Lecture 1

Overview, Labor Demand and Supply

Macroeconomics EC2B1

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London School of Economics, Winter 2025/26

Introductions

Who am I? Macroeconomist. When I don't teach I work on:

1. Why are some countries so much poorer than others?
2. How does micro heterogeneity affect macro economy / policy?

- How does your professor tick? Look at current working papers
  https://benjaminmoll.com/papers/
  - Putting the 'Finance' into 'Public Finance': A Theory of Capital Gains Taxation
  - The Trouble with Rational Expectations in Heterogeneous Agent Models: A Challenge for Macroeconomics
  - Structural Reinforcement Learning for Heterogeneous Agent Macroeconomics
  - also see https://benjaminmoll.com/research_agenda_2020/

Who is Brayan and the class teachers? You've already met...

Who are you? How many undergraduates, 2-year MSc? Econ background?

This Course: Modern Macroeconomics

- Modern = as practiced in current academic research
  - $\neq$ what's in standard textbooks
- Macro with micro foundations
  - utility and profit maximization just like in EC1A1
  - ... but general equilibrium (= prices endogenous, clear markets)

Admin

1. Lectures: Wednesday 9:00-11:00, Old Theatre
2. Office hours: SAL 1.19 (my office)
    - Wed 13:00-14:00
3. Classes and class teacher office hours: see moodle
4. Problem sets (as before)
    - one per week
    - handed out after lecture, discussed in class a week later
    - feedback on two: PS #4 (week 5) and PS #8 (week 10)
5. Assessment
    - big exam at end of year
    - project
6. Anything else?

What this course is about

- Wouter den Haan's MT part: long-run issues
  - growth, cross-country income differences etc
- **This term: short-run issues**
  - business cycles
  - economic crises: financial, energy, ...
  - macroeconomic stabilization policies: monetary, fiscal, ...

Topics we will cover (subject to change)

	Topic
Section 1	Welcome and Overview, Labor Demand and Supply
Section 2	A Simple Macro Model, Equilibrium and Welfare Theorems
Section 3	Applications: Automation & AI, Germany without Russian Gas
Section 4	Consumption, Saving, Interest Rates
Section 5	Investment and Capital Accumulation
Section 6	Business Cycle Macro and Lucas Critique
Section 7	New Keynesian Model I
Section 8	New Keynesian Model II
Section 9	The Financial Crisis, Asset Bubbles
Section 10	Unemployment (Pissarides), Inequality in Macro

Tools

As just mentioned: macro with micro foundations

- utility and profit maximization just like in EC1A1

Reflected in tools:

- differential calculus
- heavy use of **constrained optimization using Lagrangean methods**
- Need to know how to solve

$$\max_{c_1, c_2} \; u(c_1, c_2) \quad \text{s.t.} \quad p_1 c_1 + p_2 c_2 \leq m$$

using

$$\mathcal{L} = u(c_1, c_2) + \lambda \left[m - p_1 c_1 - p_2 c_2 \right]$$

- If you don't, refresh your memory using MA100, MA107 or EC1A1 notes
- Assignment 1 and class 1 will be about this

One of my main goals: train you to read newspaper properly

- Train you to critically read and evaluate discussions of macroeconomic policy in popular press, on TV, ...
- Help you understand where people come from
  - what's model in back of their minds (if any)?
- Help you evaluate quality of argument
  - is argument internally consistent?
  - what empirical evidence is there and is it credible?
  - you will find that there's huge variation in quality
- "Train your BS detector" so to speak

Textbooks

Unfortunately, there exists no textbook with the proper level and focus for this course. Instead, it will rely on lecture notes and research journal articles

That being said, the following textbooks may be useful as background reading (given the extortionate prices of textbooks these days, I want to emphasize that these are not required):

- **Kurlat, Pablo, A Course in Modern Macroeconomics**
  https://sites.google.com/view/pkurlat/a-course-in-modern-macroeconomics
  - if you do want to buy a book, buy this one ($ 32.95)
  - but will also post relevant PDF excerpts on Moodle
- Jones, Chad, Macroeconomics – one of your books from EC1B1
- Williamson, Stephen, Macroeconomics
- Romer, David, Advanced Macroeconomics
- Abel, Andrew and Ben Bernanke and Dean Croushore, Macroeconomics

Finally, all of Wouter den Haan's tips still apply

HOW TO STUDY EFFICIENTLY

- The slides are the most important. Then required readings.
- It is very beneficial if you **keep up with the course**. A lot of the material is new and will need some reflection time to sink in. Moreover, material taught later builds on material covered earlier.
- Thus, spending a bit of time every week will mean (i) you will absorb and understand the material spending less hours than when you try to catch up at a later date, (ii) you'll enjoy the lectures more since you understand more, and (iii) it may also lead to less stress.
- **MAKE SURE TO MAKE GOOD NOTES.** Revision before the exam will be easier.
- Come to classes prepared, having studied course material and the assignment.
- **BE AN ACTIVE LEARNER BY DOING THE FOLLOWING:**
  - Don't just go over the material line by line and be happy when you can follow the argument. Put all the material away and see whether you can rebuild the whole argument from scratch. On the exam (and in real life) you will be expected to do more than having memorized stuff.
  - Summarise to your boy/girlfriend, younger sibling, grandparents, stranger on the tube, and/or an imaginary friend what you have just learned.
  - Study with other students and challenge each other.
  - When you get lost, do NOT try to find more literature online or in the library. The struggle to figure things out yourself is part of studying effectively.

IF YOU NEED HELP

Some thoughts on methodology: what economists do and why

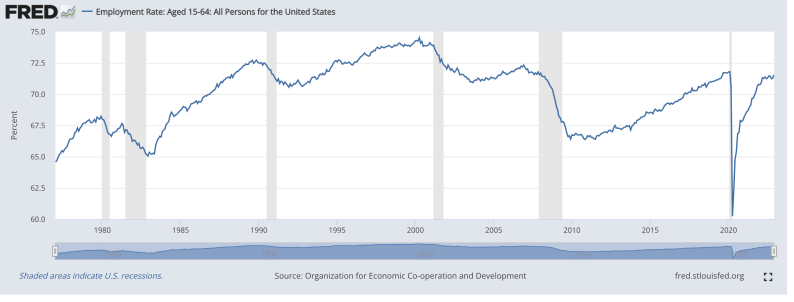
The interplay of models and data

- Like in your previous courses, will make use of models and look at data
- Example of model: firms choose labor demand to maximize profits

$$\max_{n} \; f(n) - wn$$

  where n is labor, $f(n)$ is output (f is production function), w is the wage

- Example of data:



The interplay of models and data

How to think about interplay of model and data?

- why not only data?
- why not only models?

Here: quick, superficial treatment of important methodological issues

- part of much broader methodological debates (see references)
- my main goal here: get you thinking about these issues
- disclaimer: no single “right” approach here, reflects my personal opinion

The interplay of models and data

Macroeconomics needs interplay of both theory and data

1. Theory without data
    - "smart kids playing in sandbox"
2. Data without theory
    - flying blind
    - "Let the data speak" is fiction / wishful thinking
    - there is no paper in economics without a (implicit) model
    - policy questions are questions about counterfactuals ("what happens in world with policy relative to world without policy?")
    - ... requires a model (either explicit or implicit)

Further reading for the interested (not required)

Some relevant references (discussion in many much deeper than here):

- Nakamura-Steinsson “Identification in Macroeconomics”
- Reis “Is something really wrong with macroeconomics?”
- JEP Symposium “Con out of Economics” https://www.aeaweb.org/issues/126
- Heckman-Urzua “Comparing IV With Structural Models: What Simple IV Can and Cannot Identify”
- Card “Model-Based or Design-Based? Competing Approaches in ‘Empirical Micro’” https://davidcard.berkeley.edu/lectures/woytinsky.pdf https://www.youtube.com/watch?v=S6xSEiB6E2s

Modeling in (Macro)economics

Modeling in (Macro)economics

Objective is not to build one big model we use to address all issues

- descriptive realism is not the objective
- instead make modeling choices that are dependent on the issue
- whether a model is "good" is context dependent

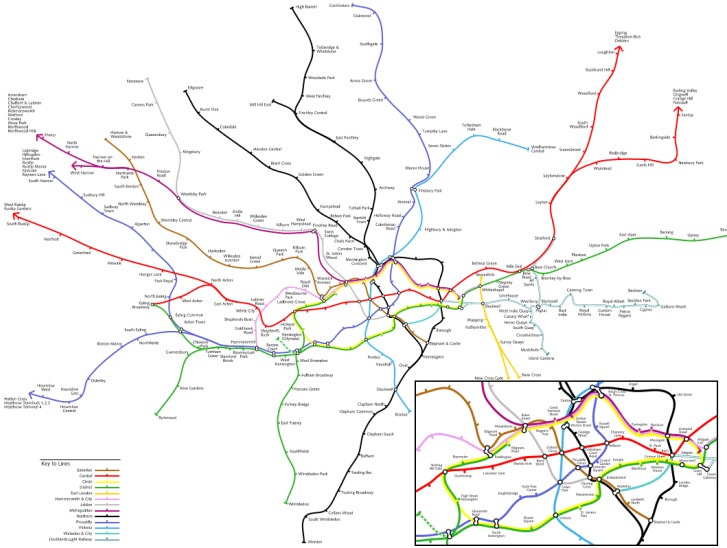
Approach to modeling in (macro)economics well summarized by

- "All models are false; some are useful"
  https://en.wikipedia.org/wiki/All_models_are_wrong
- "If you want a model of the real world, look out the window" (kidding, but only half kidding)
- "The map is not the territory" https://en.wikipedia.org/wiki/Map-territory_relation
- Literary version of this: Borges "On Exactitude in Science"
- Point in case: geographically accurate London tube map

  https://kottke.org/plus/misc/images/tubegeo.gif

  https://www.ifs.org.uk/publications/10282 by Bandiera, Machin,...

London tube map (https://kottke.org/plus/misc/images/tubegeo.gif)



My own version (same ideas)

https://economicsobservatory.com/how-are-economic-models-adapting-to-rising-inequality-and-the-pandemic

What do macro models try to do?

Most crucial economic questions cannot be answered solely by analysing data. One simple reason is that we do not have enough of it: large shocks, like COVID-19 or the financial crisis, are infrequent so that historical experience, and the data it brings, are limited. In addition, economic measures like growth and inflation affect each other, making it challenging to separate correlation from causation. Unlike natural scientists, we can't run realistic large scale 'experiments' to understand the transmission mechanisms for policy tools like interest rates or government spending. There has been substantial progress in producing soundly 'identified' evidence (research that successfully teases correlation from causation), but despite this progress we are far from understanding the macroeconomy through the lens of data alone. We therefore need to use theoretical models to help us tie such evidence into coherent narratives about the workings of the macroeconomy.

Macroeconomic models are not intended to be a perfect replication of the world. Instead, they are tools that set out some of the key mechanisms that affect the economy and help us ensure that our intuitions about how the economy works add up. To see this, consider the analogy of the London Tube map (Attanasio et al, 2017). Laying out tube lines in a simplified way makes planning your route much easier, even though the map is very unrealistic compared to a geographically accurate map. Similarly, in economic models, we capture elements of the macroeconomy that we are interested in - for instance, limits on borrowing or wealth inequality - and make other assumptions to keep the rest of the model simple enough to use. Many assumptions in the model may appear very unrealistic; the aim is that they still allow us to capture the aspects of the macroeconomy that we would like to understand.

Crucial or Critical Assumptions

A CONTRIBUTION TO THE THEORY OF ECONOMIC GROWTH

By Robert M. Solow

I. Introduction, 65. — II. A model of long-run growth, 66. — III. Possible growth patterns, 68. — IV. Examples, 73. — V. Behavior of interest and wage rates, 78. — VI. Extensions, 85. — VII. Qualifications, 91.

I. Introduction

All theory depends on assumptions which are not quite true. That is what makes it theory. The art of successful theorizing is to make the inevitable simplifying assumptions in such a way that the final results are not very sensitive.[1] A "crucial" assumption is one on which the conclusions do depend sensitively, and it is important that crucial assumptions be reasonably realistic. When the results of a theory seem to flow specifically from a special crucial assumption, then if the assumption is dubious, the results are suspect.

Source: Solow (1956) "A Contribution to the Theory of Economic Growth"

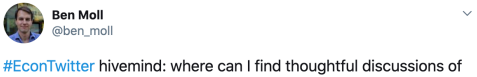
Modeling in (Macro)economics

Ten commandments for non-economists
1. Economics is a collection of models with no predetermined conclusions; do not let anyone tell you otherwise.
2. Do not criticize an economist's model because of its assumptions; ask how the results would be changed if the assumptions that seem problematic were more realistic.
3. Analysis requires simplicity; beware of incoherence that passes itself off as complexity.
4. Do not be put off by the math; remember economists use math not because they are smart, but because they are not smart enough.
5. When an economist makes a recommendation, ask what makes him/her sure the underlying model applies to the case at hand.
6. When an economists uses the term "economic welfare," ask what s/he means by it.
7. Do not assume what an economist says in public is the same as what he says in the seminar room.
8. Economists don't (all) worship markets; if they seem like they do, it's probably because they know better how they work than you do.
9. If you think all economists think alike, do attend one of their seminars.
10. If you think economists are especially rude to non-economists, do attend one of their seminars.

Source: Rodrik (2015) "Economics Rules"
http://www.centreformacroeconomics.ac.uk/pdf/Events/Slides/1510-RodrikD.pdf

Navigating Among Models

- Chapter 3 “Navigating Among Models” of “Economics Rules”
- Responses to this tweet
  https://twitter.com/ben_moll/status/1312042597876142081



- ... especially Beatrice Cherrier and Gianluca Violante’s replies

https://twitter.com/Undercoverhist/status/1312053154515693568

Toward a Simple Macro Model: Labor Supply and Demand

Toward a simple macro model

- Next lecture: your first modern macro model
- Model will be extremely (ridiculously) simple, a baby version
  - a single “representative” consumer
  - a single “representative” firm
  - only one time period, i.e. model is static not dynamic
  - only one good
  - only one factor of production (labor)
  - no frictions, “market imperfections”
  - model is sometimes called **“Robinson Crusoe economy”**
- ... but it will have key features of most modern macro models
  1. micro foundations
  2. general equilibrium
- Rest of course: build much richer, more satisfactory models

Sketch of simple macro model (Robinson Crusoe economy)

- **Preferences** (i.e. utility function):

$$U(c, h)$$

  - c: consumption of coconuts, U is increasing in c
  - h: hours worked, U is decreasing in h
- **Technology** (i.e. production function):

$$y = f(n)$$

  - y: output, i.e. production of coconuts
  - n: hours employed, f is increasing in n
- **Resource constraints:**

$$c = y, \qquad n = h$$

- Next lecture: different ways of organizing this economy
- One of them: Robinson Crusoe is alone on an island, lives off coconuts, harvesting coconuts takes time. Hence the name.

Some thoughts on the representative agent assumption

- Model assumes "representative consumer" and "representative firm" (jointly = "representative agent")
- When is this justified? Here: sketch, more in supplement (not examinable)
- **Firms**: if at least one of following 3 conditions is satisfied
  1. all firms in economy are identical
  2. particular assumptions on production functions ("homogeneity")
  3. perfect factor markets (capital, labor) $\Rightarrow$ equalize marginal products
     - see supplement
- **Consumers** (even harder): if one of following 2 conditions is satisfied
  1. all consumers in economy are identical
  2. particular assumptions on preferences ("Gorman aggregation")
     - see supplement
- Do we believe these conditions are satisfied? **No**, but...

Toward a simple macro model

Today: study key building blocks of simple macro model

1. labor demand
2. labor supply

This should largely be a refresher of material you've already seen in EC1A1

- probably with different notation
- good point to mention: you need to be able to handle changing notation
  - economists change notation all the time
  - notation varies across textbooks, courses, even within lectures
  - extreme example: rather than writing production as n^{α}, write α^{n}
- my experience: if you can't handle changing notation, you probably don't understand the economics

Vocabulary: "partial equilibrium" and "general equilibrium"

Will frequently hear macroeconomists use following two words

- "general equilibrium" = all prices endogenously determined in equilibrium
- "partial equilibrium" = problem of individual household or firm in isolation taking as given prices

Let's apply vocabulary:

- Today: labor demand and supply in partial equilibrium
- Next lecture: labor demand and supply in general equilibrium

Note: "partial equilibrium" = misnomer

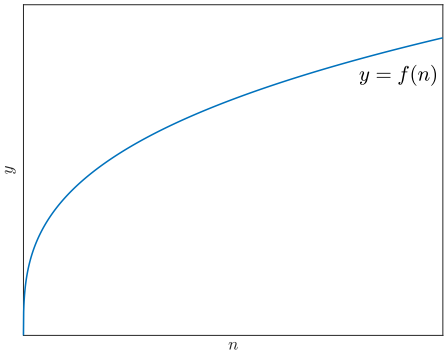
- Nothing "partial" about it, should really be "no equilibrium"
- This is specific to macro. Other fields use "partial equilibrium" differently: equilibrium in a single market.
- But very common language in macro $\Rightarrow$ will adopt even though misnomer

Labor demand

- Representative firm has production function

$$y = f(n)$$

- Assumptions: $f'(n) > 0$ and $f''(n) < 0$ for all n



- Example: $f(n) = An^{\alpha}$ with $0 < \alpha < 1$, $A > 0$

Labor demand

- Representative firm maximizes profits

$$\Pi = \max_{n} \; f(n) - wn$$

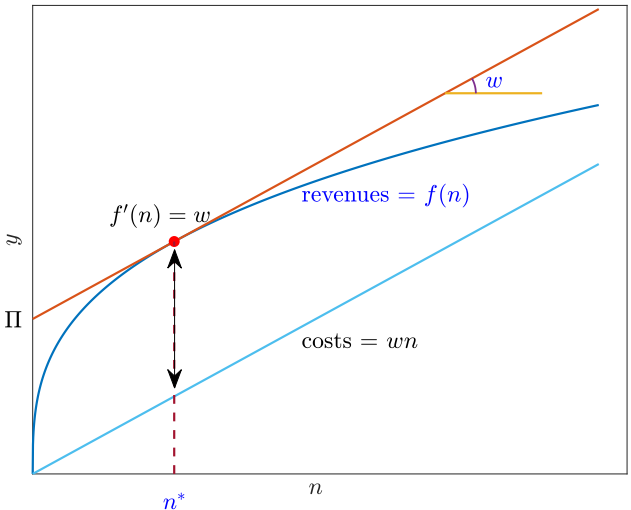
- Solution: labor demand function

$$n^* = n^d(w)$$

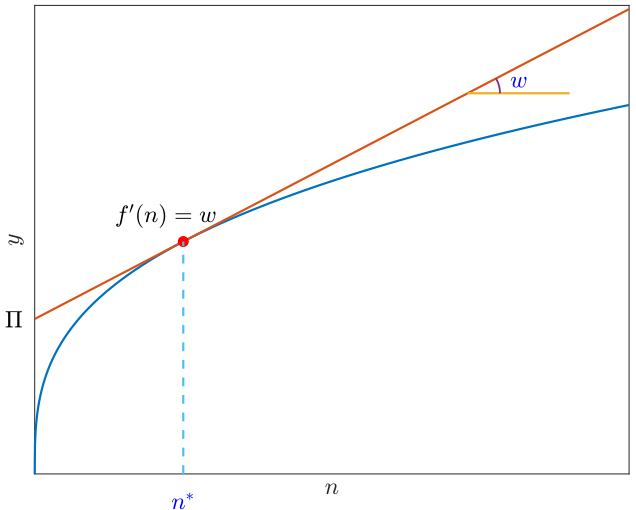
- Optimality condition

$$f'(n) = w$$

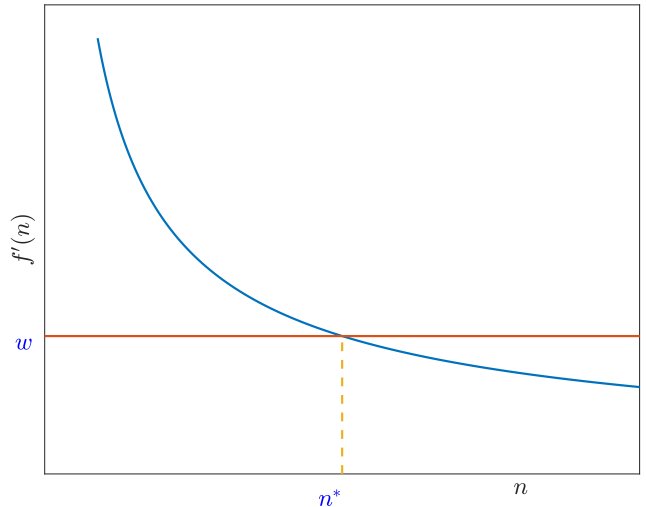
Labor demand: graphical representation



Labor demand: more minimal graphical representation



Labor demand: alternative graphical representation



Labor demand: parametric example

- Example: $f(n) = An^{\alpha}$ with $0 < \alpha < 1, A > 0$
- Representative firm maximizes profits

$$\Pi = \max_{n} \; f(n) - wn$$

- $\Rightarrow$ optimal labor demand is

$$n^* = n^d(w) = \left(\frac{\alpha A}{w}\right)^{\frac{1}{1-\alpha}}$$

  which is

  - decreasing in wage w (as a demand curve typically is)
  - increasing in productivity A

Labor supply

- Derive labor supply from utility maximization of representative household
- Good treatment in Kurlat, chapter 7.2 (see moodle)
- Two equivalent formulations
  1. in terms of hours worked h
  2. in terms of leisure ℓ
- My guess: you've probably seen the latter $\Rightarrow$ start with that one

Derivation of labor supply in terms of leisure ℓ

- Preferences (role of $\tilde{}$ will become clear momentarily)

$$u(c) + \tilde{v}(\ell)$$

  where c = consumption, ℓ = leisure, $\tilde{v}(\ell)$ = utility from leisure

- Assumptions
  - $u'(c) > 0$ and $\tilde{v}'(\ell) > 0$
  - $u''(c) < 0$ and $\tilde{v}''(\ell) < 0$
- Example

$$u(c) = \log c, \quad \tilde{v}(\ell) = \theta \log \ell, \quad \theta > 0$$

- More general version would feature non-separable utility function

$$\tilde{U}(c, \ell)$$

  but this doesn't add very much so work with simpler separable version

Derivation of labor supply in terms of leisure ℓ

Representative household solves

$$\max_{c,\ell} \; u(c) + \tilde{v}(\ell) \quad \text{s.t.} \quad c = w(1-\ell) + \Pi$$

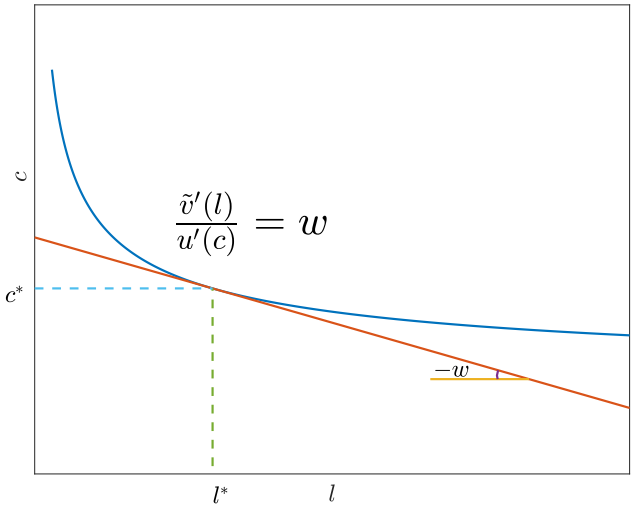
Explanation:

- household's time endowment = 1
- hours worked $h = 1 - \ell$
- note: 1 is just a normalization to save on notation, could equally have assumed time endowment = 24 hours or some abstract parameter $\bar{\ell}$
- $w(1-\ell) = wh =$ is labor income
- Π = other unearned income, e.g. dividend income from owning stocks

Solution: labor supply function

$$h^* = h^s(w) = 1 - \ell^*$$

Labor supply in terms of leisure ℓ: graphical representation



Derivation of optimality condition

You should already know this but I will do derivation once (and never again)

Two equivalent strategies:

1. Direct substitution (brute force)

$$\max_{\ell} \; u(\underbrace{w(1-\ell)+\Pi}_{c}) + \tilde{v}(\ell) \quad \Rightarrow \quad -u'(c)w + \tilde{v}'(\ell) = 0$$

2. Lagrangean

$$\mathcal{L} = u(c) + \tilde{v}(\ell) + \lambda\left[w(1-\ell)+\Pi - c\right]$$

$$\left.\begin{array}{ll} c: & u'(c) = \lambda \\ \ell: & \tilde{v}'(\ell) = \lambda w \end{array}\right\} \quad \Rightarrow \quad \frac{\tilde{v}'(\ell)}{u'(c)} = w$$

Derivation of labor supply in terms of hours worked h

- Preferences

  $$u(c) - v(h)$$

  where c = consumption, h = hours worked, $v(h)$ = disutility from work

- Assumptions
  - $u'(c) > 0$ and $v'(h) > 0$
  - $u''(c) < 0$ and $v''(h) > 0$, i.e. disutility is convex
- Link to leisure formulation: set $v(h) = -\tilde{v}(1-h) \Rightarrow$ the two are equivalent
- Example 1: $u(c) = \log c,\ v(h) = -\theta \log(1-h), \theta > 0$
- Example 2:

  $$u(c) = \log c, \quad v(h) = \theta \frac{h^{1+1/\varepsilon}}{1+1/\varepsilon}, \quad \theta, \varepsilon > 0 \ \left(\text{note: } v'(h) = \theta h^{1/\varepsilon}\right)$$

- As before, could also work with non-separable $U(c, h)$

Derivation of labor supply in terms of hours worked h

Representative household solves

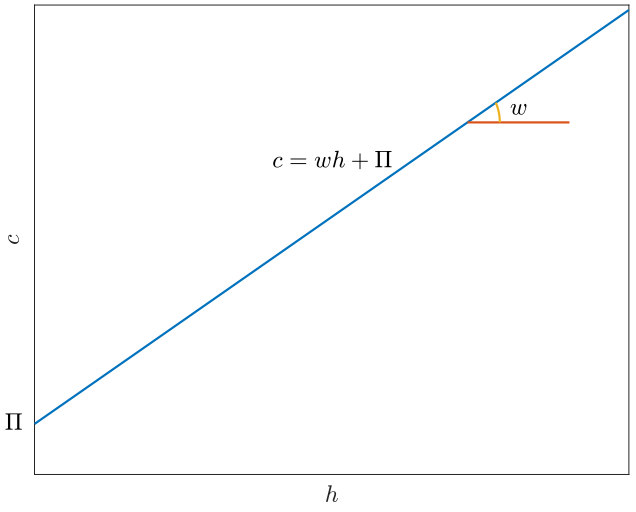
$$\max_{c,h} \; u(c) - v(h) \quad \text{s.t.} \quad c = wh + \Pi$$

- $wh =$ is labor income
- Π = other unearned income, e.g. dividend income from owning stocks

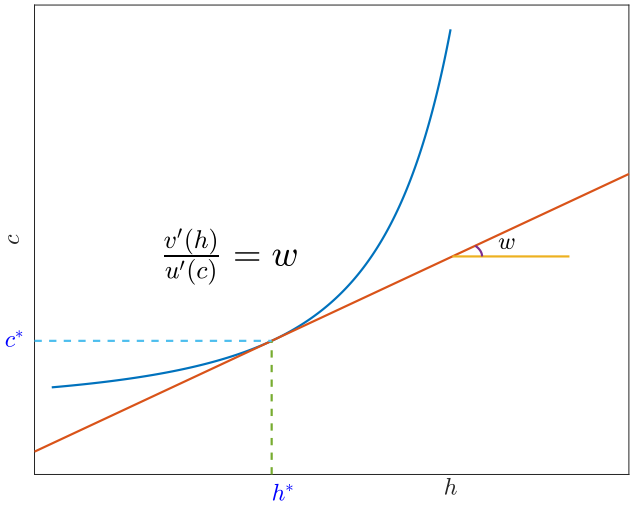
Solution: labor supply function

$$h^* = h^s(w)$$

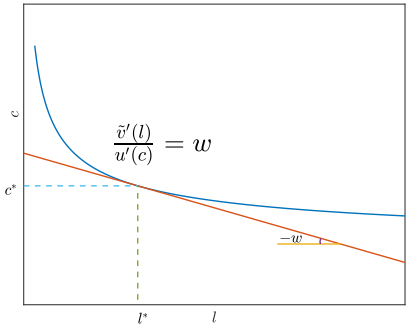
Graphical representation in terms of hours worked *h*

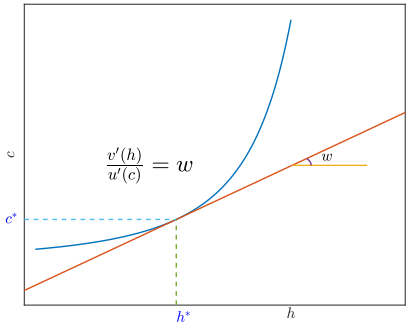


Graphical representation in terms of hours worked *h*



Note: same graph as before but with flipped x-axis





Two exercises and a question

- Exercise 1: derive optimality condition in terms of hours worked
- Exercise 2: derive optimal labor supply in example 2

$$u(c) = \log c, \quad v(h) = \theta \frac{h^{1+1/\varepsilon}}{1+1/\varepsilon}, \quad \theta, \varepsilon > 0$$

- **Question:** suppose w increases, what will happen to labor supply? Why?

Next time

- Combine labor supply and labor demand
- $\Rightarrow$ your first (baby, ridiculously simple) modern macro model

Appendix on
Income and Substitution Effects

A way of thinking about income and substitution effects

- Note: only some people find this useful (those who "think in equations")
- If you don't, please just ignore. The standard graphical analysis is just fine.
- This definition of income and substitution effects is also non-standard (compared to textbook definition) but it's helpful nevertheless
  - on my to-do list: work out exact relation to standard definition
- Recall: representative household solves

$$\max_{c,h} \; u(c) - v(h) \quad \text{s.t.} \quad c = wh + \Pi$$

- Optimal $h^*(w)$ solves optimality condition and budget constraint

$$\frac{v'(h)}{u'(c)} = w$$

$$c = wh + \Pi$$

A way of thinking about income and substitution effects

- Let's do something funny: separate notation for w in the two equations

$$\frac{v'(h)}{u'(c)} = w^S$$

$$c = w^I h + \Pi$$

  where S stands for "substitution" and I for "income" (explain momentarily)

- Obviously when $w^S = w^I = w \Rightarrow$ obtain $h^*(w)$ again
- But can still solve system even when $w^S \neq w^I \Rightarrow$ solution $h^*(w^S, w^I)$
- **Key observation:**
  - Substitution effect = change in h^* from changing w^S but not w^I, i.e. effect of price change working through first-order condition
  - Income effect = change in h^* from changing w^I but not w^S, i.e. effect of price change working through budget constraint

This is much more general

- Example: intertemporal choice (Lecture 4 and EC1A1)

$$\max_{c_1, c_2} u(c_1) + \beta u(c_2) \quad \text{s.t.} \quad c_1 + \frac{c_2}{1+r} = y_1 + \frac{y_2}{1+r}$$

- Following logic of previous slide, write first-order condition and budget constraint as

$$u'(c_1) = \beta(1 + r^S)u'(c_2)$$
$$c_1 + \frac{c_2}{1+r^I} = y_1 + \frac{y_2}{1+r^I}$$

- Substitution effect = change in (c_1^*, c_2^*) from changing r^S but not r^I, i.e. effect of price change working through first-order condition
- Income effect = change in (c_1^*, c_2^*) from changing r^I but not r^S, i.e. effect of price change working through budget constraint