LECTURE 5

1 What is the use of the Ramsey model?

- The Ramsey model is one of the workhorses of modern macroeconomics. Useful to answer long-run questions in which:

  - money plays no role (money has no real effect in the model);
  - distributional issues are not relevant (agents are identical in the model);
  - expectations and dynamics are important (e.g. announcement effects, shocks which are perceived to be temporary).

- Implications of the model to keep in mind:

  - Prices: (1) **interest rate** constant in the long run and dependent on: subjective discount, degree of risk aversion and rate of productivity growth; (2) **wages** grow at same rate as technological progress.
  - Quantities: The economy is dynamically efficiency ($k^* < k_{GR}$). Furthermore, the market equilibrium is Pareto optimal (1st welfare theorem.)

2 Adding the government in the Ramsey model.

2.1 Balanced budget

- Wasteful government expenditure G_t in efficiency units of labour.

- Financed through taxes: $T_t = G_t$.

- Consumers dynamic budget constraint becomes

$$\dot{b}_t - (r_t - n - g)b_t = w_t - G_t - c_t. \tag{1}$$

  and intertemporal one is

$$\int_0^\infty c_t e^{-R_t + (n+g)t} dt \le b_0 + \int_0^\infty (w_t - G_t) e^{-R_t + (n+g)t} dt. \tag{2}$$

- In equilibrium the dynamic budget constraint is

$$\dot{k}_t = f(k_t) - G_t - c_t - (\delta + n + g)k_t. \tag{3}$$

- Permanent changes. No affect on output. Consumption falls one-to-one. National saving is unaffected. Lifetime wealth falls permanently, so nothing to smooth.

- Temporary changes. Eventually lifetime wealth will be higher again. People want to smooth consumption and would like to borrow (eat capital). To convince them not to do so the interest rate has to increase for consumption tilting to offset the desire to smooth consumption.

- Barro's tests. Significant positive correlation between temporary deviations of expenditure from trend and real interest rates with UK data. But negative correlation with US data.

2.2 Deficit financing

Now the government can borrow at the market rate (same as private agents). So it is not necessarily $T_t = G_t$.

With an outside agent willing to borrow/lend agents have one additional asset: government debt b_t^g (measured in efficiency units of labour). Agents can now borrow/lend in the aggregate as long as the government is willing to lend/borrow.

- As private agents the government faces a dynamic constraint

$$\dot{b}_t^g - (r_t - n - g)b_t^g = G_t - T_t. \tag{4}$$

- The government also faces a No-Ponzi-game (solvency) constraint

$$\lim_{t \to \infty} -b_t e^{-(R_t - n - g)t} \geq 0. \tag{5}$$

- We assume the government satisfies its solvency constraint with equality. Otherwise its wealth would be increasing without bound which does not seem realistic. Present value of expenditure and current debt fully pins

down PDV of taxes.

$$\int_0^\infty T_t e^{-R_t + (n+g)t} dt = b_0^g + \int_0^\infty G_t e^{-R_t + (n+g)t} dt. \tag{6}$$

- If taxes are cut down today they must go up by the same present value amount at some future time.

- Now total wealth equals capital plus government bonds.

$$b_t = k_t + b_t^g \tag{7}$$

- Replacing in the consumer intertemporal budget constrain

$$\int_0^\infty c_t e^{-R_t + (n+g)t} dt \leq b_0 + \int_0^\infty (w_t - T_t) e^{-R_t + (n+g)t} dt. \tag{8}$$

we obtain again

$$\int_0^\infty c_t e^{-R_t + (n+g)t} dt \leq k_0 + \int_0^\infty (w_t - G_t) e^{-R_t + (n+g)t} dt. \tag{9}$$

- Only the PDV of expenditure is left. So if the government finances it by borrowing or taxes it does not matter (Ricardian equivalence). Government

bonds do not constitute net wealth. At odds with standard Keynesian models, where bond finance government expenditure is more expansionary than taxes.

Caveats:

1. New entries into the economy. Unaffected if parents care about their children and leave positive bequests. Even for people without kids taxes may be expected to go up within their lifetimes.

2. Borrowing constraints.

3. Non lump sum taxes in a production economy.