Behavioral Macroeconomics

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Textbook: “Behavioral Macroeconomics” Paul De Grauwe

This is an informal course which is a supplement to the main courses of study and also to my official workload. It will be graded based on a term paper of no more than 5000 words (not counting bibliographic references).

The aim of the course is to provide a hint of the potential usefulness of behavioural models, in which agents are assumed to be irrational. It will focus on exactly one kind of irrationality and discuss implications in the context of the simplest available macroeconomics models. It is based largely on the work of Paul De Grauwe, but I will discuss some possible extensions which are a joint effort of mine with Barbara Annicchiarico, Alessandra Pelloni, and Silvia Surricchio.

Lectures

1 What do psychologists and experimental economists say about expectations ?

Experimental subjects attempt to forecast a time series. They know the observations to date, so this is univariate forecasting. In various experiments they are shown a random walk (sometimes daily closing prices for an individual stock which are very close to a random walk). The typical result is that participants generally forecast mean reversion expecting a decline after a recent increases. When the series increases repeatedly over a few periods, the participants extrapolate the trend forecasting further increase. Similarly if it decreases repeatedly they forecast further decline. This result is fairly robust. The forecasts would be (approximately optimal if the series were stationary around a broken trend.

This pattern observed in labs helps explain the dynamics of asset prices. In particular, because the price agents are willing to pay depends strongly on their expectations of future prices and capital gains, beliefs about asset price patterns can be self fulfilling prophecies. People who look at asset prices without much theory note that they tend to spend most (about two thirds) of the time oscillating in a small range and the rest of the time break out of that interval and trend for a while, then return to oscillating. This means the actual behaviour corresponds to the sort of forecasts agents make when presented with a random walk. Of course it is possible that this is just another example of the (irrational) psychological pattern as the a-theoretic experts might be just acting like the experimental subjects.

The simplest possible numerical model displays dramatic behaviour which varies from simulation to simulation but sometimes looks a lot like the price of BitCoin.

Formally, expectations are modelled as a mixture of extrapolative and fundamentalist – so forecast changes are a weighted average of the most recent change and a constant with weights depending on the past performance of the two forecasting rules.

This would correspond to rational learning if the data were generated by an experimentor who first chose one of the two rules (for generating prices) by flipping a coin, always adds normally distributed nose, and each period has a small chance of switching the rule. The small chance of switching justifies geometrically

decreasing weights in the sum of forecast errors used to evaluate the two rules. Such weights are needed to have agents continue to change their minds.

The model becomes a behavioural model if the time series is not generating in the way described above, but is the result of market interactions among agents (and an unexplained exogenous disturbance). Notably, so far it doesn't matter if all agents use the same weights in the weighted average or if some extrapolate (are extrapolators) and others assume the expected value is a constant (are fundamentalists) and the weights depend on the numbers of agents of each type. Each agent updating weights or some agents switching type implies models with the same time series of prices (as a function of the exogenous shocks).

2. What does this imply for macroeconomics ?

To get a first idea De Grauwe considered the simplest macroeconomic model which is actually used in the academic literature – the three equation new Keynesian model. I will start with an absurdly simple model

W=Y = C. r = rho. Prices are fixed. So the good is produced from labour alone. All agents have the same income each period. It depends only on demand, which is all consumption (closed economy, no investment, no state). Prices are fixed forever, agents just produce as much as is demanded. The nominal and real interest rates are equal to the rate of time preference.

The reason is that I want to get to agents' consumption as a function of their expectations. Given expectations, consumers solve a not so trivial problem. I will make it trivial. For this lecture (only) I assume that agents use a rule to forecast future demand (which is equal to their future labour income). I am going to assume that agents assume that current and future demand Y_t Y_{t+1}, Y_{t+2} , Y_{t+3} etc is a constant Y . This means that the problem is very simple – an agent with wealth A plans to consume rA + Y.

Then I add a disturbance term to demand. This is not really motivated. It could be a taste shock. Mostly I follow De Grauwe (and everyone else)

The forecast Y is a weighted average of Y_{t-1} and a known constant B. The weights depend on past performance of the two forecasting rules.

Now that is a very simple model. For one thing, since all agents make the same forecast none ever borrows or lends. So each agent has wealth zero. This means actual demand is expected present *and* future demand (plus the semi-motivated disturbance term).

Even this very simple model shows a challenge. To solve the problem, agents must have an opinion about the future for the rest of their infinite lives. The solution implies a very simple equation for the expected change of consumption from t to t+1, the Euler equation, but getting to that solution requires beliefs about the indefinite future.

Now this might be cheating, but DeGrauwe just assumes that the Euler equation holds with subjective expectations of the next period in the place of rational expectations. This would be optimal if the agent just assumed that from t+1 on consumption will be constant and the real interest rate will equal the rate of time preference. There are other beliefs about the distant future which make it optimal. We don't have to favour any over the others.

We just need 2 things. First that the Euler equation holds with subjective expectations, and second that the performance of the forecasting rules is evaluated using the one period ahead forecasts.

3. The three equation New Keynesian Model and what did DeGrauwe do with it.

4. What if agents are different ? The weights can correspond to a prior or to signals agents receive other than lagged values of the three time series. It is medium important that the signals are mean zero and independent over time so agents don't accumulate financial wealth or debt. What about taking the division into extrapolators and fundamentalists literally, and assuming that the thresholds of relative performance of the two rules at which they switch are a permanent characteristic of individuals, who are differently prone to extrapolate ? This means that agents will borrow from each other. The financial wealth will always add up to zero, but an agent might accumulated massive wealth or debt.

OK now one more thing, what if agents refuse to lend to someone who is heavily in debt ? This makes sense – a game theoretic model of liquidity constraints is tricky, but a behavioural model can be simple, say don't lend to someone whose debt is greater than one periods normal income.

The risk of being liquidity constrained in the future should affect consumption in the present. But not if agents make simple silly assumptions about future income of the sort already used to solve their problem without the constraint – say that their income will be constant. They don't expect to ever want to borrow again. This is leaning pretty heavily on irrationality.

OK the modified model is very interesting.

5. What about investment ? Expectations are much more important for investment than for consumption. The hints of bubbles from Macroeconomics 1 came in the model of investment. But the leading behavioural macroeconomics model doesn't include investment at all. The reason isn't that it is hard to get stochastic investment with only small temporary shocks. The reason is that it is hard to write down a model in which agents are not fully rational but investment doesn't explode.

I think one approach is to assume agents extrapolate q not q_dot so the extrapolators just assume prices will stay high (or low) not that they will trend up (or down).