3. Benchmark: The Myopic Nash Equilibrium

On the absence of a collusion scheme, the participants might become short-sighted: as there is no agreement on what a participant should do, each participant will not internalize the effects of his current actions on the actions taken by the other bidders in the future. Therefore, each participant acts as if to maximize his current period payoff:

$$\max_{b \geq 0} vQ(b) - P(b)$$

Where $Q(b)$ is his probability of winning, given his bid b and $P(b)$ is his expected payment, given his bid. As noted in the last section, v is the participant's current period valuation.

It is easy to check that, by considering (with no loss of generality due to the Revenue Equivalence Theorem from Myerson (1981)) a second price auction: (1) an auction generates expected utility equal to $E[v_N^1]$, that is, the expected highest valuation among N participants; (2) the auctioneer expects to gain a payoff of $E[v_N^2]$; and (3), the participants expect to receive a total payoff of $E[v_N^1] - E[v_N^2]$, all of which will go to the participant with the highest valuation. Thus, considering the symmetry of the problem, each participant has a per-period expected utility of $\frac{E[v_N^1] - E[v_N^2]}{N}$.

Notice that, even though $E[v_N^1] \nearrow v^H$ as $N \to \infty$, that is, the expected payoff generated by the auction increases as the number of participants increases, when $N \to \infty$, $E[v_N^1] - E[v_N^2] \searrow 0$ since $E[v_N^2] \nearrow v^H$ too. That is, the participants receive a decreasing share of this payoff, which gets close to zero as the number of participants increases.