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Using Economics Experiments to Understand Patent Licensing Behavior

Rita Abdelnour
University of Nebraska - Lincoln, abdelnour_rita@hotmail.com

Amalia Yiannaka
University of Nebraska - Lincoln, ayiannaka2@unl.edu

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Institute of Agriculture & Natural Resources
Department of Agricultural Economics
http://www.agecon.unl.edu/Cornhuskereconomics.html

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Market Report	Yr Ago	4 Wks Ago	11/13/09
Livestock and Products,			
Weekly Average			
Nebraska Slaughter Steers, 35-65% Choice, Live Weight	$91.76	$82.14	$83.16
Nebraska Feeder Steers, Med. & Large Frame, 550-600 lb.	107.72	99.39	102.78
Nebraska Feeder Steers, Med. & Large Frame 750-800 lb.	102.85	97.15	93.55
Choice Boxed Beef, 600-750 lb. Carcass	155.68	135.29	139.94
Western Corn Belt Base Hog Price Carcass, Negotiated	51.73	49.61	52.58
Feeder Pigs, National Direct 50 lbs, FOB	54.45	*	*
Pork Carcass Cutout, 185 lb. Carcass, 51-52% Lean	57.28	55.35	57.70
Slaughter Lambs, Ch. & Pr., Heavy, Wooled, South Dakota, Direct	97.62	91.50	94.37
National Carcass Lamb Cutout, FOB	265.39	244.07	242.30
Crops,			
Daily Spot Prices			
Wheat, No. 1, H.W. Imperial, bu.	5.16	4.06	4.38
Corn, No. 2, Yellow Omaha, bu.	3.75	3.54	3.61
Soybeans, No. 1, Yellow Omaha, bu.	8.83	9.57	9.52
Grain Sorghum, No. 2, Yellow Dorchester, cwt.	4.91	5.57	6.11
Oats, No. 2, Heavy Minneapolis, MN , bu.	2.10	2.36	2.62
Feed			
Alfalfa, Large Square Bales, Good to Premium, RFV 160-185 Northeast Nebraska, ton.	202.50	*	*
Alfalfa, Large Rounds, Good Platte Valley, ton.	77.50	82.50	82.50
Grass Hay, Large Rounds, Premium Nebraska, ton.	75.00	*	*
Dried Distillers Grains, 10% Moisture, Nebraska Average.	138.50	112.50	122.50
Wet Distillers Grains, 65-70% Moisture, Nebraska Average.	48.00	39.00	41.75

*No Market

To successfully compete in today's globalized economy, agribusiness firms need to innovate. Innovation enables firms to produce new and/or differentiated products/services that satisfy specialized consumer demands, and enables firms to generate cost reducing processes to out-compete rivals in domestic and international food markets. Firms will engage in innovative activities if they are able to recoup research and development (R&D) costs and capture innovation rents, so it is critical that they are able to identify the optimal strategies of protecting and profiting from their innovations.

Patenting is the strongest form of protection, granting exclusive rights over a limited period of time; but not always resulting in the highest possible payoffs. Patents can be challenged after being granted, either via a direct validity attach and/or via infringement. Patent litigation can be very costly, with the average litigation cost (including the cost of discovery), exceeding $3 million per side and typically taking two to three years to litigate (Hsieh 2006). In addition, the outcome of the trial may be unfavorable for the patentee. In fact, more than 45 percent of patents are revoked during infringement trials (Allison and Lemley 1998), while 75 percent of the patents which are directly challenged end up being revoked or amended (Barton 2000). During 2002-2004 the lawsuit loss rate for patent owners at the appellate level was 75.6 percent (Janicke and Ren 2006).

So when should firms patent their innovations and when should they choose trade secrecy? If the decision to patent is made, how broad should the protection claimed be? When should firms litigate under infringement and when should they license their patents? While there are a number of theoretical studies that have tried to address the above questions,

empirical research that tests theoretical findings and predictions and could offer new insights into the factors that affect patenting behavior is very limited. This is mainly due to the fact that the usefulness of patent data as a means of empirically analyzing patenting behavior and understanding the patenting decision-making process is limited. One can only observe the ex-post decisions (whether the innovation has been patented or not, licensed or not, or whether a trial has taken place or not), and not the decision-making process itself. Economic experiments allow for empirical analysis without such problems. Economic experiments make use of human subjects to test, refine or develop economic theories by allowing researchers to set-up controlled situations where specific factors of interest (such as the patenting decisions) can be examined without conflicting variables present. The actions of the subjects can then be analyzed to understand their decision-making process and can also be directly compared to the predictions of theory.

Two economics experiments were developed by the University of Nebraska-Lincoln Department of Agricultural Economics, to shed light into the decision to license a patented innovation. The experiments were conducted in the "Experimental and Behavioral Economics Laboratory" (EBEL) in Filley Hall on East Campus, with undergraduate students, pursuing different majors at the University of Nebraska-Lincoln, being used as subjects.

The first experiment examined whether, when the decision to license is made, the patent holder maximizes profits, or her/his strategy is to maintain a dominant market share and whether, as suggested by theoretical studies, patentees license to weak rather than strong rivals. In this experiment each subject assumed the role of an innovator/patentee who faced two types of virtual entrants: weak and strong. Two scenarios were developed that differed with respect to the number of firms allowed to enter the industry; in the first scenario, the rival that did not receive a license stayed out of the market, while in the second scenario this rival could enter the market with a given likelihood. The first scenario was designed to capture the choice between profits and market share. The second scenario was designed to examine how the likelihood of entry by the non-licensed rival affects the innovator's licensing decision, and whether the subjects' choice is affected by the way they receive information about market structure, i.e., information is given sequentially as decisions are made versus information is given ex ante, before decisions are made.

Sixty undergraduate students participated in this non-interactive experiment, and results showed that the assumptions of profit maximization and licensing to weak competitors did not always hold. The outcome was very much dependent on the assumptions made about the potential licensee (e.g., their type and whether they would enter the market in the absence of a license or not). Results showed that the subjects that used licensing to maximize profits (rather than market share), chose strong rather than weak competitors as potential licensees, and that the way information was received significantly affected the licensing decision; the likelihood of choosing profits over market share was higher when the information was given ex ante, compared to sequentially as decisions were made.

The second experiment examined (a) whether patentees are more likely to license broad versus narrow patents (economic theory suggests that broad patents are more likely to be licensed), and (b) the likelihood of patent licensing, patent infringement and patent litigation, given the nature of the potential entrant (weak vs. strong). This was an interactive choice experiment where subjects participated in a series of games (strategic interactions), where they were randomly paired up and assumed the role of an innovator/patentee or a potential entrant. Each game simulated specific market conditions to allow for comparison of the results among various market structures, and each decision was associated with a given payoff so that the subjects' decisions in each game determined their overall payoffs. The questions of interest were examined under six different scenarios (sub-experiments) that determined whether the licensing outcome is affected by (a) the nature of the bargaining process during which the licensing fee is determined (one shot game versus multiple interactions); (b) who initiates the bargaining process, the patentee or the potential entrant; and (c) whether the players had complete versus incomplete information.

Ninety-six undergraduate students participated in this interactive experiment, and the results showed that the likelihood of licensing was affected by the breadth of the patent in a manner consistent with theoretical predictions; broad patents were more likely to be licensed than narrow ones. Also, the likelihood of licensing was greater under incomplete information, where innovators were more likely to license to weak rivals. However, contrary to theoretical findings, under complete information innovators were more likely to license to strong rivals. The likelihood of patent challenge was greater for broad rather than narrow patents, and weak rivals were more likely to challenge patents than strong rivals. Also, a patent was more likely to be challenged when no licensing offer was made. Finally, the likelihood of patent litigation was smaller for broad rather than narrow patents, and inno-

vators were more likely to litigate infringed patents when they faced a strong rather than a weak competitor and when they, rather than the potential entrants, initiated the licensing process.

While most of the results from the above experiments conform with theoretical predictions, a few contest theoretical findings and give new insights on the factors affecting patent licensing behavior (e.g., the effect of the type of entrant on the likelihood of patent challenge and patent litigation). To further investigate the inconsistency between theoretical predictions and empirical findings, these first results will be used to fine tune the experiments and run them using real life innovators as subjects.

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Rita Abdelnour, (402) 472-7865
Ph.D. Student
Dept. of Agricultural Economics
University of Nebraska-Lincoln
abdelnour_rita@hotmail.com

Emie Yiannaka, (402) 472-2047
Associate Professor
Dept. of Agricultural Economics
University of Nebraska-Lincoln
yiannaka2@unl.edu

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