Chapter 4

Consumer and Firm Behavior: The Work-Leisure Decision and Profit Maximization
The Representative Consumer

• Preferences
  – Goods: The Consumption Good and Leisure
  – The Utility Function \( U(C, l) \)
    • More Preferred to Less
    • Preference for Diversity
    • Consumption and leisure are normal goods
- Indifference Curves
  - Downward Sloping (more preferred to less)
  - Convex to the Origin (preference for diversity)
- Marginal Rate of Substitution (MRS)
  - Slope of the Indifference Curve
  - Rate at which consumer is willing to substitute leisure for consumption goods
Figure 4.1  Indifference Curves
Figure 4.2 Properties of Indifference Curves
• Budget Constraint
  – Price-taking Behavior
  – The Time Constraint \[ l + N^s = h \]
  – Real Disposable Income: after tax
  – A Graphical Representation

\[ C = wN^s + \pi - T = w(h - l) + \pi - T \]
Figure 4.3 Representative Consumer's Budget Constraint ($T > \pi$)

Consumption, $C$

$wh + p - T$

$C = -wl + wh + p - T$

Leisure, $l$

$h + (p - T)/w$

$h$
Figure 4.4 Representative Consumer's Budget Constraint ($T < \pi$)
• Optimization
  – *Rational* Behavior: can make informed optimization decision
    \[
    \max U(C, l)
    \]
    \[
    s.t. C = w(h - l) + \pi - T
    \]
  – Optimization Condition: \( MRS = \text{Relative Price} \)
    \[
    MRS_{l,c} = \frac{\partial U}{\partial l} = \frac{\partial U}{\partial C} = w
    \]
  – A Graphical Representation
Figure 4.5  Consumer Optimization
Figure 4.6 The Representative Consumer Chooses Not to Work
• Comparative Statics Experiments
  – Changes in Dividends ($\pi$) and Taxes ($T$): Pure Income Effect, relative price ($w$) no change $\Rightarrow$ both $c$ and $l$ ↑
  – Changes in the Real Wage ($w$): Income and Substitution Effects $\Rightarrow$ $c$ ↓, $l$ ↑ or ↓
Figure 4.7 An Increase $\pi - T$ for the Consumer
Figure 4.8 Increase in the Real Wage Rate—Income and Substitution Effects
• Labor Supply Curve: \( N^s(w) = h - l(w) \)
  
  – Substitution Effect > Income Effect \( \Rightarrow \) upward-sloping labor supply curve
  
  – Substitution Effect < Income Effect \( \Rightarrow \) downward-sloping labor supply curve

• Question: What does L Supply Curve look like in the data?
Figure 4.9  Labor Supply Curve

\[ N^s(w) = h - l(w) \]
Figure 4.10 Effect of an Increase in Dividend Income or a Decrease in Taxes
Figure 4.12 Real Wage in the United States, 1980–2003
Figure 4.13  Average Weekly Hours in the United States, 1980–2003
• An Example: consumption and leisure are perfect complements (with Leontief preference)

\[ \min(C, al) \]

\[ s.t. C = w(h - l) + \pi - T \]
Figure 4.11  Perfect Complements b/w C and L
• Non-wage disposable income $\pi - T \uparrow \Leftrightarrow$
  both $c$ and $l \uparrow$

• Wage $w \uparrow \Rightarrow$ both $c$ and $l \uparrow$ (no substitution effect)
The Representative Firm

• The Production Function

\[ Y = zF(K, N^d) \]

• Properties of Production Function
  – Constant Returns to Scale

\[ \lambda Y = zF(\lambda K, \lambda N^d) = \lambda zF(K, N^d) \]
– Monotonicity: \( K \uparrow, N^d \uparrow \implies Y \uparrow \)
\[
\frac{\partial Y}{\partial K} = MP_K > 0
\]
\[
\frac{\partial Y}{\partial N} = MP_N > 0
\]
– Declining \( MP_K \)
\[
\frac{\partial MP_K}{\partial K} < 0
\]
– Declining \( MP_N \)
\[
\frac{\partial MP_N}{\partial N} < 0
\]
– Changes in Capital and $MP_N$

\[ \frac{\partial MP_N}{\partial K} > 0 \]

– Total Factor Productivity

\[ z \uparrow \Rightarrow Y \uparrow, \quad MP_N \uparrow, \quad MP_K \uparrow \]
Figure 4.14 Production Function, Fixing the Quantity of Capital and Varying the Quantity of Labor

Output, $Y$

Slope = $MP_N$

$F(K^*, N^d)$

Output, $Y$

$N^*$

Labor Input, $N^d$
Figure 4.15  Production Function, Fixing the Quantity of Labor and Varying the Quantity of Capital

Slope = $MP_K$

Output, $Y$

$F(K, N^*)$

$K^*$

Capital Input, $K$
Figure 4.16 Marginal Product of Labor Schedule for the Representative Firm
Figure 4.17  Adding Capital Increases the Marginal Product of Labor
Figure 4.18  Total Factor Productivity Increases
Figure 4.19 Effect of an Increase in Total Factor Productivity on the Marginal Product of Labor
TFP and Aggregate Production Function

- Cobb-Douglas production function
  \[ Y = zK^\alpha (Nd)^{1-\alpha} \]
- Check it satisfies all the properties
- Capital income share = \( \alpha \)
- The measure of the TFP: **Solow Residual**
  \[ z = \frac{Y}{K^{0.36}N^{0.64}} \]
Figure 4.20 The Solow Residual for the United States
Profit Maximization

• Profits = Total Revenue – Total Variable Costs
  \[ \pi = zF(K, N^d) - wN^d \]

• Firm maximizes profits by setting optimization condition
  \[ M \frac{P}{N} = w \]

• This condition defines the labor demand curve
Figure 4.21  Revenue, Variable Costs, and Profit Maximization
Figure 4.22 The Marginal Product of Labor Curve Is the Labor Demand Curve of the Profit-Maximizing Firm