**Economics 501, Macroeconomics I**
**Final Exam**

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**Instructions:** Read the questions carefully, and make sure to show all your work. You have 3 hours. Good luck!

1. [40 points] There is a continuum of workers with unit mass. Each worker has preferences given by

$$E_0 \sum_{t=0}^{\infty} \left( \frac{1}{1+r} \right)^t c_t,$$

where $r > 0$ and $c_t$ is consumption. An unemployed worker receives a wage offer $w$ each period that is a draw from a probability distribution $F(w)$, where $0 \leq w \leq \bar{w}$. When employed, the worker receives $w$ units of consumption goods at the beginning of the period, and then experiences separation with probability $\delta$, where $0 < \delta < 1$. When a worker becomes unemployed, he or she receives an unemployment benefit $b$ for one period only. If an unemployed worker was also unemployed in the previous period, then he or she receives an unemployment benefit of zero. Assume that $b > 0$. [Hint: Note that you need to determine $V_e(w)$, the value of being employed at the wage $w$; $V_u^1$, the value of being unemployed in the first period of unemployment; and $V_u^0$, the value of being unemployed if the worker was unemployed in the previous period.]

   (a) Show that the reservation wage is independent of how long the worker has been unemployed, and explain why.

   (b) Determine how a change in $b$ affects the reservation wage and the steady state unemployment rate, and explain your results.

2. [40 points] There is a representative consumer with preferences given by

$$E_0 \sum_{t=0}^{\infty} \beta^t u(c_t),$$

where $0 < \beta < 1$ and $u(\cdot)$ is a strictly increasing and strictly concave utility function which is twice continuously differentiable and has the property $u'(0) = \infty$. There are two productive units in this economy, and one perfectly divisible share in existence for each productive unit. Let $y_{it}$ denote the output on the $i^{th}$ productive unit in period $t$. Assume that $y_{1t} = \theta_t y$, and $y_{2t} = (1 - \theta_t)y$, where $\theta_t$ is an i.i.d. random variable, the realization of which becomes known at the beginning of period $t$. Let $p_{it}$ denote the price at which a share in productive unit $i$ trades in period $t$.

   (a) Determine competitive equilibrium prices $p_{1t}$ and $p_{2t}$.

   (b) Determine the price $q_t$ of a riskless one-period bond that pays off one unit of the consumption good in period $t + 1$.

(c) Determine the risk premia associated with the shares in productive units 1 and 2, and explain your results.

3. [40 points] Consider the following cash-in-advance economy. There is a representative consumer who has preferences identical to those of the representative consumer in question 2. There is also a representative firm that receives an endowment of $y_t$ units of consumption goods at the beginning of period $t$, where $y_t$ is an i.i.d. random variable, the realization of which is known to the consumer at the beginning of period $t$. At the beginning of period $t$, the consumer has $M_t$ units of money carried over from the previous period, $B_t$ nominal bonds that were acquired in period $t-1$ and which each pay off one unit of money at the beginning of period $t$, and $z_t$ shares in the representative firm. At the beginning of the period, the asset market opens, on which each nominal bond issued in period $t$ exchanges for $S_t$ units of money, and each share in the representative firm trades for $Q_t$ units of money. The consumer also receives a lump-sum transfer from the government, which is $\tau_t$ in units of goods, and $P_t\tau_t$ in units of money, where $P_t$ is the price level. After the the consumer buys nominal bonds and exchanges shares on the asset market, he or she purchases goods from the representative firm with money (i.e. the consumer faces a cash-in-advance constraint). After the consumer purchases goods from the firm, the firm pays all of its revenue in money to the firm's shareholders as a dividend (note that the dividend is paid to the owners of the shares after the asset market is closed - the consumer's total dividend in period $t$ therefore depends on his or her choice of $z_{t+1}$). The government budget constraint is

$$\overline{M}_{t+1} - \overline{M}_t = P_t\tau_t,$$

where $\overline{M}_t$ is the money supply at the beginning of period $t$, before the transfer. Assume that $\overline{M}_{t+1}$ is an i.i.d. random variable that is known at the beginning of period $t$. Note that you do not have to do any scaling of the nominal variables in this problem, as I have specified the problem so that it is stationary.

(a) Determine $P_t$, $Q_t$, and $S_t$, assuming throughout that the cash-in-advance constraint always binds.

(b) How do $P_t$, $Q_t$, and $S_t$ depend on the money supply? Explain your results.