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

Discussion

- So far: How to measure variables of macroeconomic relevance
- Now, we need a model to account for the ‘stylized facts’
- This week: study a simple model of the behaviour of consumers and firms in a static (one-period) environment taking into account the technology, preferences
- Static versus dynamic..

A typical macroeconomics model

- A typical macroeconomics model contains
  - Firms and consumers
  - Goods to purchase
  - Consumer preferences
  - Production technology
  - Resources, (K,L,N)
  - Sometimes policymakers

Discussion

- Consumers: trade off between working and leisure
  - How are the preferences affected by this trade-off
  - How are the preferences affected by constraints
  - Wages, non-wage income always affect decision to work hard or less hard

A typical macroeconomics model

- We have to identify the objectives of consumers, firms and governments
  - They may optimize subject to tastes, preferences, resources and constraints
- Consistency is important: Final outcome should be an equilibrium concept (maybe competitive or non-competitive eq’m. [imperfect competition])
- Run experiments (what happens to the equilibrium if there is a shock to say government expenditures, oil prices, monetary policy etc.)
  - Experiments on issues that you know the answer (fitting the data)
  - Experiments on issues that you don’t know the answer

Discussion

- Firms: production decisions
  - Production technology
  - Market environment
  - profits
  - influence how much labour is needed to engage in production
  - Equilibrium in the goods and labour market!!
Optimizing Agents (Firms & Consumers)

- Both consumers and firms optimize!!

Representative Consumer

- Represents all consumers in the economy
  - Has preferences (Indifference Curves)
  - Faces constraints (Budget and time constraints)
  - Optimizes her utility

She can consume two types of goods
1. a (physical) consumption good.
2. leisure

Utility Function (Consumption bundles)

\[ U(C_1, l_1) > U(C_2, l_2) \]
\[ U(C_1, l_1) < U(C_2, l_2) \]
\[ U(C_1, l_1) = U(C_2, l_2) \]

Assumptions: Useful to frame our mind!

A1. More is always preferred than less!
A2. Diversity is important
A3. We are talking about normal goods! \((dC/dY>0, dI/dY>0)\)

Indifference Curve: Graphical representation of preferences

Def: An indifference curve connects a set of points representing preferred consumption bundles among which the consumer is indifferent

Indifference Curves

Properties of Indifference Curves

- downward sloping because of A1 (amount)
Figure 4-2 Properties of Indifference Curves

- convex (bowed in towards the origin) because of A2 (diversity)
  - **Marginal Rate of Substitution**
    - **Def:** MRS of leisure for consumption is the rate at which the consumer is just willing to substitute leisure for consumption goods
  - MRS_{C,L} = -(slope of the indifference curve passing through (C,L))

Properties of Indifference Curves

- Diversity implies diminishing marginal rate of substitution

Constraints

- Rep. Agent is competitive (price taker)
  - Price are taken as given, then decisions on consumption are taken
- Suppose (for the moment) barter economy
  - Two goods: consumption and time
  - Trade for leisure time

Constraints (Cont’d)

- Assume that rep. Agent’s (consumer’s) real disposable income is:
  - wN + π + T = 0
  - w: real wage rate
  - π: dividend (profit of firms are distributed to rep. Agent
  - T: lump-sum taxes
  - Consumer has no saving motive remember it is a one-period economy, so spend it (consume all!)

Some manipulations

- Substitute for N from time constraint (l + N = h)
  - C = w(h - l) + π + T
  - i.e. total market expenditure equal to real disposable income
  - Alternatively
    - C + wT = wh + π + T

Slide 13
Slide 14
Slide 15
Slide 16
Slide 17
Slide 18
Graph Consumer’s Budget Constraint

- Write in slope-intercept form
  \[ C = -wl + wh + \pi - T \]
- And graph according to \( T > \pi \)

Figure 4-3 Representative Consumer’s Budget Constraint (\( T > \pi \))

What if \( \pi > T \)?
- Budget constraint is kinked
- Slope of the BC is \(-w\) over its upper portion
- Constraint is vertical in the lower portion
- There is a kink in the budget constraint because consumer can not consume more than \( h \) hours of leisure
- Points along BD: l=h, number of hours worked is 0!

Figure 4-4 Representative Consumer’s Budget Constraint (\( T < \pi \))

In sum
- Rep. agent Budget Constraint tells us what consumption bundles are feasible given the market real wage, dividend income and taxes!

Putting Budget Constraint and Indifference Curves together: Consumer Optimization

- Assume rational agent (knows its preferences, budget constraint and is ABLE to evaluate feasible consumption bundle for itself!)
- Def: The optimal consumption bundle is the point representing a consumption-leisure pair that is on the highest possible indifference curve, and on or inside the consumer’s budget constraint

\[ MRS_{l,c} = w \]
Optimal Consumption bundle
- If is optimal (indifference curve is tangent to budget constraint)
- Why?
  1. Any point inside the Budget Constraint violates the assumption of more is preferred to less!
  2. At a point along the Budget Constraint: Point H is preferred to a Point F since
     the slope of the indifference curve at F > slope of the BC (that is, -w)
     i.e. at F the rate at which the consumer is willing to trade leisure for consumption >> the rate at which the consumer can trade leisure for consumption (i.e. \( MRS_{LC} > w \))
     Consumer would be better off if she gave up a bit of consumption for leisure (moves into higher indifference curve!)

\[ MRS_{LC} = w \]

i.e. optimizing condition makes SURE that \( MRS_{LC} \) equals the RELATIVE PRICE of leisure in terms of consumption goods (C: numeraire)

Comparative Statics
- Let’s conduct some experiments!!
- Assume some exogeneous changes in parameters of our model! (changes in the economic environment)
- See what happens to the consumption leisure decisions of our RepAg

Two Experiments
- A change in the \( \pi-T \) (an income change, that does not depend on wages)
  - Both \( \pi \) and \( T \) can change
  - Pure income effect (prices do not change, thus real wage \( w \) remains constant)

- A change in the \( w \)
  - Income and substitution effects
An Increase in the Consumer’s Dividend Income

- Move from H to K
- Why not some other point on Budget Constraint 2
- An artefact of the assumption of normal goods
- Implies that as income increases, consumption increases but labour supply decreases!!
- income increases by AF but consumption only by C2-C1
- Working less means less wage income

Figure 4-8 Increase in the real Wage Rate-Income and Substitution Effects

- An increase in w
- Remember -w represents the slope of the BC
- Keep π-T constant (isolate pure income effect)
  - C1 → C2
  - But I may increase or decrease (in the example it remains constant)
- Why?
  - Income versus substitution effects!

Increase in the real Wage Rate-Income & Substitution Effects

Substitution effect:

- w increases, suppose we take away dividend income or increase taxes such that we stay on the initial indifference curve
- When real wages increase leisure becomes more expensive relative to consumption goods
- RepAg substitutes away from the more expensive good (leisure) to relatively cheaper good
  - i.e. C increases l drops
  - Labour supply increases (N* = h - l)

Income Effect

- Give back the π-T income
- Normal goods!
- Pure income effect (both consumption and income increases)
  - final effect C increases l may increase/decrease, labour supply N* may increase/decrease

Figure 4-9 Labor Supply Curve
Figure 4-10  Effect of an Increase in Dividend Income or a Decrease in Taxes

Example: Consumption and Leisure are Perfect Complements

- Goods are perfect complements for the consumer if she always wishes to consume these goods in fixed proportions
  - Tires/cars
  - Left shoe/right shoe
  - Toothbrush/paste
  - etc
- Suppose $C = a l$

Figure 4-11  Perfect Complements

Algebraically

- Perfect complements
  - $C = \frac{\alpha}{l}$
  - $C = w (\beta - l) + \pi - T$  \hspace{2cm} (7)
  - $\alpha l + w \sigma - C \beta l$
  - $\pi = w \beta + \pi - T$ \hspace{2cm} (8)
  - $a + w$
  - $C = a \frac{w \beta + \pi - T}{a + w}$

- Note that there is no substitution effects

Figure 4-12  Real Wage in Manufacturing, 1947-1998

Figure 4-13  Average Hours per Week in Manufacturing, 1947-1998
The Representative Firm

- Firms and consumers exchange labour to produce consumption goods
- Production technology
  \[ Y = zF(K, N^d) \]
- \(Z\): total factor productivity

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Def: The marginal product of a factor of production is the additional output that can be purchased with one additional unit of that factor input, holding constant the quantities of the other factor inputs.

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Properties of prod’n function

1. constant returns to scale
2. output increases when either capital or labour input increases
3. MPL decreases as quantity of labour increases
4. MPK decreases as quantity of capital increases
5. MPL increases as the quantity of capital input increases

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Figure 4-14 Production Function, Fixing the Quantity of Capital and Varying the Quantity of Labor

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Figure 4-15 Production Function, Fixing the Quantity of Labor and Varying the Quantity of Capital

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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

Figure 4-20 The Solow Residual for the United States

Profit Maximization
- Determinants of the firm’s demand for labour
- Like the Rep. consumer, firm is competitive (it takes real wages as given)
- Maximize profits ($Y - wN^d$)

Profit Maximization
- $K$ fixed
- Choose $N^d$ to maximize the profits

\[
\pi = z F(K, N^d) - w N^d
\]

\[
\frac{d}{dN} \pi = 0
\]

\[
= z \frac{d}{dN} F(K, N^d) - w = 0
\]

\[
\rightarrow MP_L = w
\]
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