

# Economic Dynamics

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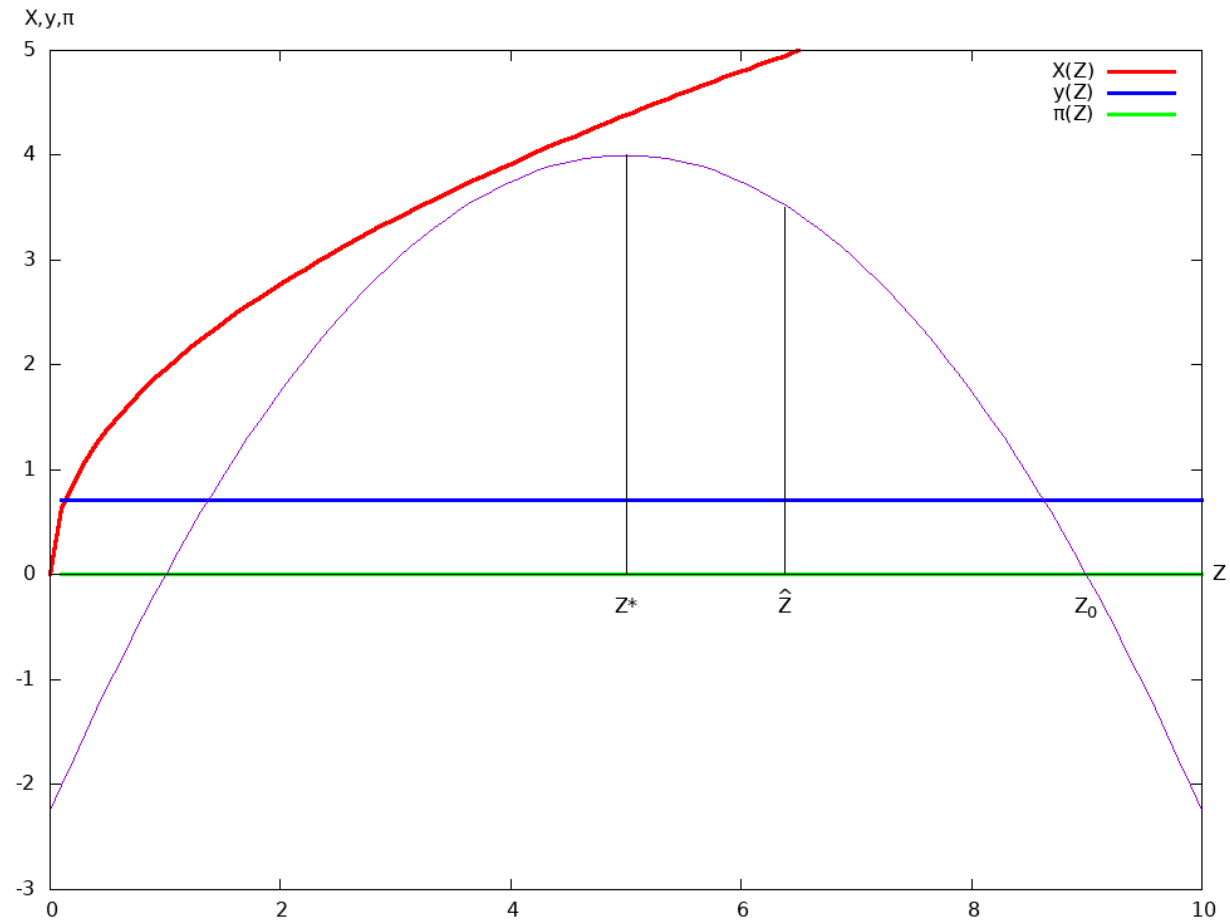
Lecture 6a: November 13, 2020

## Abstract

In the second part of today's lecture, we look at the behavior (phase diagrams *vs.* fish population) of other variables in the model, and comment on the inflexibility built in to the model by our assumptions about competition.

# Ships, catch, and profits in equilibrium

Phase diagram for number of boats (red), catch per boat (blue), and profit per boat (green).  $H$  is displayed for scale.



# Ships, catch, and profits in equilibrium (warnings)

- *All* of the curves displayed are mutually incomparable!
- Check the *units*: fish/year for  $H$ , boats for  $X$ , fish/year/boat for  $y$ , and money for  $\pi$ . All different!
  - $H$  and  $y$  might seem to be comparable if you consider the units for  $y$  to be fish/year, but this doesn't really make sense, since  $H$  affects the whole population, while to have a comparable effect, you need to multiply  $y$  by  $X$ .
  - Note that  $X$  is variable, so this is not just a question of scale.
- For example, though  $X > H$  for all  $Z$  “looks like” the graph for collapse, this is an accident of the Cobb-Douglas production function. You should try not to associate this curve with the graph that shows the steady state.

# Ships, catch, and profits in equilibrium, *cont.*

That doesn't look very realistic! Why do we get this graph? Why are fish/year/boat and profit/year constant? With  $Z$  changing, productivity *etc.* should be changing too!

- It is a consequence of our *model assumptions* and *equilibrium condition*.
- Note that profits are zero, just like the equilibrium condition. How does our model lead to equilibrium? In fact, *it does not* “lead to” equilibrium. We *assumed* long-run equilibrium, that is, the zero-profit condition. The green line is an *assumption* of our model, *not* a result!
- But then the catch per boat is *enforced* by our assumption of *price-taking* in the input and output markets, and the zero-profit condition:

$$\begin{aligned}0 &= qf(Z, X) - p \equiv qy(Z) - p, \\ y(Z) &= p/q.\end{aligned}$$

Since  $p$  and  $q$  are constant (price-taking), the graph of  $y$  is a horizontal line.

- Then  $X(Z)$  is computed to solve the equation  $f(Z, X(Z)) = p/q$ .

# Modeling strategy

- Note that we assumed *myopic, competitive* behavior.
- We saw in the previous graph how competition leads to “predetermined” behavior of the individual boats. While this is “unrealistic,” *it is useful*.
  - It is a form of the *ceteris paribus* (all other variables held constant) assumption.
  - It is analogous to the “controlled conditions” of experimental sciences.
  - It may not be a good approximation for empirical work in a given historical context. But if it is, it simplifies description of the model.
  - Even if not, it can be treated as a “standard of comparison” for the more realistic, but more complex, models.
- Myopic behavior is also unrealistic. In both the stable and collapsing cases, we saw that the population decreases over time, and so does the number of boats. That means that individual boats are *exiting*, and this is foreseeable. Why would they enter knowing they may soon be forced out?

## Modeling strategy, *cont.*

- Myopic behavior and competitive (price-taking) behavior seem “psychologically” related (at least to economists!) But relaxing both makes the model much more complicated. Which is better to change?
- That’s not quite the right question. It’s possible to change both, but only relax one. Specifically:
  - The *myopia* assumption is *relaxed*: decision-makers account for the future path of population when making decisions about current behavior.
  - The *competition* assumption is *removed and replaced* with an equally strong but very different condition: that a single decision-maker optimizes the whole industry.
- The most difficult path is to relax the assumption of myopia while maintaining the assumption of competition, because you need to incorporate business forecasts of future prices into the model.
- It’s not hard to keep myopia and change to a monopoly or social planner model, but it doesn’t make much sense that a large-scale economic entity would be both myopic *and* optimizing.