

Empirical Methods in Economics

Assignment II

Orville D. Mondal
26th of September, 2018

1. The demand for either product is around 0.4223, when the price of either equals 1, and valuations are both 2.
2. The starting value for this problem was $(P_A, P_B) = (1, 4)$. The process converged in 9 iterations, taking 0.010425 seconds to do so. The equilibrium prices are 1.598942 for either commodity, which is reasonable, given the symmetric nature of the marginal cost and marginal revenue, along with the fact that valuations for both agents are the same.

As to how one actually solves this problem: we need to find a solution to the following system of equations:

$$\frac{1 + \exp(v_A - P_A) + \exp(v_B - P_B)}{1 + \exp(v_j - P_j)} - P_i = 0, \text{ for } i \neq j, i = A, B.$$

The above are just the first order conditions implied by revenue maximisation (with price subtracted, to make the problem compatible with root finding).

3. Gauss-Seidel is, in fact, faster. It converges in 0.0057 seconds, i.e. it is almost twice as fast. However, it takes *many* more iterations: 48, compared to 9. The equilibrium prices are the same as before.

Why Gauss-Seidel results in faster convergence is not very clear to me. In the language of game theory, and Cournot, in particular, though, the method mirrors the process of *rationalisation*. A *rationalisable* strategy is precisely one that survives the sort of iteration which Gauss-Seidel employs¹.

4. This updating rule also leads to convergence, and produces the same output for equilibrium prices. In fact, it takes fewer iterations than Gauss-Sidel (18, in this case, versus 48), although it takes slightly longer (0.0063 versus 0.0057 seconds). It is faster than Broyden (0.01 seconds).
5. As one would expect, equilibrium price paid is rising in one's value for a product, while falling in the valuation for an alternative product. Equal valuations lead to equal equilibrium prices. The figure is on the next page.

¹This observation is due to Joonkyo Hong

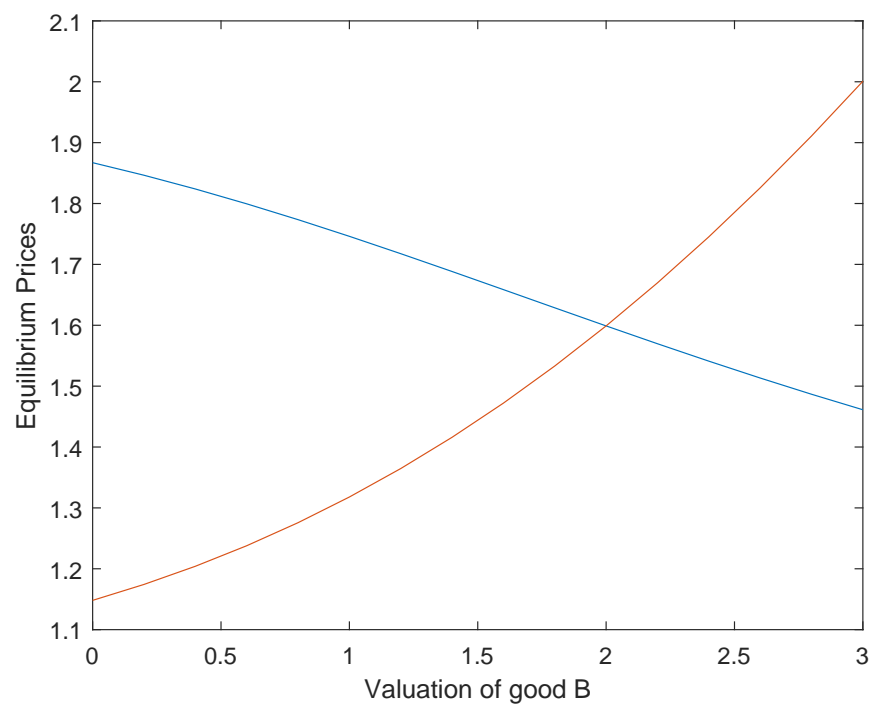


Figure 1: Change in prices, responding to changes in valuation of B. The red line represents P_B , while the blue line represents P_A .