

How to Construct a Seasonal Index

William I. Tierney, Jr., Mark L. Waller and Stephen H. Amosson*

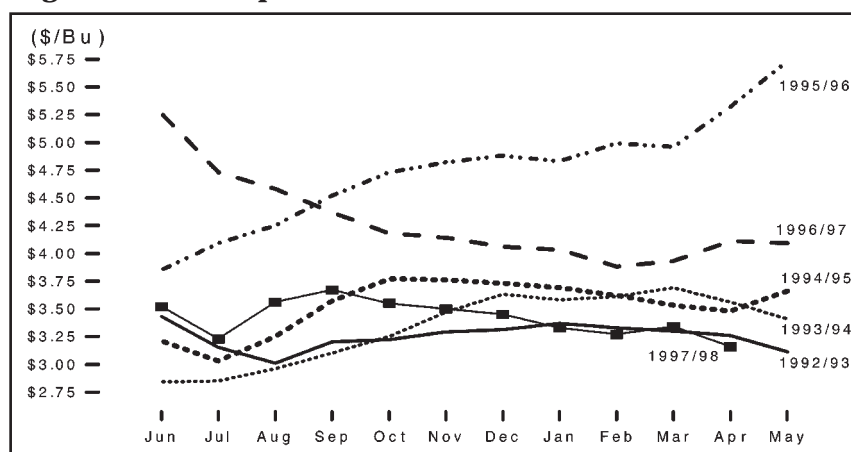
Methods of Constructing Crop Seasonals

There are several ways to construct seasonals. Perhaps the simplest is to produce a graph with the factor being studied (i.e., price) on the vertical (or "Y") axis and time (i.e., days, weeks or months) on the horizontal (or "X") axis. For a seasonal to have any significance, a number of years' worth of data need to be accumulated. They can be plotted on the chart or an average of the data can be plotted (Fig. 1). These charts are most appropriate for periods of relative stability in market conditions.

If a seasonal chart consists only of an "average" (and not all of the original data), it is often accompanied by a plotted confidence interval of plus or minus one **standard deviation**. The standard deviation is a measure of the variability of the historical data from the calculated average. It is useful for showing how reliable the average may be as an indicator of the expected price in a particular year. If the standard deviation is large, the average is not a very dependable indicator of prices; however, if it is small, it is reasonable to place more confidence in the average as a forecasting tool (Fig. 2). For example, to calculate the average used for each month in Figure 2, take the prices for each month (say June 1992, 1993, 1994, 1995 and 1996), add them together and divide by the number of years in the study (in this case, 5). The answer is your June average price. If you do the same for each of the other months, July through May, you then have your average series. If you put all of your data in a spreadsheet such as Lotus or Excel, the software will usually provide formula keys that will calculate the averages and standard deviations for you.

Another technique is to construct a seasonal "index." The "base" or "denominator" for the index is generally the average for the time period being examined (365 days, 52 weeks or 12 months).

Figure 1. Wheat price seasonal (1992/93 to 1997/98).



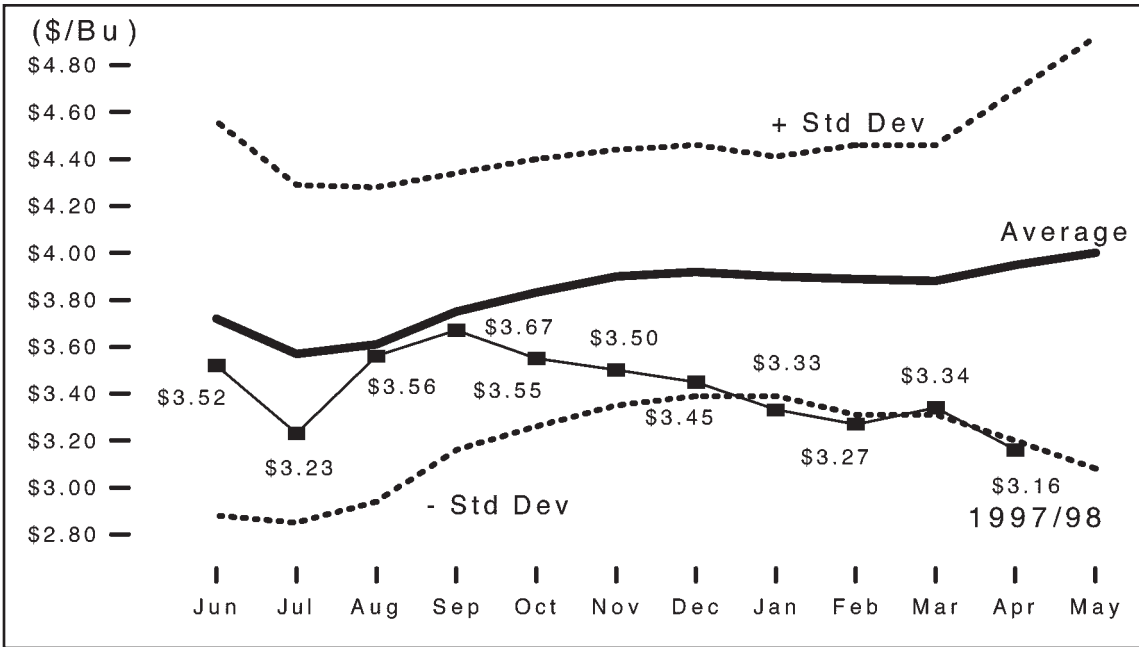
*Extension Agricultural Economist, Kansas State University Agricultural Experiment Station and Cooperative Extension Service; Associate Professor and Extension Economist, The Texas A&M University System; Professor and Extension Economist, The Texas A&M University System.

Risk Management Education



TM

Figure 2. Wheat price seasonal (1992-1996).



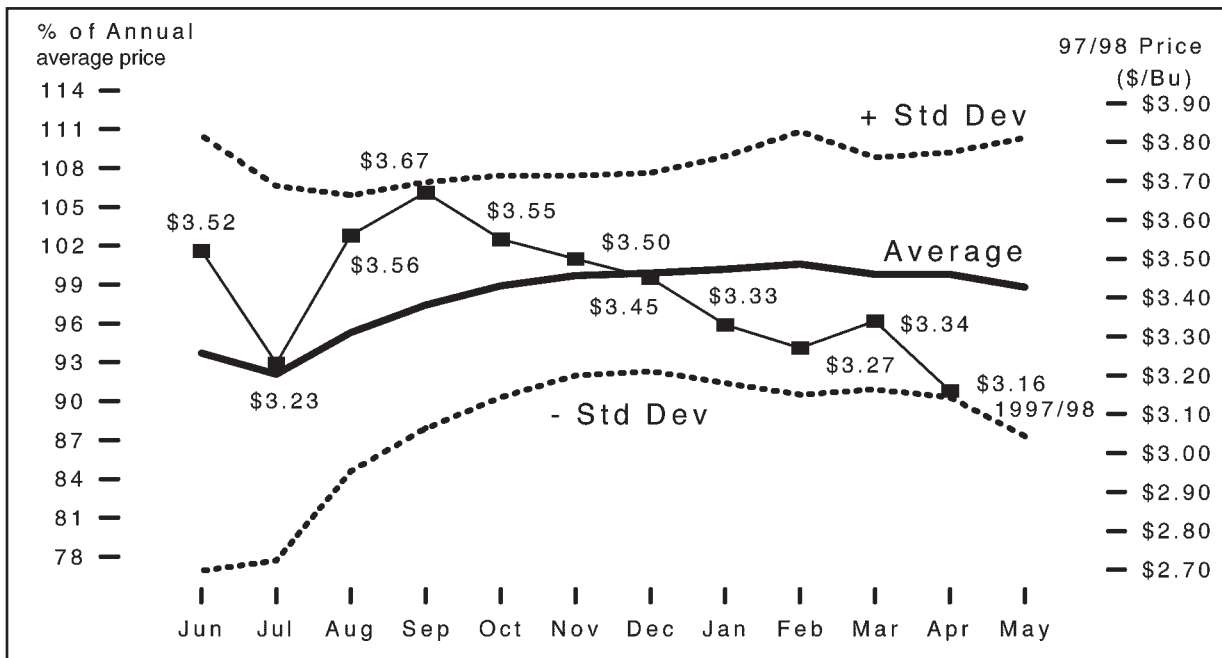
Consequently, each time period's price (or other factor, such as exports) is expressed as a percentage of the season's average and will have a value equal to, greater than, or less than 100.

Most indices of this type use a base value of 100 percent. A value of 85 (or .85) for a particular period (say the month of June for wheat prices) would mean that period's wheat price was 15 percent below that year's 12-month seasonal average price. Conversely, if the February index value was 115, that would mean that February's price was 15 percent above the seasonal average price (Fig. 3).

Example: To calculate the index in Figure 3, take your average June price for 1973-1996 and add it together with the averages for July-May. Divide by the number of monthly averages to get an overall average price (June average + ... + May average ÷ 12 = overall average). Then divide each monthly average by the overall average (June average ÷ overall average = June index; May average ÷ overall average = May index) to get the monthly indices.

This method dampens the variability that may occur from combining data from years with high annual prices with periods of low annual prices,

Figure 3. Wheat price seasonal index (1973-1996).



because what it focuses on is the relative movement of prices within the season. These intra-seasonal price movements are more likely to be uniform whether annual average prices were \$5.00 or \$3.00 a bushel.

A conditioned seasonal could be constructed using only years in which a similar feature was exhibited (i.e., one index for normal crop years and another for short crop years). Using a conditioned seasonal may give a better indication of the seasonal behavior that is likely to occur than averaging all years together. A variation on the seasonal index is to attach a second vertical (or "Y" axis) to the seasonal index and plot this year's values. Depending on how this axis is "scaled," the superimposing of this year's actual prices over the seasonal index can quickly reveal whether this year's price movements are conforming to the expected seasonal pattern (Fig. 3).

One problem with using a single season's annual average price as a base for calculating a seasonal index is that this method will miss any trend factors that may be affecting prices. This can limit the usefulness of seasonals in periods of significant upward or downward trends. Consequently, some seasonal indices are constructed using a 12-month "moving average" (Fig. 4).

To explain the development of an index based on a centered moving average would require more space than is available in this publication. One publication to refer to if you want to learn how to do this is *Agricultural Price and Commodity Market Analysis* by John N. Ferris.

Seasonals can be constructed to analyze components of crop supply/demand as well as crop prices. For wheat, one of the most influential elements of demand is exports. On average, over the last 10 years, exports have comprised 52 percent of total wheat disappearance. While wheat exports are shipped on a relatively steady schedule from U.S. ports, wheat grain export commitments (export shipments plus undelivered sales) are not so steady.

Figure 5 is a seasonal index of changes in cumulative wheat export commitments over a 13-month period measured as a percent of total annual wheat grain export inspections (left axis). If there was no seasonal nature in export commitments, the average line would be flat and would equal 7.69 percent for each month. However, as Figure 5 suggests, above average export commitments tend to be booked in the months of June, August and September, while bookings are less than average in March, April and May. The right axis has been "scaled" to reflect the assumptions that 1998/99 wheat grain export inspections will total 1,105 million bushels.

Given that assumption, it is clear when comparing the April 1998/99 commitments to the seasonal index that wheat export commitments started off well below the level one would expect if the market was to achieve the projection for total annual exports. This might suggest that if commitments don't increase, USDA may need to lower its export forecast for the year.

Figure 4. Wheat price seasonal index (1973-1996).

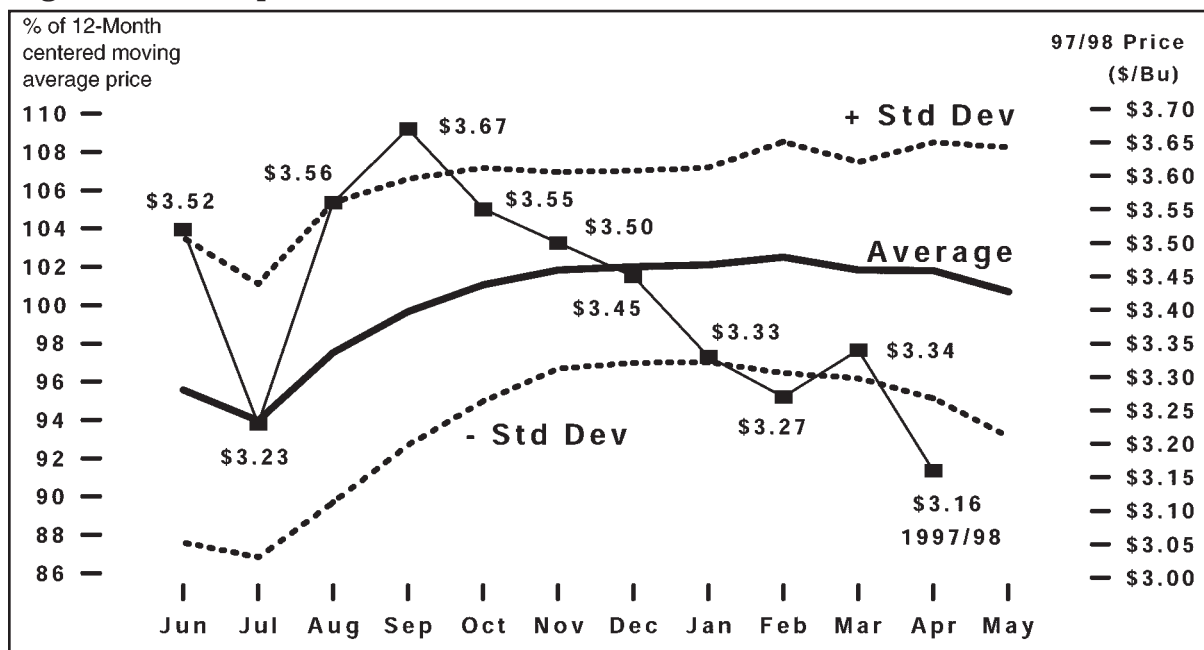
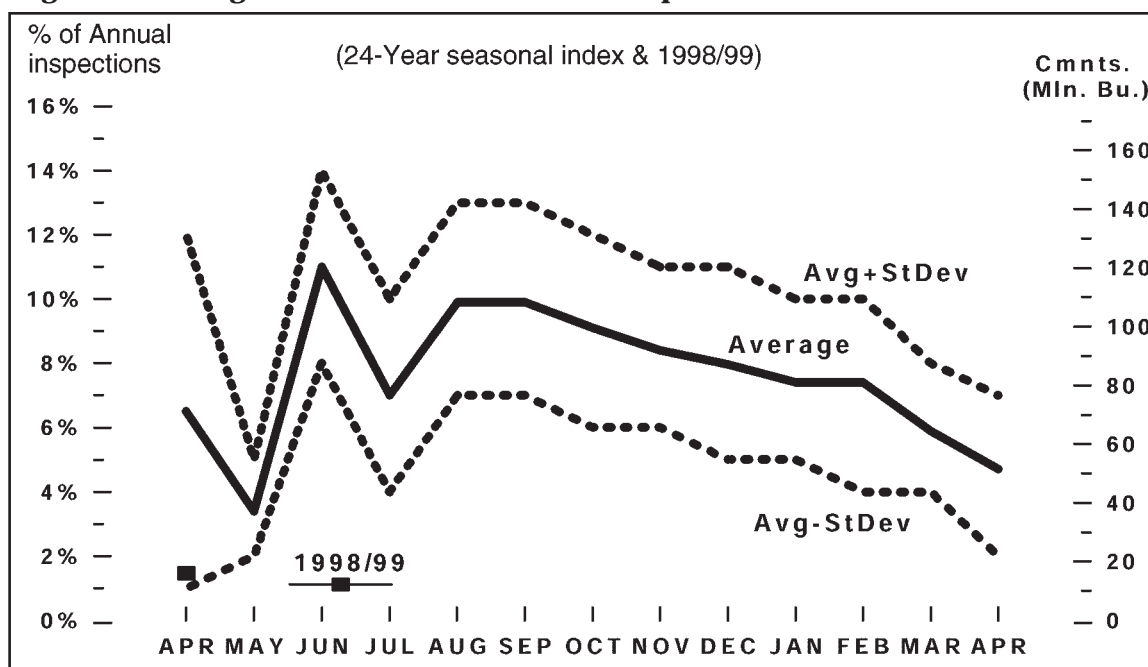


Figure 5. Change in cumulative all wheat export commitments.



Seasonals also can help in analyzing other aspects of crop prices such as basis, intercommodity spreads (corn vs. milo), intramarket spreads, option volatility, etc. While many of the graphs shown in this publication use cash prices, it is important to understand that seasonal indices also can be generated using futures prices. Given the anticipatory nature of futures prices, seasonals for futures prices may be somewhat different than seasonals for cash prices. If you are using futures and options as forward pricing tools, it will be beneficial to investigate their seasonal behavior as well.

Summary

For many of the principal field crops grown in the U.S., seasonality is often the **dominant factor influencing crop prices within a single production period** (usually 12 months). Intra-seasonal variations in supply/demand fundamentals also have an important influence on the pattern that is followed by crop prices (as well as basis, spreads, and options volatility).

Using the appropriate seasonal as a guide, a crop producer should have a better chance to correctly identify both the timing of major market moves as well as absolute price levels. Thus, seasonals can help a producer time pre-harvest sales as well as assess the prospects for profitable post-harvest strategies.

It is unwise, however, to rely exclusively on seasonals when making crop marketing decisions. For one thing, **seasonals are based on past prices and may merely reflect random effects rather than any true predisposition in market performance.** Also, even if seasonal patterns are well founded and appear to be statistically reliable, **seasonal effects can be overwhelmed by changing fundamental (and even technical) factors.**

References

Ferris, John N. "Agricultural Price and Commodity Market Analysis." W.C.B. McGraw-Hill, 1998.

Partial funding support has been provided by the Texas Wheat Producers Board, Texas Corn Producers Board, and the Texas Farm Bureau.

Produced by AgriLife Communications and Marketing, The Texas A&M University System
 Texas AgriLife Extension publications can be found on the Web at: <http://AgriLifebookstore.org>

Educational programs of the Texas AgriLife Extension Service are open to all people without regard to race, color, sex, disability, religion, age, or national origin.