Consider an RBC model where labor market clears one period before the realization of a shock. One interpretation of this assumption is that due to regulation, the amount of hours worked must be specified in advance (for both households and firms) and modifying the pre-specified hours is prohibitively costly. The household's problem is to choose c_t, h_t, i_t to maximize the discounted-sum of utility:

$$\max_{c_t,h_t,i_t} E\sum_{t=0}^{\infty}\beta^t u(c_t, h_{t-1}), \qquad 0<\beta<1$$
$$s.t. \quad c_t + i_t \leq w_{t-1}h_{t-1} + r_t k_{t-1}$$
$$k_t = (1-\delta)k_{t-1} + i_t$$

where we specify

$$u(c_t, h_{t-1}) = \ln c_t - \varphi\frac{h_{t-1}^{1+\eta}}{1+\eta}$$

where φ and η are parameters.

The production function is given by $Y_t = z_t K_{t-1}^{\alpha} H_{t-1}^{1-\alpha}$. The technology shock follows a standard AR(1) process ($\ln z_t = \rho \ln z_{t-1} + \epsilon_t$) and the resource constraint is given by $C_t + I_t = Y_t$.

1. Define the recursive competitive equilibrium, including the household's problem and the firm's problem.

2. State the sequential social planner's problem for this economy. As in the decentralized problem, assume that the social planner is constrained to make a labor decision one period in advance.

3. Derive the equilibrium conditions of this economy.

4. Suppose at the beginning of period $t-1$, a "news" shock hits and agents learn that there is a positive technology shock at the beginning of period t. Characterize intuitively the responses of consumption, hours, and output from period $t-1$.

5. Assume now that the timing of labor market clearing is the same as in the standard model (that is, assume that labor market clears after the realization of a technology shock). Suppose at the beginning of period $t-1$, a "news" shock hits and agents learn that there is a positive technology shock at the beginning of period t. Characterize intuitively the responses of consumption, hours, and output from period $t-1$.