnings. Therefore, only those companies with a primary focus on ethanol production were included.

[19] The data was collected from the NASDAQ web site www.nasdaq.com. Most of the public ethanol producers are listed under the industry "Specialty Chemicals" in the sector "Basic Materials".

There are eight publicly-listed ethanol production companies whose financial information is available online. The names and the symbols for these publicly traded companies are listed in Table B1. The market values of these companies' equities were determined by multiplying their average annual stock prices by the number of their outstanding shares. The book values of their equities and assets were collected from their annual Securities and Exchange Commission (SEC) filings between 2005 and 2008. The average price-to-book ratio for the whole industry was computed for each year of the analysis. Using the industry average price-to-book ratios, the market values and the q-ratios were computed for every ethanol production facility operating in Iowa.

The equation for the tax-adjusted q model used is as follows:

$$I_t = \gamma_t + \beta_1 q + \beta_2 T + GD + \varepsilon_{t,} \qquad (1)$$

where I_t is the investment in the current period, y_t is the time effect, q is the q-ratio as previously defined, T is the tax incentive and depreciation allowance term, GD is a geographic dummy variable with value 1 for national producers and value 0 for Iowa producers, and ε_t is the error term.

Using only the investment amount in the regression introduces two complications. First, there is concern regarding the endogeneity of the independent tax credit variable. The amounts of the awarded state tax credits (a 10 percent Investment Tax Credit, a sales tax refund, and a job training tax credit) are often determined based on the magnitudes of the projects' investments. Therefore, the amount of the State tax credits cannot be considered an exogenous variable in the regression. Thus, having the amount of tax credits included in the regression for investments would generate an inconsistent estimate.

To solve this endogeneity problem, the total public subsidy is used as an instrumental variable in equation (1) for the State tax credit. The total public subsidy equals the sum of State tax credits, federal grants, other State grants, and any local government subsidies. Because other public funds are often awarded based on factors unrelated to the amount of the project investment, the total public subsidy should be exogenous and correlated with the State tax credits, and provide an appropriate instrumental variable for the regression.

A second reason that using only investment as the dependent variable might be a problem is a concern that the results may be sensitive to firm size. Large companies usually have more resources and less financial constraints when making investment decisions. Because capital stock data was not available and thus excluded from the model, the firm size needs to be controlled for in the model. To identify the impact on investment due to firm size, a dummy variable was introduced. If the business owner has significant business operations outside Iowa which implies a larger business scale and firm size, the geographic dummy is assigned a value of 1. Otherwise, the dummy variable equals 0.

There were 34 ethanol production facilities either under construction or in operation in Iowa by the end of 2007 that had been awarded State tax credits and for which data were available. Using the ordinary least squares (OLS) regression method the coefficients of the independent variables were estimated. Table B2 shows the results of the estimation of equation (1). The coefficient of the public subsidy variable is statistically significant at a 99 percent confidence level and has a positive sign. The coefficient of the q-ratio variable has a positive sign as expected and is significant at a 90% confidence level. The coefficient of the dummy variable for the geographic character of business operations is positive but insignificant. The adjusted R-square is 0.9184. The dependent variable in the regression is the investment amount.

The last four rows in Table B2 report the amount of ethanol plant investment attributable to the State tax credits awarded to the ethanol producers based on the model's results. The predicted investment amount that would not have been invested if there had not been the State tax credits is about $2.11 billion, which is 38.4 percent of the $5.48 billion of the total investment made by producers in Iowa. Furthermore, for 2005 and prior years, the tax credits drove investment that equals $645.9 million (44.6 percent) of the investment made during the period. The 2006 tax credit-driven investment was $600.9 million (40.5 percent) of total 2006 investment. The 2007 tax credit-driven investment was $858.5 million (37.7 percent) of total 2007 investment.

Without the investment induced by the tax credits, the nameplate capacity of ethanol plants would have been lower. The investment in ethanol plants should be positively related to the nameplate capacity of the plants, which is a plant's maximum design level of product output. A Cobb-Douglas production function is employed to model the impact of capital investment in ethanol production facilities on nameplate capacity.[20] Because only the capital investment is considered in our study, a simplified Cobb-Douglas function is constructed as follows:

$$Y_i=A(K_i)^{\beta} \qquad (2)$$

where Y_i is the production capacity of ethanol plant i, K_i is the capital investment of plant i, A is the constant capturing all other factors, and β is the output elasticity of capital, which should have a value between 0 and 1.

The OLS regression method is used on the firm level data to estimate the effects of investment on production capacity. The estimation equation is as follows:

$$\ln(Y_i) = \alpha + \beta \ln (K_i) + \varepsilon \qquad (3)$$

Table B3 presents the estimation results for equation (3). The results show that the investment has a significant impact on the nameplate capacity. The impact of the investments on production capacity is positive as expected. The adjusted R-square is 0.5401.

Recall the investments that would have been reduced if there were no State tax credits are predicted in Table B2. Without the additional investments, the new nameplate capacity would have been lower by 307 million gallons in 2005 and before, 300 million gallons in 2006, and 332 gallons in 2007. The cumulative capacity loss would have been 307 million gallons in 2005, 607 million gallons in 2006, and 939 million gallons in 2007. By comparison, the total capacity of ethanol production was 13,608 million gallons in the nation and 3,534 million gallons in Iowa by the spring in 2008, according to the Nebraska Energy Office.

Second Stage: Estimate the Production Capacity's Impacts on the Corn Price

With the estimate of how much production capacity would have been reduced due to State tax credits, the next step is to use the model developed by McPhail and Babcock (2008) to estimate the impact of this capacity reduction on corn price. The McPhail and Babcock paper integrates the corn market, the ethanol market, and the gasoline market within a short-run equilibrium structural equation model. Their model simulates the future short-run equilibrium of corn price and production and finds out that the federal policies on ethanol have significant impacts on corn prices.

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[20] The Cobb-Douglas function is a commonly used functional form to model production in economics. The function is usually specified as $Y=A(K)^{\beta}(L)^{\alpha}$, where Y is output, K is capital, L is labor, and A is technology. Assuming constant returns to scale implies $\alpha+\beta=1$.

In this analysis, a simplified version of their model is used. Because the purpose is to evaluate the impact of past tax credit awards, some uncertainties existing in the McPhail and Babcock model are eliminated. The model incorporates the following assumptions.

1) One uncertainty in McPhail and Babcock (2008) is the future world crude oil price and the U.S. gasoline price. Because the world oil market has not been affected by corn and ethanol markets, the crude oil price and the gasoline price are assumed to be exogenous variables.

2) Corn production, including planted acreage, yield, and harvested acreage, is exogenous. This is a relatively strong assumption. The relaxation of this assumption will be discussed later in the analysis.

3) Ethanol demand and price are assumed to be exogenous. The ethanol price is largely determined by the gasoline price because ethanol has lower energy content. Given that ethanol-blended gasoline offers a lower mileage performance than regular gasoline and the gasoline price is exogenous in our model, consequently, the ethanol price and the demand for ethanol are assumed to be determined by the gasoline price and by gasoline demand. Occasionally, the economic shock would abruptly change ethanol price in a short period of time. However, the adjustment of the price was often temporary and is assumed not to have a lasting impact on corn market.

4) Domestic ethanol producers are assumed to operate at their full capacity, which is defined as 90 percent of the total nameplate capacity due to maintenance and efficiency problems, from 2005 through 2007. Ethanol imports fill in the gap between the ethanol demand and the domestic ethanol supply. The short-term ethanol supply is determined by the producers' short-run profit margin, domestic production capacity, and ethanol imports, which were largely from Brazil. The equation for short-run profitability for an ethanol producer is as follows:

$$\pi = (\gamma * P_e + D * P_{distiller}) - (P_c + OPC * \gamma) \quad (4)$$

where π is the ethanol producer's short-run operating profit margin per bushel of corn, γ is the number of gallons of ethanol produced from a bushel of corn, P_e is the price of ethanol per gallon, D is the number of tons of co-product (i.e., distillers grain) produced per bushel of corn, $P_{distiller}$ is the price of distillers grain per ton, P_c is the price per bushel of corn, and OPC is the operating cost per gallon of ethanol.

According to the Renewable Fuels Association (RFA), on average 2.8 gallons of ethanol is produced from a bushel of corn. According to McPhail and Babcock (2008), D is 0.0085 per ton of corn, and OPC is $0.54 per gallon. The price of distillers grain per ton is set as follows according to Babcock (2008):

$$P_{distiller} = 52.5 + 16.406 * P_c \quad (5)$$

Table B4 presents other variables in equation (4) and the estimated profit margin for ethanol producers. Annual corn prices come from the web site of the U.S. Department of Agriculture (USDA). Distillers grain prices are calculated using equation (5). National wholesale ethanol prices are not readily available. Therefore, an estimated ethanol price series is constructed as follows: Gasohol (E10) is a gasoline product with at least 10 percent ethanol content. The Iowa Department of Natural Resources (DNR) reports gasohol prices and IDR reported the monthly gasohol quantities in Iowa. Assuming all gasohol sold in Iowa is the E10 blend and that gasohol prices are the weighted average of gasoline prices and ethanol prices, an ethanol price series can be calculated in reverse as shown in the fourth column in Table B4.[21] Using the estimated Iowa ethanol prices to approximate the national ethanol prices, the short run operating profit margin of an ethanol producer is estimated using equation (4).

[21] During 2007 the E85 blend accounted for under 0.2 percent of all ethanol blended fuels sold in Iowa. Total ethanol blended fuels sold in Iowa during 2007 totaled 1,214.8 million gallons.

In Table B4, the estimated short-run operating profit margin for an ethanol producer was positive from 2005 to 2007. This result implies that ethanol producers would operate at their full production capacities during this period. Therefore, the short-run domestic ethanol supply could not increase even if there were an increase in ethanol demand. Hence, the assumption is that ethanol imports filled in the gap between the demand and the domestic production in the short-run.

With an exogenous gasoline price and largely fixed ethanol markets, only the corn market is endogenous in the model. The corn price would have been affected by the reduced demand for corn if Iowa's ethanol production capacity were lowered in the absence of the State tax credits.

Corn demand consists of five major parts: food, feed, ethanol, export, and storage at the end of the year. Table B5 presents the data on corn supply and demand in the U.S. from 2004 to 2007. The total supply in the market includes corn production and beginning storage. Total supply may not equal total demand due to missing values for the demand for seed and imports.

The demand elasticities of corn in different segments were provided by McPhail in 2008 using the Food and Agricultural Policy Research Institute (FAPRI) Model. Assuming constant demand elasticities from 2005 to 2007, the demand functions are shown in Table B6. The corn demand for ethanol is determined by the ethanol supply. As long as ethanol producers operate at their full capacities, their demand for corn equals the amount of corn required to meet their nameplate ethanol production abilities. It was assumed that every bushel of corn yielded 2.65 gallons of ethanol through 2005, and 2.8 gallons of ethanol after 2005 as estimated by Argonne National Laboratory published on RFA web site.

The equilibrium function in the corn market is as follows:

$$D_{corn\_production}+D_{corn\_storage\_beginning} = D_{corn\_food} + D_{corn\_feed} + D_{corn\_export} + D_{corn\_ethanol} + D_{corn\_storage\_end} \quad (6)$$

Using the actual data shown in Table B5, the demand functions listed in Table B6 and the equilibrium equation (6), the baseline corn prices from 2005 to 2007 were simulated. Furthermore, the corn prices under the circumstances that no State tax credits had been awarded to producers were simulated using the estimated changes in nameplate capacity from Table B3.

The baseline simulated corn prices in Table 19 are very close to the actual average corn prices. The estimated reduction in ethanol production capacity is estimated in the first stage Tobin's q model. The non-credit corn prices are the simulated corn prices using the reduced demand for corn from ethanol producers. Without the State tax credits, the corn price per bushel would have been 3 cents lower in 2005, 9 cents lower in 2006, and 17 cents lower in 2007. Assuming that Iowa farmers still produced the same amount of corn, the corn value difference measures the impacts on farmers' revenue from corn demand for ethanol production. The State tax credits increased farm corn production revenue by $64.9 million in 2005, $184.5 million in 2006, and $402.4 million in 2007.

The assumption that the acreage of corn planted would not have changed due to reduced corn prices is a strong one. Nevertheless, the farmers' planting decisions might not differ much from 2005 to 2007 in this analysis even if the corn price was reduced due to lack of the state tax credits to ethanol industry. Each year, the farmers' planting decisions are based on previous price and acreage information, among other factors such as future markets and input costs. The actual average corn price in 2006 is $3.33 per bushel, an increase of $1.33 from 2005's price of $2 per bushel. The simulated average corn price in 2006 is $3.24 per bushel, an increase of $1.27 from 2005's simulated price of $1.97 per bushel. Without the State tax credits, the increase in simulated corn price is $1.27

per bushel, merely 6 cents less than the actual price increase from 2005 and 2006. Given the difference of 6 cents is incremental compared to the price increase of more than $1 from 2005 to 2006, farmers' planting decisions in 2007 should not change significantly if there were no State tax credits. The strict assumption of exogenous planting acreage from 2005 to 2007 has the advantage of reducing the complexity of the modeling.

Land Rent and Land Value

The corn price has a significant impact on farmland rent and value (see Phipps (1984), Falk (1991), Lence and Miller (1999), Lence and Mishra (2003), and Du, Hennessy, and Edwards (2007)). Using the estimated impacts on corn prices due to the Iowa tax credits, the impacts on Iowa farmland cash rental rates and farmland prices are calculated. Du, Hennessy, and Edwards (2007) used a random effect model with spatial and temporal autocorrelation to estimate the determinants of the Iowa cash rental rates of the farmland. They found that in the short run cash rents go up by $79 per acre of cropland for a $1 per bushel increase in corn price.

Using the simulated non-credit corn prices in Table 19, the estimated impacts on cash rents from 2005 to 2007 for Iowa farmland are shown in Table 20. Furthermore, farmland prices are assumed to be the present value of the cash rents which are discounted by a constant interest rate, because farmland can be treated as the main financial asset of crop farmers and the present value method is widely used to compute the asset value. Using the annual three-month London Interbank Offered Rate (LIBOR) as the interest rate, the affected farmland prices due to the changed farmland rents are presented in Table 20.

In the absence of the State tax credits to ethanol producers, lower corn prices translate into lower cash rents of $2.37 per acre in 2005, $7.11 per acre in 2006 and $13.43 per acre in 2007 (see Table 20). Using the average three month LIBOR as the discount rate, these estimated land cash rent drops would have caused that the average farmland value per acre to fall by $66.57 (2.3 percent) in 2005, $136.73 (4.3 percent) in 2006, and $253.4 (6.5 percent) in 2007. Total agriculture land value would have been reduced by $2.1 billion, $4.3 billion and $8.0 billion from 2005 to 2007.

Table B1. Publicly Listed Corn-Based Ethanol Producers in U.S.

Company Name	Stock Symbol
Aventine Renewable Energy	AVR
AE Biofuels, Inc.	AEBF.OB
BioFuel Energy Corp.	BIOF
Four Rivers BioEnergy, Inc.	FRBE.OB
Green Plains Renewable Energy, Inc.	GPRE
Panda Ethanol, Inc.	PDAE.OB
Pacific Ethanol	PEIX
VeraSun Energy	VSE

Table B2. Regression Testing the Adjusted-q Model

Independent Variable	All Observations	t-statistic
q-ratio	11,140,618*	1.82
The Public Subsidy (T)	5.94635***	4.04
Geographic Dummy (GD)	22,773,261	1.11
Year Dummies Included	Yes	
No. of Observations	34	
Adjusted R-Square	0.9184	
Investments Attributable to State Tax Credits		
For all years	$2,105,232,000	
For 2005 and prior years	$ 645,853,000	
For 2006	$ 600,873,000	
For 2007	$ 858,506,000	

***: Significant at 99% **: Significant at 95% *: Significant at 90%

Table B3. Estimated Affected Nameplate Capacity (Million Gallons per Year)

Variable	Estimation Results	t-statistics
Intercept (α)	-7.66056***	-3.90
Ln (Investment (K))	0.64986***	6.21
No. of Observations	33	
Adjusted R-Square	0.5401	

***: Significant at 99%

Note: The dependent variable in the regression is the natural log of the nameplate capacity.

Table B4. Estimated Operating Profit Margin for Ethanol Producers

Year	P_c (\$ per bushel)	$P_{distille}$ (\$ per ton)	P_e (\$ per gallon)	π (\$ per bushel)
2005	2.00	85.3120	1.7795	2.1958
2006	3.33	107.1320	1.9700	1.5846
2007	4.79	131.0847	2.6000	2.0922

Sources: The Department of Agriculture (USDA) and DNR

Table B5. Corn Supply and Demand from 2004 to 2007 (million Bushel)

Items	2004	2005	2006	2007
Corn Production	11,807	11,114	10,535	13,074
Storage at the beginning	958	2,114	1,967	1,304
Food	1,343	1,359	1,347	1,341
Feed	6,157	6,154	5,595	5,973
Ethanol	1,323	1,603	2,119	3,000
Export	1,818	2,134	2,125	2,436
Storage at the end	2,114	1,967	1,304	1,624

Source: USDA Dataset

Table B6. Demand Functions for Corn from 2005 to 2007

Demand	Elasticities	Function
2005		
Food	-0.07	$D_{corn\_food} = 1453.60 - 47.55*P_{corn}$
Feed	-0.19	$D_{corn\_feed} = 7323.46 - 584.65*P_{corn}$
Export	-0.95	$D_{corn\_export} = 4160.93 - 1013.56*P_{corn}$
Storage	-2.50	$D_{corn\_storage} = 6885.06 - 2458.95*P_{corn}$
2006		
Food	-0.07	$D_{corn\_food} = 1441.3 - 28.32*P_{corn}$
Feed	-0.19	$D_{corn\_feed} = 6657.74 - 319.22*P_{corn}$
Export	-0.95	$D_{corn\_export} = 4144.47 - 606.34*P_{corn}$
Storage	-2.50	$D_{corn\_storage} = 4562.78 - 978.72*P_{corn}$
2007		
Food	-0.07	$D_{corn\_food} = 1434.87 - 19.60*P_{corn}$
Feed	-0.19	$D_{corn\_feed} = 7107.87 - 236.92*P_{corn}$
Export	-0.95	$D_{corn\_export} = 4749.88 - 483.10*P_{corn}$
Storage	-2.50	$D_{corn\_storage} = 5684.53 - 847.68*P_{corn}$