Labor Supply

Graham Lewis

University of Minnesota

June 2025

Review

- In the last lecture we modeled labor supply.
- The household, taking the wage as given, solved the following problem

$$\max_{c,n} \; u(c) - v(n)$$

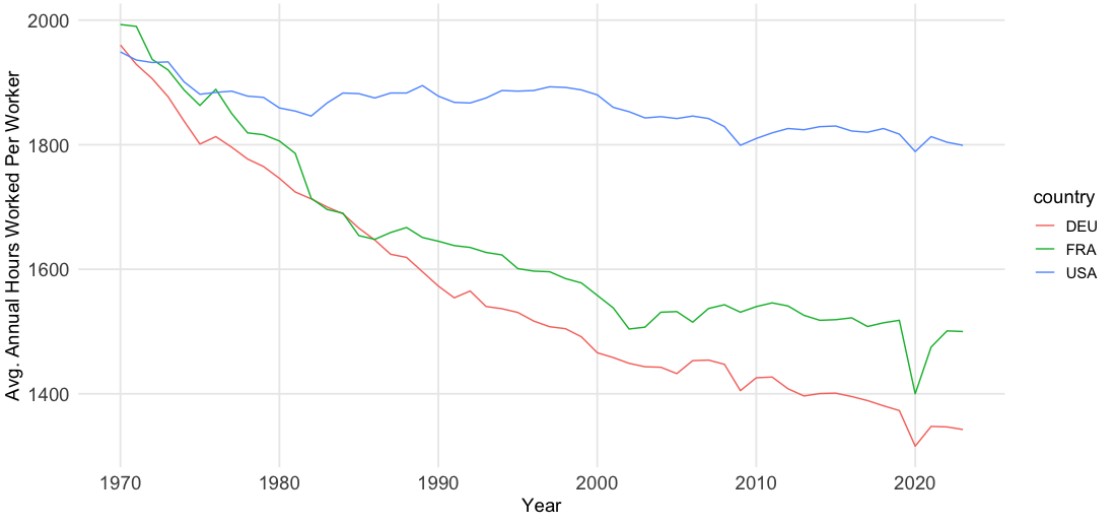
$$\text{such that } c = wn.$$

- We then solve the problem to see how changes in the real wage (w) impacted labor supplied (n).

Motivation

- In the early 1970s, the average worker in America, France and Germany worked a similar number of hours per year.
- By 2000, U.S. hours remained steady, around 1850 hours per year.
- In France and Germany, hours fell to around 1500 per year.
- Why was this the case?

Motivation


2000
1800
1600
1400
Avg. Annual Hours Worked Per Worker
1970
1980
1990
2000
2010
2020
Year
country
DEU
FRA
USA

Explaining the gap

- How can we explain this difference?
- One explanation could be differences in culture. Suppose we have

$$\text{Europe:} \quad u(c) - \chi^{\text{EU}} \frac{n^{1+\frac{1}{\varepsilon}}}{1+\frac{1}{\varepsilon}}$$

$$\text{US:} \quad u(c) - \chi^{\text{US}} \frac{n^{1+\frac{1}{\varepsilon}}}{1+\frac{1}{\varepsilon}}$$

  where $\chi^{\text{US}} << \chi^{\text{EU}}$.

- Another reason could be differences in tax systems. To answer this question, we need to incorporate taxes into the model.

Tax Wedge

- We had the problem

$$\max_{c,n} u(c) - v(n)$$

$$\text{such that } c = wn.$$

- Over the next two lectures we will answer
  1. How do we incorporate a tax on labor into this framework?
  2. How do we incorporate transfers (social security, medicare, unemployment insurance, etc.) into this framework?

Brief Tax Rate History: U.S.

- The federal income tax became permanent in 1916 (16th Amendment).
- The top marginal tax rate for individuals was over 90% from 1944 through 1963.
- Reforms later cut rates (70% by 1970, 50% by 1982, 28% by 1988).
- The top rate today is 37%.
- Around half of the federal government's revenue comes from income taxes.

Brief Tax Rate History: Europe

- Many European nations introduced income taxes in the late 19th or early 20th century.
- Top rates were similar between the U.S. and Europe in the mid-20th century.
- Top rates remain high in countries like Denmark (around 56%), France (around 55%), and Austria (55%).
- Countries such as the UK have tax rates that are more similar to the U.S. after adding in state taxes.

Tax Wedge

- We can compare tax differences between the U.S. and EU countries by looking at the tax wedge.
- The tax wedge is the difference between what employers pay for labor and what workers actually take home after taxes. It measures the distortion taxes create between gross labor costs and net income.
- A larger tax wedge can
  - reduce the incentive to work and hire by making labor more expensive and less rewarding.
  - lead to lower employment, especially in rigid labor markets.

Tax Wedge in 2024[1]

Country	Total tax wedge
Germany	47.9%
France	47.2%
Italy	47.1%
Spain	40.6%
Netherlands	35.1%
United States	30.1%
United Kingdom	29.4%

[1]Data for top 5 biggest EU economies, the US and UK from OECD

Tax Wedge

- Countries such as Germany and France have tax wedges that are near 50%. Nearly half of the employer's labor cost goes to the government in income and payroll taxes.
- On average, a middle-class income worker in Europe sends a larger portion of their paycheck to the government.
- As we noted earlier, in the 1970s, the United States, Germany & France had more similar tax systems than they do today.

Incorporating Labor Income Tax

- We had the problem

$$\max_{c,n} u(c) - v(n)$$
$$\text{such that } c = wn.$$

- We will incorporate taxes by altering the budget constraint.
- Let $0 < \tau_n < 1$ be the labor income tax. Then a household can use their after-tax wage $(1 - \tau_n)w$ on consumption, so our problem becomes

$$\max_{c,n} u(c) - v(n)$$
$$\text{such that } c = (1 - \tau_n)wn.$$

Example

- Let's reconsider our model from last time with σ-utility.
- We had

$$\max_{c,n} \frac{c^{1-\sigma}}{1-\sigma} - \chi \frac{n^{1+\frac{1}{\varepsilon}}}{1+\frac{1}{\varepsilon}}$$
$$\text{such that } c = (1-\tau_n) w n.$$

- Without any taxes, we saw that the optimal pair (c, n) had to satisfy

$$-\frac{U_n}{U_c} = w.$$

Taxes and the MRS

- Our labor income tax is a distortionary tax. That is, it is a tax that changes people's behavior.
- To see this, note that the rewards for working with an income tax is now strictly less than it was without an income tax,

$$(1-\tau_h)wn < wn \text{ for any choice of labor supply n.}$$

- Now, working more gives us $(1-\tau_n)w$ units of consumption versus w units.
- Our new MRS condition will be

$$-\frac{U_n}{U_c} = (1-\tau_n)w$$

where $U(c,n) = \frac{c^{1-\sigma}}{1-\sigma} - \chi\frac{n^{1+\frac{1}{\varepsilon}}}{1+\frac{1}{\varepsilon}}$.[2]

[2] You can also see this by using the same derivation from the appendix of the previous lecture.

Example

- We had

$$-\frac{U_n}{U_c} = (1-\tau_n)w.$$

- Using our utility specification we get

$$\frac{\chi n^{\frac{1}{\varepsilon}}}{c^{-\sigma}} = (1-\tau_n)w$$

$$c = \left(\frac{(1-\tau_n)w}{\chi n^{\frac{1}{\varepsilon}}}\right)^{\frac{1}{\sigma}}.$$

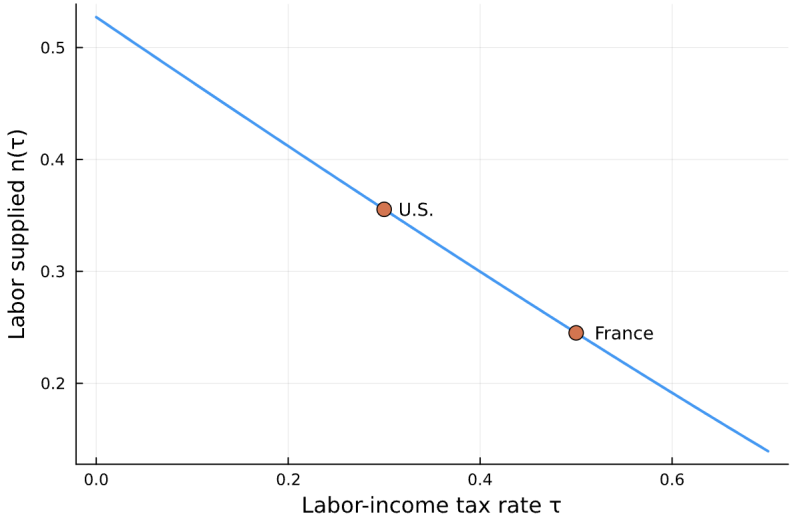
Example

- Substituting this into the budget constraint, we get

$$
\begin{aligned}
c &= (1-\tau_n)wn \\
\left(\frac{(1-\tau_n)w}{\chi n^{\frac{1}{\varepsilon}}}\right)^{\frac{1}{\sigma}} &= (1-\tau_n)wn \\
n &= \left(\frac{((1-\tau_n)w)^{1-\sigma}}{\chi}\right)^{\frac{\varepsilon}{1+\sigma\varepsilon}}
\end{aligned}
$$

- Based on our previous lecture, for an increase in the labor income tax (τ_n) to decrease labor supplied, would we need $0 < \sigma < 1$ or $\sigma > 1$?

Example[3]



[3]Parameters $\sigma = 0.3$, $\varepsilon = 3.0$, $w = 1.0$, and $\chi = 1.5$

Labor Differences

- Recall that we noticed the huge gap in hours worked between Americans and Europeans.
- In 2004, economist Edward Prescott used a model with similar labor-leisure tradeoff to ours to ask why this was the case.
- With his model, he found that the divergence in tax rates between the US and EU drove differences in labor supplied.
- The higher taxes on labor in the EU lead to significantly lower hours worked in equilibrium.
- In other works, policy, not culture, was the dominant factor.

Labor Differences

- Prescott emphasized that Europeans face a larger wedge between what a worker is paid and what a worker takes home.
- Consumption becomes relatively more expensive due to the wage increase and we see people supply less labor, pivoting more towards leisure, an example of the substitution effect.
- An increase in the tax rate meant taking time off became relatively more attractive.

Transfers and Other Factors

- While Prescott's paper focused on taxes, government transfers and market regulations also differ between the U.S. and Europe.
- With stricter worker protections, longer mandated vacations, and generous retirement benefits, Europe not only has transfer differences but institutional differences as well.
- Many of these policies are frequently associated with a high-tax environment.

Moving Forward

- We incorporated taxes into our model and saw that tax rates can explain differences in hours worked between countries.
- So far while the household has paid taxes, the household hasn't received anything back from those taxes.
- Next time we will incorporate government transfers into the model.
- Now that the government spends money as well, we'll need to keep track of government expenditures and tax revenue.