14.03 Fall 2000 Handout on Technology Choice Model

Two players currently use the status quo technology, A. Each can make an irreversible decision to switch to the new technology B, which on average is better than A. However, the benefits of switching to B are greater if the other player also switches to B. Furthermore, each player is uncertain about the other player's preferences for the two technologies.

The payoffs to using each technology are a function of q, the preference parameter, and *n*, the number of players using that technology. The payoff to using technology A is $V_A(q,n) = (1-q)n$, and the payoff to technology B is $V_B(q,n) = 1.5qn$. Note that q, which we will assume is uniformly distributed on [0,1], indexes a player's relative preference for the new technology.

The timing of the game is as follows. In the first period the players decide simultaneously whether to switch. If both players switch or if neither player switches, the game ends. Otherwise, the player that did not switch in the first period gets a second chance to switch.

Each player has three strategies:
1) Never switch
2) Do not switch in the first period, but switch in the second period if the other player switched in the first period ("jump on the bandwagon")
3) Switch in the first period

Since the benefits of switching are increasing in q, we look for a symmetric equilibrium in which each player uses the following strategy: never switch if $q < \bar{q}$, jump on the bandwagon if $q \in [\bar{q}, q^*)$, and switch in the first period if $q \geq q^*$.

To solve for $\bar{q}$, we use the fact that a player with preference parameter $\bar{q}$ is indifferent between never switching and jumping on the bandwagon. If player 1 never switches, then player 2 switches only if she is playing strategy 3, which occurs with probability 1-q^*. Hence player 1's payoff from never switching if her preference parameter is $\bar{q}$ is $q^*V_A(\bar{q},2) + (1-q^*)V_A(\bar{q},1)$. If player 1 jumps on the bandwagon, then player 2 again switches with probability 1-q^*, but in this case player 1 will switch as well. Hence player 1's payoff from jumping on the bandwagon if her preference parameter is $\bar{q}$ is $q^*V_A(\bar{q},2) + (1-q^*)V_B(\bar{q},2)$. The payoffs for the two strategies are equal if $V_A(\bar{q},1) = V_B(\bar{q},2) \Leftrightarrow (1-\bar{q}) = 1.5\bar{q}(2)$, which implies that $\bar{q}$ = ¼.

To solve for q^*, we use the fact that a player with preference parameter q^* is indifferent between jumping on the bandwagon and switching in the first period. We have already derived that for a player with preference parameter q^*, the payoff from jumping on the bandwagon is $q^*V_A(q^*,2) + (1-q^*)V_B(q^*,2)$. If player 1 switches in the first period, then player 2 will switch if she is playing either strategy 2 or strategy 3, which occurs with probability 1-$\bar{q}$ = ¾. Hence for a player with preference parameter q^*, the payoff to switching in the first period is $\frac{1}{4} V_B(q^*,1) + \frac{3}{4} V_B(q^*,2)$. The payoffs for the two strategies are equal if $q^*(1-q^*)2 + (1-q^*)(1.5)q^*(2) = \frac{1}{4}(1.5)q^*(1) + \frac{3}{4}(1.5)q^*(2)$, which implies that q^* = 19/40.

The technology choices of each player as a function of the preference parameters are given in the following table.

	$0 \le q_2 < 1/4$	$1/4 \le q_2 < 19/40$	$19/40 \le q_2 \le 1$
$0 \le q_1 < 1/4$	A,A	A,A	A,B
$1/4 \le q_1 < 19/40$	A,A	A,A	B,B
$19/40 \le q_1 \le 1$	B,A	B,B	B,B

There are two possible types of inefficiency in this model. One is *excess inertia*: both players would be better off if they switched, but instead both stick with the old technology. The players are better off switching if $V_B(q,2) > V_A(q,2) \Leftrightarrow 3q > 2(1-q) \Leftrightarrow q > 2/5$, but if neither player switches in the first period they will end up staying with the old technology. Hence this situation occurs if both players have $q \in$ (2/5,19/40).

The other type of inefficiency is *excess momentum*: one player switches in the first period with the hope the other will jump on the bandwagon, but then ends up being worse off if the other player does not switch as well. This occurs if one player never switches and the other player switches in the first period but has a preference parameter such that $V_B(q,1) < V_A(q,2) \Leftrightarrow 1.5q < (1-q)2 \Leftrightarrow q < 4/7$. Hence this situation occurs if 19/40 $\le q_1 <$ 4/7 and $q_2 <$ ¼.