

Notes VI - Models of Economic Fluctuations

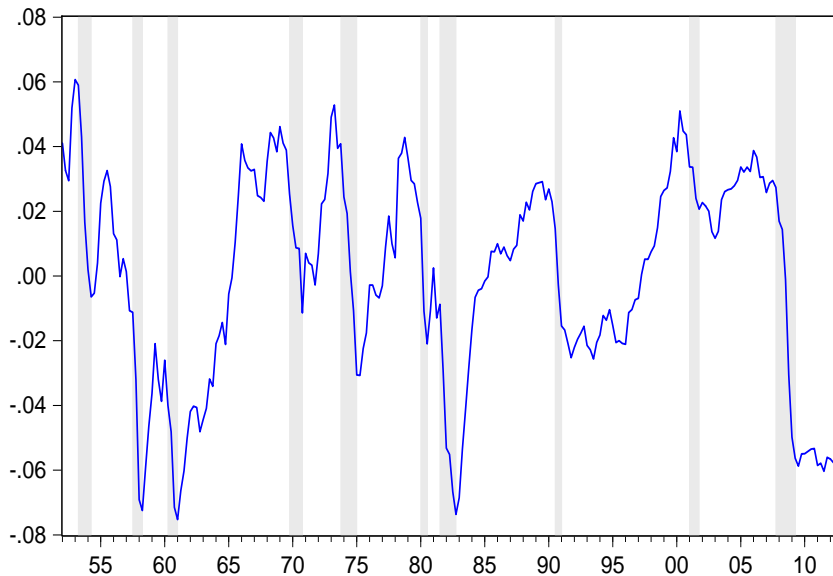
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Intermediate Macroeconomics
Fall 2017



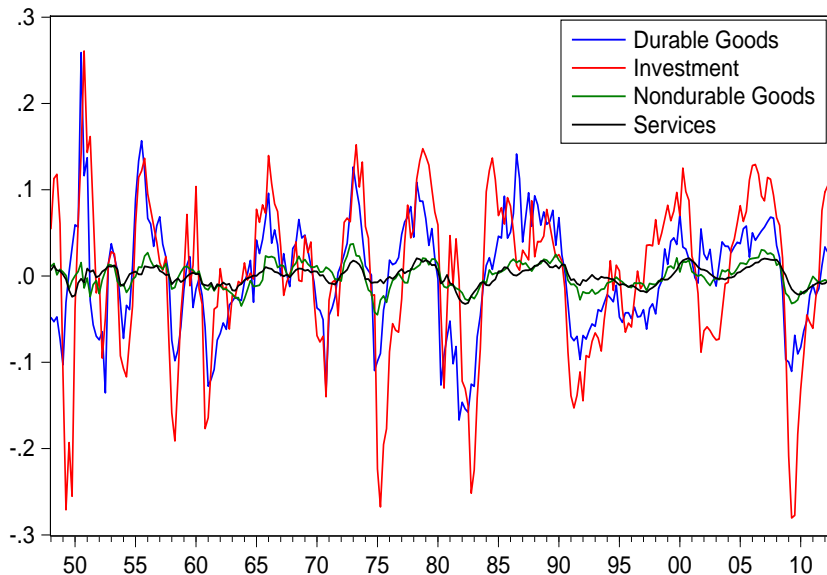
Business Cycles

- ▶ We can decompose macroeconomics into:
 1. Long-run.
 - ▶ Been there, done that.
 2. Business cycles.
- ▶ We are going to:
 - ▶ Briefly talk about the features of the data.
 - ▶ See whether our theory can account for them.
 - ▶ Consider whether policy aimed at dampening recessions is effective and/or welfare improving.

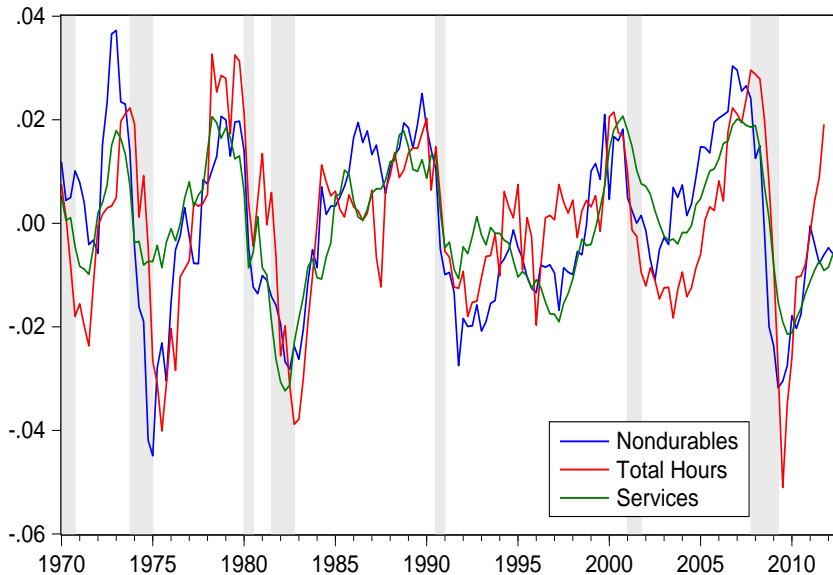
GDP



Components of GDP



Consumption and Hours



“Real Business Cycle” Model

- ▶ Kydland and Prescott (1982):
 - ▶ Business cycles are endogenous responses to real “shocks” to the economy.
 - ▶ This contrasted sharply with previous views.
 - ▶ Nobel Prize in Economics (2004).
- ▶ Our neoclassical model is a two-period version of their basic model.
- ▶ In our model what could be the “driving force” that causes fluctuations?
 - ▶ It cannot be anything but changes in A .
 - ▶ Recall the labor market equilibrium condition.

Pareto Optimality

Definition (Pareto Optimal)

*A competitive equilibrium is **Pareto Optimal** if there is no way to rearrange production or to reallocate goods so that someone is made better off without making someone else worse off.*

Welfare Theorems

Definition (First Fundamental Theorem of Welfare Economics)

*The **first fundamental theorem of welfare economics** states that, under certain conditions, a competitive equilibrium is Pareto Optimal.*

Definition (Second Fundamental Theorem of Welfare Economics)

*The **second fundamental theorem of welfare economics** states that, under certain conditions, a Pareto optimum is a competitive equilibrium.*

Implications and Criticisms of the Basic RBC Framework

- ▶ In the RBC model, the equilibrium is *optimal*.
 - ▶ There is no role for activist stabilization policy by the government.
 - ▶ No role for fiscal or monetary policy.
- ▶ Some limitations:
 - ▶ There is no unemployment.
 - ▶ What does it mean for A to decline?
 - ▶ Is it well-measured?
 - ▶ No heterogeneity.
 - ▶ Features monetary neutrality.

Introducing Money

- ▶ A second class of business cycle models holds that fluctuations are not optimal.
 - ▶ Activist policy can improve welfare.
 - ▶ These are the New Keynesian models.
 - ▶ What's new?
 - ▶ “Price stickiness” is a key feature.
- ▶ First we are going to introduce money.
 - ▶ Therefore, we are introducing another market.
- ▶ We will use the idea of *fiat* money.
 - ▶ No intrinsic value.
- ▶ We are going to create a supply and demand model.
 - ▶ A nominal interest rate clears the money market.

Basics

- ▶ Let:
 - ▶ M denote the amount of money in circulation.
 - ▶ P denote the price level of goods.
- ▶ What is the actual purchasing power of money?
 - ▶ M/P is known as “real balances”.
- ▶ We can also talk about nominal interest rates, i .
- ▶ r and i are related by the *Fisher* equation:

$$(1 + r) = (1 + i) \frac{P}{P'}$$

which can be also written as:

$$r \approx i - \pi'$$

Household

- ▶ Household gets utility from holding money.
 - ▶ Money makes it easier to carry out transactions.
 - ▶ Only utility from real balances in the first period: $\phi(M/P)$.
 - ▶ $\phi'(M/P) > 0$ and $\phi''(M/P) < 0$
- ▶ The budget constraints are given by:

$$C + S + \frac{M}{P} = wN + D - T$$

$$C' = w'N' + D' - T' + S(1+r)\frac{P}{P'} + \frac{M}{P'}$$

- ▶ Real balances can change from one period to the other.
- ▶ What is the rate of return of saving via M ?

Household's Problem

$$\max_{M, C, C', N, N'} u(C, 1 - N) + \phi(M/P) + \beta [u(C', 1 - N) + v(1 - N')]$$

Subject to:

$$C + \frac{C'}{1+r} + \frac{M}{P} \left(\frac{i}{1+i} \right) = wN + D - T + \frac{w'N' + D' - T'}{1+r}$$

- ▶ Focusing on the first order condition for M .

$$\phi'(M/P) = \frac{i}{1+i} u_C(C, 1 - N)$$

- ▶ Marginal benefit equal to marginal cost.
- ▶ Essentially, another MRS equal to price ratio condition.
- ▶ What does this tell us about money demand?

Money Demand

- ▶ How do changes in i , C and P affect money demand?
 - ▶ If $i \uparrow \Rightarrow M \downarrow$.
 - ▶ More costly to hold money.
 - ▶ If $C \uparrow \Rightarrow u'(C) \downarrow \Rightarrow \phi'(M/P) \downarrow \Rightarrow M \uparrow$.
 - ▶ If you are consuming more, you want more money to carry out transactions.
 - ▶ However, this is not what is driving this result.
 - ▶ If $P \uparrow \Rightarrow M \uparrow$.
 - ▶ Household cares about real balances.
- ▶ We can summarize these results as

$$M^d / P = L(Y, i)$$

- ▶ L is the liquidity function.
 - ▶ How the demand for real balances, depends on income and interest rates.
 - ▶ $L(Y, i)$ is increasing in Y and decreasing in i .
- ▶ Rearranging:

$$M^d = PL(Y, r + \pi')$$

Graphically

- ▶ We have the demand.
- ▶ Where is the money supply coming from?
 - ▶ Fed.
- ▶ We are going to graph everything in the (M, P) dimension.
 - ▶ Demand still has negative slope.

Classical Dichotomy

- ▶ The *Classical Dichotomy* is a benchmark for thinking about how money affects things.
 - ▶ Real variables are determined independent of nominal variables.
 - ▶ Separates analysis of the money market.
- ▶ Anything that affects Y or r will cause M^d curve to change.
 - ▶ We are going to take π' as given.
- ▶ From there we determine the nominal variables.

Consider Increase in A

- ▶ Current labor and current goods market are as before.
- ▶ What about the money market?
 - ▶ Money is “neutral” .
 - ▶ Changes in the money supply have no real effect.
 - ▶ Increase in Y makes M^d flatter.
 - ▶ Decrease in r also makes M^d flatter.
 - ▶ Price level falls.
- ▶ Notice how flexible prices are.
- ▶ What is the mechanism through which prices adjust?
 - ▶ In the process, money is scarce, so its value is driven up.
 - ▶ Same as saying $P \downarrow$.
- ▶ Fed *could* hold the price level constant.
 - ▶ Then price level wouldn't have to adjust.

New Keynesian Models

New Keynesian Models

New Keynesian Models

- ▶ The key to Keynesian models is that prices are assumed to be sticky.
 - ▶ This is not what happens in the basic Neoclassical model.
- ▶ What's "new" here?
 - ▶ In traditional Keynesian models, simple static decision rules were assigned.
 - ▶ Now, agents are forward-looking maximizers.
- ▶ Why might price be sticky?
 - ▶ Menu costs.
 - ▶ Lucas misperceptions.
 - ▶ Rational inattention.

Why and how?

- ▶ Why?
 - ▶ Generates monetary non-neutrality.
 - ▶ Generates inefficiency. The equilibrium will be, in general, suboptimal.
 - ▶ There may be role for policy.
- ▶ How?
 - ▶ Firms set prices for their goods in previous periods at the level \bar{P} and are bound by them.
 - ▶ Firm will supply whatever is demanded at the given price.
 - ▶ Output is “demand determined” .
 - ▶ Here is where the inefficiency arises.

How can Money be Non-neutral

- ▶ Assume an increase in money supply.
 - ▶ Neoclassical model:
 - ▶ M^s shifts right, price level adjusts.
 - ▶ Money market clears, r doesn't change.
 - ▶ New Keynesian model:
 - ▶ Price is stuck at \bar{P} .
 - ▶ $M^s > M^d$
 - ▶ $r + \pi'$ must fall to induce people to borrow and hold money.
 - ▶ r adjusts to clear the money market.
 - ▶ In the goods market the equilibrium is also affected.
 - ▶ This also contributes to the shift of M^d .

How to Think About Monetary Policy?

- ▶ We can think of monetary policy in two different ways.
 1. Fed sets the money supply and there is an r that will adjust.
 2. Fed sets r and there is some level M^s that will achieve the equilibrium.
- ▶ Fed takes the second approach: target r^* .
 - ▶ In reality, they set i^* , but we are taking π' as given.
 - ▶ We can think of r^* as being set exogenously, and M^s as endogenous.

How is the Equilibrium Determined?

- ▶ Once the Fed has set the interest rate r^* , output is determined in the IS curve.
- ▶ The firm just supplies that amount of output, Y_0 .
 - ▶ It has to adjust labor, N .
 - ▶ N^d is fixed at N^* .
 - ▶ Is the firm optimizing?
 - ▶ Given Y_0, r^*, π' and \bar{P} , we can determine M^s .
 - ▶ $M^s = M^d = \bar{P}L(Y_0, r^* + \pi')$.
- ▶ The Fed must be setting M^s at that level to achieve r^* .

“Recipe”

1. In the goods market, Y is determined by r^* and Y^d .
 - ▶ Then determine C and I .
 2. In the labor market, N is determined from the production function.
 - ▶ Wage is the one that clears the market.
 3. In the money market, determine the M^s that the central bank must supply to achieve r^* .
 - ▶ Given \bar{P} and Y from Step 1.
- ▶ We would like to compare the sticky-price model with the flexible equilibrium.
- ▶ Why?
 - ▶ Two main reasons: efficient and long-run benchmark.
 - ▶ r^f and Y^f refer the equilibrium values in the flexible-price world.

“Tightening” Policy

- ▶ Consider an increase in the target r^* .
 1. Output declines.
 - ▶ $\uparrow r \Rightarrow C \downarrow, I \downarrow$
 2. In the money market, since $\uparrow r$ and $\downarrow Y$, we know that $M^d \downarrow$.
 - ▶ This implies that M^s must shift left.
 - ▶ Thus, “monetary tightening”.
- ▶ Are recessions caused by the Fed?
 - ▶ The Fed could inadvertently tighten.
 - ▶ Think in a shift in Y^d .
 - ▶ Some argue a monetary tightening made the Great Depression worse.

Effects of a Supply Shock: Increase in A

1. Y^f would shift right, but since Y^d doesn't shift and r^* remains unchanged:
 - ▶ There is no change in actual output $Y_1 = Y_0 = Y_0^f$.
 2. Firms demand less labor, because output hasn't change and they are now more productive.
 - ▶ $N \downarrow$ and $w \downarrow$.
 3. Neither Y or r^* changed so the Fed doesn't need to change M^s .
- ▶ How does the response of this economy compare to the flexible price case?
- ▶ With price rigidities there is no boom, in fact labor actually declines.

Effects of a Demand Shock: Increase in A'

Keynesian “animal spirits”.

1. Goods market:

- ▶ Investment demand increase.
- ▶ $Y \uparrow$ and hence $C \uparrow$
- ▶ $Y^s \uparrow$ in flexible price world so it isn't clear what would happen with Y^f .

2. Labor market:

- ▶ $Y \uparrow \Rightarrow N^d \uparrow$.
- ▶ $Y' \uparrow \Rightarrow N^s \downarrow$.

3. Money market:

- ▶ $\uparrow Y \Rightarrow M^d$.
- ▶ Fed must increase M^s in order to maintain r^* .

Should the Fed do Something?

- ▶ Welfare maximizing policy would like to make the economy reach efficient equilibrium.
- ▶ In the case of $\uparrow A$:
 - ▶ Output in the New Keynesian model underreacts compared with the flexible price world.
- ▶ In the case with $\uparrow A'$:
 - ▶ Output in the New Keynesian model overreacts compared with the flexible price world.
- ▶ These features suggest that the Fed shouldn't sit on its hands.
 - ▶ It should respond to these shocks by changing r^* .
 - ▶ Remember, the flexible-price equilibrium is the efficient outcome.

Response to Shocks

- ▶ With sticky-prices, the Fed can influence the economy's outcome.
 - ▶ How? By changing the interest rate.
- ▶ Think about a positive productivity shock.
 - ▶ Without action of the Fed:
 - ▶ $Y < Y^f$ and $r^* > r^f$.
 - ▶ What if the Fed lowers its target to $r^* = r^f$?
 - ▶ Goods market moves to the flexible-price equilibrium.
 - ▶ In the labor market, since $r \downarrow$, $N^s \downarrow$.
 - ▶ Now, $\uparrow A$ would $N^d \downarrow$ but now the $Y \uparrow$ due to $\downarrow r$ would $N^d \uparrow$.
 - ▶ Impact on N isn't ambiguous: we end up in the flexible price equilibrium so $N \uparrow$ (assuming that's what would happen there).
 - ▶ In the money market, $\uparrow Y, \downarrow r \Rightarrow M^d \uparrow$.
 - ▶ Fed should increase M^s to achieve the fall in r^* .
 - ▶ Contrasting with the flexible price case, now the Fed accommodates and increases the money supply.

Practical Issues & the Fed Dual Mandate

- ▶ On the blackboard, monetary policy is easy.
- ▶ In practice, it is hard.
 - ▶ Fed doesn't directly observe Y^f and r^f .
 - ▶ If the fed targets $r^* < r^f$ then $Y > Y^f$.
 - ▶ Firms are producing more than they would if prices were flexible.
 - ▶ As soon as they get a chance to adjust prices, they will raise them.
 - ▶ $\pi' > 0$.
 - ▶ This suggest an empirical correlation between the “output gap”, $Y - Y^f$, and inflation, π' .
 - ▶ This is the Phillips curve

$$\pi' = \alpha_0 + \alpha_1(Y - Y^f)$$

- ▶ Trying to push output above potential will lead to inflation.

“Liquidity Trap” and the “Zero Lower Bound”

- ▶ Nominal interest rate cannot be negative.
 - ▶ Why would you hold money in the first place?
- ▶ This results in a “liquidity trap” .
 - ▶ Purchasing short-term treasuries and paying with cash, doesn't affect nominal interest rates.
 - ▶ Fed funds rates is between 0 and 0.25%.
 - ▶ Yield on a 1-month T-bill is around 0.02% and on a 1-year T-bill is 0.10.
- ▶ Recall the Fisher equation: $r = i - \pi'$.
 - ▶ There is a lower bound $r_{lb} = -\pi'$.
 - ▶ This create a dilemma if $r^f < r_{lb}$.
 - ▶ Deflation doesn't help.

Possible Policy Responses to the ZLB

- ▶ Create inflationary expectations.
 - ▶ Not easy if banks are sitting on the cash.
- ▶ Fiscal stimulus.
 - ▶ Y^d will shift out, but Y^s will also move.
- ▶ “Quantitative easing” .
 - ▶ Fed buys longer-term assets.
 - ▶ So far the Fed has bought over 2.5 trillions in long-term treasuries and MBS.
 - ▶ What will happen when it chooses to undo the QE?

Taking Stock