Public Economics: Tax & Transfer Policies
(Master PPD & APE, Paris School of Economics)
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Lecture 2: Tax incidence:
macro & micro approaches
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(check on line for updated versions)
• Tax incidence problem = the central issue of public economics = who pays what?

• General principle: it depends on the various elasticities of demand and supply on the relevant labor market, capital market and goods market.
• Usually the more elastic tax benefit wins, i.e. the more elastic tax base shifts the tax burden towards the less elastic

• Same pb with transfer incidence: who benefits from housing subsidies: tenants or landlords? – this depends on elasticities

• Opening up the black box of national accounts tax aggregates is a useful starting point in order to study factor incidence (macro approach)
• But this needs to be supplemented by micro studies
Standard macro assumptions about tax incidence

- Closed economy: domestic output = national income = capital + labor income = consumption + savings
  \[ Y = F(K,L) = Y_K + Y_L = C + S \]
- Total taxes = capital taxes + labor taxes + consumpt. taxes
  \[ T = \tau Y = T_K + T_L + T_C = \tau_Y Y_K + \tau_L Y_L + \tau_C C \]
- See Eurostat estimates of \( \tau_L, \tau_K, \tau_C \)
- Typically, \( \tau_L = 35\%-40\%, \tau_K = 25\%-30\%, \tau_C = 20\%-25\% \).
- But these computations make assumptions: all labor taxes (incl. all social contributions, employer & employee) are paid by labor; all capital taxes (incl. corporate tax) paid by capital; not necessarily justified
- Open economy tax incidence: \( Y + \text{Imports} = C + I + \text{Exports} \)
  → taxing imports: major issue with VAT (fiscal devaluation)
Basic tax incidence model

- Output $Y = F(K,L) = Y_K + Y_L$
- Assume we introduce a tax $\tau_K$ on capital income $Y_K$, or a tax $\tau_L$ on labor income $Y_L$
- Q.: Who pays each tax? Is a capital tax paid by capital and a labor tax paid by labor?
- A.: Not necessarily. It depends upon:
  - the elasticity of labor supply $e_L$
  - the elasticity of capital supply $e_K$
  - the elasticity of substitution $\sigma$ between $K$ & $L$ in the production function (which in effect determines the elasticities of demand for $K$ & $L$)
Reminder: what is capital?

- \( K = \) real-estate (housing, offices..), machinery, equipment, patents, immaterial capital,..
  
  \( (\approx \) housing assets + business assets: about 50-50)  
  \( Y_K = \) capital income = rent, dividend, interest, profits,..

- In rich countries, \( \beta = K/Y = 5-6 \)  
  \( (\alpha = Y_K/Y = 25-30\%) \)  
  (i.e. average rate of return \( r = \alpha/\beta = 4-5\% \))

- Typically, in France, Germany, UK, Italy, US, Japan:  
  \( Y \approx 30 \, 000\€ \) (pretax average income, i.e. national income /population),  
  \( K \approx 150 \, 000\text{-}180 \, 000\€ \) (average wealth, i.e. capital stock/population); net foreign asset positions small in most countries (but rising); see [this graph](#) & [inequality course](#) for more details
Back to tax incidence model

• Simple (but unrealistic) case: linear production function
  \[ Y = F(K,L) = r K + v L \]
  With \( r \) = marginal product of capital (fixed)
  \( v \) = marginal product of labor (fixed)
  Both \( r \) and \( v \) are fixed and do not depend upon \( K \) and \( L \)
  = infinite substituability between \( K \) and \( L \) = zero complementarity = robot economy

• Then capital pays capital tax, & labor pays labor tax
  (it’s like two separate markets, with no interaction)

• Revenue maximizing tax rates:
  \[ \tau_K = 1/(1+e_K) \]
  \[ \tau_L = 1/(1+e_L) \]
  (= inverse-elasticity formulas)
The inverse-elasticity formula $\tau = 1/(1+e)$

- Definition of labor supply elasticity $e_L$: if the net-of-tax wage rate $(1-\tau_L)v$ rises by 1%, then labor supply $L$ (hours of work, labor intensity, skills, etc.) rises by $e_L\%$

- If the tax rate rises from $\tau_L$ to $\tau_L+d\tau$, then the net-of-tax wage rate drops from $(1-\tau_L)v$ to $(1-\tau_L-d\tau)v$, i.e. drops by $d\tau/(1-\tau_L)\%$, so that labor supply drops by $e_L d\tau/(1-\tau_L)\%$

- Therefore tax revenue $T = \tau_L vL$ goes from $T$ to $T+dT$ with:
  
  $$dT = vL \ d\tau - \tau_L v \ dL = vL \ d\tau - \tau_L vL \ e_L \ d\tau/(1-\tau_L)$$

  i.e. $dT = 0 \iff \tau_L = 1/(1+e_L)$ (= top of the Laffer curve)

- Same with capital tax $\tau_K$. Definition of capital supply elasticity $e_K$: if the net-of-tax rate of return $(1-\tau_K)r$ rises by 1%, then capital supply $K$ (i.e. cumulated savings, inheritance, etc.) rises by $e_K\%$

- More on inverse-elasticity formulas in Lectures 4-7
Tax incidence with capital-labor complementarity

- Cobb-Douglas production function: \( Y = F(K,L) = K^{\alpha} L^{1-\alpha} \)
- With perfect competition, wage rate = marginal product of labor, rate of return = marginal product of capital:
  \[ r = F_K = \alpha K^{\alpha-1} L^{1-\alpha} \quad \text{and} \quad v = F_L = (1-\alpha) K^{\alpha} L^{-\alpha} \]
- Therefore capital income \( Y_K = r K = \alpha Y \)
  & labor income \( Y_L = v L = (1-\alpha) Y \)
- I.e. capital & labor shares are entirely set by technology (say, \( \alpha=30\% \), \( 1-\alpha=70\% \)) and do not depend on quantities \( K, L \)
- Intuition: Cobb-Douglas ↔ elasticity of substitution between \( K \) & \( L \) is exactly equal to 1
- I.e. if \( v/r \) rises by 1\%, \( K/L=\alpha/(1-\alpha) v/r \) also rises by 1\%. So the quantity response exactly offsets the change in prices: if wages \( \uparrow \) by 1\%, then firms use 1\% less labor, so that labor share in total output remains the same as before
• Assume $\tau_L \to \tau_L + d\tau$. Then labor supply drops by $dL/L = -e_L\frac{d\tau}{1-\tau_L}$.

• This in turn raises $v$ by $dv$ & reduces $r$ by $dr$ and $K$ by $dK$.

• In equilibrium: $dv/v = \alpha (dK/K - dL/L)$, $dr/r = (1 - \alpha) (dL/L - dK/K)$

\[ dL/L = - e_L \left[ \frac{d\tau}{1-\tau_L} - \frac{dv}{v} \right], \quad dK/K = e_K \frac{dr}{r} \]

\[ \Rightarrow \frac{dv}{v} = \frac{\alpha e_L}{[1 + \alpha e_L + (1 - \alpha)e_K]} \frac{d\tau}{1-\tau_L} \]

\[ \frac{dr}{r} = -(1 - \alpha) e_L \frac{d\tau}{[1 + \alpha e_L + (1 - \alpha)e_K]} \frac{d\tau}{1-\tau_L} \]

• Assume $e_L = 0$ (or $e_L$ infinitely small as compared to $e_K$).
Then $dv/v = 0$. Labor tax is entirely paid for labor.

• Assume $e_L = +\infty$ (or $e_L$ infinitely large as compared to $e_K$).
Then $dv/v = d\tau/(1-\tau_L)$. Wages rise so that workers are fully compensated for the tax, which is entirely shifted to capital.

• The same reasoning applies with capital tax $\tau_K \to \tau_K + d\tau$.

• I.e. if $e_K$ infinitely large as compared to $e_L$, a capital tax is entirely shifted to labor, via higher pretax profits and lower wages.
Tax incidence with general production function

- CES: \( Y = F(K,L) = [a K^{(\sigma-1)/\sigma} + (1-a) L^{(\sigma-1)/\sigma}]^{\sigma/(\sigma-1)} \)
  
  (=constant elasticity of substitution equal to \( \sigma \))

- \( \sigma \to \infty \): back to linear production function

- \( \sigma \to 1 \): back to Cobb-Douglas

- \( \sigma \to 0 \): \( F(K,L) = \min(rK,vL) \) (« putty-clay », fixed coefficients)

- \( r = F_K = a \beta^{-1/\sigma} \) (with \( \beta = K/Y \)), i.e. capital share \( \alpha = r \beta = a \beta^{(\sigma-1)/\sigma} \) is an increasing function of \( \beta \) if and only if \( \sigma > 1 \) (and stable iff \( \sigma = 1 \))

- Tax incidence: same conclusions as before, except that one now needs to compare \( \sigma \) to \( e_L \) and \( e_K \):
  - if \( \sigma \) large as compared to \( e_L, e_K \), then labor pays labor taxes & capital pays capital taxes
  - if \( e_L \) large as compared to \( \sigma, e_K \), then labor taxes shifted to \( K \)
  - if \( e_K \) large as compared to \( \sigma, e_L \), then capital taxes shifted to \( L \)
What do we know about $\sigma$, $e_L$, $e_K$?

- Labor shares $1-\alpha$ seem to be relatively close across countries with different tax systems, e.g. labor share are not larger in countries with large social contributions $\rightarrow$ labor taxes seem to be paid by labor; this is consistent with $e_L$ relatively small
- Same reasoning for capital shares $\alpha$: changes in corporate tax rates do not seem to lead to changes in capital shares
- $\beta = K/Y$ is almost as large in late 20c-early 21c as in 19c-early 20c, despite much larger tax levels (see graphs 1, 2, 3) $\rightarrow$ this is again consistent with $e_K$ relatively small
- Historical variations in capital shares $\alpha = r \beta$ tend to go in the same direction as variations in $\beta$ (see graphs 1, 2) $\rightarrow$ this is consistent with $\sigma$ somewhat larger than 1
- If $\sigma$ is large as compared to $e_L$, $e_K$, then the standard macro assumptions about tax incidence are justified
• But these conclusions are relatively uncertain: it is difficult to estimate macro elasticities.

• Also they are subject to change. E.g. it is quite possible that $\sigma$ tends to rise over the development process. I.e. $\sigma<1$ in rural societies where capital is mostly land (see Europe vs America: more land in volume in New world but less land in value; price effect dominates volume effects: $\sigma<1$). But in 20c & 21c, more and more uses for capital, more substitution: $\sigma>1$. Maybe even more so in the future.

• Elasticities do not only reflect real economic responses. E.g. $e_K$ can be large for pure accounting/tax evasion reasons: even if capital does not move, accounts can move. Without fiscal coordination between countries (unified corporate tax base, automatic exchange of bank information,..), capital taxes might be more and more shifted to labor.
Micro estimates of tax incidence

• Micro estimates allow for better identification of elasticities... but usually they are only valid locally, i.e. for specific markets

• Illustration with the incidence of housing benefits:
  - One can show that the fraction $\theta$ of housing benefit that is shifted to higher rents is given by $\theta = \frac{e_d}{e_d + e_s}$, where $e_d = $ elasticity of housing demand, and $e_s = $ elasticity of housing supply
  - Intuition: if $e_s=0$ (i.e. fixed stock of housing, no new construction), and 100% of housing benefits go into higher rents
  - Using extension of housing benefits that occured in France in the 1990s, Fack estimates that $\theta = 80\%$. See graphs.
  - The good news is that it also works for taxes: property owners pay property taxes (Ricardo: land should be taxed, not subsidized)
• Illustration with the incidence of value added taxes (VAT):

• Q.: Is the VAT a pure consumption tax? Not so simple
• First complication. Valued added = output – intermediate consumption = wages + profits. I.e. value added = \( Y = Y_K + Y_L = C + S \)
• So is the VAT like an income tax on \( Y_K + Y_L \)? No, because investment goods are exempt from VAT, and \( I = S \) in closed economy
• Second complication. Even if VAT was a pure tax on \( C \), this does not mean that it entirely shifted on consumer prices. VAT is always partly shifted on prices and partly shifted on factor income (wages & profits). How much exactly depends on the supply & demand elasticities for each specific good or service.
One can show that the fraction $x$ of VAT that is shifted to prices is given by $x = \frac{e_s}{e_d + e_s}$, where $e_d$ = elasticity of demand for this good, and $e_s$ = elasticity of supply for this good.

Intuition: if $e_s$ is very high (very competitive sector and easy to increase supply), then a VAT cut will lead to a large cut in prices (but less than 100%); conversely if $e_s$ is small (e.g. because increasing production requires a lot of extra capital and labor that is not easily available), then producers will keep a lot of VAT cut for themselves; it is important to understand that it will happen even with perfect competition.

Using all VAT reforms in France over 1987-1999 period, Carbonnier finds $x=70-80\%$ for sectors such as repair services ($e_s$ high) and $x=40-50\%$ for sectors such as car industry (requires large investment). See graphs.