Assignment #3 (Due Oct. 30, 2023)

For Q1 and Q2, handwriting or typing is both acceptable.

Q1. We call the model in Akcigit and Ates (2023 JPE) with $f(m_{ijt}) = 1$ as the *baseline model* (notice that i denotes firm, j denotes industry, and t denotes time; $f(m_{ijt}) = 1$ leads to $q_{ij(t+\Delta t)} = \lambda q_{ijt}$). Solve the following problems with step-by-step derivations:

1. Final good producer's problem (Y_t, Y_{jt}, P_t, P_{jt});
2. Intermediate good producer's production problem (p_{ijt}, z_{ijt}, y_{ijt}, l_{ijt}, mu_{ijt}, π_{ijt}, where mu_{ijt} is the markup);
3. Demand elasticity $\varepsilon_{ijt} \equiv \frac{\partial \ln(y_{ijt})}{\partial \ln(p_{ijt})}$;
4. Suppose intermediate good producers produce *perfectly* substitutable varieties of goods in each industry. Recompute 1 to 3 and explain the difference.

Q2. Based on the *baseline model*, write down the computation algorithm for BGP equilibrium and transition dynamics. Explain the tricks or procedures you use as detailed as possible.

Q3. Numerically solve the BGP equilibrium of *baseline model*. Plot intermediate firms' production and innovation decision rules. In particular, plot the following:

1. How p_{ijt}, z_{ijt}, y_{ijt}, and π_{ijt} vary with m_{ijt}; show the result with $\lambda = 1.1$ and $\lambda = 3.1$;
2. How x_{ijt} varies with m_{ijt}; show the result with $\lambda = 1.1$ and $\lambda = 3.1$;
3. How x_{ijt} varies with m_{ijt}; show the result with $\phi = 0.01$ and $\phi = 0.30$;
4. Suppose there are no entrants in the model economy. How x_{ijt} is affected? Replot 1 to 3 and explain the difference.

Q4. (bonus) Suppose there are no entrants in the model economy. Impose a change in knowledge diffusion δ by 10% from initial to new BGP. Numerically solve the transition dynamics. Explain how the results differ from those in the *baseline model*. You can use parameters in Akcigit and Ates (2013 JPE) to pin down the initial BGP.