Sample questions for waiver exam Macroeconomics

1 Suppose that the behavior of a given industry can be described by *monopolistic competition*. That is, the demand for the product of an individual firm j at date t is given by

$$y_t(j) = \left(\frac{P_t}{P_t(j)}\right)^{\theta} y_t,$$

where y_t and P_t are the aggregate production and price level of the industry and $y_t(j)$ and $P_t(j)$ are the individual production and price of firm j, and $\theta > 1$. The aggregate price level is given by

$$P_t = \left(\int_0^1 P_t(j)^{1-\theta}\right)^{\frac{1}{1-\theta}}.$$

Furthermore, suppose the technology is uniform and the marginal cost is MC_t for all firm j.
a) Suppose that prices are *flexible*. Show that $P_t(j) = \theta(\theta-1)^{-1}MC_t$. Provide a formula for P_t, as well.
b) Now suppose that prices are *sticky*. In each time period fraction $\frac{1}{N}$ of firms reset their prices and the new prices remain valid for N periods. Show that the if firm j sets its price optimally at date t, then the new price is given by

$$\widetilde{P}_t(j) = \frac{1}{b(\beta,N)} \sum_{T=t}^{t+N-1} \beta^{T-t} \mathrm{E}_t \left[\widetilde{P}_T + \widetilde{mc}_T\right], \tag{1}$$

where β is the discount factor of firm j, $b(\beta,N) = \sum_{T=t}^{t+N-1} \beta^{T-t}$, $mc_T = MC_T/P_T$ is the real marginal cost and the tilde denotes the log deviation of a variable from its steady state. Provide a formula for $\widetilde{P}_t^*$ the average price level of the firms set their prices at t.
c) Explain why we need the assumption of *monopolistic competition*, why *sticky prices* and *perfect competition* are incompatible.
d) Show that the aggregate price index determined by the following expression,

$$\widetilde{P}_t = \frac{1}{N} \sum_{T=t}^{t-N+1} \widetilde{P}_T^*. \tag{2}$$

e) Suppose $N = 2$. By equations (1) and (2) show that

$$\begin{aligned}\tilde{P}_t &= \frac{1}{2(1+\beta)}\left(\widetilde{P}_{t-1} + \beta \mathrm{E}_{t-1}\left[\widetilde{P}_t\right] + \widetilde{P}_t + \beta \mathrm{E}_t\left[\widetilde{P}_{t+1}\right]\right) \\ &+ \frac{1}{2(1+\beta)}\left(\widetilde{mc}_{t-1} + \beta \mathrm{E}_{t-1}\left[\widetilde{mc}_t\right] + \widetilde{mc}_t + \beta \mathrm{E}_t\left[\widetilde{mc}_{t+1}\right]\right).\end{aligned}$$

f) Define the inflation surprise $\epsilon_t \equiv \mathrm{E}_{t-1}\left[\widetilde{P}_t\right] - \widetilde{P}_t = \mathrm{E}_{t-1}\left[\pi_t\right] - \pi_t$ and $x_t = \widetilde{mc}_t + \beta \mathrm{E}_t\left[\widetilde{mc}_{t+1}\right]$. Express the above formula as

$$\pi_t = \beta \mathrm{E}_t\left[\pi_{t+1}\right] + \beta\epsilon_t + \left(x_{t-1} + x_t\right).$$

2 Suppose the behavior of the inflation and the output gap can be described by the New Keynesian Phillips Curve (NKPC),

$$\pi_t = \beta \mathrm{E}_t\left[\pi_{t+1}\right] + \kappa x_t + u_t.$$

Furthermore, the central bank wants to minimize the following quadratic loss function

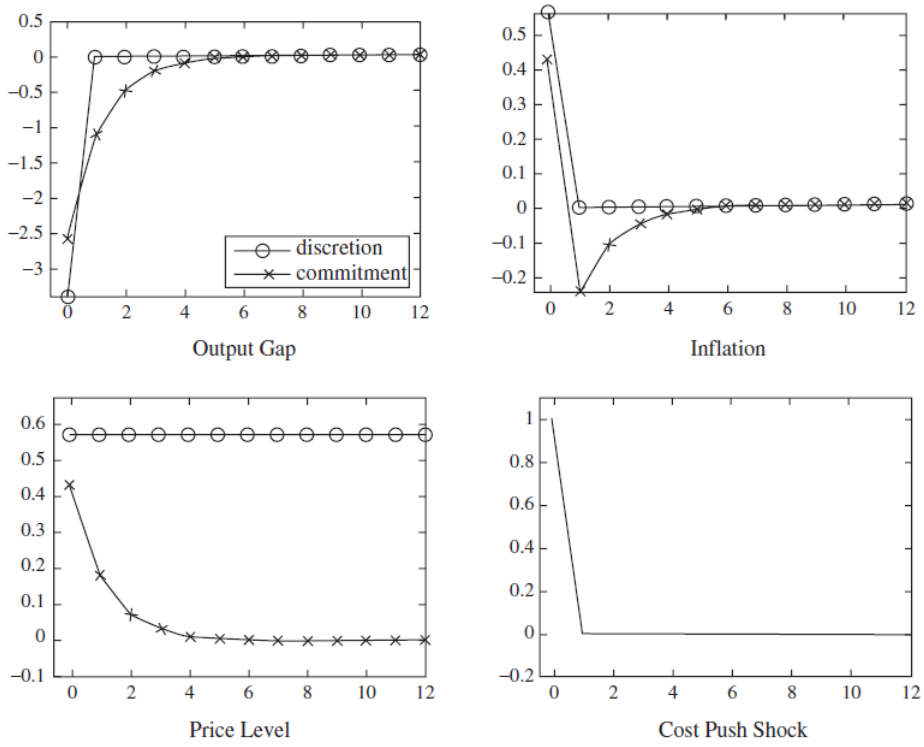
$$\frac{1}{2}\sum_{t=0}^{\infty} \beta^t \mathrm{E}_t\left[\pi_t^2 + \alpha_x x_t^2\right],$$

that is, the steady state of the economy is *not distorted*.
a) Express *formally* the optimization problem belonging to the optimal *discretionary* policy. Explain what the discretionary policy is, why it can be expressed as a sequence of static problems, although the NKPC is a dynamic equation.
b) Show that the solution to the above problem is

$$\pi_t = \alpha_x \Psi u_t, \text{ and } x_t = -\kappa \Psi u_t,$$

where $\Psi = [\kappa^2 + \alpha_x(1 - \beta\rho_u)]^{-1}$ and ρ_u is the autoregressive parameter of cost-push shock u_t.
c) Express *formally* the optimization problem belonging to the optimal *commitment* policy. Explain why it is a dynamic problem. (Do not derive the solution.)
d) Using *Figure 1*, compare the optimal responses of the discretionary and the commitment policies in the presence of a transitory cost push shock. Explain the difference between the two policies. Is the commitment policy time consistent? Why?

Figure 1: Optimal responses to a transitory cost push shock



3 Suppose an investor has equity E. She buys asset A financed by debt D and equity. The purchasing price of the asset is q and the return on the asset is R^A, the interest rate is r, $R = 1 + r$.
a) The net revenue of the investor is $R^A qA - RD$. Show that this can be expressed as

$$\left[R^A(1+\phi) - R\phi\right] E,$$

where $1 + \phi$ is *leverage*.
b) Show the that the *threshold for default* is given by

$$R^d = \frac{\phi}{1+\phi} R.$$

Show that the *probability of default* is increasing in ϕ.
c) Suppose the probability distribution of R^A is such that $R^A \in [R^l, R^u]$, $R > R^l > 0$. Suppose the investor wants to choose the highest possible leverage ($\bar{\phi}$) consistent with *zero probability of default*. Show that

$$\bar{\phi} = \frac{R^l}{R - R^l}.$$

c) Explain how the above result is related to the *financial cycle* and the *credit channel* of monetary policy.

4 What is the liquidity trap? How can a financial crisis induce liquidity trap? Explain why deflation is dangerous. Explain how positive steady state inflation can reduce the probability of occurring a liquidity trap. What are the possible policy responses for a liquidity trap?

5 Explain what the *Ricardian equaivalence* is. If you were a real world policy maker, would you take into account the *Ricardian equivalence* when you design your *fiscal policy*? Why?

6 Consider the production function $Y = AK + BL$, where A and B are positive constants. Assume that population grows at the constant rate of n and that capital depreciates at the constant rate of δ.
a) Is the production function a neoclassical one?
b) Write the production function in intensive form. What is the marginal product of capital per capita? What is the average product of capital per capita?
c) Write down the fundamental capital accumulation equation of the Solow model. Derive the equation for the growth rate of capital per capita.
d) Under what conditions does this model have a steady state solution?
e) When does the model exhibit endogenous growth? Under endogenous growth, how does the growth rate of capital per capita change over time? How about the growth rates of output per capita and consumption per capita?
f) If $s = 0.4$, $A = 1$, $B = 1$, $\delta = 0.08$ and $n = 0.02$, what is the long run growth rate of this economy? What if $B = 5$? Explain the difference.

7 Suppose that the instantaneous utility function is $u(C_t) = C_t - \frac{a}{2}C_t^2$, where $a > 0$ and the interest rate and the discount rate are zero. Suppose, however, that goods are durable. Specifically, suppose $C_t = (1-\delta)C_{t-1} + E_t$, where E_t is purchases in period t and $0 \leq \delta < 1$.
a) Consider a marginal reduction in purchases in period t of dE_t. Find values of dE_{t+1} and dE_{t+2} such that the combined changes in E_t, E_{t+1} and E_{t+2} leave the present value of spending unchanged (so $dE_t + dE_{t+1} + dE_{t+2} = 0$) and leave C_{t+2} unchanged (so $(1-\delta)^2 dE_t + (1-\delta)dE_{t+1} + dE_{t+2} = 0$).
b) What is the effect of the change in part *(a)* on C_t and C_{t+1}? What is the effect on expected utility?
c) What conditions must C_t and $E_t[C_{t+1}]$ satisfy for the change in part *(a)* not to affect expected utility? Does C follow a random walk?
d) Does E follow a random walk? If $\delta = 0$, what is the behavior of E? Explain intuitively.

8 Is the following statement True, False, or Uncertain? Explanation determines grade. The answer should be specific and concise, preferably not exceeding a couple of sentences.
'Consumption behavior features excess sensitivity when examined in *microeconomic* data'

9 Is the following statement True, False, or Uncertain? Explanation determines grade. The answer should be specific and concise, preferably not exceeding a couple of sentences.
'Government bonds are net wealth'