

Models In Economics and Science

The background is a solid teal color with a subtle gradient. At the bottom right, there is a silhouette of a mountain range in a darker shade of teal.

Definition of a Model

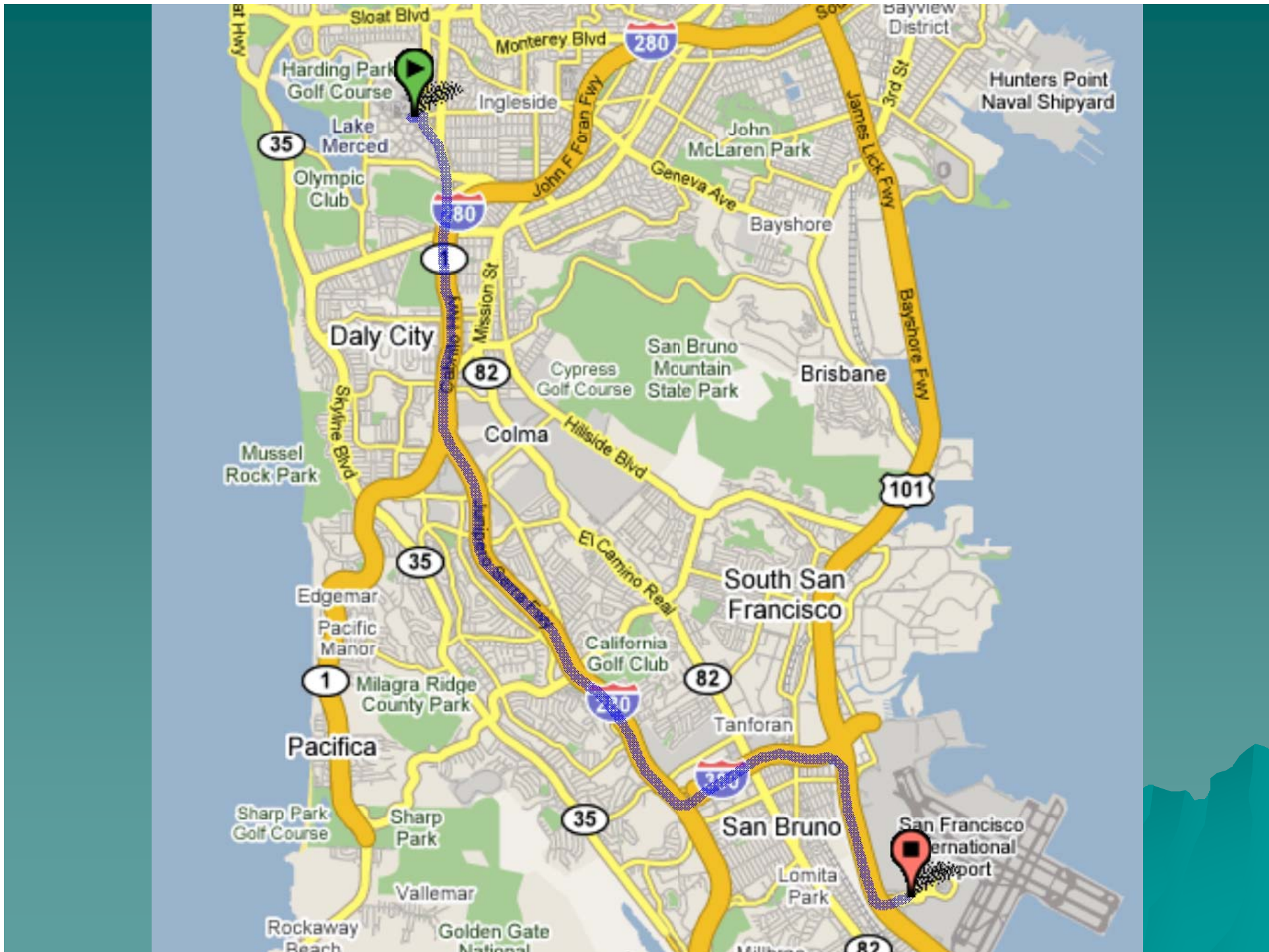
- ◆ A model is a simplified version of the real object that we study.

By model, we don't mean this...



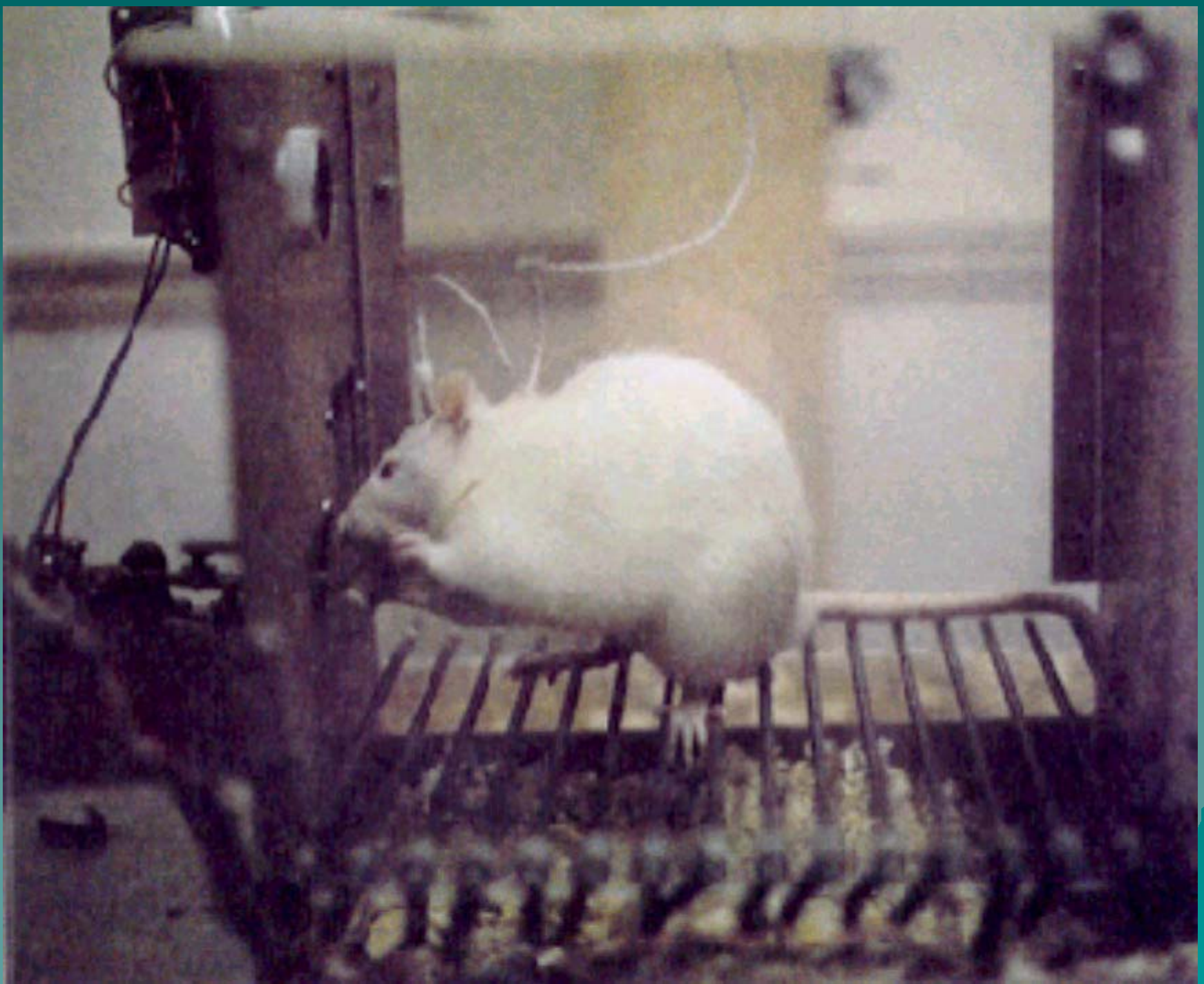
Examples of Models

- ◆ A Map (in geography)



Examples of Models

- ◆ A Rat (in neuroscience)



Examples of Models

- ◆ A model of the U.S. government.

Three Branches of Government

1 What branch can declare laws unconstitutional?

2 To whom do cabinet members report?

3 What branch of government initiates and approves laws?



Legislative
(makes laws)

Senate

House of Representatives



Executive
(carries out laws)

President

Vice President

Cabinet



Judicial
(evaluates laws)

Supreme Court

Other Federal Courts

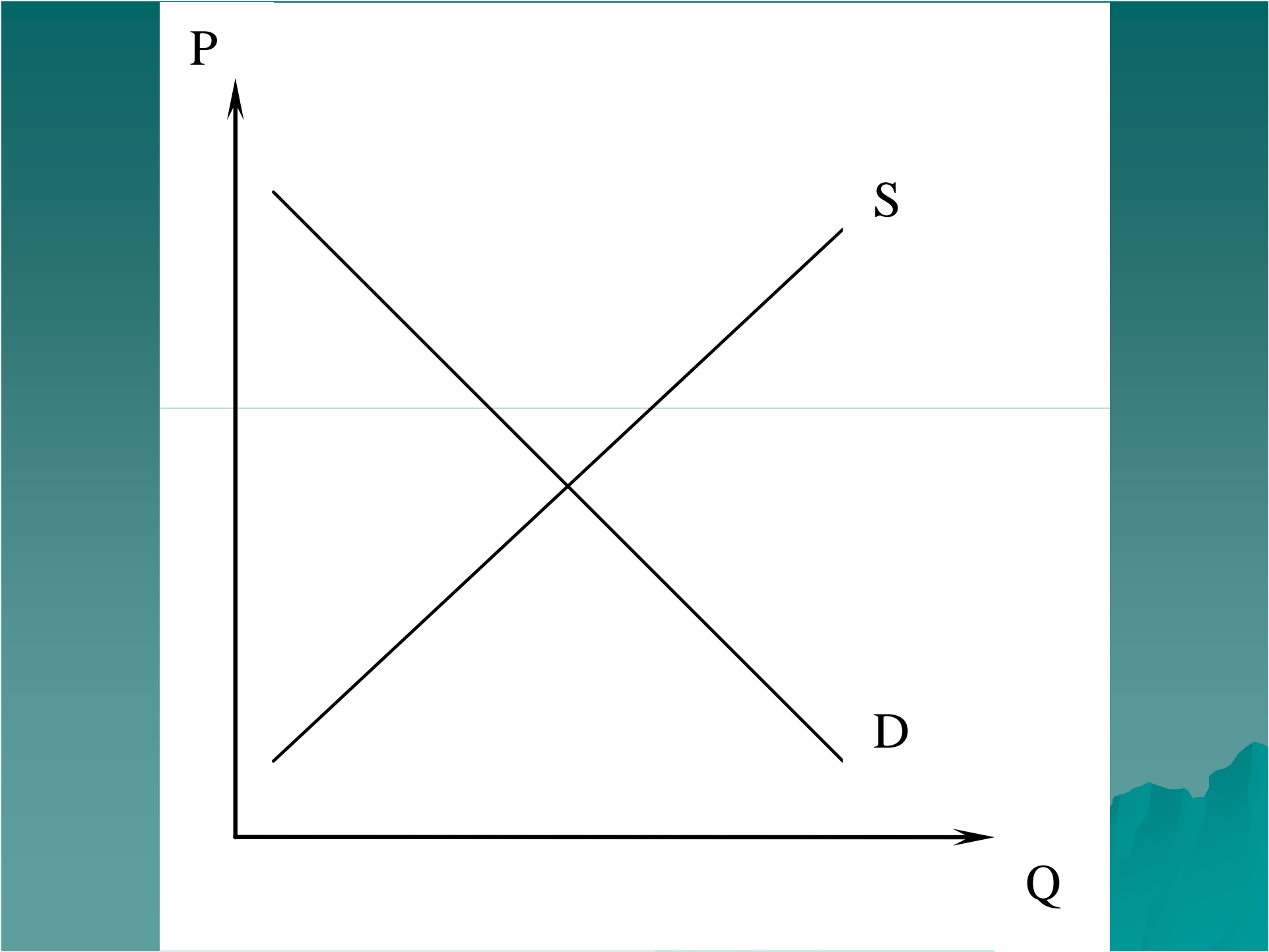
Examples of Models

- ◆ Pregnancy.



Examples of Models

- ◆ Supply and Demand (Economics) – a model of a market.



This doesn't look like markets in real world



Causality: what causes what?

- ◆ **Exogenous** variables - determined outside of the model
- ◆ **Endogenous** variables - determined within the model
- ◆ In any model, the exogenous variables are "causing" the endogenous variables. All the endogenous variables are determined by the exogenous variables.

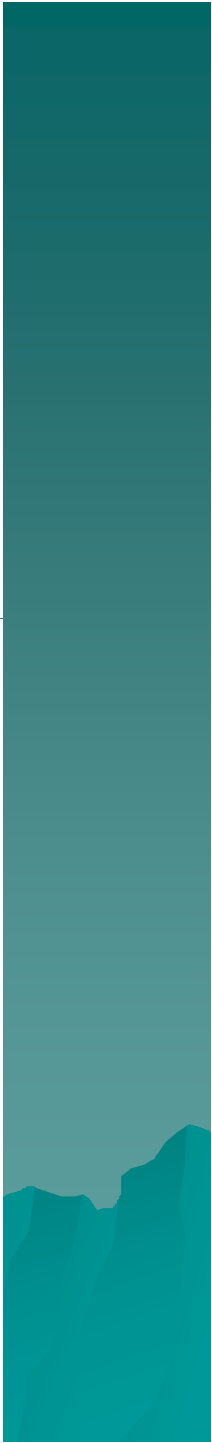
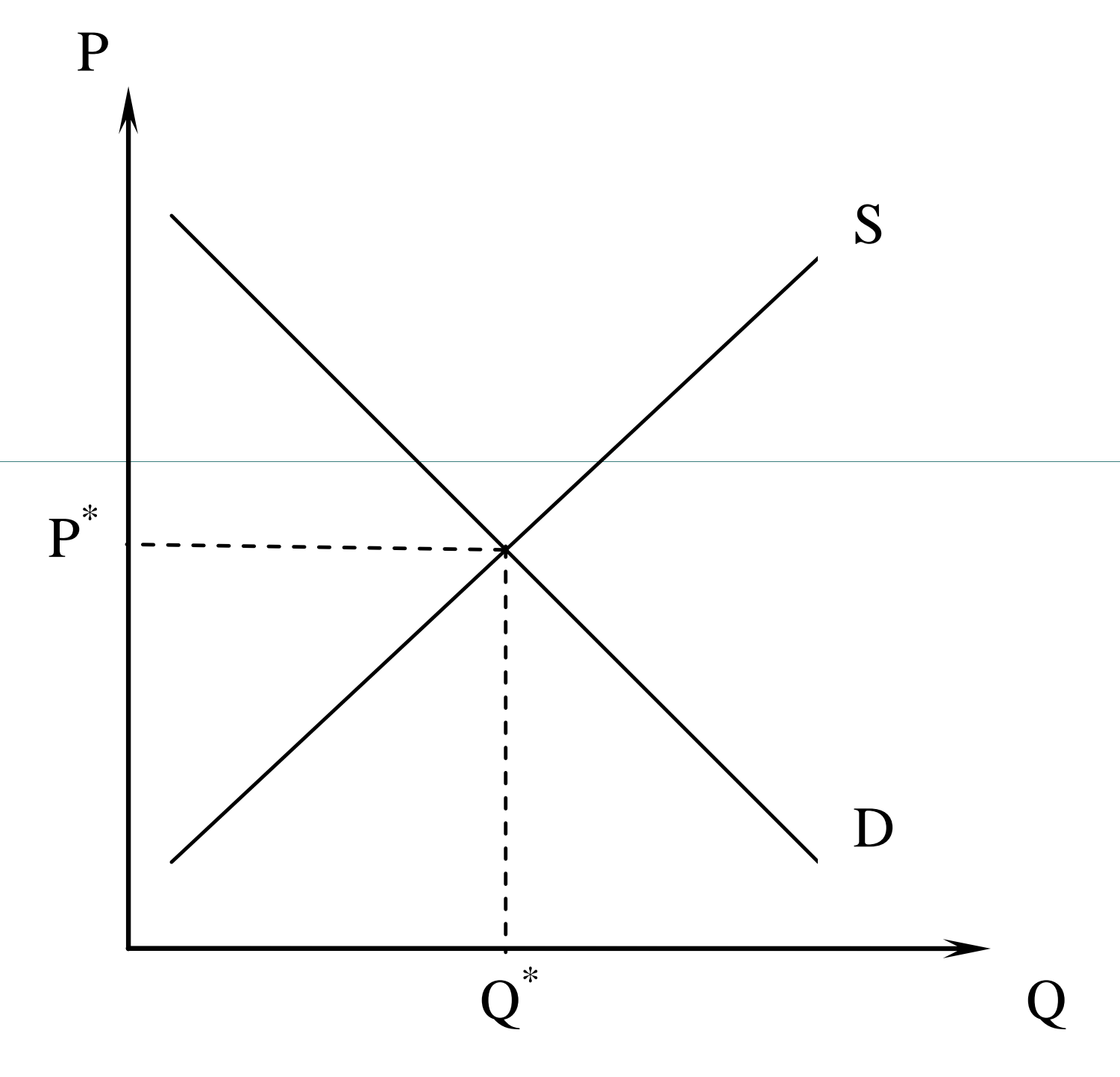
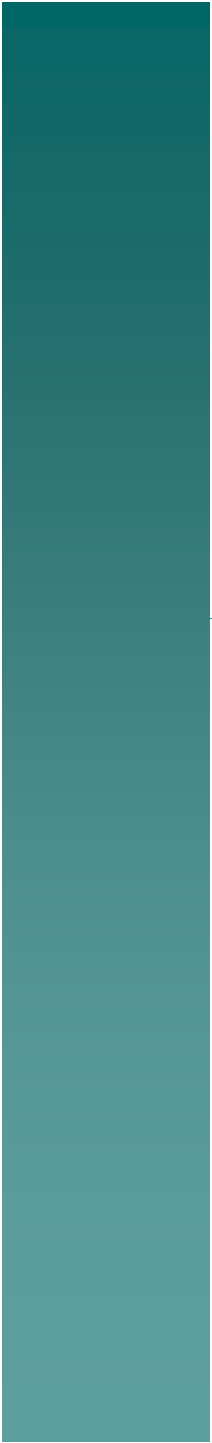
Exogenous → *Endogenous*

Model's Prediction

- ◆ Models generate prediction about the endogenous variables for different values of exogenous variables

Model's Prediction

- ◆ **Example:** In the model of Supply and Demand the endogenous variables are price (P) and quantity traded (Q), and exogenous variables are those that determine the location of supply and demand curves (such as income, prices of related goods, tastes of consumers, prices of inputs, technology of firms, etc.).
- ◆ The model generates a prediction about P and Q for any set of exogenous variables. The model's prediction about P and Q is called **competitive equilibrium**.



Why Models?

1. **Models help us understand the real world.**
 - ◆ Models don't tell us what the world looks like. Instead, they tell us what we can expect to happen in the world **if the world was like the model**. For example, the supply and demand diagram doesn't look anything like the markets in the real world.
 - ◆ But it tells us that **if the real world was like the model**, then higher demand would lead to increase in equilibrium price and quantity, lower supply would lead a decrease in price and quantity, etc.

Why Models?

- 2. Models can be used to perform controlled experiments.**
 - ◆ In the real world many things change at the same time; the technology changes, government policies change, etc. In the model we can perform controlled experiments of changing one thing at a time (*ceteris-paribus*). This is impossible to do with actual economies.

Why Models?

3. Models can be used for policy analysis.

- ◆ Suppose that we tested a model, and its predictions are consistent with the evidence. We can answer “what if” questions:
 - **What if** the federal tax rate goes up?
 - **What if** the government increases subsidies to education?
 - **What if** the central bank increases the money supply?

Models are not realistic and are not supposed to be.

- ◆ When the object of study is very complicated, we need models that will highlight some important features of the object and leave out many other features. For example, when we study the economy of an entire country with millions of people, thousands of markets and firms, it is difficult for us to understand the behavior of the economy by just looking at it.
- ◆ Moreover, if we don't have any models to work with, we don't even know what data should be collected about the object of our study. For example, the model of supply and demand tells us that we don't need to collect data of all the names of buyers and sellers in a market in order to understand how it works.

The construction of a model is motivated by questions

- ◆ The first macroeconomic model in this course is the **classical model**.
- ◆ Questions it attempts to answer:
 1. What causes business cycles?
 2. What is the effect of government policies on the economy?
 3. Can the government do something to smooth the business cycles?