Economics 304 Fall 2014

Country-Analysis Project Part 5: Inflation and Unemployment

Introduction

In this part of the project, you will examine the long-run behavior of inflation and unemployment and the interrelationship of these variables in the short run (the Phillips curve). You will need, at minimum, data on a broad price index, measures of the national money supply, and the unemployment rate, along with time series on real GDP.

This analysis can be conducted at the quarterly level if you have all of the data that you would need, or you can use annual data. If you use quarterly data, be sure that the inflation rates you calculate are "annual rates." The easiest way to calculate annual rates is to subtract the natural log of last period's price level from the natural log of this period's price level, and multiply by 4 to change from a quarterly rate of change to an annual rate of change.

You should use the broadest price index that you have: a GDP index or deflator is the best. A consumer price index excludes goods and services purchased by businesses and governments and should be used only if no GDP index is available. A producer price index usually omits services and focuses almost exclusively on manufacturing products, which is problematic.

For the money supply, you should ideally have two alternative measures, one of "broad money" and one of "narrow money." The broad money measure would include currency and all liquid deposits at financial institutions. The narrow measure would count only currency and deposits in transaction accounts. Another alternative is the monetary base or "high-powered money," but try for sure to get something for narrow or broad money if possible.

If your country is part of the Euro Zone, the collection and interpretation of monetary data will present particular challenges both because of the currency change in 2003 and because of the difficulty of disaggregating data on money supplies across the (now) 18 countries using the euro. Although some data sources present series that span the euro and pre-euro periods, you should be careful to investigate how those series were assembled. You may want to explore whether the behavior of these variables changed at the time your country joined the euro.

The ideal series for the unemployment rate is the International Labour Organization's "harmonized" unemployment rate. For many countries, the headline unemployment figure is the number unemployed, not the rate. You can calculate the rate as the ratio of the number unemployed to the number in the labor force if you can get the latter two numbers.

Inflation and money growth in the long run

If the demand for real money is a stable function of aggregate real spending and if the interest rate is relatively stable, then we know that a relationship of the form

$$\frac{M}{P} = kY^{\gamma}$$

should hold, with γ possibly equal to one. This is essentially the quantity-theory model of money and inflation (if $\gamma = 1$). Note that Y is *real* GDP, not nominal. ($P \times Y$ is nominal if P is a GDP price index.) M is the *nominal* money supply.

Plot time series for the natural logs of M, P, and Y on the same diagram (using multiple vertical-axis scales if this makes your graph more readable). From the visual evidence, does it seem like the above relationship holds loosely over time? (Remember that no one expects this relationship to hold tightly year to year.) Are there points in time where the long-run behavior of inflation seemed to change from before to after? If so, you might want to analyze these sub-samples separately below.

In terms of long-run rates of change, the equation above means that

$$\pi = \mu - \gamma g,$$

with π being price inflation, μ money growth, and g the growth rate of real output. Calculate and plot the time series for inflation, money growth, and output growth on the same graph. Again, assess whether the relationship seems broadly reasonable.

Assuming first that $\gamma = 1$, examine how well this relationship holds for your country by using growth rates averaged over your full sample period (and over appropriate sub-samples of ten years or more) to calculate π and $\mu - g$. Does π approximately equal $\mu - g$?

Next use the year-by-year rates of change over your sample to estimate γ using the same Excel SLOPE function that you used in the previous assignment. Your dependent variable should be $\pi - \mu$ and your independent variable should be g. Is your γ close to one? Using your estimate of γ, calculate the average value of $\mu - \gamma g$ for the full sample (and appropriate sub-samples from above) and compare this to the corresponding average inflation rates. Does the quantity-theory model appear to describe the long-run behavior of inflation in your country?

If you have multiple measures of money (narrow and broad, for example) and/or prices (GDP index and CPI), repeat the analysis above for each variant. Do some variants conform to the theory more closely than others?

Long-run unemployment

To begin your examination of long-run unemployment for your country, plot the time series unemployment rate. Does it fluctuate around a constant average throughout your sample or does there appear to be a fairly smooth upward/downward trend or a one-time change in the average rate over time? If there are two or three sub-periods (of at least 10 years or so) that seem to have different average unemployment rates, calculate the average unemployment rate of each sub-period. How would you estimate a natural unemployment rate for your country based on these results: as a constant, a trend, or a variable with discrete changes? Choose and present a time series (or constant value) for the natural rate based on your choice. (Remember that we are trying to estimate what the unemployment rate would be at "full employment," if the business cycle were at its average point. Try to extract the long-run tendency from the effects of short-run shocks.)

The paper on the reading list by Nickel, Nunziata, and Ochel discusses the determinants of long-run unemployment rates in the OECD. Does unemployment in your country tend to be above or below the OECD average? Obtain data for as many of their variables as you can and assess which ones may be causing your country's unemployment rate to be high or low.

The Phillips curve

The modern theory of the Phillips curve says that there should be a negative relationship between the "unemployment gap" (the actual unemployment rate minus the natural rate) and the "inflation surprise" (the actual inflation rate minus the expected rate). In order to examine the Phillips curve relationship for your country, you will need (1) a natural rate of unemployment series and (2) a series for the expected rate of inflation.

Natural unemployment rate: In your analysis above, you studied the long-run behavior of the unemployment rate for your country. The conclusion from your analysis characterized the natural rate as a constant for the entire sample period, a constant that changed at various points in the sample, or possibly a trend that has changed continuously through the sample or parts of it. Based on your estimated series for the natural unemployment rate, calculate the unemployment gap as the difference between the actual and natural unemployment rate in each period.

Expected inflation rate: Very few, if any, of your countries will have directly measured data series on the expected inflation rate. In order to estimate your Phillips curve, you'll need to create one. There are many hypotheses, some simple and some complex, about how expectations are formed. The simplest is **myopic expectations**, under which the expected inflation rate for this period is just last period's rate. In this case, the "inflation surprise" is just the change from one period to the next in the inflation rate. A slightly more sophisticated measure is **adaptive expectations**, in which the expected inflation rate is some kind of average of recent inflation rates. You can experiment with different forms: a simple average going back two or three years, or a weighted average in which more weight is given

to recent years and less to the more distant past. (An example of such a model would be $\pi_t^e = 0.7\pi_{t-1} + 0.3\pi_{t-2}$. If you are using annual data, you probably need only go back two periods; with quarterly you should probably go back at least a year (4 periods). In either case, make sure that the "weights" (the 0.7 and 0.3 in the example) add up to one. There are fancier models that attempt to implement **rational expectations**; these would require that you use Stata or Excel to estimate multiple regression models. In such models, you would estimate the weights that the agents in your economy would use if they understood how inflation evolved over time. If you want to do this, I'm happy to provide individual guidance. You should calculate the myopic expectations measure and at least one adaptive expectations measure (and perhaps a couple of alternatives). Based on each of these measures, calculate a series for the inflation surprise: the difference between actual and expected inflation in period *t*.

Once you have series for the inflation surprise and the unemployment gap, use Excel the Excel SLOPE and INTERCEPT commands to compute estimates of α and β in the equation $UnempGap_t = \alpha + \beta(InflSurprise_t)$. (The INTERCEPT command has exactly the same arguments as the SLOPE command you used before and gives an estimate of α.) If you have discrete sub-samples in which behavior changes drastically, such as the end of a hyperinflation or another change in monetary regime, then you should probably estimate the equation separately for the sub-samples. Theory predicts that β should be negative and α should be close to zero, because unemployment should be near the natural rate when the inflation surprise is zero. Present and describe your results. If you have multiple estimated series for natural unemployment and/or expected inflation, do some of them give "better" results than others? Discuss the various results and which of them you find most plausible.

Finally, summarize your results about the behavior of unemployment and inflation in your country in a short concluding section.