Real Business Cycle (RBC) Theory
ECON 30020: Intermediate Macroeconomics

Prof. Eric Sims

University of Notre Dame

Spring 2018

Readings

- GLS Ch. 17
- GLS Ch. 19

The Neoclassical Model and RBC Theory

- ▶ Real business cycle (RBC) theorists take the neoclassical model not just as an adequate description of an economy over the medium run (several years to a decade) but as a good description of the economy in the *short run*
- ▶ Implications of RBC theory:
    1. Money is neutral
    2. Supply shocks (in particular, productivity shocks) drive everything
    3. No role for activist stabilization policies – equilibrium is (approximately) efficient
- ▶ Question: do we want to take these implications seriously?
- ▶ Need to know whether model can fit the data

Measuring the Business Cycle

- ▶ We think of "the business cycle" as being measured by movements in real GDP (Y_t in the model) about some longer run trend

- ▶ Lots of statistical/econometric debates about how exactly to measure the trend and therefore how to extract the cyclical component

- ▶ But basically:

$$\ln Y_t = \ln Y_t^\tau + \ln Y_t^c$$

- ▶ The business cycle refers to how $\ln Y_t^c$ (the cyclical/detrended component) moves around

- ▶ Periods of recession are periods in which this goes negative (i.e. output is below trend)

Cyclical/Detrended Component of GDP

HP Filtered Component of Real GDP
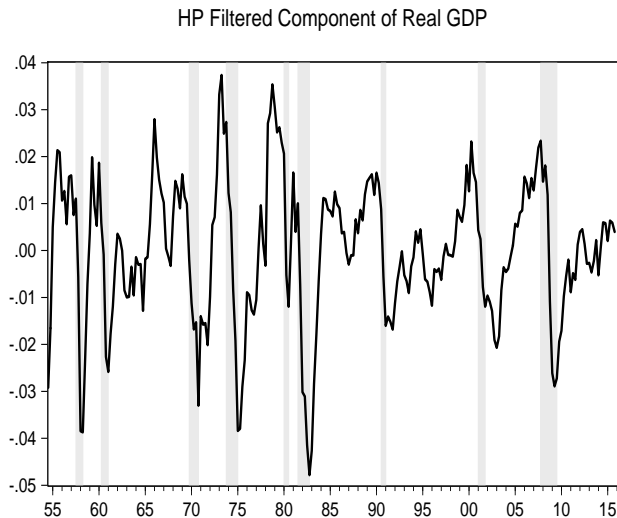
The Business Cycle in the Neoclassical Model

- ▶ In our version of the neoclassical model, output only reacts to *supply shocks* (i.e. changes in A_t or θ_t)
- ▶ *Demand shocks* don't do anything to output; even in version of model where Y^s is non-vertical they won't do much
- ▶ Questions:
    1. How do other endogenous variables (e.g. C_t, r_t) co-move with output over the business cycle?
    2. Can model relying on exogenous changes in A_t or θ_t reproduce these co-movements?
    3. Is there any good evidence of changes in A_t or θ_t corresponding to observed changes in Y_t in the data?

Co-movements Over the Cycle

- Generally speaking, quantities (C_t, I_t, N_t) are *very* procycical (positively correlated with output)
- Real wage is *mildly* procyclical
- Real interest rate is *acyclical* (uncorrelated with output)
- Price level is *countercyclical* (negatively correlated with output)

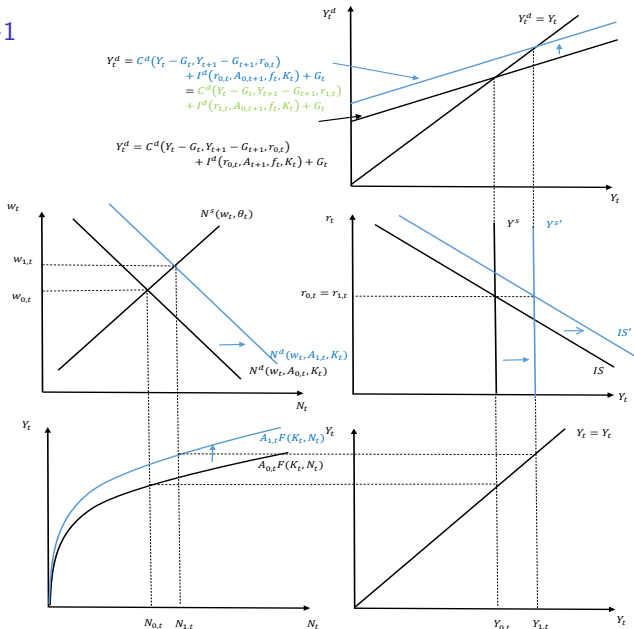| Variable	Corr w/ Y_t in Data	Corr conditional on A_t	Corr conditional on θ_t
C_t	0.88	+	+
I_t	0.91	+	+
N_t	0.87	+	+
w_t	0.20	+	-
r_t	0.10	-	-
P_t	-0.46	-	-

Co-Movements in the Model

- θ_t produces a conditionally *countercyclical* real wage in the model – inconsistent with the data

- Observed cyclicality of real wage in data probably understates true cyclicality due to *composition bias* (Solon, Barsky, and Parker 1994)

- Fluctuations in A_t get all correlations right except perhaps r_t

- This is relatively easy to fix – consider *persistent* changes in A_t (i.e. both A_t and A_{t+1} simultaneously go up)

Persistent Productivity Shock
$\uparrow A_t, A_{t+1}$

$Y_t^d = C^d(Y_t - G_t, Y_{t+1} - G_{t+1}, r_{0,t})$
$\qquad + I^d(r_{0,t}, A_{0,t+1}, f_t, K_t) + G_t$
$\qquad = C^d(Y_t - G_t, Y_{t+1} - G_{t+1}, r_{1,t})$
$\qquad + I^d(r_{1,t}, A_{0,t+1}, f_t, K_t) + G_t$

$Y_t^d = C^d(Y_t - G_t, Y_{t+1} - G_{t+1}, r_{0,t})$
$\qquad + I^d(r_{0,t}, A_{t+1}, f_t, K_t) + G_t$

Is There Evidence A_t Moves Around in Data in Same Way as Y_t?

- ▶ Neoclassical model can do decent job matching empirical facts if it is driven by changes in A_t
- ▶ Is there evidence of large changes in A_t coinciding with observed changes in Y_t in *short run*?
  - ▸ We already know from our study of the Solow model that differences in measured A_t seem to account for cross-country differences in Y_t
- ▶ As in Solow model, measure total factor productivity (TFP) by assuming Cobb-Douglas production function:

$$\ln TFP_t = \ln Y_t - \alpha \ln K_t - (1 - \alpha) \ln N_t$$

- ▶ TFP is a the "residual" in output that cannot be explained by observed capital and labor
- ▶ Correlation of cyclical components of TFP and GDP in data is high – 0.78

Cyclical/Detrended Components of TFP and GDP
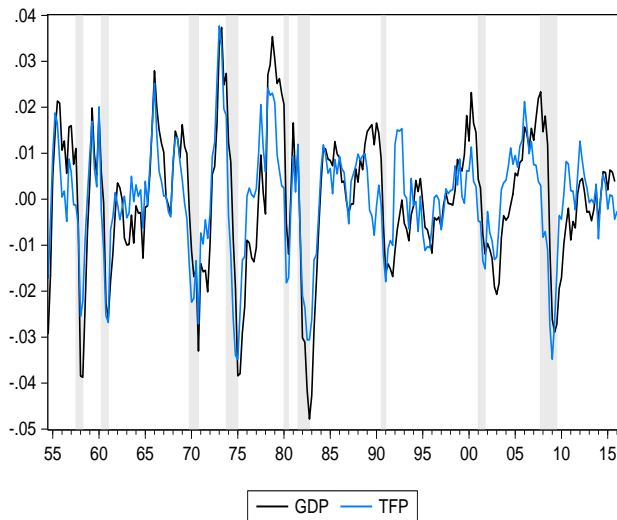
Normative Implications of RBC Theory

- ▶ Neoclassical model *can* produce movements in endogenous variables which share similarity with what we observe in data
- ▶ There *is* some evidence that A_t moves around in a way consistent with what the model needs to match the data
- ▶ This might mean we want to take the model seriously in drawing policy implications
- ▶ Main implication: equilibrium of model is (approximately) *efficient* (GLS Ch. 14)
- ▶ Efficiency: you cannot change the equilibrium allocations (i.e. quantities like C_t and N_t) in order to improve welfare (lifetime utility) of representative household
- ▶ Recessions are *efficient* responses to exogenously lower productivity
- ▶ *No justification* for activist policies (monetary or fiscal) to try to combat recessions

Do We Really Buy This?

▶ Potential criticisms of RBC theory:
1. What exactly are these productivity shocks? Why don't we read about them in the newspaper (Larry Summers quote)?
2. To generate realistic movements in Y_t, model needs to rely on very elastic labor supply (i.e. labor supply curve flat) which seems at odds with micro data
3. Other demand shocks don't matter – money is neutral, and credit spread shocks don't affect output. Does this seem right?
4. Is what we're measuring as TFP really measuring exogenous productivity in the model or something else?

# Credit Spreads (empirical measure of f_t) are Counteryclical
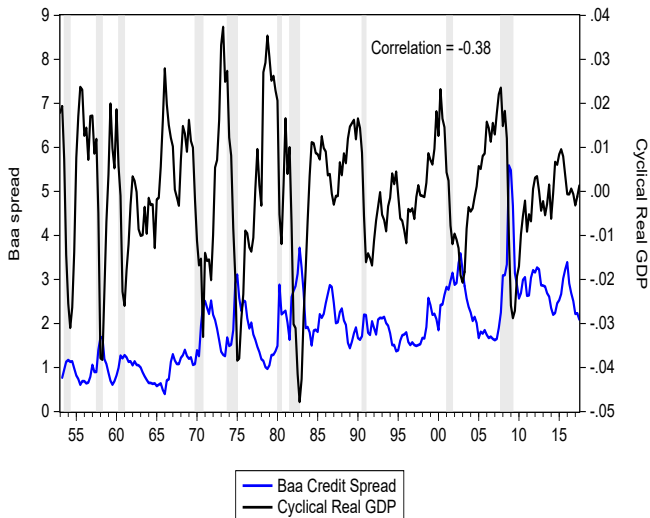
Is TFP Appropriately Measured?

- Suppose that the true production function is:

$$Y_t = A_t(u_t K_t)^\alpha N_t^{1-\alpha}$$

- u_t: capital utilization. Can't adjust K_t in short run, but can adjust u_t (i.e. how hard you work your capital)
- But TFP as typically measured isn't accounting for this – not going to measure just A_t
- Demand shocks could be causing u_t to move, making it look like A_t is moving with Y_t even if it really isn't
- Basu, Fernald, and Kimball (2006): construct a "utilization-adjusted" measure of TFP and it is acyclical

Utilization-Adjusted TFP is Acyclical

GDP — Adjusted TFP
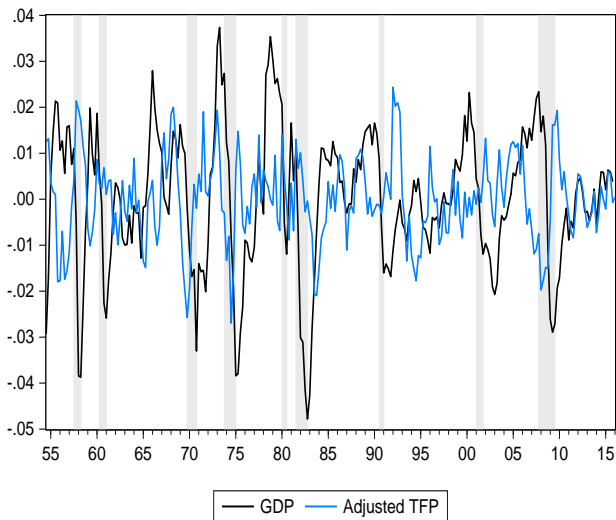
Concluding Thoughts

- ▶ Each of these criticisms (and others) have merit
- ▶ Today, few economists really believe that short run fluctuations are efficient responses to changes in productivity
- ▶ Neoclassical model is a useful benchmark, particularly for the "medium run"
- ▶ But to think about short run business cycles and policy, need to modify the framework to allow for demand shocks to matter, money to be non-neutral, and equilibrium to be inefficient
- ▶ We do so next when we study the *New Keynesian Model*