Econ 702

Macroeconomics I

Charles Engel and Menzie Chinn

Spring 2020

Lecture 11: Assessing the Neoclassical Model

We have used the neoclassical model to explain the "medium run".

But can it be used to explain business cycles?

The business cycle is not really a cycle. We are just talking about the fluctuations of the GDP (and other macro variables) around their longer-term trend.

That is, we might think:

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

How should we measure the trend?

One way is to fit a line through the time series of output – a linear trend – as we have done previously.

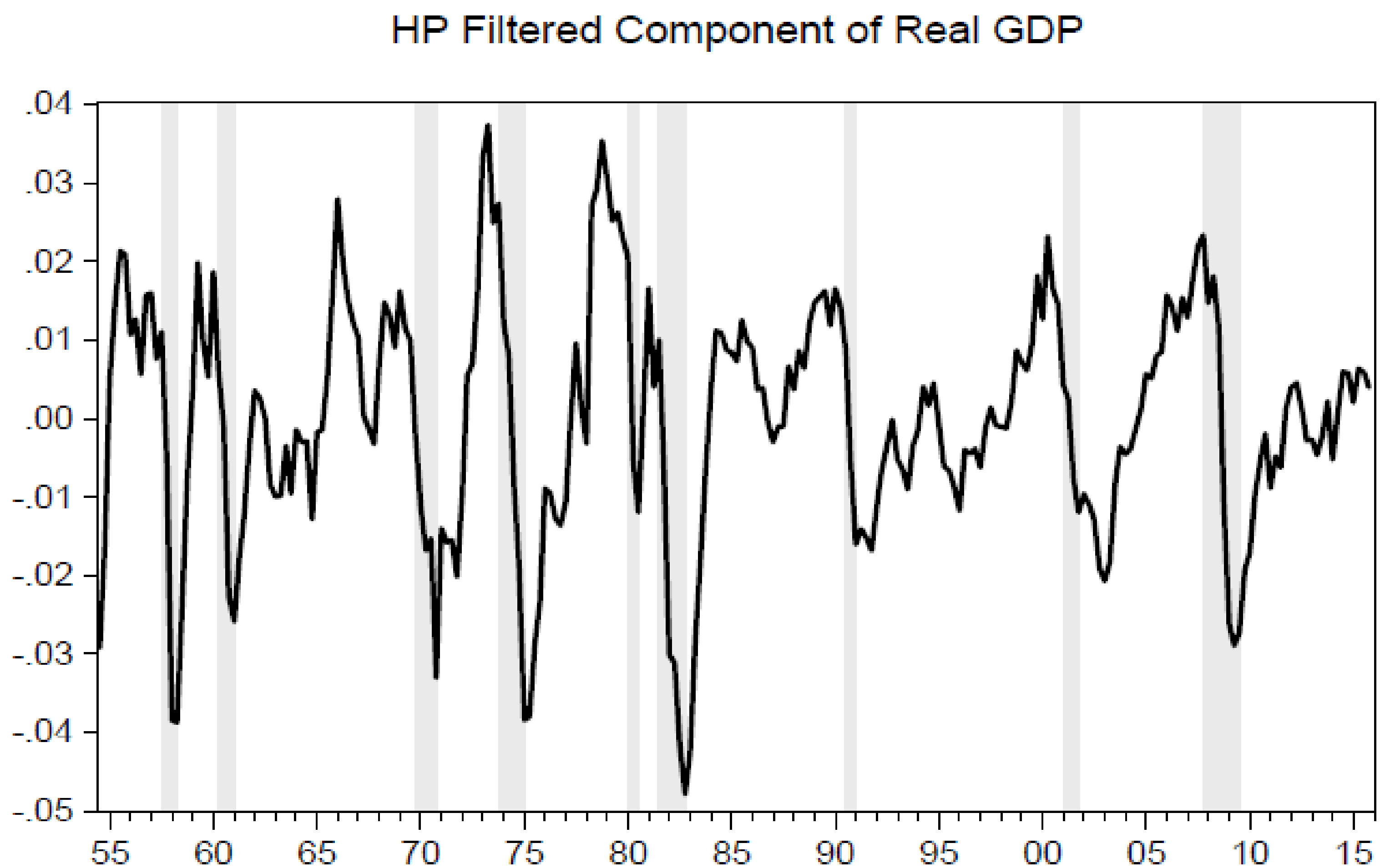
Maybe it would be better to take a "moving average". For example we could calculate a 2-year moving average as:

$$Y_t^{\tau} = \text{average}\,(Y_{t-4}, Y_{t-3}, Y_{t-2}, Y_{t-1}, Y_t, Y_{t+1}, Y_{t+2}, Y_{t+3}, Y_{t+4})$$

The Hodrick-Prescott filter (HP filter) is a sort of moving average filter. It is widely used to measure the trend and the cyclical component of many variables.

It is not universally agreed this is a good measure, but we will use it here.

Figure 19.1: Cyclical Component of Real GDP



Can the neoclassical model account for these fluctuations around the trend?

The “real business cycle” (RBC) model uses the neoclassical model to explain these fluctuations.

How well does it do?

Recall that in the model, only shocks to TFP (A_t) or to labor supply can cause real output to change.

Economists agree that shocks to labor supply cannot be a major explanatory variable. A choice to supply less labor would lead to recessions. But with labor scarce, wages should rise during recessions if this were their cause. But they clearly fall.

That leaves TFP to be the main explanatory variable.

How do we measure TFP?

With a Cobb-Douglas production function, we had:

$$Y_t = A_t K_t^{\alpha} N_t^{1-\alpha}.$$

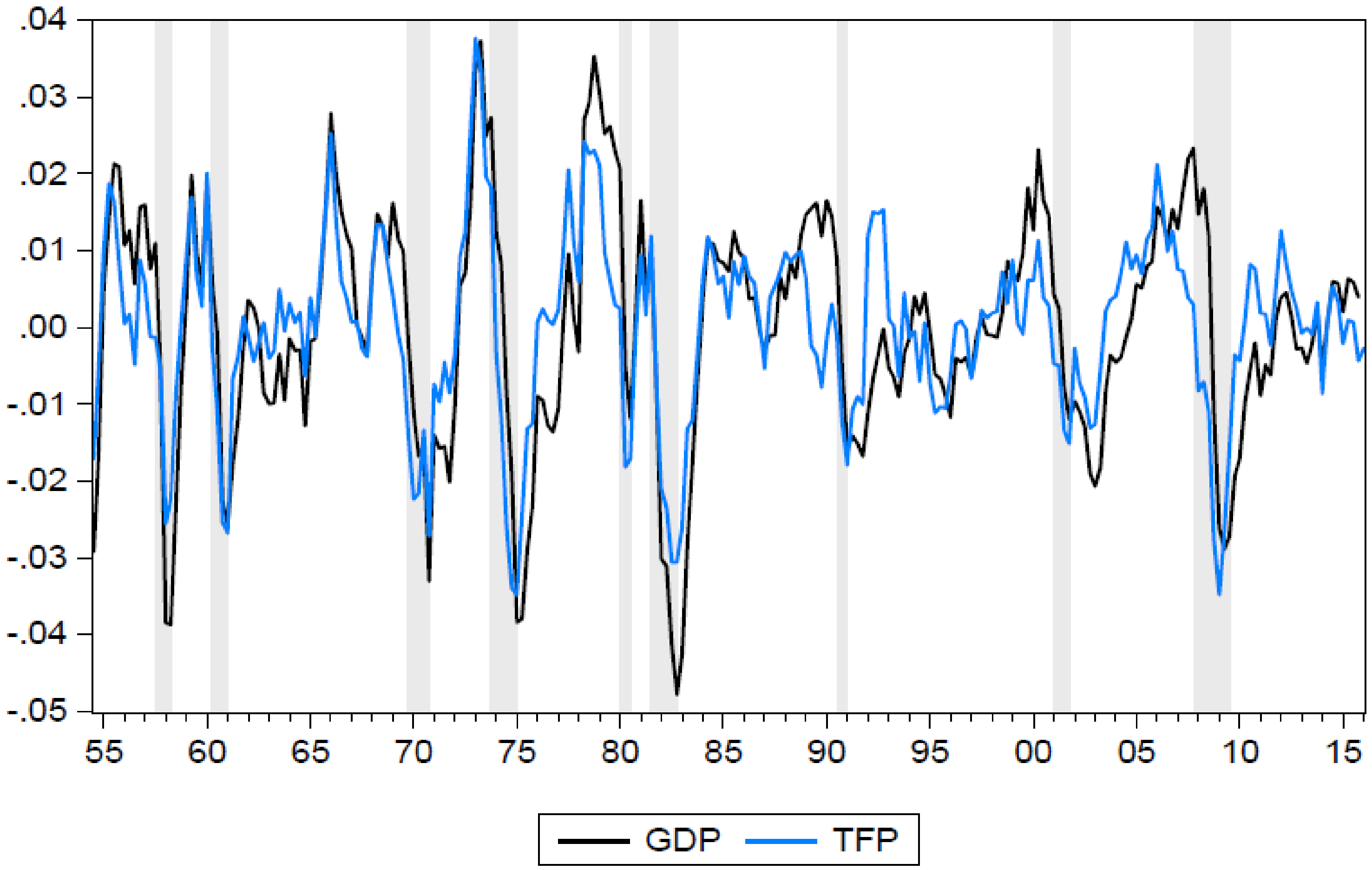
This implies $\ln(Y_t) = \ln(A_t) + \alpha \ln(K_t) + (1-\alpha)\ln(N_t)$

Since we can measure output, capital and labor, we can use the "Solow residual" to measure TFP:

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

The Solow residual is highly correlated with output:

Figure 19.3: Cyclical Components of Real GDP and TFP



The model makes many predictions about how other variables should move as output goes up or down:

Variable	Corr w/ Y_t in Data	Corr conditional on A_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	-

The model seems to do well, except for matching the correlation of the interest rate with output.

However, when A_t rises, its increase is persistent. That is, A_{t+1} also rises.

We have seen that while an increase in A_t causes r_t to fall, an increase in A_{t+1} causes it to increase.

Putting the two together (as your homework asks you to do), the effects on the interest rate work in opposite directions.

It is possible that the effects will deliver a small negative correlation, as in the data.

We will return shortly to the question of whether this is *really* a good model of business cycles, but first we turn to nominal variables.

Money and Prices

The model has the prediction that changes in the money supply affect prices, but not output.

What is money? Recall, it is an asset that is useful for transactions.

But that is difficult to measure. Cash is surely money. Also checking accounts (demand deposits.) What about money market funds? Saving accounts?

We will use the M1 measure of money, which includes cash and demand deposits.

How does the central bank control the supply of money? By buying and selling government bonds from the public.

Using the Model

We had $M_t = P_t \cdot M^d\left(i_t, Y_t\right)$

A widely used functional form for $M^d\left(i_t, Y_t\right)$ is $M^d\left(i_t, Y_t\right) = \psi_t i_t^{-b_1} Y_t$.

That gives us: $M_t = P_t \psi_t i_t^{-b_1} Y_t$.

If we define $V_t = \left(\psi_t i_t^{-b_1}\right)^{-1}$, we can write the money supply and demand relationship as:

$$M_t V_t = P_t Y_t$$

V_t is often called "velocity".

If we have $M_t V_t = P_t Y_t$, then $g_t^M + g_t^V = g_t^Y + \pi_t$, which gives us:

$$\pi_t = g_t^M + g_t^V - g_t^Y.$$

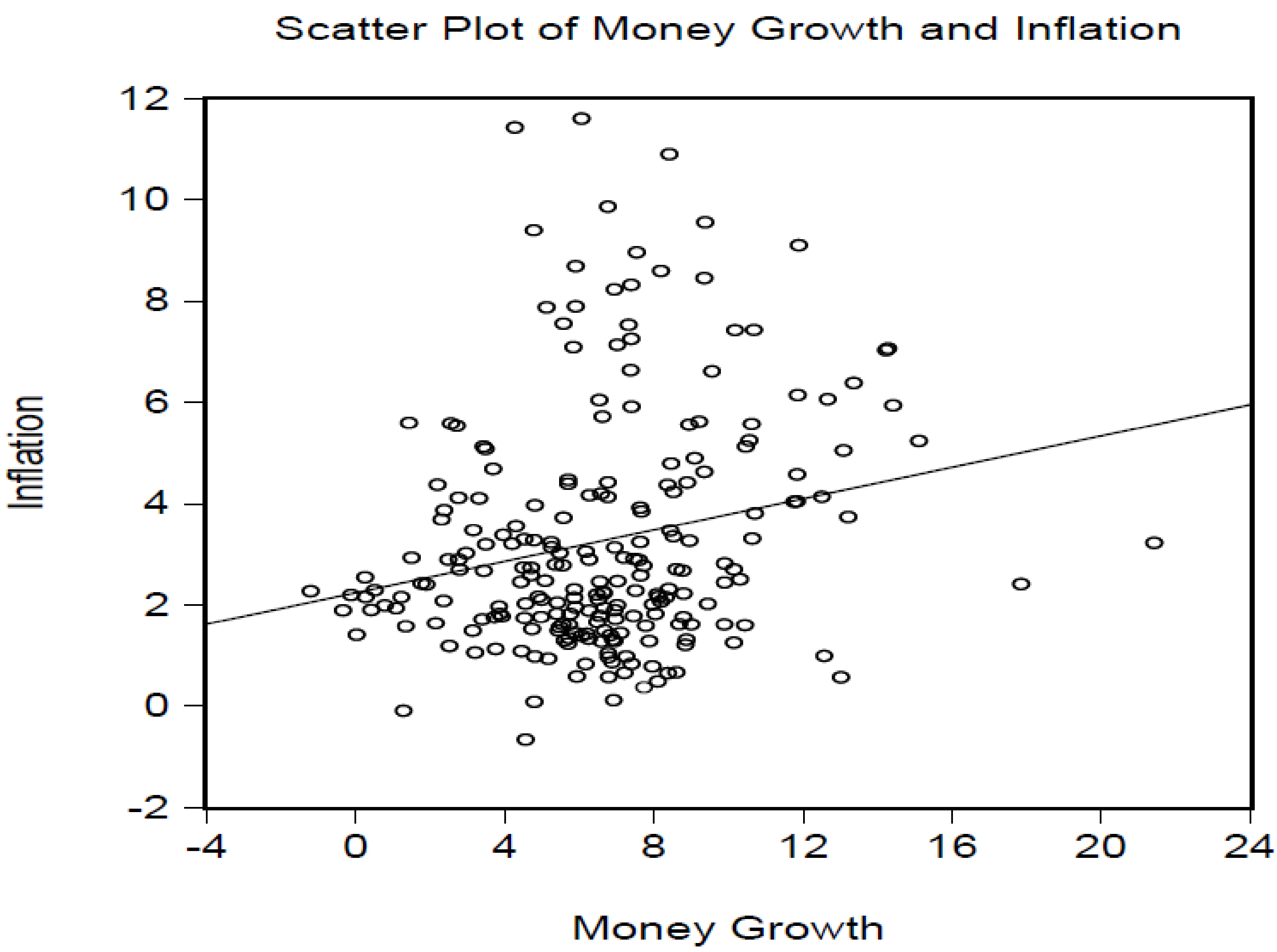
Many claim that over longer periods of time, velocity is constant. That would give us:

$$\pi_t = g_t^M - g_t^Y$$

How does that look in the data?

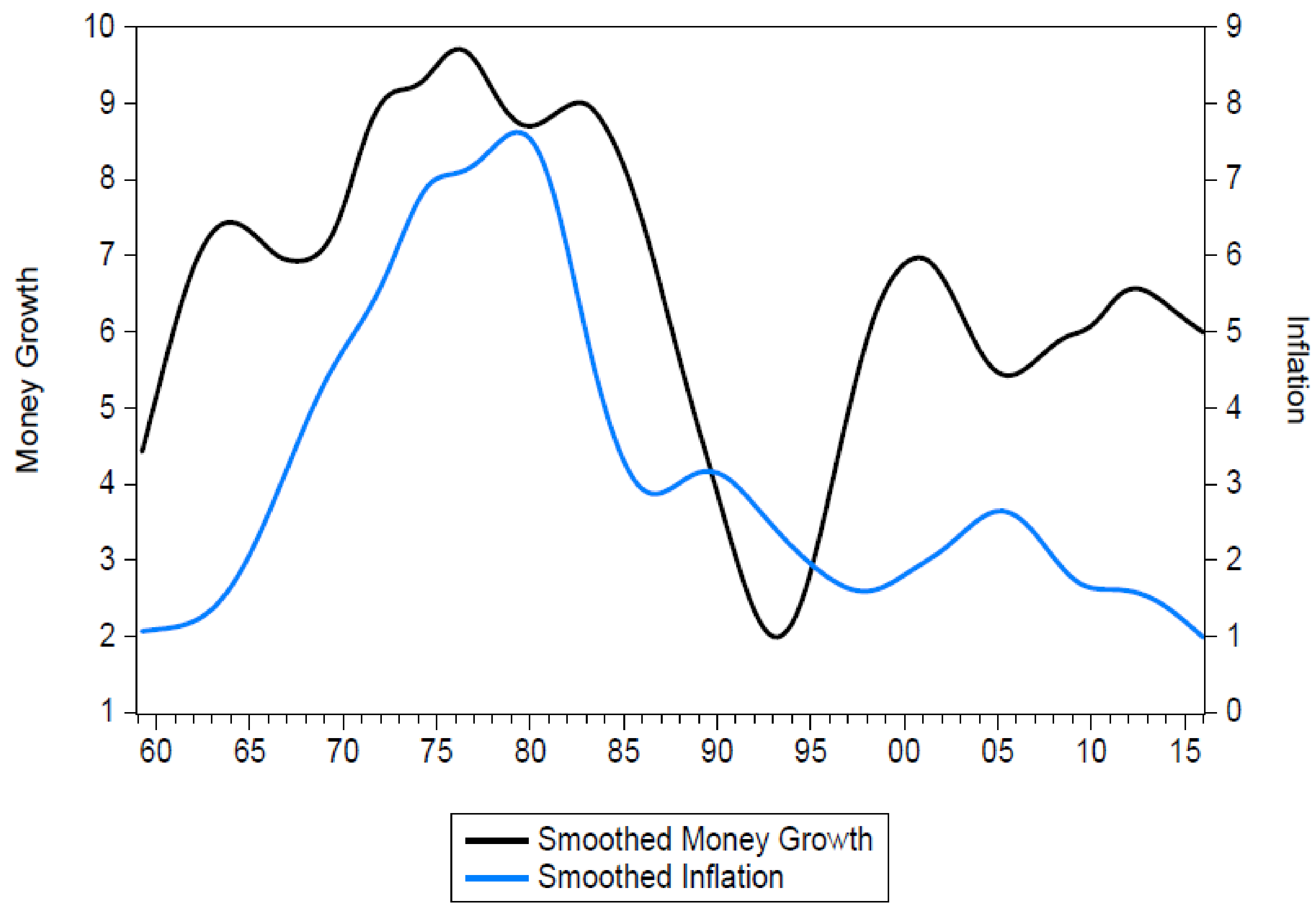
The relationship is there, but it seems pretty weak:

Figure 20.4: Scatter Plot: Money Growth and Inflation



However, we can look at the trend component of money growth and inflation, using the HP filter. Here we find:

Figure 20.5: Smoothed Money Growth and Inflation



That is consistent with what the model says if we interpret it as a medium run model. The relationship does between money growth and inflation does not hold well in the short run, but better in the medium run.

But look how money growth rises after the mid-1990s, but inflation falls. How can that be?

Velocity must have fallen. Does our model of velocity capture this. We had:

$$V_t = \psi_t^{-1} i_t^{b_1}$$

Velocity is positively related to the nominal interest rate.

And indeed, nominal interest rates have fallen after the mid-1990s.

Figure 20.6: Velocity

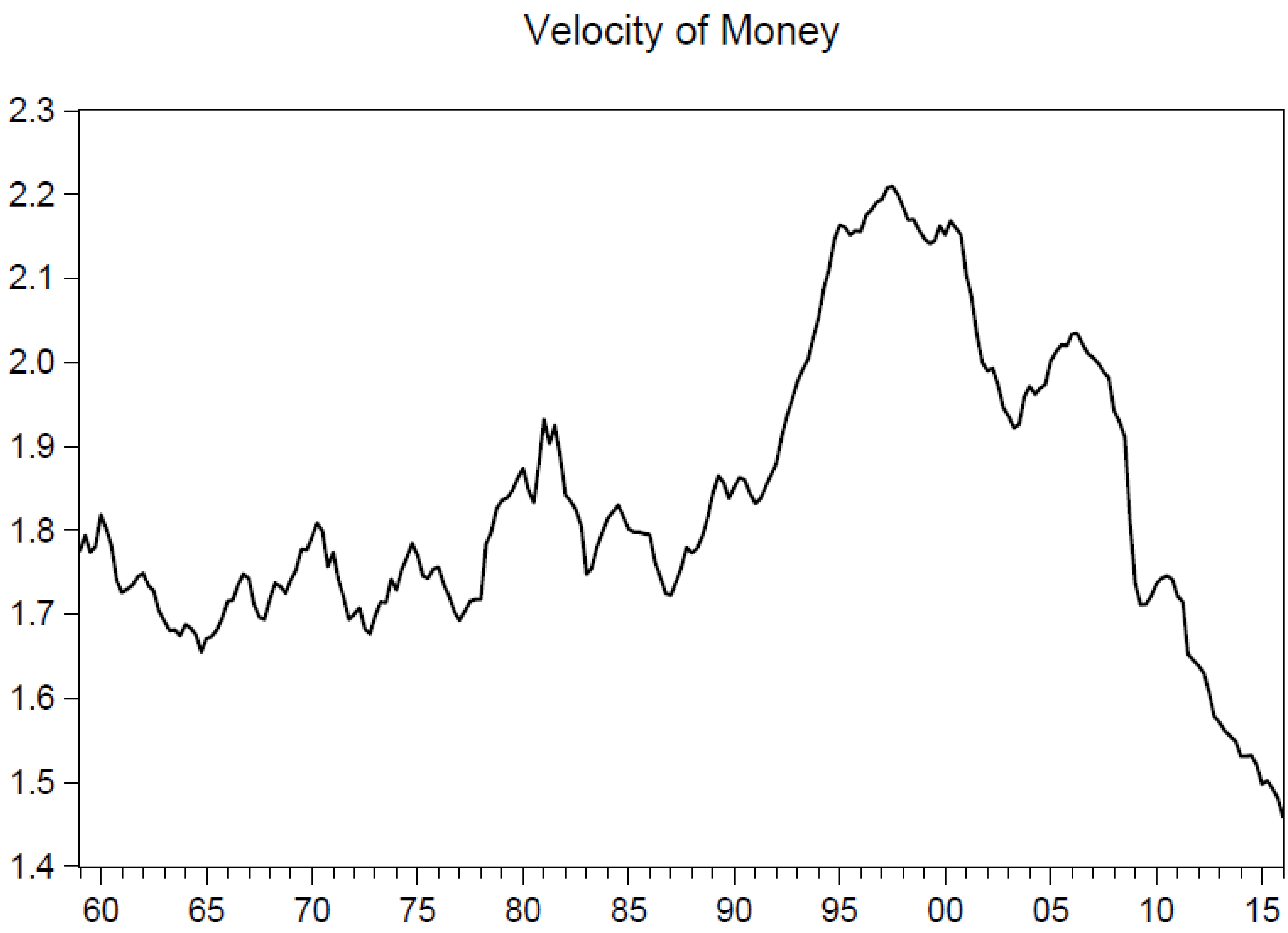
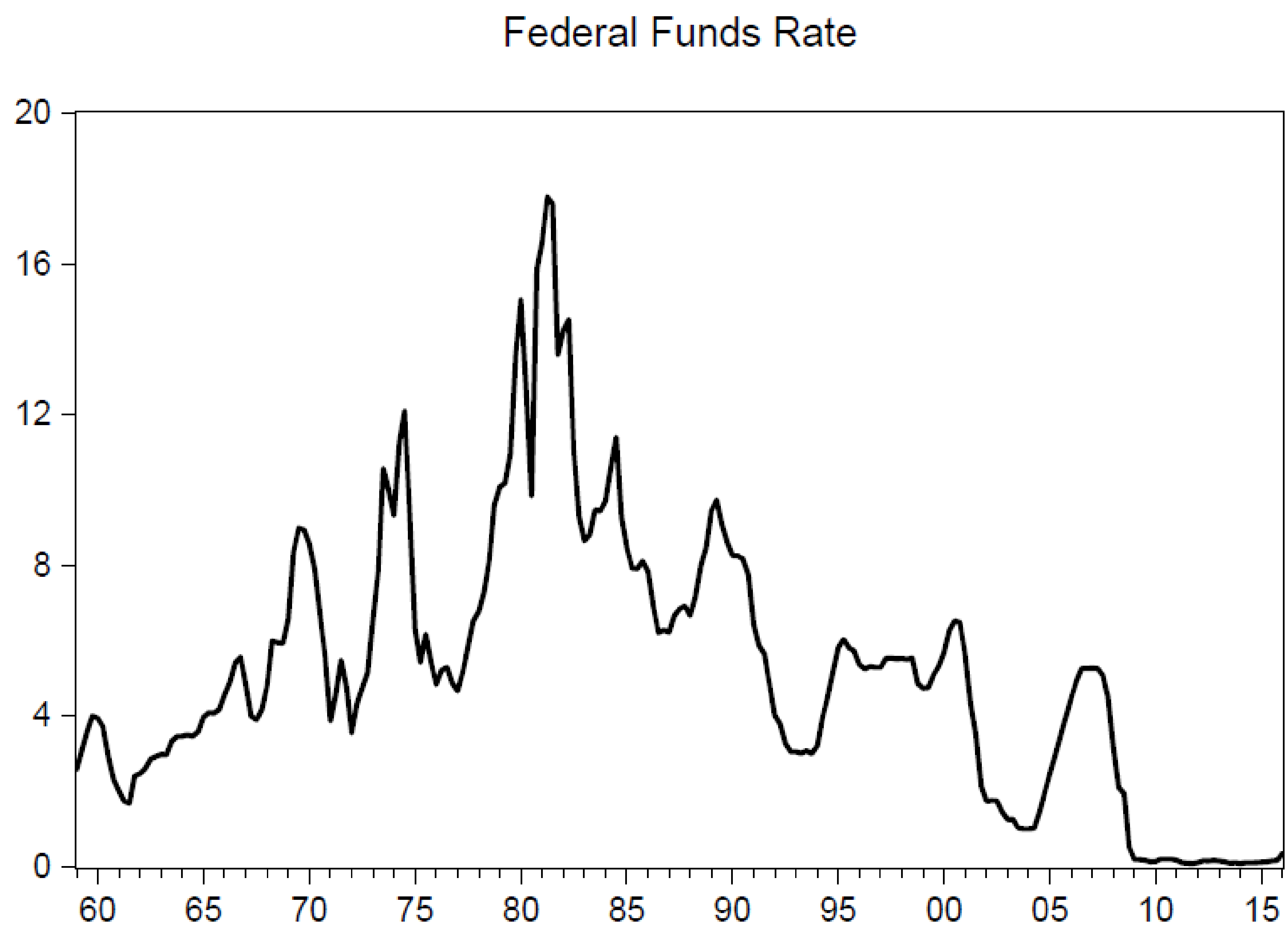


Figure 20.7: Nominal Federal Funds Rate



Velocity fell much more sharply than nominal interest rates since the mid-1990s.

So it is not only the decline in nominal interest rates that led to a decline in velocity. Other things shifted the demand for money upward:

Electronic deposits make money more attractive.

Before the 1980s, demand deposits paid no interest (as in our model), but these days they do – but a lower interest rate than other investments.

People began to hold more money during the global financial crisis because it is safe.

Interest rates

Our model says that if in the medium run, the real interest rate is fairly constant, than nominal interest rates should be driven mostly by changes in inflationary expectations:

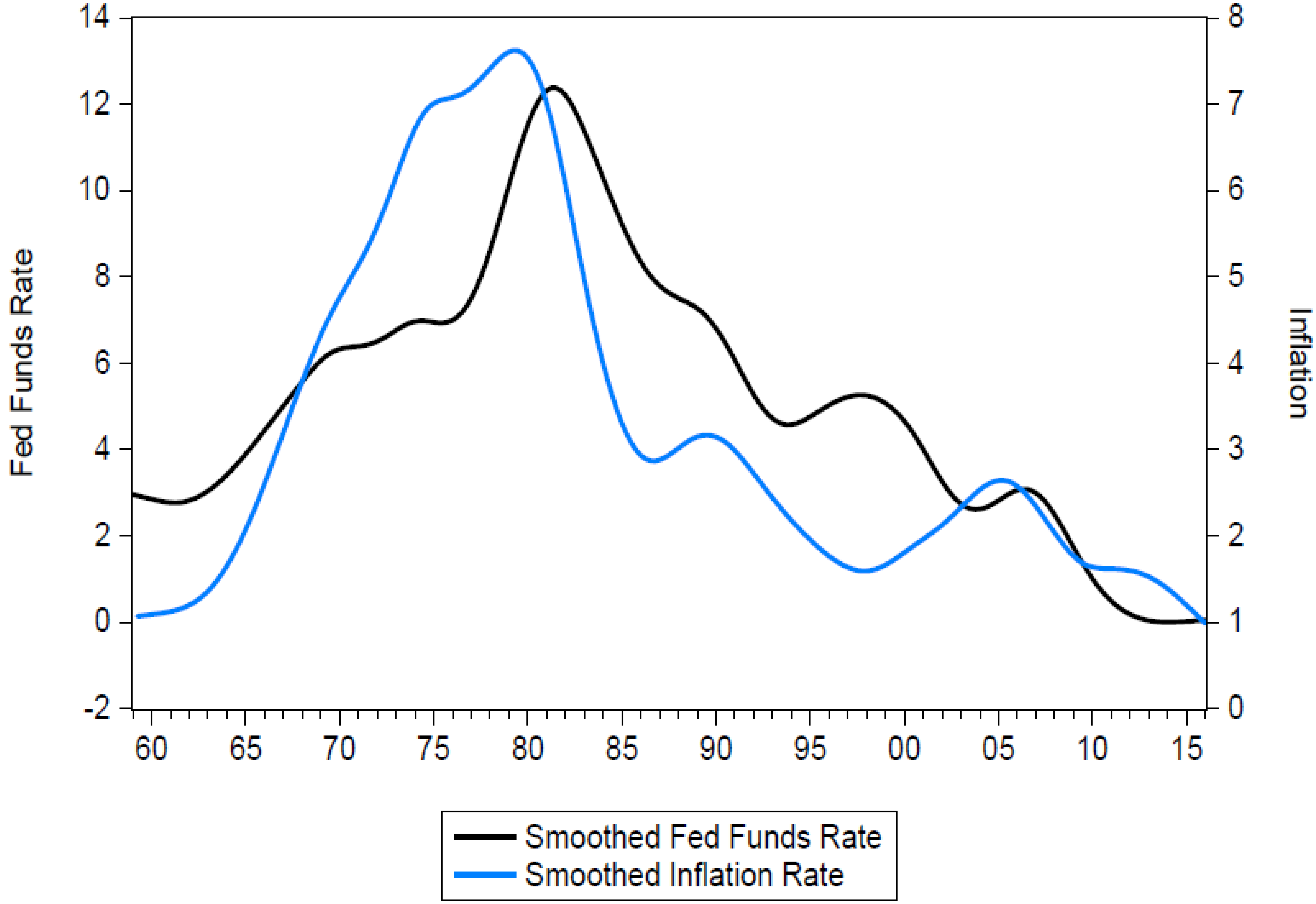
$$i_t = \pi_{t+1}^e + r_t$$

In fact, if we look at the HP trends in nominal interest rates and inflation, we see a fairly close relationship.

Inflation was generally high in the 1970s and 1980s, as were nominal interest rates.

Since the mid-1990s, inflation and nominal interest rates have been low.

Figure 20.8: Smoothed Inflation and Interest Rates



Money and Output

The model predicts changes in the money supply have no effect on output. The data suggests that there is an effect in the short run:

Table 20.1: Dynamic Correlations between M2 and Output

Variable	Correlation with $\ln M_t$
$\ln Y_t$	0.22
$\ln Y_{t+1}$	0.32
$\ln Y_{t+2}$	0.37
$\ln Y_{t+3}$	0.37
$\ln Y_{t+4}$	0.33
$\ln Y_{t+5}$	0.26
$\ln Y_{t+6}$	0.19
$\ln Y_{t+7}$	0.10
$\ln Y_{t+8}$	0.03

Criticisms of RBC Model

1. Solow residual does not really measure TFP.
   - labor hoarding
   - unused capital capacity:

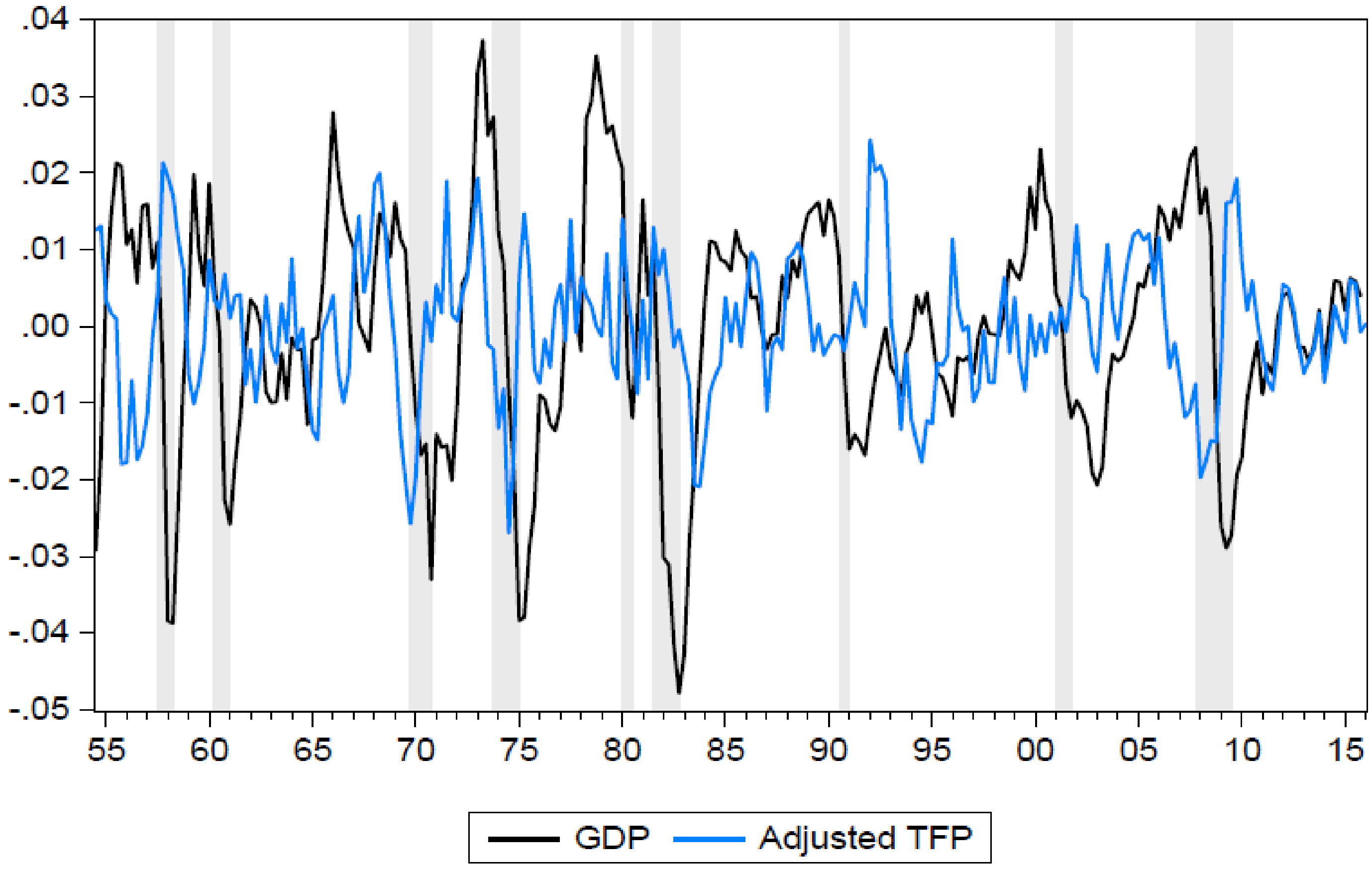
$$Y_t = A_t \left(u_t K_t \right)^{\alpha} N_t^{1-\alpha}$$

Then we find our measure of TFP includes capacity utilization:

$$\ln TFP_t = \ln A_t + \alpha \ln u_t$$

Measures of TFP that adjust for capacity utilization are not very highly correlated with output (in fact, negatively correlated):

Figure 21.1: Cyclical Components of GDP and Utilization-Adjusted TFP



2. What are productivity shocks? How can they be negative and account for recessions?

3. In the model, hours worked are about half as volatile as output, but in the data they are equally volatile.

4. The description of the labor market is too simple – for example, most people either work a standard work week or they are not employed. People don’t have much choice of the number of hours they can work.

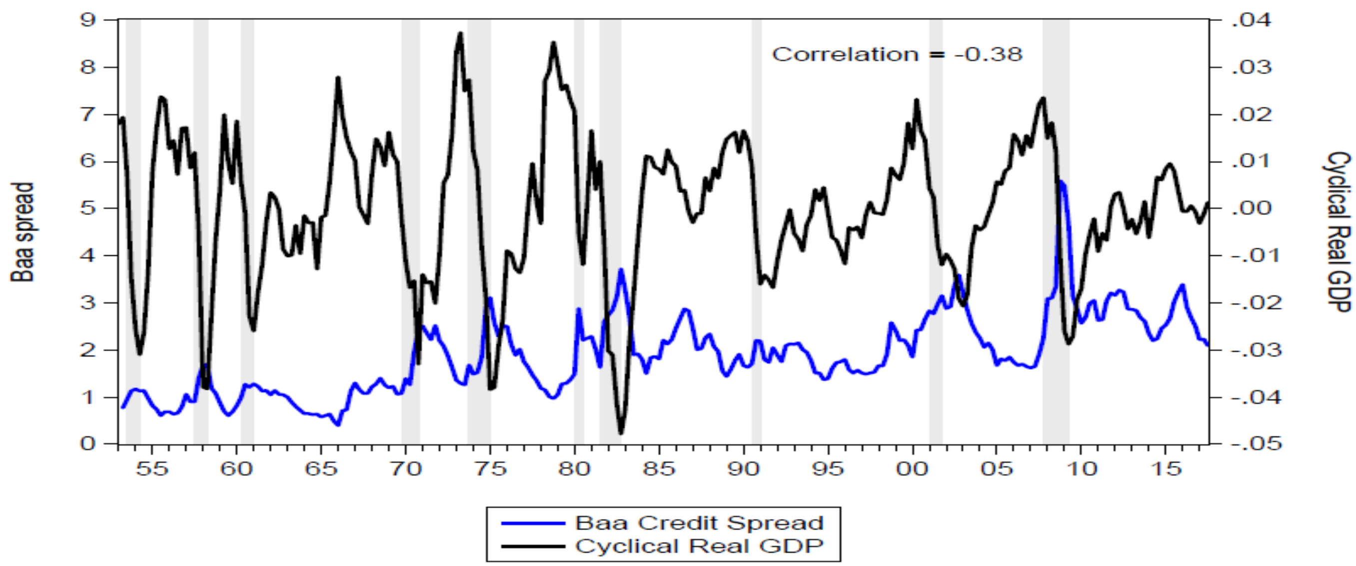
5. Monetary neutrality – contradicted by the data.

6. Other demand shocks also influence output (changes in G_t or news about A_{t+1}.)

7. No role for financial sector, which clearly is very important in causing downturns:

- Japanese "lost decade" of the 1990s
- Asian financial crisis, 1997-1998
- "Dot-com" bubble, 1990
- Global financial crisis 2007-2009
- European debt crisis 2010-2012

Figure 21.2: Cyclical Components of GDP and Baa Credit Spread



Why Did We Look at this Model?

1. It works well for the medium run

2. It is a “benchmark” against which we can compare the contributions of the short-run model we will look at next.

3. The outcomes for output, real wages, and other real variables are “efficient”. We can use this model to gauge what the efficient levels of various economic aggregates are.