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
- $T = \tau Y = T_K + T_L + T_C = \tau_K Y_K + \tau_L Y_L + \tau_C C$
- See Eurostat estimates of τ_L, τ_K, τ_C
- Typically, τ_L=35%-40%, τ_K=25%-30%, τ_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 + Imports = C + I + 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 τ_K on capital income Y_K , or a tax τ_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 σ 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,..
  (≈ housing assets + business assets: about 50-50)
  Y_K = capital income = rent, dividend, interest, profits,..

- In rich countries, $\beta = K/Y = 5\text{-}6$ ($\alpha = Y_K/Y = 25\text{-}30\%$)
  (i.e. average rate of return $r = \alpha/\beta = 4\text{-}5\%$)
- Typically, in France, Germany, UK, Italy, US, Japan: Y ≈ 30 000€ (pretax average income, i.e. national income /population), K ≈ 150 000-180 000€ (average wealth, i.e. capital stock/population); net foreign asset positions small in most coutries (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 τ_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. $dT = 0 \Leftrightarrow \tau_L = 1/(1+e_L)$ (= top of the Laffer curve)

- Same with capital tax τ_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: $\mathbf{Y = F(K,L) = K^{\alpha} L^{1-\alpha}}$
- With perfect competition, wage rate = marginal product of labor, rate of return = marginal product of capital:

$$r = F_K = \alpha K^{\alpha-1} L^{1-\alpha} \text{ and } v = F_L = (1-\alpha) K^{\alpha} L^{-\alpha}$$

- 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, α=30%, 1-α=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 ↑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 $dL/L = -\, e_L\, d\tau/(1-\tau_L)$
- This in turn raises v by dv & reduces r by dr and K by dK.
- In equilibrium: $dv/v = \alpha\,(dK/K - dL/L)$, $dr/r = (1-\alpha)\,(dL/L - dK/K)$

$$dL/L = -\, e_L\, [d\tau/(1-\tau_L) - dv/v]\ ,\ dK/K = e_K\, dr/r$$

$$\to dv/v = \alpha e_L/[1+\alpha e_L+(1-\alpha)e_K] \quad d\tau/(1-\tau_L)$$

$$dr/r = -(1-\alpha)e_L/[1+\alpha e_L+(1-\alpha)e_K] \quad d\tau/(1-\tau_L)$$

- 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 reasonning 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 σ)
- $\sigma \rightarrow \infty$: back to linear production function
- $\sigma \rightarrow 1$: back to Cobb-Douglas
- $\sigma \rightarrow 0$: $F(K,L)=\min(rK,vL)$ (« 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 β if and only if σ>1 (and stable iff σ=1)

- Tax incidence: same conclusions as before, except that one now needs to compare σ to e_L and e_K:
- if σ large as compared to e_L,e_K, then labor pays labor taxes & capital pays capital taxes
- if e_L large as compared to σ,e_K, then labor taxes shifted to K
- if e_K large as compared to σ,e_L, then capital taxes shifted to L

What do we know about σ, e_L, e_K ?

- Labor shares 1-α seem to be relatively close across countries with different tax systems, e.g. labor share are not larger in countries with large social contributions → labor taxes seem to be paid by labor; this is consistent with e_L relatively small
- Same reasonning for capital shares α: changes in corporate tax rates do not seem to lead to changes in capital shares
- β=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)
  → this is again consistent with e_K relatively small
- Historical variations in capital shares α = r β tend to go in the same direction as variations in β (see graphs 1, 2)
  → this is consistent with σ somewhat larger than 1
- If σ 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 σ 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:
- G. Fack "Are Housing Benefits An Effective Way To Redistribute Income? Evidence From a Natural Experiment In France", *Labour Economics* 2006. See [paper.]
- One can show that the fraction θ of housing benefit that is shifted to higher rents is given by $\theta = e_d/(e_d+e_s)$, 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 θ = 80%. See [graphs.]
- The good news is that it also works for taxes: property owners pay property taxes (Ricardo: land should be taxed, not subsdized)

- Illustration with the incidence of value added taxes (VAT):
- C. Carbonnier, “Who Pays Sales Taxes ? Evidence from French VAT Reforms, 1987-1999”, *Journal of Public Economics* 2007. See paper.

- Q.: Is the VAT a pure consomption 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 $x = e_s/(e_d+e_s)$, 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.