

Introductory to mathematical economics

EE320

Semester 1/2017

Kittichai Saelee

Logistics

▶ **About the Instructor:**

- ▶ Kittichai Saelee
 - ▶ Ph.d.in economics (UW-Madison)
 - ▶ Specialized: macroeconomics / structural macroeconometrics
- ▶ Email: [kittichai_lee\[at\]econ.tu.ac.th](mailto:kittichai_lee[at]econ.tu.ac.th)
- ▶ Office: RM#516. (Thur: 2.00 – 4.00 pm, or by appointment)

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- ▶ **About the lecture:**

- ▶ Rm# 303; Tuesday/Thursday
- ▶ Class will start at 11.05 am and finished at 12.30 pm.
- ▶ Teaching will be lecture-based.

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▶ Rules

- ▶ I don't check for your class attendances; however, I encourage everyone to attend my class.
- ▶ Please don't come late. (5-min walk should be enough.)
- ▶ No chat, No Cellphone, No #instragram, No FB (also live).
- ▶ Please address all the questions/discussions in **English**.

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► Evaluations

- Quiz (10%)
 - 6 quizzes; short question, 15 mins.
 - Rule: dropping the lowest one out. (Each counts 2%)
- Homework (10%)
 - 5-6 assignments. (no dropping rule applies here!)
 - Attempt all, but grading will be based only one/two question(s) randomly selected.
 - Due date is one week after the assigned date. (3 pm at the BE office)
- Mid-term (30%): Oct, 3th (2 hours: 11 am – 1 pm)
- Final (50%): (3 hours: Dec, 24th: 13.30 am – 16.30 pm)

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▶ **About the exam:**

- ▶ The exam will be the 50-50 option.
 - ▶ Both sections will be sharing at least 50% of the questions in each exam. (only for midterm and final)
- ▶ We do the grading separately.
 - ▶ Nothing to do with the other section.

▶ **Materials:**

- ▶ My own lecture notes. (Manage to get a copy on your own.)
- ▶ Some other references in course syllabus.

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▶ **Materials:**

- ▶ Upload on BE moodle.
 - ▶ The four-digit code is **2531**.
 - ▶ Any announcements/correspondences thereafter will be made via email.
- ▶ When you contact me, please tell me who you are. (I'd like to know your name.)

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- ▶ Grading is based on curve!
- ▶ My suggestion:
 - ▶ Study hard “*regularly*”. (Don’t just the two weeks before each exam!)
 - ▶ Form up your own study group, and help one another.
 - ▶ Do the *practice problem set (no grade) / assignment (graded)* yourself!
 - ▶ Don’t piggy-back your friend. *Free-riding doesn’t help you in the long term.* It only works to get you 10% for the homework, but the rest of 90% would be on your own.
- ▶ **NO** favorable treatment! Everything is on your hand.

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Course overview / Nature of economics analysis

Agenda

- ▶ **Course overview**
- ▶ **Nature of economics analysis**



What is this course all about?

- ▶ This course is mainly about the **application** of mathematics for economics analysis.
- ▶ That is, we show students how to “represent” and “analyze” **some of the economic theories** that you’ve learned in ee211/ee212 in the mathematical form.
- ▶ MA216 tools + some new tools.

Why using math in economic analysis

- ▶ Sound difficult, so why bother using mathematics in the economic analysis.
- ▶ Limitations of the *narrative* and *graphical* approach in addressing the complex analysis that requires understanding the relationship of variables in **multi-dimensional** array.
- ▶ Mathematical model is an important ground for taking the model to test with the data: a foundation for econometric model that links between **theory** and **data**.

Why using math in economic analysis

- ▶ In terms of economic theory, we are **not** going to introduce any new theoretical concepts: all these should be already seen in 212/213.
- ▶ In terms of mathematics, we will focus on three important tools:
 - ▶ Function/relation
 - ▶ Method of solving system of equations (linear and non-linear)
 - ▶ Univariate and multivariate calculus
 - ▶ Optimization theory

What is this course all about?

- ▶ Function/Relation in MA216:
 - ▶ $y = f(x)$
- ▶ Function in EE320 is to put “y” and “x” into economic context.
 - ▶ Describing relationship between y and x, using equation.

What is this course all about?

- ▶ Method of solving system of equations

$$a_{11}x_1 + a_{12}x_2 + \cdots + a_{1n}x_n = b_1$$

$$a_{21}x_1 + a_{22}x_2 + \cdots + a_{2n}x_n = b_2$$

$$\vdots \quad \quad \quad \vdots \quad \quad \quad \vdots \quad \quad \quad \vdots$$

$$a_{m1}x_1 + a_{m2}x_2 + \cdots + a_{mn}x_n = b_m.$$

- Most economic concepts can be formulated as system of equations, which equilibrium outcome of the model can be obtained by solving for the solution of such a system of equations.

What is this course all about?

► Univariate calculus

- Single variable: $y = f(x), \frac{dy}{dx} = f'(x),$
higher order $f''(x), \dots, f^n(x)$

► Multivariate calculus

- Multiple variable: $y = f(x_1, x_2, \dots, x_n)$
- Various concepts of finding the derivative for multivariable case: partial derivative, total differential, etc.

What is this course all about?

- ▶ **Optimization theory** is the central toolkit for mathematical economics model.
- ▶ Application of calculus to solve for the extreme point problem.
 - ▶ Choosing for “x” that **maximize or minimize** a function.
- ▶ Suppose that we interpret this problem in economic context, what can they be?
 - ▶ Most economics problems are about the extreme point problem!!
 - ▶ The concept of optimization problem matches perfectly well with the idea of economic decision making, in which agent **chooses for any actions** that best generate the **highest returns/benefits**, given the **constraints** facing.
 - ▶ New tools given is the **optimization under constraints**.

Agenda

- ▶ Course overview
- ▶ Nature of economics analysis



Structure of economic analysis

- ▶ How do we study economics?
 - ▶ Model-based analysis
- ▶ Model is an **abstract** form of the problem that we are interested in.
 - ▶ The problem that we are interested in aims at getting us some insights, **helping us understand something about how the world/economy works.**
 - ▶ Typically, all the results in a certain model hinges on the assumptions used in the analysis.

Structure of economic analysis

- ▶ Models developed to answer three broad classes of analytical questions that economists conceptually ask:
 - ▶ Determine the equilibrium → static equilibrium analysis
 - ▶ If something happens, make predictions about the new equilibrium → comparative static equilibrium
 - ▶ How do we move from old to new equilibrium → dynamic analysis

Structure of economic analysis

- ▶ **Micro: Price determination model**
 - ▶ Question: At what price and quantity of output, market will trade?
 - ▶ To understand this issue, we need to conceptualize behavior of the **two parties** in trading arrangements: **buyers and sellers**

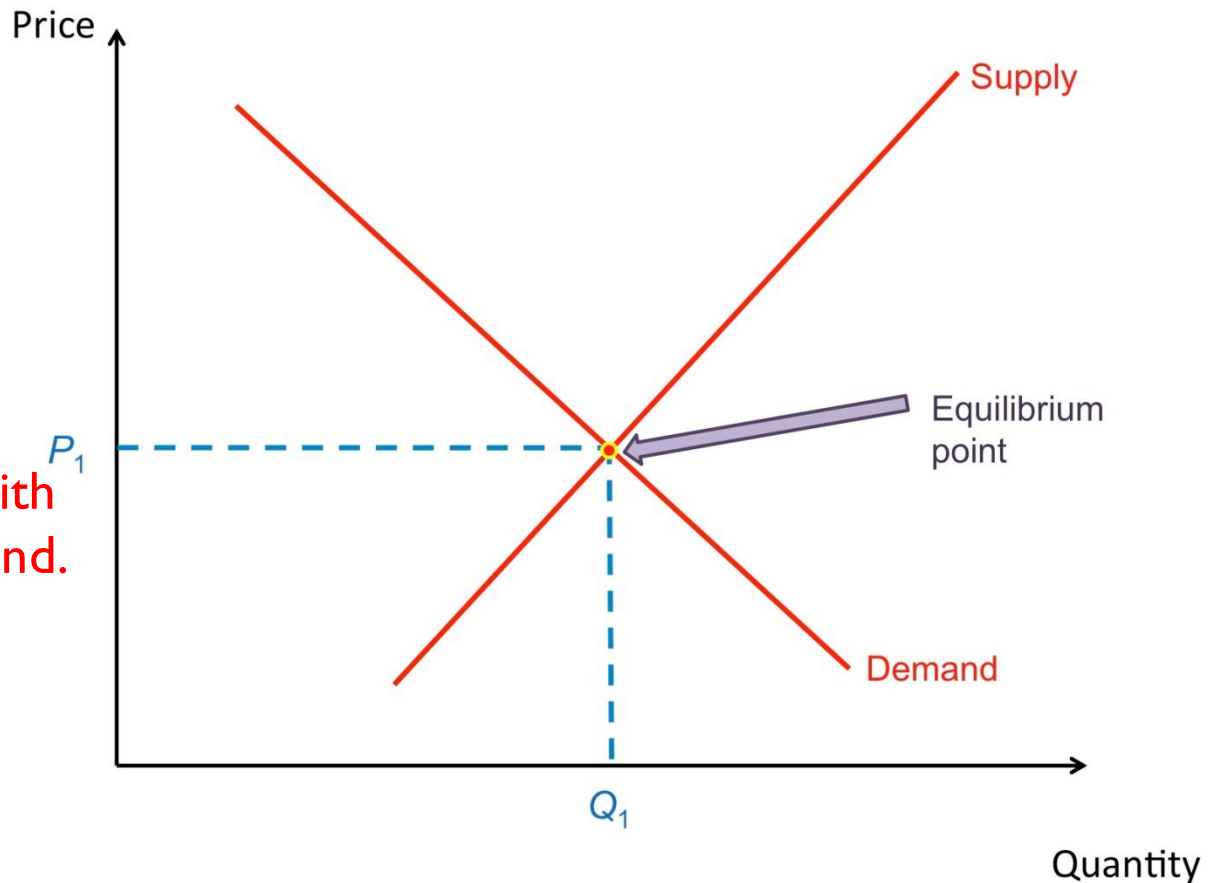
Structure of economic analysis

- ▶ How do we do that?
 - ▶ Conceptual framework for understanding the behavior of these two parties are often summarized in terms of **DEMAND** and **SUPPLY**.
 - ▶ Conventionally, behavioral assumptions are that
 - ▶ Demand: Given all other factors, quantity demanded is negatively related to price.
 - ▶ Supply: Given all other factors, quantity supplied is positively related to price.

Structure of economic analysis: Static equilibrium analysis

Static analysis:

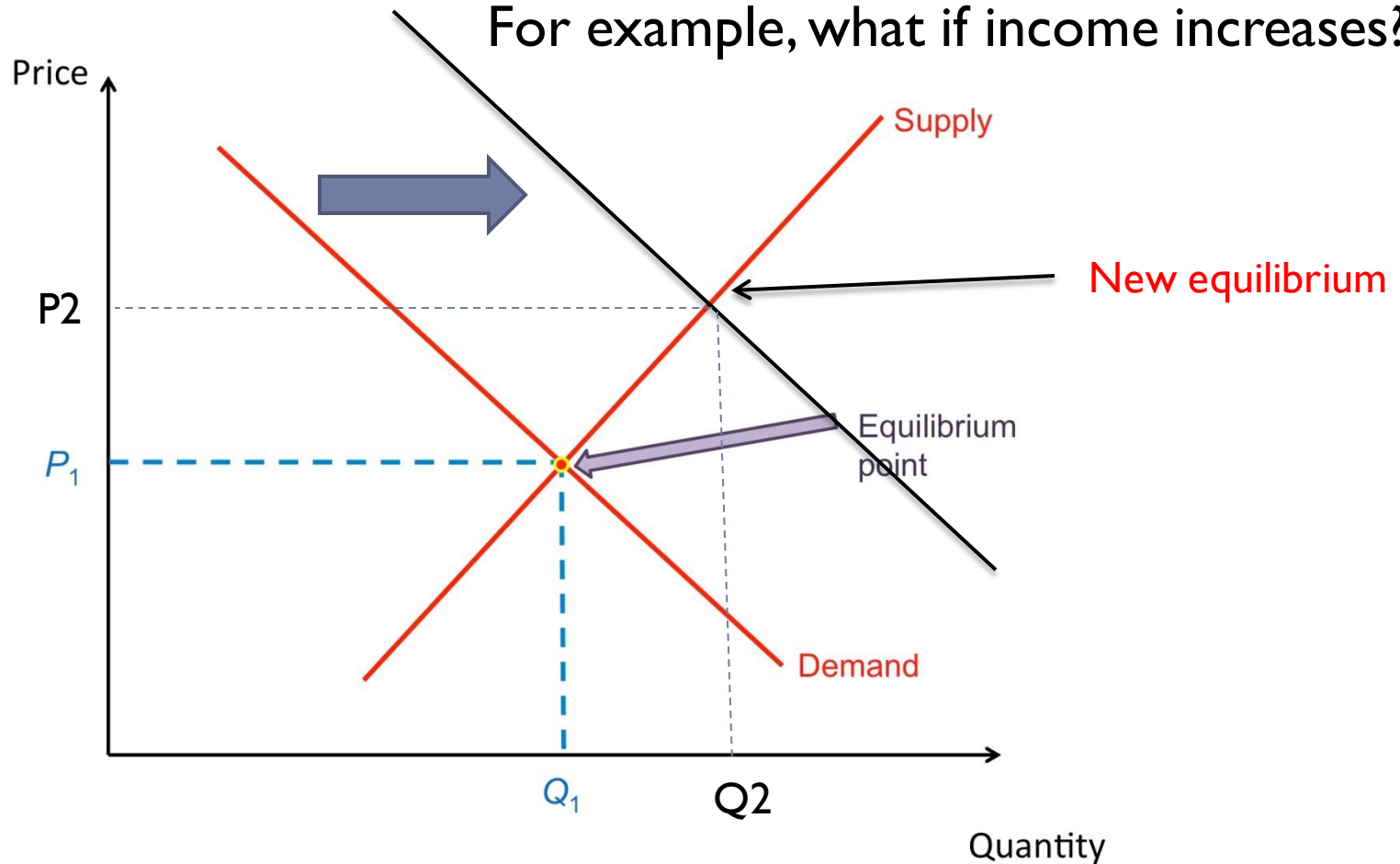
- Draw demand/supply onto p-q diagram
- Equilibrium occurs when price clears the market. That is, demand matches with supply, aka no excess demand.



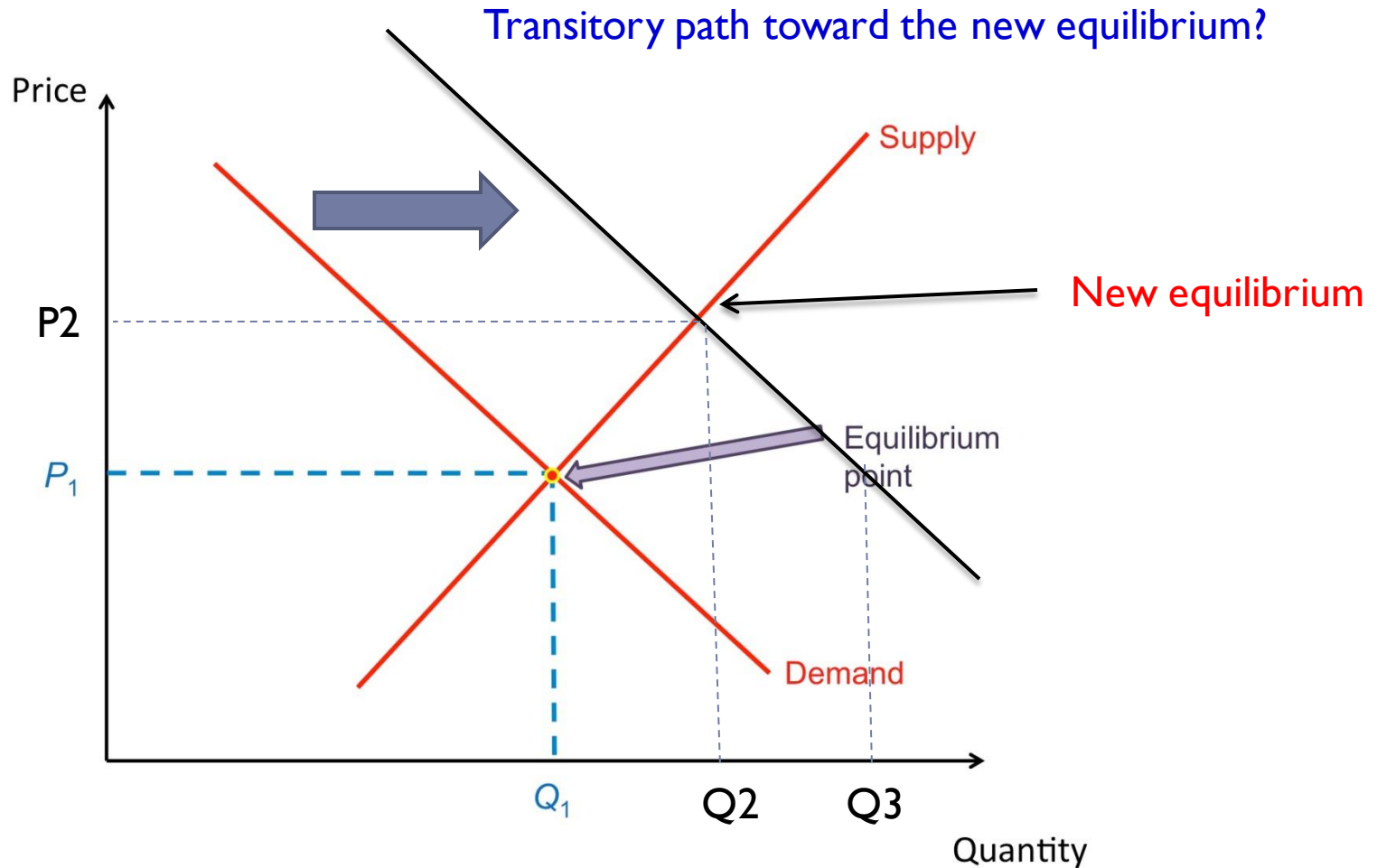
Structure of economic analysis:

Comparative static analysis

Comparative static analysis:
For example, what if income increases?



Structure of economic analysis: **Dynamic** analysis



Structure of economic analysis: Dynamic analysis

