A Comparative Analysis of Soybean Production Between the United States, Brazil, and Argentina

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Abstract

Introduction and Problem Identification

The soybean industry has been very dynamic since the 1970s. During that decade, China and the United States dominated the market for soybeans, while Brazil and Argentina were essentially start-ups in the industry. By 1987-88 Brazil was producing 18 million metric tons (mmt) of soybeans and exporting 2.7mmt, while the US exported 17.8mmt. By 2002-03, Brazil had increased soybean production to 51mmt and exports to 20.5mmt and was regarded as one of the world's leading soybean producers and exporters. The U.S., while still a dominant producer of soy, had much slower growth and only exported 2.5mmt more beans than Brazil during that same period (Flaskerud). Argentina's growth has essentially mirrored that of Brazil's, albeit on a somewhat smaller scale. Like Brazil, Argentina was a relatively small player in the soybean market during the 1970s, but was firmly established as the third leading worldwide producer of soybeans by 1998-99. In fact, Argentina's growth has been so rapid as of late that in 2001 they produced 27 million tons, more than twice as many soybeans as they produced in 1991 (11.1 million tons) (Schnepf, et al., 2001a).

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It is because of the rapid growth of Brazil and Argentina over the last 15 years that the U.S. has recently been seriously challenged as the world's top producer. Due to their heavy investment in the industry over the last 30 - 35 years, the two countries' combined total soybean production each year is now greater than that of the United States as shown in Figure 1. The harsh reality of declining market power for the United States comes at a time when the demand for soybeans has been historically strong and has the potential to become much stronger in the near future. It could be argued that the instability in the soybean market hierarchy has many U.S. farmers worrying about one issue that is not fully understood: Just how competitive are Brazil and Argentina in soybean production compared to the United States?

Both the strength and the market share of the United States in soybean production are vital to the economic lives of many American farmers, including most of those in South Dakota. With the increasing prominence of South American countries in the soybean market - particularly in Brazil and Argentina - the United States may need to find ways to maintain its current market share or even reclaim its former dominant status in the market. "Since the beginning of the 1990s, soybean production has increased by more than double in Argentina and Brazil, while soybean production in the United States has expanded by about 42 percent," (Schnepf, et al., 2001a).

Agriculture is also vital to the economies of the US's major foreign soybean competitors - representing 14 percent of GDP (Gross Domestic Product), 33.5 percent of the value of exports, and harboring 31 percent of the labor force in Brazil; and 7 percent of GDP, 52 percent of the value of exports and 12 percent of the labor force for Argentina. In contrast, agriculture in the United States does not impact GDP (2%), export value (10%), or labor force (3%) the way it does in Brazil and Argentina (Schnepf, et al., 2001a). However, the economic well being of South Dakota, compared to that of the U.S. as a whole, is affected more profoundly by changes in the agricultural market. Agriculture in South Dakota represented 7.2 percent of the labor force in 2001 and 7.5 percent of GSP (Gross State Product) in 2000 (South Dakota Chamber of Commerce and Industry).

Objectives

The overall objective of this research was to analyze soybean production and marketing costs for U.S. and international producers. This required a focus on three main components, which are addressed in the paper: (1) a comparison of the cost of production budgets between the United States, South Dakota, Brazil, and Argentina; (2) an analysis of the average yield trends for the three countries; and finally, (3) a comparison of the transportation costs to Rotterdam. These three parts will be addressed by collecting various literature, data tables, and production cost budgets on those specific topics, and concluded by constructing a brief summary of Brazil's and Argentina's soybean industry as it compares to the United States and South Dakota. It should be noted that specific farm programs in Brazil, Argentina, and the U.S will not be looked at in any section of this paper, nor will they be considered in the budgets created, except in cases where the cited author has already done so.

Related Literature

Conditions have changed greatly in the soybean industry over the last decade. Soybean production has increased due to the strong influence that buyers and producers have had on the market. The question is whether or not the demand for soybeans will increase enough to offset the large market share the U.S. continues to lose to Brazil and Argentina and still allow U.S. soybean farmers to operate at a profit.

Today, Brazil and Argentina continue to increase their market share. According to Schnepf, et al. (2001a) in *Agriculture in Brazil and Argentina: Developments and Prospects for Major Field Crops*, the combined exports of soybeans and soybean products from Brazil and Argentina has surpassed U.S. exports. In fact, a recent report indicated that Brazil alone has exported 26 million metric tons of soybeans, which is an increase of 2.83 million tons from September 2003 and 2.42 million tons higher than U.S. exports (Agriworld). In *Soybean Production Costs and Export Competitiveness in the United States, Brazil and Argentina*, the authors indicate that the US's share of the worldwide soy complex exports have fallen from 55 percent in 1980 to approximately 33 percent in 2000, while the combined efforts of Brazil and Argentina have increased their market share from 31% to 50% in that same timeframe. (Schnepf, et al., 2001b)

Much of the primary focus of the Schnepf, et al. research in 2001a and 2001b is based on several factors that they found to have contributed to the ascension of Argentina and Brazil as market leaders in world soybean production. These include: political reforms that have helped create a more stable business environment when dealing with other countries; more efficient transportation of soybeans and a stronger infrastructure than in the past; high international soybean prices during a time of economic and political reforms that favored production; Brazil's improved farm practices that have helped them expand into their interior lands; and finally, due to the large amount of arable land and favorable climates, both Argentina and Brazil enjoy a lower cost of production advantage over the United States (Schnepf, et al., 2001a).

Both the actual and the predicted growth of Argentina and Brazil have affected many soybean producers in the United States and are no doubt often debated topics by those affected by the two countries' growth in the industry. Flaskerud attempted to determine the possible effect that soybean production in Brazil would have on North Dakota by using production cost numbers and other data from the harvest of 2003. Over the course of his research, Flaskerud determined that soybean production and yields in Brazil have continued to grow quickly, particularly in the Center-West region (Mato Grosso). In fact, after freight costs are considered, soybean production in Mato Grosso is still significantly more profitable than that of North Dakota and Iowa. North Dakota produces at a return to management per acre of $15.97 and a total cost per bushel at Rotterdam of $5.76; because of their high land cost, Iowa produces at a return to management per acre of -$44.97 and a total cost per bushel at Rotterdam of $7.21; and Matto Grosso produces at a return to management per acre of $51.97 and a total cost per bushel at Rotterdam of $4.57.

Leibold makes production cost comparisons between Iowa and two areas in Brazil: Parana and Matto Grosso. The results of his findings are that both Parana and Matto Grosso are more cost effective than Iowa on a per bushel basis (Parana: $3.82/bu, Matto Grosso: $3.42/bu, and Iowa $5.90/bu). Some of the key production components that put the two Brazilian areas at a cost advantage are labor, seed + inoculant (with Iowa being almost twice as costly), and machinery, with Iowa paying almost 39 percent more than the two Brazilian regions.

The cost issue is of real concern for farmers in the United States because of the high incentive that significantly lower costs of production gives to Brazilian and Argentine farmers to expand their production. The tremendous potential to expand in Brazil and Argentina is well known by many individuals who are involved with the soybean market. However, according to Shean, the high estimates of Brazilian potential for soybean production could in fact be grossly understated given that the nation has a great deal of available land and because of the highly professional nature of those involved with agribusiness. The FAS conservatively estimates that 145-170 million hectares of land (358.3-420 million acres) are available to Brazil for future crop expansion. In addition, the FAS states that cultivated land under soybeans might see an increase of 50 to 100 million hectares (123.55-247.1 million acres) if supportive political, macro-economic, and agricultural policy conditions are prevalent over the next few decades. The following excerpt can best state the reason for the oversight in prior estimations of Brazil's available land:

> It has become apparent that the criteria used to determine growth potential for grain and oilseed production were overly conservative. These studies exclude significant sources of arable land and often used static agro-economic assumptions regarding production and transport costs, crop yields, and technology. This analytic approach tended to limit official expansion projections to levels thought "realistic" under subjective political and economic circumstances (Shean).

Schnepf, et al. (2001a) effectively evaluated the factors that could play a favorable part in soybean production for Brazil and Argentina in the future. These factors include: potential area available within the two countries (in particular Brazil) to expand production; the decisions farmers in Argentina face in regards to producing meat rather than soybean or vice versa; the fact that the yield potentials of both countries have yet to be realized; Brazil's probable wheat importation increase due to lack of favorable production environments for such crops in the southernmost area of Brazil; and finally, the increased usage of biotech varieties by Argentina.

Schnepf, et al. (2001a) worked extensively to determine what setbacks, if any, could prevent Brazil and Argentina from

expanding their market share over the next decade. They discovered that both countries face "bottlenecks" due to the large debt in the agriculture and public sectors, inefficient credit unions, and high interest rates limiting the amount of credit to producers. In addition, both countries are in need of a more sophisticated transportation infrastructure, as well as improved port facilities. Such improvements would dramatically lower costs for Argentina and Brazil on the export market.

Argentina has enjoyed the ability to produce GMO (Genetically Modified Organisms) soybeans since the late 1990s. The Brazilian government, however, has only recently accepted the use of biotech crops - having approved the use of herbicide tolerant soybeans at the end of September 2003. This new strategy may help Brazil achieve an even greater cost advantage in the soybean market. Fifty percent of the Brazilian soybeans planted in 2003 were of the GMO variety, which equates to approximately three million hectares (7.413 million acres) (James).

Undoubtedly, one of the most important questions that soybean producers are faced with is: "Are U.S. or Brazilian soybean farmers best suited for producing soybeans?" According to Hauser in "The Emperor has no clothes; I'm a lousy golfer; and Brazil has soybeans." from the *Illinois Rural Policy Digest*, the answer to that question varies. In the case of ***absolute*** advantage to Rotterdam, the United States and Argentina may be at an advantage over Brazil when only considering non-land costs which is $4.00 per bushel for the U.S. and Argentina, and $5.66 per bushel for Brazil. Hauser suggests that analyzing absolute advantage by exempting non-land expenditures may be more accurate than including them in the cost because land rents/prices are calculated residually. However, one opportunity cost of growing soybeans is forgoing the choice to grow corn in its place. Since Brazil does not grow corn as efficiently as the United States, the comparative advantage may actually favor Brazil (Hauser). Despite the comparative advantage argued by Hauser, Flaskerud's analysis of North Dakota and Brazil's soybean production concluded by stating that North Dakota should still be able to produce soybeans at a profit, despite the rapid growth of Brazil which could increase in cropland acres as much as 500 percent in the future (Flaskerud).

So far, the authors of the related literature covered in this paper have focused on the extent to which Brazil and Argentina have increased their respective soybean market shares; explained which factors have contributed to the two countries' rapid expansion in the market; the effect Brazil's increased soybean production has had on North Dakota and Iowa farmers; Brazil's potential for soybean acreage expansion; factors that could help foster Brazil and Argentina's continued expansion; possible setbacks the two countries could face; Brazil's recent acceptance of GMO use; and finally, a comparison of absolute advantage versus comparative advantage of soybean production between the U.S., Brazil, and Argentina. The rest of this paper is dedicated to analyzing how the U.S., Brazil, and Argentina compare to one another in soybean production by analyzing the cost of production budgets, average yield, and transportation costs to Rotterdam for each country.

Comparative Analysis of Soybean Production

At the heart of analyzing the world's leading soybean producers are the cost of production budgets for each country. The budgets shown in Table 1 are for the 2003 planting season and have been assembled from a number of different sources. In particular, both the Brazilian and the Argentine budgets required Portuguese and Spanish translation to English, the numbers were converted from hectares to acres, and finally costs were changed from *reals* (Brazil's currency) and *pesos* (Argentina's currency) to 2003 U.S. dollars.

Methods and Procedures

The first thing that needs to be said about the assembly of these budgets - so that the methods for construction are clear - is that no two budgets were created the same, and as a result, there were a number of categories that had to be condensed into one or several main categories. This was done so that comparisons made between regions would be simpler for the reader. The analyses done for this paper are done based on the more comprehensive budgets available from the authors upon request.

Second, the budgets for Brazil have been taken from the two main soybean producing states in the country, Parana (21.89% of the national production) and Mato Grosso (29.70%) (Agrianual FNP®). This was done as an alternative to constructing a cumulative weighted average total of the states in Brazil and theoretically avoids the risk of a tainted budget.

Third, the cost of production analysis for East Central South Dakota has been taken from a no-till budget. The reason for this was that the conventional budgets available did not include the use of GMO soybeans. Because the vast majority of soybeans in South Dakota are of the GMO variety, it seems that seed costs of this type are a necessary cost to incorporate.

Fourth, there is no listing given for land rent in the Brazilian budgets found for 2003. Thus, there are no numbers shown for land rent in the Brazilian budget here either. Initially, the reason for lack of information was unclear, but after a bit of searching, it has been determined this is due to the fact that land prices are valued in a very unconventional way in Brazil relative to the United States. The per hectare prices in Brazil are not expressed in U.S. dollars, nor are they expressed in Brazilian reals, but are instead conventionally valued by sacks of soybeans. This type of land appraisal exists as a means of avoiding inaccurate pricing that has stemmed from the hyperinflation that once plagued Brazil in past years (AgBrazil). Getting a homogenous number for this type of valuation is very difficult, and was thus avoided altogether by the authors of the budgets we found.

Finally, there is a very large disparity in the financial cost section between the U.S. budgets for 2003 and the budgets for Brazil, Argentina, and even East Central South Dakota. Upon a further look at the U.S. budgets, it was determined the most expensive portion of its financial cost was in capital recovery.

Ali, the author of the budgets used from the USDA, indicates that the reason for the large disparity in capital recovery cost relative to the rest of the regions studied is, "After switching to the AAEA task force recommendations, the capital recovery method for estimating asset ownership costs replaced the previous capital replacement and non-land capital estimates" (Ali). It appears that the difference in valuation method gives a quite different estimate of the cost of ownership. Although the values for ownership in South Dakota are quite different from those of the USDA, they are in line with the ownership numbers given in enterprise budgets for states adjacent to EC South Dakota (NRIAI). Machinery costs in South America are significantly lower than those of the U.S. According to Liepold, this is due to lower purchase price, more years of useful life, and many more hours used per year due to double cropping.

Observations of the Cost of Production Budgets

One observation that can be made based on the comparison of budgets shown in Table 1 is that costs before considering land rent seem to show East Central (EC) South Dakota having the lowest per acre average cost, followed by Parana, Argentina, Mato Grosso, and then the U.S. (in that order). The most significant savings for EC South Dakota versus Argentina appear to be costs involving agro-chemicals and operations. The reason for the difference in operations likely relates to the more efficient costs to market (i.e., transportation and storage facilities) existing in South Dakota relative to Argentina. When compared to Brazil, EC South Dakota seems to have the most noteworthy savings in fertilizers. This is likely due to the fact that much of the land in Parana and Mato Grosso requires more fertilizer than South Dakota land; this is especially the case in Mato Grosso where a large number of the soybean plantations are on the *cerrado*. The *cerrado* is a vast land area consisting of acidic soil found in Brazil. Before the *cerrado* was cultivated, it was often viewed as being a wasteland and not suitable for agriculture.

Secondly, the totals after land rent seem to favor Argentina relative to the U.S. and EC South Dakota. This is likely because many of the land costs in Argentina are lower than those in the U.S. The after-land rent totals in Brazil are not as easily calculated due to their significantly different valuation methods relative to the other budgeted areas in this paper. Assuming, however, that land rental prices in Mato Grosso and Parana are still relatively close to those found by the Economic Research Service in the late nineties, the costs of land rent would be approximately US$6 per acre in Mato Grosso and US$14 per acre in Parana (Schnepf, et al., 2001a). This would imply that land costs in Brazil are significantly cheaper than in the U.S., and thus a lower cost of production would result.

Finally, the cost of seed in the US, EC South Dakota, Argentina, and Brazil also appears to vary greatly. Knowing that Argentina uses GMO soybeans in over 90 percent of its crop, the drastically different costs of soybeans relative to the US and EC South Dakota were initially perplexing. The price disparity of seed cost is likely due to the fact that Argentine producers have been using unlicensed GMO soybeans, thus avoiding the technology fees associated with the bio-engineered soybeans and not depicting these fees on their budgets. Also, it could be

possible that both Brazil and Argentina pay a different amount in tech fees relative to U.S. producers, which would explain the lower cost of seed in those countries.

Average Yield

Another particularly noteworthy aspect for soybean producers and analysts to consider when evaluating the potential for production within a country is the average yield. It has already been acknowledged that Brazil has a larger potential land area available for soybean cultivation. In addition, it seems that as of 2003 the yield per acre favors Brazil over the U.S. as well, with a production rate of 37.32 bushels per acre. The U.S. on the other hand, produces soybeans at a yield of 33.46 bushels per acre, while Argentina produces 36.13 bushels per acre (USDA 2). Brazil's higher yield relative to the U.S. can be attributed to various factors: (1) Brazilian hybrids are composed of 120 to 150 day hybrids, which is 20-50 days better than U.S. hybrids; (2) Brazilian soybean plants are taller and have more leaf area before flowering; (3) rainfall is more predictable and spans into the growing season longer; (4) inputs are cheaper; and finally, (5) new hybrids have been created that are more suited for their environment; thus, Brazilian soybean yields have increased over time (Leibold).

Whether or not the higher yield trends that currently favor Brazil will continue in the future is difficult to predict. Figure 2 shows that since 1987, advantages in average yield have favored each one of the three countries at one point or another. In the last eight years, it seems yield trends for soybeans have been near parity.

Cost at Rotterdam

The final aspect being comparatively analyzed between the U.S., Brazil, and Argentina is the difference in price at Rotterdam - the major port in Europe for inbound agricultural products. Table 2 shows that the overall price at Rotterdam (relative to the costs of production found by Schnepf, et al.) favors Argentina over the United States by a margin of US$0.70/bushel, $0.58/bu over Mato Grosso, and $0.36/bu over Parana.

From Table 2, it is apparent that some of the cost of production savings experienced by Brazil and Argentina relative to the U.S. are lost once the soybeans finally reach Rotterdam. The reasons for these losses are because both the internal transport and marketing costs and the freight costs to Rotterdam are greater for Brazil and Argentina when compared to the U.S. In the case of internal transport and marketing costs, the U.S. can boast a US$0.42/bushel advantage over Parana, a $0.91/bu advantage over Mato Grosso, and a $0.38/bu advantage over Argentina. Likely the greatest reason for the relatively large disparity between the break-even price for each country is due to the superior marketing and infrastructure advantage the U.S. holds over its main foreign competitors. Freight costs to Rotterdam favor the U.S. over its competitors by a large amount as well. It costs the United States US$0.19/bu less than Brazil and $0.11/bu less than Argentina to ship soybeans to Rotterdam.

Based on the information provided by Schnepf, et al., a number of calculations can be made about the final cost of soybeans for each country upon reaching Rotterdam:

1. Before the soybeans are shipped to port, Parana's costs of production are 19 percent less than the U.S., Mato Grosso's are 24 percent less, and Argentina's are 23 percent less.
2. Once the soybeans reach the seaport at the edge of their respective countries, the cost advantage over the U.S. drops to 10 percent for Parana, 6 percent for Mato Grosso, and 15 percent for Argentina.
3. Finally, the cost advantage drops one more time when the soybeans reach Rotterdam: Parana falls to 6 percent, Mato Grosso to 2 percent, and Argentina to 12 percent.

Because of the losses incurred by Brazil and Argentina between the field and the port in Rotterdam, soybeans shipped from the U.S. are able to remain competitive, and thus, the incentive to produce continues.

Conclusions

When comparing the 2003 production budgets for Brazil, Argentina, the U.S., and EC South Dakota, a number of conclusions can arguably be made: (1) Production costs before taking land rent into account favor EC South Dakota. This is due to the higher direct costs of production in Brazil and Argentina. (2) After-land rent costs seemed to favor Argentina the most. However, this conclusion could not effectively be substantiated because Brazil's land rent costs were unavailable

due to the significantly different methods of valuation. (3) Seed costs seemed to vary a great deal between each of the areas budgeted. Although the reason for the difference in seed costs could not be identified, it may be possible that tech fees for GMO use vary between each country.

The average yield of each nation shows that Brazil has the advantage to soybean production, followed by Argentina and then the U.S. The advantages that Brazil has over the U.S. are mostly due to the following factors: (1) longer growing seasons; (2) superior hybrids; (3) taller soybean plants and with more leaf area before flowering; (4) predictable rainfall in Brazil that spans into the growing season longer; (5) cheaper inputs; and finally, (6) new and better suited hybrids that increase yields over time (Leibold). It is worth mentioning that over the past 40 years each of the three countries has at some time held the advantage in yield, but on the whole, yields have steadily increased over time.

Though Argentina and Brazil are low cost leaders over the United States, many of the cost advantages are lost by the time the soybeans reach Rotterdam due to the more efficient means of transportation in the U.S. Thus, by the time each of the three countries' soybeans reach the international market, the United States is still able to compete with the break-even soybean price of Brazil and Argentina.

It should be noted that since we are dealing with the international market, exchange rates do play an important role in determining the competitive position of all the countries in this analysis. As the dollar either strengthens or weakens with respect to the Argentine peso or the Brazilian real, U.S. soybeans can become either more or less expensive relative to our competition. Since 1999, the value of the peso and real have fluctuated dramatically. Over the five-year period of 1999 to 2004, the value of the peso has ranged between .992 per dollar to 3.88 per dollar with an average of 2.213 over the period. The real has also had a wide range of values, from 1.708 per dollar to 4.0 with an average of 2.643 over the period (OANDA.com). This results in a 234 percent change for the real and 391 percent for the peso, from high to low. Fluctuations of this magnitude can erase any cost advantages that may exist for any country in the international soybean market.

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Table 1. Soybean Production Costs 2003[1]

	Argentina		Brazil (Parana)		Brazil (Mato Grosso)		United States		E.C. South Dakota[6]	
DIRECT COSTS	**$/acre**[2]	**% cost**	**$/acre**[2]	**% cost**[5]	**$/acre**[2]	**% cost**[5]	**$/acre**	**% cost**	**$/acre**	**% cost**
Seed	$7.01	4.73%	$9.68	8.20%	$16.58	10.61%	$25.78	9.65%	$34.85	19.03%
Agro-Chemicals	$30.39	20.50%	$33.04	27.97%	$20.87	13.35%	$22.82	8.54%	$14.70	8.03%
Fertilizers	$8.94	6.03%	$23.52	19.91%	$64.15	41.05%	$8.98	3.36%	$7.33	4.00%
Operations[4]	$71.49	48.23%	$41.69	35.29%	$44.26	28.32%	$48.74	18.24%	$40.60	22.17%
Direct Cost Total	***$117.83***	***79.50%***	***$107.93***	***91.37%***	***$145.86***	***93.33%***	***$106.32***	***39.78%***	***$97.48***	***53.24%***
INDIRECT COSTS										
Financial Cost	$4.40	2.97%	$5.68	4.81%	$4.66	2.98%	$62.25	23.29%	$15.83	8.65%
Land Rent	$25.99	17.53%	(n/a)[3]	(n/a)[3]	(n/a)[3]	(n/a)[3]	$83.12	31.10%	$69.80	38.12%
Other Indirect Costs	(n/a)	(n/a)	$4.51	3.82%	$5.77	3.69%	$15.59	5.83%	(n/a)	(n/a)
DIRECT + INDIRECT										
total	***$122.22***	***82.47%***	***$118.12***	***100%***	***$156.29***	***100%***	***$184.16***	***68.90%***	***$113.31***	***61.88%***
total (after rent)	**$148.21**	**100%**	**(n/a)[3]**	**(n/a)[3]**	**(n/a)[3]**	**(n/a)[3]**	**$267.28**	**100%**	**$183.11**	**100%**

1. A comprehensive look at each budget is available from the author.
2. The exchange rates used for these budgets have been calculated by averaging the total daily rates for Brazil & Argentina in 2003. Accessed 3/16/04 7:30PM. Source: http://www.echangerate.com/past_rates_entry.html.
3. The Brazilian budgets used for this paper did not have any figures for land cost.
4. Operations include: operations, repairs, after-harvest, and other variable expenses.
5. Because there is no listing of land rent for Brazil all percentages are considered without land costs.
6. East Central South Dakota budgets are calculated for 2003 no-till.

Data for Argentine budgets from: Instituto de Technologia Agropecuaria 2004
Data for Brazilian budgets from 2004 Agrianual FNP ®
Data for US budgets from: Economic Research Service USDA. Costs of Production Forecast
Data for East Central SD budget from: 2003 Estimated Costs of Production for Spring Crops, SDSU EMC 931

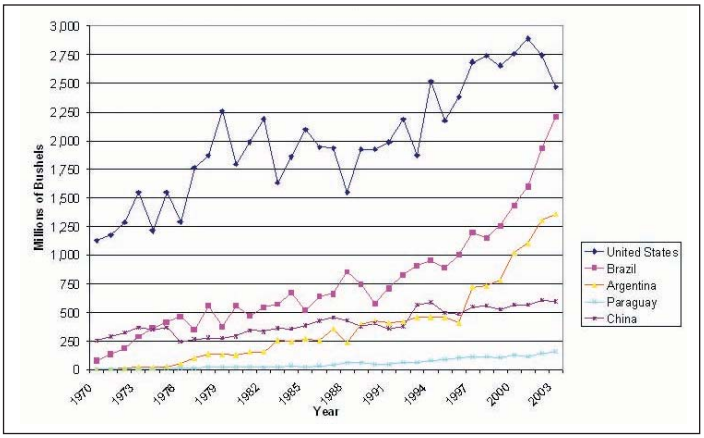
Table 2. The Export Competitiveness of the U.S. Heartland, Mato Grosso, Parana, and Argentina 1998/1999

Cost item	U.S. Heartland	Brazil				Argentina	
		Parana		Mato Grosso		Buenos Aires / Santa Fe	
	$/bu	$/bu	% of US Cost	$/bu	% of US Cost	$/bu	% of US Cost
Production costs[1]							
Variable costs	1.71	2.78		3.17		1.90	
Fixed costs	3.40	1.38		0.72		2.02	
Total production costs	**5.11**	**4.16**	**81**	**3.89**	**76**	**3.92**	**77**
Internal transport & marketing[2]	0.43	0.85		1.34		0.81	
Costs at border	**5.54**	**5.01**	**90**	**5.23**	**94**	**4.73**	**85**
Freight costs to Rotterdam[3]	0.38	0.57		0.57		0.49	
Price at Rotterdam	**5.92**	**5.58**	**94**	**5.80**	**98**	**5.22**	**88**

1. Variable and fixed costs in each country are based on local marketing year costs in 1998/1999 (see table A-1 of Schnepf, et al., 2001b).
2. Internal transport and marketing charges for Argentina are estimated as the sum of port charges [the spread between f.o.b. and free-alongside-ship (f.a.s.) Rosario prices] and estimated transportation and other marketing costs. For Brazil, internal marketing and transportation costs are the average spread between farm prices and f.o.b. port prices during calendar years 1998 and 1999.
3. Freight costs are calculated as the average spread between f.o.b. port prices for each country and the c.i.f port price in Rotterdam during calendar years 1995-99.

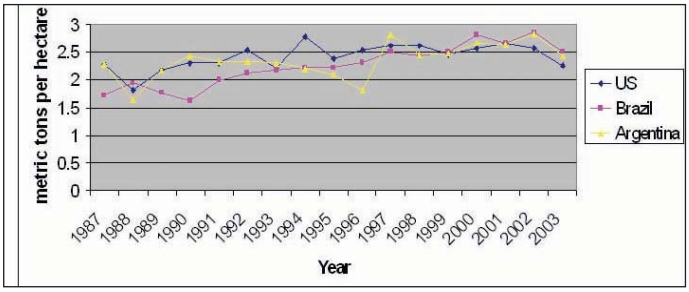
Source: Agriculture in Brazil and Argentina. Schnepf, et al., 2001b

Figure 1. Worldwide Major Soybean Producers



Data for this chart obtained from: http://www.farmdoc.uiuc.edu/marketing/grainoutlook/html/102103/soybeantables.html.

Figure 2. Soybeans Yields in Argentina, Brazil, and the U.S. 1987-2003



Source: Foreign Agricultural Service, United States Department of Agriculture. "FAS_world_production_numbers.xls" http://www.fas.usda.gov.psd/. 2004.