

LECTURE 19: MONEY AND BUSINESS
CYCLES II: STICKY PRICES AND NOMINAL
WAGE RATES
See Barro Ch. 16

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Fall, 2017

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- ▶ So we'll introduce a second model: the sticky price/wage model

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- ▶ You could imagine there are **menu costs**, costs of changing prices on your menu
- ▶ If your prices are only a tiny bit out of whack, it's not worth it to change them

IMPERFECT COMPETITION

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- ▶ So let's think about the firm's problem now

FIRM'S PROBLEM-I

- ▶ Firm j has production function Y_j :

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- ▶ How does the firm choose how much to produce? (What price to set?)
- ▶ It needs to consider the marginal cost of production (how much extra it costs to make one more unit) and the marginal benefit

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- ▶ The markup is therefore $\frac{\text{What I get}}{\text{What I pay}} = \frac{P_j}{\frac{w}{MPL}}$

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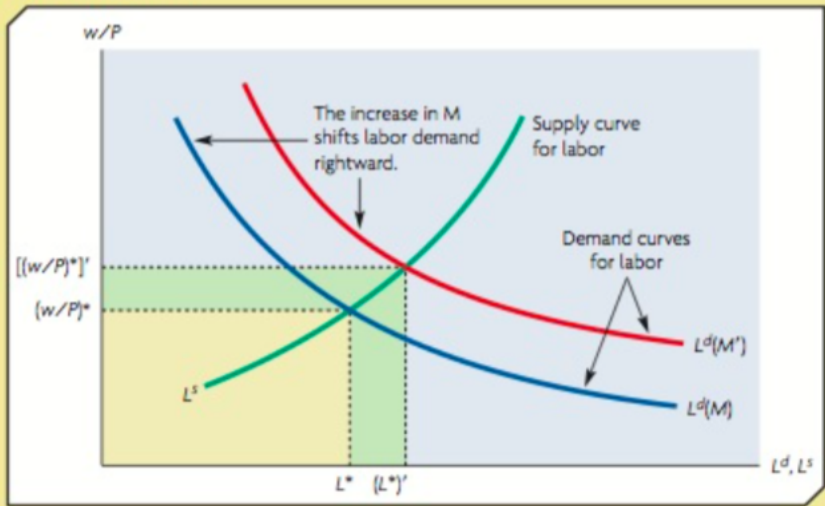
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- ▶ $M \uparrow, P \cdot \Rightarrow C \uparrow \Rightarrow L \uparrow \Rightarrow w \uparrow$

Figure 16.1 *Effect of a Monetary Expansion in the New Keynesian Model*



IMPROVEMENT FROM THE PRICE MISPERCEPTIONS MODEL

- ▶ In the price misperceptions model, we tricked people into thinking they were productive when they weren't
- ▶ When went up, real wage went down
- ▶ In this model, labor demand shifts out so real wage increases
- ▶ Real wage in this model is countercyclical
- ▶ This is a real improvement, because it was a serious failure of the price-misperceptions model!

A MILD FAILURE

- ▶ Our equilibrium business cycle model and the data agree: average product of labor is procyclical
- ▶ When A went up, Y/L went up
- ▶ In the New Keynesian model, A is fixed
- ▶ In NK, when L increases, Y/L will decrease a little (why?)
- ▶ Consequently, NK predicts countercyclical average product of labor (contrary to data)
- ▶ One response is to have firms “hoard labor” in the model: they don't fire a lot of non-working laborers, so labor productivity goes down in recessions and up in booms

THE LONG RUN

- ▶ In the short run, prices are sticky
- ▶ In the long run, they're flexible

$$\text{Markup Ratio} = \frac{P_j}{\frac{w}{MPL_j}}$$

- ▶ When the price level P_j was fixed for all firms, the overall price level, P was fixed, so real wages could increase when M increased
- ▶ As we free up price, firms slowly increase their prices: as that happens real wage falls and our story reverses
- ▶ In the long run, money is neutral: with freed-up prices in the long run, we're back to our old model
- ▶ How sticky are prices?

HOW STICKY ARE PRICES? BILS AND KLENOW-I

Category	Freq	Months	Subs	NSubs	Weight
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- ▶ “Months” is average time between price changes
- ▶ Subs is substitution rate (new product because old one gone)
- ▶ NSub is average noncomparable item substitution rate
- ▶ Weight is CEX weight

HOW STICKY ARE PRICES? BILS AND KLENOW-II

Category	Freq	Months	Subs	NSubs	Weight
Eggs	61.8	1	0.64	0.26	0.107
Lettuce	62.4	1	0.06	0.05	0.064
Utility natural gas service	64.2	1	0.34	0.08	1.012
Airline fares	69.1	0.9	0.45	0.25	0.829
Tomatoes	71	0.8	0.22	0.03	0.078
Premium unleaded gasoline	76.2	0.7	2.81	0.89	0.998
Mid-grade unleaded gasoline	77.5	0.7	2.55	0.82	0.865
Regular unleaded gasoline	78.9	0.6	2.56	0.83	1.031

HOW STICKY ARE PRICES? BILS AND KLENOW-III

Category	Freq	Months	Subs	NSubs	Weight
Bicycles	19.6	4.6	6.94	1.1	0.047
Automotive body work	19.7	4.6	10.11	1.45	0.098
Window coverings	19.9	4.5	2.13	0.71	0.038
Other condiments (excluding olives, pickles, relishes)	20.1	4.5	2.48	1.35	0.135
Intercity bus fare	20.3	4.4	1.31	0.09	0.051
China and other dinnerware	20.4	4.4	5.19	2.34	0.042
Outboard motors and powered sports vehicles	20.5	4.3	6.98	0.96	0.176

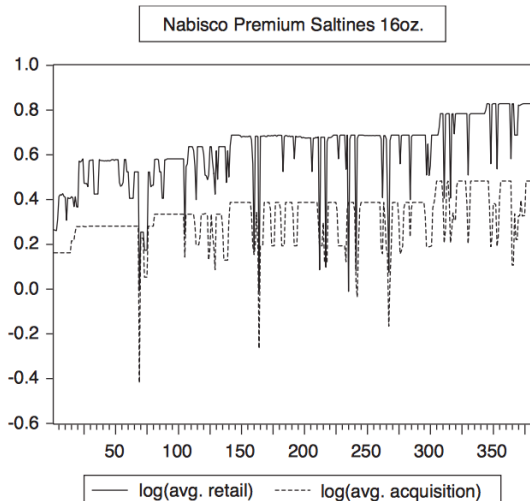
HOW STICKY ARE PRICES? BILS AND KLENOW-IV

Category	Freq	Months	Subs	NSubs	Weight
Coin-operated apparel laundry and dry cleaning	1.2	79.9	0.53	0.17	0.148
Vehicle inspection	1.4	69.9	0.00	0.00	0.033
Driver's license	1.8	56.3	1.04	0.39	0.023
Coin-operated household laundry and dry cleaning	2.1	46.4	0.00	0.00	0.014
Intracity mass transit	2.5	40.2	0.66	0.14	0.223
Local automobile regis- tration	2.8	34.8	3.26	0.66	0.019
Legal fees	2.9	34.3	0.48	0.37	0.289
Vehicle tolls	3.2	31.2	0.70	0.00	0.059

HOW STICKY ARE PRICES? BILS AND KLENOW-V

Category	Freq	Months	Subs	NSubs
Mean	26.1	3.3	3.4	1.7
Median	20.9	4.3	1.7	0.8

HOW STICKY ARE PRICES? ROTEMBERG 2005



Menu prices seems like a terrible model (at least for some firms)

HOW STICKY ARE PRICES? TAKEAWAY

- ▶ Some prices change very frequently, particularly
 - ▶ Groceries/food
 - ▶ Gasoline
 - ▶ Clothing
 - ▶ Cars, computers
- ▶ Some a bit less frequently, like
 - ▶ Cable television
 - ▶ Furniture
 - ▶ Automotive repair and body work
- ▶ Some very infrequently, like
 - ▶ Government services and fees
 - ▶ Coin-related services (newspapers, laundry, vending)
 - ▶ Medical services
- ▶ If you think the first are extremely competitive and the last aren't, this might make sense in a monopolistic competition framework in which some firms have markups and sticky prices and other's don't

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- ▶ What should the New Keynesian model predict about the cyclical pattern of:
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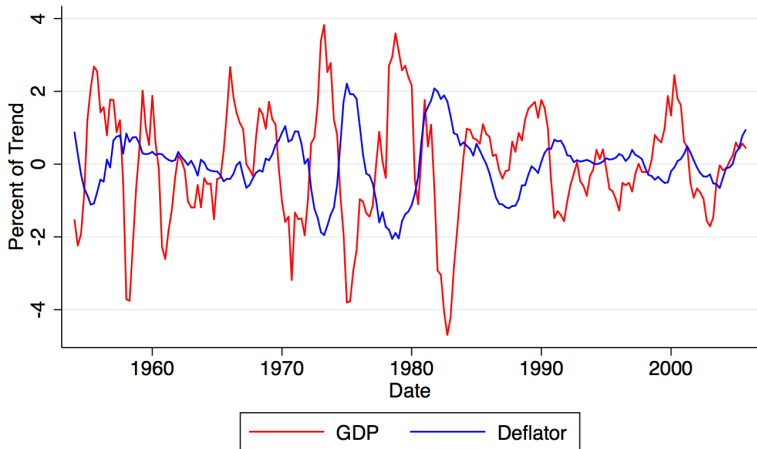
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CYCLICALITY OF THE PRICE LEVEL: BARRO REPLICATION

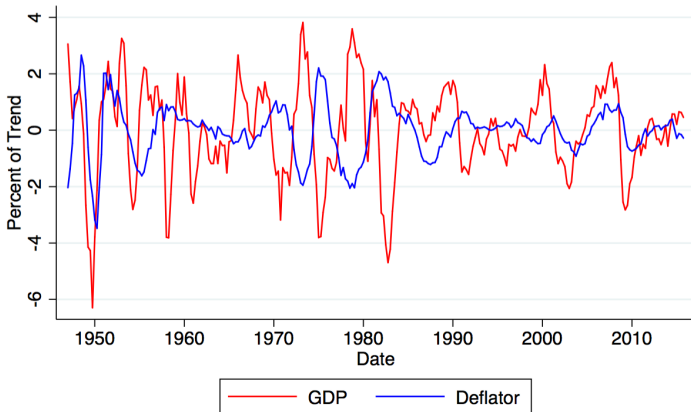
Cyclical GDP and Price Level 1954-2005



Correlation of -.6

CYCLICALITY OF THE PRICE LEVEL: EXTENDED EVIDENCE

Cyclical GDP and Price Level
1947-2015



Correlation of $-.18$

CYCLICAL PATTERNS OF MACROECONOMIC SUMMARY

Variable	Data	Eqm. business cycle model	Price misper- ceptions	NK
M	pro*	pro	pro	pro
P	counter	counter	pro	counter
L	pro	pro	pro	pro
$\frac{w}{P}$	pro	pro	counter	pro
$\frac{Y}{L}$	pro*	pro	counter	counter

COMPARING PREDICTIONS

- ▶ New Keynesian model succeeds on real wage rate, which price-misperceptions failed on
- ▶ Fails at average product of labor, but...
 - ▶ Average product of labor is only weakly procyclical
 - ▶ Even less so recently
 - ▶ And labor hoarding may be able to fix this
- ▶ We have two viable candidates to explain the business cycle

AGGREGATE DEMAND

- ▶ We noted that an increase in money supply that raises wages but not prices (because they're sticky) can increase GDP
- ▶ But if prices are sticky, then any increase in aggregate demand can increase GDP
- ▶ Say we're able to get households to save less
- ▶ Firms see an increase in demand for their goods but can't change prices
- ▶ They hire more labor, wages go up, and the same story holds

MONEY AND NOMINAL INTEREST RATES

- ▶ In our model, we've been having "the government" choose P by choosing M
- ▶ And what about the short run? Isn't P fixed?
- ▶ The Federal Reserve doesn't control M directly...
- ▶ Instead, it controls the Federal Funds rate, the rate at which banks loan to one another overnight
- ▶ This in turn will control the money supply and price level

FOMC

- ▶ The Federal Reserve's Federal Open Market Committee (FOMC) controls OMO
- ▶ New York trading desk buys and sells bonds for money
- ▶ If it wants overnight interest to be higher, it sells bonds and takes money out of circulation
- ▶ If it wants overnight interest to be lower, it buys bonds and prints money

- ▶ Recall that:

$$M = PL(Y, i)$$

- ▶ But in the short run, P is fixed!
- ▶ Then if M increases, in order for people to hold the right amount of money, either L , Y , or i must change.
- ▶ Typically, it's i . If money is printed, interest rates lower so people are willing to hold it.

FOMC: IN ENGLISH

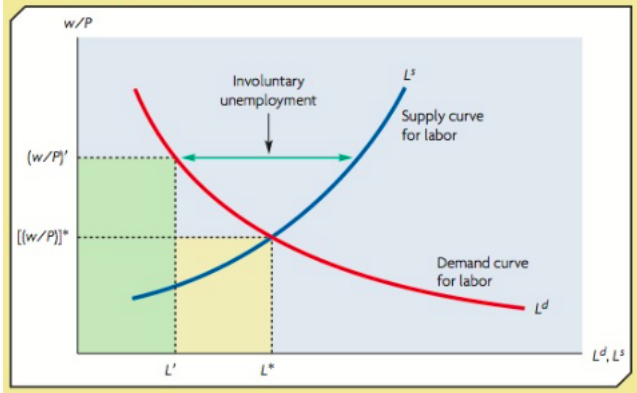
- ▶ We want to lower the amount of money in circulation
- ▶ We sell bonds: now people have more bonds, and less money
- ▶ Banks need to borrow money from one another to keep up with reserve requirements
- ▶ Now there's less supply of money
- ▶ In order for supply to equal demand, the “price” (interest rate) must shift up.
- ▶ Selling bonds increases the interest rate: buying bonds will lower the interest rate

KEYNESIAN MODEL

- ▶ We've seen the New Keynesian model and the equilibrium business cycle model
- ▶ That's essentially all of modern macroeconomics: microfounded and focusing on intertemporal choice and optimization
- ▶ The New Keynesian model is the equilibrium business cycle model but with sticky prices and monopolistic competition
- ▶ There's an older version that isn't microfounded: the Keynesian model
- ▶ We'll have sticky nominal wages stuck above what market-clearing would require, like a price floor

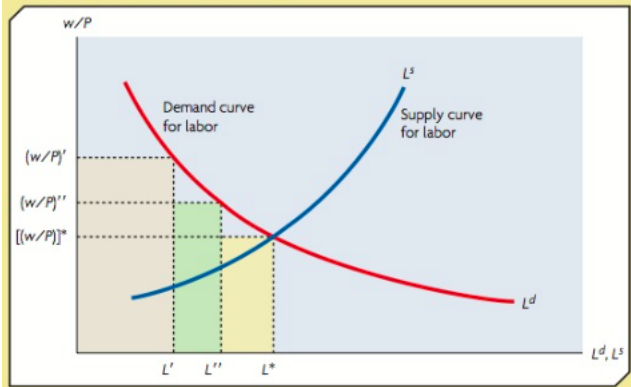
KEYNESIAN MODEL

Figure 16.3 *The Labor Market in the Keynesian Model with Sticky Nominal Wage Rates*



KEYNESIAN MODEL

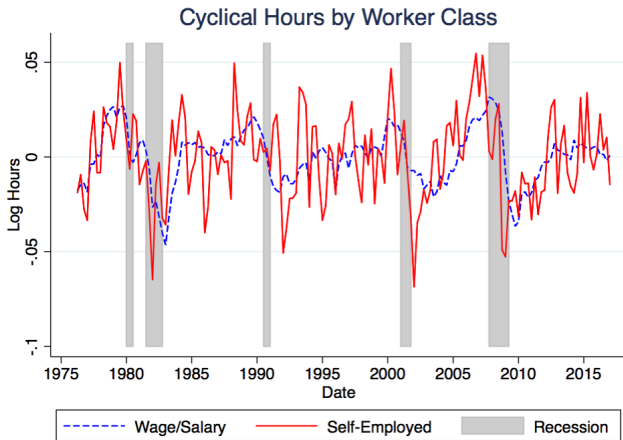
Figure 16.4 *Effect of Monetary Expansion in the Keynesian Model with Sticky Nominal Wage Rates*



LONG-TERM CONTRACTS AND STICKY NOMINAL WAGE RATES

- ▶ An increase in money causes an increase in inflation which causes a lowering of real wages
- ▶ This helps to clear the market
- ▶ But it also means that real wages are high during recessions and low during booms: the opposite of what we've seen in the data
- ▶ This failure is part of why the NK model was developed

GALLEN (2018)



Sticky wages aren't likely to be the problem if self-employed workers also reduce hours!

CONCLUDING BARRO

- ▶ You now have a coherent model in which you can discuss:
 - ▶ Consumption/savings/investment tradeoffs
 - ▶ Capital accumulation and utilization
 - ▶ Labor/leisure tradeoffs
 - ▶ Growth and business cycles
 - ▶ Government taxation, debt, deficits, expenditure, and transfers
- ▶ As well as three models to understand monetary policy
 - ▶ Equilibrium business cycle model (monetary neutrality)
 - ▶ Price-misperceptions model
 - ▶ New Keynesian sticky price model
- ▶ This finishes off Barro: for the rest of the semester we're on financial institutions and the financial crisis

REFERENCES

- ▶ Gallen, Trevor S., 2018. “Is the labor wedge due to rigid wages? Evidence from the self-employed.” *Journal of Macroeconomics*, 55, 184-198.