Chapter 7

New Keynesian models of business cycles

7.1 Coordination failure models

Another class of real (i.e., non-monetary) model of business cycles is the class of coordination failure or multiple equilibria models. These models have the feature that the economy has multiple equilibria, so that the functioning of the economy can respond to non-fundamental shifts such as "panics" "consumer confidence", etc. These models capture some of the big elements of Keynesian models.

7.1.1 Bryant (1983)

We start with an example due to Bryant. There are N workers. Each worker has $\bar{e}$ units of labor, and works $e_i \in [0, \bar{e}]$. His utility function is:

$$U_i = c_i - e_i \tag{7.1}$$

where c_i is his consumption

Each agent produces an identical good, so consumption is simply equal to output. Each agent's production function exhibits *complementarities* or *spillovers*.

$$c_i = \alpha \min[e_1, e_2, e_3, \ldots, e_N] \tag{7.2}$$

where $\alpha > 1$

An aside on game theory

Definition 7.1.1 (Game) *A game is a set of players, a set of strategies for each player, and a set of payoff functions which map each combination of strategies (strategy profile) into (utility) payoffs for each player.*

Players: $i \in \{1, 2, 3, \ldots N\}$

Strategies for player i: $e_i \in [0, \bar{e}]$

Payoff function for player i: $\alpha \min[e_1, e_2, e_3, \ldots, e_N] - e_i$

Definition 7.1.2 (Best response function) *Player i's best response function is a function which, for each strategy profile, describes the strategy for player i which maximizes payoffs for player i taking the rest of the strategy profile as given.*

Definition 7.1.3 (Nash equilibrium) *A Nash equilibrium is a strategy profile in which each agent is playing a best response.*

Best response function: $e_i(e) = \min[e_1, e_2, \ldots, e_{i-1}, e_{i+1}, \ldots, e_N]$

Nash equilibrium: There is a continuum of Nash equilibria. Pick any $e \in [0, \bar{e}]$ There exists a Nash Equilibrium in which everyone puts out effort e.

Back to the economics

This model is ridiculously simple. But let's take it seriously for a minute. This is the simplest example of a wide class of models that exhibits *coordination failure*. Coordination failure means two things:

1. There are multiple (Nash) equilibria
2. The equilibria are Pareto-rankable, or at least one equilibrium is Pareto superior to another.

Here, the equilibrium in which everyone selects $\bar{e}$ is Pareto superior to any other equilibrium.

If all of the agents could get together and sign contracts on how much they will work, they would all agree to pick $\bar{e}$. But if they cannot, they may find themselves at another, inferior equilibrium.

Where there are multiple equilibria in a macro model, a few other interesting things can appear:

1. Self-fulfilling prophecies: if everyone guesses that no one will work tomorrow, no one will, so the guess was correct. This sort of model can explain things like currency crises, bank runs, stock market bubbles, etc. Maybe it also explains recessions.

2. Sunspots: a factor which has no intrinsic relevance to the economy becomes a driving force. For example, suppose that everyone in the economy believes that no one will work tomorrow if Fed chairman Alan Greenspan wears a gray suit, and everyone will work if he wears a blue suit. It will turn out that this belief is correct, and Mr. Greenspan's clothing will determine the path of the economy.

7.1.2 Cooper - John (1988)

Analyzed a much more general version of Bryant's model. Showed that it actually contained many more complex economic models as a special case.

Everyone picks $e_i \in [0, \bar{e}]$.

Payoff function is $\pi(e_i, e_{-i})$. We only consider symmetric equilibria.

Definition 7.1.4 (Result 1) *We see multiple equilibria only if there is strategic complementarity*

$$\frac{\partial^2 \pi}{\partial e_i \partial e_{-i}} > 0 \tag{7.3}$$

Definition 7.1.5 (Result 2) *Multiple symmetric Nash equilibria are Pareto-rankable if the game exhibits positive spillovers:*

$$\frac{\partial \pi}{\partial e_{-i}} > 0 \tag{7.4}$$

Strategic complementarity means that when others increase their effort levels, you wish to increase yours as well. Positive spillovers mean that when others increase their effort levels, you are better off. Makes sense, right?

Potential sources of strategic complementarity are active areas of research and include:

- Technological complementarity - maybe it's cheaper to make stuff if your neighbors are making it.
- Thick-market externalities - maybe search cost is lower when everyone is out looking.
- Imperfect competition leading to aggregate demand externalities.
- Network externalities - in which the payoff to adopting a new technology goes up when others adopt it too.