Life-cycle Labour Supply

- The simple static labour supply model discussed so far has a number of short-comings
- For example,
- The model does not allow for borrowing or saving
- I.e. does not account for the fact that individuals may be forward looking
- The model has been used to look at the economic determinants of labour supply (wages, non-labour income etc.) but may not be as useful when looking at correlates such as age
Stylized Facts

To get a sense of what labour supply looks like over the life-cycle let’s look at participation rates by age for men and women, separately.

- Cross sections
- Different census years
- As we might expect, the participation profile for men is an inverted “U”

- Participation increases as men move into their 20’s
- Reaches a maximum in their early 30’s and remains there until their 50’s
- Declines as the conventional retirement age approaches
- Across census years men are retiring earlier

1971:

- Typical woman increased her labour supply into her 20’s
- Reduced participation sharply (late 20’s early 30’s) likely to raise children
- Slight return to work in 40’s and 50’s until retirement

The age-participation profile for women has not been stable over time.
Stylized Facts

- This suggests that we have to be careful to sort between life-cycle effects and cohort or year-of-birth effects.
- The dashed lines suggest that women born more recently have higher participation rates – early in the life-cycle:
  - Consistent with changes in attitudes towards working women.
  - May also be due to changes in economic variables like wages etc.

Dynamic Life-Cycle Labour Supply

- What explains these labour force patterns over the life-cycle?
- Clearly, some common life-cycle phenomena are important here:
  1. The effect of education decisions on the life-cycle timing of work.
  2. Fertility decisions.
  3. Retirement decisions.
- These patterns may also be explained by economic factors such as an individuals wage profile over the life-cycle.
Dynamic Life-Cycle Labour Supply Models

To be certain, the simple static labour supply model is overly simplistic to determine what role these factors play.

Alternative models:
1. Simply treat life-cycle labour supply as a sequence of static labour supply problems.
   - The individual simply maximizes utility in each period given the wage etc. in that period.
   - If the substitution effect > income effect.
   - Individuals work most when wages are highest in the life-cycle.

Dynamic Life-Cycle Labour Supply Models

Problem
- Still does not account for the fact that individuals may be forward looking.

Examples:
(a) If I know that next year’s wage is going to be really high I may react this year by working less.
(b) If I know that a decrease in my wage will only last a year, I may react differently than if the change were permanent.
2. Dynamic Framework

- The idea is that individuals make decisions about lifetime labour supply based on expected lifetime wages.
- Assume the individual lives for N periods.
- Individuals know wages etc. in the future with certainty (can relax this).

Preferences:
- Individual has preferences over consumption and leisure over all N periods of life.

\[ U = u(C_1, C_2, \ldots, C_N, l_1, l_2, \ldots, l_N) \]

Budget constraint:
- Assume that the price of consumption is constant (i.e. no inflation).
- The individual knows wages in every period and has no non-labour income.
- For a model with just 2 periods:

\[ C_1 + C_2 = w_1H_1 + w_2H_2 \]

Lifetime Consumption = Lifetime Earnings.

- This assumes that the interest rate equals zero.
- e.g. could consume everything in the first period.

\[ C_1 = w_1H_1 + w_2H_2 \]

- Consume next year’s earning this year without paying interest.
Dynamic Life-Cycle Labour Supply Models

- More realistic to assume that the individual can borrow and lend at interest rate \( r \)

\[
C_1 + \frac{C_2}{(1 + r)} = w_1 H_1 + \frac{w_2 H_2}{(1 + r)}
\]

P.V. Consumption = P.V. Lifetime Earnings

- Recall that \( H_t = T - l_t \) in any period (t)

- Thus, we can rewrite the budget constraint as:

\[
C_1 + \frac{C_2}{(1 + r)} + w_1 l_1 + \frac{w_2 l_2}{(1 + r)} = w_1 T + \frac{w_2 T}{(1 + r)}
\]

P.V. Consumption (goods and leisure) = P.V. Lifetime Labour endowment

Comparative Statics

- The individual maximizes utility by choosing an optimal amount of consumption and leisure in each period

- Optimal labour supply depends on the interest rate, wages in each period and lifetime resources

Comparative Statics (income/substitution effects):

- Much more complicated than the static model
- Can illustrate some simple comparative statics to show the difference between the models
- It turns out that it matters whether the wage changes are permanent or transitory and anticipated or unanticipated
Comparative Statics

To help illustrate the differences between these let’s look at two hypothetical life-cycle earnings profiles

- Wages increase initially but may decline
- Jump at t is unanticipated wage change
- Allows us to look at 3 different sources of wage change
- For comparison each has the same magnitude

1. A-B Permanent Unanticipated Wage Increase
   - Reflects wages that differ by a permanent amount over the entire life-cycle

2. B-C Evolutionary Anticipated Wage Increase
   - Could be, for example, as a result of increased experience

Comparative Statics

- Get typical income and substitution effects that work in opposite directions
- Income effect: higher expected lifetime income with which to purchase more leisure, if leisure is normal (work less)
- Substitution effect: Higher wage implies a higher opportunity cost of leisure (work more)
- Overall effect: indeterminate
Comparative Statics

Income effect: Because the wage change is fully anticipated there will be no income effect
- The income effect was already accounted for when the individual maximized utility
Substitution effect: There is a substitution effect, however, which makes leisure more expensive
- A worker that is forward looking will work more when the returns to work are highest
Overall effect: Increase in work
- The increase due to “intertemporal substitution” will be larger than a permanent unanticipated wage increase because there is no income effect

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3. C-D Transitory, Unanticipated Wage Increase

- One time wage increase that is unanticipated and occurs at age t
- Could be unexpected “acting promotion” in one year
Income effect: Will likely be small because a one year increase in the wage will have a small effect on lifetime wealth
- Thus, if leisure is normal, small reduction in work
Substitution effect: The opportunity cost of leisure goes up, so that the individual works more at age t
Overall effect: The individual can afford to work slightly less over life-cycle but will likely work more at age t
Comparative Statics

- The overall effect depends on whether the wage change is permanent or temporary and whether it is anticipated or not.
- The magnitude of the three effects examined here can be ranked as follows:
  - B-C: largest effect – no income effect
  - C-D: medium effect – small income effect
  - A-B: smallest effect – larger income effect

Fertility and Child Bearing

- From our earlier diagram it is clear that fertility decisions play an important role in the life-cycle labour supply of women.
- Recent analyses of the fertility decision are cast in a dynamic setting much like the previous model.
- This is because decisions about fertility today will impact future economic factors such as future wages.
- We will examine some of the simpler aspects of the fertility decision.
Becker/Mincer Model

- Apply the principles of consumer demand theory to the decision to have children
- Think of children as a “good” that is “consumed”
- Difficult to think of children this way?
- It is argued that individuals respond to economic factors when making fertility decisions

Examples:
1. Some families put off having children until they can afford it
2. Individuals with the lowest opportunity cost of having children (low wages) tend to have more children

Factors Influencing Fertility

- If we view children as consumer goods what factors influence the fertility decision?

**Income:**
- Ceteris paribus effect of an increase in income will be an increase in the desired number of children if children are “normal goods”
- Usually, education and opportunity cost of children are related to income, however

**Cost of Children:**
- Costs include both direct costs (food, clothing etc.) and opportunity cost (foregone income)
Factors Influencing Fertility

- Economic theory suggests that the demand for children will be negatively related to the cost.
- However, an increase in the potential income of wives (opportunity cost) has both income and substitution effects.
  - Substitution effect: higher wage means higher opportunity cost of children – subs away
  - Income effect: higher income will allow family to “purchase” more of all normal goods including children.

Price of Related Goods:
- Increase in the price of complements such as day care and education will reduce the desired number of children.
- Could encourage larger family sizes by reducing some of these costs.

Tastes and Preferences:
- Family planning and women’s liberation movement have likely led to smaller family sizes.
- Economists usually view tastes as exogenous.
- It is, however, possible that tastes help to shape and are shaped by the economic environment.
## Factors Influencing Fertility

- e.g. Large number of women entering the labour market during WWII may have changed attitudes about the role of women in society

**Technology:**

- The introduction of “the pill” and other contraceptive devices likely reduced family size
- Others such as fertility drugs may help to increase family size

## Retirement

- Decision by older persons not to participate in the labour force
- In Canada the leading edge of the “baby-boom” has reached the normal age of retirement
- The number of seniors (65+) is projected to double from 5 million to 10 million by 2036
- This rapid aging of the population will leave few working aged individuals to support seniors
- Thus, the retirement decision and its impact have received an enormous amount of attention by researchers
Retirement

- Given its importance and the fact that the government has many “tools” that affect retirement, it’s no surprise it attracts so much attention.
  - “Tools” - mandatory retirement
  - public pensions

- We will examine the retirement decision as follows:
  1. Restating income-leisure model
  2. Possible determinants
    - mandatory retirement
    - wealth and earnings
    - health and nature of work and family
    - pension system
  3. Empirical evidence

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Income-Leisure Choice Model Restated

- Could substitute years of retirement for leisure on the x-axis and use our model for analysis.

- Let T be the number of years until death minus say 25
- supposing start work at 25 and can work that long

- I^o is the number of years of retirement we choose and T - I^o the number of years to work

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Income-Leisure Choice Model Restated

- \( w^E \) is now the “expected” wage (different than going wage)
- The expected wage may be influenced by:
  - current wage
  - expectations about future earnings
- Also note, that individuals preferences for work may change over a lifetime - so will their indifference curves.

Possible Determinants

1. **Mandatory Retirement**
   - Refers to either:
     - Automatic Retirement: individual has to retire and can’t be retained
     - Compulsory Retirement: individual can be forced to retire or can be retained
   - Note: No legislated age at which individuals must retire
     - age is set by employer policy or negotiated in a collective agreement
     - public pensions do not prevent individuals from working
Mandatory Retirement

How does mandatory retirement affect the decision to retire?

- Start age 25
- Die age 90
- 65 years work possible
- Mandatory retirement means you must retire at 65 → take 25 years of retirement
  - end up at E₁ with lower utility
- Would like to choose point like E₀
  - 20 years of leisure
  - work (65-20=45) years to age 70
- Suppose agreement to retire at 65

Wealth and Earnings

2. Wealth and Earnings

Wealth: savings, investment values, etc.

- What will happen if wealth increases (receive a bequest)?
- I-L model predicts that one would retire earlier (choose more leisure)
- Why?
- Pure income effect
- As wealth increases simply buy more of all normal goods such as leisure (years of retirement)
Earnings

Earnings: flow of funds
- What will happen if expected earnings increase?
- The outcome is indeterminate
- Has both income and substitution effects
- Opportunity cost of retiring goes up -- substitute away.
- Real wealth rises -- increasing demand for retirement

Health and Nature of Work

3. Health and the Nature of Work and Family

Health:
- As people age their health can influence the retirement decision.
- Less likely to continue working if you or your spouse is unhealthy.

Nature of Work:
- If you have a physically demanding job you may be more likely to retire early.
- Doesn’t explain increase in early retirement as there has been an increase in “white collar” jobs over the harder “blue collar” jobs.
Family

Family:
- Decline of extended family suggests individuals should retire later (less support)
- However, there has been an increase in two earner families which may lead to earlier retirement (more wealth)
- Most of these affect the shape of the individuals indifference curve.

Example: Changes in Tastes for Work

- As you get older preferences for leisure tend to increase (job becomes more difficult).
- Initially at $E_0$
- With age you become more willing to consume leisure
- Now better off at $E_1$
Pensions

4. Pension System
- The generosity of public and private pensions is the most likely cause of the increase in early retirement.
- Canada’s pension system has three tiers

I. Universal Old Age Security Pension:
- Unconditional grant given to all persons over the age of 65
- Same as a pure income effect
- Therefore, leads to earlier retirement

The Guaranteed Income Supplement (GIS):
- A means tested pension which can be paid to those over age 65

If you qualify for GIS and work then your earnings are taxed back at a rate of 50%
Similar to a simple welfare program both income and substitution effects lead to a decrease in work time

II. Social Insurance Pensions (CPP/QPP)
- Financed by compulsory employer and employee contributions (payroll tax).
- Qualify by age and work experience.
- Pay out based on past earnings.
- United States social security had a “retirement test”
  - receive full pension as long as income is less than threshold ($17,000 in 2000)
  - income above threshold is taxed back at a rate of 33%
Social Security

- Get full benefits (B) upon retiring
- Can work (T - I) hours without being taxed
- B - C is parallel to initial constraint.

Beyond I, taxed back at 33%.
C - D wage is lower.
At D all retirement income is taxed back.
Back on original income constraint.

Effects of Pension Plan

**Income Effect:**
- Increased income with OAS with which to purchase leisure (retire earlier)

**Substitution Effect:**
- The opportunity cost of leisure is either the same as before (B - C) or less (C - D) (Partial Retirement Test)
- Therefore, choose more leisure
Employer Sponsored Pensions

Employer Sponsored Pension Plan:
3 types - based on how benefits are calculated

1. **Earnings Based (most common)**
   - Pension based on:
     - Length of service
     - Earnings in either
       - (a) Final years
         - e.g. 2% of average earnings in final 3 years for each year of service up to 35 years
         - i.e. 70% replacement rate
       - (b) Average over career

2. **Flat Benefit**
   - Receive a fixed benefit for each year of service
     - e.g. $20 per month per year of service to a maximum of 35 years → $700 per month.

3. **Defined Contribution (covers fewest)**
   - Benefits are equal to the value of contributions made by the employee or employer
   - 1 and 2 are so-called “defined benefits” plans because the benefits are defined at the outset
   - The plans influence retirement decisions because of:
     - Economic benefits
     - Age at which these become available “normal retirement age”.
Empirical Evidence

- 2 types of studies
  (i) Survey Interviews - ask why retired
  (ii) labour force participation studies - statistical
- The two give conflicting answers as to what affects retirement decisions.

Survey:
- Find ill health as the prime motivating factor
- Social insurance pensions have not induced early retirement
- May be biased:
  - Socially acceptable to retire for ill health
  - Individuals may now be sick and respond this way

Statistical:
- Social insurance pensions have effect on retirement.
- Ill health also has an effect especially if a pension is available.
- Employer sponsored plans have the expected effect also
  - continue to work until big pay-out
  - don't work beyond “normal” age