

J. Bradford DeLong: Econ 2: UC Berkeley

Problem Set 6

Due April 30, 2014

A. Inflation

Right now inflation is not a problem in pretty much any North Atlantic economy. Nor is there any reasonable prospect that inflation will become a problem in the next five years or so. But someday inflation will become a problem: this problem looks forward to that day...Supposed the inflation rate π in this year t is given by the equation:

$$\pi_t = E(\pi_t) + \beta(u^* - u_t)$$

With:

- $E(\pi_t)$ the expectation last year of what inflation would be this year
- β a parameter, equal to 0.5
- u^* the “natural” rate of unemployment: that at which, income, production, and expenditure are equal to potential output
- u_t this year’s actual rate of unemployment

1. Baseline: Suppose, with the parameter $\beta = 1/2$, that inflation expectations for this year $E(\pi_t) = 4\%$, with the natural rate of unemployment $u^* = 5\%$ and the actual unemployment rate this year u_t equal to 3% . What is this year’s rate of inflation π_t ? What would π_t be if expected inflation were 2% ? What would π_t be if expected inflation were 2% and the natural rate of unemployment were 7% ?

2. Static Expectations: Suppose that inflation expectations for this year are $E(\pi_t) = 2\%$, and suppose inflation expectations remain at 2% per year for each of the next five years. Suppose that the Federal Reserve thinks that the natural rate of unemployment $u^* = 4\%$, and sets interest rates so as to attain that rate of unemployment for each of the next five years. But also suppose the actual natural rate of unemployment is 6% . What will the inflation rate be this year and in each of the next five years?

3. Static Expectations II: Suppose that inflation expectations for this year $E(\pi_t) = 4\%$, and inflation expectations remain at 4% per year for each of the next five years. Suppose that the Federal Reserve thinks that the natural rate of unemployment $u^* = 8\%$, and sets interest rates so as to attain that rate of unemployment for each of the next five years. But also suppose the actual natural rate of unemployment is 6%. What will the inflation rate be this year and in each of the next five years?

4. Adaptive Expectations: Suppose that inflation expectations for this year $E(\pi_t) = 3\%$. Suppose that the Federal Reserve thinks that the natural rate of unemployment $u^* = 5\%$, and sets interest rates so as to attain that rate of unemployment for each of the next five years. But also suppose the actual natural rate of unemployment is 6%. And suppose that in the future each year's expected inflation is the past year's actual inflation. What will the inflation rate be this year? What will the inflation rate be next year?

5. Adaptive Expectations II: Suppose that inflation expectations for this year $E(\pi_t) = 2\%$. Suppose that, as in (1b) the Federal Reserve thinks that the natural rate of unemployment $u^* = 4\%$, and sets interest rates so as to attain that rate of unemployment for each of the next five years. But also suppose the actual natural rate of unemployment is 6%. And suppose that in the future each year's expected inflation is the past year's actual inflation. What will the inflation rate be this year and in each of the next five years?

B. Rational Inflation Expectations

1. Plausibility: In the scenario of (A5), is it reasonable to suppose that the expected inflation rate in year $t + 6$ will still be “adaptive”—that it will still be equal to what inflation was in year $t+5$? Explain why or why not.

2. Rational Expectations: In the scenario of (A5), suppose that in year $t + 6$ people shift their expectations: instead of expected inflation being equal to the past year’s actual inflation, it is 1% higher than the past year’s actual inflation. What then will the inflation rate be in year $t+6$ if the Federal Reserve continues to set demand so that the unemployment rate is 4%? Explain why.

3. Rational Expectations II: With the inflation rate π in this year t given by the equation: $\pi_t = E(\pi_t) + \beta(u^* - u_t)$, with the parameter $\beta = 1/2$ and the natural rate of unemployment $u^* = 6\%$... Suppose that the economy has rational expectations, in which $E(\pi_t) = \pi_t$... What will the unemployment rate u_t be, and why?

C. The Government Budget

“An insurance company with an army”—that’s Paul Krugman’s line about what the U.S. federal government does and is. Go to the Congressional Budget Office’s 2014 Economic and Budget Outlook <http://www.cbo.gov/sites/default/files/cbofiles/attachments/45010-Outlook2014_Feb.pdf> and read through it...

1. Health Spending: How large, as a share of GDP, were the federal government’s health-care spending programs—Medicare, Medicaid, SCHIP, plus exchange subsidies—in 1980? In 2000? How large as a share of GDP does the Congressional Budget Office project they will be in 2024?

2. Defense Spending: How large, as a share of GDP, were the federal government’s defense spending programs in 1980? In 1990? In 2000? In 2008? How large as a share of GDP does the Congressional Budget Office project they will be in 2024?

3. Social Security Spending: How large, as a share of GDP, was the federal government’s Social Security spending program in 1980? In 1990? In 2008? How large as a share of GDP does the Congressional Budget Office project they will be in 2024?

4. Total Spending: How large, as a share of GDP, were the federal government’s total spending program in 1980? In 1990? In 2000? In 2008? How large as a share of GDP does the Congressional Budget Office project they will be in 2024?

5. National Debt: How large, as a share of GDP, was the net national debt held by the public in 1980? In 1990? In 2000? In 2008? How large as a share of GDP does the Congressional Budget Office project it will be in 2024?

D. Long-Run Economic Growth

Start by making a few very simple but very stylized assumptions:

- A 1% increase in the land and natural resources N available for human beings to use would increase total production Y by 0.2%.
- A 1% increase in the produced capital stock K available for human beings to use would increase total production Y by 0.3%.
- A 1% increase in the amount of labor L available for society would increase total production Y by 0.5%.
- A 1% increase in the efficiency of labor E due to better technology and better organization would increase total production Y by 0.5%.

We summarize these assumptions in one equation:

$$Y = (K)^{0.3}(N)^{0.2}(E \times L)^{0.5}$$

1. Malthus: Suppose that the supply of natural resources N is fixed at $N = 1$, that savings produce a capital stock K that is always equal to three times annual output Y , and that when Y/L --production per year per capita--rises above the "subsistence" level of \$500, population grows to drive it back down to \$500. And suppose the population is always twice the labor force. Use these assumptions to eliminate Y , N , and K from the equation, and so derive an expression for the labor force L and the population as a function of the efficiency of labor E .

2. Malthus II: Start with your answer to (D1)--your equation for the labor force/population L as a function of the efficiency of labor E . The world had a labor force of 80 million in the year 1 and of 250 million in 1501. Assuming population under Malthusian conditions is twice the labor force, at what rate in percent per year did the population grow from 1 to 1501? At what rate did the efficiency of labor grow?

3. Kuznets: Since 1900 the world population has grown from 1.5 billion to 7.4 billion, with the labor force still a constant half of global population, and total world real output has grown from \$1.8 to \$56 trillion/year (in 2014 purchasing-power dollars). Assuming that the stock of natural resources has remained constant and that the capital-output ratio K/Y has remained constant, how rapidly has the labor force/population grown? Average real income per worker Y/L ? The efficiency of labor E ?

4. Kuznets II: Suppose that between today and 2100 the world population grows from its current 7.4 billion to stabilize at 10 billion. Suppose output per worker grows at the same rate it has grown since 1900. And suppose savings makes the capital stock three times annual output. What will total real GDP be in 2100?

5. Kuznets III: Start from your answer in (D4) for 2100. Suppose global warming destroys half the economic value of natural resources and land. What then will total real GDP be in 2100?

E. Inequality

Suppose that ownership of income-earning property W --a wider concept than produced capital--is owned by a small elite! the 1%. And further suppose that the rate at which income is earned on property W is a real interest rate r determined by:

$$r = r_0 \times (W/(4Y))^{(-0.5)}$$

And the income of the 1% as a share of total income is:

$$1\% \text{share} = r \times W/Y$$

And suppose that next year's values for property W and total income Y in the economy are determined by:

$$W_{t+1} = (1 + r - \omega)W_t; Y_{t+1} = (1 + g)Y_t$$

With g , the growth rate of the economy, and ω , the wedge between the rate of return--what the 1% earn--and the rate of accumulation--what the 1% save and invest--being parameters of the model.

1. The Bargaining Power of Capital: What factors do you think might determine r_0 , the bargaining power of wealth? What social, political, and economic institutions and features might make this gauge high? What institutions and features might make it low?

2. The Wedge Between Profit and Accumulation: What factors do you think might determine ω , the wedge between the income the 1% receive on their wealth and how much they save and invest? What social, political, and economic institutions and features might make this wedge high? What institutions and features might make it low?

3. The Middle Ages, 1000-1500: Key parameters are:

- $r_0 = 7\%/year$: wealth has considerable bargaining power—largely because if you don't pay your tithes to the church you are likely to be damned, and if you don't pay your feudal dues to the nobles...
- $g = 0.1\%/year$: this is still a "Malthusian" age
- $\omega = 7.5\%/year$: medieval wars and plagues are very destructive, and a large share of the income of the rich is used for display or devoted to religious foundations

What, in the middle ages, are the equilibrium values of W/Y and $r \times W/Y$ to which the economy is tending?

4. The Gilded Age, 1850-1914: Key parameters are:

- $r_0 = 7\%/year$: the rich are less able to use force to extract wealth from the poor, but they do own highly-productive capital...
- $g = 1.2\%/year$: the Industrial Revolution has taken hold, and growth is rapid
- $\omega = 3.0\%/year$: the requirements of display are less in relative terms than in early eras, and both a long peace and a political order with the propertied firmly in control diminish the wedge

What, in the Gilded Age, are the equilibrium values of W/Y and $r \times W/Y$ to which the economy is tending?

5. The Twentieth Century, 1914-1980: Key parameters are:

- $r_0 = 7\%/year$: the rich are less able to use force to extract wealth from the poor, but they do own highly-productive capital...
- $g = 3.0\%/year$: this is a golden age of global economic growth...
- $\omega = 5.0\%/year$: it is also an age of totalitarian tyrannies, immensely destructive wars, and sharply progressive taxation both to finance war and as a reaction to the growing political power of the 99%

What, in the twentieth century, are the equilibrium values of W/Y and $r \times W/Y$ to which the economy is tending?

6. Today, 1980-2014: Key parameters are:

- $r_0 = 7\%/year$: the rich are less able to use force to extract wealth from the poor, but they do own highly-productive capital...
- $g = 1.5\%/year$: global limits are starting to curb growth...
- $\omega = 3.0\%/year$: the end of the totalitarian tyranny epoch brings peace; the fall of communism also enables a reaction against social democracy which makes taxation less progressive...

What, today, are the equilibrium values of W/Y and $r \times W/Y$ to which the economy is tending?

7. Tomorrow: Do you think the economy's wealth and income distribution will continue to head toward the steady-state equilibrium values you calculated in part E6? Why or why not?