We have shifted the shocks that govern whether agents acquire MAs or licenses in the model from Type 1 Extreme Value shocks to normal (or log normal) shocks. This makes computing continuation values marginally more complicated, so this document explains how this is done.

Here I explain how I calculate continuation values in phase A of a given period. Continuation values are based off of expected utility in phase B, wherein the agent chooses whether or not to get a **license.** The method for computing continuation values in phase D (in anticipation of the agent choosing whether to get their **MA** in the upcoming phase A) is quite similar. The equations here represent continuation values for agents who DO NOT yet have a license, as continuation values for agents that DO already have a license are trivial.

Expression of the Phase-A Continuation Value

Subsume all state variables not related to licensure in the vector Ω. Denote $C_\ell(\Omega)$ as the cost for acquiring a license — absent the utility shocks — for an agent in state Ω. An agent in phase B chooses to acquire a license if

$$\mathbb{E}[V_d(\Omega,1)] - \exp(C_\ell(\Omega)+\varepsilon) \geq \mathbb{E}[V_d(\Omega,0)],$$

where $\varepsilon \sim N(0,1)$ (Quick question: we obviously get a location normalization for the distribution of ε if there's a constant in $C_\ell(\Omega)$. Do we get a location normalization too?). Thus, the agent gets a license if

$$\varepsilon \leq \log\left(\mathbb{E}[V_d(\Omega,1)] - \mathbb{E}[V_d(\Omega,0)]\right) - C_\ell(\Omega) \equiv T,$$

where T represents the threshold governing whether the agent gets a license. Recall that phase B value functions are given simply by expected phase-D utility minus licensure costs, should the agent choose to get a license. In phase A, then, the agent's continuation value EV_A can be given by

$$EV_A = \mathbb{E}[V_d(\Omega,0)] \cdot Pr(\varepsilon \geq T) + \mathbb{E}[V_d(\Omega,1) - \exp(C_\ell(\Omega)+\varepsilon)|\varepsilon \leq T] \cdot Pr(\varepsilon \leq T)$$

$$EV_A = \mathbb{E}[V_d(\Omega,0)] \cdot (1-\Phi(T)) + \mathbb{E}[V_d(\Omega,1)] \cdot \Phi(T) - \exp(C_\ell(\Omega))\mathbb{E}[e^\varepsilon|e^\varepsilon \leq e^T]Pr(e^\varepsilon \leq e^T).$$

The CDF expressions simplify due to ε being distributed standar normal. For the final term, use the fact that with normality, we have

$$\mathbb{E}[e^\varepsilon|e^\varepsilon \leq e^T] \cdot Pr(e^\varepsilon \leq e^T) = e^{0.5\sigma_\varepsilon^2} \cdot \left[\Phi\left(\frac{T-\sigma_\varepsilon^2}{\sigma_\varepsilon}\right)\right].$$

(Note: the above expression was ripped from Chao's 751 notes. Would be good to confirm.) Since we assume that ε is distributed standard normal, the continuation value then reduces to

$$EV_A = \mathbb{E}[V_d(\Omega,0)] \cdot (1-\Phi(T)) + \mathbb{E}[V_d(\Omega,1)] \cdot \Phi(T) - \exp(C_\ell(\Omega))\sqrt{e} \cdot \Phi(T-1).$$