

# Chapter 8 : Business Cycle Models with Flexible Prices and Wages

EE312

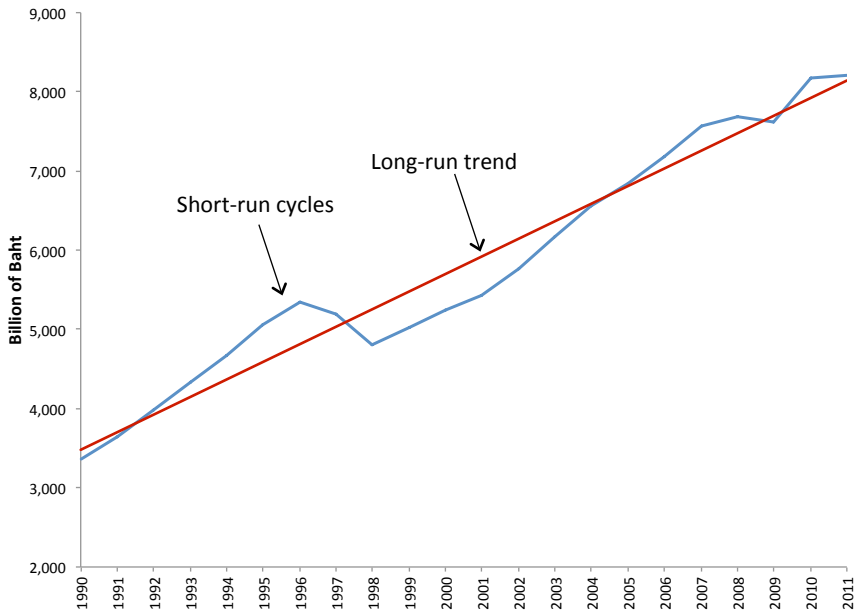
Macroeconomics, Stephen Williamson, Chapter 13

April 2014

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- The macro-economy is characterized by short-run fluctuations — business cycles.
- Two classes of models explaining **business cycles**:
  - **Market clearing equilibrium models**: real business cycles, segmented markets.
  - **Keynesian models**: equilibrium in which markets do not clear — sticky-wage and sticky-price models.

## Thailand's GDP Trend (CVM 2002)



- John Maynard Keynes: '*The General Theory of Employment, interest and Money*' (1936).
  - Unemployment equilibrium and fiscal policy.
- **Keynesian macroeconomics** (1950s-1960s).
  - Sticky-price, sticky-wage models.
  - Short-run non-neutrality of money.
  - Markets are defective and slow to adjust.
  - Fiscal policy for economic stabilization.

- The crisis of Keynesianism of the 1970s.
  - High inflation and unemployment — stagflation.
- **Monetarism** (1970s-1980s): Milton Friedman.
  - Ineffective fiscal policy.
  - Short-run non-neutrality of money: the money surprise model.
  - The constant money growth rule and laissez-faire.
- **Robert Lucas's critique (1976)**: “Macroeconomic modeling should be based on microeconomic foundations.”

- Both Keynesianism and monetarism assume the adaptive expectations hypothesis.
- Economic agents make repeated mistakes.
- John F. Muth, Robert Lucas.
  - Expectations are formed on the basis of all available relevant information on the variable being predicted.
  - Individuals use available information intelligently.

- Robert Lucas, Thomas Sargent, Neil Wallace, Robert Barro (the 1980s – present).
  - Macroeconomic models with micro-foundations.
  - Representative agent models.
  - The rational expectations hypothesis.
  - Competitive equilibrium: markets clear at all times.
  - New classical policy ineffectiveness proposition.



- Robert Emerson Lucas, Jr. (b1937), University of Chicago, Nobel Prize 1995.
- Thomas J. Sargent (b1943), New York University, Nobel Prize 2011.

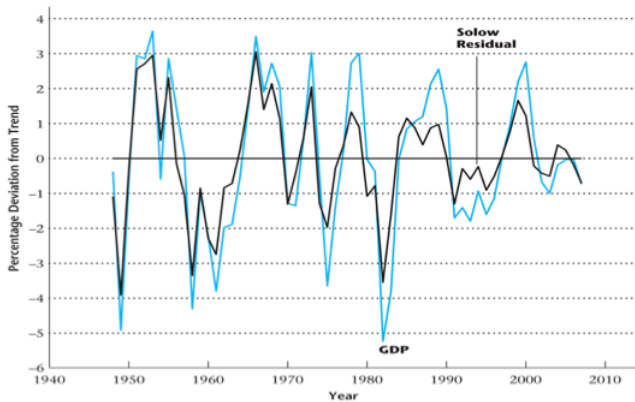
- New Keynesian economics (the 1990s-present): Gregory Mankiw, David Romer.
  - Micro-foundations and rational expectations.
  - Market failures and imperfect competition.
  - Price-wage stickiness; markets do not clear.
  - Menu cost models, efficiency wage models, insider-outsider models.
  - Fiscal and monetary policy for stabilization.

- New classical models of the business cycle.
- Finn Kydland and Edward Prescott (1982).
  - Uses of standard growth models subject to random productivity shocks.
- Short-run fluctuations are mainly results of random productivity (i.e., real) shocks.
  - Trends in Solow residuals tracked trends of real GDP.

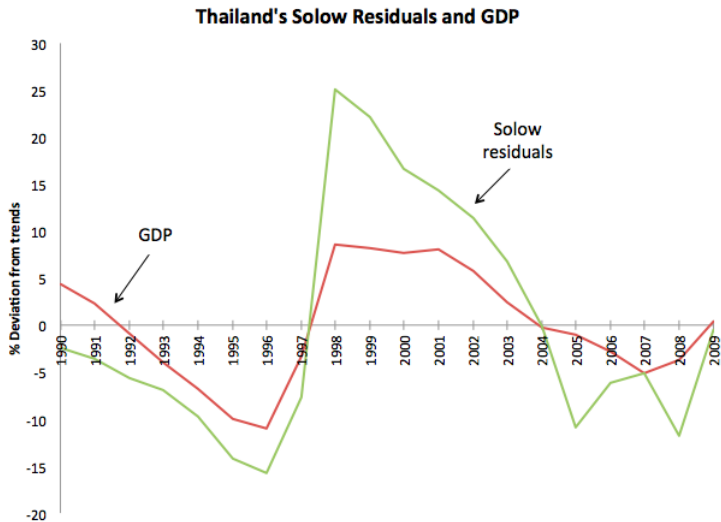


- Finn E. Kydland (b1943), University of California, Santa Barbara. Edward C.
- Prescott (b1940), University of Chicago.
- Nobel Prize 2004.

# The US's Solow residual and GDP



# Thailand's Solow Residuals and GDP



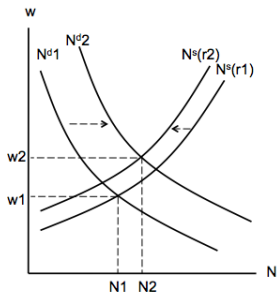
## Changes in total factor productivity

- Changes in  $z$ : the same inputs produce more/less output.
  - Weather, technological innovations, changes in government regulations, energy prices, etc.
- Total factor productivity shocks are persistent in its initial trend.
  - A higher current  $z$  tends to be followed by a higher future  $z'$ .

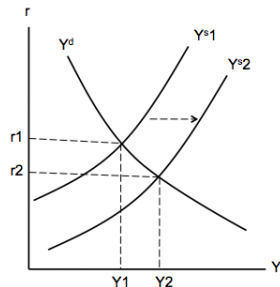
# Increases in $z$ and $z'$

- Increases in  $Z$  (For the details, read CH5 - 6 - 7)

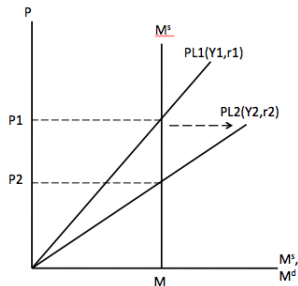
## Labour Market



## Output Market

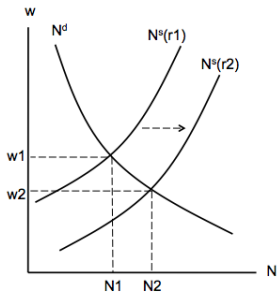


## Money Market

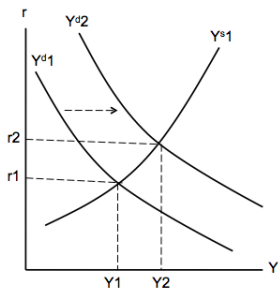


- Increase in  $Z'$  (For the details, read CH5 - 6 - 7)

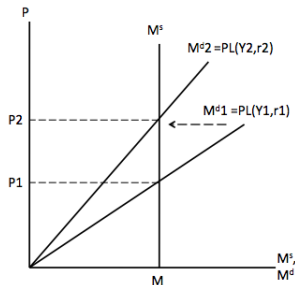
## Labour Market



## Output Market

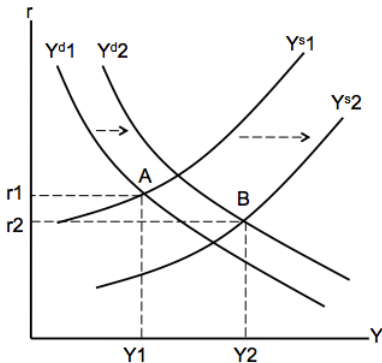


## Money Market



- **STEP 1 :**

- The effect of  $z$  is stronger than  $z'$ , so the real interest rate falls.

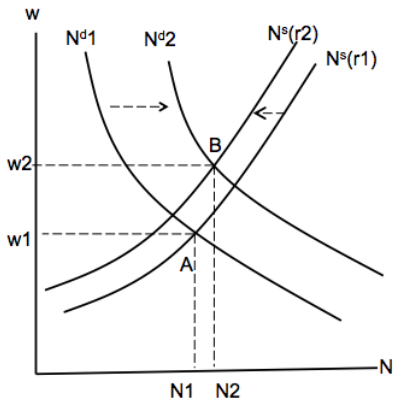


## Stronger effect of current $z$

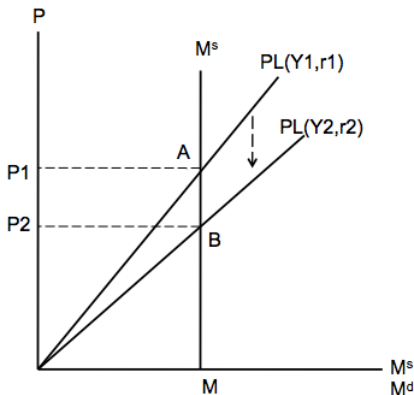
- The effect of the increase in current  $z$  (on  $Y^s$ ) occurs in the current period.
- The effect of the expected increase in future  $z'$  on current investment (on  $Y^d$ ) is weaker.
  - The increase in future real income is smaller than the increase in current real income.
  - Consumption smoothing results in a small increase in current consumption (and  $Y^d$ ).

- **STEP 2 : effect of falling  $r$  on  $N^S$**

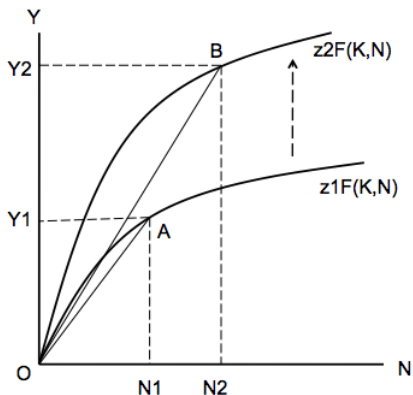
- The lower real interest rate reduces labor supply.
- $N^S$  shifts left and partially offsets  $w$  and  $N$ .
- Effect of  $r$  is small, so  $N^d$  dominates.



- **STEP 3 : effect on Money Market**
- Higher  $Y$  and lower  $r$  cause nominal  $M^d$  to shift right (increase).
- The price level drops.



- **STEP 4 : effect on average productivity**
- With rising  $z$ , higher  $Y$  and  $N$ , average labor productivity  $\left(\frac{Y}{N}\right)$  also increases (slope  $OB >$  slope  $OA$ ).



- A persistent increase in  $z$  (and  $z'$ ) results in:
  - Higher employment and the real wage (strong  $Y^S$ ).
  - Output increases; the real interest rate decreases (weaker effect of  $z'$  on  $C^d$ ,  $I^d$  and  $Y^d$ ).
  - The price level decreases as  $M^d$  increases.
  - Higher consumption (rising current and future income and lower real interest rate).
  - Investment increases (higher  $MP'_K$  and lower  $r$ ).
  - Average labor productivity increases.

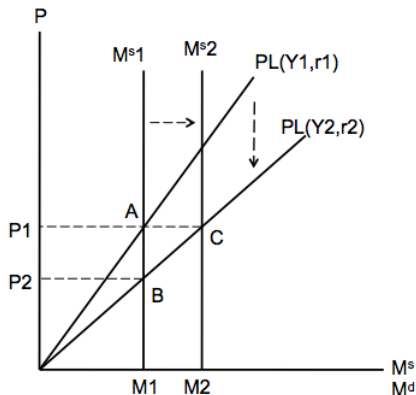
**Table 12.1** Data Versus Predictions of the Real Business Cycle Model with Productivity Shocks

| <b>Variable</b>            | <b>Data</b>     | <b>Model</b>    |
|----------------------------|-----------------|-----------------|
| Consumption                | Procyclical     | Procyclical     |
| Investment                 | Procyclical     | Procyclical     |
| Price Level                | Countercyclical | Countercyclical |
| Money Supply               | Procyclical     | -               |
| Employment                 | Procyclical     | Procyclical     |
| Real Wage                  | Procyclical     | Procyclical     |
| Average Labor Productivity | Procyclical     | Procyclical     |

- Most business cycle models have neutral money: a level change in  $M^S$  has no effect on real variables; only the price changes.
- Thomas Cooley and Gary Hansen (1989) incorporates endogenous money.
  - The money supply includes bank deposits which vary with banking activity, output and income.
  - The central bank also varies the money supply to stabilize the price level.

# Endogenous money

- A  $M^d$  right-shift causes the price to fall ( $P_1$  to  $P_2$ ).
- Endogenous money increases ( $M_1$  to  $M_2$ ) to stabilize the price at  $P_1$  (at C).



## Money supply: cause or effect?

- The money supply trends lead trends in GDP.
  - The Keynesians and monetarists.
- The problem of statistical causality.
  - Real activity requires prior bank financing.
  - The money supply appears to lead real activity.
- The central bank correctly anticipates the real changes and adjusts the money supply to preempt the real effect.

## Government role

- Money is neutral, so no role for monetary policy.
- Markets always clear, so no role for government to improve efficiency.
  - No shortages, no excess output.
  - The labor market is in equilibrium; all unemployment is 'voluntary'.
- Short-run fluctuations are optimal responses to changes in total factor productivity.
  - Consumers continue to maximize utility while firms continue to maximize profits.
- Only government role in market failures and distortions (to reduce welfare loss).

- Real business cycle models fit the cycle data better than other models.
- RBC models are internally consistent and based on solid micro foundations.
- **Criticisms:** the measurement of total factor productivity (through the Solow residual) involves statistical errors.
  - Statistical calculation of  $z$  is not independent of  $Y$ .

$$Y = zF(K, N)$$

$$z = \frac{Y}{F(K, N)}$$

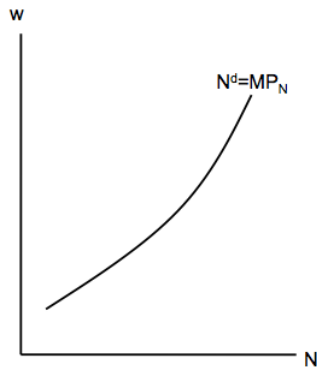
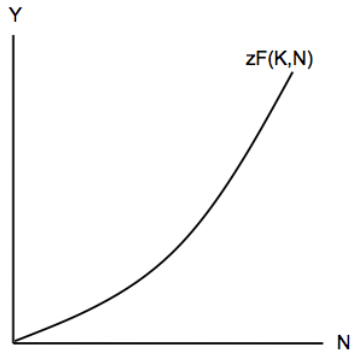
- During a boom, K and N are fully utilized.
  - Y is high, so z appears to be high. |
- In a recession, K and N are not laid off but only underutilized.
  - The uses of K and N are artificially high.
  - But lower output (Y), so z appears to be low.
- z appears to be 'procyclical'.

- Peter Diamond (1982), Russell Cooper and Andrew John (1988), Jess Benhabib and Roger Farmer (1994), Roger Farmer and Jang-Ting Guo (1994).
- Keynes' 'General Theory' (1936): failure of private-sector workers and producers to coordinate their actions results in chronic unemployment.

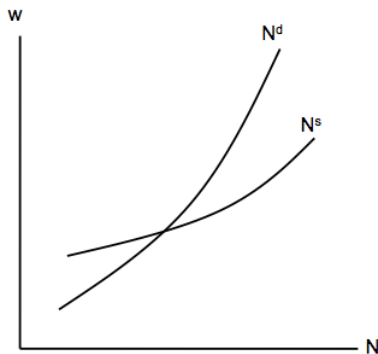
## Strategic complementarities

- One person's willingness to engage in some activity increases with the number of other people engaged in that activity.
  - Going to a party, football match, concert, etc.
  - Two possible outcomes (multiple equilibria): no one goes or everyone goes.
- One producer's decision to produce depends on what other producers are doing.
- The economy with strategic complementarities yields multiple equilibria:
  - High output and employment versus low output and employment.
  - Individual firms have constant returns to scale.
  - But increasing returns to scale at the aggregate level.
- The aggregate production function is convex.
  - The marginal product of labor (and labor demand) has a positive slope.

# Production function with IRS

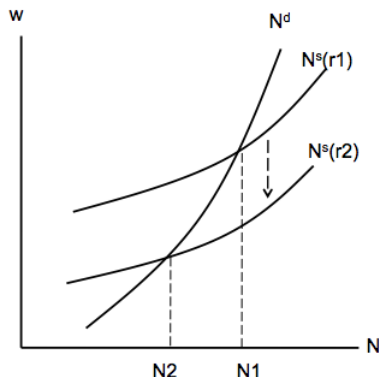


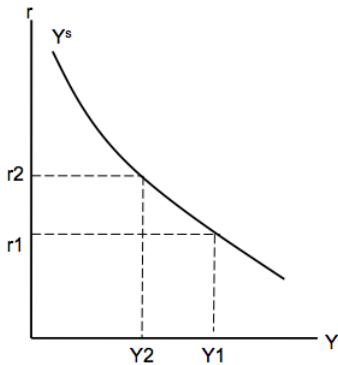
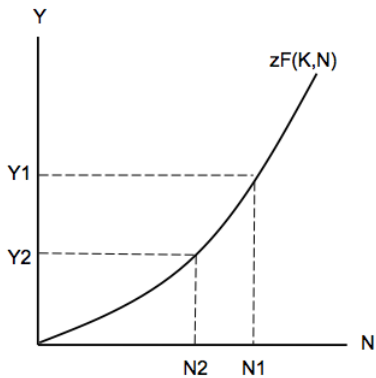
- With coordination failure,  $N^d$  must be steeper than  $N^s$ .



## Output supply curve

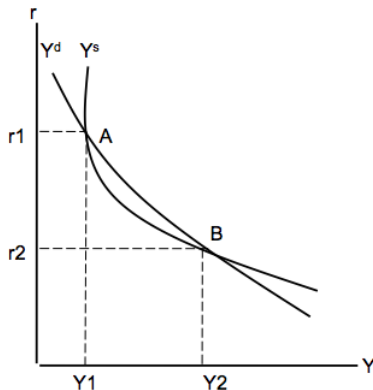
- Assume 'r' to rise from  $r_1$  to  $r_2$ .
- Labor supply increases;  $N^S$  shifts right.
- But employment decreases due to positively-sloped  $N^d$ .



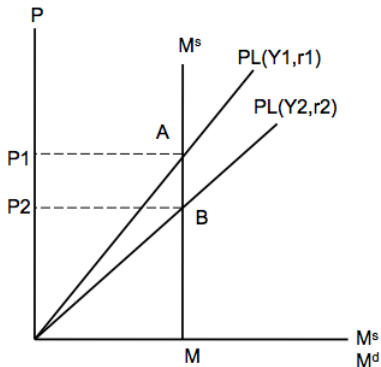
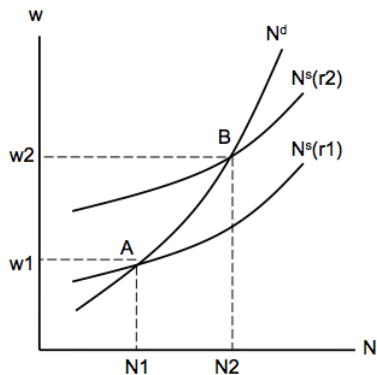


## Example of coordination failure

- A = 'bad' equilibrium (high  $r$  and  $P$  but low  $y$  and  $w$ ).
- B = 'good' equilibrium (low  $r$  and  $P$  but high  $y$  and  $w$ ).

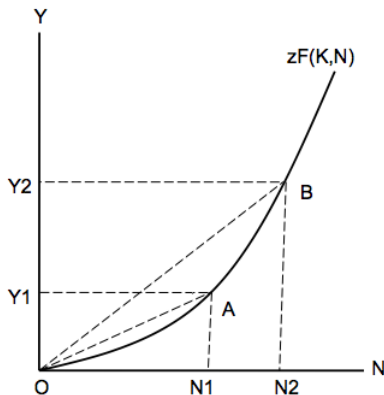


# 'Bad' and 'good' equilibria



## Average labor productivity

- Slope of OA and OB = average labor productivity ( $AP_N$ ).
- High  $AP_N$  at B but low at A.

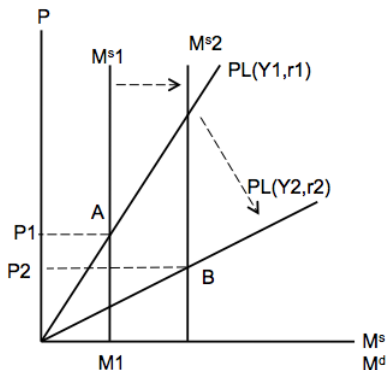


- The economy may get stuck at 'bad' equilibrium due to general pessimism and negative expectations.
- Business cycles result when firms and consumers are alternately optimistic and pessimistic.
  - The economy alternates between the 'bad' and the 'good' equilibria.
  - Keynes' 'General Theory': investors' animal spirits.

- Extraneous events unrelated to the fundamentals (technology, preferences, endowments) may cause business cycles.
- Events trigger sudden changes in expectations and movement towards the other equilibrium.
- Changes in the money supply (monetary policy) may act as a sunspot variable.
  - High and low  $M_s$  triggers optimism and pessimism, respectively.

# Money supply as a sunspot

- Changes in  $M^S$  trigger alternate movements between A and B.



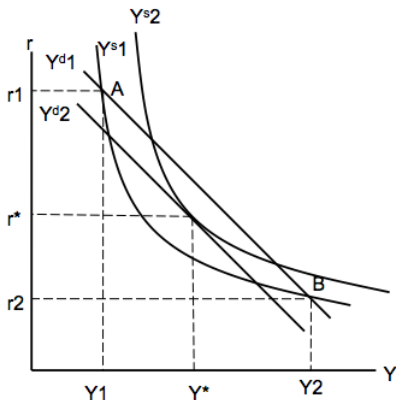
## The US's data and the coordination failure model

| <b>Variable</b>            | <b>Data</b>     | <b>Model</b>    |
|----------------------------|-----------------|-----------------|
| Consumption                | Procyclical     | Procyclical     |
| Investment                 | Procyclical     | Procyclical     |
| Price Level                | Countercyclical | Countercyclical |
| Money Supply               | Procyclical     | Procyclical     |
| Employment                 | Procyclical     | Procyclical     |
| Real Wage                  | Procyclical     | Procyclical     |
| Average Labor Productivity | Procyclical     | Procyclical     |

- Government action could affect the economy's movement towards 'good' equilibrium.
  - Government and the central bank encourage 'positive' sentiment among firms and consumers.
- Possibility for government to eliminate business cycles altogether.
  - Adjustment in government spending or taxes to achieve a unique equilibrium.

# Business cycles eliminated

- A decrease in  $G$  shifts  $Y^d$  left and  $Y^S$  right.
- Multiple equilibria are eliminated.
- Single equilibrium  $(r^*, Y^*)$  results.



- A decrease in government spending ( $G$ ) affects both output demand and output supply.
  - Current expenditure decreases, shifting  $Y_d$  to the left.
  - The PV of taxes decreases and lifetime wealth increases; current labor supply decreases.
  - $Y^s$  shifts right (due to IRS in the model).
- Social welfare is worse than 'good' equilibrium (B) but with less uncertainty and fluctuations.

- The model fits the cycle data well.
- Self-fulfilling expectations (optimism and pessimism) can generate business cycles.
- But the model rests on the IRS assumption.
  - labor demand is sloped upwards and steeper than labor supply.
  - Weak evidence of IRS in the economy.
- Expectations are the trigger, but they are unobservable.