IAS 107 Lecture: Inflation Economics III

J. Bradford DeLong
U.C. Berkeley
IAS107 Lecture Notes

http://delong.typepad.com/berkeley_econ_101b_spring/

March 31, 2011

Resolution for screencast capture: 1024x768
Assignments

- Problem Set 7 due April 5, 11 am
- April 7 class “optional”
- April 14 take-home assignment...
  - Due April 19 at start of class
Inflation Economics III

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The Consumer Price Index
The Inflation Rate
The Federal Reserve System

- The Federal Reserve Board
  - Chair (4-yr term)
  - Vice Chair (4-yr term)
  - Five members

- The FOMC
  - Chair of Fed is Chair of FOMC
  - President of FRBNY is Vice Chair of FOMC
  - Six FR Board members are voting members of FOMC
  - Eleven other regional bank presidents
    - Four of whom vote in any given year
    - Presidents of Cleveland and Chicago FRBs are special
The Federal Reserve

- Moves by consensus
- Was scarred by the inflationary episode of the 1970s
- Was further scarred by the depth of the recession of the 1982 “Volcker disinflation” downturn
- Is outside of its comfort zone right now
Normal Federal Reserve Procedures

- Increase the money supply by buying short-term U.S. Treasury bonds for cash
- Decrease the money supply by selling short-term U.S. Treasury bonds for cash
- Occasionally loan via the “discount window”
- Clear checks
- Regulate banks
  - The money multiplier $\mu$: how many dollars of liquid checking account deposits are banks willing to make for each dollar of bank reserves $R$?
Controlling the Money Stock

- “Money” = “assets people are holding only because they are ways of paying for things that they buy”

- The Federal Reserve makes money: “high powered money”
  - It does so by buying bonds and paying for them with:
    - Cash which the Treasury prints
    - Deposits which the Federal Reserve simply announces exist

- Banks offer individuals and businesses checking accounts
  - The proportionality between checking accounts and bank reserves
  - Are checking deposits too high relative to reserves? Banks can and do make them less attractive...

- $M = \mu R$
  - $\mu$ for the money multiplier, determined by banking system behavior
  - $R$ for high powered money, determined by the central bank
Why Would Anybody Allow Inflation?

- If you want to stop inflation, simply stop letting the money stock increase.
- But what if people expect inflation? Then not fulfilling those expectations will create high unemployment.
- And what if you want to goose the economy? Richard Nixon.
- And what if the government spends but cannot tax:
  - It can borrow for a while.
  - But then?
Hyperinflation

Mugabe vs Milosevic

Sources:
(Marks/USD) - Thomas J. Sargent, Rational Expectations and Inflation, 2nd ed. (New York: Harper Collins, 1993); (Dinar/USD) - Steve Hanke; (ZWD/USD) - Imara Asset Management Zimbabwe
$Z100,000,000,000,000,000
Ladies and Gentlemen, to Your i>Clickers...

- At the start of 2005, $1=Z10. By the end of 2008, $1=Z1,000,000,000,000,000,000,000,000,000,000. What was the average rate of inflation in % per day over those four years?
  - A. 1% per day
  - B. 4% per day
  - C. 10% per day
  - D. 100% per day
  - E. 1000% per day
An Answer: The Arithmetic of Compound Growth...

- $e = 2.71828$
  - A number growing at $k\%$ per day equals $e^{kT}$ after $T$ days...
  - $10^3 = e^7$ more-or-less (actually $e^7=1096.7$)
- $10 = 10^1 = e^{2.3}$
- $1,000,000,000,000,000,000,000,000,000 = 10^{24} = e^{56}$
- 1460 days...
- Grow at 1% per day then after 1460 days = $e^{14.6}$
- 56 is four times as big as 14
  - So the Zimbabwean price level is growing 4 times as fast, so 4% per day...
Inflation and Central Bank Reactions

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Suppose We Have a Situation...

- The central bank thinks inflation is too high...
- It wants to do something about it...
- It moves cautiously...
  - It raises the short-term safe nominal interest rate it controls via contractionary open market operations—sales of bonds for cash
  - It promises to continue this policy
  - Long-term real interest rates rise
  - Investment spending and exports fall
  - GDP falls
  - The unemployment rate rises
For Simplicity...

- Suppose that the central bank can set the inflation rate wherever it wishes.
  - It can’t, not really: it can try, but there is a lot of error and slack in this process of trying to curb inflation by provoking unemployment.

- We have our Phillips Curve, and we also have a monetary policy reaction function:

\[ \pi = \pi^e + \beta(u^* - u) \quad :: \text{Phillips Curve} \]
\[ u = u_0 + \phi(\pi - \pi') \quad :: \text{Monetary Policy Reaction Function} \]
Ladies and Gentlemen, to Your i>Clickers...

- The Phillips Curve Is:
  - A. One of the most armor-plated, reliable, stable findings in all empirical economics
  - B. Too uncertain to be relied on
  - C. Tells you little about what will happen to inflation next year—hence ignorable
  - D. Tells you a lot about what will happen if unemployment stays high (or low) for even half a decade—hence essential
  - E. About to be tested: will the U.S. see actual deflation as it has never seen it since the Great Depression itself?
Some Algebra: Where the Economy Will Be...

\[ \pi = \pi^e + \beta(u^* - u) \quad :: \quad \text{Phillips Curve} \]

\[ u = u_0 + \phi(\pi - \pi^t) \quad :: \quad \text{Monetary Policy Reaction Function} \]

\[ \pi = \pi^e + \beta \left( u^* - [u_0 + \phi(\pi - \pi^t)] \right) \]

\[ \pi = \pi^e + \beta(u^* - u_0) + \beta\phi\pi^t - \beta\phi\pi \]

\[ (1 + \beta\phi)\pi = \pi^e + \beta(u^* - u_0) + \beta\phi\pi^t \]

\[ \pi = \frac{\pi^e}{(1 + \beta\phi)} + \frac{\beta\phi\pi^t}{(1 + \beta\phi)} + \frac{\beta(u^* - u_0)}{(1 + \beta\phi)} \]
Some Algebra: Where the Economy Will Be...

\[ \pi = \frac{\pi^e}{(1 + \beta \phi)} + \frac{\beta \phi \pi'}{(1 + \beta \phi)} + \frac{\beta (u^* - u_0)}{(1 + \beta \phi)} \]
Some More Algebra: If Nothing Changes...

\[ \pi_t^e = \pi_{t-1} \]
\[ \pi_t = \frac{\pi_{t-1}}{(1 + \beta \phi)} + \frac{\beta \phi \pi^t}{(1 + \beta \phi)} + \frac{\beta (u^* - u_0)}{(1 + \beta \phi)} \]
\[ \pi^* = \frac{(u^* - u_0)}{\phi} + \pi^t \]
Some More Algebra: If Nothing Changes...

\[ \pi^* = \frac{(u^* - u_0)}{\phi} + \pi^t \]

Federal Reserve misperceptions of "normal" unemployment

Expectationally-consistent equilibrium inflation

Federal Reserve inflation target
That the wage-unit may tend to rise before full employment has been reached, requires little comment or explanation. Since each group of workers will gain, cet. par. , by a rise in its own wages, there is naturally for all groups a pressure in this direction, which entrepreneurs will be more ready to meet when they are doing better business. For this reason a proportion of any increase in effective demand is likely to be absorbed in satisfying the upward tendency of the wage-unit...
In actual experience the wage-unit does not change continuously in terms of money in response to every small change in effective demand; but discontinuously. These points of discontinuity are determined by the psychology of the workers and by the policies of employers and trade unions. ... These points, where a further increase in effective demand in terms of money is liable to cause a discontinuous rise in the wage-unit ... have ... a good deal of historical importance. But they do not readily lend themselves to theoretical generalisations...
We Are Going to Ignore Keynes

- We are going to make theoretical generalizations...
- Three kinds of inflation expectations:
  - Static: inflation expectations are well-anchored and do not change (like the 1960s)
  - Adaptive: inflation expectations are what inflation has recently been in the past (like the 1970s and the 1980s)
  - Rational: inflation is expected to be what it will be
Let’s Suppose We Have Adaptive Expectations of Inflation...

- And let’s suppose we have a Phillips Curve
- And let’s suppose we have a Monetary Policy Reaction Function
- And let’s suppose that inflation, for some reason, jumps to some place higher than $\pi^*$
- And let’s suppose that nothing else happens to disturb the economy thereafter...
- Where, then, does inflation go?
And Yet More Algebra...

\[
\pi_t = \frac{\pi_t^c}{(1 + \beta \phi)} + \frac{\beta \phi \pi_t^i}{(1 + \beta \phi)} + \frac{\beta (u^* - u_0)}{(1 + \beta \phi)}
\]

\[
\pi_t = \frac{\pi_{t-1}}{(1 + \beta \phi)} + \frac{\beta \phi \pi_t^i}{(1 + \beta \phi)} + \frac{\beta (u^* - u_0)}{(1 + \beta \phi)}
\]

\[
\pi_t - \pi^* = \frac{\pi_{t-1} - \pi^*}{(1 + \beta \phi)} - \frac{\beta \phi \pi^*}{(1 + \beta \phi)} + \frac{\beta \phi \pi_t^i}{(1 + \beta \phi)} + \frac{\beta (u^* - u_0)}{(1 + \beta \phi)}
\]

\[
\pi_t - \pi^* = \frac{\pi_{t-1} - \pi^*}{(1 + \beta \phi)} - \frac{\beta \phi}{(1 + \beta \phi)} \left( \frac{(u^* - u_0)}{\phi} + \pi^i \right) + \frac{\beta \phi \pi_t^i}{(1 + \beta \phi)} + \frac{\beta (u^* - u_0)}{(1 + \beta \phi)}
\]
And Yet More More More Algebra...
Conclusions: Where Inflation Is Going and How Fast It Gets There

\( \pi^* = \frac{(u^* - u_0)}{\phi} + \pi' \)

Federal Reserve misperceptions of "normal" unemployment

Expectationally-consistent equilibrium inflation

Federal Reserve inflation target

\( \pi_t - \pi^* = \frac{\pi_{t-1} - \pi^*}{(1 + \beta \phi)} \)

Convergence
Inflation Economics: Equations to Know

\[ \pi = \pi^e + \beta(u^* - u) \]

\[ u = u_0 + \phi(\pi - \pi^t) \]

static: \( \pi^e = \bar{\pi} \)

adaptive: \( \pi_t^e = \pi_{t-1} \)

rational: \( \pi_t^e = \pi_t \)
Inflation Economics: Equations to Know

$$\pi = \frac{\pi^e}{1 + \beta\phi} + \frac{\beta\phi\pi^t}{1 + \beta\phi} + \frac{\beta(u^* - u_0)}{(1 + \beta\phi)}$$

$$\pi^* = \frac{(u^* - u_0)}{\phi} + \pi^t$$

$$\pi_t - \pi^* = \frac{\pi_{t-1} - \pi^*}{1 + \beta\phi}$$

$$\pi_t - \pi^* = \frac{(\pi_{t=0} - \pi^*)}{(1 + \beta\phi)^t}$$
Depression Economics: Equations to Know

\[ Y = C + I + G + (GX - IM) \]

\[ Y = \frac{c_0 + I + G + GX}{1 - (1 - t)c_y + im_y} \]

\[ Y = \frac{A_0 + G - (I_r + X_\varepsilon \varepsilon_r)r}{1 - (1 - t)c_y + im_y} \]

\[ r = i + \rho^t + \rho^r - \pi^e \]

\[ u - u^* = 0.5(1 - Y / Y^*) \]

\[ \Delta u = 0.5 \left( \frac{\Delta Y}{Y} - 2.7\% \right) \]
Growth Economics: Equations to Know

\[ Y = K^\alpha (EL)^{1-\alpha} \]

\[ \frac{Y}{L} = \left( \frac{K}{L} \right)^\alpha (E)^{1-\alpha} \]

\[ E_t = E_0 e^{gt} \approx E_0 (1 + g)^t \]

\[ (1 + g)^{72/g} \approx 2 \]

\[ \frac{Y}{L} = \left( \frac{s}{n + g + \delta} \right)^{\alpha/(1-\alpha)} E \]
Test Your Knowledge: Inflation

- Why does the Phillips Curve slope down?
- What is the natural rate of unemployment \( u^* \)?
- How many significant shifts in inflation expectations have there been in the post-WWII U.S.?
  - When did they occur?
- Why is inflation worth worrying about?
  - What are the three reasons to fear inflation?
- How can the Federal Reserve expand or contract the money stock?
  - How can the banking system as a whole expand or contract the money stock?
- Why would any central bank allow inflation, ever?
- What is hyperinflation?