31E00700 Labor Economics:
Lecture 1

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Practicalities

Lecturers

- Matti Sarvimäki, Tuomas Pekkarinen

Grading

- problem sets (30%): TBA
- final exam (70%): January 9th at 9am (4 hours)
- retakes: March 7th, May 24th

Material

- Lectures
- Journal articles (see syllabus)
- Borjas: Labor Economics (5th Edition)
The Labor Market

- Arguably the most important market
  - time
  - income / wealth
  - friends, spouses, identity...
The Labor Market

- Arguably the most important market
  - time
  - income / wealth
  - friends, spouses, identity...

- and one of the most regulated ones
  - minimum wages, maximum hours
  - pensions, unemployment insurance, social benefits
  - public provision of education, qualification requirements
  - parental leaves, safety regulations, immigration policy...
Labor Economics

- Exchange of labor is assumed to take place in a market where:
  - utility maximizing workers sell labor in exchange of compensation → labor supply
  - profit maximizing employers buy labor to produce goods and services → labor demand
  - conflicting interests balanced out in the market equilibrium
  - government intervention may affect the equilibrium
Theory and Empirics

A good model is

- relevant (addresses an important question)
- simple (carricature, not description of everything)
- testable
Theory and Empirics

A good model is
- relevant (addresses an important question)
- simple (caricature, not description of everything)
- testable

A good empirical study is
- relevant (documents important facts, tests a model, measures a key parameter or evaluates a policy intervention)
- plausible
- transparent
# Topics of This Course

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Today: Static Labor Supply

1. Stylized facts
2. The neoclassical model of labor supply
3. Application: the impact of non-labor income on labor supply
Stylized Fact 1: Employment Rate Varies over Time (Finland 1989–2012)

Stylized Fact 2: Employment Rate Varies by Age, Sex (Finland 2010)

Source: Statistics Finland
Stylized Fact 3: ... and by country (United States 2005)

Source: Borjas (2010), Figure 2-20
The neoclassical model of labor and leisure

- Workers value
  - consumption
  - leisure

- They choose
  - whether to participate in the labor market (extensive margin)
  - how many hours to work (intensive margin)

- ... to maximize utility subject to a budget constrain
  - tradeoff between consumption and leisure
Preferences

Utility function

\[ U = U(C, L) \]

where \( C \) is bundle of consumption goods and \( L \) is leisure.

\[ U_C > 0 \quad , \quad U_L > 0 \]
\[ U_{CC} \leq 0 \quad , \quad U_{LL} \leq 0 \]

ie. more is better, but marginal utility is decreasing

- This yields indifference curves with the following properties
  - Higher IC indicates higher levels of utility
  - ICs are downward sloping in C,L-space
  - ICs are convex to the origin
  - ICs do not intersect
Indifference Curve

Source: Borjas (2010), Figure 2-2
Budget Constraint

Money and time constraints

\[ C \leq wH + V \]
\[ H = T - L \]

where \( C \) is consumption, \( H \) is hours worked, \( w \) is the wage rate, \( V \) is non-labor income, \( T \) is the maximum time available and the price of consumption is normalized to one.
Budget Constraint

Money and time constraints

\[ C \leq wH + V \]
\[ H = T - L \]

where \( C \) is consumption, \( H \) is hours worked, \( w \) is the wage rate, \( V \) is non-labor income, \( T \) is the maximum time available and the price of consumption is normalized to one.

Plugging-in the second constraint to the first one yields

\[ C + wL \leq wT + V = R \]

where \( R \) is the potential income (if all time dedicated to working).
### Budget Constraint

![Budget Constraint Graph](image)

- **Source:** Borjas (2010), Figure 2-6
Optimal consumption and leisure

Source: Borjas (2010), Figure 2-6
Optimal consumption and leisure

Source: Borjas (2010), Figure 2-6
Optimal consumption and leisure

Worker’s decision problem

\[
\max_{\{C,L\}} \ U(C, L) \quad \text{s.t} \quad C + wL \leq wT + V
\]

[the Lagrangian: \( \mathcal{L}(C, L, \lambda) = U(C, L) + \lambda (R - C - wL) \)]
Optimal consumption and leisure

Worker’s decision problem

\[
\max_{\{C,L\}} U(C, L) \quad \text{s.t.} \quad C + wL \leq wT + V
\]

[the Lagrangian: \( \mathcal{L}(C, L, \lambda) = U(C, L) + \lambda(R - C - wL) \)]

First-order conditions

\[
\begin{align*}
\frac{\delta \mathcal{L}(C, L, \lambda)}{\delta C} &= U_C - \lambda = 0 \\
\frac{\delta \mathcal{L}(C, L, \lambda)}{\delta L} &= U_L - \lambda w = 0 \\
\frac{\delta \mathcal{L}(C, L, \lambda)}{\delta \lambda} &= R - C - wL = 0 \quad \text{with } \lambda > 0
\end{align*}
\]
Demand for leisure and consumption

The FOCs imply

\[
\frac{U_L(C^*, L^*)}{U_C(C^*, L^*)} = w
\]

\[
C + wL = R
\]

First equation: marginal utility of leisure equals the marginal utility of consumption that one would get from slightly increasing labor supply. Second equation: all potential income is used either for consumption or leisure.
Demand for leisure and consumption

The FOCs imply

\[
\frac{U_L(C^*, L^*)}{U_C(C^*, L^*)} = w \quad \text{and} \quad C + wL = R
\]

First equation: marginal utility of leisure equals the marginal utility of consumption that one would get from slightly increasing labor supply. Second equation: all potential income is used either for consumption or leisure.

This gives us the demand for leisure and consumption

\[
L^* = L(w, R) \quad \text{and} \quad C^* = C(w, R)
\]

i.e. both are functions of only wages and non-labor income (recall that \( R = wT + V \) )
Non-labor income and labor supply

Source: Borjas (2010), Figure 2-7
Non-labor income and labor supply

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Non-labor income and labor supply

Increase in non-labor income

- Pure income effect (expansion of the opportunity set)
Non-labor income and labor supply

Increase in non-labor income

- Pure income effect (expansion of the opportunity set)
- Impact on labor supply depends on whether leisure is
  1. a normal good $\rightarrow$ labor supply decreases
  2. an inferior good $\rightarrow$ labor supply increases
- Seems reasonable to think that leisure is a normal good (and this is confirmed by the empirical application discussed later in the lecture).
Wages and labor supply

Consumption ($)

Source: Borjas (2010), Figure 2-8
Wages and labor supply

Consumption ($)

Source: Borjas (2010), Figure 2-8
Wages and labor supply

Consumption ($)

Income effect: P-Q
Substitution effect: Q-R

-> Better wages may increase or decrease labor supply

Source: Borjas (2010), Figure 2-8
Reservation wage

Consumption ($) vs. Hours of Leisure

- Endowment $E$
- Slope $-w_{low}$

Source: Borjas (2010), Figure 2-10
Reservation wage

Consumption ($)

Source: Borjas (2010), Figure 2-10
(Individual) labor supply curve

Source: Borjas (2010), Figure 2-11
Labor supply elasticity

Responsiveness of hours of work to changes in the wage rate

\[ \sigma = \frac{\Delta h / h}{\Delta w / w} = \frac{\Delta h}{\Delta w} \times \frac{w}{h} \]

i.e. percent change in hours worked divided by the percent change in wage rate.

elg worker’s wage initially 9n € per hour and she works 9jqnn hours per yearl 7fter she gets a raise to on € per hourj she decides to work ojnqn hours per year

When we run regressions where the outcome gelgl hoursh and the treament gelgl wagesh are in logarithmsj the resulting estimates can be directly interpretted as elasticities

6UT? wdentification requires us to compare

differences between
counterfactual states of the world

How much more’less would you work if your wages would be x instead of y” but we only observe one state of the world

See the additional notes on empirical strategies
Labor supply elasticity

Responsiveness of hours of work to changes in the wage rate

\[ \sigma = \frac{\Delta h}{\Delta w} = \frac{\Delta h}{w} \times \frac{w}{h} \]

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- e.g. worker’s wage initially 10€ per hour and she works 1,900 hours per year. After she gets a raise to 20€ per hour, she decides to work 2,090 hours per year → 10%/100% = 0.1
- When we run regressions where the outcome (e.g. hours) and the treatment (e.g. wages) are in logarithms, the resulting estimates can be directly interpreted as elasticities.
Labor supply elasticity

Responsiveness of hours of work to changes in the wage rate

\[ \sigma = \frac{\Delta h/h}{\Delta w/w} = \frac{\Delta h}{\Delta w} \times \frac{w}{h} \]

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- When we run regressions where the outcome (e.g. hours) and the treatment (e.g. wages) are in logarithms, the resulting estimates can be directly interpreted as elasticities

- BUT: Identification requires us to compare differences between counterfactual states of the world
  
  - How much more/less would you work if your wages would be \( x \) instead of \( y \) ... but we only observe one state of the world
  
  - See the additional notes on empirical strategies
Estimating labor supply elasticities

We would like to estimate

\[ h_i = \alpha + \beta w_i + \gamma V_i + \delta X_i + \epsilon_i \]

where \( h_i \) is a logarithm of the hours worked by individual \( i \), \( w_i \) is the logarithm of her hourly wage rate, \( V_i \) is her non-labor income, \( X_i \) is a set of observable characteristics and \( \epsilon_i \) an index of unobservable characteristics that also affect \( h_i \). The parameters of interest are \( \beta \) (elasticity of labor supply w.r.t \( w_i \)) and \( \gamma \) (elasticity of labor supply w.r.t \( V_i \)).

* Is this labor supply function consistent with utility maximization?
  * Yes, if you choose a specific functional form for utility function. Stern (1986) shows how to recover the utility function behind the estimation equation.
  * But just running this regression for a typical dataset is unlikely to identify these parameters because...
Challenges in estimating $\beta$

1. Measurement error ("division bias")
   → exaggerate income effects
   - wages typically calculated as $\frac{\text{annual salary}}{\text{annual hours}}$
   - people unaware of their true hours
   - overreporting: denominator too large → hourly wage too small
     → spurious negative correlation between hours and wages
   - underreporting: denominator too small → hourly wage too large
     → spurious negative correlation between hours and wages

2. Marginal vs. average wage
   Wages from an additional hour may differ from average wage

3. Selection
   people work only if wage offer above reservation wage
   nonworking people dropped from data OR selection correction methods used (which often rely on implausible assumptions)
   but also nonworking people react to wages that would be available for them
Challenges in estimating $\beta$

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Challenges in estimating $\gamma$

1. Reverse causality
   - current nonlabor income depends on past labor income
   - “taste for work” $\rightarrow$ positive correlation between $V$ and $\epsilon$
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   - current nonlabor income depends on past labor income
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2. Selection
   - see above
Estimates of labor supply elasticities

- Huge variation in the estimates of $\beta$, but there is some sort of consensus that for prime age men, on average, it is around -0.1.
Estimates of labor supply elasticities

- Huge variation in the estimates of $\beta$, but there is some sort of consensus that for prime age men, on average, it is around -0.1. If true, this implies that
  - Average elasticity of labor supply w.r.t. wage is negative $\rightarrow$ income effect dominates
  - Average elasticity is small $\rightarrow$ labor supply is inelastic

Note that the model suggests large heterogeneity across individuals and demographic groups.

$\gamma$ estimates also vary hugely. Probably the best available estimate discussed next is...
Estimates of labor supply elasticities

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  - Average elasticity is small $\rightarrow$ labor supply is inelastic

- Note that the model suggest large heterogeneity across individuals and demographic groups

- Estimates of $\gamma$ also vary hugely. Probably the best available estimate (discussed next) is -0.1.
The effect of unearned income on labor earnings
(Imbens, Rubin, Sacerdote, AER 2001)

Identification problem
  - Unearned income is not randomly assigned
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Solution used in this paper

- Lotteries assign large amounts of money randomly
  (in the US context also over long periods of time)
The effect of unearned income on labor earnings
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Identification problem
- Unearned income is not randomly assigned

Solution used in this paper
- Lotteries assign large amounts of money randomly
  (in the US context also over long periods of time)

Takeaway
- average income elasticity of labor supply is around -0.11
Caveats and comparison to previous literature

Potential caveats

- Representativeness of the lottery players
- Do people treat lottery prizes differently than other sources of income?
Caveats and comparison to previous literature

Potential caveats

- Representativeness of the lottery players
- Do people treat lottery prizes differently than other sources of income?

However, likely to be significantly better than previous attempts

- Using capital income or spouse’s earnings
  (Difficult to believe that these are exogenous)

- Negative income tax experiments
  (Short duration, modest size)

- War repatriations, inheritances
  (selection, representativeness)
Summary statistics (Table 2, Figures 1 and 2)

- Average annual prize (for winners) was $55,000
- Winners bought more tickets than non-winners
- Non-winners more educated and older than winners
  - non-winners are a sample of season ticket holders
- However, there are little difference between winners of small and big prices
- Average earnings and the propensity of having positive earnings (i.e. labor force participation) declines sharply among big winners
The Model

- A life-cycle version of the model discussed above
  - Parametrization of utility function: instantaneous utility of leisure is \( \beta_l \ln(l_i - \gamma_l) \), where \( \gamma_l \) is the subsistence level. Utility from several types of consumption takes a similar form. Note that this \( \gamma \) has nothing to do with the notation used above.

- The model implies that labor earnings are

  \[
  y_{it} = \alpha - \beta_l \bar{\lambda} \left( \frac{L_i}{20} \right) + \epsilon_{it}
  \]

where \( y_{it} \) is labor earnings of individual \( i \) at time \( t \), \( \beta_l \) is the preference parameter for leisure, \( \bar{\lambda} \) is the population average of a discounting term, \( L \) is the total lottery prize (which is divided over 20 years) and \( \epsilon \) captures variation in wages, other unearned income and life span.
Identification

Estimation equation

\[ y_{it} = \alpha + \beta \left( \frac{L_i}{20} \right) + X_i \theta + \epsilon_{it} \]

where \( \beta = -\beta_i \bar{\lambda} \) and \( X_i \) is a set of observable factors.
Identification

Estimation equation

\[ y_{it} = \alpha + \beta (L_i/20) + X_i \theta + \epsilon_{it} \]

where \( \beta = -\beta \lambda \) and \( X_i \) is a set of observable factors

- Identifying assumption
  - \( L_i \) independent of \( \epsilon_i \) (after conditioning on \( X_i \))

- Potential caveats
  1. \( L_i \) is a function of \#tickets bought → control for the \#tickets
  2. season ticket holders (non-winners) and single ticket buyers (winners) may differ → drop the non-winners from the sample and exploit the variation in the magnitude of the prize
Results (Table 4)

- Estimates of the marginal propensity to earn out of unearned income
  - i.e. how much labor earnings change as a response to a change in non-labor earnings
- Difference between columns 1–4 and 5–6: winners of very large prices dominate the linear specification
  - similarly columns 6 vs 7–8
- The takeaway estimate: \( -0.11 \)
- It takes about a year for adjusting the labor supply to the desired level
Application 2: Demand for Sleep
(Biddle and Hamermesh, JPE 1990)

- Sleep is the largest single use of time for most people
  - An average respondent in the B&H data spends more time sleeping than in market work
- Biddle and Hamermesh ask whether labor market opportunities affect the demand for sleep
Application 2: Demand for Sleep
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- Sleep is the largest single use of time for most people
  - An average respondent in the B&H data spends more time sleeping than in market work
- Biddle and Hamermesh ask whether labor market opportunities affect the demand for sleep
- The data and some instructions available at https://noppa.aalto.fi/noppa/kurssi/31E00700/
  - If you haven’t worked with microdata before, this will help you to get through the exercises
  - Stata available at computer classes G113 ja PC250
- Stata will be used in excercise classes, but you are free to use whatever software you like, e.g R is a powerful and free statistical software (http://www.r-project.org/)