

Problem Set 2

Due at classtime, Thursday 25 Sep 2003

Problem sets should be your own work. Please hand in listings of any MATLAB programs used to generate the answers to these problems.

1. Consider the asset–replacement–with–maintenance problem presented in demo program demddp03.

a. In comparison to the baseline, determine the threshold cost of servicing which makes it optimal never to service the asset during its life.

To the nearest integer, a threshold cost of 18 prevents servicing from ever being performed.

b. In comparison to the baseline, determine the threshold replacement cost which makes it optimal to replace the asset every year.

To the nearest integer, a replacement cost of 13 would induce replacement every year.

2. Consider the binomial option pricing model presented in demo program demddp04.

a. In comparison to the baseline, show how lengthening the term of the option (T) will affect the option premium, or fair price.

A longer term, holding all else constant, will unambiguously increase the fair price (premium) of any option, since it provides for a longer time horizon in which positive–return events may occur.

b. In comparison to the baseline, show how increasing the volatility of the underlying asset price (σ^2) will affect the option premium, or fair price.

A higher volatility of the underlying asset price will unambiguously increase the fair price (premium) of any option, since it widens the range of likely outcomes, improving the return from in–the–money options while not affecting the zero return from out–of–the–money options.

c. Redo the baseline case for an American call option rather than an American put option, and discuss how the results differ.

The American call will behave symmetrically to the American put; the return diagram and option premium curve are reflected on the x–axis around the strike price. However, it will never be optimal to exercise an American call; one should sell it instead, and capture its time value. This lack of symmetry is caused by the unbounded nature of returns from a call, whereas the corresponding put’s returns are bounded: the asset price cannot fall below zero.

3. Consider the industry entry/exit model presented in sections 8.3.2 and 9.6.2. Run the baseline model (demdp02).

In the baseline model, firms will enter with a profit of 3.70 and exit with a profit of -2.27.

a. What would be the effect of raising the cost of exit from 5 to 25 units? Explain this result, and relate it to legislation that prevents money-losing firms from shutting down, laying off workers, etc.

This much higher cost of exit will make it likely that firms will stay in operation even though they suffer large losses. The critical values are now 3.79 for entry but -9.25 for exit. Government intervention that prevents shutdowns and layoffs will guarantee noneconomic activities will be undertaken.

b. Compared to the critical decision values of the original model, what would be the effect of raising the cost of entry from 10 to 100 units? Explain this result, and relate it to “barriers to entry” that may make it difficult for new contestants to compete with established firms.

This much higher cost of entry will make it unlikely that a firm will enter the industry unless very high profits are forthcoming. The critical values are 9.62 and -2.27 for entry and exit, respectively. Established firms will be able to protect their market share.

c. Compared to the critical decision values of the original model, what would be the effect of setting parameter $\bar{\pi}$ to 2.0? Explain the workings of the autoregressive scheme that governs short-run profit, and discuss how positive long-run profits affect the critical decision prices in the problem.

The higher long-run average profit will cause firms to be much more likely to enter (with a threshold of 1.46) and less likely to exit (with a threshold of -5.37) than in the baseline case. The AR scheme causes long-run profits to be mean-reverting: in this case, to a positive value, so that abnormal profits are being earned on average. This will make participation in the industry very attractive.