# Real Business Cycle (RBC) Theory

## ECON 30020: Intermediate Macroeconomics

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# Readings

GLS Ch. 20

GLS Ch. 22

# The Neoclassical Model and RBC Theory

Real business cycle (RBC) theory takes 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

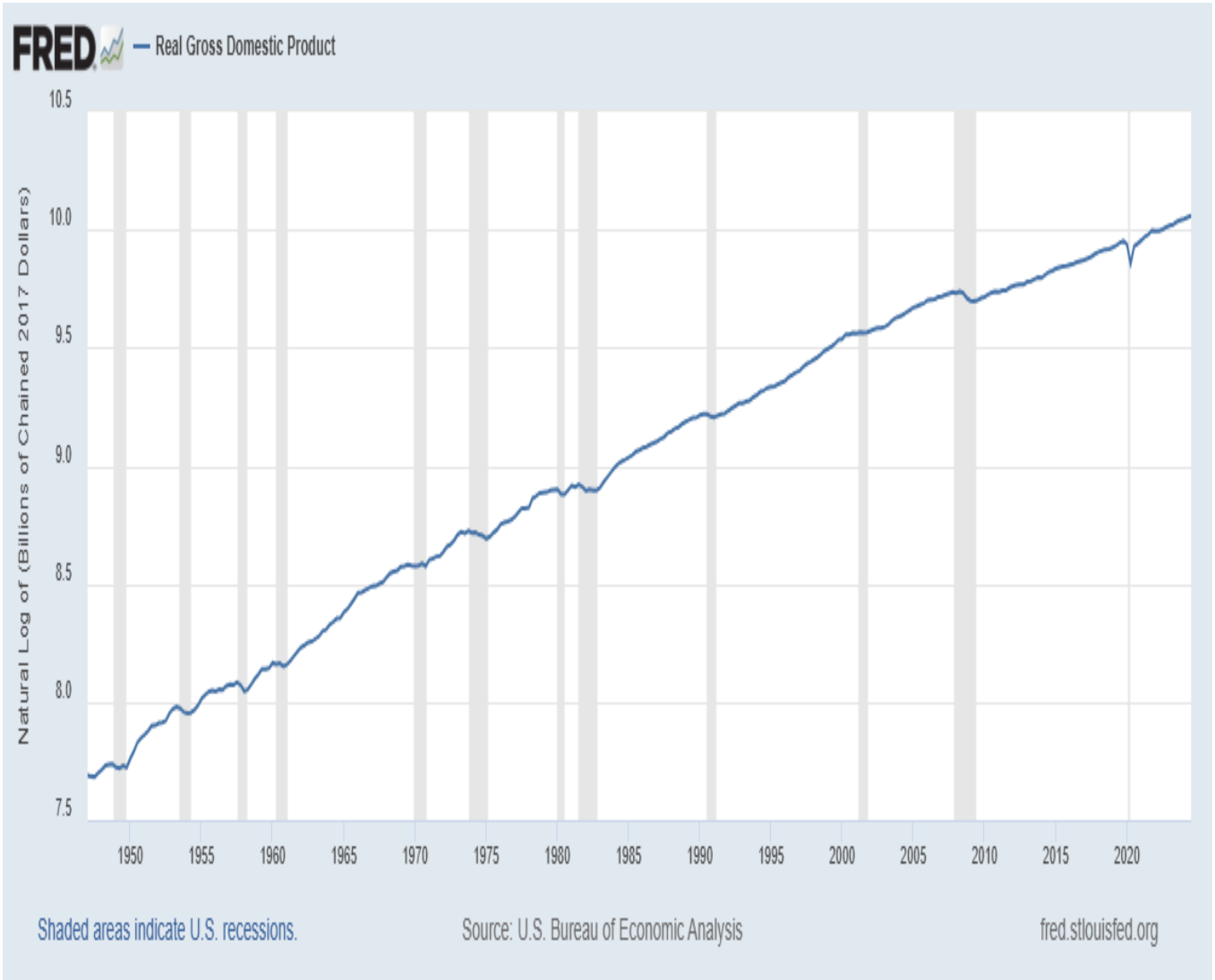
Lots of statistical/econometric debates about how exactly to measure the trend and therefore how to extract the cyclical component, but basically:

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

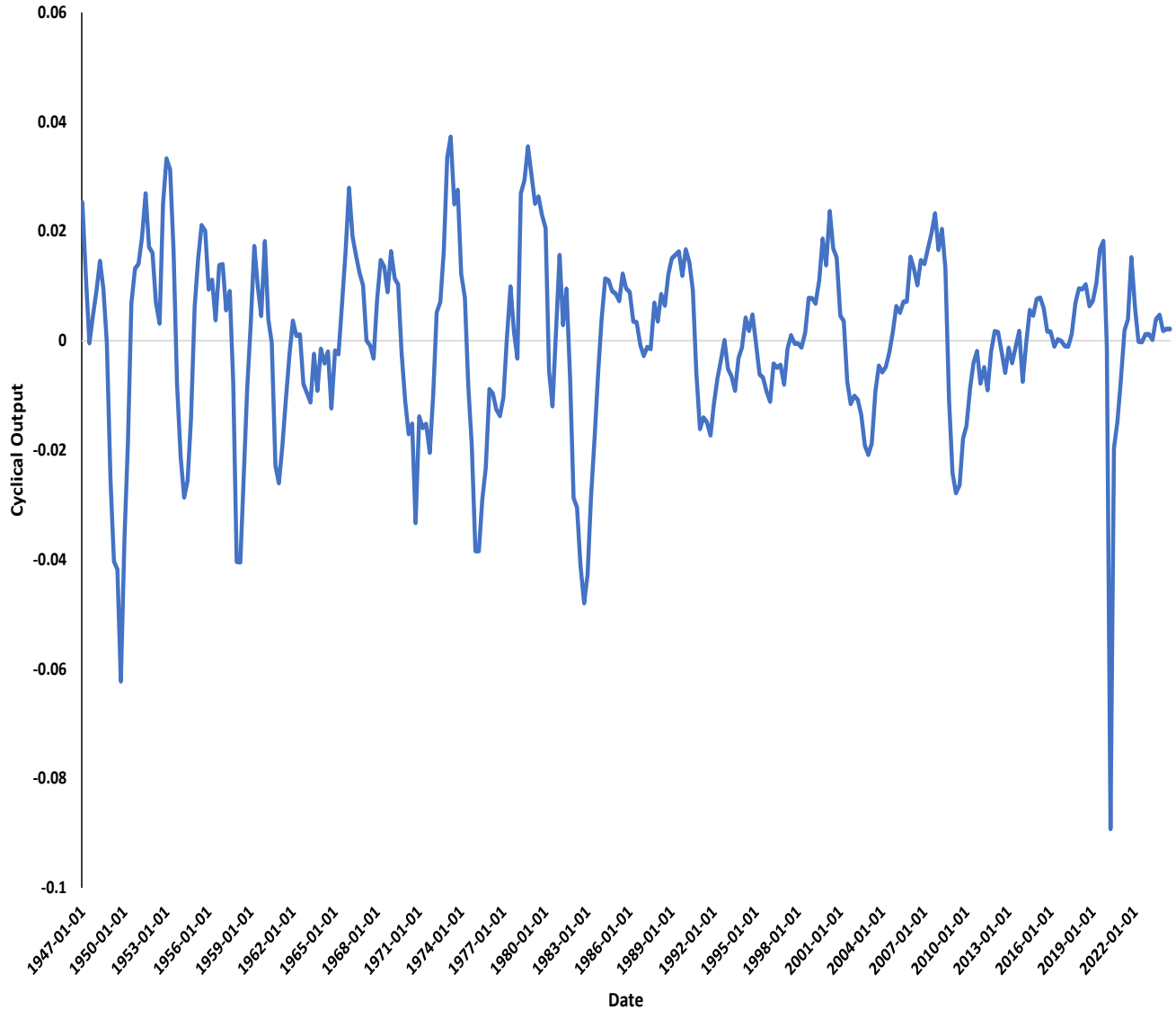
The business cycle refers to how $\ln Y_t^c$ (the cyclical/detrended component) moves around

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

# Real GDP: Log Level



# Cyclical/Detrended Output



# 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 $\theta_t$)

Demand shocks don't do anything to output; even in version of model where $Y^s$ is non-vertical they won't do much

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 $\theta_t$ reproduce these co-movements?
3. Is there any good evidence of changes in $A_t$ or $\theta_t$ 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 or acyclical (uncorrelated with output)

Real interest rate is acyclical or countercyclical (negatively correlated with output)

Price level is countercyclical

# Empirical Correlations

| Variable | Corr w/ $Y_t$ in Data | Corr conditional on $A_t$ | Corr conditional on $\theta_t$ |
|---|---|---|---|
| $C_t$ | 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

$\theta_t$ produces a conditionally countercyclical real wage in the model – inconsistent with the data

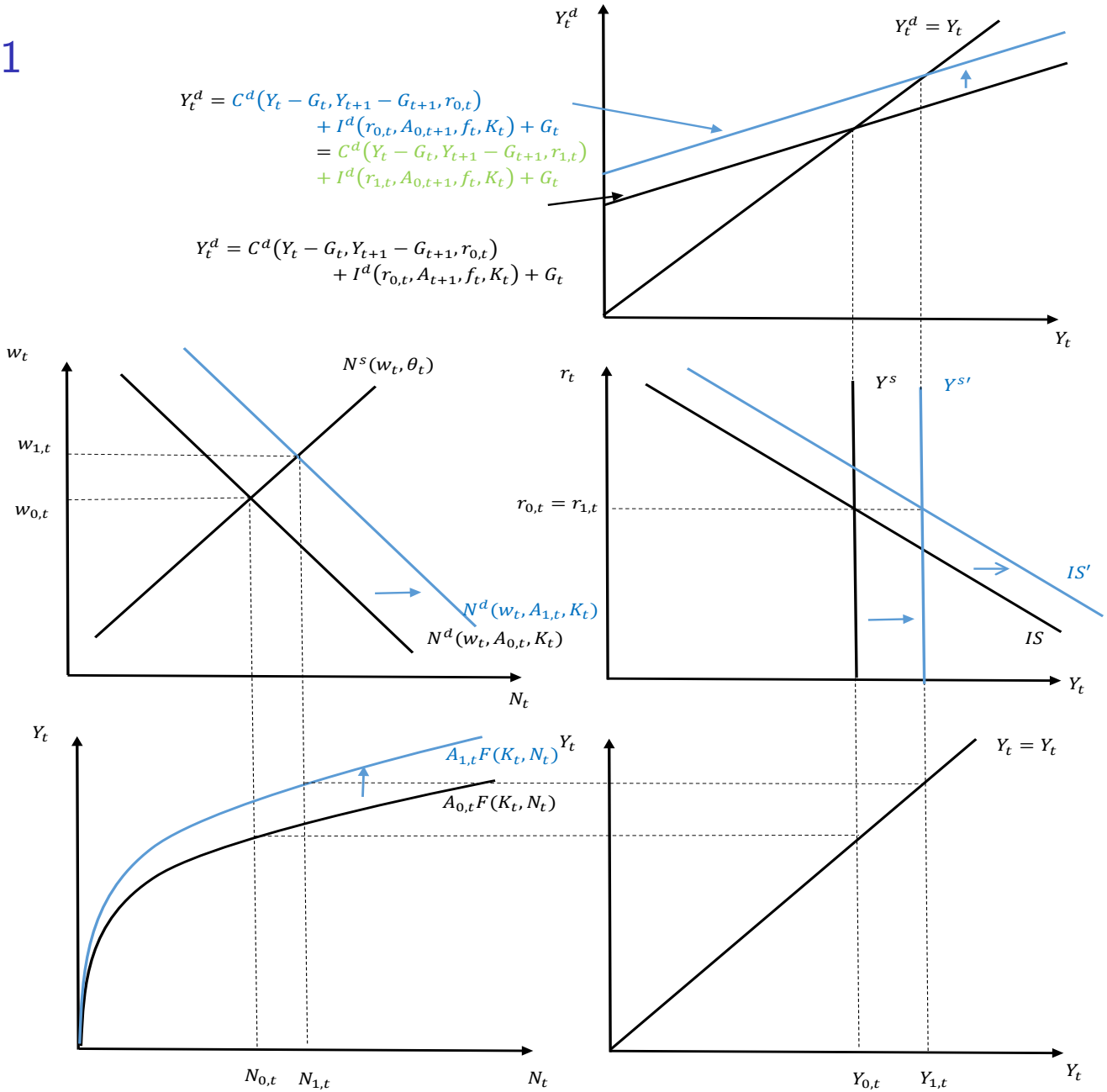
Observed cyclicality of real wage in data probably understates true cyclicality due to composition bias (Solon, Barsky, and Parker 1994)

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

$\uparrow A_t, A_{t+1}$



# 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 $Y_t$

# TFP

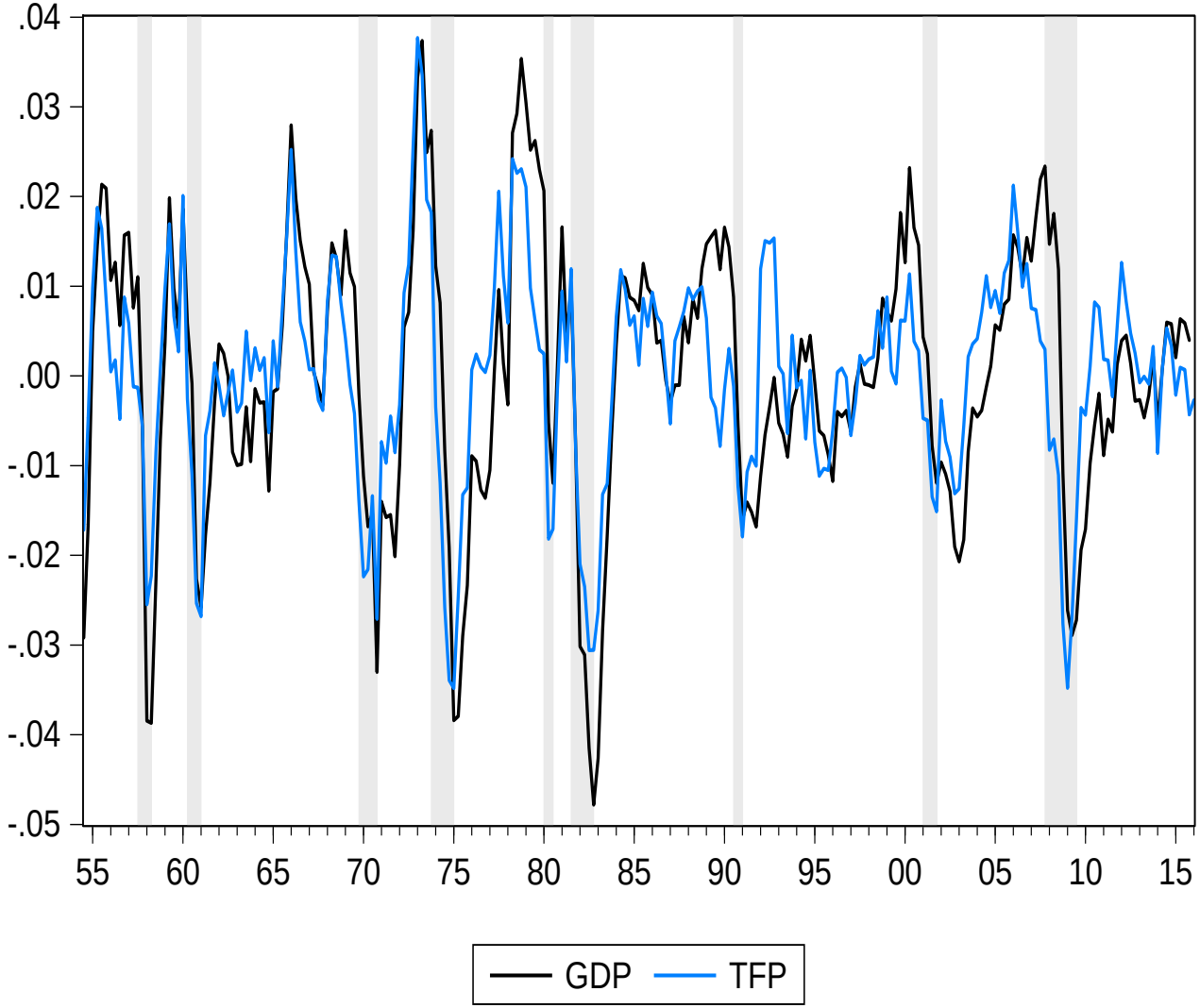
As in Solow model, measure total factor productivity (TFP) by assuming Cobb-Douglas production function:

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

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



# Model Fit

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

# Policy Implications

Main implication: equilibrium of model is (approximately) efficient (GLS Ch. 15 – have to assume $f_t = 0$)

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 (or changing preferences for leisure)

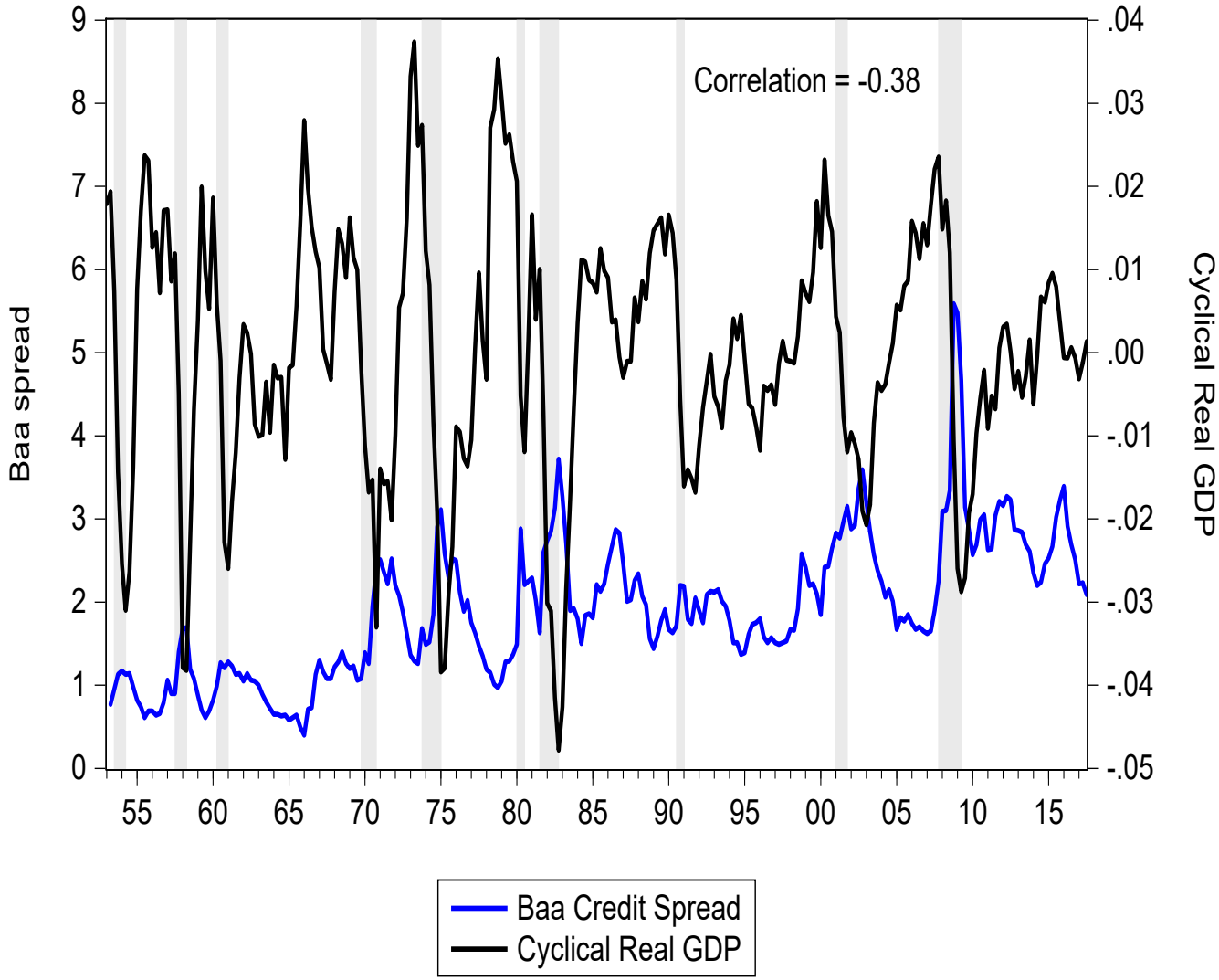
No justification for activist policies (monetary or fiscal) to try to combat recessions

# 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:

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

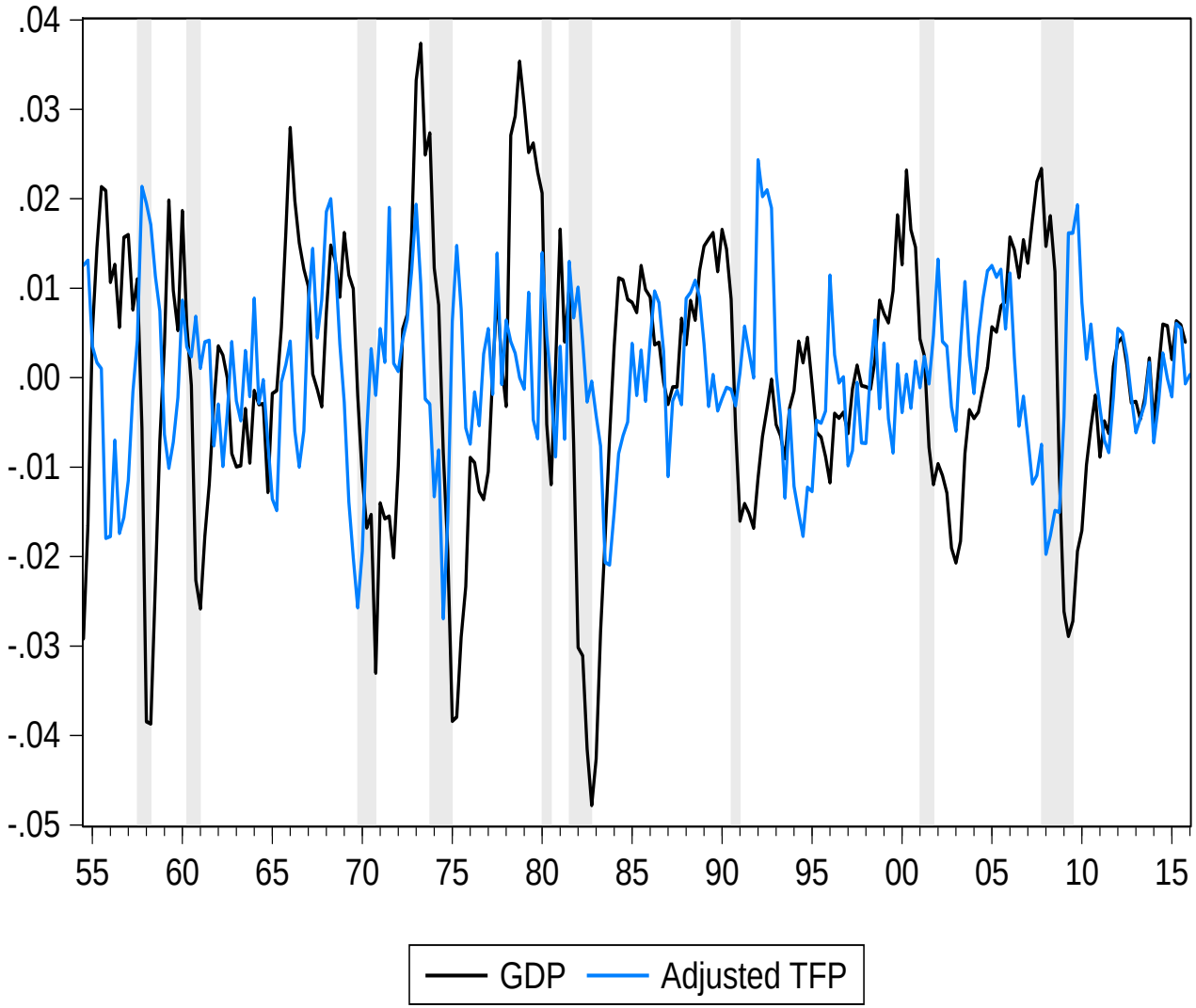
$u_t$: capital utilization. Can't adjust $K_t$ in short run, but can adjust $u_t$ (i.e. how hard you work your capital)

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 or even countercyclical

# Utilization-Adjusted TFP is Acyclical



# 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