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A Tale of Two Businesses: Intellectual Property Rights and the Marketing of Agricultural Biotechnology

by Peter Goldsmith, Gabriel Ramos, and Carlos Steiger

An odd situation exists in Argentina. The volume of the soybean seed market is three times the corn market, yet little or no money is made by the leading branded seed companies. The corn market, in contrast, is highly profitable. How can these two businesses, which are complements in the US, perform so differently in Argentina? How can the corn business reflect the best of times while the soybean business reflects the worst?

The difference involves intellectual property. Corn's intellectual property is protected whereas soybean's is not. The protection differences exist because corn is a hybrid and soybeans are not. This difference provides a vivid example of the economic effects of weak intellectual property rights.

Soybeans and Corn in Argentina

Argentina is the third leading soybean-producing country in the world, producing 33% of US output. Close to 11 million hectares of soybeans were planted in 2001. Since the release of Roundup Ready® soybeans in 1996, the rate of annual increase in soybean hectares has tripled to over 850 thousand additional hectares per year (Figure 1).

Although the soybean industry is growing dramatically, the soybean seed sector struggles. For example, Monsanto and Pioneer, leaders in soybean seed sales globally and leading seed companies in Argentina, were unable to conduct viable soybean businesses in Argentina. An executive with Pioneer makes this point quite directly: "In 2001-2002 the country planted a million new hectares of soybeans. We [Pioneer] didn't sell one more bag of seed" (Director of Marketing, Pioneer-Argentina). Monsanto suffered significant losses on soybean and

herbicide sales in Argentina, which caused the resignation of its CEO (Barboza, 2002).

Although the formal market for soybean seeds is poor, corn profitability was much higher even though its market is only one third that of soybeans (Table 1). In 2001, close to 4 million hectares of corn were grown in Argentina, making it the seventh leading corn-producing country in the world (11% of US output). Contrary to the soybean market, hectares planted in corn over the last twenty years have declined. Pioneer has 18% of the corn seed market in Argentina and earned 15 times¹ the net profit compared to the soybean division (Figure 2).

Table 1. Corn and soybean yield comparison.

	Corn			Soybeans		
	Argentina	US	Ratio	Argentina	US	Ratio
1971-1975^a	2,475	5,456	0.45	1,461	1,826	0.80
1976-1980	2,944	6,030	0.49	1,987	1,945	1.02
1981-1985	3,313	6,628	0.50	2,049	2,020	1.01
1986-1990	3,416	7,013	0.49	2,022	2,161	0.94
1991-1995	4,336	7,443	0.58	2,162	2,437	0.89

^a Five-year averages expressed as metric tons per hectare. Source: SAGPyA, 2001 and authors' calculations.

1. Internal Pioneer financial data is expressed in relative terms for proprietary reasons.

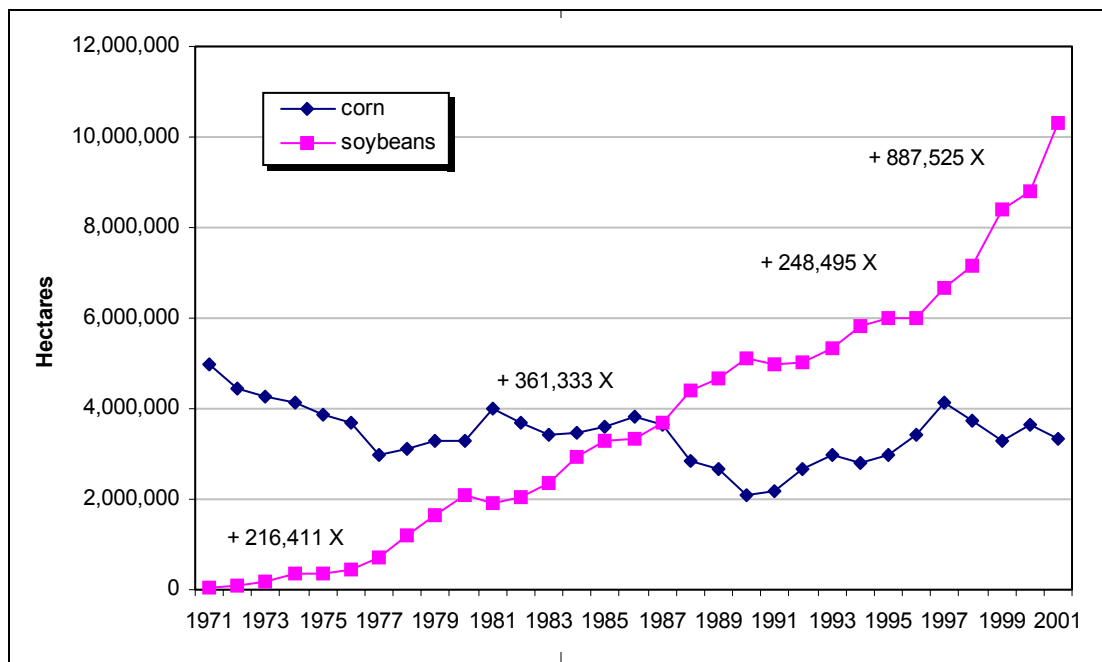


Figure 1. Corn and soybean hectares in Argentina.

Note: Internal figures represent annual slope coefficients for the 1970s, 1980s, 1990-1995, and 1996-2001. Source: SAGPyA, 2001.

Property Rights in Corn vs. Soybean Seed

A corn plant is only pollinated by another corn plant (cross-pollination). If corn seed is saved from one year to next, the corn plant loses its hybrid vigor and performs poorly. A farmer must return each year to the seed seller to buy an updated corn hybrid. Soybeans are self-pollinating. They can reproduce with minimal yield drag from year to year. A farmer can keep seeds from one crop and replant them next year. With soybeans, a farmer saves money by not having to buy new seed every year.

Roundup Ready® soybeans allowed dramatic growth in farmer-saved seed (legal in Argentina) and brown-bagged seed (illegal in Argentina). The informal marketing of soybean seed now has a nearly 90% market share (Argentine Association of Regional Consortiums for Agricultural Experimentation, 2001). Profits from branded seed have been lost. Under brown bagging independent firms, not independent farmers, are producing, packaging, and marketing pirated seed.

In the US, Monsanto introduced and enforced a grower contract that prohibits saved or multiplied seed (Goldsmith, 2001). This has protected Monsanto's branded seed and herbicide sales in strong IPR countries such as the US and Canada.

The situation raises new issues facing the global agri-food system: (a) the increasing effects of knowledge assets, such as patents, on global competition; (b) how private entities exert greater influence on food-related research and development, and (c) how property rights protection changes industrial structure. Although it is generally agreed that intellectual property rights are important for economic growth, little evidence is available about their effects on developing countries and on innovation.

Weak Property Rights

The lack of clear benefits from IPR production might reflect fundamental differences in belief systems about private versus communal property, the negative effects of monopolies on innovation, or a "tit for tat" view in which southern countries are "owed" the technology based on a history of northern resource extraction and farm support policies (Goldsmith, Ramos, & Steiger, 2003). The result is reluctance by southern countries to actively protect IPRs.

The experience of Pioneer in Argentina is a good case study of the economic effects of weak IPR. The case study, conducted in 2001 and 2002, involved interviews with competitors, regulators, and supply chain members, use of secondary data

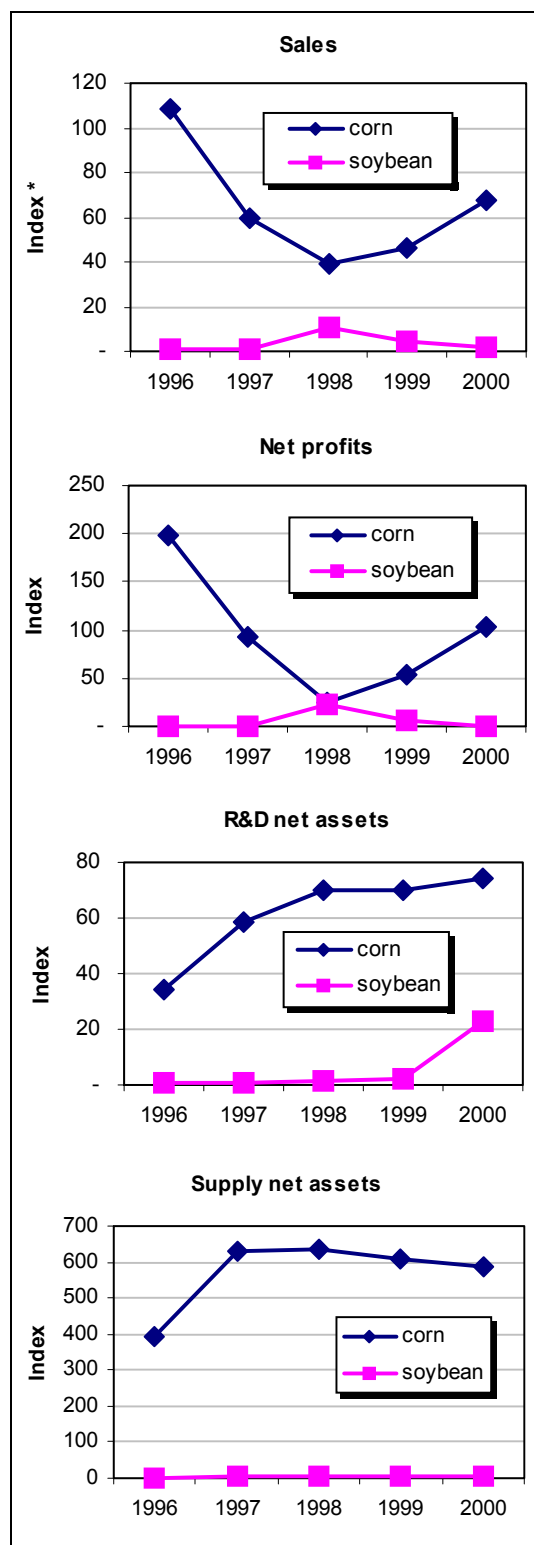


Figure 2. Pioneer financial indices.
 *Indexed to 1996 soybean values. Source: Pioneer Internal Documents, 2000.

about crop agriculture in Argentina, and photographic documentation of investment. We

employed a digital video camera inside key Pioneer R&D and manufacturing sites to document dedicated investment serving both corn and soybean businesses, corn-only business, and soybean-only business. The guiding idea is that underinvestment occurs with weak property rights, and significant investment occurs under strong property rights.

Pioneer maintains separate corn and soybean divisions, thus facilitating an understanding of how differences in IPRs between the two divisions influence plant, equipment, and human capital investment; supply chain structure; product pricing; and business performance. The corn division reflects a strong IPR environment and the soybean division a weak IPR environment. The analysis reveals behavioral differences between the two seed divisions as well as differences in technological spillovers to Argentina (Goldsmith, Ramos, & Steiger, 2003).

Pioneer-Argentina

In 2001, Pioneer-Argentina had annual sales of \$35 million. Soybean sales were 33 times lower than corn in 2000-2001, although the market is one third as large. Management describes the business environment for the soybean division.

- Pioneer does not bring new products to Argentina because it would risk losing them” (Pioneer, Director of Research).
- The lack of IPR reduces the potential market for Pioneer, and its remaining size is not sufficient to justify a specific breeding program” (Pioneer, Director of Marketing).
- Soybeans nowadays are not a good business; there is not enough control of the brown bag problem” (Pioneer, District Sales Manager Soybeans).

The corn and soybean divisions each have three units: Research and Development (R&D), Supply (seed production/processing), and Marketing.

R&D Unit

Over the last five years, the corn division has averaged 33.6 times greater investment in R&D than the soybean division. This shows the linkage between rent appropriability and research investment. The inability to capture economic rents on soybean seed spills over to the host country—fewer professional workers are hired, and technology is less specialized. Additionally, all soybean research is



Figure 3. Pioneer-Argentina's only dedicated soybean asset—a 30-year-old wooden soybean seed classifier.

conducted outside the country, limiting the multiplying effect of new knowledge. R&D expenses in the corn division are higher as well.

- “Breeding programs are established when the firm has economic reasons... the problem is that the size of the market is not enough...the size of the legal market” (Pioneer, Director of Research).
- “I consider that if the [IPR] conditions would change, there would be a soybean breeding program similar to corn; I recognize that doing soybean breeding is easier, but I am sure that the testing program would be much bigger than what it is right now” (Pioneer, Director of Marketing).
- “Argentinean farmers do not value that we go and demonstrate the quality of our products, that we provide him with an adequate technological package; the research behind our product.... [So] Pioneer invests and it is not profitable because farmers choose the brown bag; while doing this [the farmer] is discouraging marketing or research in soybeans” (Pioneer, District Sales Manager Soybeans).

Supply Unit

The supply unit scales up R&D products for commercial purposes. Included are field operations to generate the seed and cleaning, sorting, and packaging of the finished product. The investments in the corn and soybean supply stages differ dramatically. Over the last five years, net assets in supply

operations of the corn division averaged 174 times greater than those in the soybean division.

Pioneer’s Director of Plant Operations describes how the company leverages the corn infrastructure to produce soybeans.

“We have been producing soybeans all these years using the corn technology.... We try to synchronize the soybean crop so that the plant is free of corn and we can process soybeans.... We have to take special care to process soybean seed because it is very easy to damage.... In soybeans, zero investment in infrastructure, that is it; we do not invest in soybeans; we use what we have here and maximize it.”

The only soybean equipment was a 30-year-old wooden soybean seed classifier (Figure 3). “That machine has been around for 30 years; we bought it used and refurbished it nine years ago” (Pioneer, Director of Plant Operations). The lack of investment in soybean supply operations results in a loss to the company approaching \$15 million in direct development, plus operations, maintenance, and 45 permanent and numerous temporary jobs (Pioneer, CEO).

Distribution and Marketing Unit

Weak IPR affects the corn and soybean marketing stages differently. Vishwasrao (1994) raised an important argument offering internalization (or vertical integration) as a strategy for protecting a firm’s intellectual property. This is consistent with the theory of the multinational enterprise as a risk-reducing mechanism (Rugman, 1982; Caves, 1990; Goldsmith & Sporleder, 1998). The Pioneer case, however, shows a result that contradicts theory. Internalization does not occur where intellectual property is at risk (soybeans), but instead occurs where property is more protected (corn). In the soybean division, outsourcing operational activities is preferred, utilizing independent seed dealers who step up foundation seed to commercial volumes, final packaging and distribution. Internalization occurs in the corn division because strong property rights justify investment in specific assets.

Pioneer financial records confirm that the costs of goods sold and marketing expenses per unit average 2.75 times higher for corn than for soybean. According to a Pioneer district sales manager, “...my boss asks me to mainly focus on corn, and that is reasonable, because it is in corn where we

conduct more research, where we spend more and also gives us the best profitability, and that is the goal of a firm....”

Economic Effects of Weak IPR

Pioneer’s business focus is skewed by the weak IPR environment. Pioneer loses while the Argentinean farmer gains. The case clearly shows that inability to protect intellectual property influences the firm’s behavior. Additional analysis is needed, however, to better understand the economic effects of weak IPR.

First, the firm’s economic losses are not a total loss. Pioneer adjusted to weak property rights by adopting a second-best strategy. That includes shifting investment among divisions, radical cost management, and bundling of product and services. Soybeans are bundled with the other more highly valued products such as corn. In addition, similarities in the demand for soybeans in the US and Argentina allow Pioneer to leverage its US soybean investments in order to offset the weak property rights environment in Argentina.

Second, the latest soybean technology at the R&D, production, or marketing stages is not being used in-country. So much of the value of the seed is contained in the seed itself that the domestic seed industry can be bypassed. Roundup Ready technology has advanced to the point where any farmer can quickly benefit and achieve superior performance from a brown-bagged product that requires few other inputs, and no technical assistance, product support, or seed adaptation.² As evidence of this, Argentinean soybean yields are similar to those in the US even though the seed is uncertified (Table 1). This reduces costs by avoiding duplication of seed production capabilities between countries. Although soybean production may be able to leverage investments in the US, the lack of technology, investment, and human resource training spillovers reduce Argentina’s ability to engage other crop development or ancillary opportunities.³

For example, because the seed technology is so robust, Argentina could essentially operate its seed

2. *Only one herbicide is required—glyphosate—and no tillage is utilized to prepare the warmer soils of central and northern Argentina.*

business by importing all of its seeds directly from the US. Farmers would go to the port, pick up their seed straight from the ship, and go directly to the field for planting. On the one hand, this is efficient because costs have been driven out of the system and the system can operate with greater scale economies. Alternatively, though, the host country risks not developing the capabilities to conduct seed research, produce certified seed, market high quality seed products, or properly support end users. If it is a question of soybeans, then there is no risk. However, if the country had unique needs (say, other crops) or in the future soybean IP could be protected, the country would be unprepared or lag far behind in its ability to engage in those businesses.

Finally, the seed industry’s vulnerability to weak property rights might benefit other stages of the soybean supply chain. The Argentinean soy food and feed industry is competitive, dynamic, and a bright spot in Argentina’s economy. Inexpensive and plentiful soybeans produced by local farmers are critical to the industry’s competitive advantage. The down-chain soy complex benefits from the rapid diffusion of the latest soybean technology. The country could be better off when the benefits gained by others in the industry are considered.

Pioneer’s offerings are two to three years behind those found in the US (Goldsmith, Ramos, & Steiger, 2003). It is not the product alone, however, that moves from the more developed to lesser developed countries. Rather, the entire technology moves. Argentina and Brazil together have recently surpassed the US as the world’s dominant soybean suppliers. Much of this growth reflects the dominance of the Roundup Ready technology. Countries need little else to achieve global competitiveness. Competitiveness in agriculture depends critically on managing intellectual property.

Conclusion

The Pioneer case is about investment and adaptation to national environments. IPR protection facilitates technology transfers, spillovers, and

3. *This was certainly the case for Brazil, which had unique needs in developing low-latitude soybean varieties.*

employment opportunities. Pioneer chooses corn over soybeans, because IPR protection makes corn seed financially viable. The Pioneer case shows how the institutional environments distort investment and firm behavior. The most compelling implication of weak IPR is incapacity to address a country's needs and priorities.

For More Information

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