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Due: *Apr., 25th 2023*
AECO 701

Short Handout Assignment 1

The assignments this week are meant to review a couple of important concepts for the prelim. They do not need to be turned in, but can hopefully shed some light on a couple sources of confusion. **Thinking about state and choice ariables** Consider the following stylized neoclassical growth model. A representative agent maximizes utility by choosing consumption, c, capital saved, k', and labor supplied, ℓ. They take prices, $r(K, L)$ and $w(K, L)$ as well as the aggregate law of motion for capital, $K' = G(K)$. They face the following problem:

$$V(k; K) = \max_{c,l,k'} u(c, 1 - \ell) + \beta V(k'; K') \text{s.t.} \quad c + k' \leq \quad (1 + r(K, L) - \delta)k + w(K, L)\ell \tag{1}$$

$$\ell \in (0, 1), k_0 \ given. \tag{2}$$

where prices are given by a profit maximizing firm:

$$\Pi = \max_{K,L} F(K, L) - wL - rK \tag{3}$$

The equilibrium in this economy is a recursive competitive equilibrium, where c, ℓ, k' solves the workers problem, prices, w, and r, are determined competitively, aggregation holds, $K = \int k' dF(k)$, $L = \int \ell dF(k)$, and the individual decision rules are consistent with the aggregate laws of motion, i.e., $K' = g(K, K)$, where $g(.)$ is the representative agents decision rule ($k' = g(k, K)$).

a) Why are k and K both state variables? Why are L and ℓ not?

b) The function $K' = g(K, K)$ appears innocuous, but it is actually a fairly strict assumption. Describe in your own words, what it means.

c) Why do we "take prices as given" when using a representative agent (or any model with atomistic agents)?

Now suppose that labor productivity is determined by the human capital, h, of the representative agent. Human capital is an AR1 process that evolves according to the following: $ln(h') = \rho ln(h) + \epsilon_h, \epsilon_h \sim N(0, \sigma_h)$. The firms problem is now

$$\Pi = \max_{K,L} F(k, HL) - rK - wHL \tag{4}$$

d) What are the state variables for the workers problem?