

INTELLECTUAL PROPERTY RIGHTS AND CONCENTRATION IN AGRICULTURAL BIOTECHNOLOGY

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The relationships between intellectual property rights (IPRs) and structural change are examined in this paper. Intellectual property rights are a complex, multifaceted area and one in which corporate strategies are poorly understood. Nevertheless, it is argued here that IPRs can affect firm entry, can make vertical integration in downstream industries more or less necessary, and can create financial incentives for downstream mergers and acquisitions. Hence, IPRs can have significant structural impacts.

Key words: intellectual property rights; agrobiotechnology; industry structure; research and development (R&D)

The later 1990s have been a tumultuous time for merger and acquisition activity among firms involved in agricultural biotechnology. By the end of the third quarter of 1998, Monsanto alone had been involved in 18 acquisitions and had itself agreed and then reneged on a merger with American Home Products. In addition, Monsanto completed overseas acquisitions worth a total of \$7.3 billion over two years. Novartis was formed by the merging of Sandoz and Ciba-Geigy, while DuPont chose to enter the market through joint ventures; a total of 20 joint ventures valued at over \$5 billion (Moore, 1998).

These mergers have contributed greatly to a restructuring of the seed industry. Most notably, Monsanto controlled up to 40 percent of seed for the 1998 United States (U.S.) soybean crop and, if approved, full acquisition of Delta & Pine Land will give Monsanto ownership of at least 80 percent of the U.S. cotton seed industry (Kilman & Warren, 1998).

This is not the only incidence of major acquisition activity, a previous one occurred about 20 years earlier. Butler and Marion (1985) list 27 mergers during the period 1978-80. The 1980 date is pivotal as it marks some strengthening amendments to the United States Plant Variety Protection Act. At that time, a number of observers identified a direct causal relationship between the strengthening of intellectual property rights and merger activity. Leibenluft (1981) noted, “The success of the Act in creating such incentives is reflected . . . by the more than 50 seed company acquisitions by pharmaceutical, petrochemical and food firms” This position

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is, if anything, more strongly held today. Yet the situation has evolved. Whereas many of the acquiring firms in the 1980s merger round were new entrants to the sector, the current round involves existing participants.

The purpose of this paper is to review the relationships between IPRs and agricultural biotechnology industry concentration. Attention is primarily on industry structure at the interface with farmers. At one level, a connection between IPRs and private sector investment is evident. Intellectual property rights allow private firms to appropriate returns that would otherwise accrue to the public and, hence, justify investments. Hybridization, a biological form of property rights protection, demonstrates the connection with investment and concentration. Private investment in seed breeding occurred earliest for hybrid corn. Furthermore, before 1980 estimated four-firm concentration across the U.S. seed industry was 14 percent, versus 57 percent for corn (Lesser & Masson, 1983; Leibenluft, 1981). A similar pattern is evident in developing countries where the first private firm entry following deregulation is in hybrids. Intellectual property rights now provide legal protection roughly paralleling that of hybridization, and private sector investment in plant breeding has increased substantially since the 1980s. What this initial observation leaves unanswered is the source and form of the investment -- whether it is by expansion, new entry, or acquisitions.

Intellectual Property Rights, Research And Development, And Industry Structure

We begin an exploration of the relationships between IPRs and concentration by considering the theoretical literature. As most of this literature relates investment, not IPRs, to industry structure, it is necessary first to assume a direct relationship between IPRs and investment. The general IPR/investment relationship, the strong theoretical justification aside, has mixed empirical support. Harabi (1995), for example, concluded that “patents are an ineffective means of protection against imitation;” and “patents were seen as the least effective [means]” compared to alternative methods of protection including secrecy and superior sales and service efforts. However, at the sectoral level, patent protection is typically rated highly by industry representatives in biotechnology and pharmaceuticals, to a large degree because of the regulatory costs and the relative ease of copying of these products (see Nogues, 1990). And certainly, for plants, secrecy is not a possibility. Thus, here we will assume IPRs contribute to research and development (R&D) investment, and explore the relationships between R&D and the agricultural biotechnology industry structure.

Schumpeter, a leading theorist, hypothesized that successful innovation reinforces size and market power (Swann & Gill, 1993). Under this scenario, IPRs strengthen the incentive to invest which provides greater opportunities to the large firms, compounding their position. Supporting this conceptual position was early work by Phillips (1956; 1966) and Mansfield (1962) who found that successful innovators grew more rapidly, enhancing concentration. When the focus was on process innovations, the resultant technologies tended to increase scale economies, again leading to enhanced concentration (Mansfield, 1983; 1984).

However, the evidence is not consistent, for innovation contains deconcentrating components as well. In part, this is attributable to the declining scale effects of many technologies developed over the past 60 years (Blair, 1972). Perhaps more pertinent, Gort and Klepper (1982) argue that small entrant firms have a greater incentive to initiate radical innovations, defined as those which render obsolete previous technologies and products. Winter (1984) found new entrants were responsible for twice the number of radical innovations as incumbents, which focused more on ongoing, routinized innovations. This perspective can be cast in the mold of product life cycles whereby

initial, radical innovations tend to be deconcentrating, transitioning to concentration-increasing routinized R&D (Mueller and Tilton, 1969). While many of these studies are dated, the concepts resonate with current thinking regarding the difficulty of large firms to remain creative and responsive to change. Arrow (1962) shows the incentive of monopolists is always less than under competition as monopoly output is lower, at about the ratio of monopoly to competitive output for minor inventions.

Overall, this literature presents a contradictory picture. In some cases, innovation is concentrating, in others, deconcentrating. Partly, this might be attributable to the cross-sectional nature of many studies that involve sector-specific factors. Irrespective of direction, the literature does suggest a clear connection between investment in innovation and industry structure.

Intellectual Property Rights And Entry Barriers

Equally pertinent is the literature addressing entry barriers. Comanor (1964) found expensive and risky R&D acted as a barrier to entry, while Scherer (1984) noted that the speed of innovation raises the costs and risks of innovation. Together, these studies suggest that rapidly evolving and costly agricultural biotechnology innovations tend to limit entry. Consistent with this argument is the observation that only limited entry (or more correctly, escalation of commitment) has occurred in recent years in the agricultural biotechnology industry. Intellectual property rights may play an additional role in limiting entry into the agricultural biotechnology sector.

Barton (1998) noted the unusually large number of patent suites in the area of agricultural biotechnology, a total of 48 as of May 1997. While some such disputes are common to all industries and are needed to clarify the scope of related patent grants, other disputes involve very broad grants, such as the right to the use of *Bacillus thuringiensis* (Bt). *Bacillus thuringiensis* is a biological pesticide introduced into cotton, corn, and other crops, as claimed by Mycogen, Plant Genetic Systems (PGS), Novartis, and DeKalb. Such broad patents tend “to drive all competitors out of the market . . .” Further, it is noteworthy in the case of agricultural biotechnology that there is the greater “incentive to sue outsiders seeking to enter the industry than to sue other major participants . . .” (Barton, 1998). Infringement litigation is very costly, easily in the multi-million dollar range, because of the complex issues raised by agricultural biotechnology; and even the threat of litigation can deter smaller entrant firms. Patents, of course, are not the only available legal mechanism for discouraging entrants. Material transfer agreements, a form of contract, can have the same effect for firms that need to access component technologies like promoters or markers.

Under this scenario, patents and contractual rights may be manipulated specifically to deter entry and, indirectly, to increase concentration. Documenting the effectiveness of that strategy is difficult, but clearly major firms like Novartis and DuPont have the financial wherewithal to enter regardless. Thus, effectiveness is limited against the more potent entrants.

Intellectual Property Rights And Stock Values

The truly scarce factor in agricultural biotechnology is not research capacity nor expertise with regulatory requirements nor the financial resources to protect IPRs. Strictly limited in the short

run are the old line skills of seed breeding and distribution. Many agricultural biotechnology products must be delivered through seeds, which requires the skills of traditional firms with access to germplasm and marketing channels. One analyst puts it this way, “A new gene is worthless without a quality seed base to put it in and the infrastructure to deliver it.” (Furman Selz LLC, 1998). Recreating this expertise *de nouveau* would be a slow and costly process, a clear barrier to entry. And it is just these types of firms -- companies like DeKalb, Asgrow, Delta and Pine Land, and Mycogen -- which have been bought in recent years. Hence, weakness of intellectual property rights may lead to mergers and acquisitions and industry restructuring.

An alternative explanation of the observed downstream mergers is purely financial. In the main, the stock market has valued biotechnology firms highly. Monsanto's shares pre merger plans with American Home Products had P/Es over 100; current levels are still in the 70 range despite a 33 percent drop in price. Other major firms, being involved as they are in chemicals (DuPont) or pharmaceuticals (Novartis), are not as pure a play in agricultural biotechnology as Monsanto so the effect is muted. But it is clear that the success of agricultural biotechnology has contributed greatly to the share prices of seed companies. DeKalb's capitalization rose ten-fold over the 14 months when Monsanto's ownership went from 40 to 100 percent.

From a firm perspective, acquisition of downstream assets, particularly if done using shares valued at high levels, would be seen as a good investment. Delay could result in higher future prices, even as biotechnology created the new share value. Moreover, once acquisitions begin, the process creates additional acquisition incentive to avoid being foreclosed from market access, a typical issue with vertical mergers. In this scenario, IPRs play a strictly secondary role as they create the firm value, but financial considerations direct the acquisition strategy.

Conclusions

Intellectual property rights are a complex, multifaceted area and one in which corporate strategies are very poorly understood. Fundamentally, IPRs are essential for the incentive to create easily copied products. As discussed here, however, IPRs can affect entry, make vertical integration in downstream industries more or less necessary, and create financial resources encouraging downstream mergers and acquisitions. Hence, IPRs can have significant structural impacts.

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