Inequality, Household Behavior and the Macroeconomy
(Optimal Taxation)

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  - income risk
  - heterogeneity across households
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  But why?
- These things matter for practically any important policy question

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- so that we can see why
  - heterogeneity across households
  - and incomplete markets

  are important.

Optimal Taxation

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to maximize the welfare of societies. There are some trade-offs:

1. If taxes are not lump sum, they bring about distortions
2. The government has exogenous financing needs
3. There is a demand for redistribution etc...

With the models we studied so far we can understand the trade-offs

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First best in a simple setting

Assume that

- The total financing needs (G) of the government do not depend on households' choices
- There is a representative customer
- Capital markets are perfect:
  - either full menu of Arrow-securities;
  - or there is no uncertainty and there is one asset, without borrowing limits.

Then

1. It does not matter how taxes are timed: the government just takes away some money with $NPV = G$
2. Resolving the household's problem after reducing its resources with G (in NPV) leads to the first best allocation
3. $\Rightarrow$ lump-sum taxes are the best from the welfare point of view!

When are capital income and wealth taxes equivalent?

As long as a tax is proportional to savings, it does not matter if it is written as a

- capital income tax: $\tau_t^a r_{i,t} a_{i,t}$
- or before-return wealth tax $\tau_t^w a_{i,t}$
- or after-return wealth tax $\hat{\tau}_t^w (1 + r_{i,t}) a_{i,t}$

as long as **everybody earns the same return**, so $r_{i,t}$ is constant in i.

For example, given τ_t^a, replacing capital income tax with a before-return wealth tax equal to $\tau_t^w = \tau_t^a r_t$ results in identical allocations.

This is **not** true if people earn different returns! More on this next lecture. Today we skip wealth taxes.

Taxation of a representative household with no uncertainty

Let us now consider the problem of the household, where $u()$ is increasing (and concave) in leisure l_t and consumption c_t:

$$\max \sum_{t=0}^{\infty} \beta^t u\left(c_t, l_t\right)$$

$$\text{s.t} \quad l_t = 1 - \underbrace{n_t}_{\text{labor supply}}$$

$$c_t(1+\tau_t^c) + a_{t+1} + T = (1-\tau_t^n) w_t n_t + \left(1 + (1-\tau_t^a) r_t\right) a_t$$

τ_t^n, τ_t^a and τ_t^c are the tax rate on labor income, capital income and consumption respectively. T is a lump sump tax

Taxation of a representative household with no uncertainty

The Lagrangian of the problem is

$$\mathcal{L} = \sum_{t=0}^{\infty} \beta^t \left[u\left(c_t, l_t\right) + \lambda_t \left(-c_t(1+\tau_t^c) - a_{t+1} - T + (1-\tau_t^n) w_t n_t + \left(1 + (1-\tau_t^a) r_t\right) a_t \right) \right]$$

the FOCs are:

$$\begin{aligned} u_c\left(c_t, l_t\right) &= \lambda_t (1+\tau_t^c) \\ u_l\left(c_t, l_t\right) &= \lambda_t (1-\tau_t^n) w_t \\ \lambda_t &= \beta \lambda_{t+1} \left[1 + (1-\tau_{t+1}^a) r_{t+1}\right] \end{aligned}$$

Taxation of a representative household with no uncertainty

We can rearrange the FONCs to obtain the condition for labor supply and the Euler equation:

$$u_l\left(c_t, l_t\right) = u_c\left(c_t, l_t\right) \frac{\left(1-\tau_t^n\right)}{\left(1+\tau_t^c\right)} w_t$$

$$u_c\left(c_t, l_t\right) \frac{\left(1+\tau_{t+1}^c\right)}{\left(1+\tau_t^c\right)} = \beta u_c\left(c_{t+1}, l_{t+1}\right)\left[1+\left(1-\tau_{t+1}^a\right) r_{t+1}\right]$$

Taxes create distortions! Positive τ_t^n, τ_t^a and τ_t^c take us away from the first best allocation where

$$u_l\left(c_t, l_t\right) = u_c\left(c_t, l_t\right) w_t$$

$$u_c\left(c_t, l_t\right) = \beta u_c\left(c_{t+1}, l_{t+1}\right)\left[1+r_{t+1}\right]$$

would hold. Note: T does not create distortions!

Distortions in labor choice

$$u_l(c_t, l_t) = u_c(c_t, l_t) \frac{(1 - \tau_t^n)}{(1 + \tau_t^c)} w_t$$

Since, $\frac{(1-\tau_t^n)}{(1+\tau_t^c)} \leq 1$, agents will

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- and work too little (consume too much leisure).

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Intuition:

- There are two goods (material goods and leisure) in this economy, but these taxes treat them differently:
- Consuming goods is punished, while
- **Not** consuming leisure is punished.
- In many models it turns out that the government should subsidize work, instead of taxing it...

Distortions from consumption taxes

$$u_c\left(c_t, l_t\right) \frac{\left(1+\tau_{t+1}^c\right)}{\left(1+\tau_t^c\right)} = ...$$

Only $\frac{(1+\tau_{t+1}^c)}{(1+\tau_t^c)}$ appears here, so

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- consumption taxes are **distortive only if changing** over time.
- Recognizing this is one reason why the importance of consumption taxes is slowly increasing in most advanced economies.

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Intuition:

- In optimum, every earned cent will be spent at some point in the future ...
- only once!
- If consumption taxes are constant, they don't influence when to spend.
- $\Rightarrow$ no distortion!

Distortions from capital taxes

$$... = \beta u_c \left(c_{t+1}, l_{t+1}\right) \left[1 + \left(1 - \tau^a_{t+1}\right) r_{t+1}\right]$$

τ^a_{t+1} makes you give less weight to the future, so

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Intuition:

- In some sense, capital tax is like an ever-increasing consumption tax. Why?
  - Some part of your savings you eat in the next year. Some in two years, three, etc.
  - You pay capital income taxes **several times** on the part of your savings that you keep for several years
  - So you effectively pay higher tax on the part that you consume later.
- We already saw that changing consumption taxes are distortive.

Taxes and Welfare

How to measure welfare?

Obvious in a representative agent economy!

- Welfare is just its value function given the initial state variables
- Equivalently, (the expectation of) the discounted sum of time utilities given the initial state variables and given that choices follow the policy function

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As shown earlier, differences can be expressed as consumption equivalents.

- Can be computed for any utility function
- Very convenient with CRRA utility

How to choose taxes optimally? The Ramsey Problem—I

The Ramsey problem is defined given a general equilibrium environment where

- A government needs to finance an exogenous stream of public expenditure taxing labor and capital income and/or issuing government debt
- The representative household is defined as above + also holds government bonds
- Production happens with labor, supplied by the representative household, and capital, which is owned by the representative household.

An equilibrium is a 1) feasible allocation, 2) price system, 3) government policy where

- Given 2) and 3), 1) solves both the problem of the firm and of the household
- Given 1) and 2), 3) satisfies the sequence of government budget constraints

How to choose taxes optimally? The Ramsey Problem—II

The Ramsey problem is to choose an equilibrium that maximizes $\sum_{t=0}^{\infty} \beta^t u(c_t, l_t)$ given an initial level of debt and capital

In practice, the problem is to maximize $\sum_{t=0}^{\infty} \beta^t u(c_t, l_t)$ under the constraints below

- The government's budget constraint imposing the firm's FOCs
- The aggregate resource constraint (C+I+G=Y)
- The Euler equation and the labor supply condition from the household's FOCs

Of course, problem would be trivial if lump-sum taxes were allowed, but they are not.

How to choose taxes optimally? The Ramsey Problem—III

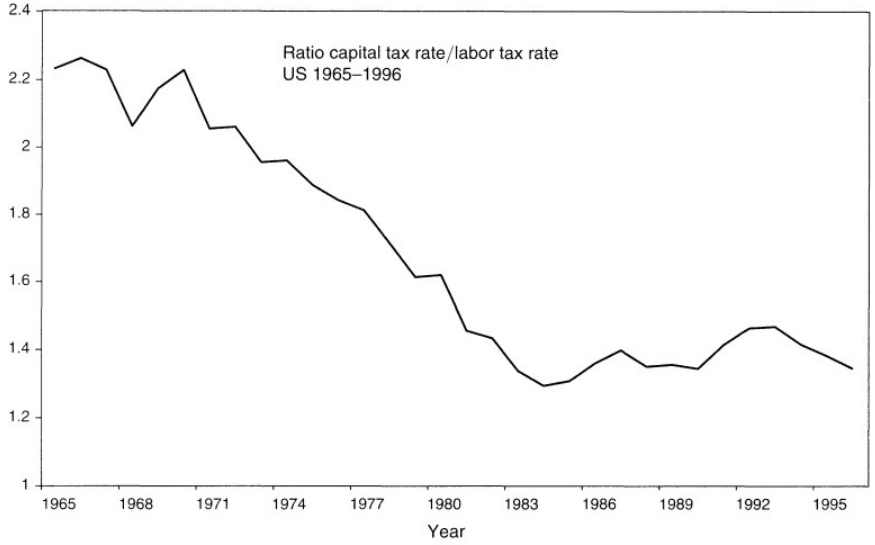
Common wisdom result: In steady state, capital income taxes should be zero!!!

Why? Chamley (1986): positive capital tax is equivalent to a (very distortive!) rising tax on consumption

Two caveats:

1. This result holds in the long run. In $t = 0$, capital taxation is not distortive because initial capital is given
2. The result was recently criticized by Werning and Straub (2020):
   - they say Chamley (1986) relies on assumptions that are far from trivial / sometimes wrong even within the model.

Ratio of Capital Taxes to Labor Taxes - US



Why are capital taxes positive?

According to the Ramsey Problem set up above, capital taxes should be eliminated in the long run (Chamley 1986, Judd 1985b)

Why are capital taxes positive?

The median voter (high wage over wealth ratio) would suffer from abolishing capital taxes (Garcia-Mila, Marcet, Ventura, 2009)

Do you think that what we studied so far could be useful in this respect?

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Why are capital taxes positive?

Indeed, what we studied matters for optimal taxation and the no capital income taxation is unlikely to be optimal.

We will see how the following frictions/ingredients matter for wealth inequality

- Borrowing constraints
- Idiosyncratic insurable income risk
- Family labor supply
- Next lecture: optimal combination of capital and wealth taxation as an antidote against capital misallocation.

Taxes and Welfare

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Some common choices:

- Utilitarian welfare is the average of the value functions in the population, given the state variables of each household. Compare across economies with different tax systems

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- Compute if the value of the median household would increase or decrease.

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- Compute equivalents difference in wealth (absolute, not relative) and take the average.

  Could you reshuffle wealth a bit in a way that everyone would be happier in the new tax system?

Taxes and Welfare

When using the utilitarian approach,

At what age t should we look at the value functions? It depends on the question/model!

- If the model has age, consider the value function in $t = 0$
- If models are defined in general equilibrium (GE), average value functions are computed in the steady-state
- Welfare changes are quantified in terms of constant consumption equivalence

Taxes and Welfare

Once introducing a new tax system, the economy converges to a new steady state.

- In representative agent settings usually enough to compare steady states
- Not the case in a heterogeneous agent model:
  - New taxes mean redistribution
  - Inequality changes
  - There are winners and losers, whose losses over the transition are not trivial

Borrowing constraints and Optimal Taxation—I

The Euler Equation of the deterministic consumption saving problem with borrowing limits and taxes is:

$$u_c(c_t)\frac{(1+\tau^c_{t+1})}{(1+\tau^c_t)} = \beta u_c(c_{t+1})\left[1+(1-\tau^a_{t+1})r_{t+1}\right]+\mu_t$$

μ_t: Lagrangian multiplier of the (no) borrowing constraint

If steep income growth with t, borrowing constraints are likely to bind, i.e. $\mu_t > 0$

Households lose utility when the unconstrained Euler equation is not satisfied

Can taxes help avoid this?

Borrowing constraints and Optimal Taxation—II

Ideally, we would want to tax consumption of constrained agents less.

(At least) two realistic strategies are available:

1. *Age-dependent consumption taxes*. Consumption taxes can be set to be increasing in t: these will be high (low) when the the household is old (young) and unlikely (likely) to be borrowing constrained

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1. *Age-dependent consumption taxes*. Consumption taxes can be set to be increasing in t: these will be high (low) when the the household is old (young) and unlikely (likely) to be borrowing constrained
2. *Capital income taxes*. When age dependent taxes are not available, a nonzero tax on capital income is also useful, as it can (imperfectly) mimic consumption tax rates that rise in t
   - Why? On average (not always!) young individuals have less wealth than older individuals

The value function in $t = 0$ can be improved using these strategies wrt a situation with constant consumption taxes over age or no capital taxes

Precautionary Savings and Optimal Taxation—I

What is the implication of incomplete financial markets + idiosyncratic earnings shock + prudence for optimal taxation?

Domeij and Heatcote (2004) study the welfare gains to go from the 2004 U.S. capital income tax rate of 39.7% to a range of new capital tax rates between 0 and 50%.

Note: higher (lower) capital taxes needs to be compensated by lower (higher) labor taxes to satisfy the government budget constraint. It is a GE model

They compare three (infinite horizon) models where preferences display prudence:

1. Rep. agent
2. No-earning-risk: households have the same constant labor productivity, but their amount of wealth (which is their state variable) differs
3. Benchmark: Idiosyncratic earnings risk and incomplete markets

Precautionary Savings and Optimal Taxation—II

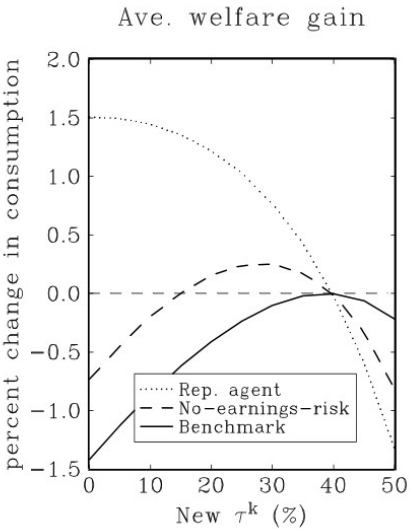
Consumption equivalents on vertical axis.

Baseline: $\tau^k = 39.7\%$

The policy and reforms are evaluated in steady-state

Results:

- Current (high) capital income tax is optimal
- More that 70% of agents would be unhappy with abolishing the capital income tax
- Somewhat different picture when capital income tax is replaced by consumption tax.



Precautionary Savings and Optimal Taxation—III

What do we learn?

- Low-wealth households are the losers of a reform which decreases capital taxation.

  Since they have larger marginal utilities, in aggregate the welfare effect of lowering capital taxes are negative

- Due to incomplete financial markets individuals over-accumulate wealth. This increases the capital stock and suppresses interest rates. The government can correct wealth over accumulation through positive capital taxation

Family Labor Supply—I

Does family-driven consumption insurance matters for optimal taxation?

Wu and Krueger (2021) say: Yes! Their methodology:

1. Build a life cycle two-earner household model with endogenous labor supply on the intensive and extensive margins
2. The estimated model rationalize the extent of consumption insurance against shocks to male and female wages, as estimated empirically by BPS 2016 (class 21)

Their model features progressive labor income taxes, which are (very) distortive but provide consumption insurance + proportional capital income taxes

Once we account for family-driven insurance, the additional effect of progressive taxes is low $\rightarrow$ labor taxes should be less progressive than previously tough

Family Labor Supply—II
Welfare and Insurance Effects of Tax Progressivity