LECTURE 5
CONSUMERS AND UTILITY MAXIMIZATION
JANUARY 31, 2017

I. INTRODUCTION TO CONSUMER OPTIMIZATION

II. THE BUDGET CONSTRAINT
   A. Description
   B. Diagram for the case of 2 goods
   C. What causes the budget constraint to change?
      1. Changes in income (discussion of the paper by Duflo)
      2. Changes in prices

III. UTILITY MAXIMIZATION
   A. What do consumers seek to maximize?
   B. Marginal utility
   C. Diminishing marginal utility
      1. Intuition and example
      2. Relationship between total utility and marginal utility (including a brief
digression using calculus)
   D. Variation in how quickly marginal utility declines
   E. The condition for utility maximization (the rational spending rule)

IV. WHY DEMAND CURVES SLOPE DOWN
   A. Substitution effect
   B. Income effect
   C. A more general example
   D. Individual and market demand curves

V. WHY DEMAND CURVES SHIFT
   A. A change in tastes
   B. A change in income (further discussion of the paper by Duflo)
LECTURE 5
Consumers and Utility Maximization

January 31, 2017
Announcements

• Hand in Problem Set 1.

• Suggested answers will be posted after class on Thursday.

• Office hours this week will be on Friday, 2:30–4:30.
I. INTRODUCTION TO CONSUMER OPTIMIZATION
Why Consumer Optimization Is Important

• It has implications for how we view the desirability of market outcomes.

• It can help us to understand the many choices that consumers make.
II. THE BUDGET CONSTRAINT
A Household’s Budget Constraint

• **In words:** The total amount the household spends cannot exceed its income.

• **In symbols:**

\[ P_a \cdot q_a + P_b \cdot q_b + P_c \cdot q_c + \ldots + P_z \cdot q_z = \text{Income}, \]

where the P’s are the market prices of the various goods, and the q’s are the quantities that the household buys.
Budget Constraint for the Case of Two Goods

\[ P_{\text{food}} \cdot q_{\text{food}} + P_{\text{clothing}} \cdot q_{\text{clothing}} = \text{Income} \]

- Intercept = \( \frac{\text{Income}}{P_f} \)
- Slope = \( -\frac{P_c}{P_f} \)
- Intercept = \( \frac{\text{Income}}{P_c} \)
A Rise in Income

Budget constraint_2

Budget constraint_1
“Grandmothers and Granddaughters” by Esther Duflo

• The development that she focuses on:
  • A shift in budget constraints.
  • Specifically, a large expansion in old-age pensions in South Africa in the early 1990s.
  • Affected some households but not others.
• Example of a “natural experiment.”
The Same Percentage Increase in Both Prices
A Rise in the Price of Clothing

\[ q_{\text{food}} \]

\[ q_{\text{clothing}} \]

Budget constraint \(_1\)

Budget constraint \(_2\)
III. Utility Maximization
What do we think consumers maximize?

- Happiness, satisfaction, utility.
- We don’t make judgments about what gives people happiness.
Utility

• **Total Utility:** The total happiness one gets from consuming some amount of a good.

• **Marginal Utility:** The extra utility derived from consuming one more unit of a good.
Diminishing Marginal Utility

• As a household consumes more of a good, the marginal utility of the good declines.
Diminishing Marginal Utility
Relationship between Total Utility and Marginal Utility

• Suppose

\[ U = f(q) \]

where \( q \) is the quantity of some good a household consumes, and \( U \) is the total utility the household gets from consuming the good.

• Then

\[ MU = f'(q), \]

where \( MU \) is marginal utility.
Relationship between Total and Marginal Utility

Total Utility

Marginal Utility

$q$

$q$
Marginal Utility Likely Declines at Different Rates for Different Goods

Good a

\[ MU_a \]

\[ q_a \]

Good b

\[ MU_b \]

\[ q_b \]
The Condition for Utility Maximization (the Rational Spending Rule)

• A household is doing the best that it can—that is, it is maximizing its utility—if:

The marginal utility derived from spending one more dollar on a good is the same for all goods.
The Condition for Utility Maximization with Just Two Goods (Food and Clothing)

\[
\frac{1}{P_c} MU_c = \frac{1}{P_f} MU_f
\]

This is the same as:

\[
\frac{MU_c}{P_c} = \frac{MU_f}{P_f}
\]

Where the P’s are the market prices of the two goods and the MU’s are the marginal utilities of an additional unit of the two goods.
The General Condition for Utility Maximization (the Rational Spending Rule)

\[
\frac{MU_a}{P_a} = \frac{MU_b}{P_b} = \ldots = \frac{MU_z}{P_z},
\]

where the P’s are the market prices of the different goods, and the MU’s are the marginal utilities of an additional unit of the different goods.
IV. WHY DEMAND CURVES SLOPE DOWN
A Rise in the Price of Clothing

• Suppose the household starts with:
  \[
  \frac{MU_c}{P_c} = \frac{MU_f}{P_f}
  \]

• If $P_c$ rises, and the household didn’t change its purchases, then:
  \[
  \frac{MU_c}{P_c} < \frac{MU_f}{P_f}
  \]

• The household will need to buy less clothing (and more food) until:
  \[
  \frac{MU_c}{P_c} = \frac{MU_f}{P_f}
  \]
Why Demand Curves Slope Down

- **Substitution effect**: When the price of a good rises, households want less of the good and more of other goods, because the good is relatively more expensive.

- **Income effect**: When the price of a good rises, households want less of all goods, because their budget constraint has changed for the worse.
A Rise in the Price of Clothing

\[ q_{\text{food}} \]

\[ q_{\text{clothing}} \]

Budget constraint_1

Budget constraint_2
Returning to the Market for Blueberries

• An optimizing consumer sets:

\[
\frac{MU_{\text{blueberries}}}{P_{\text{blueberries}}} = \frac{MU_{\text{everything else}}}{P_{\text{everything else}}}
\]

• A decline in the \( P_{\text{blueberries}} \) causes:

\[
\frac{MU_{\text{blueberries}}}{P_{\text{blueberries}}} > \frac{MU_{\text{everything else}}}{P_{\text{everything else}}}
\]

• The optimizing consumer will want to consume more blueberries because of both the substitution and income effects.
Demand Curves

**Individual Consumer**

**Market**

![Individual Consumer Demand Curve](Diagram 1)

![Market Demand Curve](Diagram 2)
Individual and Market Demand Curves

• The total demand (or market demand) for a good at a given price is the horizontal sum of individual consumers’ demands.

• Because individuals’ demand curves (d) slope down, the market demand curve (D) slopes down.

• Because individuals’ demand curves are derived from optimizing behavior, the market demand curve is as well.
V. **WHY DEMAND CURVES SHIFT**
Blueberries may help prevent Alzheimer's, new research suggests

4:41PM GMT 13 Mar 2016

Scientists say the fruit is loaded with healthful antioxidants which could help prevent the effects of the increasingly common form of dementia.

Blueberries, already classified as a “superfruit” for its health boosting properties, could now also help fight dementia, new research suggests. The study shows the berry, which can potentially lower the risk of heart disease and cancer, could also be a weapon in the battle against Alzheimer's disease. Scientists say the fruit is loaded with healthful antioxidants which could help prevent the devastating effects of the increasingly common form of dementia. One study involved 47 adults aged 68 and older, who had mild cognitive impairment, a risk condition for Alzheimer’s disease.
Positive News about Blueberries

• An optimizing consumer sets:

\[
\frac{MU_{\text{blueberries}}}{P_{\text{blueberries}}} = \frac{MU_{\text{everything else}}}{P_{\text{everything else}}}
\]

• A rise in the MU_{\text{blueberries}} causes:

\[
\frac{MU_{\text{blueberries}}}{P_{\text{blueberries}}} > \frac{MU_{\text{everything else}}}{P_{\text{everything else}}}
\]

• The optimizing consumer will want to consume more blueberries at the same \( P_{\text{blueberries}} \)*
Positive News about Blueberries

MU

q

MU₁

MU₂

q₁
Effect of Positive News on the Demand Curve

![Graph showing the effect of positive news on the demand curve]
Table 3. Effect of the Old-Age Pension Program on Weight for Height: OLS and 2SLS Regressions

<table>
<thead>
<tr>
<th>Variable</th>
<th>OLS</th>
<th></th>
<th></th>
<th>2SLS</th>
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<tr>
<td></td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
<td>(7)</td>
</tr>
<tr>
<td><strong>Girls</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eligible household</td>
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<td></td>
<td></td>
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<tr>
<td>Woman eligible</td>
<td>0.24*</td>
<td>0.61*</td>
<td>0.61*</td>
<td>1.19*</td>
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<td></td>
<td>(0.12)</td>
<td>(0.19)</td>
<td>(0.19)</td>
<td>(0.41)</td>
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<tr>
<td>Man eligible</td>
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<td>0.11</td>
<td>0.056</td>
<td>-0.097</td>
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<td></td>
<td>(0.22)</td>
<td>(0.28)</td>
<td>(0.19)</td>
<td>(0.74)</td>
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<td>Observations</td>
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<td>1533</td>
<td>1533</td>
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<tr>
<td><strong>Boys</strong></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Eligible household</td>
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<tr>
<td>Woman eligible</td>
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<td>0.28</td>
<td>0.31</td>
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<td></td>
<td>(0.14)</td>
<td>(0.28)</td>
<td>(0.28)</td>
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<tr>
<td>Man eligible</td>
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<td>(0.22)</td>
<td>(0.34)</td>
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<td>Presence of older members</td>
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<td>Yes</td>
<td>Yes</td>
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<td>Yes</td>
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<tr>
<td>Child age dummy variables</td>
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<td>Yes</td>
<td>Yes</td>
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</table>

*Significant at the 5 percent level.
A Rise in Income

• If the household didn’t change its purchases, \( \frac{MU_f}{P_f} = \frac{MU_{ee}}{P_{ee}} \) would still hold.

• But the household isn’t using all its income.

• So it can spend more on both food (which lowers \( MU_f \)) and everything else (which lowers \( MU_{ee} \)).
If the MU$_f$ declines more slowly than the MU$_{ee}$, we would expect q$_f$ to rise more than q$_{ee}$ in response to the rise in income.
Increase in Income Shifts Out the Demand Curves

But the demand curve for food for girls shifts out more.