COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF KENTUCKY • COLLEGE OF AGRICULTURE

Dairy Simulation of Put Options

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General Explanation

A put option is a tool that dairy farmers can use to reduce risk. It is basically a form of price insurance. The main benefit of a put option is not to increase your gross income, but to reduce the variability of income. This computer program has been developed to simulate risk management using put options.

This program simulates a year of milk income for a dairy farmer. You have the opportunity to compare what would happen both with and without put options. The program is based on a Monte Carlo process and is thus different each time it is run. The program is based on a year but actually runs longer, because the comparison between no options and using options does not start until the option expires (this is the number of months ahead chosen).

Options are purchased for the first 12 months. Once the first option expires, the simulation program starts recording the mailbox price. For the next 12 months, the program keeps track of the mailbox price received both with and without options. The bottom lines of Columns 1 and 2 of the table of accumulated earnings and monthly earnings (N in Figure 1a) list the total gross revenue when no put options are used (Column 1, Mailbox) and when put options are used (Column 2, Total).
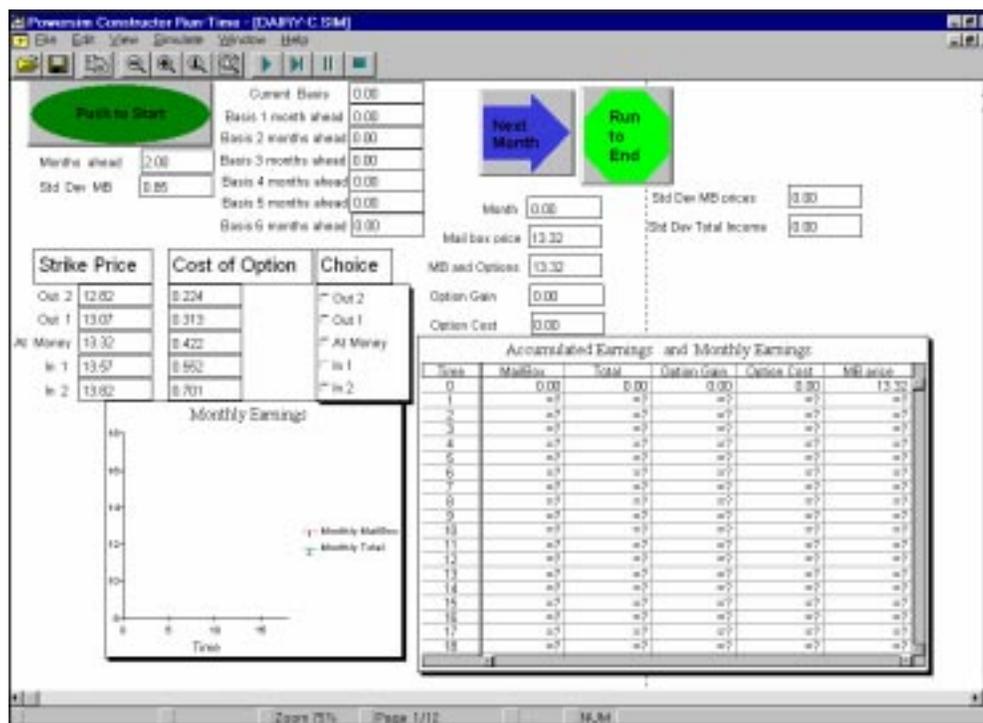
Figure 1. *Start-up screen.*

How to Start

1. Insert CD and then open this drive from Windows.
2. Open the folder called "RunTime."
3. Double click on "Powersim.exe."
4. From the file menu, open the file called "Dairy_C.sim."
5. The screen should look like the illustration in Figure 1 (Start-up screen).

How to Run

1. Click on the button in the upper left-hand corner that says "Push to Start."
2. Choose the number of "Months ahead" to examine. This number must be between 2 and 6.
3. Enter basis information (note: the months ahead to examine and the basis information are entered only at the start of the simulation).
4. Pick one of the put option choices.
5. Click on the right arrow button in the upper right-hand corner of the screen to move the simulation forward one month at a time. At the end of each month, a new option choice can be chosen.
6. Continue clicking on the arrow button to examine the year-long simulation month by month.
   or
   Press the "Run to End" stop-sign button to automatically run the simulation to the end of the year without stopping at each month.

Explanation of Start-Up Screen

This section explains the parts of the simulation. Figure 1a (below) is coded to the explanations listed below:

A. Click on this button to start the simulation.
B. This is how far in advance you want to consider looking at put options. For example, if it is January and you enter a 3, then you are considering put options for April.
C. This controls the variability of the basic formula price (BFP). This simulation is based on two years (1997 and 1998) of historical data. Normally, this standard deviation is not changed, but it can be if the user finds price variability is different than the variability reflected in 1997 to 1998 prices. Entering a larger number in Std Dev MB increases the price variability.
D. Basis information. The current basis is the difference between the mailbox price and the BFP futures price in the same month. This is how basis is normally reported. In this simulation, basis is the difference between the current mailbox price and the current BFP futures price. BFP future prices can be found on the Chicago Mercantile Exchange Web site at <http://www.cme.com/>. The basis for however many months ahead you choose is the difference between the current mailbox price and the BFP futures price

that many months ahead. This information is needed to properly prime the simulation. Keep in mind this basis for months ahead is not the actual basis that is reported in newspapers and magazines. The numbers from the computer simulation are used to indicate if future prices are rising or falling. For example, if the basis three months ahead is smaller than the current basis, then future prices are expected to rise. Only the current basis and the basis for the number of months ahead picked in step B need to be entered.

E. Moves the simulation forward one month at a time.
F. Runs the simulation to the end of the year without pausing at each month.
G. Five put option choices are available. There are two in the money, two out of the money, and one at the money. One of these options must be chosen each month, and the choice can change each month. The strike prices and costs should be fairly realistic, because they are based on the current price and historical data.
H. This lists the current month of the simulation. The simulation runs for one year but does not fully start until the number of months ahead is reached for which the option is chosen. Thus, the game ends at 12 plus the number of months ahead chosen in B.
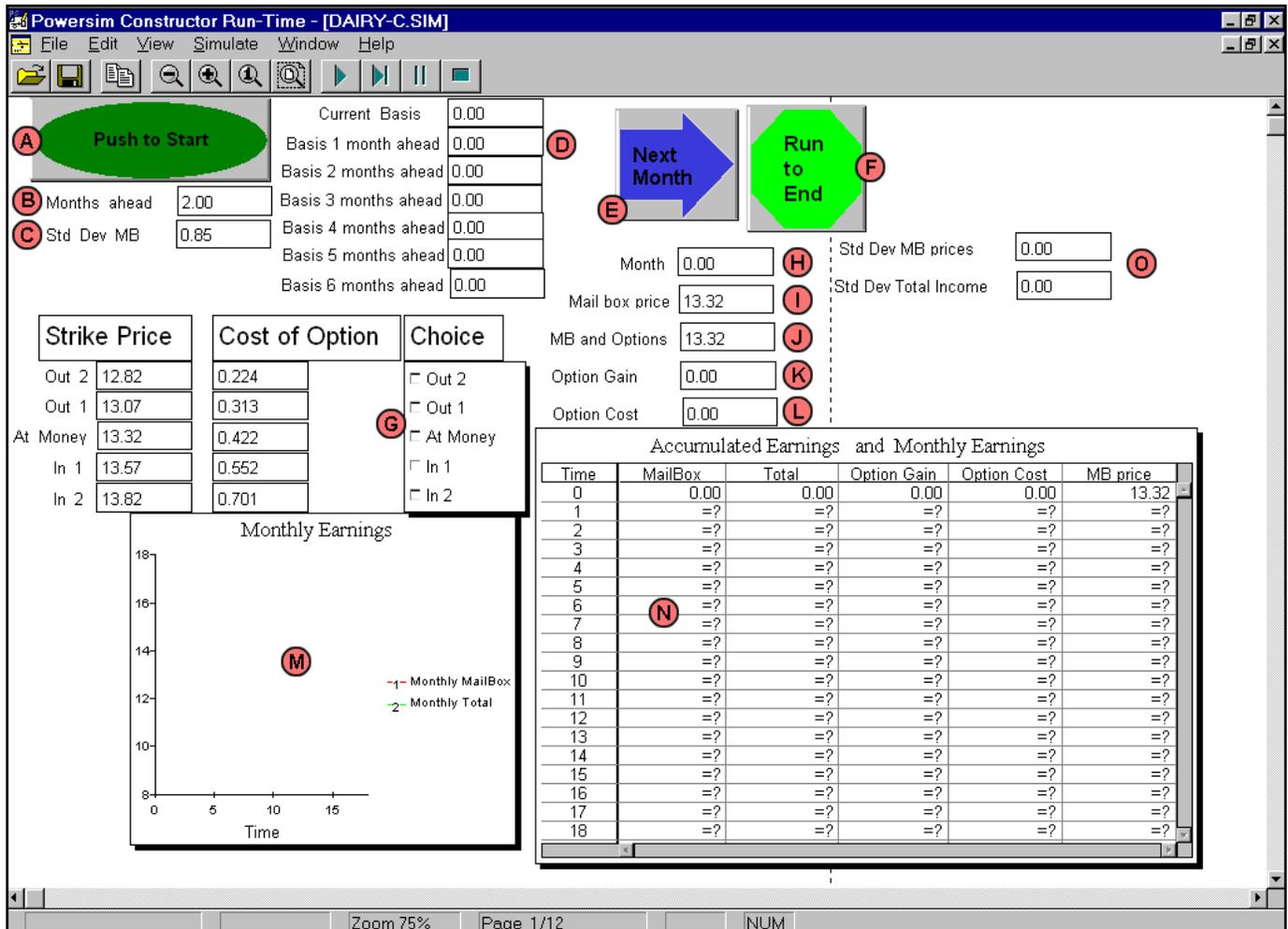
Figure 1a. *Start-up screen (coded).*

I. This is the mailbox price for that month.

J. This is the mailbox price plus or minus any gains or losses from options in that month.

K. This reports if the options paid anything in that month.

L. This is what it costs to buy an option in that month. (Options are purchased for the first 12 months.)

M. This is basically a plot of items I and J. It lists what you would receive each month from your mailbox price and also what you would receive from the mailbox price combined with any option gains and costs from purchasing the options.

N. The first column (Mailbox) is an accumulated, or running, total, of what you would receive without using any put options. The second column (Total) is a running total of what you receive from the mailbox price adding the option gains and subtracting the option purchase costs. The last three columns list what occurs each month. These three columns record the numbers from K (Option Gain), L (Option Cost), and I (Mailbox Price).

O. This lists the standard deviation of returns when options are not used and when options are used. A lower number is better. The put options should help to even out your monthly income.

Explanation of End of Simulation

This section explains the results of the simulation. The following discussion is based on Figure 2, which shows a typical one-year simulation.

The first two columns of the table of accumulated and monthly earnings within the figure list the accumulated earnings when using options and when not using options. The first column (Mailbox) lists the total accumulated mailbox earnings with no options. Because in this example options were purchased two months ahead, the simulation really does not start until Month 3.

Column 2 (Total) represents accumulated earnings when using options. The first two months show only option purchase costs. At Month 3, the simulation starts, and mailbox earnings are added to the option gains and option purchase costs. The $3 gain over the first column (Month 14) indicates this was a good year to use options. Because prices declined for much of the year—as shown in the graph—options were a profitable tool.

The last three columns show what occurs on a month-by-month basis. Notice the delay between any option gains and the option cost. This delay occurs because options were bought for two months ahead.
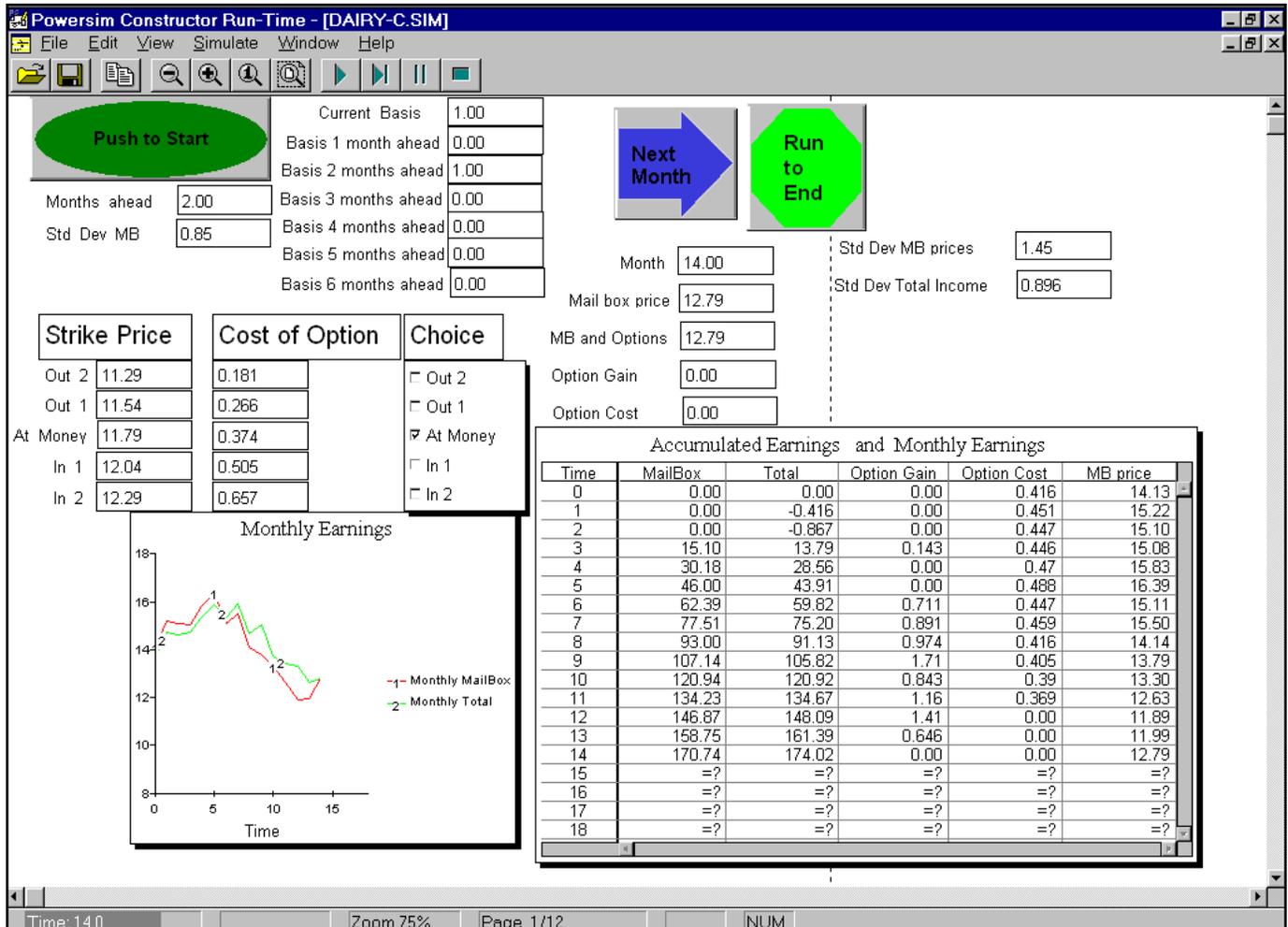
Figure 2. *End of simulation.*
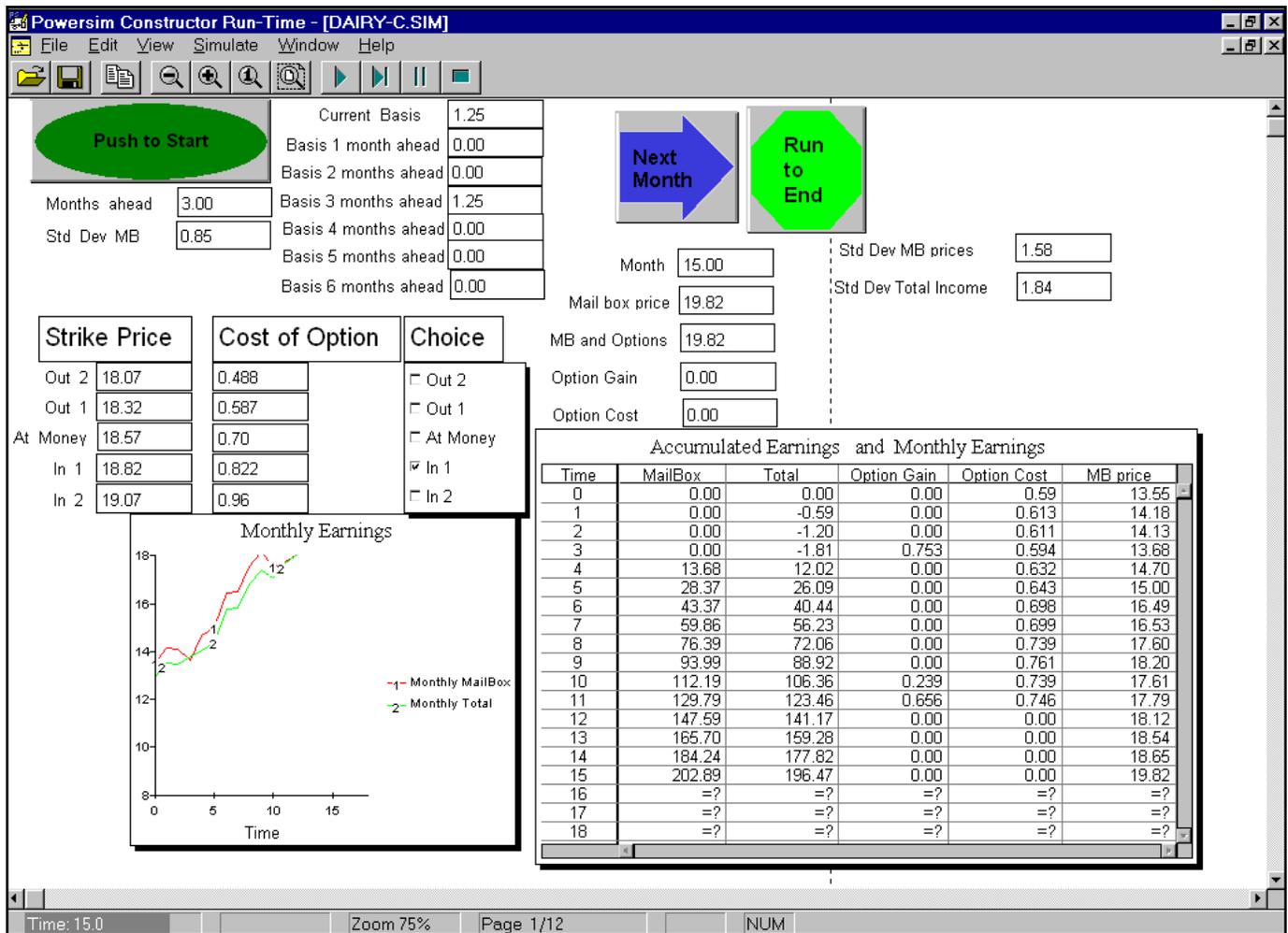
Figure 3. *Another example.*

The standard deviation indicates that variability of income is reduced by using options. The standard deviation of 0.896 when using options is less than the 1.45 value of not using options. While put options do not usually increase income, they should help reduce the variability of income. A reduction in income variability is usually considered a reduction in risk.

Figure 3 shows another run of the simulation. In this particular example, an option in the money and three months ahead is chosen. Notice that in this simulation year, prices are rising, so put options do not work well—the total income when using options is less than when not using options. As Column 3 (Option Gain) shows, using the options only paid off in three months. Even the standard deviation, which is normally the benefit of using options, is higher, indicating greater variability in income. However, this example represents just one year. Multiple runs of this simulation should be used to get a fair idea of how put options will work on your farm.