Exam - Tax Policy - Fall 2015 - Answers

Part 1: Tax incidence

(1A) **Q:** Market clearing requires that demand equals suppy:

$$D(q) = S(p)$$

Insert $q = p + t$ and differentiate with respect to p and t

$$D'(q)(dp + dt) = S'(p)dp$$

Rearrange:

$$D'(q)dt = (S'(p) - D'(q))dp$$

$$\frac{dp}{dt} = \frac{D'(q)}{S'(p) - D'(q)}$$

Use that $D(q) = S(p)$ and that $q = p$ when t is initially zero to rewrite as

$$\frac{dp}{dt} = \frac{D'(q)\frac{D}{q}}{S'(p)\frac{S}{p} - D'(q)\frac{D}{q}}$$

$$\frac{dp}{dt} = \frac{\varepsilon_D}{\varepsilon_S - \varepsilon_D}$$

The equation $q = p + t$ implies that

$$\frac{dq}{dt} = \frac{dp}{dt} + 1$$

Insert dp/dt from above to obtain

$$\frac{dq}{dt} = \frac{\varepsilon_S}{\varepsilon_S - \varepsilon_D}$$

Q: The reason why the economic incidence of a tax need not coincide with the formal incidence is that taxes affect prices. The two equations dq/dt and dp/dt fully describe how prices adjust and thus who bears the economic incidence in the simple partial equilibrium model. The results show that the incidence will tend to be on the least elastic side of the market. When supply (demand) is perfectly elastic and demand (supply) is not, the full incidicence will be on consumers (producers). When supply and demand are both less than perfectly elastic, the two sides will share the incidence but the larger burden will fall on the least elastic side.

Q: The desired graph shows $D(q)$ has $S(p)$ as a function of q and p respectively. Introducing a tax t paid by the consumers shifts the demand curve down by the amount t (consumers are willing to pay t less per unit at a given quantity) The intersection of the new demand curve and the old supply curve yields the equilibrium producer price p^* under such a tax. The equilibrium consumer price is given by

$q^* = p^* + t$. Introducing a tax t paid by the producers shifts the supply curve up by the amount t (producers are asking t more per unit at a given quantity) The intersection of the old demand curve and the new supply curve yields the equilibrium consumer price q^* under such a tax. The equilibrium consumer price is given by $p^* = q^* + t$. The equilibrium prices (and thus equilibrium quantities) are identical under the two taxes.

(1B) **Q**: The paper exploit an incidence where two US states, Indiana and Illinois, suspend gasoline taxes for a pre-defined period whereas surrounding states do not change gasoline taxes. Exploiting this time-state variation, the authors employ a difference-in-differences estimator to estimate the effect of gasoline taxes on gasoline prices, dq/dt, where the change in gasoline prices in the states that do not change taxes are used as a counterfactual for the change in gasoline prices in the states that do change taxes. The figure shows the log-difference in gasoline prices between treatment states and control states at the daily level around the time when gasoline taxes are suspeneded and subsequently repealed. Under the identifying assumption is that gasoline prices would have followed the same trend in treatment and control states absent the tax changes in the treatment states (a flat line in the figure), the jumps around the times when gasoline taxes change can be interpreted as the causal effect of the tax changes. The results imply that the incidence of the gasoline taxes are mostly on consumers.

(1C) **Q**: The formula may be derived following the same procedure as in (1A): market clearing requires that demand equals supply:

$$D(p,t) = S(p)$$

Differentiate with respect to p and t

$$D'_p(p,t)dp + D'_t(p,t)dt = S'_p(p)dp$$

Rearrange:

$$\frac{dp}{dt} = \frac{D'_{q|t}}{S'_p - D'_{q|p}}$$

where $D'_{q|t}$ is short-hand notation for the derivative of demand with respect to q where the change in q derives from a change in t. Analogously for $D'_{q|p}$.

Now, use that $D(p,t) = S(p)$ and that $q = p$ when t is initially zero to rewrite as

$$\frac{dp}{dt} = \frac{D'_{q|t}\frac{D}{q}}{S'_p\frac{S}{p} - D'_{q|p}\frac{D}{q}}$$

$$\frac{dp}{dt} = \frac{\varepsilon_{D,q|t}}{\varepsilon_S - \varepsilon_{D,q|p}}$$

Using the definition to replace $\varepsilon_{D,q|t}$ yields the solution. Alternatively, the formula can be derived with reference to the steps in the figure.

When consumers are paying the tax, the initial drop in demand following a tax increase (holding the producer price constant) is numbed by the lack of salience. The smaller the initial drop in demand, the smaller the necessary adjustment in the producer price to get back to equilibrium. It follows that the less salient the tax, the more of the incidence is on consumers. If the tax is fully non-salient and therefore trigger no behavioral responses ($\theta = 0$), the full incidence is on consumers.

This is illustrated in the figure. The lower the tax salience, the smaller the downward shift in the demand curve and the smaller the drop in p necessary to establish equilibrium.

Q: If producers pay the tax instead of the consumers, the standard formula derived in (1A) applies (under the assumption that taxes are fully salient to producers). The tax would shift the supply curve in the same way as in the standard model and thus require the same increase in q to equilibrate supply and demand. The reason is that consumers see the tax increase as an increase in the posted price p, which is fully salient, and not as an increase in the sales tax t.

Part 2: Economic efficiency

(2A) **Q:** At a constant marginal tax rate, tax payers optimally choose their labor supply such that the marginal rate of substitution between consumption and income equals $(1-t)$ where t is the marginal tax rate. Given heterogeneity across workers, a smooth distribution of skills and preferences translates into a smooth distribution of labor incomes. When a kink is introduced in the tax schedule by increasing the marginal tax rate to $t + dt$ at some income level z^*, there will be bunching at the kink because those choosing the income level z^* are no longer just individuals with $MRS(z^*) = (1-t)$ but all individuals with $MRS(z^*)$ between $(1 - t - dt)$ and $(1 - t)$. This can be illustrated in a figure similar to Figure 1, Panel A in Saez (2010).

(2B) **Q:** Saez (2010) shows that the amount of excess mass at the kink point is determined by three factors:

(i) the size of the kink: the larger the jump in the marginal tax rate, the larger the range of individuals who will find it optimal to choose the income level z^*.

(ii) the counter-factual density around z^*: the more individuals who have incomes in a neighborhood around z^* without the kink, the more will choose the income level z^* in the presence of the kink

(iii) the elasticity of taxable income: the larger the elasticity of taxable income, the larger the range of individuals who will find it optimal to choose the income level z^*

While the size of the kink (i) can be measured directly, the excess mass at z^* as well as the counterfactual density (ii) can be easily approximated. With knowledge of three out of four variables in an equation, it is possible to back out the unknown fourth variable, the elasticity of taxable income.

Q: Behavioral responses to taxation can take a number of forms: fewer hours worked, less effort at work, lower propensity to take jobs requiring commuting etcetera. To the extent that these behavioral responses reduce government revenue, they cause a deadweight loss and the deadweight loss is measured as the loss of government revenue. The channel through which behavioral responses reduce government revenue is always a reduction in taxable income. It follows that the elasticity of taxable income with respect to the net-of-tax-rate summarizes all the behavioral responses to income taxation that reduce government revenue. In other words, it is a sufficient statistic that fully describes the efficiency properties of the income tax.

(2C) **Q:** The yellow bars in the figure show the lower end of the income distribution in the US whereas the dotted line indicates the size of the Earned Income Tax Credit as a function of income. There are three kinks in the EITC schedule: (i) when the EITC reaches its maximum at around $8,000 and the marginal subsidy disappears thus increasing the marginal tax rate; (ii) when the EITC starts being phased out at around $16,000 and the marginal tax rate increases once again; (iii) when the EITC is completely taxed away at around $34,000 and the marginal tax rate is reduced again. At each of these kink, we should expect to see bunching because of the theoretical mechanism described in 2A. There is visually discernable bunching at the lower kink but hardly any evidence of bunching at the two higher kinks.

The table shows the estimates of the elasticity of taxable income at each of the three kinks for the full sample and for wage earners and self-employed separately. The elasticity of taxable income is significantly different from zero, but only at the first kink, and only for the self-employed. For wage earners, the elasticity of taxable income is generally not statistically distinguishable from zero at all kinks and for self-employed at the .two higher kinks

The bunching estimator only measures the intensive margin of the labor supply. A low responsiveness on that margin at the bottom of the income distribution, as found in Saez (2010), could suggest that a "negative income tax" with a high transfer at zero earned income taxed away with a high marginal tax rate is optimal. However, Saez (2002) shows that with if responses on the extensive margin are large and responses on the intensive margin are small, an "earned income tax credit" with low (zero) transfers at zero earned income and a subsidy to earned income is optimal.

Part 3: Shorter questions

(3A) **Q:** The optimal top marginal tax rate is given by

$$\tau^* = \frac{1}{1+ae} \text{ with } a \equiv \frac{z^m}{z^m - z^*}$$

where e is the elasticity of taxable income with respect to $(1-\tau)$ and z^m is the average income of individuals with an income exceeding z^* (students are not asked to state the formula so this is not necessary for a perfect answer). According to Douglas and Saez (2011), the government attaches no value to the welfare of top income earners and thus set the top marginal tax rate to maximize the revenue extracted from this group. At the optimal tax rate, the marginal "mechanical" revenue gain of increasing the tax rate thus equals the marginal "behavioral" revenue loss.

A higher elasticity of taxable income e implies a lower optimal tax rate because it increases the marginal behavioral revenue loss associated with an increase in the marginal tax rate. There is considerable uncertainty about the empirical magnitude of e, but modern studies tend to find values in the neighborhood of 0.25.

The parameter a captures the "thinness" of the pre-tax distribution of incomes: a larger a implies a shorter and thinner tail of the income distribution. A larger a implies a lower optimal tax rate because it reduced the marginal mechanical revenue gain associated with an increase in the marginal tax rate. In principle, there is no uncertainty about the empirical magnitude of a as it depends only on the empirical income distribution, which is directly observable. The value of a at high income levels is around 1.5 in the US and somewhat higher in Europe.

Q: The government does not generally set a 100% marginal tax rate on top incomes because this is above the revenue-maximizing rate due to the behavioral responses to taxation. The optimal top marginal tax rate is 100% in the special case where there are no behavioral responses to taxation, i.e. when $e = 0$.

(3B) **Q**: Optimal commidity taxes deviates from the commodity taxes that minimize the excess burden by reducing (raising) taxes on commodities that are disproportionately consumed by individuals with a large (small) net social marginal value of income (μ_i). The net social marginal value of income reflects several factors: (i) the marginal welfare gain of increasing utility of an individual (dW/dV_i), (ii) the individual's marginal valuation of income (dV_i/dZ_i), (iii) the marginal spending patterns of the individual - if the individual spends marginal income on highly taxed goods, the social cost of providing income to the individual is lower. Factors (i) and (ii) will tend to correlate negatively with the income level so that - everything else equal - the optimal commodity tax system will reduce (raise) taxes on goods consumed by low-income individuals relative to the tax system that minimizes the excess burden.

Q: If the government has access to a non-linear income tax and assuming that preferences are separable in leisure and consumption, there is no scope for redistribution with commodity taxes. The income tax, which only distorts the labor supply, achieves redistribution more efficiently than commodity taxes, which additionally distort consumotion patterns. The government therefore optimally applies a uniform (or zero) commodity tax and uses a non-linear income tax to redistribute.

(3C) **Q**: Under the new view of firm taxation, the marginal source of finance is retained earnings. The relevant choice for the firm is therefore whether to distribute dividends now or later. This choice is unaffected by the dividend tax rate, because this tax will apply regardless of whether dividends are paid out now or later. Hence, dividend taxes have no bearing on firms' payout policies. Conversely, the choice is distorted by the corporate tax. If the firm pays out retained earnings out as dividends now, no corporate tax is paid. If the firm invests retained earnings and pay out as dividends later, the return on the investment will be subject to corporate tax. Hence, the higher the corporate tax, the larger the incentive to pay out immediately and the smaller the incentive to reinvest funds within the firm.

The value of the firm is the net present value of future cash-flows. Both corporate taxes and dividend taxes reduce the after-tax value of future cash-flows and thus reduce the value of the firm.