Impact of Limited Autonomy, Bargaining, and Legal Rights on Firm's GMC Application

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Abstract

Genetically modified crops have various economic costs and benefits. Their significance and benefits are numerous with highly concentrated biotech seeds controlling 88-94% of all corn, soybean, and cotton production. The purpose of this market analysis research is to determine if there is any negative impact on farmer autonomy when determining the use of seed in agriculture production. Negative aspects of adhesion contracts such as autonomy loss, bargaining and legal rights, and future potential market risk should be considered; however, if a producer mitigates risk exposure and acknowledges the loss of bargaining and legal rights GM crops are often advantageous and should be implemented. The negative aspects of the contract are evaluated using market concentration analysis, patent data, legal analysis of stewardship/technology agreements, and referencing peer reviewed research.

Keywords: Genetically modified organisms, intellectual property, firm autonomy, risk mitigation, Concentration Ratio, Farmers, GM crops, Monsanto, bargaining rights

Introduction

Imagine the grocery store produce section. The vast array of full, fresh, and vivid colors with the best Earth's ecosystem can offer. It isn't an accident or a natural process that brings this food to your local store. It is the sum-total of 10,000 years of the greatest achievement in human history: It is agriculture. It is the pruning, processing, and constant tinkering that brought to you a potato that didn't cause illness, a tomato that started in Peru at the size of a golf ball, and it is this process that has developed over 7,500 botanical varieties of apples worldwide. Agriculture is

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no longer the farmer artificially selecting preferred traits for their goals: It has reached the level of biotechnological engineering to create foods that have genetically been modified for targeted attributes. It is natural selection on steroids with higher yield goals in mind. Agriculture has shifted the destination of farmers' harvest from the local market to the global commodities market. A genetically modified crop (GMC) is a plant that has been genetically modified by adding a small quantity of targeted genetic code into an organism to create an organism's desired phenotypical trait. Genetically modified organisms (GMO) have been altered in a way that provides protection from predation, pesticide resistance, and/or improvement to plant quality. The economic significance for GM crops is that they can produce a larger number of bushels per year by using a GM crop over its organic counterpart and the market price of corn decreases due to higher supply. A concern in the general public is that genetic modification may have unwanted health risks associated which are yet undiscovered (Morris, 2011).

The scientific evidence currently does not support a claim that health complications have risen due to consuming GM crops (Kimbrell, 2006; Kayabasi, 2011; Maghari, 2011).The Food and Drug Administration (FDA) has a clear policy that a GM-crop must be substantially equivalent to organic root plant's nutritional value to be treated equally as non-GM-regulation without approval (Food, 2006). The industry has an impressive track record for safety and is nearly unblemished in terms of the number of products they have produced against public safety violations that have occurred. Market analysis studies the attractiveness and dynamics of a special market within a special industry. This market analysis has shifted away from the traditional Strength, Weaknesses, Opportunities, Threats (SWOT) archetype and offers breadth that couldn't otherwise be achieved. The following key attributes are encompassed within this research: current and future market size, market trends, market growth, industry structure, market profitability, and pertinent legal information. The primary purpose of this market analysis research is to determine if there are any negative implications on farmer autonomy[2] and bargaining rights when determining the use of seed in agriculture production. It has been designed for a reader with a basic knowledge of economic theory but does not require a quantitative research background.

[1]*Autonomy: state of existing or acting separately from others*

This analysis hopes to offer the reader information on the costs, current market distribution, potential market changes, and implementation requirements of GM-seeds.

Historical Analysis: Market and Case Study of Monsanto

The story of GMOs begins with the discovery of the double-helix structure of deoxyribonucleic acids (DNA) by Watson and Crick in 1953: the genetic "blueprint" that creates all living organisms. This discovery allowed scientists to splice targeted DNA from one organism to the DNA of a completely different organism. In 1973, Herbert Boyer and Stanley Cohen were the first to successfully create a recombinant DNA organism. In 1980, *Diamond V. Chakabarty* ruled that genetically-modified organisms are intellectual property and eligible for patent protection. In 1986, 1987, and 1992 plants such as GM tobacco and tomatoes were approved by the US Department of Agriculture for commercial production. It was a significant time period as well for GMO production firms because the FDA ruling declared that GMOs are not inherently dangerous and do not require any special regulation (Qaim, 2009). The largest genetically modified seed distribution company will be used as an example of some of the conflicts presented between farmers and the use of genetically modified seeds in North America. Monsanto has become a global leader in seed development, production, and distribution. Monsanto shares this market with other transnational agri-business like Du Pont, Shell, and Sandoz. Monsanto alone currently holds a dominant control 90% of the seed distribution market with a 95% market control in all soybeans and 80% of all corn (Schimmelpfennig, 2004).

Market Concentration: Hypothetical Case of Mealybugsi Impact on Orange Market

Market distribution raises concerns of subcompetitive performance resulting from interdependence among rivals (Varian, 2009). The presence of oligopolistic market conditions will artificially alter the market on supply-side product distribution by restricting product output and present a higher nominal price while reducing market welfare. Corn markets for individuals can be stated as generally elastic[3] (Slaughter, 2001). Farmer's demand for liquid capital is often inelastic meaning they have a much higher tolerance to price fluctuations in a

[2] *Elasticity: How sensitive the demand for a good is to changes in economic variables (specifically price)*

highly unstable commodities market. Economies of scale[4] do this to reach optimal profits while shaving product surpluses. To demonstrate this point I will take the example of the orange market. Suppose that it is 2019 and a recent outbreak of pesticide-resistant *Mealybugs* has spread throughout the Southern United States and caused a 40% loss in orange production domestically. The lack of production has direct consequences to the local markets that grow the orange trees with lower production on the supply-side and less demand for workers to harvest the oranges. It forces businesses to adjust by cutting expenses with layoffs and pay cuts. The loss of production causes an increase in prices in the short run and consumers may lean towards substitute products that have a steady price within their willingness-to-pay range such as apples or pears. The aggregate wealth of the producer will decrease as they must encounter increased waste in opportunity cost. The market equilibrium will eventually be reached over a long-term shortage as the consumers who previously demanded oranges now prefer apples due to their lower market price. This seems fair and advantageous to a both consumers and producers.

The example of genetically modified seeds is different. It is not a simple task to produce a successful, viable, and safe genetically modified organism that can be harvested and sold in a global economy. A new company would need a group of highly skilled scientists, research and development facilities, competitors' contractual agreements with consumers, advanced laboratory, a group of specialized biotechnological engineers, patent lawyers, and endure the strenuous amount of testing on the product's safety and efficacy. This high capital requirement acts as a barrier to entry into the market, decreasing the incentive to enter the market which inhibits any change in the market equilibrium.

Market Concentration: Patent Data, and CR Concentration

Limited monopoly power is necessary to provide an incentive for profit-seeking firms to enter a market with such high initial capital demands. The firm's largest cost is Research and Development. The cost of research to find a viable GMO is relatively high but the cost of production of GM-seeds once established is relatively low. The market's external forces are what have caused an imbalanced firm distribution at the equilibrium

[3]*Economies of Scale: the cost advantages that firms obtain due to size or scale of operation, with cost per unit of production decreasing with increasing scale because fixed costs are spread out over greater units of output*

point considering all factors (King, 2000). Table 1 demonstrates the market share of genetically modified seed companies in terms of the number of patents assigned to each. These data are representative of a few key factors when analyzing this market distribution in that the top firms maintain a high number of assigned patents and we can infer that they will also maintain dominance in this market due to the extended intellectual property rights they will maintain in future technology and development (Qaim, 2009). It uses a concentration ratio of the top 4 firms within the market (CR4)

A01H0001 Top Eight Firm Patent Assignees

1. Monsanto LLC.	1. Monsanto LLC.
2. Pioneer Hi Bred Inc.	2. Pioneer Hi Bred Inc.
3. Syngenta Participations Inc.	[illegible]
[illegible]	4. Syngenta Participations Inc.
5. Stine Seed Farm Inc.	5. Mertec LLC.
6. Nat. Inst of Agrobio Science	6. D&PI Technology Holding
7. Seminis Vegetable Seeds Inc.	7. Seminis Vegetable Seeds Inc.
8. Mertec LLC.	8. Kirin Brewery

Table 1: Source (King, 2000, Fuglie, 2012)

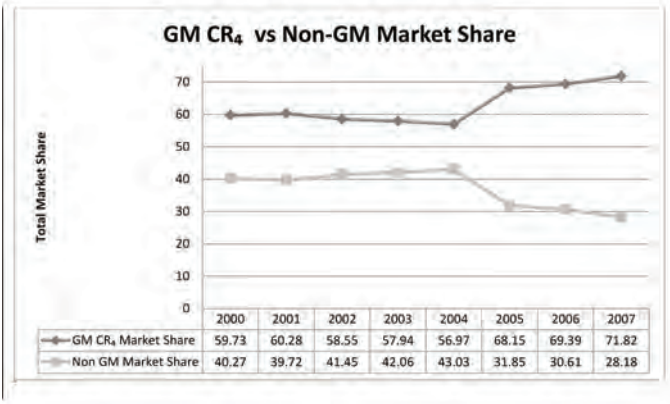

Figure 1: Source (Fuglie, 2012; King 2000)

These data were collected from Fuglie (2012) and King (2000). The market is oligopolistic[5] and we can assume that this will be unchanged in the future if the market conditions are relatively similar. The important factor to notice is the high disparity between the Top 1-4 and Top 5-8. It illustrates further the increasing market power that a single firm can possess when

[4]*Oligopolistic: A market condition consisting of so few sellers that any action committed by one of them will materially affect price and have a measurable impact on competitors*

high barriers to entry are present; namely limited inter-firm price taking, subcompetitive dependence, and few larger producers. I have compared the two variations of patent data in the table as A01H001 and A01H002. These patent codes refer to their biological terms. The GM seed market maintains a CR4 value of over 40%. The scale uses the top four market leaders combined in a single industry to compare with the rest of the total output in that industry (Rhoades, 1995). The graph below demonstrates the CR4 and the growing disparity over the total length of time in the market.

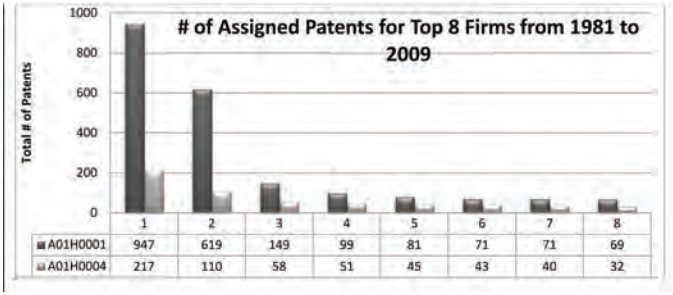

Figure 2: Source (Fuglie, 2012; King 2000).

This graph provides further clarity in the increasing market change over the length of seven years. The table represents the total seed market. The restrictions we have assumed are that a producer purchasing a GM seed would in turn not be purchasing non-GM seeds due to contractual agreements set in purchasing GM seeds from firms (e.g. Monsanto Stewardship Agreement). The distinction being a producer would have either a homogenous field of GM-corn or Non-GM corn based upon contractual agreements.

Adhesion Contract: Limiting Autonomy and Legal Protection

Bt-corn is a genetically modified plant altered to express a specific gene which produces Bacillus Thuringiensis (Bt) toxins within the plant. The gene activates the production of a protein which is an effective endotoxin to a variety of insects. It efficiently exterminates the European and Southwestern Corn Borer. The agricultural industry was animated about the production of a nontoxic plant that actually created its own pesticide. In 1996, the FDA approved production of Bt-Corn in the United States. Monsanto began seed production through

private seed producing farms in preparation for public release. 1992-1996 was a crucial time period for both farmers and seed companies. Seed companies needed to hit the market quickly to contact, and sign farmers onto "technology agreements". An example of a product usage contract is the Monsanto Stewardship Agreement. Monsanto also issues a similar product usage agreement with independent companies that distribute seeds to Monsanto's clients. Farmers used this time period to research, budget, and meet with Monsanto sales representatives if they wish to use Bt-corn. The product usage agreements the farmer and distributors sign are restrictive to grower's autonomy. Contract's mandate price premiums varying $8-30 per acre on which Monsanto seeds are planted. The end of each harvesting year requires that the farmer delivers all crops to a grain-elevator or crushing plant and no seeds from previous year can be used or kept the following harvest. Adhesion contracts bind the firm to the producer. The contracts contain limited grower remedy clauses (only cost of seed covered if wronged by company) but also contain one-sided clauses for the firm to recoup attorney fees, inspection costs, and damages by the grower. The farmer is recommended to spray the glyphosate broad-spectrum herbicide on acreage as specified by the Monsanto Technology Agreement. They also must open their records to any Monsanto representative at any time under contract as to maintain a paper trail of their product through the process. If farmers decide to dissolve this agreement the following harvest they are subjected to random inspections of land by Monsanto for three years to ensure no patented crops had been harvested without contract. Monsanto contracts also stipulate that a grower must notify them within 15 days of first noticing a problem with the seeds before he/she is able to sue. If growers do pursue legal action against Monsanto, they are required to litigate all cases in the Eastern District of Missouri, increasing the costs of litigation with travel expenses. Patent data show a significant concentration of three out of the four top firms in both categories with total firm distribution becoming increasingly polarized (Nachtigal, 2001). Significantly imbalanced agreements exist between large seed production firms and small scale farmers. Key disadvantages are the following: per acre premium, seed costs, required pesticide usage, increased log keeping, and extensive cleanup of seeds after harvest.

Global Trade, Role of Multinational Corporations, and Industry Risks

The focus throughout this research has been on North American trade of Bt-corn but the transition that chemical companies like Monsanto, Du Point, Shell, and Sandoz made by becoming a force in biotechnology is an important point to be analyzed. The economy has become globalized and transnational corporations have distinct role in agriculture. Economic systems benefit from trade between nations. Firms in perfect competition systems as relative costs for production differ from the between specialized firms for certain goods (King, 2001). The correlation between high firm concentration and innovation is disputed among economists. The two schools of thought are that high concentration has a negative impact on market efficiency (King, 2001) and economies of scale can provide credibility, lower average costs, and gain in efficacy due to lower fixed costs (McCorriston, 2002). Transnational agricultural companies (TNC) can control prices because of their ownership in processing plants, wholesalers, and retailers. They are able to control large stocks of a variety of foods. The United Nations Economic and Social Development Department states that "61% of flour mills are owned by four companies, 81% of beef packing facilities are owned by four companies, 60% of terminal grains handling facilities are controlled by four companies, and 82% of corn exporting is handled by three companies" (Schimmelpfennig, 2004). They are given access to political arenas, greater access to information, and capital. Small players like a farmer of Bt-corn in North America simply have no chance to compete directly against these large TNC because if current technology rates and corn prices remained static it would push small-scale farming operations out of the market. The transnational corporation however has the ability to wait out the costs for a longer period of time. It is analogous to the formation of union strikes. The cost within a private sector corporation is minimal per employee production in comparison to per hour worked by the employee. A potential solution that could be implemented is increasing the comparative advantage for producers to enter the field in spite high barriers of trade. An equalizing balance may be achieved by increasing the effectiveness of economic policies within the World Trade

Organization. An alarming trend since GM-crops have taken dominance in certain markets is the drop in University Study Grant Aid for conventional crop seeds. It is crucial to study because farmers might be feeling without an answer to GM-crops. A nominal increase in funding will increase the probability that new data will be discovered in genetic information, and crop health. The current market concentration cannot and should not be dismantled using antitrust regulation. Creating, altering, or enforcing antitrust laws would prove costly to the total economy because it increases attractiveness of foreign markets while decreasing the incentive to perform business domestically (Smith, 2010).

Possible Future Market Changes

It is estimated that 88 to 94 percent of soybean, corn, and cotton is devoted to a genetically modified variant domestically in the United States. The economic incentive to forego self-sufficiency is higher than the incentive to use collective non-GM seeds (Ma, 2012). A risk of structural change in GM food labeling laws would cause burdensome regulation on the segregation of food (Golan, 2001). As stated previously, GM crops have been noted as safe, effective, and are substantially equivalent to non-GMs. This has been documented in numerous studies (Committee, 2004). However, a consumer base that perceives a differentiation between the two goods may be benefited by mandatory labeling regulations to reduce search costs, increase market efficiency, and attach a price premium to non-GM products. It would also alleviate consumer concerns on asymmetrical product information (Siipi Uusitalo, 2008). If it is important for consumers and their demand for labeling requirements is high enough, the market will surely provide it to them. The concern is regarding production externalities to farmers. Firms producing non-GM crops would face increase production costs in ensuring no cross-contamination occurred. Examples would be separate shipping containers, genetic testings, etc. They might also need to develop crop sector strategies such as surrounding a large acreage U-shape of targeted non-GM crops with the rest of the area filled with targeted GM crops. This decreases the chances of genetic drift from neighboring farmers. It increases the opportunity cost of non-GM crops. Consumers could also face a market

with increased cost and a similar product if precautions cannot guarantee product differentiation. If regulatory changes occur it would alter the entire seed market. Non-GM seeds with credentials (e.g. product certifications, approval from third party) of their product's purity could command a higher selling price while GM-seeds may become less lucrative.

Conclusion

A firm producing agricultural goods presented with an opportunity to implement GM-crops should make consideration of personal circumstances, risk analysis, and implementation costs. The imbalance of contract rights is not a strong enough deterrent in most cases to prevent GM-crop implementation. Market price is the strongest incentive to produce GM-crops. Farmers should absolutely be concerned and note their loss of autonomy and bargaining/legal rights; however, the benefits of implementing GM-crops outweigh these negative consequences in the current market structure. A producer of Monsanto Bt-corn who properly uses the product, follows mandatory guidelines, and sacrifices some bargaining rights allows their firm legal access to a seed which increases yields, decreases pesticide use, and does so on less acreage. Monsanto has a restrictive contract and annual seed limitations to recoup profits from the relatively high R&D costs they incurred. They would no longer produce, develop, or improve their seeds if a limited-monopoly power was not provided to them. The negative circumstances of the contract are expressly aggravated by producers who do not read, understand, or seek proper legal counsel before aligning their business with a GM-seed producer. They can mitigate their risk by implementing the guidelines that the company requires (Monsanto Technology Guide) to ensure a decreased liability if seed failure occurs.

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