Econ 504, part II
Spring 2001
RBC Models and the Facts*

How Much of the Business Cycle Seems to be "Real"?

- Calibration claims
  - Historically, the Kydland-Prescott claim that the order of magnitude of observed macroeconomic fluctuations and the relative variances of consumption and investment could be reproduced in an RBC model were impressive. The result fit the assumptions neither of the Keynesians nor of the monetarists, which at the time was seen as an partition of the space macroeconomists.
  - There was no attempt to match detailed serial correlation properties of the data.
  - Certain aspects of the data were clearly not matched well:
    * the behavior of labor hours and productivity
    * the relationship between lagged interest rates and current output
  - There have been many efforts since to patch the model up. Gary Hansen's lumpy labor supply; Eichenbaum and Christiano's government expenditure shocks; home production models; etc.
  - Contrary to King-Rebelo, there have been quite a few previous efforts to correct the interest rate implications, and with adjustment costs on K, plus stickiness, these can be matched. The claim that no efforts of this kind have produced as "reliable a model as the RBC workhorse" is at least exaggerated. The "workhorse" is well documented to be *un*reliable, and there are examples of DSGE (dynamic, stochastic general equilibrium) models with stickiness that match sample moments as well as the "workhorse" model. (Jinill Kim, "Constructing and Estimating a Realistic Optimizing Model of Monetary Policy", *JME*, April 2000, for example.)

- Watson *JPE*. Represent the data y as $y = x + u$, where x is model simulation output and u is "error". We can observe the autocovariance properties of y from the data. We can calculate the autocovariance properties of x by model simulation. "Estimate" u by minimizing $\mathrm{Var}(u)$ subject to $y = x + u$ and the known autocovariance properties of x and y. The result implies u and hence also x are exact linear functions of y. See the plots in the paper. The fit is quite bad. Most of the variation of output in US postwar recessions is attributed to the error term. Many (though not all) of the recessions are not accompanied by any negative growth in the x component.
- Structural VAR monetary policy literature: As an implicit critique/support of RBC models.
  - These models all work off the observation (which does not depend on identifying assumptions) that surprise increases in the nominal interest rate are followed, with a delay of 6 to 24 months, by a decline in output. This, as King and Rebelo point out, has not been reproduced by standard RBC models, even with money added. (It is reproduced, though, by the Kim sticky price paper cited above.)
  - These models almost all agree that the proportion of business cycle variation accounted for by monetary policy disturbances is modest, with most estimates around 10-30%. This leaves plenty of room for real business cycle mechanisms to operate.
  - These models also all agree that most variation in monetary policy instruments, like the Federal Funds Rate, are accounted for by systematic reactions of monetary policy to disturbances that originate elsewhere in the economy, and that these same non-policy disturbances account for much of the business cycle. It is an open question whether, as RBC theory would suggest, the reactions of monetary policy to real disturbances play no important role in propagating them.
- Blanchard-Quah.
  - Rests on treating Aggregate Supply and Aggregate Demand as distinct and statistically independent sources of stochastic variation.
  - Microeconomic supply and demand, where supply is affected by weather, behavior of a distinct class of producing agents, demand is affected by shifts in consumer tastes, are plausibly treated as statistically independent, at least as a working hypothesis.
  - "Aggregate demand" depends on investment behavior, which surely is

influenced by the same technology shocks that enter the marginal product of labor curve, and thus into aggregate supply. In this sense aggregate demand and supply are not as clearly distinct, as sources of variation, as are microeconomic demand and supply.

– So the B-Q finding that aggregate demand plays a very substantial role in generating fluctuations has not been treated by RBC modelers as a problem for their approach.

Why Capital Taxes Are Different

- Static analysis suggests that deadweight loss from taxation at rate τ is $0(\tau^2)$ — that is, that for small tax rates the ratio of deadweight loss to revenue is arbitrarily small.
- Consider a labor tax. Its effects on work, L, are $0(\tau)$. The equilibrium condition is $(1-\tau)f'(L) = -D_L U / D_C U$. But since the distortion involves trading C for leisure, and in the neighborhood of $\tau = 0$ the leisure gained is of the same utility as the consumption lost, the effects on welfare are small. There is of course a loss due to the C that gets appropriated for G, unless the government is optimizing so that G has utility that compensates for the decline in C. But the *additional* loss due to use of labor rather than lump-sum taxes is second-order.
- Consider the steady-state effects of a tax on capital income. The equilibrium condition is $(1-\tau)D_k f(K,L) = \beta^{-1} + \delta - 1$. ($\delta$ is the depreciation rate.) The tax decreases the steady-state capital-labor ratio and thereby also lowers the equilibrium wage and equilibrium L. The decline in C due to the decline in L is a second-order effect, but the decline that comes about because of the K/L decrease is not. In other words, steady-state C declines by more than can be compensated by the increase in steady-state leisure. This means steady-state U declines by more than is necessary to allow for the government spending, and the effect is first-order.
- But, a one-time, surprise capital levy is completely non-distorting.
- A temporary capital tax has the same $0(\tau^2)$ deadweight loss behavior as a labor tax.
- A permanent capital tax has the same $0(\tau^2)$ deadweight loss behavior as a labor tax, when this is measured in terms of discounted utility. The long run

decline in utility from lower consumption in the future is, in the neighborhood of $\tau = 0$, exactly compensated for by the temporary rise in utility as dissaving allows temporarily higher consumption.

The nature of a optimal taxes

Capital tax τ

- Optimal τ is zero in the long run.
- It is as high as you like right now.
- This raises problems of time consistency.
- There is no steady state with fixed optimal $\tau \neq 0$.
- Optimality of socialism?

Labor tax ψ

- There is a steady state with $\tau \equiv 0$ and fixed $\psi \neq 0$ — one for each B.

Why the difference? The effects of "compounding". A constant proportional capital tax changes the relative prices of current and future consumption. The effect is small in the current period, and over any finite number of future periods. But no matter how small τ is, $(1 - \tau)^n$ eventually (for large enough n) is closer to zero than to one. So the distortion in the relative prices of present and future consumption is large for the distant future, even when τ is small. With discounted utility, this doesn't matter because the big distortions are also heavily discounted.