Exam - Tax Policy - Fall 2020
ANSWERS

Part 1: Income taxation

(1A) **Q:** The mechanical revenue gain is the increase in revenue associated with a small increase in τ holding behavior, i.e. pre-tax incomes, constant. This is the number of top tax payers N multiplied by their average income above the threshold $z^m - z^*$ multiplied by the tax increase $\Delta\tau$:

$$\Delta M = N(z^m - z^*)\Delta\tau$$

The social welfare loss is the direct utility loss associated with a small increase in τ holding behavior, i.e. pre-tax incomes, constant expressed in revenue terms. This is the mechanical revenue gain times the average marginal welfare weight on the top tax payers $G(z)$:

$$\Delta W = N(z^m - z^*)G(z)\Delta\tau$$

The behavioral revenue loss is the decrease in revenue associated with a small increase in τ through behavioral changes, i.e. reductions in earnings. A top tax payer with income z reduces income by $e(z/1-\tau)\Delta\tau$. The total revenue effect is this income reduction evaluated at the average income level among top tax payers z^m, multiplied by the number of top tax payers N and multiplied by the top tax rate τ.

$$\Delta B = Nez^m \frac{\tau}{1-\tau}\Delta\tau$$

Q: A small change in the tax rate affects welfare through the three channels captured by ΔM, ΔW and ΔB. Behavioral reponses have no first-order impact on tax payers' utility because they are intially optimizing their labor supply ("envelope theorem"). If τ is set optimally, a small change in the tax rate has no first-order effect on welfare. Hence, the first-order condition for optimality is:

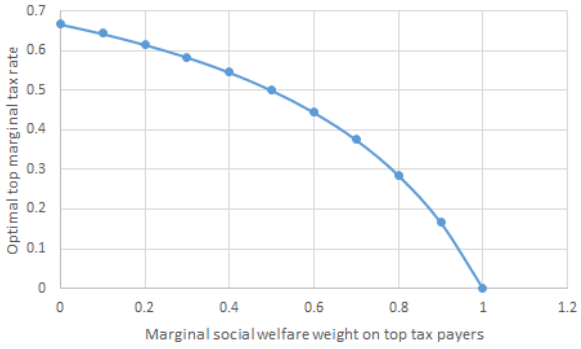
$$\Delta M = \Delta W + \Delta B \tag{1}$$

Inserting the expressions for ΔM, ΔW and ΔB into (1) and rearranging, we obtain:

$$\tau^* = \frac{1 - G(z)}{1 - G(z) + ae} \text{ where } a \equiv \frac{z^m}{z^m - z^*}$$

(1B) **Q:** Computing τ^* for different values of $G(z)$ (0, 0.1, 0.2,...,1) and plotting yields the following scatter plot:

Q: At $G(z) = 0$, the social planner disregards the utility of the top tax payers (on the margin) and optimally sets the top marginal tax rate that maximizes



revenue, i.e. $\tau^* = 0.67$. At $G(z) = 1$, the social planner has the same marginal welfare weight on the average top tax payer as on the average tax payer in the population as a whole. Hence, as taxation reduces efficiency and redistribution is not associated with a welfare gain, the social planner optimally does not tax incomes above z^* at all, i.e. $\tau^* = 0$.

(1C) **Q:** Accounting for the two types, $\Delta B'$ reads:

$$\Delta B' = \{N\alpha e_1 z_1 + (1-\alpha)Ne_2 z_2\} \frac{\tau}{1-\tau}\Delta\tau$$

The two types have different elasticities. Moreover, a given percentage change in the net-of-tax-rate has different consequences for revenue for the two types because they start at different income levels.

Q: With the following definition:

$$e = \alpha e_1 \frac{z_1}{z^m} + (1-\alpha)e_2 \frac{z_2}{z^m}$$

we can write

$$\Delta B' = \{Nez^m\} \frac{\tau}{1-\tau}\Delta\tau$$

which is just the same as ΔB. The interpretation of e is the income-weighted average of the individual elasticities taken across all the top tax payers. The individual elasticities are weighted with income because a given percentage change in income has a larger dollar-impact on the revenue at higher income levels.

Q: With the stated parameter values, the average income level z^m equals $\$200,000$ and $e = 0.25$. This implies that $\tau^* = 0.67$. We note that high-income tax payers ($e_2 = 0.3$) have a larger impact than low-income tax payers ($e_1 = 0.1$) on the relevant elasticity ($e = 0.25$).

Part 2: Tax incidence

(2A) **Q:** The price data for countries where taxes are *not* changed can be used to construct the counterfactual change in beer prices in Germany if beer taxes had not been raised. The difference between the actual price and counterfactual price changes can be interpreted as the causal effect of the tax change. One may be concerned that price changes in other countries are not a good counterfactual for price changes in Germany if beer prices in different countries are subject to different demand and supply shocks. Possibly, this concern may be alleviated by comparing German prices to prices in a select group of countries (e.g. neighboring countries) or regions (e.g. regions close to Germany's borders) where shocks might plausibly be more similar.

Q: Following Doyle and Samphantharak (2008), one could imagine at least two different research designs.

First, one may compute the average beer price in German stores and in non-German stores on each day and compute the log-difference:

$$\Gamma_t = log(\overline{Q}_{c=Germany,t}) - log(\overline{Q}_{c\neq Germany,t})$$

This is approximately the percentage difference between average German and non-German beer prices on a given day t. One may plot Γ_t against time in a suitable window around 1 July 2019 and interpret the "jump" on this day as the effect of the beer tax increase on German prices. The "jump" may be estimated as the actual difference between $\Gamma_{30\ \text{June}}$ and $\Gamma_{1\ \text{July}}$ or the difference predicted by a local linear regression.

Second, one may estimate the following equation:

$$\log(Q_{ict}) = \alpha + \beta_0 GE_c + \beta_1 POST_t + \beta_2 GE_c \times POST_t + \gamma \mathbf{X}_{ict} + \varepsilon_{ict}$$

where GE indicates observations from Germany and $POST$ indicates observations after 1 July 2019. Here, β_2 expresses the percentage change in German beer prices (comparing the average level before the reform and the average level after the reform) over and above the percentage change in beer prices in the reference countries. This is the estimated effect of the German tax reform on beer tax prices.

Q: The identifying assumption in both designs is that German beer prices would have followed the same trajectory as non-German beer prices in the absence of the German reform. The first design allows for an assessment of that assumption: if German beer prices followed the same trajectory as non-German beer prices in the pre-reform period, it is plausible that they would have continued following it in the post-reform period absent the reform.

(2B) **Q**: Both designs sketched above identify the percentage change in beer prices caused by the reform $\widehat{\beta}_2$. Dividing by the percentage change in $(1 + t)$ implied by the tax reform, one obtains the share of the tax burden borne by

consumers. For example, suppose we estimated $\widehat{\beta}_2 = 0.05$ and suppose the German reform increased the beer tax rate from 50% to 65% so that $(1+t)$ increased by 10% (from 1.5 to 1.65). In that case, half of the burden is on consumers and the other half is on producers / retailers.

(2C) **Q**: One could use the wine prices to account for country-specific shocks to the supply or demand of alcoholic beverages as such. For instance, one could define:

$$\begin{aligned}\Gamma'_t &= \big(log(\overline{Q}_{c=Germany,t}) - log(\overline{Q}_{c\neq Germany,t})\big) - \\ &\quad \big(log(\overline{W}_{c=Germany,t}) - log(\overline{W}_{c\neq Germany,t})\big)\end{aligned}$$

which subtracts the percentage difference in wine prices from the percentage difference in beer prices and repeats the exercise described under (2A). If a shock coinciding with the German tax reform affects demand for alcholic beverages (e.g. the entry on the German market of a new supermarket chain), such a shock would not affect the estimated effect of the tax reform (assuming that the shock affects the market for beer and wine in the same way). The identifying assumption is that the difference between German and non-German beer prices relative to the difference between German and non-German wine prices would have remained constant absent the reform.

One may be concerned, however, that the increase in the beer tax might have a general equilibrium effects on wine prices if German consumers facing higher beer prices after the tax reform substitute to wine and drive up wine prices. This would introduce a downward bias in the estimate.

Part 3: Shorter questions

(3A) **Q:** Under the old view of firm taxation, firms finance marginal investment with new equity capital. This implies that the marginal cost of capital equals $r/(1+t^C)(1+t^D)$. The return to the marginal investment is first taxed at the corporate level with the corporate tax and then at the shareholder level with the dividend tax. It follows that an increase in either the dividend tax or the corporate tax drives up the cost of capital and depresses investment.

(3B) **Q:** Under the current international tax system, each affiliate of a multinational firm is taxed on its own profits in the country where it is located. For a multinational firm present in both high-tax and low-tax countries, this creates an incentive to book exactly zero profits in high-tax countries. If profits are positive in a high-tax country, global after-tax profits can be raised by shifting some to a low-tax country. The gain per dollar shifted equals the tax differential. If profits are negative in a high-tax country and positive in a low-tax country, global after-tax profits can be raised by shifting some into the high-tax country. The gain per dollar shifted equals the low tax rate and arises because negative profits do not trigger a negative tax payment. There are some caveats to the latter argument (losses can be carried forward), which need not be discussed.

Profit shifting across countries can be achieved in several ways, for instance through *mispricing of intra-firm transfers* where low-tax affiliates over-charge for sales to high-tax affiliates and high-tax affiliates under-charge for sales to low-tax affiliates; *debt shifting* where both external and internal debt is allocated to high-tax affiliates to maximize the tax value of the interest deductions; *IP shifting* where intellectual property is allocated to low-tax affiliates so that the corresponding royalty income is taxed at a low rate.

(3C) **Q:** The key constraint of the commodity tax system is the inability to tax leisure: commodity taxation creates a wedge between the price of taxed consumption (commodities) and untaxed consumption (leisure). The optimal tax system therefore, everything else equal, taxes at a higher rate commodities that are complemetary to leisure and at a lower rate commodities that are substitutes to leisure. This is an indirect way of taxing leisure. Arguably, home improvement services are precisely substitutes to leisure: rather than taking time off to improve one's home, one may work more and pay professionals to do the work. Thist suggests that home improvement services should be taxed lightly.