Public Economics

Final Exam, January 9, 2018 - 2 hours

The exam is 2 hours long and can be done either in French or English. ***No*** *document whatsoever is allowed.*

1 Questions [9 pts]

1. What are the rationales for capital taxation? (1 pt)

   Answer:

   - "Fuzzy frontier": if the frontier btw labor and capital income flows not so clear (e.g. for self-employed), then it is better to tax both income flows at rates that are not too different
   - "Fiscal capacity": for top wealth holders, wealth is a better indicator of the capacity to contribute than income
   - "Meritocracy": individuals are not responsible for their inherited wealth, so maybe this should be taxed more than their labor income; but incentives and imperfect k markets imply that part of the ideal inheritance tax tax should be shifted to lifetime k tax

2. The modified golden rule is given by: $r^\star = \delta + \gamma \cdot g$.

   i) What is the meaning of a γ? (0.5 pt)
   Answer: γ is the concavity of social welfare function. It measures the speed at which the marginal social utility of consumption goes to zero.

   ii) What is the implication of having $\delta > 0$? (0.5 pt)
   Answer: Higher δ means that the current generation put a lower welfare weight on future generations.

3. To estimate the impact of air pollution on infant health, early studies would typically run the following OLS regression using cross-sectional data:

$$y_s = \alpha + \beta \cdot p_s + u_s$$

where y_s is an infant health outcome (e.g. prematurity rate) in area s in a given year, p_s is the level of pollution in area s in the same year and u_s is the error term.

a) Why is this approach likely to yield a biased estimate of the parameter of interest? (1 pt)

Answer: One can think of two main sources of bias:

i) Omitted variable bias: the level of pollution that prevails in a given area is likely to be correlated with unobserved area characteristics which are themselves correlated with infant outcomes. For instance, the level of pollution tends to be higher in urban areas than in rural areas, which differ along many dimensions such as average household income, average level of education, access to health care, all of which can independently affect infant health outcomes. The bias can be either positive or negative depending on whether pollution is positively or negatively correlated with the unobservable determinants of infant health outcomes.

ii) Self-selection bias: household may self-select into different areas based on their children's health status. In particular, parents of children in weak health will probably avoid living in highly polluted areas. This phenomenon would lead the OLS estimate to be upward biased (i.e., the negative effect of pollution on infant health would be underestimated).

b) Suppose that measures of pollution levels and infant health outcomes in different areas were available in two different years. How could you improve on the previous estimation strategy? Can you think of a scenario under which this estimation strategy would still be invalid? (1 pt)

Answer: The availability of measures of pollution levels and infant health outcomes in two different years (denoted 0 and 1) would allow to take equation (1) in first differences, i.e.:

$$y_{s,1} - y_{s,0} = (\alpha_1 - \alpha_0) + \beta \cdot (p_{s,1} - p_{s,0}) + u_{s,1} - u_{s,0}$$

This specification would control for area-specific time-invariant unobservable characteristics that may affect infant health outcomes (i.e. the part of $u_{s,t}$ which is fixed over time). Under this specification, the impact of pollution on health outcomes would be identified from within-area changes in the level of pollution over

time. This identification strategy might, however, be invalid if local changes in pollution are correlated with local changes in unobserved determinants of health outcomes. This could happen, for instance, if changes in pollution levels in a given area are correlated with the business cycle in this area: in periods of high economic growth, pollution levels would tend to rise but so would the average income in the area. In this case, the estimated β could be confounding the impact of income on health outcomes with the effect of pollution per se.

4. In the presence of labour supply responses along the extensive margin, are traditional welfare programmes with high phasing-out rates desirable? (2 pts)
   Answer: See Diamond and Saez (2011) p.175-177.

5. What is a public good? Can public good be provided optimally by volontary contributions? (1 pt)

   Answer: Public goods are defined by non-rivalry and non-excludability. Private choices ignore the social benefits of additional provision. An increase in contributions would lead to a Pareto-improvement.

6. Comment the sentence "VAT is usually paid by consumers". Is that belief supported by theory and empirical evidence? (2 pts)

2 Health insurance and genetic testing [4 pts]

Consider a country where the largest part of health insurance is provided by private insurers, e.g. the United States. Some health insurance companies would like to use genetic testing to have more information about the health status of their applications. Should the government allow them to do so? Hint: You might want to consider two possible initial states for the insurance market before the introduction of genetic testing: (i) a separating equilibrium, (ii) a pooling equilibrium (enforced by a government mandate), and think about the following issues. Would genetic testing exacerbate or mitigate the problem of adverse selection in the health insurance market? Would it help or hurt those who have bad health prospects? Would it help or hurt those who have good health prospects?

Answer: Health insurance is a classical example of adverse selection. Since genetic testing would alleviate the information asymmetry between insurers and individuals seeking health insurance, it would tend to mitigate the problem of adverse selection in the health insurance market. However, such a measure could have large redistributional effects, which would depend on the initial state of the insurance market.

a) If the fraction of low risk (individuals with good health prospects) is relatively low and high-risk types prefer a full-insurance and actuarially fair contract to being uninsured, a separating equilibrium exists where low-risk and high-risk individuals face different contracts. In the Rothschild-Stiglitz model, the equilibrium is such that low risk individuals (those with good health) are under-insured such as to prevent high-risk individuals (those with bad health) to buy the same contract. The price difference between contracts allows those in good health to signal their health status, which is unobservable by insurers. Hence, genetic testing would be beneficial for low risk individuals as this will reveal their health status. This improvement would occur at no cost for those in bad health. All in all, genetic testing would mitigate the problem of adverse selection.

b) If the fraction of low risk is relatively high (the most likely situation), no private equilibrium exists at all (a separating equilibrium would be undermined by pooling policies) and the government can improve the situation of every person by mandating a pooling full-insurance contract for everyone. This policy would lead the low risk to cross-subsidize the high risks. If genetic testing was introduced and private insurers were allowed to introduce different types of contracts, the likely outcome would be that different (full insurance) contracts would be offered to the two types of risks: the high risk types would be better off whereas the low risk types would be worse off. Moreover, these separating contracts might push those in bad health out of the market – leaving them with no insurance at all.

As a general result, the government should take its decision to allow insurance companies to use genetic testing depending on the initial situation of the health insurance market: under a separating equilibrium, participation rates won't change but low-risk individuals would be better off, without harming high-risk individuals. Under an initial pooling equilibrium, low-risk individuals would be better off but high risks would be worse off and might decide to become uninsured.

3 The 2003 dividend tax cut in the U.S. [9 pts]

Part A: Theoretical framework [5 pts]

You, as a researcher, want to investigate theoretically the impact of dividend and corporate taxes. To answer this question, you develop a simple two period model with the following features.

Consider a firm that has initial cash holdings of X at the beginning of period 0. These cash holdings represent profits from past operations. The firm can raise additional funds by issuing equity (E).

The firm's manager can do two things with the firm's cash holdings: pay out dividends or invest the money in a project that yields revenue in the next period. Let I denote the level of investment and $D = X + E - I$ the firm's dividend payment in period 0. In period 1, the firm generates net profits of $f(I)$, where f is a strictly concave function. The firm then closes and returns its net-of-tax profits and principal to shareholders. The shareholders can also purchase a government bond that pays a fixed, untaxed interest rate of $r > 0$.

The firms' profits are subject to two types of taxes. First, the firm pays a corporate tax at rate t_c on its net profits in period 1, so that net-of-corporate-tax profits are $(1-t_c)f(I)$. Second, it pays a dividend tax at rate t_d on distributed profits in all periods. However, the principal invested by shareholders (E) is not subject to the dividend tax.

The manager's objective is to choose the level of equity issues and dividends (and investment) that maximize the value of the firm:

$$max_{D,E}\ V = (1-t_d)D - E + \frac{(1-t_d)[(1-t_c)f(X+E-D)+X-D]+E}{1+r}$$

1) What are the net-of-tax payouts in period 0 and period 1? (0.5 pt)

Answer: Net-of-tax payout in period 0: $(1-t_d)D$;
in period 1: $(1-t_d)\left[(1-t_c)f(X+E-D)+X-D\right]+E$

2) Show that the firm will never issued equity and paid dividends simultaneously, i.e. never set $E > 0$ and $D > 0$ simultaneously. (0.5 pt)

Answer: If a firm both issued equity and paid dividends, it could strictly increase its value V by reducing both E and D by \$1 and lowering its tax bill by $\$\frac{t_d \cdot r}{1+r}$.

Let's consider two types of firms. A cash-rich firm has retained profits X such

that $(1-t_c)f'(X) \leq r$, while a cash-constrained firm has retained profits X such that $(1-t_c)f'(X) > r$.

3) Show that a cash rich firms will never issue equities and that the optimal choice of dividends satisfies the first order condition $(1-t_c) \cdot f'(X-D^\star) = r$. Comment. (1 pt)
(hint: Use the fact that a firm will never set $E > 0$ and $D > 0$ simultaneously by computing a) the marginal value of issuing equity when $D = 0$, b) by computing the marginal value of paying dividends when $E = 0$.)

Answer:

$$\frac{dV}{dE}(D=0) = -1 + \frac{(1-t_d)(1-t_c)f'(X+E^\star)+1}{1+r} = \frac{(1-t_d)(1-t_c)f'(X+E^\star)-r}{1+r} \leq 0$$

because $(1-t_c)f'(X) \leq r$, f is concave, and $0 \leq t_d \leq 1$. This expression implies that a cash rich firm optimally sets $E^\star = 0$.

$$\frac{dV}{dD}(E=0) = 1 - t_d - \frac{1-t_d}{1+r}\left[(1-t_c)f'(X-D^\star)+1\right] = 0$$

The optimal choice of dividends satisfies the first order condition:

$$(1-t_c)f'(X-D^\star = r$$

Cash rich firms invest to the pt where the net-of-corporate-tax marginal product of investment $f'(I)$ equals the return on investment in the bond, r.

In contrast with cash rich firms, cash-constrained firms will never pay dividends and their optimal choice of equities issues is given by:

$$E^\star = 0 \ \textit{if} \ (1-t_d)(1-t_c) \cdot f'(X) < r$$

$$(1-t_d)(1-t_c) \cdot f'(X+E^\star) = r \ \textit{if} \ (1-t_d)(1-t_c) \cdot f'(X) \geq r$$

4) What is the impact of the dividend tax and the corporate tax on the investment and dividend payments of cash rich firms? of cash-constrained firms? (2 pts)

Answer: For cash rich firms, the increases in the corporate tax rate reduce the level of investment, increase period 0 dividend payments, and reduce period 1 dividend payments. However, the dividend tax rate t_d has no impact on dividend payments and investment levels. Dividend taxation has no impact on the behavior of cash-rich firms because they must pay the dividend tax regardless of whether they pay out profits in

the current or next period. In contrast, the corporate tax changes the relative price of paying out dividends immediately and investing to earn further profits, and therefore distorts behavior.

For cash-constrained firms, the dividend tax distorts the behavior of low cash firms. An increases in t_d reduce equity issues and investment. Intuitively, a dividend tax increase lowers the marginal product of investment but does not affect the price of investment for cash-constrained firms. Firms therefore reduce investment, issue less equity, and pay fewer dividends in period 2. Corporate taxes produce the same effects because they affect the value of cash-constrained firms in exactly the same way as dividend taxes. Note that dividend payments are not affected by tax changes in the short-run. Following a dividend or corporate tax change, investment and equity issues respond immediately (period 0), and dividends change only when the additional investment pays off (period 1).

Part B: Empirical estimation [4 pts]

Following the success of your theoretical model, the government asks you to estimate the impact of the dividend tax cut **implemented in 2003** and to assess whether it stimulated corporate investments. To do that, the government provides you cross-sectional data on US corporate income tax returns from years 1996 to 2008.

6) One of your colleague (a theoretician economist) advise you to use the following regression specification:

$$INVESTMENT_{it} = \alpha_0 + \alpha_1 POST_t + \beta X_{i,t-2} + \varepsilon_{it}$$

where $INVESTMENT_{it}$ denotes scaled investment for firm i in a year t between 1998 and 2008, $POST_t$ denotes an indicator for year t being 2003 or later, $X_{i,t-2}$ denotes a vector of lagged firm controls. Scaled investment means that investment is divided by firm's tangible capital assets (expressed in \$) averaged over the two preceding lags.

i) How your colleague seems to interpret α_1? What would be the meaning of $\alpha_1 = 0.1$? (1 pt)

Answer: α_1 represents the mean effect of the tax cut on corporate investment. The dividend tax cut increase the investment by \$0.1 per dollar of lagged tangible capital assets.

ii) Do you think the regression specification above is able to capture the causal

relationship of the 2003 dividend tax cut on investments? Why? (0.5 pt)

Answer: No, because corporate investment is too cyclical to distinguish tax effects from business cycle effects.

7) Your dataset offer a decomposition of firms between C-corporations and S-corporations. C-corporations and S-corporations face similar corporate tax rates except that C-corporations are subject to dividend taxation while S-corporations are not.

i) What estimation strategy would you advocate to recover a causal estimate of the dividend tax cut on investments ? Report the regression specification. (1 pt)

Answer: Diff-in-diff strategy with S-Corp = control group, C-corp = treated group, treatment period =2003–2008.

$$INVESTMENT_{it} = \alpha_1 CCORP_{i,t-2} + \alpha_1 CCORP_{i,t-2} \times POST_t + \beta X_{i,t-2} + \gamma YEAR_t + varepsilon_{it}$$

where $INVESTMENT_{it}$ denotes scaled investment for firm i in a year t between 1998 and 2008 and $CCORP_{i,t-2}$ denotes an indicator for whether firm i was a C-corporation in $t-2$, $POST_t$ denotes an indicator for year t being 2003 or later, $X_{i,t-2}$ denotes a vector of lagged firm controls, and $YEAR_t$ denotes a vector of year fixed effects.

ii) What is the identification assumption underlying this research design? (0.5 pt)

Answer: C- and S-corporation outcomes would have trended similarly in the absence of the tax cut.

8) Your main result implies a precisely estimated elasticity of investment with respect to one minus the top statutory dividend tax rate of 0.00. What will you say to the government? Explain the reasoning by supporting your answer with the results of the theoretical framework. (1 pt)

Answer: The dividend tax cut caused zero change in corporate investment! This result is consistent with the investment behavior of cash rich firms. Cash rich firms have a lot of cash due to abundant retained profits, which allow them to fund all profitable investment. Because those preexisting profits will inevitably be subject to dividend taxes (whether paid out immediately, or retained for investment and paid out in the future), a permanent dividend tax cut increases the post-tax return on investment by the same factor that it increases the opportunity cost of investment. The dividend tax cut will therefore not have any impact on the dividend tax rate.