

TAKEHOME EXAM

This exam is to be turned in, either electronically to `sims@princeton.edu` or on paper in the department office, by 9AM Tuesday, 1/20. While on the problem sets you were encouraged to collaborate, on this exam you must work independently and not discuss the exam with anyone before the time it is due. The first question has twice the weight of the second in grading.

(1) FTPL in an old Keynesian disequilibrium model

Suppose representative consumer/workers solve

$$\max_{C,B} \int_0^{\infty} e^{-\beta t} (\log C_t + \log(1 - L_t)) dt \quad \text{subject to} \quad (1)$$

$$C + \frac{\dot{B}}{P} = \frac{W}{P}L + \pi - \tau + \frac{rB}{P}, \quad (2)$$

where C is consumption, L is labor, B is nominal government bonds, P is the price level, W is the nominal wage, π is dividends from the firm, r is the nominal interest rate, and τ is real lump-sum taxes. Time subscripts are omitted in the constraint, but all variables might be time varying, and the constraint holds at all dates.

Note that this is an “old Keynesian” model: the consumer/workers do not see themselves as controlling L . Their labor simply matches demand for labor by firms. But they do see themselves as having the opportunity to shift consumption over time via the bond market.

Firms take their output as determined by the consumers’ choice of C . They therefore simply hire labor to make $C = L^\theta$, where the right hand side is the production function and $\theta \in (0,1)$. They return dividends

$$\pi = L^\theta - \frac{W}{P}L \quad (3)$$

to their owners, the consumers.

We postulate that wages increase or decrease at a rate determined by the gap between the ratio of marginal utility of consumption to the marginal utility of leisure and the real wage. I.e. the change in nominal wages is determined by whether workers feel they are working more or less than is optimal at the current real wage. Similarly, we postulate that prices increase or decrease at a rate determined by the gap between the marginal product and the real wage, so that inflation is determined by whether firms would like more

or less production at the current real wage. Specifically,

$$\frac{\dot{W}}{W} = \alpha \left(\log C - \log(1 - L) - \log \frac{W}{P} \right) \quad (4)$$

$$\frac{\dot{P}}{P} = \delta \left(\log \frac{W}{P} + (1 - \theta) \log L - \log \theta \right), \quad (5)$$

where α and δ are positive constants.

The government budget constraint is

$$\frac{\dot{B}}{P} = \frac{rB}{P} - \tau. \quad (6)$$

We will consider only the case where the government sets both τ and r to be positive constants.

In this kind of model it is assumed that P and W have continuous paths, even at time zero, i.e. that they cannot “jump”. C and L , on the other hand, are assumed to be able to jump at time 0. B also cannot jump, just as usual in FTPL models.

Assume we can rule out explosive time paths for any of the variables, including prices. If FTPL reasoning is to work here, it must be that C can move in response to the levels of τ and r set at time zero so as to guarantee intertemporal budget balance.

Determine whether there is a stable equilibrium with determinate C , L , P and W paths and whether it is unique. The system is somewhat nonlinear, so you can linearize it around a steady state for purposes of this analysis. If for some (or all) parameter values it has no equilibrium, explain why and suggest what aspects of the model or the policy rule need to be changed to allow equilibrium to exist. If it does have an equilibrium, see if you can characterize, at least qualitatively, what the effect would be of a permanent, unanticipated, reduction in τ , with r held fixed.

Note that for a system of the form

$$\dot{y} = Ay, \quad (7)$$

the system has stable time paths if all the eigenvalues of A are real and negative or complex with negative real parts. You might first consider the system formed by the social resource constraint (not shown explicitly above), the consumer’s FOC w.r.t. B , and the two equations for wage and price growth, which can be reduced to a 3×3 system, then consider the consequences of adding the government budget constraint to the system.

(2) Essay question on DSGE’s and the crisis

Did the DSGE econometric models work pretty well in the crisis, correctly interpreting the crisis as a sequence of big random disturbances feeding through a stable structure? Would they have done better if they had incorporated

the types of financial frictions that some economists had already proposed including before the crisis? In what sense, if any, would they have “done better”? Support your arguments by citing results from the literature.