FINAL EXAM

(3) (25 points) Consider an economy characterized by the following equations:

$$\text{Taylor rule}: \quad r_t = \gamma + \alpha(E_t p_{t+1} - p_t) + \theta(E_t y_{t+1} - y_t) + \varepsilon_t \tag{3.1}$$

$$\text{Real vs. nominal rate}: \quad r_t = \rho_t + E_t p_{t+1} - p_t \tag{3.2}$$

$$\text{Savings decision}: \quad \rho_t - \beta = \phi(E_t c_{t+1} - c_t) \tag{3.3}$$

$$\text{Accounting identity}: \quad \omega c_t + (1 - \omega) g_t = y_t \tag{3.4}$$

$$\text{Phillips curve}: \quad p_t = \nu E_t p_{t+1} + \delta(E_t y_{t+1} - \bar{y}) \tag{3.5}$$

(3.6)

In this system r is the nominal interest rate, ρ is the real rate, p is the price level, y is output, c is consumption, g is government spending (taken as exogenous), and ε is an exogenous shock process. Both ε and g may have serial correlation of unknown form, and it is plausible that they might be correlated with each other. The Greek letter parameters are all positive, ν and ω are less than one, and α is greater than one.

(a) Discuss what identification problems might arise in trying to estimate the Taylor rule from data generated by this model. [Hint: You don't need to solve the model to answer this question. Can you generate another equation that has the same form as the Taylor rule (3.1)?]

Linear combinations of the Taylor rule (3.1) and (3.2) would have the same form as the Taylor rule if the real rate were unobservable. However (3.3) (sometimes called the IS equation) implies that so long as c is observable, we have a variable that can stand in for ρ_t. With c and y both observable, and distinct, the two equations would in principle be distinguishable were it not that the problem statement says that g_t and ε_t may be correlated with each other and with their own lags. While it is reasonable that disturbance terms be treated as uncorrelated when they correspond to separate behavioral units, here both g_t and ε_t are shocks to government policy behavior.

Using (3.4) and (3.3) in (3.2), we can arrive at

$$r_t = \beta + \frac{\phi}{\omega}(E_t y_{t+1} - y_t) - \frac{1-\omega}{\omega}\phi(E_t g_{t+1} - g_t) + E_t p_{t+1} - p_t \,.$$

If c_t or g_t is observable, this equation is distinguished from the Taylor rule by its containing *only* $E_t g_{t+1} - g_t$ as an exogenous disturbance. (This is probably unrealistic. It implies that the equation holds without error.) But linear combinations of this equation with the Taylor rule will look just like the

Taylor rule, except for having different coefficients. The linear combinations will contain g_t, but because ε_t is correlated with g_t, this does not distinguish the equations. So there is an identification problem, no matter what methods we try to use to estimate the equation.

(b) Discuss to what extent the identification problems in this model are unusual or instead typical of identification problems in estimating monetary policy behavior.

If g is observable — that is we use data on g — and if we were willing to assume g orthogonal to ε, we could identify the policy equation. No one clearly noted that the question of whether data on g is available was crucial. A great deal more could be said. For example, there is the question of whether the identification questions here are the same ones that Cochrane is discussing in his paper. They are not, really, since Cochrane is considering mainly the situation where all we know about the policy rule is that the interest rate is on the left. We are positing some restrictions on the model, and the question is whether they are enough to achieve identification. But the problem here — that the policy equation is specified to look a lot like the Fisher equation — will be common to most models, and most people noted that.

(4) (8 points) "A government that faces a rational public who understand its policy will, if it can make no commitments about future actions, immediately inflate away or repudiate its existing debt. On the other hand, this will happen just once, while if it *can* make commitments and be believed, it will *repeatedly* inflate away or repudiate its debts." Are there assumptions that make these statements true? Explain.

This was a question based on one particular reading, which was also discussed to some extent in class — the "Fiscal Consequences for Mexico..." paper. Not a single exam got the main point here. It is true that a government that cannot commit will repudiate. Most people explained that point. But a government that can commit, in a model without sticky prices but with distorting taxes, will keep tax rates constant, allowing fiscal shocks to be absorbed in (non-distorting) surprise inflation and deflation that alters the real value of government debt. Especially when outstanding nominal debt is small, shocks may be too big to be financed with surprise inflation. In that case the optimizing government will be pre-committed to repudiate debt and raise taxes to a new, constant level. The key point here is that by committing to use the inflation tax and repudiation only as tools to absorb observable fiscal shocks, the government with commitment can achieve optimally contingent public debt. This is not possible without commitment, because a government without commitment will always default immediately, after which it cannot issue debt.

(5) (8 points) "A central bank that commits to a policy of keeping the money stock constant or growing at a positive constant rate can do so without any worry that initial negative net worth will make its policy infeasible, while if it instead tries to approximate the 'Friedman rule' — deflating so that the nominal interest rate is close to zero — it may need fiscal backing if its initial net worth is negative." Is this assertion correct? Explain..

Some people got this, some didn't. A policy of steady positive money growth can be followed without any worries about net worth, because it involves only printing money and using it to buy bonds. The central bank's balance sheet has no effect on its ability to print money. A policy of negative money growth, needed to implement the Friedman rule, requires contracting the money supply. This requires selling debt in open market operations. If the central bank has negative net worth, and if (as under the Friedman rule) the debt is paying little or no interest, then it will run out of assets to sell as its liabilities shrink.

Several people suggested that fiscal backing matters even if the policy is steady positive money growth. This mistake arose from failing to recognize that a steady-money-growth policy accepts that there may be fluctuations in the inflation rate despite the steady money growth. It is only if the central bank deviates from the steady money growth policy in order to affect the price level or the inflation rate that it might need fiscal backing.

(6) (8 points) Are Shannon-theory rational inattention models observationally equivalent to models in which agents observe data with measurement error? Are there in principle ways to distinguish rational inattention behavior from measurement-error based behavior using aggregate data or experimental data? Explain your answer.

Some people gave a pretty good explanation as to why there is in certain sense an equivalence. No one gave a very good answer as to how the difference could be tested. RI models generally correspond to an equivalent observation-error model, but the RI models make predictions about the nature of the measurement error, connecting it to the objective function and the stochastic process followed by the information variables. So RI models are a restricted subset of measurement error models, and the restrictions are in principle testable.

(7) (1 point) This point is free. You don't have to write anything to get it.