Fluctuations. Organization of the course, and facts

Olivier Blanchard*

March 2002

*14.452. Spring 2002. Topic 1.

Housekeeping. Meet on tuesday, thursday, 10.30am.

No explicit office hours. But here nearly all pms. (and can make appointments with Alterra, for wednesday pms)

TA: Thomas Philippon. Web page.

Waiver this friday.

1 Fluctuations. Overview

Intermediate textbooks have it right (need to read one)

- In the **short run**

  Monetary policy controls the interest rate.

  Current and expectations of interest rate and income affect aggregate demand.

  Aggregate demand determines output and unemployment, which can differ from the natural rate.

  ISLM model captures most of this.

- In the **long run**

  Prices adjust.

  Output, unemployment, the real interest rate all return to their natural rate.

- Some shocks affect the deviations from natural rate, others the natural rate, others both.

- Things can go wrong:

  Can take very long to get to the long run. Great Depression. Japan in the 1990s.

  And because of expectations of the future matter today, the medium/long run affects the short run.

The purpose of this course is to get to roughly the same place, but with a deeper understanding of the mechanisms, of the imperfections, needed; sense of welfare implications. In the process, improve on the intermediate text models.

2 Organization

- Facts. What are we trying to explain?
- The simplest model. A model with a C/S choice, uncertainty, and shocks. Natural starting point. Ramsey model (really Arrow Debreu). (Why Ramsey, not OLG; no good reason)

  Methodological contribution of Prescott here. Before, starting point would have been a more static version (Patinkin).

  Useful methodologically. C/S choice central to any model. But clearly short of the mark. No employment movement.
- Allowing for labor/leisure choice. Natural starting point to generate employment fluctuations.

  The RBC model (can still think of it as Arrow Debreu). Problems at two margins. The existence of the shocks. The labor/leisure choice. But again, useful benchmark.
- Allowing for investment decisions. In benchmark RBCs, investment decision is trivial/degenerate. In fact, complex decision. Useful to expand by allowing for costs of adjustment.

  A saving decision/an investment decision. The sequence of intertemporal prices (term structure of interest rates) clears. (This is the mechanism that fails when nominal rigidities, below)
- Allowing for two goods. Much of our intuition in macro is based on a one–good model.

But can be dangerous (some intuitions do not extend. correlation of employment in consumption and investment sector).

And, in some contexts, open economy in particular, need to have two goods. Domestic/foreign. Tradable/non tradable.

- Clear evidence that movements in money affect output. (that the Fed is not irrelevant). So next step is to introduce money as a medium of exchange.

  Forces us to think how a monetary economy looks like. The decentralization of exchange. The use of money in transactions.

  Natural question. Very different economy. What difference does it make? The answer is: not a lot, per se. Insights into fiscal policy, inflation. Not so much about fluctuations.

- Money as numeraire. Price setting. Monopolistic competition, with price setters. costs of adjusting prices.

  So called New Keynesian models. Deliver the basic implications, short run/medium run. Allow for welfare analysis. (Non trivial results, because start with imperfections)

- Look more closely at price setting/staggering. So, as to get close to a model we can use to think about policy. The current state of the arts machine. Good enough?

- Finally, look at a number of policy and current issues within this class of models. Rules for central banks. Dynamic effects of fiscal policy. Back to the stuff of textbooks. But hopefully, with solid foundations.

In short. Develop a model with:

- Shocks. Which ones? Still unclear.

- Strong intertemporal mechanisms. Consumption smoothing. Investment.
- Imperfections. Monopolistic competition. Nominal rigidities.

Enough to start. But clearly many issues left aside, which affect the nature and the effects of fluctuations. Credit market imperfections. Labor market imperfections.

- 14.453. Consumption, Investment decisions. More theory, more evidence.
- 14.454. Imperfections in goods, labor, credit, financial markets. Implications for macro.

A word on the **textbooks**. Each useful in some dimension.

- BF encyclopedic and simple, but a bit old.
- OR more consistent about the use of discrete time, and stronger on open economy.
- LS stronger on techniques.
- Woodford gives a good synthesis of New Keynesian models and applications.

3 Some Facts

3.1 Covariance stationarity

Can hope to characterize facts is only if there are some regularities. If things repeat themselves.

This is what the expression "Business cycles" captures. If output high now, it is likely to still be high next quarter, next year, low two years from now.

For this, covariance stationarity is the relevant concept (for one variable, or a vector of variables).

Definition.

$$EY_t = \mu \text{ for all } t$$

$$E(Y_t - \mu)(Y_{t-k} - \mu) = g_k \text{ for all } t$$

Then, we can hope to actually learn the moments, look at the stochastic process, and do more.

Reasonable assumption?

- Sometimes not. Some episodes appear to be sui generis. Unemployment during the Great Depression. (Graph). Hyperinflations.

  Maybe some deeper process which generates such episodes infrequently. But given the length of the series we have, irrelevant.

- Sometimes yes. Post war US GDP. Not covariance stationarity as trends up (back to this in a minute). But a transformation of it seems to be. Use with care.

  Even there, can see that this is not quite true. Decrease in variance of GDP over time. Graph.

3.2 Wold decomposition, MAs and ARMAs

If a series is covariance stationary, then it can be represented by a Wold decomposition (an infinite MA representation):

$$Y_t = \sum_j \psi_j \epsilon_{t-j} + k(t)$$

where ϵ is iid, mean 0, constant variance. This may not be the true

process. The process may be highly non linear (even deterministic. examples: chaos. Markov processes). But this is a representation.

Very convenient. Can be approximated quite well by ARMA(n,m) process, or even AR(n) process. Easy to estimate.

Example: AR(1):

$$Y_t = \rho Y_{t-1} + \epsilon_t$$

In this case, $\psi_j = \rho^j$.

Considered one variable (univariate). But same applies to many variables, so Y and ϵ are vectors. (multivariate) VARs.

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + ... + \epsilon_t$$

Then, can look at correlations, cross correlations, regression coefficients, and so on.

(Can also think of this as the reduced form of a linear structural model with shocks. The epsilons are then linear transformations of the underlying shocks. Think of the reduced form of a supply demand model.)

3.3 Trends

Many economic time series trend up. So must deal with/remove the trend. Not a statistical issue, but an economic issue.

Example 1. Suppose a variable follows (in logs):

$$Y_t = d + Y_{t-1} + \epsilon_t$$

So absent shocks, grows linearly. Is there a trend? Turn off the shocks. then continue on the current trend. No return to anything.

Now suppose you generate data and fit a linear trend. Call the difference the cyclical component. The difference will look like it tends to go to zero.

In fact, no such component.

Example 2.

$$Y_t = T_t + C_t \tag{3.1}$$
$$T_t = d + T_{t-1} + e_{Tt} \tag{3.2}$$
$$C_t = aC_{t-1} + e_{Ct} \tag{3.3}$$

Can we separate the trend and the cycle components?

- Yes, if we assume that e_T and e_C are uncorrelated, or are perfectly correlated (see Stock and Watson 1988 JEP) Reasonable? Typically not.
- Or if e_T has small variance. Then, can hope to get the trend out by taking out a smooth curve:

  Linear trend, or a quadratic trend. Or an HP filter.

$$min \sum_{t_0}^{t_1} ((y_t - T_t)^2 + \lambda(T_t - T_{t-1})^2)$$

  Make λ very large and get it very smooth. Dangers: the trend and by implication the cyclical component depends on future values.

  Or look at first differences. Contain mostly the cyclical component, if e_{Tt} is small.

- How much of a difference? Results for GDP. Graph.
- The frequency domain. Instead of the infinite MA representation, can characterize behavior by the spectrum, giving the importance of the components at different frequencies.

Then, can take out the very low frequencies, perhaps the very high ones. Keep the part of the spectrum corresponding to 6 quarters to 8 years. This is the Stock Watson approach. Graph.

3.4 Co-movements of output with components.

Stock Watson looks at the correlation between cyclical components of output and other variables.

$$\rho(X_{ct},\ Y_{ct+k}) \quad k = -6, ..., 0, ..., +6$$

(in quarters)

If ρ is positive and highest for $k < 0$, then X is procyclical and lags.

If ρ is positive and highest for $k > 0$, then X is procyclical and leads.

Results (Table 2)

- Output, consumption. high and positive. col 9.
- Output, investment high and positive. col 14.

  Surprising? More than you might think. You might have thought that fluctuations came from changes in discount rate (people really liking the present, so consuming more, may be working less, then investment would go down.)

- Output and inventory investment high and positive. Should you be surprised by this? Yes, if Keynesian. High demand should be smoothed by firms, leading to negative investment. Change in the 1990s.
- Little correlation with exports. does not look export driven.
- Little correlation with government spending.

- Looking across sectors. High correlation for all, except mining. (Similar results in Christiano et al) A clear indication of how far we are from the old cycles.

3.5 Comovements with employment

- High and positive. lag. suggests output then bodies.

  Should also be seen as a surprise: if booms are good times, why take less leisure? Or if value utility more now, then why not take both more consumption and more leisure?

- Coincident with hours. suggests adjustment at that margin

- High and positive with total factor productivity (Solow residual) and average labor productivity. leads.

3.6 Comovements with prices and wages

One central intra-temporal price: the real wage. One central inter-temporal price: the real interest rate.

Not much cyclical movement in either.

- cyclical component of the wage? (think about detrending)

  Real wage (definition of the deflator is not given). probably real product wage. Slightly pro-cyclical, but not much. A-cyclical is a good characterization.

  Clearly inconsistent with only movements along a labor demand curve, or labor supply curve. (Old Keynes/Tarshis discussion) consistent with shifts in labor demand, or a mix. or with a model with further deviations from standard labor market equilibrium.

- Correlation with interest rates.

Nominal: strongly procyclical and lags output. High in booms.

Real: mildly countercyclical: low in booms. Leads output a bit. This suggests a story in which low interest rates lead to high demand and high output, but then leads to higher nominal rates.

- Now look at correlation with inflation (GDP deflator or CPI). strong correlation, max at lag 4.

  This is the Phillips curve relation. More standard scatter diagram. High GDP, low unemployment, leads to higher inflation with a lag.

3.7 Co movements with money

.

Long held belief that money has major effects on output. Friedman and Schwartz on Great Depression. The Volcker recession of 1980-82. Surely, markets believe that the Fed can affect output. Federal funds rate and output.

- Correlations high. Both nominal and real. But what does this prove?

- Need more convincing identification. Will just present the results of the study by Christiano et al. (based on a VAR)

  [add the survey on vars to the reading list. "Vector autoregressions," JEP 2002, by James Stock and Mark Watson.]

  Idea: Look at the federal funds rate. Quarterly data. regresses the fund rate on output and other variables. assumes that residual is exogenous change and traces the effect on output and other variables. (correct if no reaction of variables to ff).

  VAR in Y, P, Pcom (price of sensitive commodities), NBRD (non borrowed reserves), FF, TR, plus whatever variable is under consideration,

Results. 1% increase in the federal funds rate. remains for about 8 quarters (figure 2). then long lasting effect on output, on employment, on unemployment. Not much effect on the price level until 6 quarters.

How much data mining?

3.8 Summary of facts

- Components move together
- Not much movement of real wages
- Relation with inflation
- Monetary policy appears to affect output, not prices in the short run.

Then all the special episodes. Argentina. Asian crisis. Mexico. European unemployment. and so on, working back in time.