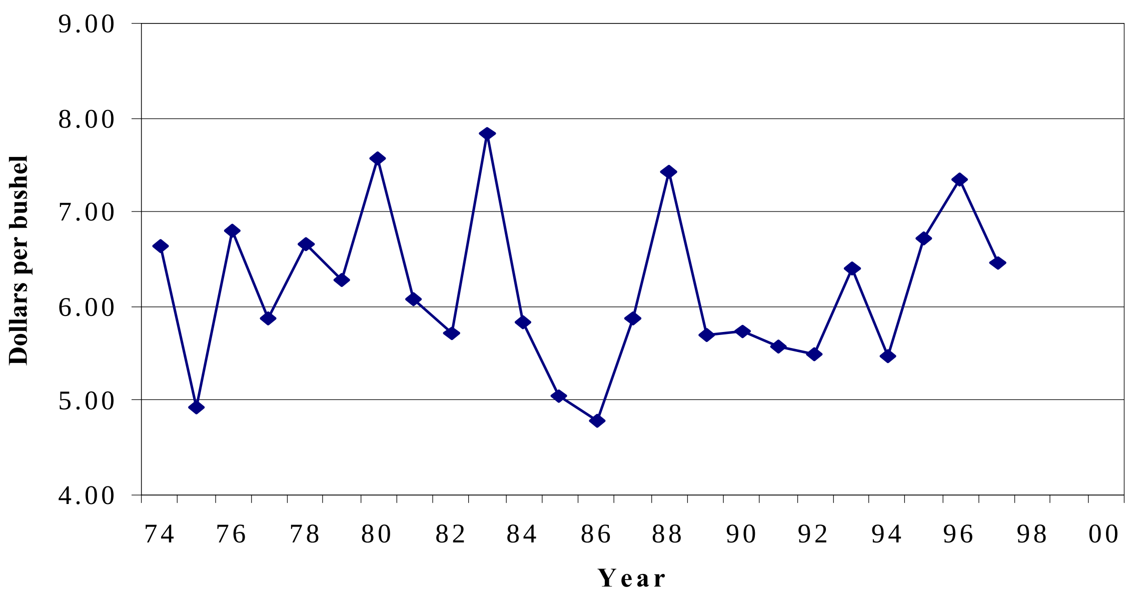
Soybean Pricing Guide

David Kenyon and Katie Lucas



David Kenyon is Professor and Katie Lucas was Undergraduate Student, Department of Agricultural and Applied Economics, Virginia Tech

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INTRODUCTION

Every spring soybean producers are faced with marketing and production decisions that require the use of an estimated season average price. The purpose of this publication is to provide soybean producers with the necessary historical data and a price forecasting model to estimate season average price. The historical data in Table 1 provide a benchmark against which to evaluate current acreage, production, use, ending stocks, and season average price. The price forecasting model provides a method to estimate the upcoming season average price for soybeans under various conditions.

This publication is divided into four sections. The first section, Supply and Demand, explains how a supply and demand table is constructed. A producer who understands the basics of a supply and demand table will understand the major factors that influence the price of soybeans. The second section, Forecasting Model, describes the price forecasting model and how to forecast the United States season average price using 1998/99 as an example. The third section, Price Sensitivity, explains how to analyze the impact of changing yield and exports on expected price. The fourth section, Developing a Pricing Strategy, provides guidelines for developing a pricing strategy based on estimated ending stocks and historical November futures prices.

SUPPLY AND DEMAND

Table 1 is the United States soybean supply and demand (S&D) table for the last nine years. The S&D table is divided into four sections: Supply, Demand, Ending Stocks, and Price. Table 1 will be used in the price forecasting model; therefore, understanding the four sections before using the model is important.

I. Supply

Beginning stocks represent ending stocks from the previous crop year. The crop year for soybeans begins September 1 and ends August 31 of the next year. For example, the beginning stocks for the 1997/98 crop year are ending stocks from the 1996/97 crop year.

Production is the bushels of soybeans produced in a crop year. Production depends on the number of acres planted, acres harvested, and yield per harvested acre. Soybeans planted in the spring and summer will be harvested and marketed in the upcoming crop year. For example, soybeans planted in the spring of 1998 will be harvested in the 1998/99 crop year that begins in September.

The **Imports** category represents the soybeans brought into the United States from other soybean exporting countries such as Brazil and Argentina.

II. Demand

Total demand is equal to the estimated uses of soybeans for the next 12 months. Use is divided into three categories: crush; exports; and seed, feed, and residual. The individual level and variability of each use category since 1970 is shown in Figure 1.

Crush is the largest component of use and is largely dependent on the demand for soybean meal. Even though crush results in both meal and oil, the primary reason for crush is the production of soybean meal. Each 60-pound bushel of soybeans yields about 48.5 pounds of 48 percent soybean

Table 1. U.S. Soybean supply and demand

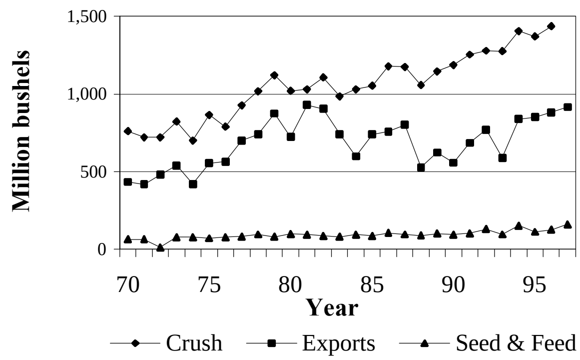
ITEM	UNITS	89/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98
Planted Acreage	mil. ac.	60.8	57.8	59.1	59.3	60.1	61.7	62.6	64.2	70.9
Harvested Acreage	mil. ac.	59.5	56.5	58.0	58.4	57.3	60.9	61.6	63.4	69.9
Yield/Harvested acre	bu./ac.	32.3	34.1	34.2	37.6	32.6	41.4	35.3	37.6	39.0
SUPPLY										
Beginning Stocks	mil bu	182	239	329	278	292	209	335	183	131
Production	mil bu	1,924	1,926	1,987	2,190	1,871	2,517	2,177	2,382	2,727
Imports	mil bu	3	2	3	2	6	5	4	9	5
Total Supply	mil bu	2,109	2,167	2,319	2,470	2,170	2,731	2,516	2,575	2,865
DEMAND										
Seed, Feed, & Residual	mil bu	101	94	102	130	96	153	112	126	188
Crush	mil bu	1,146	1,187	1,254	1,279	1,276	1,405	1,370	1,436	1,580
Exports	mil bu	623	557	685	770	589	838	851	882	880
Total Demand	mil bu	1,870	1,838	2,041	2,179	1,961	2,396	2,333	2,443	2,648
ENDING STOCKS	mil bu	239	329	278	292	209	335	183	131	215
Days Supply	days	47	65	50	49	39	51	31	20	31
Percent Use	%	13	18	14	13	11	14	8	5	8
PRICE										
Loan Rate	$/bu.	4.53	4.50	5.02	5.02	5.02	4.92	4.92	4.97	5.26
Season Average Price	$/bu.	5.69	5.74	5.58	5.50	6.40	5.48	6.72	7.35	6.45
Price/Loan	$/bu.	1.26	1.28	1.11	1.10	1.27	1.11	1.37	1.48	1.23

Source: *Oil Crops Situation & Outlook Report*, ERS, USDA; or WASDE, WAOB, USDA, various issues at *http://www.mannlib.cornell.edu/usda/usda.html* primarily on the number of animals being fed, the cost of feed and feed substitutes, and the profitability of feeding livestock and poultry.

Exports represent the amount of soybeans exported to other countries. The quantity of soybeans exported is increasingly dependent on events around the world. Soybean exports depend on exchange rates, the production of soybeans in other exporting countries, government programs in the United States, and the world-wide demand for soybeans.

Seed, Feed and Residual (SFR) is a relatively small and erratic number. It includes primarily seed, quantities lost in processing, drying, movement, and errors in the estimation of crop size, which are usually quite small.

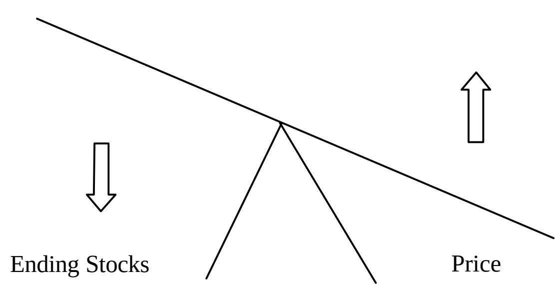
Figure 1. Soybean use



III. Ending Stocks

Ending stocks are the bushels of soybeans left at the end of a crop year when total demand is subtracted from total supply. If ending stocks increase relative to beginning stocks, supply increases relative to demand, and prices will tend to decrease. If ending stocks are lower than beginning stocks, supply decreases relative to demand, and prices will tend to increase. The relationship between ending stocks and price is like a teeter-totter: when ending stocks decrease, the price increases Figure 2.

Figure 2. Price versus ending stocks



Ending stocks are measured several ways by industry analysts. Since total use continues to increase over time, the same level of ending stocks over time is actually a smaller reserve compared to increased use. Hence, analysts frequently calculate two measures of ending stocks relative to use. These two measures are days supply and percent use.

Days Supply represents the number of days that ending stocks would last at the current rate of use. To calculate days supply, use per day is calculated by dividing total demand by 365 days. Then ending stocks are divided by use per day to determine days supply.

For example, total demand in 1996/97 was 2,443 million bushels. Use per day was 6.693 million bushels (2,443/365). Days supply was 20 (131/6.693). In other words, the stocks on August 31 would only last 20 days at the rate of use experienced during 1996/97 and without additional supply.

Percent Use is ending stocks divided by total demand expressed as a percent. In 1996/97, percent use equalled 5 percent (131/2,443 * 100). Like ending stocks, as days supply and percent use decline, prices increase and vice versa. Days supply and percent use are good measures to use when comparing supply and demand over long time periods, like 10 to 25 years. Ending stocks expressed in bushels is more appropriate for shorter time periods.

IV. Season Average Price

The season average price represents the United States average price per bushel that producers receive during a crop year. Season average price is largely determined by United States ending stocks and South American soybean production. If stocks are low, supply is short relative to demand and season average price will tend to be high. In 1996/97, ending stocks were 131 million bushels and season average price was $7.35. If ending stocks are high, supply is abundant relative to demand and season average price will be low. In 1994/95, ending stocks were 335 million bushels and season average price was $5.48.

The relationship between ending stocks and price can be graphed to create an estimated price curve (Figure 3). Ending stocks are on the horizontal axis and season average price is on the vertical axis. The price curve was obtained statistically by analyzing the historical relationship between price and the natural logarithm of ending stocks. The price curve explains 86 percent of the variation in season average price from year to year For example, the calculation in 1996/97 would be

$$
\begin{aligned}
\textbf{Price} &= \textbf{17.20 - 2.206 * Ln(Ending Stocks)} \\
\textbf{Price} &= \textbf{17.20 \quad 2.206 *Ln(131)} \\
&= \textbf{17.20 \quad (2.206 * 4.875)} \\
&= \textbf{\$7.32}
\end{aligned}
$$

Actual prices deviate from the price curve for several reasons. First, world stocks of soybeans can have a significant affect on the price United States producers receive. Second, the price and availability of wheat, corn, and other feedgrains can affect the demand for soybeans and its price. And third, production of competing meals and oils can affect soybean price.

FORECASTING MODEL

During the second week in April, producers can develop an initial estimate of the season average price for soybeans for the upcoming crop year. By estimating the categories in the supply and demand table, they can estimate ending stocks. The estimated ending stocks can then be used to estimate the season average price using the price equation in Figure 3. The estimated season average price can be used to help develop a forward pricing strategy for the season.

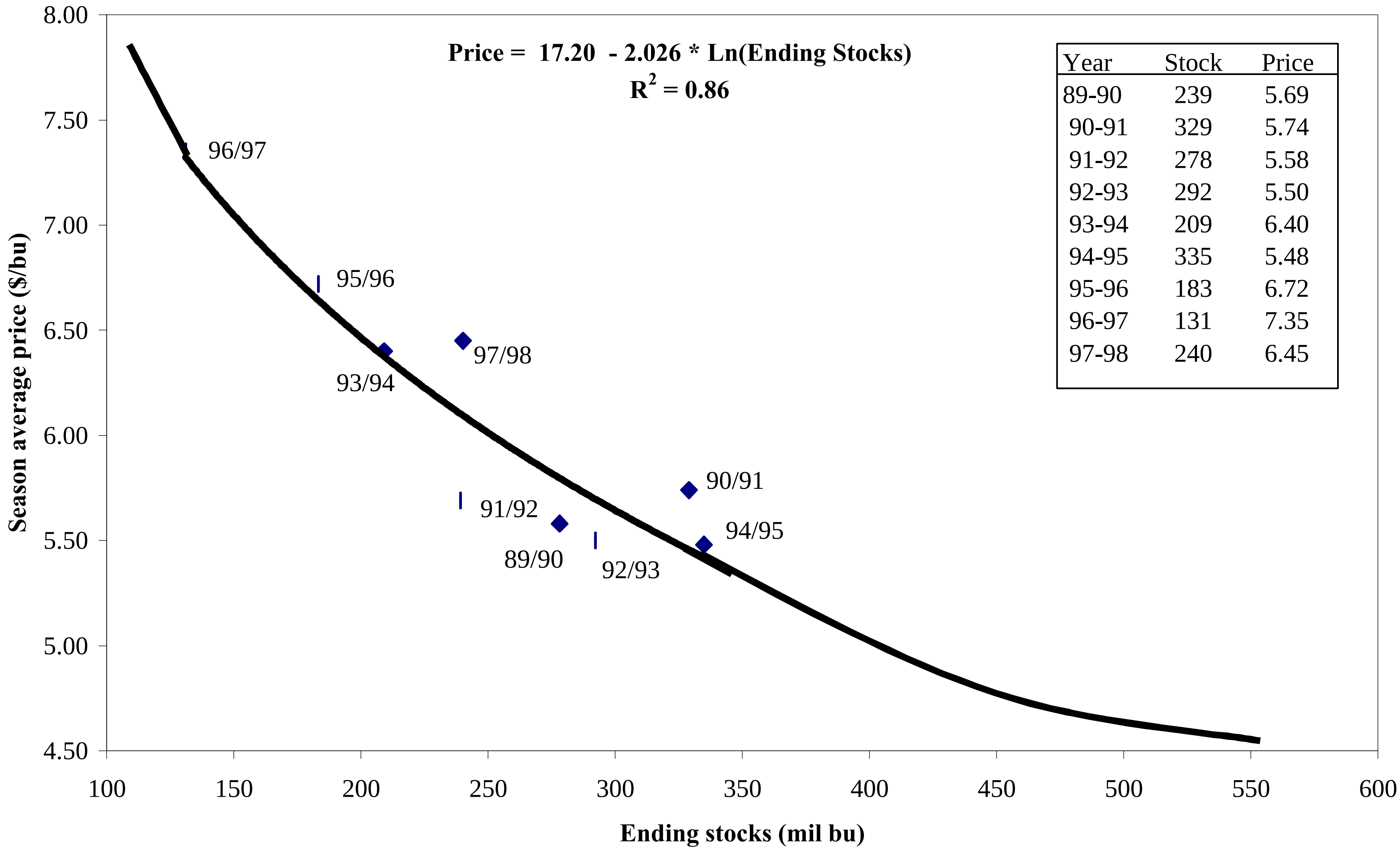
The 1998/99 data will be used as an example to demonstrate the forecasting model. The results of each step need to be entered in the 98/99 column of Table 2.

I. Supply

Beginning Stocks is the first item to consider when estimating supply. An estimate can be found in the monthly USDA publication *World Agriculture Supply and Demand Estimates* (WASDE). Beginning stocks for the 1998/99 crop year are ending stocks from the 1997/98 crop year. The estimated beginning stocks for 1998/99 in April 1998 were 235 million bushels. Enter 235 in the box for 1998/99 beginning stocks in Table 2.

Production is the next item in supply to consider. Production depends on planted acres, harvested acres, and yield per harvested acre.

Figure 3. Soybean stocks and price



Year	Stock	Price
89-90	239	5.69
90-91	329	5.74
91-92	278	5.58
92-93	292	5.50
93-94	209	6.40
94-95	335	5.48
95-96	183	6.72
96-97	131	7.35
97-98	240	6.45

Table 2. Estimated United States soybean supply, demand, stocks and price

Item	Units	95/96	96/97	97/98	98/99
Planted Acreage	mil ac	62.6	64.2	70.9	
Harvested Acreage	mil ac	61.6	63.4	69.9	
Yield	bu/ac	35.3	37.6	39.0	
Supply					
Beginning Stocks	mil bu	335	183	131	
Production	mil bu	2177	2382	2727	
Imports	mil bu	4	9	6	
Total Supply	mil bu	2516	2575	2865	
Use					
Seed, Feed & Residual	mil bu	112	126	160	
Exports	mil bu	851	882	945	
Crush	mil bu	1370	1436	1525	
Total Use	mil bu	2333	2443	2630	
Ending Stocks	mil bu	183	131	235	
Days Supply	days	31	20	34	
Percent Use	%	8	5	9	
Loan Rate	$/bu	4.92	4.97	5.26	
U.S. Season Average Price	$/bu	6.72	7.35	6.50	
Va. Season Average Price	$/bu	6.85	6.85	6.50	

1. Planted Acres

In late March, planting intentions are reported by USDA in *Prospective Plantings*. Planted acres for all soybeans in the spring of 1998 for the 1998/99 crop year were reported to be 72.0 million acres. Enter 72.0 in Table 2 in the space for the 1998/99 planted acres.

2. Harvested Acres

Producers do not harvest soybeans from all acres planted. Variable growing and harvesting conditions result in some soybeans being left unharvested. Table 3 gives the historical relationship between actual planted acres and actual acres harvested. The average ratio of harvested to planted acres from 1994 to 1997 is 98.6 percent. Multiplying the March estimate of 72.0 million acres by 98.6 percent gives an estimate of 71.0 million acres to be harvested in the fall of 1998. Enter 71.0 in Table 2 in the box for harvested acres.

Table 3. United States intended, planted and harvested soybean acreage

Year	February/March Intentions[a]	Actual Planted[b]	Actual Harvested[b]	Ratio[c]
	-------------------------1,000 acres		--------------------	%
1989	61,720	60,820	59,538	97.9
1990	59,425	57,795	56,512	97.8
1991	57,115	59,180	58,011	98.0
1992	57,415	59,330	58,383	98.4
1993	59,300	60,135	57,347	95.4
1994	61,940	61,670	60,859	98.7
1995	61,450	62,575	61,624	98.5
1996	62,478	64,205	63,409	98.8
1997	6,800	70,850	69,884	98.6
1998	72,000	72,000	---------	-------
1999	--------	--------	---------	-------
2000	--------	--------	---------	-------

Source: http://www.usda.gov/nass/
[a] *Prospective Plantings*, NASS, USDA.
[b] *Crop Production*, NASS, USDA
[c] Ratio = Actual harvested divided by actual planted * 100

3. Yield

The next step is to estimate yield per harvested acre. The United States average yield varies considerably from year to year (Figure 4). Since 1970, United States average soybean yields have increased about 0.44 bushels a year. Table 4 contains the historical and estimated United States yields for the past 28 years and estimated yields for the next 4 years. Yield is expected to be 37.6 for the 1998/99 crop year (Table 4). Enter 37.6 in the box for yield in Table 2.

With estimates of harvested acres and yield per harvested acre, United States production can be estimated. The estimated production for the 1998/99 crop year is 2,670 (71.0 * 37.6) million bushels. Enter 2,670 in the box for 1998/99 production in Table 2.

Imports have not significantly affected total supply over the past two decades. Before 1987, soybean imports were not reported in major government publications. However, over the last 5 years, imports have averaged about 5 million bushels. Enter 5 in the box for 1998/99 imports in Table 2.

With beginning stocks, production, and imports estimated for 1998/99, total supply can be estimated by adding these three sources of supply. Total supply for 1998/99 is 2,910 million bushels (235 + 2,670 + 5). Enter 2,910 in the box for 1998/99 total supply in Table 2.

The total supply estimate can vary greatly from the time that it is estimated in April to the time soybeans are actually harvested. Producers may change their March planting intentions and imports may increase or decrease, but most of the variability lies in estimated yield. The impact of yield variability on production and price is discussed in the price sensitivity analysis section.

II. Demand

To estimate total demand, the three categories that make up demand must be estimated individually.

1. Crush

The demand for soybean meal is largely a function of the number of poultry and hogs being fed. In April, estimates for fourth quarter poultry and hog production numbers for the calendar year are published in WASDE. The fourth quarter of the calendar year (October-December) roughly corresponds with the first quarter of the soybean crop year (September-November). Producers can estimate crush by multiplying last year's crush by the percentage change in fourth quarter poultry and hog production numbers from last year to the current year. This method assumes that the percentage change in fourth quarter poultry and hog production is representative of the percentage change in poultry and hog production throughout the soybean crop year.

Table 4. Actual and Estimated Yields

Year	Actual	Estimated	Act. – Est.
	-----------bushels/acre----------		
1970	26.7	25.4	1.31
1971	27.5	25.8	1.68
1972	27.8	26.3	1.54
1973	27.8	26.7	1.11
1974	23.7	27.1	-3.43
1975	28.9	27.6	1.33
1976	26.1	28.0	-1.90
1977	30.6	28.4	2.16
1978	29.4	28.9	0.53
1979	32.1	29.3	2.79
1980	26.5	29.7	-3.24
1981	30.1	30.2	-0.08
1982	31.5	30.6	0.89
1983	26.2	31.0	-4.85
1984	28.1	31.5	-3.38
1985	34.1	31.9	2.18
1986	33.3	32.4	0.95
1987	33.9	32.8	1.11
1988	27.0	33.2	-6.22
1989	32.3	33.7	-1.36
1990	34.1	34.1	0.01
1991	34.2	34.5	-0.33
1992	37.6	35.0	2.64
1993	32.6	35.4	-2.80
1994	41.4	35.8	5.57
1995	35.3	36.3	-0.97
1996	37.6	36.7	0.90
1997	39.0	37.1	1.86
1998	____	37.6	____
1999	____	38.0	____
2000	____	38.4	____
2001	____	38.9	____

Source: Oil Crop Situation and Outlook <http:\\www.usda.gov/nass/>

Figure 4. United States soybean yield

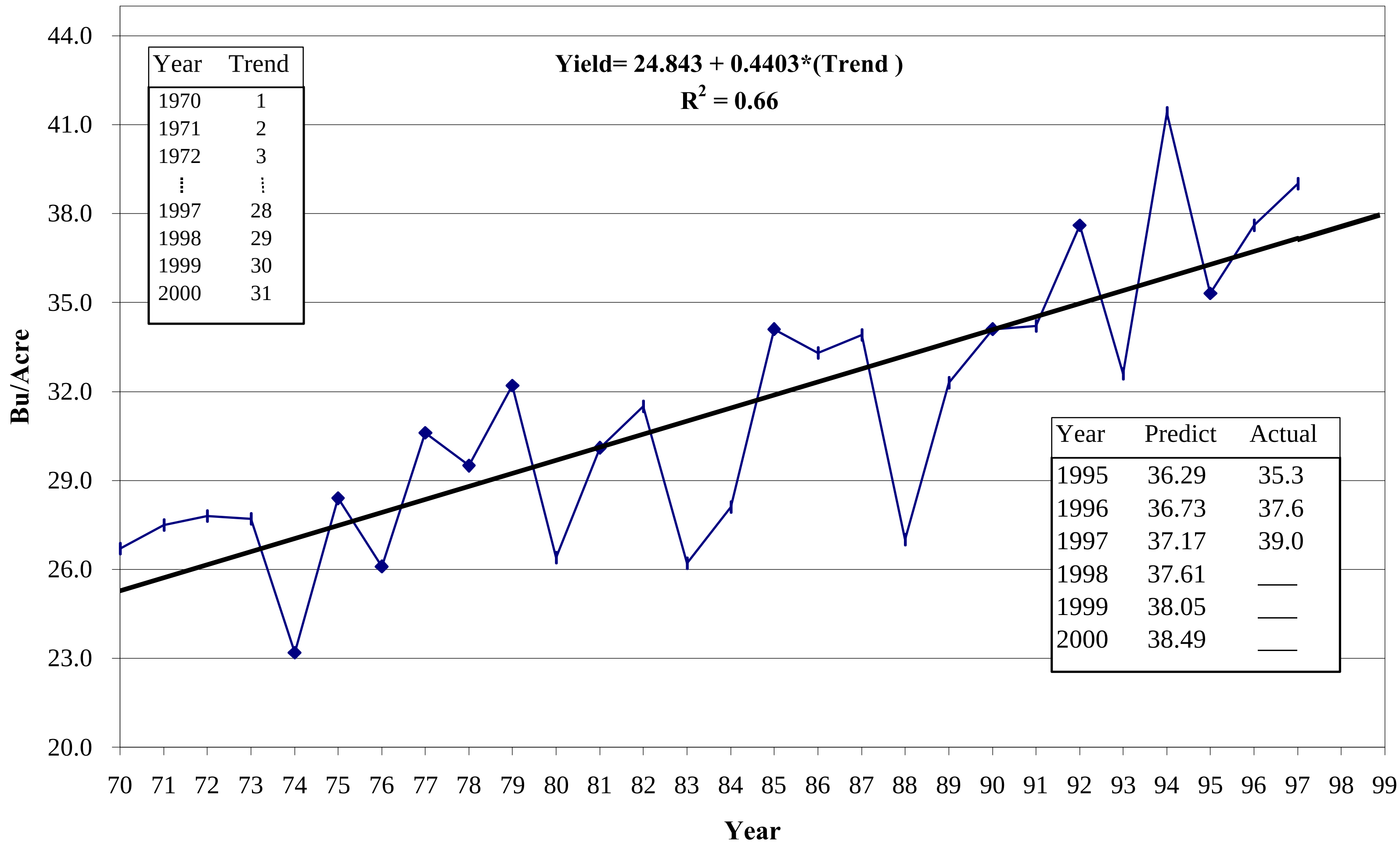


Table 5 contains the percentage change in poultry and hog production numbers for the past eight years. The change in poultry and hog production numbers for the 1998/99 crop year is 3.24 percent. By increasing last year's crush of 1,525 by 3.24 percent, an estimate of 1998/99 crush can be obtained. The crush estimate for 1998/99 is 1,574 (1,525 * 1.032). Enter 1,574 into the box for 1998/99 crush in Table 2.

Table 5. Fourth quarter poultry and hog production

Year	Actual Quarter IV	Year	Estimated Quarter IV	% Change
	(mil. lbs.)		(mil. lbs.)	%
1990	10,241	1991	10,695	4.43
1991	10,714	1992	11,130	3.88
1992	11,211	1993	11,505	2.62
1993	11,508	1994	11,575	0.58
1994	12,251	1995	12,605	2.89
1995	12,373	1996	12,775	3.25
1996	12,492	1997	13,075	4.67
1997	13,149	1998	13,575	3.24
1998	____	1999	____	____
1999	____	2000	____	____
2000	____	2001	____	____

Source: WASDE, April, 1998. *http://www.usda.gov/nass/*

2. Exports

Exports are largely determined by price, exchange rates, government programs in the United States and other countries, politics, and production in the United States and South American countries. South American soybean production has increased dramatically since 1974 as shown in Figure 5 and Table 6. South America's crop is planted in the fall and harvested in the following spring in April, May, and June. USDA aligns the production of the two countries in the following way. The United States crop that is harvested in the fall is aligned with the South American crop to be harvested in the following spring. For example, the United States harvested 2,727 million bushels in the fall of 1997 that was to be used during the 1997/98 marketing season. South American harvest was 48.6 million metric tons (mmt) in the spring of 1998. The spring 1998 harvest in South America is aligned with the 1997/98 United States marketing season.

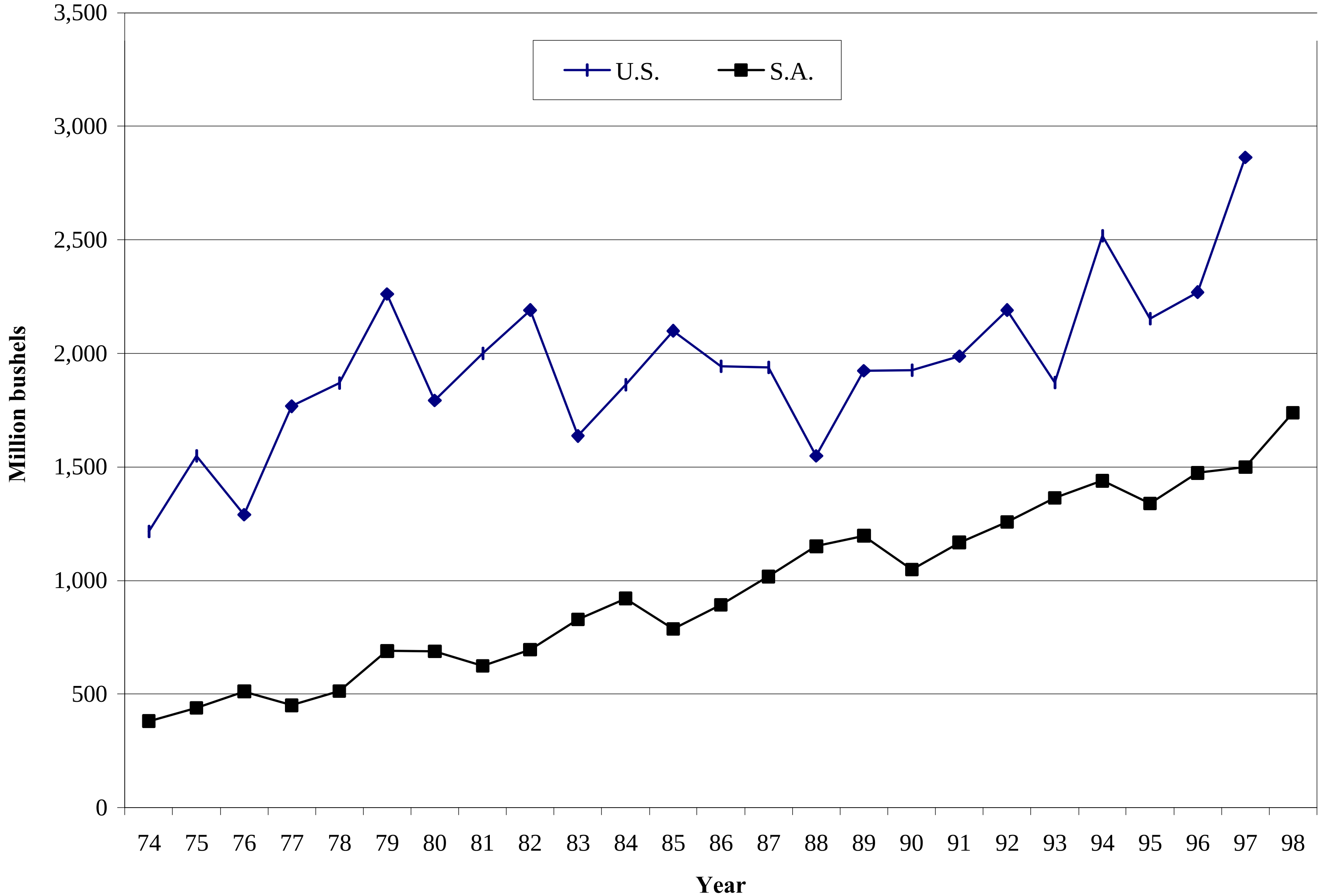
South America exports a large percentage of their production each year. As South American production increases, it provides strong competition for United States exports. Hence, United States exports are estimated using the equation

EXPORTS= 24.2 + (0.437 * **USPRODN)** – (5.980 *** SAPRODN**)

where

EXPORTS = United States Exports (mil bu)
USPRODN = United States Production (mil bu)
SAPRODN = South American Production (mmt)

Figure 5. United States and South American soybean production



The equation explains 73 percent of the variation in United States exports from year to year. When United States production increases, United States exports increase, but when South American production increases, United States exports decrease.

Data from 1997/98 can be used to demonstrate how the equation is used. In 1997/98 U.S. production was 2,727 million bushels and South American production was 48.6 million metric tons. Insert these two numbers into the equation to estimate 1997/98 exports.

EXPORTS = 24.2 + (0.437 * 2727) – (5.980 * 48.6)
= 24.2 + 1192 – 291.0
= 925.3

The equation estimates 1997/98 exports at 925.3 million bushels. Actual exports were 880 million bushels.

In the same way, exports for 1998/99 can be estimated using the equation. United States production is estimated earlier to be 2,670 million bushels. South American production keeps increasing each year unless weather reduces yields. Assume 1999 production in South America will be 50 million metric tons. With these estimates, United States exports would be

Table 6. United States and South America Soybean Production

U.S. Marketing Year	U.S. Production Mil. Bu.	S. A. Production Mil. Metric Ton	S.A. Production Mil. Bu.
1974/75	1,216	10.4	382
1975/76	1,549	11.9	437
1976/77	1,289	13.9	511
1977/78	1,767	12.2	448
1978/79	1,869	13.9	511
1979/80	2,261	18.8	691
1980/81	1,798	18.7	687
1981/82	1,989	17.0	625
1982/83	2,190	18.9	694
1983/84	1,636	22.5	827
1984/85	1,861	25.0	919
1985/86	2,099	21.4	786
1986/87	1,943	24.3	893
1987/88	1,938	27.7	1,018
1988/89	1,549	31.3	1,150
1989/90	1,924	32.6	1,198
1990/91	1,926	28.5	1,047
1991/92	1,987	31.8	1,168
1992/93	2,190	34.2	1,257
1993/94	1,871	37.1	1,363
1994/95	2,517	39.2	1,440
1995/96	2,177	36.6	1,344
1996/97	2,382	38.0	1,396
1997/98	2,727	48.6	1,785
1998/99	------	----	------
1999/00	------	----	------
2000/01	------	----	------

Metric ton = 36.7347 U.S. soybean bushels

EXPORTS = 24.2 + (0.437 * 2670) – (5.980 * 50)
= 892

Estimated U.S. exports for 1998/99 are 892 million bushels. Enter this number in Table 2 in the export box.

3. Seed, Feed, Residual

The seed, feed, and residual category (SFR) is a small percentage of total demand. If soybean acres increase, seed use increases and vice versa. To estimate SFR for next year, the most recent number for a year with similar planted acres is used. For the 1998/99 estimate, SFR from 1997/98 is most similar. Enter 160 in the 1998/99 seed, feed, and residual box.

Total demand can now be estimated by adding all three categories: crush, exports, and SFR. Total demand for 1998/99 is 2,626. Enter 2,626 in the box for total demand in Table 2.

III. Ending Stocks

The ending stocks for 1998/99 can be calculated by subtracting total demand from total supply. Ending stocks for 1998/99 is 284 million bushels. Days supply is calculated by dividing ending stocks by use per day. Use per day is 7.19 (2626/365). Days supply is 39 days (284/7.19). Percent use is 11 (284/2626 * 100). Enter these estimates of ending stocks, days supply, and percent use in the appropriate boxes in Table 2.

IV. Season Average Price

The season average price for 1998/99 can now be estimated using the price curve in Figure 6. Locate 284 million bushels on the horizontal axis. Draw a vertical line at 284 million bushels up to the price curve (line A). Then draw a horizontal line (B) from the price curve to the vertical axis. The horizontal line crosses the vertical axis at about $5.70. The equation can be used to arrive at a more precise estimate of price.

$$\textbf{Price} = 17.20 - 2.026 * \mathrm{Ln}(\text{Ending Stocks})$$
$$= 17.20 - 2.026 * \mathrm{Ln}(284)$$
$$\text{Where } \mathrm{Ln}(284) = 5.649$$
$$\textbf{Price} = 17.20 - (2.026 * 5.649)$$
$$= \$5.76$$

The resulting price estimate is $5.76. Enter this price in Table 2.

The estimated equation for the price curve explains 86 percent of the variation in the United States season average price from year to year. In some years, the difference between the predicted and actual price is as large as 40 cents per bushel. Since 1989/90, these April price estimates have been, on average, about 20 cents per bushel from the actual price. In years when yields change substantially from spring to harvest, the errors will be larger than the average.

The United States season average price can be used to estimate the Virginia average price. On average, Virginia soybean price is about equal to the United States season average price from 1987-1996 (Table 7). If Virginia production is down compared to United States production, the difference is positive and vice versa.

Figure 6. Soybean ending stocks and prices

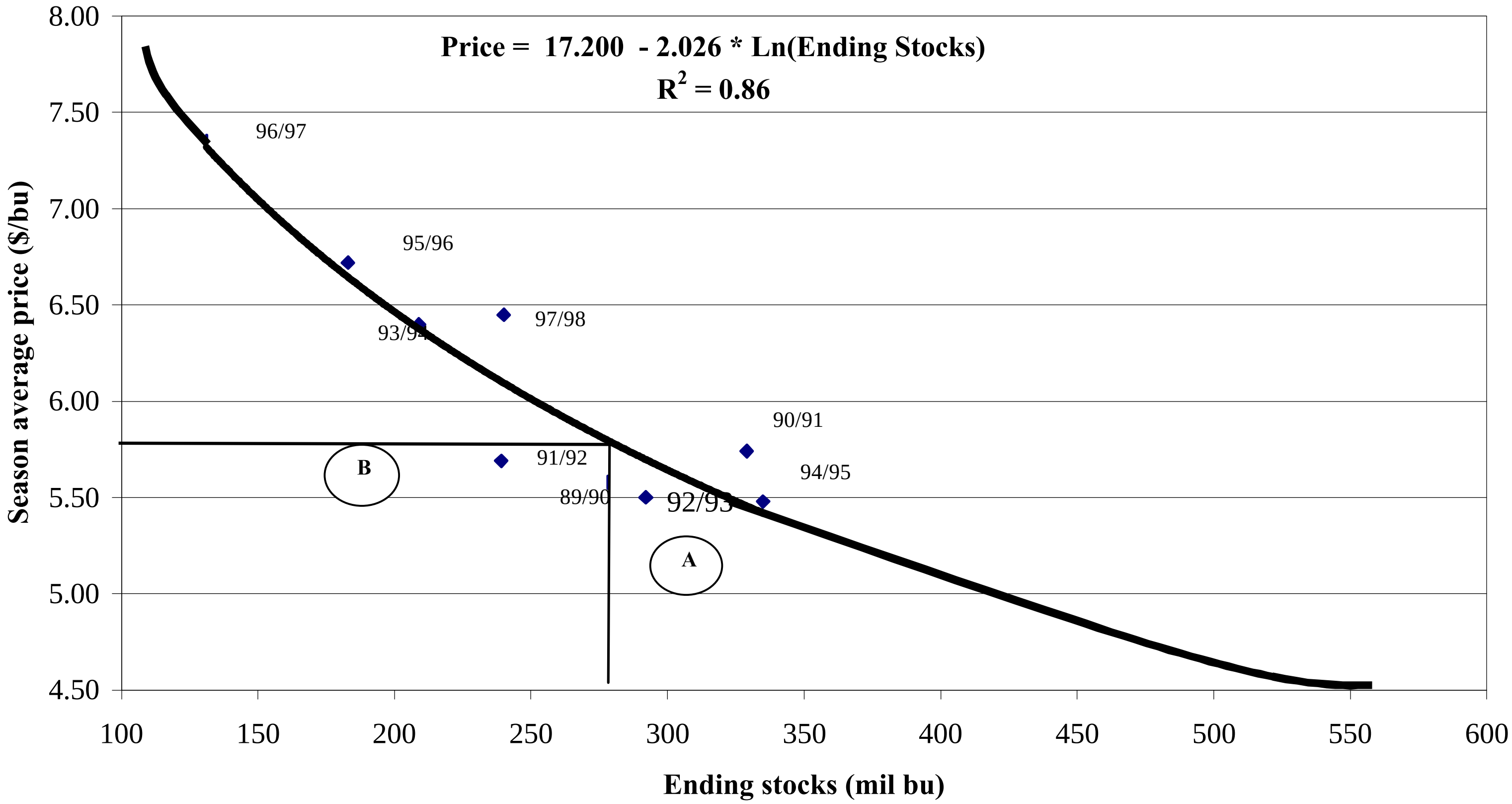


Table 7. U.S. and Virginia production and season average price

Year	---------Production--------		----------Season Average Price---------		
	U.S.	Virginia	U.S.	Virginia	Va. – U.S.
	---------mil bu-------		--------------------$/bu-------------------		
1976	1288	8.2	6.81	7.00	0.19
1977	1762	8.4	5.88	5.90	0.02
1978	1870	12.7	6.66	6.85	0.19
1979	2268	15.3	6.28	6.42	0.14
1980	1792	9.2	7.57	7.89	0.32
1981	2000	16.8	6.07	6.09	0.02
1982	2190	18.6	5.71	5.70	-0.01
1983	1636	9.8	7.83	7.95	0.12
1984	1861	21.5	5.84	5.95	0.11
1985	2099	17.4	5.05	5.15	0.10
1986	1943	13.7	4.78	4.90	0.12
1987	1938	10.9	5.88	6.05	0.17
1988	1549	15.4	7.42	7.40	-0.02
1989	1924	17.2	5.69	5.70	0.01
1990	1926	16.8	5.74	5.65	-0.09
1991	1987	14.5	5.58	5.50	-0.08
1992	2167	15.5	5.50	5.50	0.00
1993	1871	10.8	6.40	6.45	0.05
1994	2517	16.6	5.48	5.35	-0.13
1995	2177	11.3	6.72	6.85	0.13
1996	2382	16.3	7.35	6.85	0.50

Source: *Crop Production* and WASDE at *http://www.usda.nass/gov/*

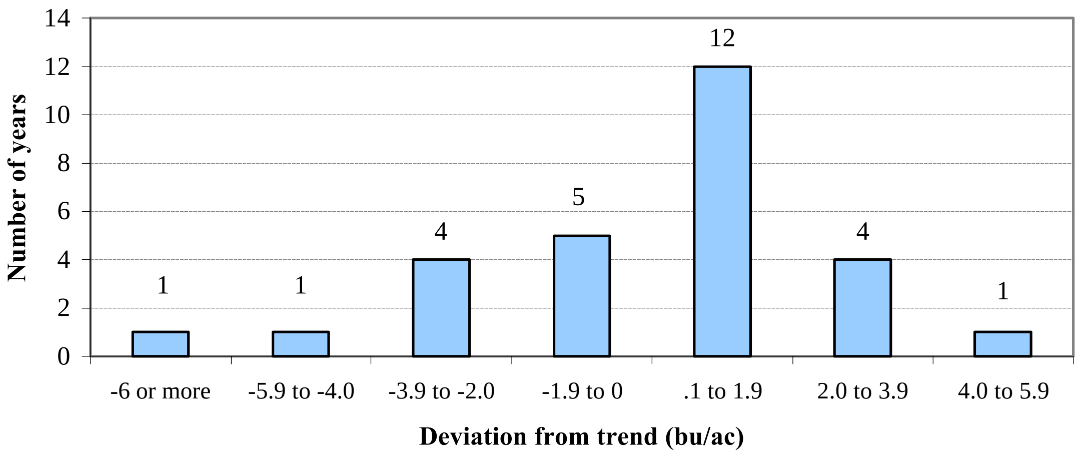
PRICE SENSITIVITY ANALYSIS

The estimated price from the model is based on assumptions about yield, harvested acres, and demand. The actual levels of these variables may change dramatically from April until harvest. The potential impact of these changes on price can be determined by assuming alternative yield and demand levels.

The most variable factor to consider is yield per harvested acre. USDA does not estimate yields by field surveys until August. The 1998 estimate of 37.6 bushels per acre only takes into consideration historical trends. It does not consider the possibility of extremely favorable or unfavorable weather conditions. The accuracy of past trendline yield predictions is shown in Table 4 and Figure 4. In 6 out of the last 10 years, actual yields were within two bushels of trendline yields. But in 2 of the last 10 years actual yields were more than 5 bushels above or below the trendline.

Historically, the chances of 1998 yields being below 37.6 are about 40 percent. The chances that yields will be above 37.6 are about 60 percent (Figure 7). **Yields have a tendency to be above the trendline more often than they are below it.** However, when yields fall below the trendline, they average 2.6 bushels below compared to 1.7 bushels when they are above the trendline.

Figure 7. Difference between trend and actual yield, 1970-1997



If yields are higher than 37.6 in 1998/99, then total production will be higher. Total supply and ending stocks will increase if estimated demand does not change. With an increase in ending stocks, season average price will be lower than the 1998/99 estimate of $5.76 per bushel.

Ever-changing local and world events have a significant impact on the amount of soybeans used during a crop year. Changes in world supply and demand as well as government programs may dramatically increase or decrease exports. Changes in the cost of feed substitutes such as corn and wheat may have an impact on the amount of soybeans crushed. A producer needs to be aware of substantial changes in corn and wheat production. Increases and decreases in production and price of corn and wheat can affect the price of soybeans.

Table 8 is constructed like Table 2. Table 8 is used to show season average price changes when factors such as yield and use change. Three scenarios have been calculated for Table 8. Scenario 1 and 2 represent a yield increase and decrease, respectively. In scenario 3, an increase in United States exports lowers ending stocks, thus increasing season average price.

Scenario #1

If yields increase to 39.3 (37.6 + 1.7) bushels per acre, production will increase to 2,790 (39.3 * 71.0) million bushels. Since exports are a function of United States and South American production, exports will increase to 944 million bushels, assuming South American production remains constant at 50 million metric tons. These changes will result in an increase of ending stocks to 357 million bushels. According to the equation in Figure 6, season average price would decline to $5.29 under this scenario.

Price = 17.20 – 2.026 * Ln(Ending Stocks)
= 17.20 – 2.026 * Ln(357)
where Ln(357) = 5.878
Price = 17.20 – (2.026 * 5.878)
= $5.29

Table 8. Estimated United States soybean supply, demand, stocks, and price					
Item	Units	98/99	98/99	98/99	98/99
		---Scenario---			
		Most Likely	Yield Increase	Yield Decrease	Export Increase
Planted Acreage	mil ac	72.0	72.0	72.0	72.0
Harvested Acreage	mil ac	71.0	71.0	71.0	71.0
Yield	bu/ac	37.6	39.3	35.0	37.6
Supply					
Beginning Stocks	mil bu	235	235	235	235
Production	mil bu	2,670	2,790	2,485	2,670
Imports	mil bu	5	5	5	5
Total Supply	mil bu	2,910	3,030	2,725	2,910
Use					
Seed, Feed & Residual	mil bu	160	160	160	160
Exports	mil bu	892	944	811	922
Crush	mil bu	1,574	1,569	1,569	1,569
Total Use	mil bu	2,626	2,673	2,540	2,651
Ending Stocks	mil bu	284	357	185	259
Days Supply	days	39	49	27	36
Percent Use	%	11	13	7	10
Loan Rate	$/bu	5.26	5.26	5.26	5.26
U.S. Season Average Price	$/bu	5.76	5.29	6.62	5.94
Va. Season Average Price	$/bu	5.76	5.29	6.62	5.94

Scenario #2

If yields decline to 35.0 (37.6-2.6) bushels per acre, production will decrease to 2,485 million bushels. Since exports are a function of United States and South American production, exports would decline to 811 million bushels, assuming South American production is 50 million metric tons. Assuming other uses remains constant, total use would decline to 2,540 million bushels, and ending stocks would be 185 million bushels. At 185 million bushels, season average price would be $6.62 per bushel.

Scenario #3

If United States supply remains constant but South American production declines to 45 million metric tons, United States exports will increase. According to the export equation, United States exports would increase to 922 million bushels. The increase in exports would increase total use, and ending stocks would decline to 259 million bushels. The season average price estimate would then be $5.94 a bushel.

Comparing these three scenarios begins to give a producer some idea of the price range to expect during the growing season. The wide range in price estimates from $5.29, with above average yields to $6.62, with below average yields, illustrates the pricing dilemma producers face. The United States price of soybeans for the current growing season will be largely determined by the weather and its impact on yield. For planning purposes in April, producers can only base plans on the average yield, knowing there is a 40 percent chance yield will be lower and a 60 percent chance yield will be higher. These potential outcomes can be compared to pricing opportunities in previous years to help formulate a pricing strategy for the current crop year.

PRICING STRATEGY

Table 8 contains estimates of ending stocks for the 1998/99 marketing year under the three scenarios described. If using the ending stocks to price relationship in Figure 6, season average price estimates are generated for each scenario. The development of a pricing strategy must take into consideration many factors, such as the possible events presented in the three scenarios. The ending stock and price estimation can be used to develop the initial pricing strategy in April. Three steps are involved in developing a pricing strategy: first, determining price direction; second, setting a price target, and third, comparing the price target to historical futures price levels.

The price direction is established by comparing projected ending stocks to ending stocks for the current marketing year. If ending stocks are projected to increase, the general price trend will be down. If ending stocks are projected to decrease, the general price trend will be up. In terms of formulating a pricing strategy, when prices are expected to trend down, a producer should be more aggressive in pricing early in the production season. If prices are expected to trend up, a producer should forward price none or only a small percentage of expected production early in the growing season.

For 1998/99, the April estimate of ending stocks is 284 million bushels compared to 235 million bushels in 1997/98. If these estimates are accurate, the direction in price during the 1998 growing season should be down compared to 1997/98. An estimate of 284 million bushels is near the high end of historical ending stock levels (Table 1) and has been associated with prices in the $5.50 to $5.75 range. Hence, producers need to consider pricing a substantial portion of their expected crop early in the season, if favorable prices can be established. When the expected price direction is clearly down, the producer should consider pricing 30 to 50 percent of expected production in the spring and early summer.

Once the direction is established, the second step is to determine a target price level. The target price level is determined by finding previous years with similar ending stock levels and analyzing the highest November futures prices recorded in those years. Ending stock levels for 1998/99 are forecast at 284 million bushels. Ending stocks in 1992/93 were 292 million bushels and 278 million bushels in 1991/92. The November futures charts for 1991 and 1992 should be analyzed to determine what price levels were reached in those two years. November soybean futures charts for years 1982 through 1998 are included in the Appendix for this purpose. In 1991, November futures prices were trading near $6.20 during April. They declined to $5.20 by July and traded again near $6.20 for a few days in July and September. Futures prices ended near $5.60 a bushel in November. In 1992, November futures prices traded between $6.20 and $6.40 in late April and early May. Most of the season they traded between $5.60 to $6.40 and ended the season in November around $5.60. These two contracts suggest the likely high price in 1998 would be in the spring and between $6.20 and $6.40. A reasonable target price seems to be $6.40. A producer should be very aggressive in forward pricing at this level, since in both 1991 and 1992, prices at harvest were $5.60 a bushel.

From January to March 1998, November 1998 futures traded between $6.40 and $6.85. These prices were available before the March 31 *Prospective Plantings* report. After the report showing increased acreage for 1998 was published, November 1998 soybean futures traded between $6.15 and $6.40 during April. This price level was very consistent with the target of $6.40. Given the projected increase in ending stocks and strong downward direction in price and given that futures prices at harvest in 1991 and 1992 were $5.60, a producer should forward price at least 33 percent of expected production at $6.40. If prices increase to the $6.60 area during the summer, a producer should price up to 50 percent of expected production unless indicators strongly suggest that yields will be less than 38 bushels per acre.

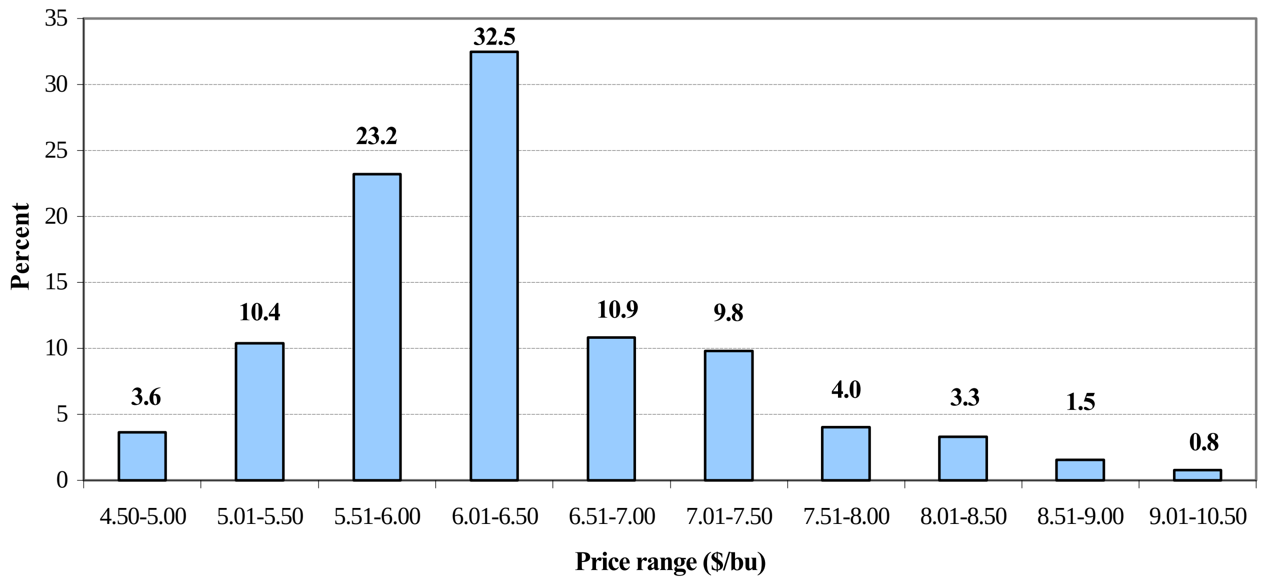
The third step in developing a pricing strategy is to compare currently available prices to past futures price levels. The historical distribution of November closing futures prices from 1980-1996 are shown in Figure 8. The distribution is based only on November futures prices. It does not include other futures contract months. Over 7,000 prices are used in calculating this historical distribution. The figure indicates the percentage of time prices traded within the price ranges shown on the horizontal axis. For example, the most likely price range for November soybean futures is between $6.01 to $6.50. During the last 17 years, prices traded in this range 32.48 percent of the time. November futures only trade above $8.00 about 5.61 percent of the time (3.29 + 1.54 + 0.78).

November futures trade above $6.51 about 30 percent of the time (Figure 8). Hence, a November 1998 futures price of $6.40 is near the top third of historical prices. Given that projected ending stocks are approaching previous record levels, $6.40 seems to be a very good price.

All three indicators seem to suggest that forward pricing at least 1/3 of expected production at $6.40 is a good strategy based on the information available in April. The increased ending stocks suggest the price direction is down. In two years with similar ending stock levels, the highest November futures prices were around $6.40, a very good price in light of projected ending stocks of 284 million bushels and historical prices.

Of course, many things could change between April 1998 and harvest. Yields could decline, exports could increase, crush could increase, etc. But based on the information available it appears that prices will be considerably lower than $6.40 during 1998/99 if yields and use do not change substantially from current expectations. A producer needs to monitor all of the variables in the supply and demand table (Table 1) as the season progresses. A new Supply and Demand table is released by USDA around the 10th of each month. If any of the variables change substantially, the above procedures can be used to revise the pricing strategy.

Figure 8. Price distribution November soybean futures: 1980-1996

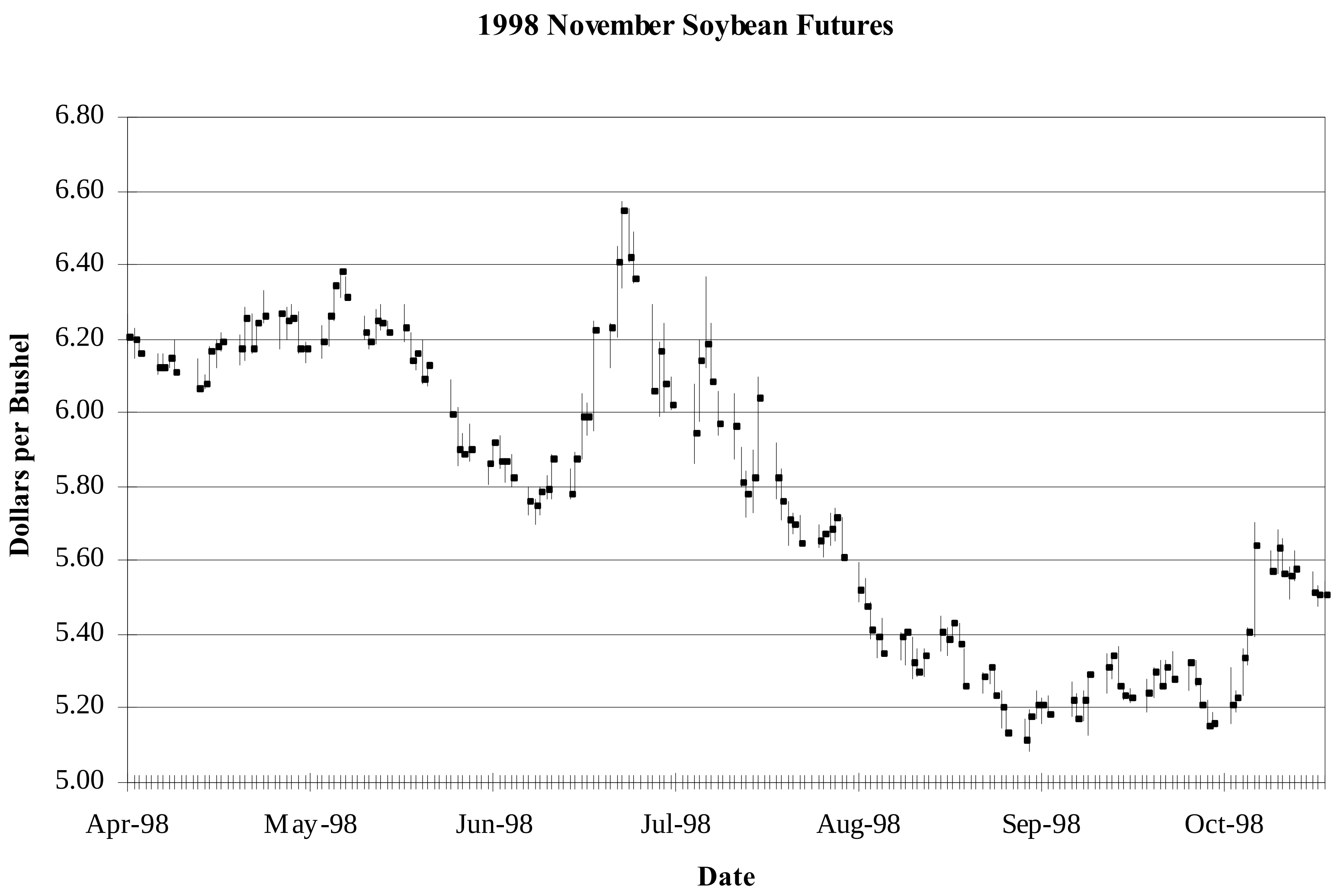


SUMMARY

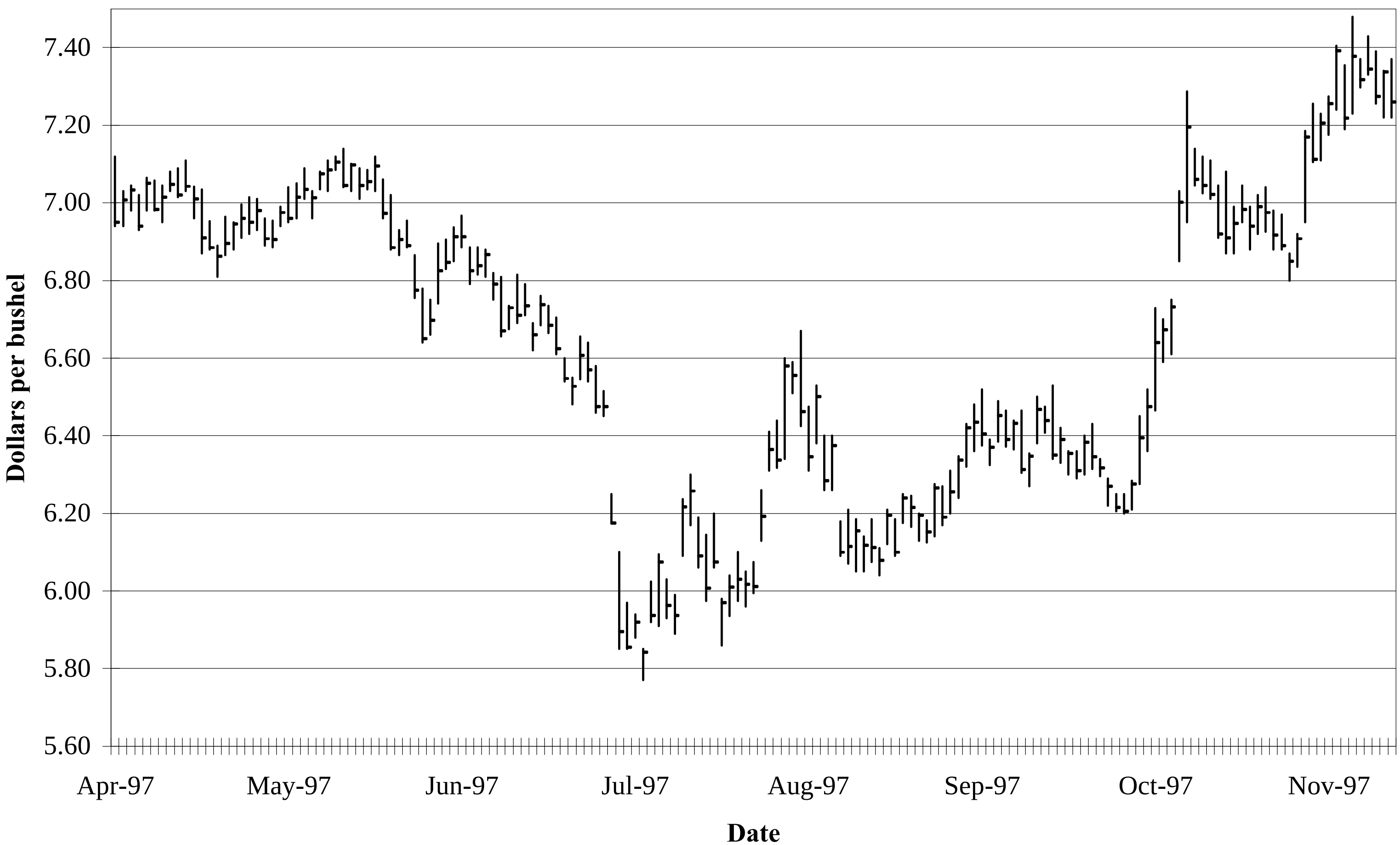
The historical Supply and Demand tables make it possible to put current Supply and Demand estimates in historical perspective. The price forecasting equation permits the producer to estimate the season average price based on projected ending stocks. Estimated ending stocks can then be used to develop a pricing strategy. The strategy is developed based on the expected direction in price, price targets in November futures based on similar years, and an evaluation of the current price level relative to historical futures prices. By monitoring Supply and Demand each month, producers can modify their strategy during the growing season as new information becomes available.

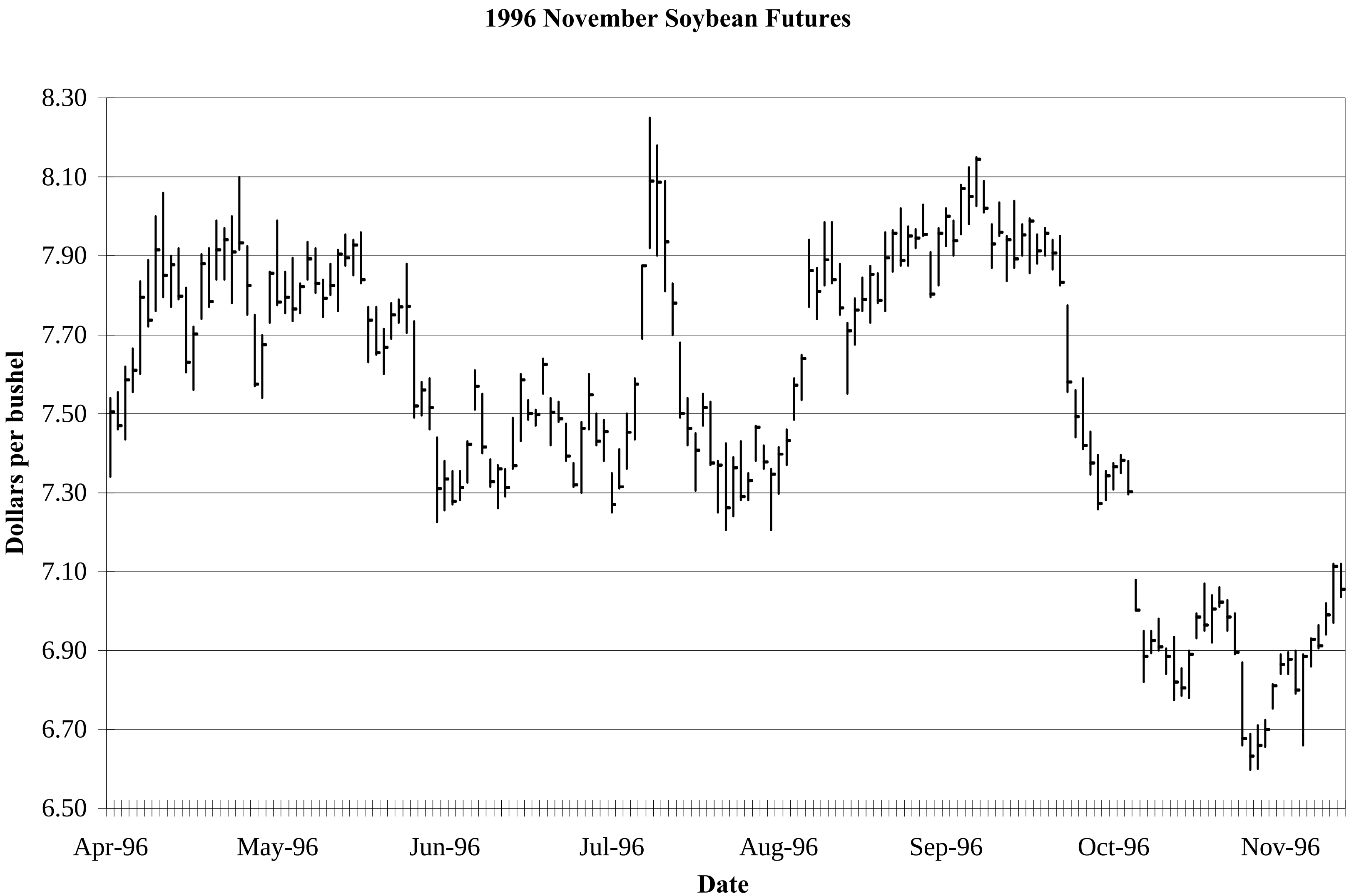
This pricing manual can only improve producers' pricing decisions if they know the advantages and disadvantages of forward pricing with cash contracts, futures, and options. The best prices rarely occur at harvest. Soybean producers who know how to use these pricing tools will have the opportunity to increase average prices or reduce price risk over time.

APPENDIX:
NOVEMBER
SOYBEAN FUTURES
1982-1998

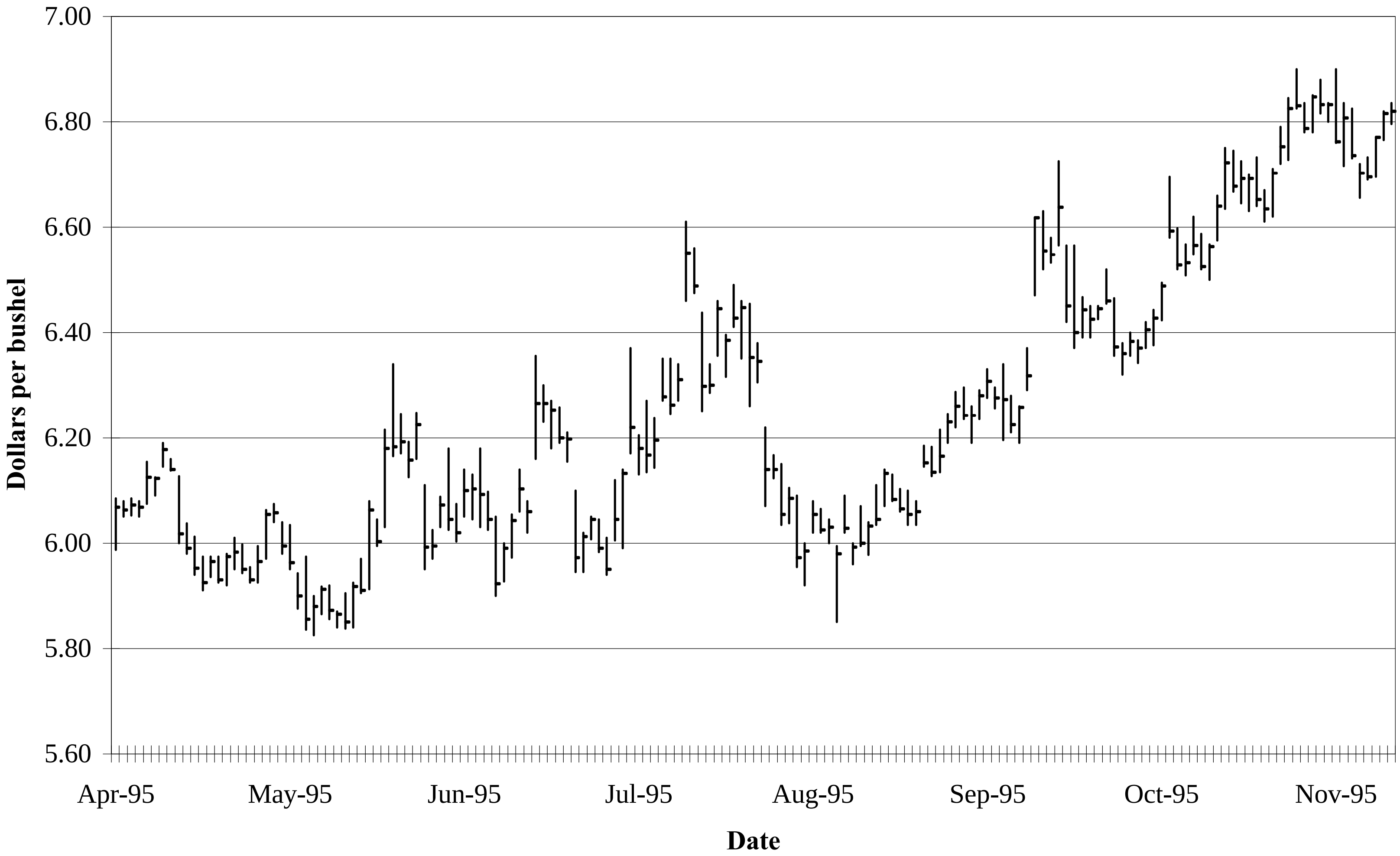

1998 November Soybean Futures
Dollars per Bushel
6.80
6.60
6.40
6.20
6.00
5.80
5.60
5.40
5.20
5.00
Apr-98
May-98
Jun-98
Jul-98
Aug-98
Sep-98
Oct-98
Date

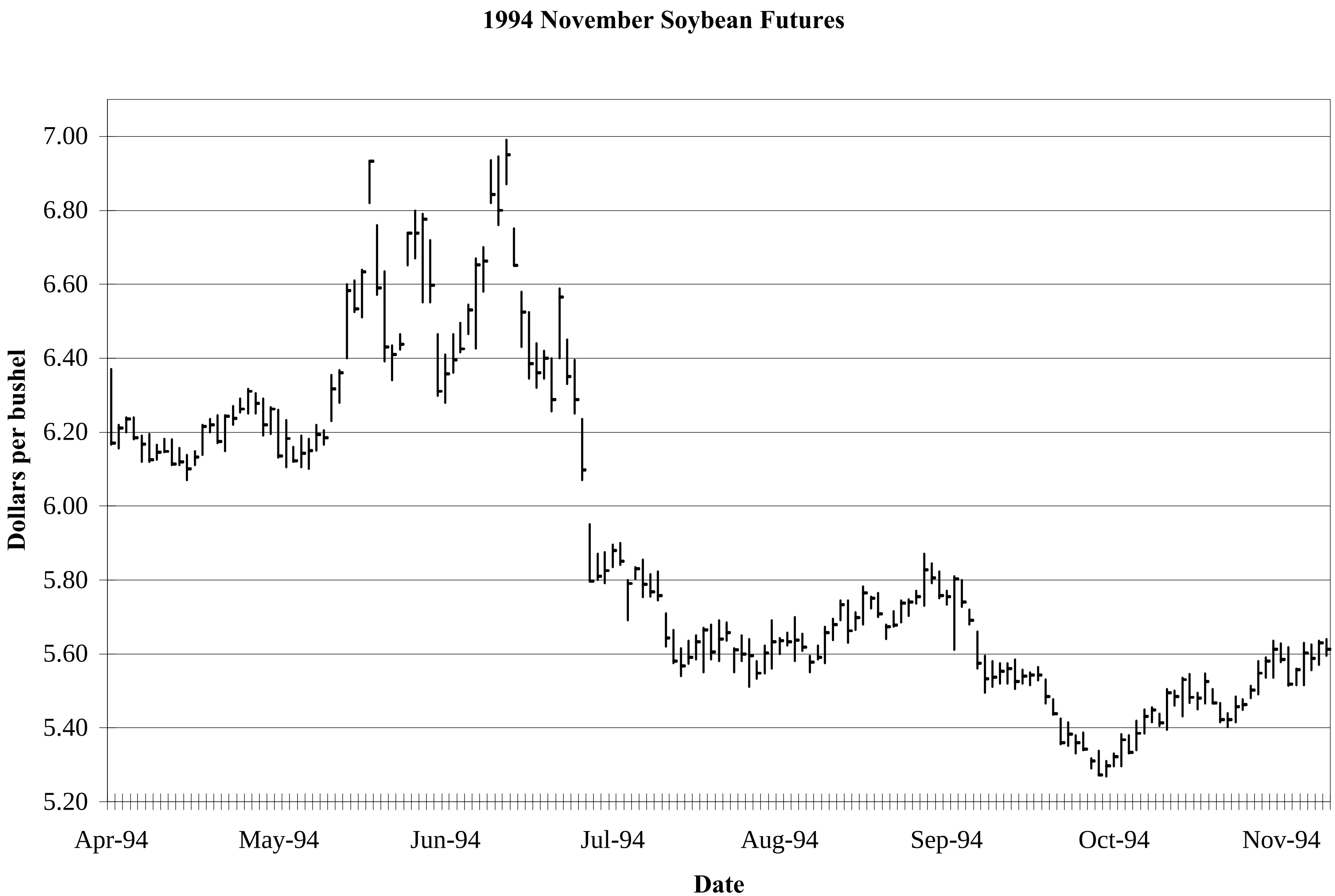
1997 November Soybean Futures



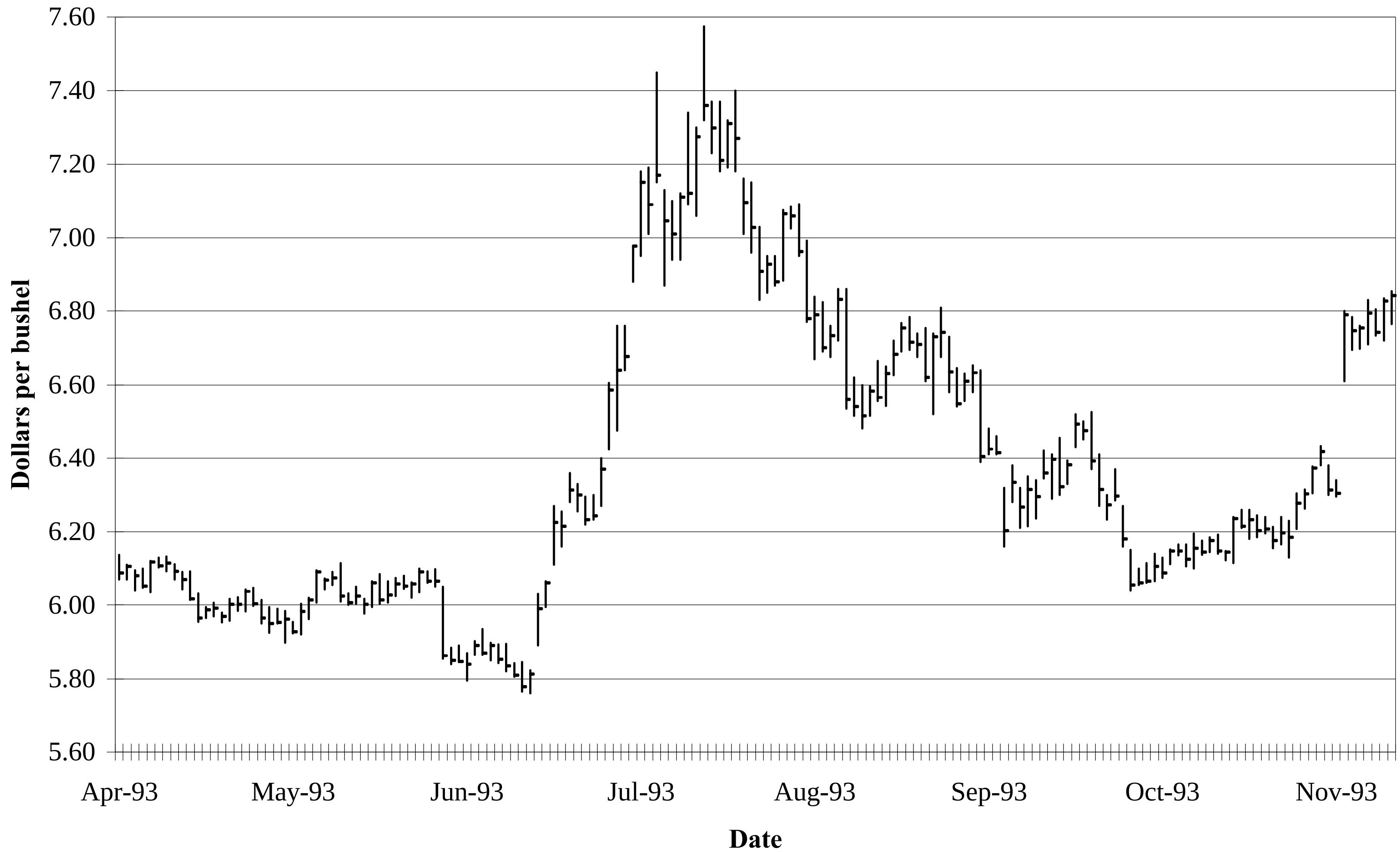

1996 November Soybean Futures
8.30
8.10
7.90
7.70
7.50
7.30
7.10
6.90
6.70
6.50
Dollars per bushel
Apr-96
May-96
Jun-96
Jul-96
Aug-96
Sep-96
Oct-96
Nov-96
Date

1995 November Soybean Futures

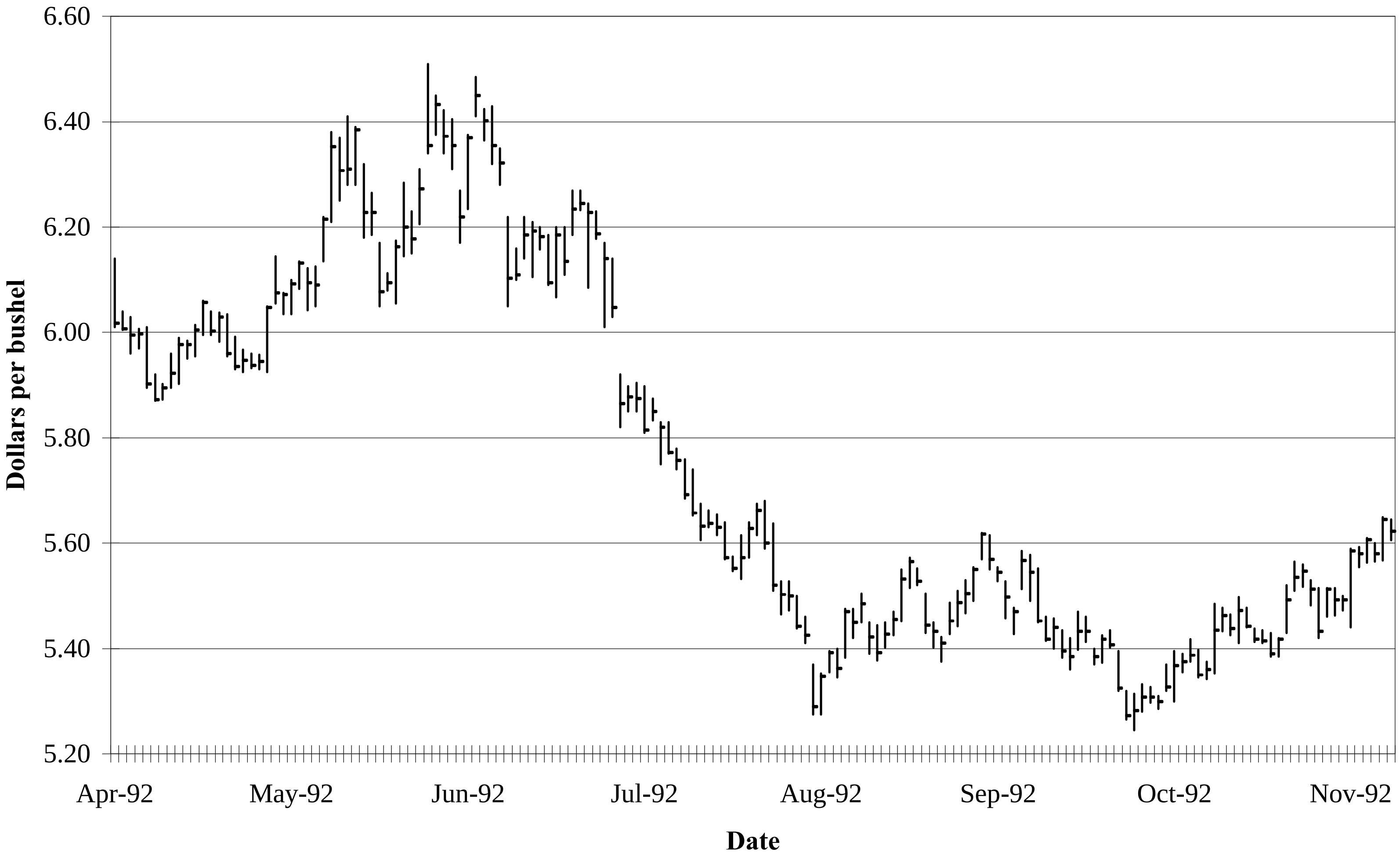



1994 November Soybean Futures
Dollars per bushel
7.00
6.80
6.60
6.40
6.20
6.00
5.80
5.60
5.40
5.20
Apr-94
May-94
Jun-94
Jul-94
Aug-94
Sep-94
Oct-94
Nov-94
Date

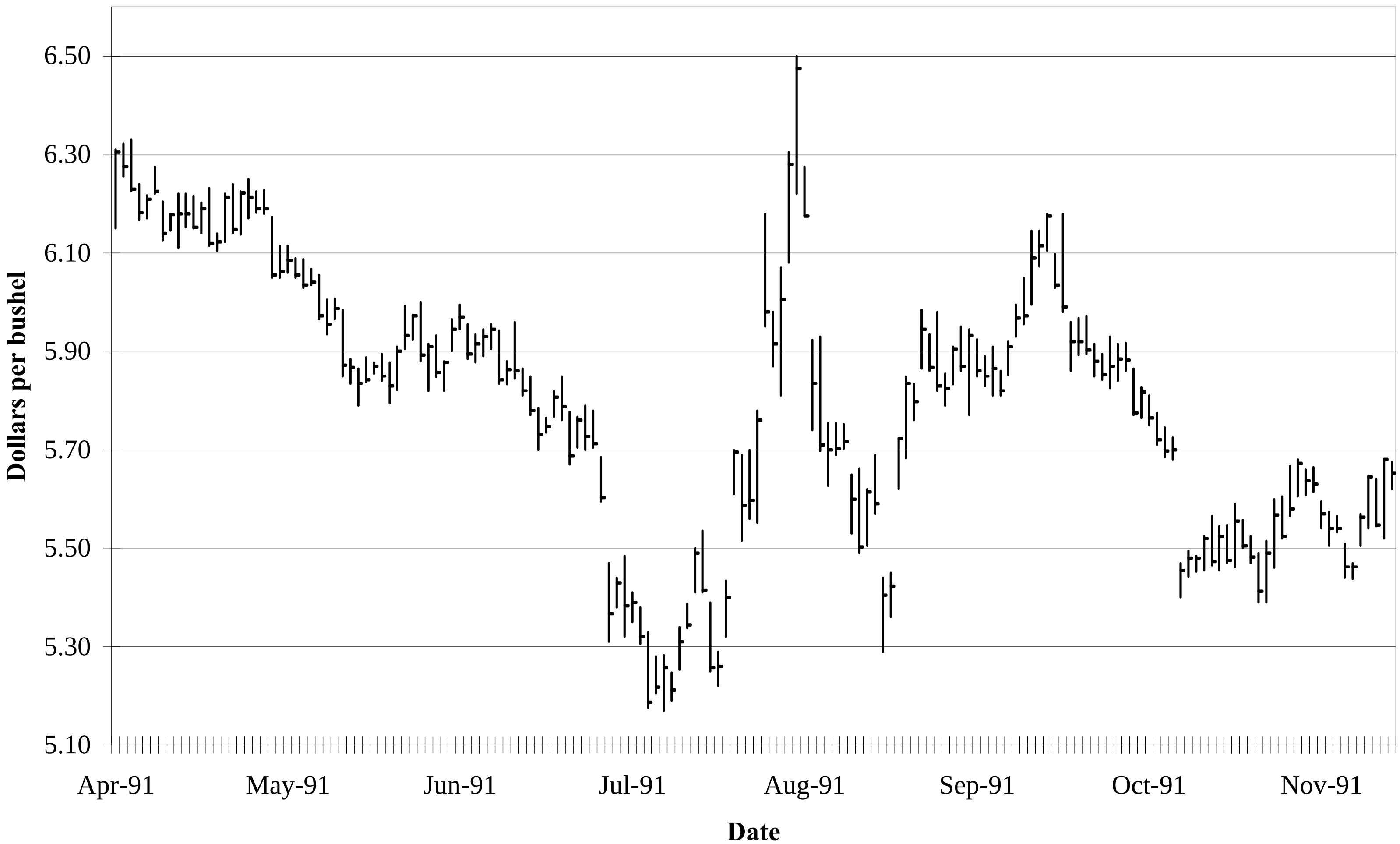
1993 November Soybean Futures

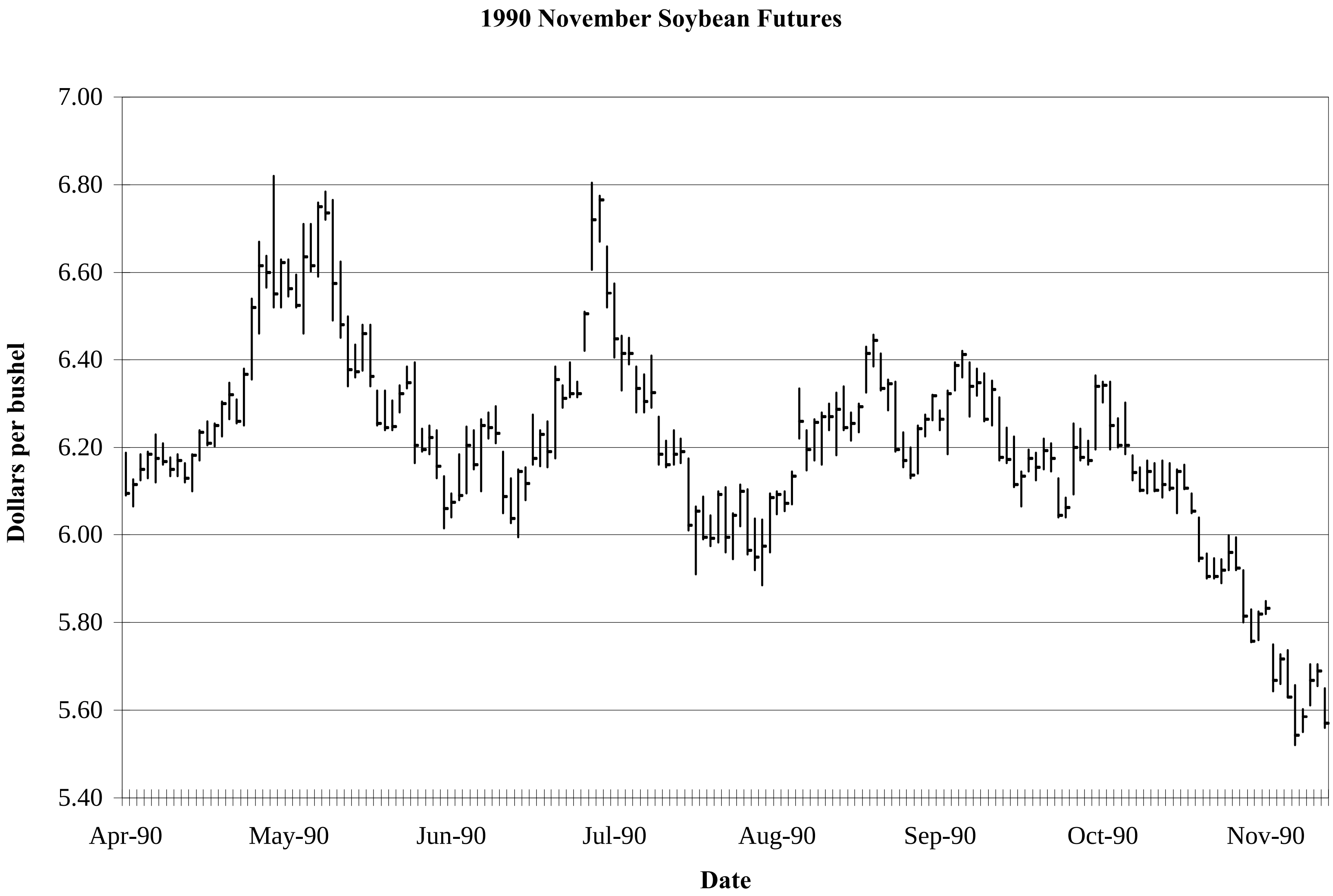


1992 November Soybean Futures

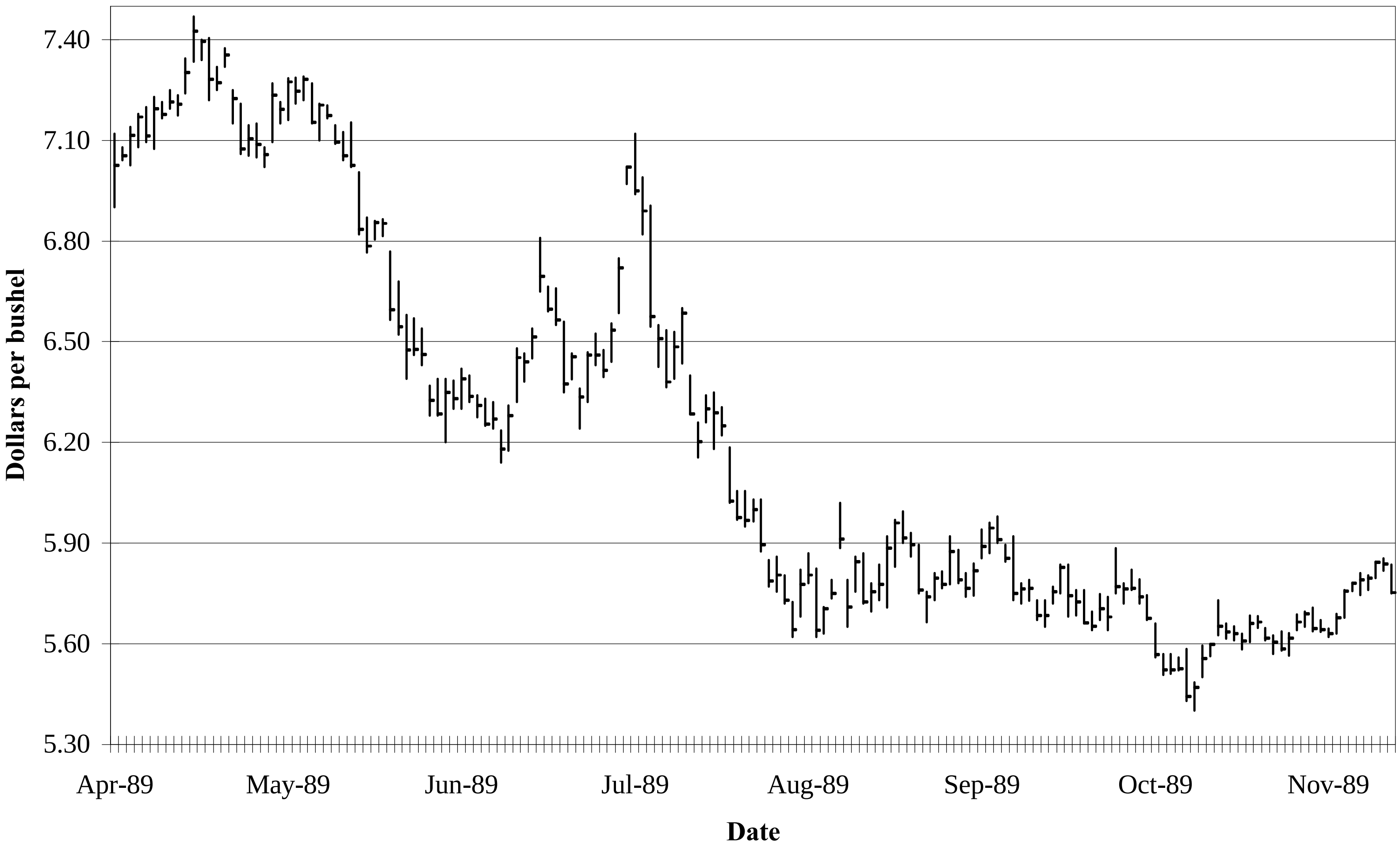


1991 November Soybean Futures

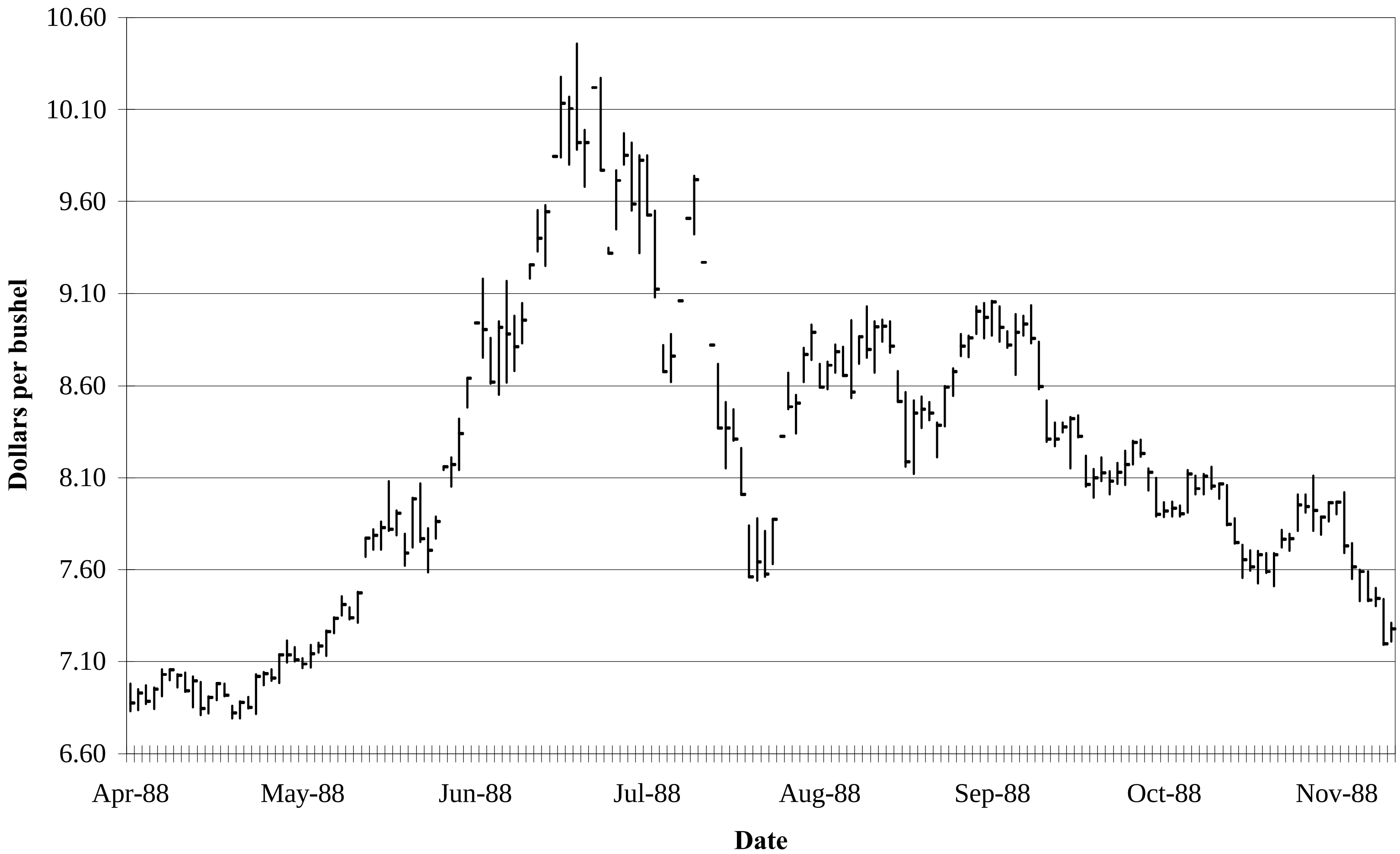



1990 November Soybean Futures
Dollars per bushel
7.00
6.80
6.60
6.40
6.20
6.00
5.80
5.60
5.40
Apr-90
May-90
Jun-90
Jul-90
Aug-90
Sep-90
Oct-90
Nov-90
Date

1989 November Soybean Futures

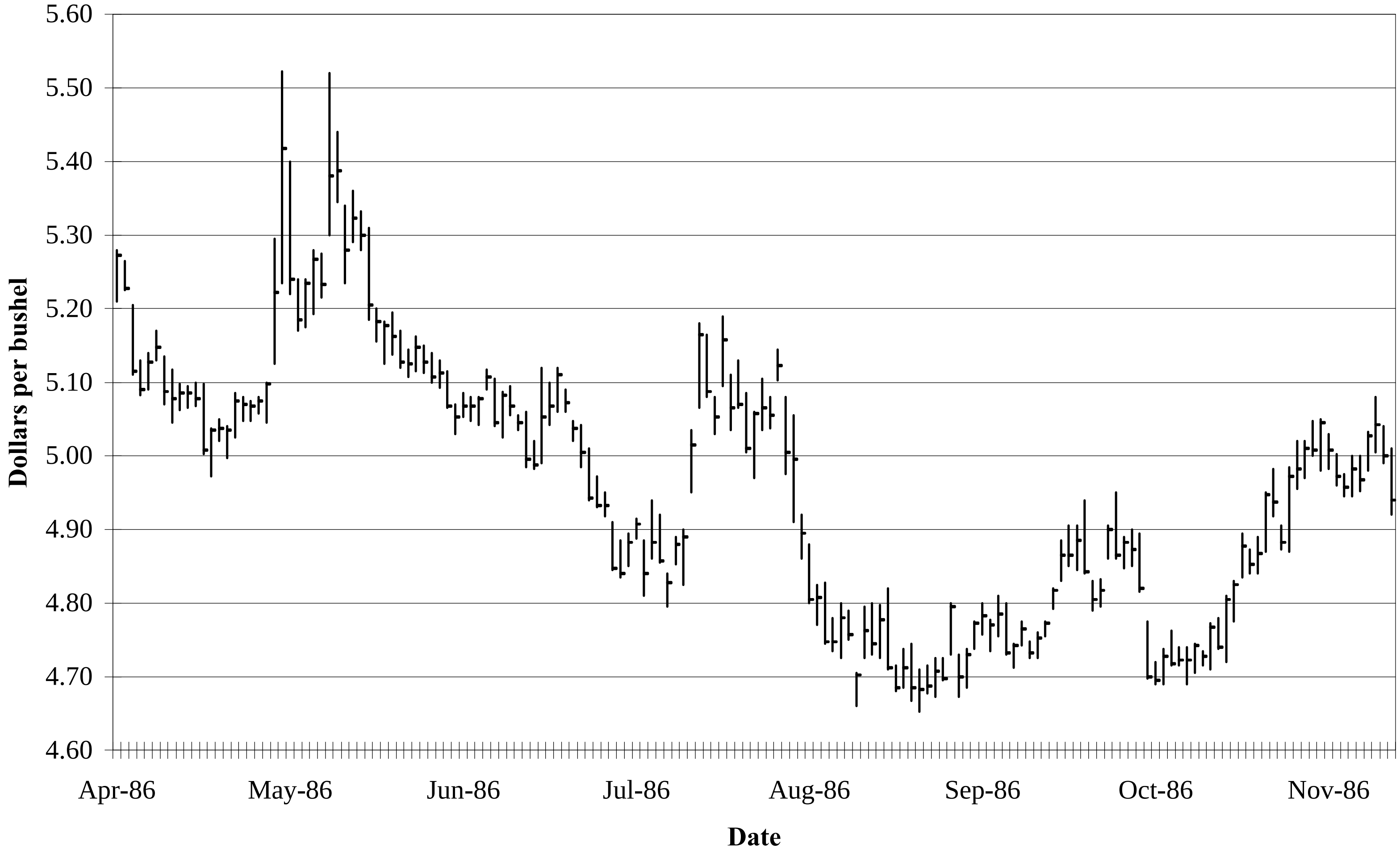


1988 November Soybean Futures

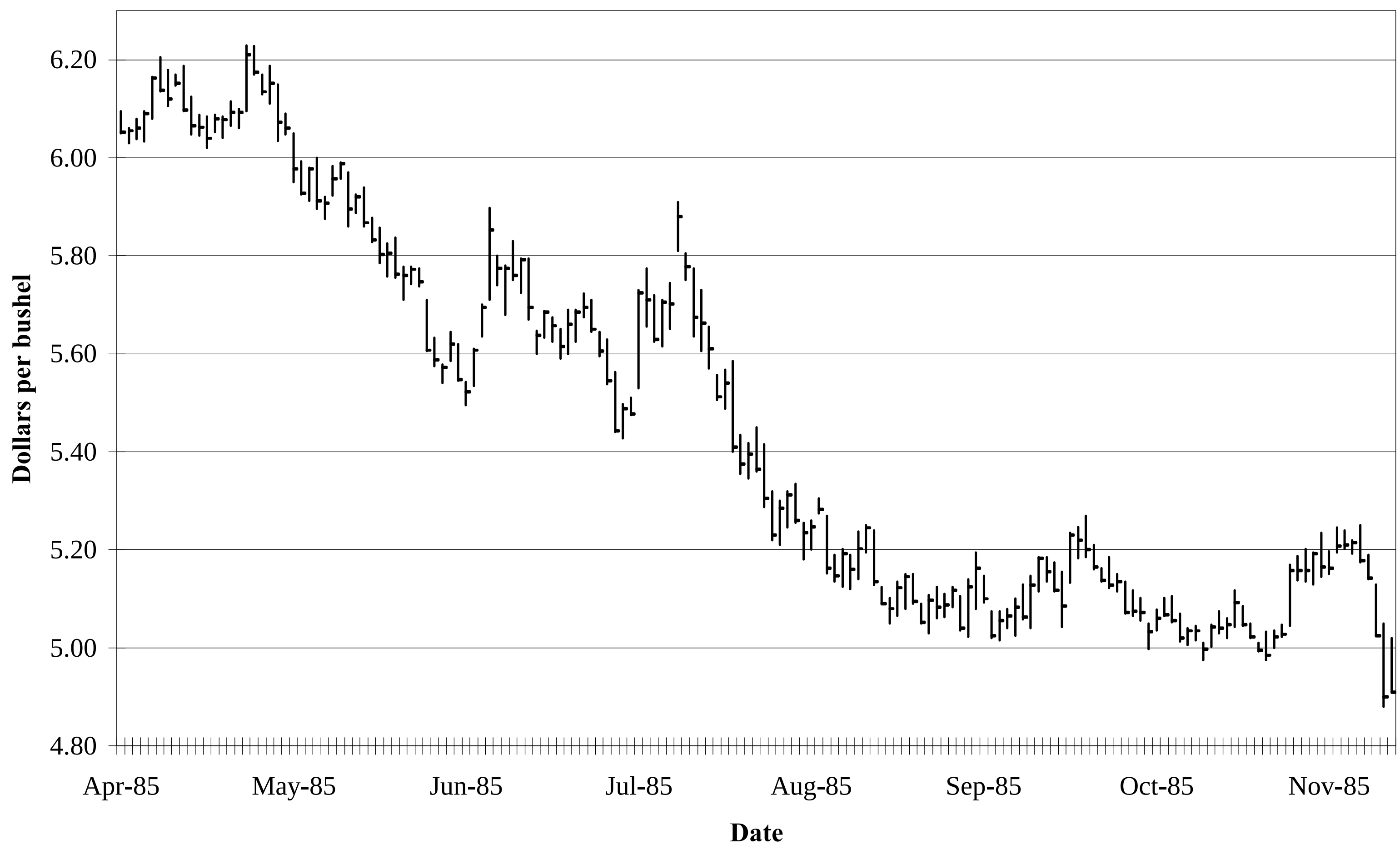


1987 November Soybean Futures

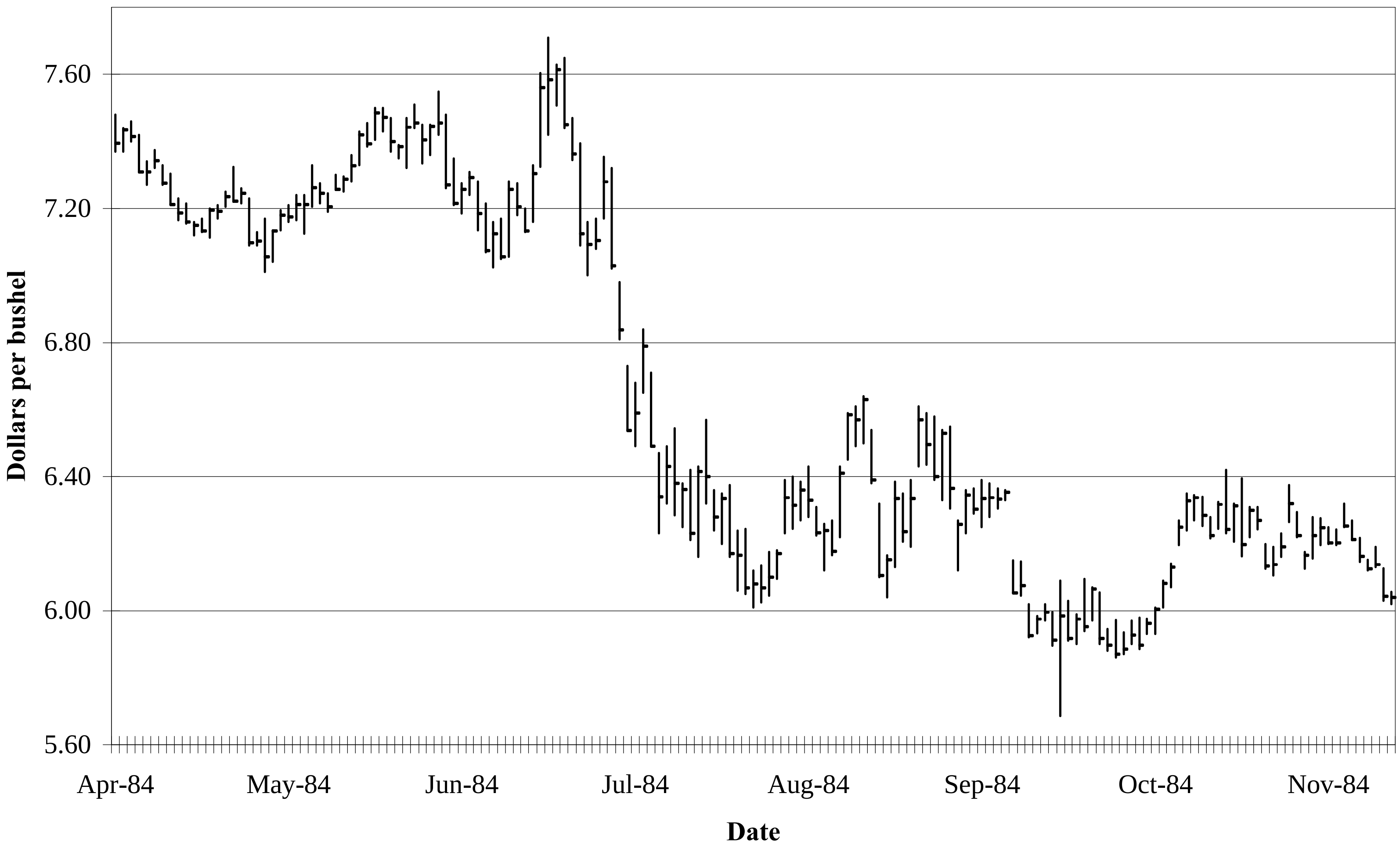
1986 November Soybean Futures



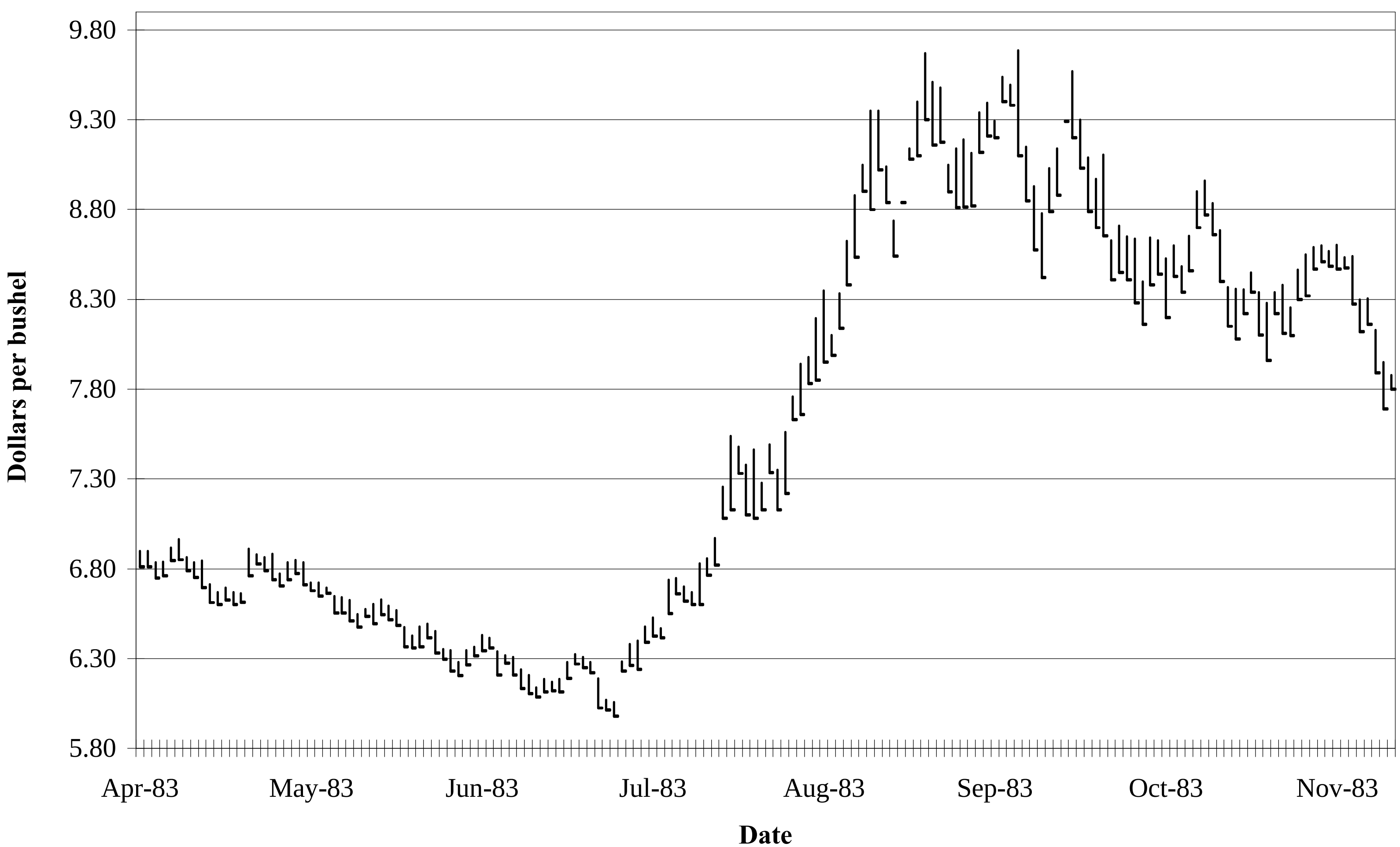
1985 November Soybean Futures

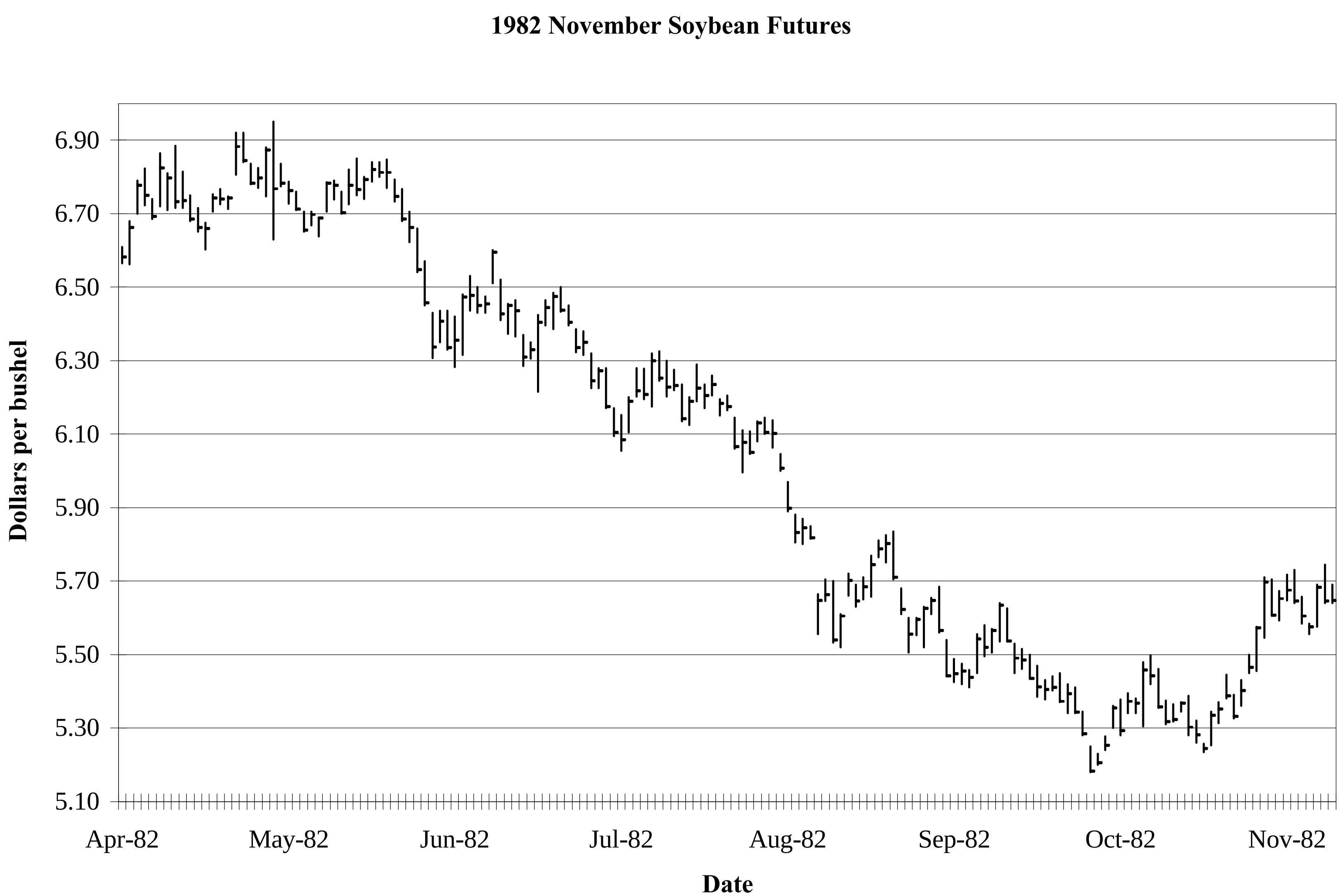


1984 November Soybean Futures



1983 November Soybean Futures




1982 November Soybean Futures
Dollars per bushel
6.90
6.70
6.50
6.30
6.10
5.90
5.70
5.50
5.30
5.10
Apr-82
May-82
Jun-82
Jul-82
Aug-82
Sep-82
Oct-82
Nov-82
Date