Environmental Economics

Consumers

Hiroaki Sakamoto*

May 7, 2018

*Faculty of of Law, Politics, and Economics, Chiba University

Announcement

Class schedule

We will have an extra class at

- May 28, 17:50–19:20 (the same room)

Most likely, it will be a review or/and QA session which covers the topics we discuss in the first half of the course. The purpose of this session is to prepare you for the midterm exam on June 11.

This will be the most useful if you prepare a list of questions in advance and ask me those questions during the session.

Today’s activity

More on China’s growth

More on the local knowledge problem

More on China's growth

Planet Money episode

Listen to the following episode:

- The secret document that transformed China

which tells you a story of a secret document written in a small village in China in 1978, which ended up having completely transformed China's economy.

Questions

And try to answer the following questions:

- What China was like in 1978?
- What did the farmers in the small village decide to do?
- What happened as a result?

More on China's growth

What China was like in 1978?

Millions of people living in rural areas were in poverty.

- Back in this era, everything was centrally planned and people were working together for the common good.
- Nobody was allowed to own anything.
- Every output you produce belong to the collective farm and it does not matter how hard you work.

People did not have an incentive to work hard and the productivity of the economy was very low.

More on China's growth

What did the farmers in the small village do?

Out of desperation, farmers in a small village came up with an idea.

- They had to call for a secret meeting to discuss it because if they get discovered, they would be executed.
- They basically set up their own economy where each farmer owns what they grow.
- They ended up writing down this idea in the form of a contract.

This secret, voluntary contract completely changed the incentive structure of farmers in the village. Everyone worked harder and competed with each other.

More on China's growth

What happened as a result?

They were so successful that it was impossible to hide it at the harvest time.

- They produced a huge amount of harvest, more than what they had grown in the previous five years combined.
- Fortunately to the farmers, the communist party official was open-minded and encouraged them to make this experiment continue to work.
- Pretty soon, the system they introduced in this small village got popular all over China.

Since then, China's economy grew like crazy and, as a result, something like 5 hundred million people in China had risen out of poverty.

More on the local knowledge problem

Another Planet Money episode

Listen to the following episode:

- The pickle problem

which tells you how Feeding America, a large nonprofit organization that collects donations of food and distributes them to the hungry people across the United State transformed itself based on a market-based system.

Questions

And try to answer the following questions:

- What is the problem Feeding America had under the old food distribution system?
- How they changed the system and what happened under the new system?

More on the local knowledge problem

What was the problem of Feeding America?

Up until 2005, Feeding America distributed food based on a straightforward system.

- When they get donations of food, they distribute them to the people at the top of their waiting list.
- Under this system, foods often ended up in the wrong places.
- Local knowledge problem: somebody else is making a decision for you, when they do not have the knowledge of what you actually need.

All sorts of mismatches in supply and demand are expected under this system.

More on the local knowledge problem

How they changed the system?

As Hayek pointed out, the most effective solution to the local knowledge problem is a market.

- Market mechanism works without actually trying to collect the information in the economy.
- Feeding America set up their own market in which each local food bank can buy and sell donated foods based on their needs and preferences.
- The new system started in 2005 and quickly proved successful.

What is particularly remarkable about this story is that not only efficiency, but at the same time, equity were also achieved through the market system.

Theory of consumers

Set of alternatives

Preference

Utility function

Demand function

Economic model of decision making

In one sentence

Given a **set of alternatives**, people choose **the one they like the best**.

Formalizing the idea

Need to be a bit more explicit about what we mean by

- ‘set of alternatives,’ and
- ‘the one they like the best’

Set of alternatives

We denote by X the set of all alternatives from which people can potentially choose an element. The set X describes the trade off involved in decision making.

Examples

Here are some examples:

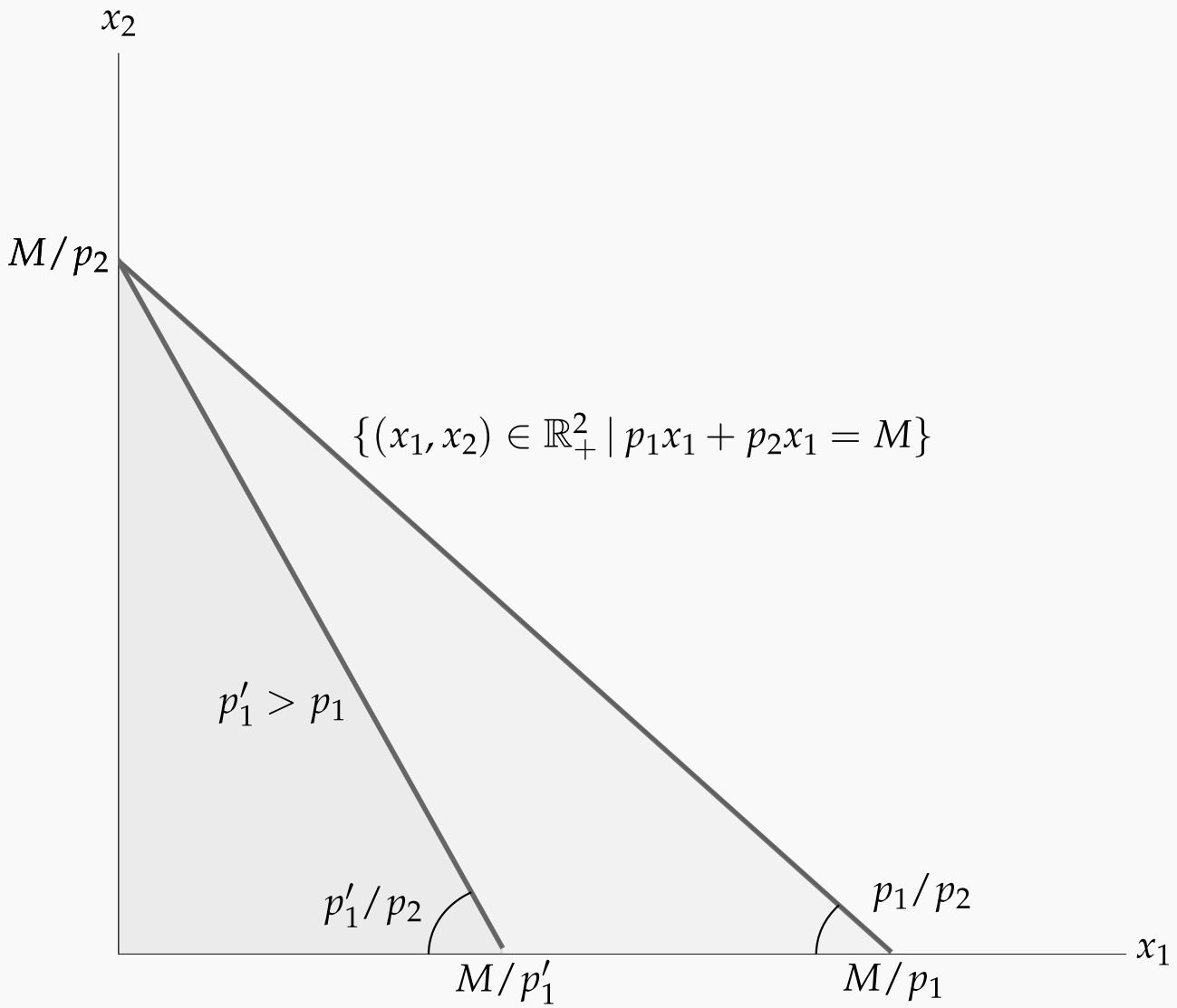
$$X := \{(\text{1 apple, 2 oranges}), (\text{2 apples, 1 orange})\}, \tag{1}$$

$$X := \{(1,5), (2,4), (3,3), (4,2), (5,1)\}, \tag{2}$$

$$X := \{(x_1, x_2) \in \mathbb{R}_+ \times \mathbb{R}_+ \mid p_1 x_1 + p_2 x_2 = M\}, \tag{3}$$

where (3) is called the budget line (or budget set).

Set of alternatives



Preference

It should be reasonable to assume that each individual has a personal ranking $\succsim$ defined over the set of alternatives, which we call their **preference**.

Notations

We write

$$(x_1, x_2) \succ (x_1', x_2') \tag{4}$$

to mean that (x_1, x_2) is preferable to (x_1', x_2'); and

$$(x_1, x_2) \sim (x_1', x_2') \tag{5}$$

to mean that (x_1, x_2) and (x_1', x_2') are equally preferable. Also, we write

$$(x_1, x_2) \succsim (x_1', x_2') \iff \text{(4) or (5)} \tag{6}$$

Preference

Examples

If

$$X := \{(1,5),(2,4),(3,3),(4,2),(5,1)\} \tag{7}$$

is the set of alternatives,

$$(2,4) \succsim (3,3) \succsim (1,5) \succsim (4,2) \succsim (5,1) \tag{8}$$

is one possible preference over X, and

$$(4,2) \succsim (3,3) \succsim (5,1) \succsim (2,4) \succsim (1,5) \tag{9}$$

is another possible preference over X.

Model of individual decision making (revisited)

Given a set of alternatives X, an individual with preference $\succsim$ would choose (x_1^*, x_2^*) such that

$$(x_1^*, x_2^*) \succsim (x_1, x_2) \quad \forall (x_1, x_2) \in X \tag{10}$$

Example

If the set of alternatives is

$$X := \{(1,5), (2,4), (3,3), (4,2), (5,1)\} \tag{11}$$

and the preference is

$$(2,4) \succsim (3,3) \succsim (1,5) \succsim (4,2) \succsim (5,1), \tag{12}$$

then, we predict that $(2,4)$ would be chosen by this individual.

Utility function

Utility function

Given preference $\succsim$, we say that a **utility function** $U : X \to \mathbb{R}$ represents the preference if

$$U(x_1, x_2) \geq U(x_1', x_2') \iff (x_1, x_2) \succsim (x_1', x_2') \tag{13}$$

for all $(x_1, x_2) \in X$.

Example

Let $X := \{(1,5), (2,4), (3,3), (4,2), (5,1)\}$ and consider a preference $\succsim$ on X such that

$$(2,4) \succsim (3,3) \succsim (1,5) \succsim (4,2) \succsim (5,1) \tag{14}$$

This preference is represented by $U(x_1, x_2) := x_1^{1/3} x_2^{2/3}$ b/c

$$U(2,4) \geq U(3,3) \geq U(1,5) \geq U(4,2) \geq U(5,1) \tag{15}$$

Utility function

Utility maximization problem

Consider an individual whose preference $\succsim$ is represented by a utility function $U : X \to \mathbb{R}$. Then (10) is equivalent to

$$U(x_1^*, x_2^*) \geq U(x_1, x_2) \quad \forall (x_1, x_2) \in X. \tag{16}$$

Therefore, the consumer's problem may be rewritten as the **utility maximization problem**

$$\max_{(x_1, x_2) \in X} U(x_1, x_2) \tag{17}$$

Demand function

Let (x_1^*, x_2^*) be the solution of (17). We know from Fact 3 in the math review that (x_1^*, x_2^*) must satisfy

$$\frac{U_1(x_1^*, x_2^*)}{U_2(x_1^*, x_2^*)} = \frac{p_1}{p_2} \tag{18}$$

and

$$p_1 x_1^* + p_2 x_2^* = M. \tag{19}$$

Solving this system of equations yields (x_1^*, x_2^*) as a function of (p_1, p_2, M), which we call the **demand function**.

Demand function

Example

Consider the case where the choice set is

$$X := \{(x_1, x_2) \in \mathbb{R}_+ \times \mathbb{R}_+ \mid p_1 x_1 + p_2 x_2 = M\} \tag{20}$$

and the utility function is

$$U(x_1, x_2) = x_1^{1/2} x_2^{1/2}. \tag{21}$$

Denote as (x_1^*, x_2^*) the solution of

$$\max_{(x_1, x_2) \in X} U(x_1, x_2) \tag{22}$$

Demand function

Then

$$\frac{U_1(x_1^*, x_2^*)}{U_2(x_1^*, x_2^*)} = \frac{p_1}{p_2} \iff \frac{x_2^*}{x_1^*} = \frac{p_1}{p_2}$$
$$\iff p_2 x_2^* = p_1 x_1^*, \tag{23}$$

which, together with $p_1 x_1^* + p_2 x_2^* = M$, implies

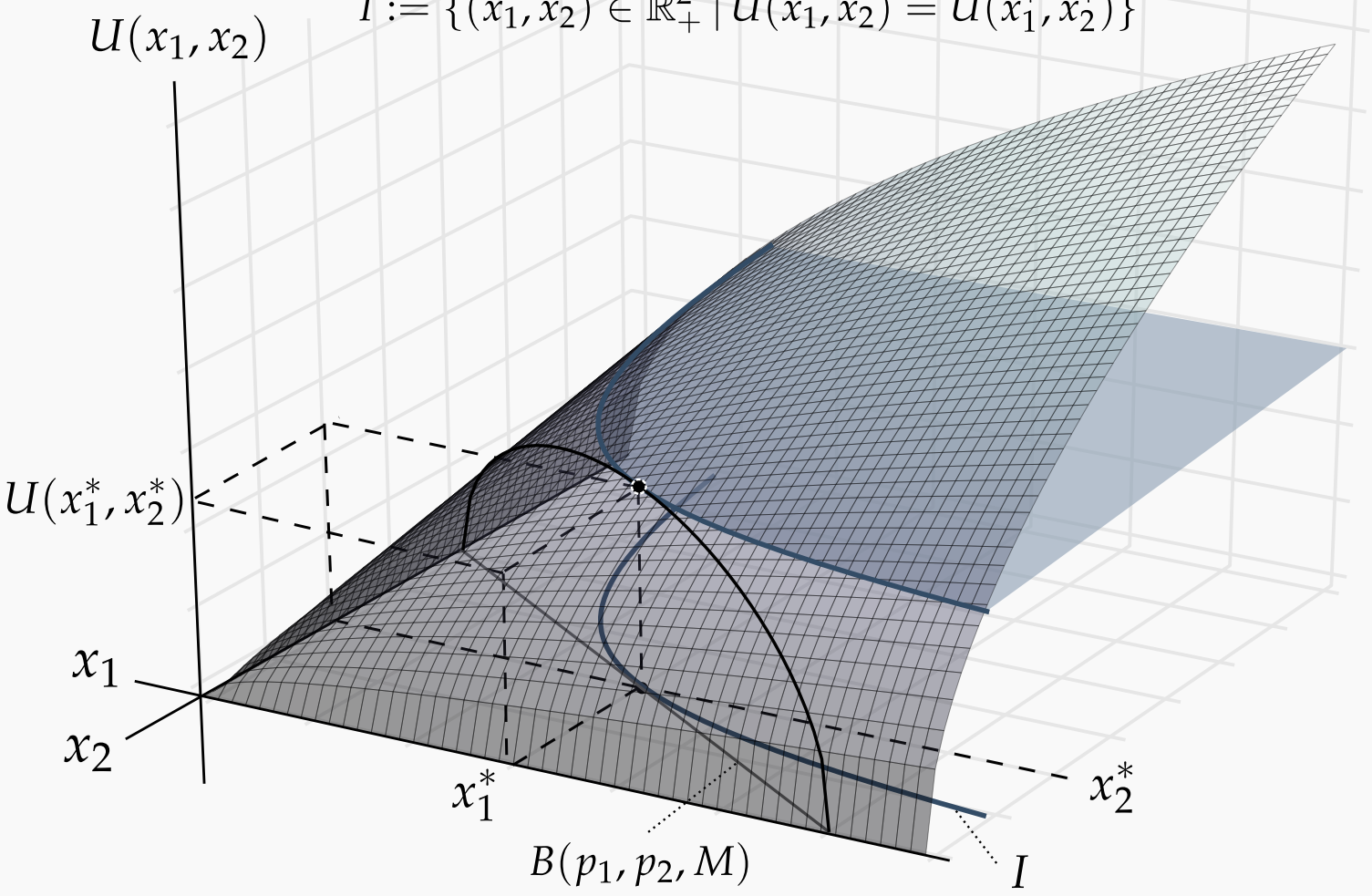
$$x_1^* = \frac{M}{2p_1}, \quad x_2^* = \frac{M}{2p_2}. \tag{24}$$

Notice that the demand x_i^* is decreasing in p_i and is increasing in M.

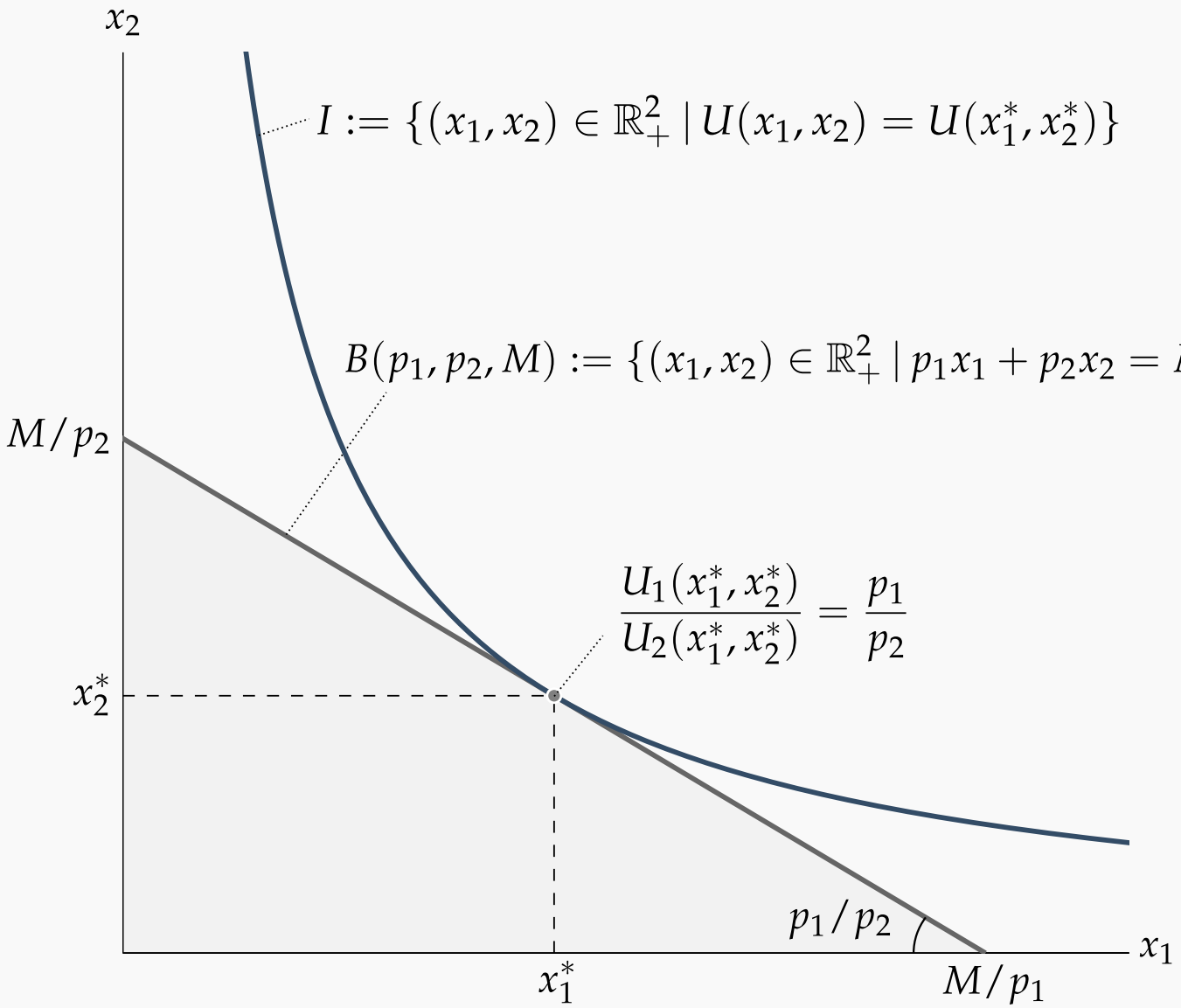
Demand function

$$B(p_1, p_2, M) := \{(x_1, x_2) \in \mathbb{R}^2_+ \mid p_1 x_1 + p_2 x_2 = M\}$$

$$I := \{(x_1, x_2) \in \mathbb{R}^2_+ \mid U(x_1, x_2) = U(x_1^*, x_2^*)\}$$



Demand function



Demand function

Exercise 1

Consider a consumer whose preference is represented by a utility function

$$U(x_1, x_2) := x_1^{2/3} x_2^{1/3}. \tag{25}$$

Derive the demand function for each good.

Exercise 2

Consider another consumer whose preference is represented by a utility function

$$U(x_1, x_2) := \left(x_1^{-1} + x_2^{-1} \right)^{-1} \tag{26}$$

Derive the demand function of this consumer for each good.