

Property Rights and Incentives to Invest in Seed Varieties: Governmental Regulations in Argentina

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This paper analyzes the evolution of property rights legislation in Argentina with respect to new seed varieties. In comparison to the United States, Argentina has weak protection and enforcement of property rights for new seeds. These weak property rights affect the registration and commercialization of new soybean seeds. This paper shows how private producers of seeds react to differences in property rights between Argentina and the United States and also between corn and soybeans. Investment efforts will concentrate on those crops with more secure property rights at the expense of the markets in which property rights are less secure. This effect has important consequences for a developing market producing in a global market.

Key words: Argentina, biotechnology, market regulation, property rights, seed markets.

Introduction

In the past few decades, impressive advancements in biotechnology have resulted in dramatic changes to the structure of agricultural markets (Guzman, 2004). Argentina, as one of the global leaders in corn and soybean production, has been an attractive market for new agricultural technologies, especially genetically modified (GM) seeds. However, the sale and use of GM seeds necessarily implicate the intellectual property (IP) rights and protections accorded to GM seed producers. The extent of these rights plays an important role in shaping the biotechnology market and is the source of much debate (Kesan, 2000; Moschini, 2001). Governments, international organizations, the private sector (firms and farmers), scholars, and scientists are actively discussing how best to accommodate the market for GM seeds and how property rights should be defined and enforced to promote social welfare (Fernandez-Cornejo, 2004). Developed countries have made efforts to enforce intellectual property rights over seeds in developing countries in order to promote and protect the investments of their companies abroad. In contrast, developing countries have insisted on maintaining a loose property rights system that favors their farmers by allowing access to new technologies at the lowest possible cost (Goldsmith, Ramos, & Steiger, 2002).

In Argentina, patent protection is not generally available for plant varieties. Seed producers' only forms of protection are Plant Variety Protection Certifications (PVPCs), which were established by the 1978 International Convention for the Protection of New Varieties of Plants (UPOV 78). The lack of patent protection has been the source of much tension between the Argentinean government and foreign companies. A breaking

point was reached in 2004 when Monsanto completely withdrew from the Argentinean soybean market, blaming black-market competition and the lack of enforcement of IP rights by the government (Burke, 2004).

This paper analyzes how the scope and enforcement of property rights affect the introduction of new seed varieties by comparing Argentina's insecure intellectual property rights regime to that of the United States, which has a strong intellectual property regime. In particular, we compare investment in new varieties of corn hybrids, which cannot be reused, to that of soybeans, which can be reused. We find that both domestic and foreign seed producers respond in a similar fashion to market incentives that are influenced by property rights. We conclude that the implementation of PVPCs according to the UPOV 78 guidelines provides enough protection for corn seeds, which require a low level of IP rights protection. However, the PVPCs provide completely ineffective protection of soybean seeds. Our model predicts that the bias in the enforcement of IP rights generates an overproduction of corn seeds and underproduction of soybean seeds, despite Argentina's position as one of the main producers of soybeans in the world market.

Argentina's Soybean and Corn Markets

Argentina is an important actor in international agricultural markets (Schnepf, Dohleman, & Bolling, 2001). During the 1990s, the liberalization of the country provided new impulses to agriculture, resulting in the rapid expansion of soybean production (Schnepf et al., 2001). The area planted with soybean increased a dramatic 669% from 1978 to 2003, and the total annual produc-

tion increased from 2.5 million metric tons to 35 million metric tons (Secretaría de Agricultura, Ganadería, Pesca y Alimentos [SAGPyA], 2004). Over the same period, the area planted with corn decreased a slight 6.5%; however, corn production increased by 72.9% because of improvements in yield.

The boom in the production of soybean has propelled Argentina into the international agriculture market spotlight. From 1999 to 2000, Argentina's soybean production accounted for 15.2% of the total world production and had an impressive 11.2% share of the total world exports (US Department of Agriculture [USDA], n.d.). Over the same period, the total production of corn represented just 2.6% of the total world production; however, Argentina captured 11.5% of the total world exports (USDA, n.d.). As a result of their production levels, both crops occupy an important position in the agricultural sector of the country and in the international market. In addition to exports, Argentina also occupies an important role in the international market for seeds (Fernandez-Cornejo, 2004). Its domestic market for seeds is the eighth largest in the world and is comparable to the seed markets of developed countries. Finally, Argentina has been one of the early adopters of GM soybean and corn seed. In 1996, the government approved the use of GM seeds, and since then farmers have been utilizing Roundup Ready soybean and Bt corn intensively (US General Accounting Office [GAO], 2000). Given Argentina's prominent role in the international agriculture market and its relationship with the biotechnology industry, the scope and enforcement of IP rights are critical in sustaining its leading global position and in continuing its growth through access to new agricultural technologies (Trigo & Cap, 2003)

Property Rights in Argentina and the United States

This section provides a description of how the IP rights system has evolved in both the United States and Argentina. The United States IP protection regime offers strong protection and is used as a standard for comparison with Argentina, a country with a weak IP protection system. Empirical evidence demonstrates how the strength of the protections available to producers affects the introduction of new seed varieties for soybean and corn.

Seed Protection in the United States

The intellectual property rights protection regime in the United States is one of the friendliest in the world for

biotechnology inventors (Fernandez-Cornejo, 2004). Seed producers can protect their inventions with a range of regimes, including the Plant Variety Protection Act of 1970 (PVPA; Kesan & Janis, 2001), the Plant Patent Act of 1930 (PPA), and the Patent Act of 1952, as in the case of any utility patent. Furthermore, the Supreme Court has reinforced the importance of patents for plants, by allowing the use of utility patents for plants in the key case of *Diamond v. Chakrabarty* (1980) and in the recent case of *J.E.M. Ag Supply, Inc. v. Pioneer Hi-Bred International, Inc.* (2001). As a result, the United States has a system in which intellectual property rights are well-defined and easily enforced and in which researchers can choose the level of protection they consider sufficient to protect their inventions in the market.

Seed Protection in Argentina

The Argentinean legal framework regarding new seed varieties has evolved over time to give increased protection to researchers and the industry. The first law addressing new seed varieties was enacted in 1935. Although this legislation provided for the registration of new seeds and required government approval for new varieties to be introduced in the market, it did not provide any legal protection to intellectual property rights for the new seeds. In 1973, the military government passed a decree called the "Law of Seeds" (SAGPyA, 2005). This was the first piece of legislation that gave commercialization rights to the inventors of new seed varieties. It also provided for the creation of the National Seed Commission (Comision Nacional de Semillas, CONASE) to be in charge of advising and evaluating governmental policies regarding the regulatory regime. Although the Law of Seeds was a step forward in protecting intellectual property rights, it was not fully implemented until 1978. In addition, this law did not ultimately provide enough protection and enforcement of intellectual property rights for new seed varieties, because its regulations are similar to the PVP certificates in the United States (Helfer, 2002).

The Law of Seeds was modified in 1991 under Decree 2183, introducing important changes to the regulatory regime and updating the legislation according to international standards. The catalyst for Decree 2183 was not just the need for modernization of property rights legislation but also the political pressure exerted by some associations of seed producers and other interest groups inside CONASE, such as the Argentine Seed Association and the Association for the Protection of Plant Breeders (Domingo, 2003). Most notably, the

“modified law” called for the creation of the National Seed Service (Servicio Nacional de Semillas, SENASE), a new agency to manage and enforce the regulatory regime for new seed varieties. As a result, all the activities concerned with the management of the property rights system were concentrated in a specific government agency instead of being dispersed among different secretaries under the Secretary of Agriculture. Accordingly, this change allowed the government to focus on enforcement and the definition of norms for the market of new varieties (SAGPyA, 2005).

The year 1991 also saw the passage of Decree 2817, which called for the creation of the National Seed Institute (Instituto Nacional de Semillas, INASE), which took over SENASE’s role in the management of the Law of Seeds (SAGPyA, 2005). This agency is also in charge of the national registry for varieties and properties of seeds, the enactment of rules regarding the management of the system, and the enforcement of the regulations of the law. By creating this new agency, the government sought to improve enforcement and control of property rights in new varieties. However, the property rights protection offered by INASE has not been useful to protect the soybean seed market from brown-bagging and stealing (GAO, 2000). In contrast to CONASE, INASE’s role is to oversee the management and enforcement of the issues concerning commercial rights of seeds (SAGPyA, 2005).

With respect to the farmer’s privilege, INASE issued Norm 35 in 1996 to define the limits and scope of the privilege broadly established by the Law of Seeds, which allowed some uses for saved seed (SAGPyA, 2005). Norm 35 attempted to limit the application of the farmer’s privilege to save seed for the next crop by limiting the scope of the allowance established by Article 27 of Law 20,247.

In 1994, the Law of Seeds was again modified, bringing the legislation up to the guidelines set by the International Agreement for the Protection of the Vegetal Obtentions (UPOV/78), approved in Paris in 1961 and subsequently modified in Geneva in 1972 and 1978 (International Union for the Protection of New Varieties of Plants, 2002). The most important change to the Law of Seeds arose from the decision to be part of the UPOV international agreement. The approval of the UPOV 1978 guidelines are not as complete as the more recent UPOV 1991 agreement, which has yet to be approved in Argentina. However, due to the economic crisis of early 2000, the Secretary of Agriculture closed the INASE agency, leaving the regulatory regime for new varieties

without any management. INASE was reopened in 2004.

The evolution of legislation in Argentina has focused on the development and improvement of the Plant Variety Protection (PVP) type of property rights without any advance on the field of patenting new varieties. As a result, the level of protection established by the PVP regime is weak in the case of plants like soybean, in which a patent provides better property rights protection. Nonetheless, a PVP can provide enough protection for the commercialization of hybrid varieties, such as corn. As mentioned before, this difference in actual market protection will generate different incentives for investment and commercialization of new seed varieties (Kesan & Gallo, 2004).

Insecure Property Rights and Investment in Seed Varieties

This section analyzes how differences in the scope and enforcement of property rights between Argentina and the United States impact the commercialization of new seed varieties. We compare the performance of new soybean varieties with that of corn in an effort to understand the impact that differing property rights have within the same market.

Research and Development

Legislative advances strengthening property rights in Argentina should provide an increased incentive for research and development of new seed varieties. Argentina’s legislative actions in the 1990s, offering property rights protections that favored corn as opposed to soybean, have given rise to the number of registrations of new corn varieties that surpasses the number of new soybean varieties (Figure 1). After 1994, there was a sharp increase in the number of new corn varieties registered, while new soybean variety registrations maintained low levels despite an increase in 1996—the result of legislation allowing the registration and commercialization of GM varieties. From 1995 to 2003, 21.2% of the new corn varieties registered were transgenic, while the percentage for soybean reached 61.5% during the same period (Domingo, 2003). The decrease observed after 1998 was due to economic crisis and the closing of the INASE because of lack of budget resources from 2000 to 2004.

In the case of the United States, where property rights are better defined and enforced for both corn and soybean, the number of new varieties registered was similar for both corn and soybean in the 1990s (Figure

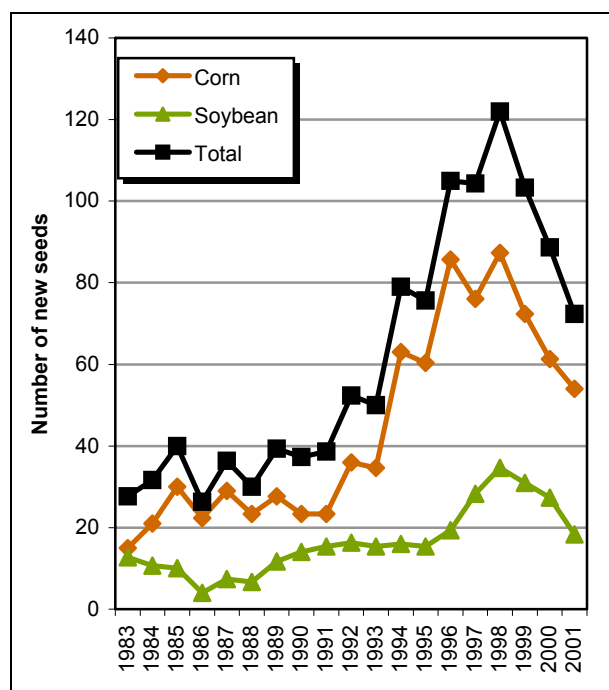


Figure 1. New seed variety registration, Argentina.

Note. Based on data from INASE.

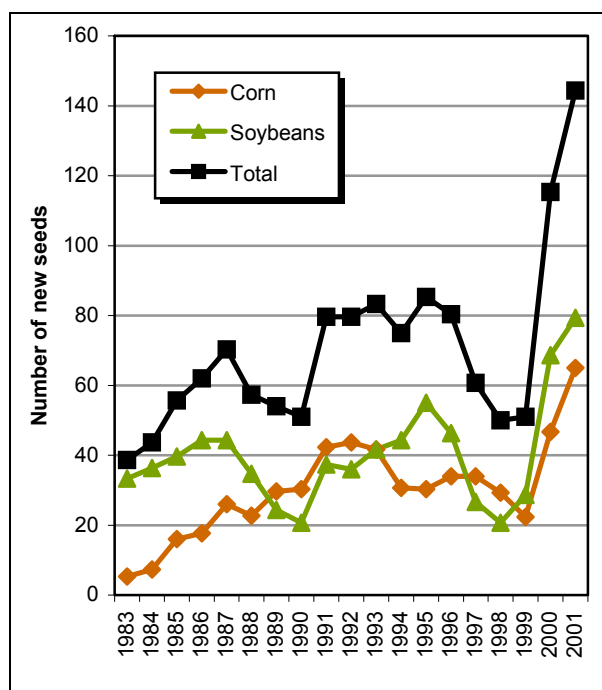


Figure 2. New seed variety registration, United States.

Note. Based on data from USDA.

2). This is an indication that differences in appropriation in the market can generate disparate incentives for research and development (Janis & Kesan, 2002; Kesan, 2000).

Consumption of Seeds, Production, and Yields

More secure property rights have several effects on market transactions (Kesan & Gallo, 2004). First, there is an increase in the sale price of the variety whose property right is enforced as compared to other varieties where there is no enforcement. In the case of Argentina, a higher price for new corn seeds as compared to new soybean seeds indicates that the producers of corn seeds can exploit monopolist rights in the market but soybean producers cannot (Table 1). Prices for corn varieties in the 1990s were close to the prices in the United States, while at the same time there was an increase in the number of new corn varieties. Notably different is the case of soybean, which yielded lower prices than in the United States. In this case, seed producers could not reap monopoly benefits because of the lack of property rights protection. Therefore, the price for soybean varieties declined, despite the fact that the number of new varieties was much lower than corn and (as will be

Table 1. Agricultural seed prices in Argentina.

Year	Corn (\$/80 lbs.)		Soybean (\$/50 lbs.)	
	United States	Argentina	United States	Argentina
1996	78	n/a	15	n/a
1997	84	n/a	16	n/a
1998	87	87	17	11
1999	88	87	17	8
2000	88	65	17	7
2001	92	n/a	21	n/a
Average	86	80	17	9
% US price	93%		51%	
GAO estimate				
Average	95	87	18	11
% US price	92%		61%	

Note. Data from Goldsmith et al. (2002).

explained in the next section) there was a boom in the production of soybean.

The lack of protection in the market for seeds has generated a sizeable black market for soybean seeds, which has reduced the prices of soybean seeds (Table 2). For example, around 80% of the acreage planted with soybean in Argentina is Roundup Ready soybean, pro-

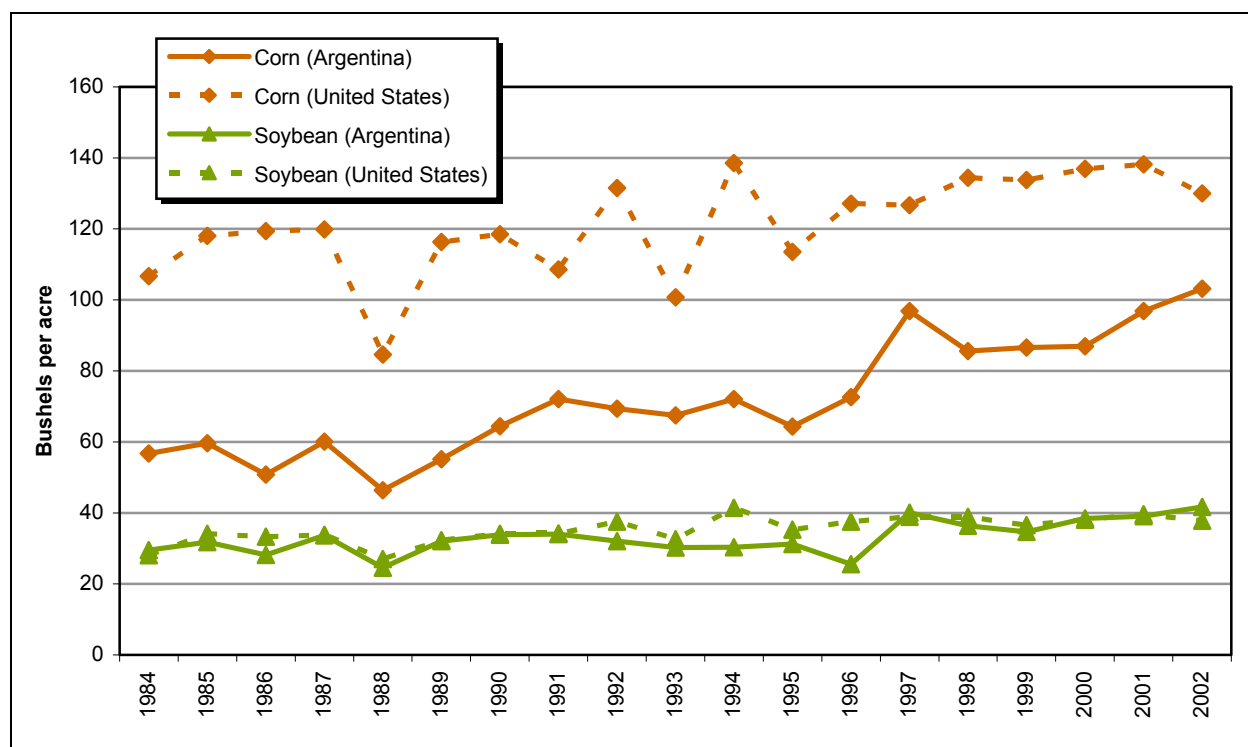


Figure 3. Crop yields in Argentina and the United States.

Note. Based on data from INASE and USDA.

Table 2. Sources of soybean seeds, as estimated percentage of total soybeans planted.

Source of seeds	United States	Argentina
Commercial sales	80–85	28–50
Farmer-saved	15–20	25–35
Black market sales	0–2	25–50

Note. Data from US GAO (2000).

duced by Monsanto, while the percentage of legally sold soybeans reaches 28–50% (Table 2). Legal sellers of Roundup Ready soybeans had to adjust their prices to the black market prices. In 1997, when Roundup Ready was introduced, the price of a 50lb bag of seed was \$25, while the price on the black market was \$15. By 1999, the legal price had dropped to \$9, very close to the price of the black market, which was slightly lower (GAO, 2000). As mentioned before, Monsanto stopped selling Roundup Ready technology in Argentina in early 2004.

Data on crop yields support the inference that Argentinean farmers benefit when property protection systems are in place, despite the increase in seed cost. With respect to corn, Figure 3 shows a substantial increase in crop yields. In 1990, corn yields in Argentina were 54% of the yields in the United States, while in 2002 that ratio increased to 79.2%. This increase in

yields is an indication that higher investment in research and development in corn varieties in Argentina had a positive impact on productivity. This increase is likewise attributed to subsequent introduction of genetically modified corn (Trigo & Cap, 2003).

In contrast to corn, there was not much difference in soybean yields between Argentina and the United States (Figure 3). Soybean yields in Argentina for the period 1990–2002 were nearly equivalent to those in the United States (Goldsmith, 2001). The equivalence in soybean yields, despite the low investment to develop new seed varieties in Argentina, can be attributed to the fact that it is difficult to protect and exclude consumption of soybean innovation (e.g., Roundup Ready soybeans) in a poor IP rights environment, because soybean is a self-pollinated crop that breeds true. As a result, we see similar soybean yields in the United States and in Argentina (see Figure 3).

Crossed Research Effort

Comparing the number of new soybean varieties registered in Argentina against the United States during the 1990s, the number of new varieties in the United States increased, while in Argentina it stayed at low levels (Figure 4). In the period before legislative reforms,

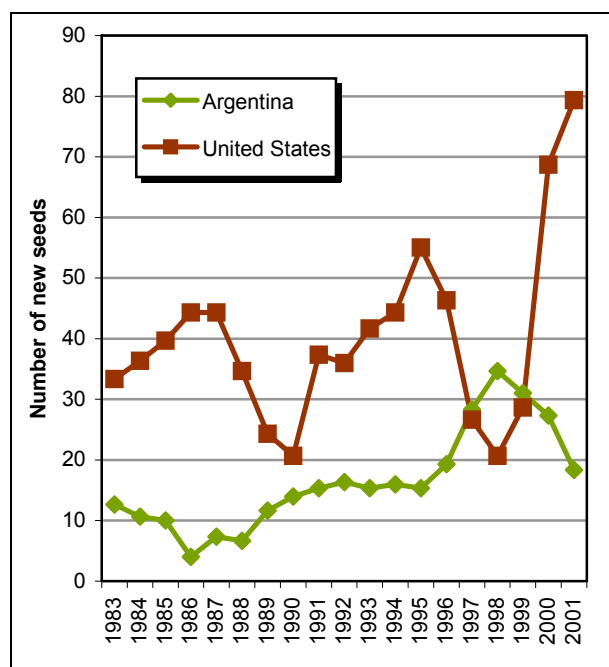


Figure 4. New soybean varieties registered in Argentina and the United States.

Note. Based on data from INASE and USDA.

1979–1993, there were 134 new varieties of soybean registered in Argentina, compared with 511 in the United States,¹ implying that Argentina had only 26% of the varieties registered in the United States. From 1994 to 2002, the new varieties registered in Argentina were 205, while in the United States this number reached 892. In this case, the number of varieties registered in the 1990s in Argentina represented 23% of those registered in the United States. The increase in new varieties registered in Argentina was 53%, while in the United States the increase was 75%. The increase in the number of varieties registered after 1996 in Argentina can again be attributed to the legalization of GM varieties for soybeans.

In contrast to soybean registration, registration of corn varieties follows a substantially different pattern (Figure 5). From 1979 to 1993, there were 325 new varieties of corn registered in Argentina, compared with 453 in the United States, implying that Argentina had 72% of the number of varieties registered in the United States. From 1994 to 2002, the new varieties registered in the United States was 755, while in Argentina new registered varieties reached 605. In this case, the num-

1. The number of new varieties for the United States also includes patents obtained for both corn and soybean.

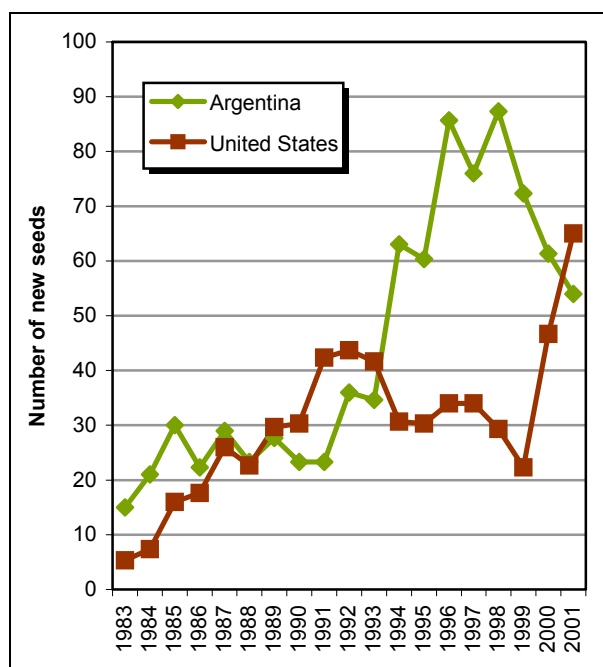


Figure 5. New corn varieties registered in Argentina and the United States.

Note. Based on data from INASE and USDA.

ber of varieties registered in the 1990s in Argentina represented 80% of those registered in the United States. The increase in new varieties in Argentina was 86%, while in the United States the increase was 67%. As a result, we can see that the new legislation promoted the registration of new corn varieties instead of soybean varieties.

The interplay between property rights and research becomes apparent when the property rights system's ability to provide protection varies depending on the seed type. Because the Argentinean property rights system better protects the market for corn seeds, we should expect that firms in Argentina would specialize in the production of corn seeds as compared with soybean (Goldsmith et al., 2002; Kesan & Gallo, 2004).

It is interesting to note that the boom in the registration of new varieties in the 1990s in Argentina compared within the United States is a result, in part, of the incentives of private firms to invest in corn and not soybean. Differences in IP rights protection in Argentina have led to a preference to innovate and register new varieties of corn as compared with soybean. Accordingly, private companies in Argentina, both local and foreign, will bias the allocation of their research resources to the production of corn varieties. Furthermore, secure property rights in corn have attracted more

Table 3. Number of companies registering new varieties in Argentina.

Year	Corn	Soybean
1979	3	0
1980	7	0
1981	12	0
1982	13	14
1983	7	6
1984	25	18
1985	31	8
1986	34	4
1987	2	0
1988	51	18
1989	17	2
1990	15	15
1991	38	25
1992	17	6
1993	53	18
1994	34	22
1995	102	8
1996	45	16
1997	110	34
1998	73	35
1999	79	35
2000	65	23
2001	40	24
2002	57	8

Note. Based on data from INASE.

firms than in the soybean market to compete for new varieties (Table 3). During the 1990s, there was an important increase in the number of firms entering the market for corn varieties. However, the number of firms competing in the market for new soybean varieties stayed almost the same. There was an important increase after 1996, which again coincides with the permission to commercialize GM seeds in the country. Companies can register new varieties, which they have produced, and then, when they produce seeds for commercialization, the INASE requires the seed to be registered in order to protect the property rights of the owners of the variety.

Finally, we would like to compare the behavior of foreign and local seed companies. According to many authors, domestic seed producers in developing countries are not responding to the same incentives as foreign producers (Goldsmith, 2001). In the case of Argentina, legislation offers the same incentives to foreign and domestic producers. As a result, we should

observe that each type of producer specialized in corn instead of soybeans. The evidence shows that foreign and domestic producers have followed a similar pattern in the production of new seed varieties (Figures 6 and 7). The main difference we observe is that there was a higher number of corn varieties registered by foreign companies and a higher number of soybean varieties registered by domestic producers. This difference could be attributed to the lack of property protection in the market for soybean. As a result, foreign companies would not offer their varieties of soybean in the domestic market (Goldsmith et al., 2002). It could also be the case that for domestic producers, the base market for soybeans is the domestic market, which they must supply with new varieties despite the lack of property protection. This would result in a slightly higher number of varieties registered by domestic producers over foreign producers. Nonetheless, we also observe that domestic producers prefer to allocate their resources to the production of corn instead of soybean by registering more new corn seeds compared to new soybean seeds.

Conclusion

The effect of the scope and enforcement of intellectual property rights on biotechnology in agricultural markets is the source of much debate. Of particular interest is the extent to which property rights protection provides incentives to firms to invest in research and development. The difference between Argentina and the United States in their approach to intellectual property rights regulation and enforcement has an observable effect on the corn and soybean market. We use the case of Argentina because of its position as a leading world producer and exporter of both corn and soybean, and, in contrast to the United States, Argentina has weak protection and enforcement of property rights for new seeds. Thus, we can compare and evaluate how private firms behave differently under the different paradigms.

From our empirical case study, we obtain several conclusions. First, increases in market appropriation will increase investment in all varieties only if the increase in appropriation is similar for all market varieties. As we show, a change in legislation providing for plant variety protection for seed protection and an increase in enforcement efforts in the early 1990s produced an increase in the number of new corn varieties registered in Argentina. However, soybean varieties, which need stricter property protection than currently available in Argentina, did not experience a strong increase in the number of new varieties.

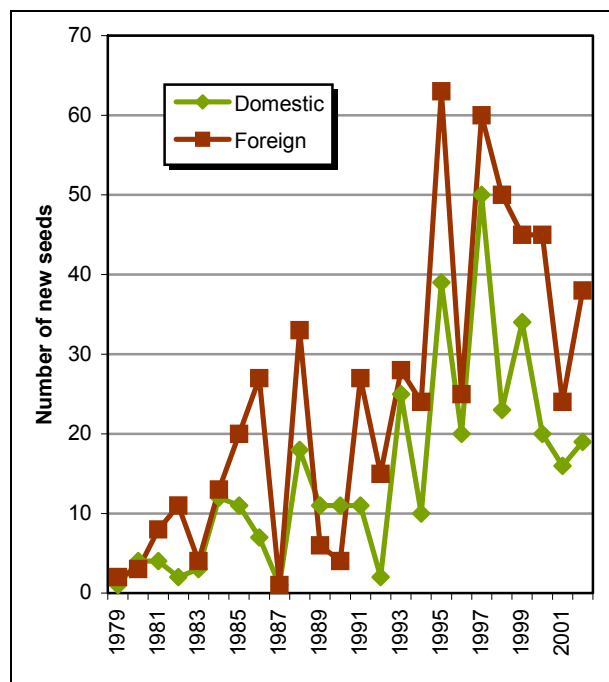


Figure 6. New corn seeds registered by foreign and domestic companies.

Note. Based on data from INASE and USDA.

Second, changes in property protections favoring one variety over another should result in an increase in investment and research for that protected variety. In Argentina, because the limited property rights are better suited to protect corn, there is a higher allocation of resources to the registration of new corn varieties. In contrast, the registration of new soybean varieties market is growing slowly.

Third, greater security in intellectual property rights will result in higher market prices for new seeds and a higher quantity of supplied seeds. As we show, the strong protection of corn results in Argentina's corn seed prices closely approximating those in the United States. In contrast, the prices for poorly protected soybean seed are very low, approaching the black-market price, and are far below the United States' prices.

Fourth, we should observe productivity gains for the higher investment in the varieties with more secure property rights. In the Argentine case, we observe that the increase of investment in research and development in corn was positively correlated with the increase in yields, producing a convergence to the levels of yields observed in the United States. This allowed the country to increase production and exports, even when there was a substitution from corn to soybean crops as the result of higher international prices for soybean. Farmers also

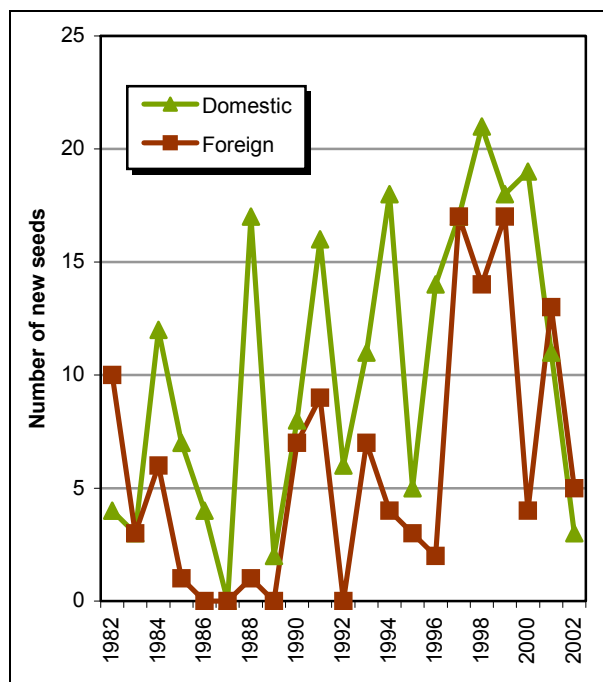


Figure 7. New soybean seeds registered by foreign and domestic companies.

Note. Based on data from INASE and USDA.

benefited from this situation, since they could buy cheap soybean seeds on the black market and sell their crops in the international market. They also benefited from the gains in yields. Finally, even though foreign companies have the highest share of the market for seeds, we observe a dynamic domestic seed production sector, which has evolved similarly to foreign counterparts. This is an indication that foreign and domestic firms face similar restrictions and opportunities offered by the property rights regime.

We can conclude that the type and strength of property rights regimes are important for research and development. Plant variety protection type of protection can be sufficient for crops like corn, but it is ineffective in the case of self-pollinating seeds, like soybean, which need patent protection.

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