

## **CAPITAL MARKET VALUES OF AGRICULTURAL BIOTECHNOLOGY FIRMS: HOW HIGH AND WHY?**

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Market values of agricultural seed and biotechnology firms have increased in recent years due to expected future growth increases from a proliferation of new genetic technologies. In this paper, a market valuation index is constructed for leading firms. Firm valuations are then related to expected future earnings increases, with the implications discussed.

*Key words:* agriculture; biotechnology; capital market; firm valuation; investment

**M**arket values of agricultural seed producers and biotechnology firms have increased dramatically in recent years. Capital markets allocate wealth in pursuit of high returns. Specific valuations are derived from investors' collective expectations of the firms' future cash flows from investment and operations. Because U.S. capital markets are relatively efficient at incorporating information and knowledge into prices, resulting valuations represent relatively informed and unbiased predictions about future performance. In the seed and biotechnology industries, valuations have increased in response to expectations of greater earnings to be generated from a proliferation of new technologies and products.

This paper provides a measure of how high current valuations are in the cases of five leading, publicly traded, United States (U.S.) firms in corn, soybean, and cotton biotechnology, and seed production and marketing. These firms are: Pioneer Hi-Bred International, Inc., Mycogen Corporation, Monsanto Company, Delta and Pine Land Company, and DeKalb Genetics Corporation. Three of these firms are merging into larger firms and so their market values now reflect an acquirer's bid rather than a market assessment of their stand-alone prospects; at the end of October 1998, Mycogen was acquired by Dow Agrosiences, a subsidiary of the Dow Chemical Company; and Delta and Pine Land and DeKalb are being acquired by Monsanto.

### **Valuation Drivers**

Agro-biotechnology and seed firm valuations are driven increasingly by:

- The development of new genetic traits that modify and create higher value products that (1) reduce farm production costs; or (2) offer new agricultural product attributes for end users such as manufacturers of food, feed, pharmaceutical (nutriceutical), or industrial products.

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- Synergies, whereby research capabilities and technology are shared across multiple product lines. These synergies result in cost reductions and greater potential for new product development.

With agro-biotechnologies moving into the commercialization phase in the 1990s, firms with complementary assets have been combining or partnering (Kalaitzandonakes and Bjornson, 1997). These combinations include mergers and acquisitions, such as Monsanto applying its biotechnology platform to the seed germplasm and distribution systems of its acquisitions, DeKalb, and Delta and Pine Land. Combinations also occur across firms. For example, the joint venture between E.I. DuPont de Nemours and Company, with its technology in end-user gene traits, and Pioneer, with its biotechnology, seed germplasm, breeding technology, and marketing system.

### Measuring Relative Valuation

The market value analysis is based on a standard discounted cash flow valuation model (e.g., Copeland *et al.*, 1996). It includes a pro forma cash flow that extends 20 years into the future by which time it converges to a steady state, beyond which cash flows are valued as a constant-growth perpetuity.

The model incorporates assumptions for: (1) sales growth, (2) operating asset levels and related investment cash outflows, and (3) cost and expense outflows and resulting after-tax operating profits. Sales growth rates and percentage changes in asset efficiency and required investments do not have as large of a proportionate impact on earnings growth and firm value as do percentage changes in profit margins. This is algebraically true because profit margin changes fully impact the valuation calculation whereas sales growth rate and asset efficiency changes do not translate fully into percentage profit changes. The approach used here is to model sales growth rates similarly across firms and to model asset requirements as consistent with historical norms and trends. Then, expenses are modeled as percentages of concurrent sales and are calibrated to a level that results in firm value equal to total firm market value as of December 7, 1998 (October 30, 1998 for Mycogen, the last trading date before its acquisition by Dow Agrosciences). Expected performance improvements are captured as required expense percentage reductions in a relative and scale-independent index of each firm's valuation (index calculation shown below).

#### Assumptions

- *Sales Assumptions.* Sales for fiscal year 1998 were not available for Monsanto or Mycogen and so *pro forma* amounts were estimated from nine-month interim financial statement results. Actual 1998 results were available for the other three firms. Sales levels for 1998 are shown here for a size comparison of the five firms.

<b>Firm</b>	<b>Pioneer</b>	<b>Mycogen</b>	<b>Monsanto</b>	<b>Delta &amp; Pine Land</b>	<b>DeKalb</b>
Fiscal year 1998 Sales (\$ billion)	\$1.7	\$0.2	\$8.3	\$0.2	\$0.5

After 1998, nominal sales (including inflation) for all five firms are assumed to grow at the same rate comprised of: (1) an average quantity growth factor equal to the expected real interest rate which is a proxy for expected real economic growth, and (2) an average price growth factor equal to the expected general inflation rate. Expected general inflation rates and

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real interest rates are derived from yield curve data on nominal and inflation indexed U.S. treasury bonds.

- *Investment Assumptions.* Investment in working capital and long-term asset balances for each firm are modeled as a percentage of sales each year, consistent with the firm’s historic norms. The investment cash flows are derived from increasing asset levels from concurrent *pro forma* balance sheets.
- *Expense Assumptions.* Production and operating expenses through 2003 are estimated to be consistent with the respective firm’s historical record. Many of the new products that will have higher margins will appear gradually in the future and the cost synergies will only be realized after firms have been operationally integrated. Also, agricultural industries are currently suffering from reduced demand and appear to be going into a recessionary period. Thus, although new products will substitute for chemicals and existing farm input technologies, much of the net new value is modeled to occur after 2003. Expense percentages are modeled to decline ratably from 2003 to a level in 2009 that is constant thereon. This expense percentage in 2009 is calibrated to equate the discounted cash flow valuation with the capital market value of the respective firm. This expected performance improvement is the basis for constructing the valuation index.

Valuation Index

The *valuation index* is a relative measure of how much the firm’s profit margins are expected to improve, and is constructed for each firm as:

$$Index = (\text{Expense \% of sales in 2003} - \text{Expense \% in 2009}) / (\text{Expense \% in 2003}).$$

This represents the improvement in the expense percentage as a proportion of the 2003 expense percentage. This proportionate improvement is what is necessary for the profit margins that result in a firm valuation equal to its market value. The resulting index calculations provide a relative and scale-independent measure of each firm’s market value.

<b>Firm</b>	<b>Pioneer</b>	<b>Mycogen</b>	<b>Monsanto</b>	<b>Delta &amp; Pine Land</b>	<b>DeKalb</b>
Valuation Index	0.23	0.68	0.30	0.84	0.59

For perspective, an index value of zero represents the baseline where no performance improvement in margins is necessary to realize the current market value. An index value of one is an infeasible upper bound, implying that the firm would have to reduce its expenses to zero percent of sales. In the case of Delta and Pine Land, it is valued so highly that it would have to reduce expenses (as a percent of sales) by a factor of 0.84 (index level) from 2003 to 2009. Pioneer would have to improve by a factor of only 0.23.

**Implications**

The market values of these five firms are high, implying substantial expected improvements in performance. This is a turn of events. At the beginning of the 1990s, Pioneer, DeKalb, and Delta and Pine Land were in the mature, slow growth business of seed breeding. Monsanto was a large industrial and agricultural chemical company. Monsanto had begun to invest in agro-biotechnology by the early 1980s, though it was a small portion of their total business. In the

1980s, Mycogen was a speculative start-up company investing in biotechnology with no commercial seed products. High present-day capital market valuations reflect that the seed business has remade itself into a growth industry. Resulting high stock prices in turn reduce the cost of new equity capital to these firms, stimulating investment.

These firms will not realize expected earnings growth through conventional cost cutting, and will not fully realize it through global acreage increases. Instead, they will have to combine their collective technologies and seed germplasm to create new types of products that offer more value to farmers and manufacturers of food, feed, health, or industrial products; and share research and development capabilities and resulting technology across a broader but related product scope.

In the case of Monsanto, the company's valuation index is separate from, and additional to, the improvement implied by the high values it bid for its acquisitions, Delta and Pine Land, and DeKalb. Monsanto's value reflects the market's knowledge that it must execute the performance improvements for Delta and Pine Land and DeKalb just to maintain a normal return on these acquisition investments. Yet, improvements will be realized jointly by their collective assets. Monsanto will continue to apply its genetic trait technology to Delta and Pine Land's and DeKalb's germplasm to create more value in seed products. They will use the downstream marketing and distribution assets of these acquisitions to reach farmer-buyers and retain a higher portion of potential profits. But to realize the expected increases, Monsanto must also achieve greater synergies by applying its technology portfolio in genomics to a broader scope of products in the realm of food, nutrition, and health.

Mycogen has a broad lineup of strategic assets, including biotechnology research and development capabilities, gene traits, seed germplasm and seed distribution systems. Its acquirer, Dow Agrosciences, bid up its value and must realize the implied earning power by adding value to products for both agricultural and industrial users. Acquisition targets often have an upward bias in their acquisition valuation, which decreases returns to acquiring firms (e.g., see Bradley *et al.*, 1988); this may also have further boosted the valuation indexes of acquisition targets, Delta and Pine Land and DeKalb, while suppressing the valuation index of their acquirer, Monsanto.

Over the past several decades, Pioneer has developed a leadership position in seed breeding and marketing. These assets and capabilities are complementary to the new biotechnology. Its outstanding germplasm is an excellent base for new gene traits and its marketing and distribution system is renowned at getting new seed products into farmers' hands. Pioneer is incorporating new technologies through research agreements, partnerships, and joint ventures, thereby capturing the value of this complementarity with its partners. However, Pioneer has the lowest valuation index of the five firms as much of their new product focus is on end-user traits for which the technology and marketing infrastructure is developing more slowly.

The other more highly valued firms have focused on farm production traits for which viable products have been entering the market since the mid-1990s. Yet, these other firms' higher valuations mean that they must improve performance considerably more just to realize the same return on their current capital market value. Monsanto investors and Dow-Agrosciences (Mycogen's acquirer) are betting that they will improve performance this much or more in the brave new world of biotechnology, and thereby earn superior returns on their investments.

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