
Number 4
(a)
Foundation tax rate= 2 percent.
Foundation level = $6,000
Income elasticity of demand for education = 1.2

<table>
<thead>
<tr>
<th>Tax base</th>
<th>$200,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial spending</td>
<td>$4,000</td>
</tr>
<tr>
<td>Tax rate</td>
<td>2% = \frac{4,000}{200,000}</td>
</tr>
<tr>
<td>Foundation grant</td>
<td>$2,000 = 6,000 \times 0.02 \times 200,000</td>
</tr>
<tr>
<td>Initial Income</td>
<td>$20,000</td>
</tr>
<tr>
<td>Percent change in income</td>
<td>10%</td>
</tr>
<tr>
<td>New spending</td>
<td>$4,480 = 1.12 \times 4,000</td>
</tr>
<tr>
<td>Local contribution</td>
<td>$2,480 = 4,480 - 2,000</td>
</tr>
<tr>
<td>New tax rate</td>
<td>1.24%</td>
</tr>
</tbody>
</table>

(b) $1,000 \times 2,000 = $2,000,000

(c) \frac{0.24}{2000} = 0.05

Number 5
Initially the tax price of education is $1. Under GTB, the tax price is .75 (for every $1 raised, this district has to pay .75 in taxes, the other .25 comes from outside the district). Thus the percentage change in price is:

\[\% \Delta p = \frac{0.75 - 1}{1} = -0.25\]

The percentage change in spending is

\[\% \Delta Q = \frac{4200 - 4000}{4000} = 0.05\]
The price elasticity is then

\[ Elasti\_city = \frac{\% \Delta Q}{\% \Delta p} = \frac{.05}{-.25} = .20 \]

Number 6

The GTB reduces the tax price to .75 the same as before. So the percentage change in price is -25%. Since the price elasticity of demand is -.80, the quantity demanded increases .8*25%=20%.

(a) With a 20% increase in spending, the new level is $3,600.
(b) The local contribution is .75 per dollar or $2,700.
(c) The state contribution per student is $900. The total state contribution for the 100 students is $90,000.
(d) The increase is education spending is 600 per 900 of new state money or .67 cents on the dollar.

**Question 2: Competition for Business**

In class we considered the case where the disutility of business \( x \) of located in area 1 is \( bx \) and in area \( b(1-x) \). In class, we assumed that the cost to the government of a business locating the area was zero. Suppose instead there is a cost \( c \) for each business recruited. In the homework problem, \( b = 25 \) and \( c = 10 \). Here I provide an answer for general \( b \) and \( c \).

Consider first the case where the two governments must employ uniform taxation (this is question (b) on the homework). Suppose that the governments maximize “profit” equal to tax revenue collected minus costs of providing services. Consider the problem of government 1’s choice of \( t_1 \). Government 1 takes as given government 2’s choice of \( t_2 \). The marginal business \( x \) satisfies

\[ bx + t_1 = (1-x)b + t_2 \]

or

\[ x = \frac{t_2 - t_1}{2b} + \frac{1}{2} \]

The profit of government 1 is

\[ (t_1 - c)x \]

\[ = (t_1 - c) \left( \frac{t_2 - t_1}{2b} + \frac{1}{2} \right) \]

Differentiating with respect to \( t_1 \) (holding \( t_2 \) fixed) yields the first order condition

\[ \left( \frac{t_2 - t_1}{2b} + \frac{1}{2} \right) - \frac{1}{2b} (t_1 - c) = 0 \]
In a symmetric equilibrium $t_2 = t_1 = t$. Substituting this into the above yields
\[
\frac{1}{2} = \frac{1}{2b}(t - c)
\]
or
\[
t = c + b.
\]
Note this is the formula we derived in class (with $c = 0$). The cutoff business is $x = \frac{1}{2}$. Revenue for each government is $(c + b)\frac{1}{2}$ and profit is $\frac{b}{2}$.

Now consider the discriminatory case (part (a) of the homework). Here each government sets a different tax rate for each business $x$. The equilibrium here is:
\[
t_1(x) = c, \; x \geq .5
\]
\[
= b - 2bx + c, \; x < .5
\]
\[
t_2(x) = c, \; x < .5
\]
\[
t_2(x) = 2b(x - .5) + c
\]
To see why this is so, consider $x = 0$. We know that city 1 will win $x = 0$ in the end. City 2 has nothing to lose by offering a tax of $c$ to this business (since the business is not coming). If city 1 sets a tax of $b + c$ or less, then $x = 0$ will locate in 1. So city 1 sets the maximum it get obtain, $t_1(0) = b + c$. Note that in any equilibrium $x = 0$ will have to be indifferent between locating in 1 or 2 because otherwise city 1 should just raise the tax a little and $x = 0$ will still locate there. Suppose $t_2 > c$ in an equilibrium. Then city 2 could lower the tax just a little and get $x = 0$ to locate there. Thus the only equilibrium is for $t_2(0) = c$ and $t_1(0) = c + b$. Now the case of $x = \frac{1}{2}$, the two locations are perfect substitutes. From familiar reasoning with Bertrand competition, $t_1(.5) = t_2(.5) = c$ (price is bid down to marginal cost). The cases in between $x = 0$ and $x = .5$ follow analogous reasoning.

Now lets turn to the homework.

(a) $t_1(x)$ and $t_2(x)$ follow the above with $b = 25$ and $c = 10$. The revenue of each city is 11.25. (To see this plot the tax functions on a graph and break up the revenue area into a triangle with area $6.25=25*5*.5$ plus a rectangle of $5=10*.5$). Profit equals $6.25+11.25$. (Where 5 is the cost of servicing the .5 businesses that locate in city 1. Remember x=.5 is the cutoff.)

(b) With uniform pricing $t_1 = t_2 = t = c + b = 10 + 25 = 35$. Revenue now equals $17.5=35*.5$. The Burstein-Rolnick policy raises revenue by 6.25.

(c1) The cities have an incentive to use the TIF policy because, holding fixed what the other city does, the use of the TIF increases the number of business that locate
in the city. In the end, a city not benefit from the advent of the program because the program will change what the rival city does.

(c2). With the TIF policy, the equilibrium of competition has the following effect. Each city charges a tax of \( t_1 = t_2 = 35 \). However, in the first year the city governments hand over a subsidy of $50 to each firm. So from the firm’s perspective, the net tax paid in the first year is \( 35 - 50 = -15 \) (so the firm actually makes a profit). The TIF policy costs the state $50 in revenue per firm, but does not benefit the state in any way since the total number of businesses remain the same.

(c3). In the new equilibrium, the cities end up getting no benefit from the TIF program. The TIF is just a handout that goes to the firms. The equilibrium number of businesses remains the same, and the local tax revenue remains the same.

(c4) This example makes the TIF program look bad. It is a direct subsidy from the government to business that does not create any new business or new tax revenue. In the model as described, there is no inefficiency, since businesses end up locating at the same place as they would without the program. Remember, however, that the tax revenue from the subsidy has to come from somewhere. The taxes levied to fund the subsidy may distort labor supply and consumption decisions. Plus the money might come from government spending (such as education) that might have high marginal social benefit.

In order for the TIF program to have an efficiency benefit for the state as a whole, it must contribute to increasing the total amount of business activity in the state as a whole. To the extent that the TIF policy redistributes businesses such as Best Buy from one city in the state to another city in the state it does not increase the welfare of the state as a whole. And remember, for the TIF to have an efficiency benefit, it is not enough to show simply that the number of businesses goes up—the emergence of new businesses much provide some kind of external benefit. Possible external benefits include:

1. The new business will provide knowledge spillovers for the state.

2. The new business will provide jobs that pay above market level wages (i.e. workers that would ordinarily get $10 an hour will get $20 with the new business)

3. The new business will stimulate demand for local increasing returns businesses (i.e. local businesses with price greater than marginal cost.)

4. The new business will provide fiscal externalities to the state (i.e., the business will pay more in tax revenues that it will cost in additional services.)