THE EFFECTS OF TAXES ON CROSS-BORDER SHOPPING

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ABSTRACT

Although some states and national governments are considering new tax revenue sources, including lotteries and gambling, most continue to rely on adjusting their tax structures to increase tax revenues. The problem facing these states/nations is that as the tax rate increases the tax base shrinks, due to residents shopping in neighboring states or cross-border shopping. States should consider the actions of their competitors when choosing the optimal tax strategy that maximizes tax revenues.

While there is incentive for states to compete for these tax revenues by lowering their tax rates, this potentially reduces the aggregate tax revenues for a nation or a union of nations. Attention should be placed not only on the individual state maximizing revenue tax rates, but also on the unified tax revenue functions of border states.

This paper develops a model, which examines the interdependencies of state tax rates in maximizing the joint revenue function of border governments. This helps address if states should exercise tax competition or compliance? If there is tax compliance, should it be set at the minimum or a weighted-average of the tax rates? Results depend on the elasticity of demand, location of home citizens, and the size of the governmental bodies.

INTRODUCTION

How should a border-free Europe set up their tax structure? Who becomes a tax haven? How should we tax electronic commerce? Should the US and Mexico have tax harmony? Is tax coordination desirable? How can states maximize their revenues? What are the central features of the interaction between national tax systems? These and other questions reflect

the interdependence of government tax policies in an increasingly integrated world.

Although some state and national governments are considering new tax revenue sources, such as lotteries and gambling, most will continue to rely on adjusting their tax structures to increase revenues. States in fiscal competition should consider the actions of their competitors and then choose the optimal strategy to increase tax revenues. However, the problem facing these states in their attempt to raise tax revenues is as the tax rate increases the tax base shrinks, due to residents shopping elsewhere, or cross-border shopping.

Alternatively, a state may try to compete for cross-border shoppers by reducing tax rates. However, this brings about the traditional Prisoner's Dilemma or "race to the bottom". Therefore, the decision of a state to alter tax rates depends on the tax policy of bordering governments.

Despite the interdependencies inherent in state taxation, interstate tax policy coordination has evolved slowly. The Multi-state Tax Compact established in the sixties has produced only limited cooperation according to Stephenson and Hewett (1983). Although the New England Fuel Tax Agreement showed an increased awareness of tax interdependencies, there has been inadequate attention to integrated regional tax policy.

In the United States interstate bootlegging of cigarettes has been a continuous concern to the Advisory Commission on Intergovernmental Relations. According to Keen (1987), in the European Community tax rates are not allowed to vary by more than   2.5 percentage points from the community norm. Even more recently, is the growing concern of how to tax electronic commerce sales.

Stephenson and Hewett (1983) show that state tax revenues are dependent on their own tax rates and the tax rates of surrounding jurisdictions. In their model, the revenue for the state of Iowa is a function of income, population, relative prices, a price index and the tax rates. Using data from Iowa and Missouri from 1950-1979, they show that the own income tax rate elasticity for income tax revenue in both Iowa and Missouri are large, positive, and significant. The same is true for home sales and the fuel tax elasticities. Increases in home motor fuel sales tax rates have a

positive effect on the other states motor fuel revenues. In general, they find that when the home country increases their own sales tax rate the home citizens and citizens of other jurisdictions buy less domestically due to both a reduction in the home citizens purchases and the home citizens cross-border shopping. Not surprising, as the tax rates increased, people bought less and/or shopped elsewhere, making the effect of an increase in a competing state's sales tax rate negative for sales and motor fuel tax revenues for both Iowa and Missouri. The changes in regional sales tax rates have a positive effect on sales tax revenues, which suggests that an increase in the sales tax elsewhere will generate an increase in purchases at home. Crombrugghe and Tulkens (1990) also find that an increase in both countries tax rates will generate an increase in both countries tax revenues, creating a Pareto superior solution. Examining the effects of monopoly power on cross-border shopping, Christiansen (1994) finds that the tax revenue effects depend on the degree of monopoly power. He further suggests that it is domestic and not total demand that is important in formulating tax decisions. Kanbur and Keen (1993) use a reservation price for the demand of a good and find that the relative size of the bordering economy is an important determinant of the optimal tax strategy. Unlike Christiansen (1994) and Hewett and Stephenson (1983), their reservation price for the demand of the good does not allow the elasticity of demand to influence the optimal tax revenue generating tax rates.

MODEL

Building on Kanbur and Keen's model, which points out the importance of the size of bordering countries, I develop a model with a single good that has the same marginal and fixed costs being offered in two neighboring countries. Country h is the population in the home country and H is the population in the neighboring country. A country is considered small if its population is smaller than its neighboring country. Since costs are the same in each country, the only difference in price is due to the different destination or sales tax rates between the two countries, which is represented

by (t) for the home country's tax rate and (T) for the neighboring country's tax rate.

Unlike Kanbur and Keen, who assume the reservation price is the same within the country and different between the two countries, I relax this assumption and allow both the home and neighboring country demands to respond to changes in the price. Therefore, both countries have to consider not only the changes in cross border shoppers associated with changes in tax rates, but also the changes in home country demand.

Since home citizens decide to either shop at home or abroad, their demand becomes a function of the home and neighboring countries tax rates, and the travel cost of crossing the border. These travel costs are equal to the travel cost per mile donated by delta and the distance in miles donated by s or delta times s. Following the assumptions of Kanbur and Keen (1993), I assume that home citizens will only travel across the border if the gain in consumer surplus from traveling is greater than the cost of travel. In other words, citizens will cross-border shop only if the costs of shopping at home are greater than the cost of traveling and buying the good abroad. The consumer surplus from buying the good is assumed to be positive.

In the simple case, with strict border controls, there is no cross border shopping, which allows each country to extract the entire consumer surplus. As seen in Christiansen (1994), this makes the maximizing revenue tax rates equal to one over the home country elasticity of demand and one of the neighboring country elasticity of demand as seen in equation 1.

$$1) \quad t^* = \frac{1}{\left| \varepsilon_{D,home} \right|} \quad \text{and} \quad T^* = \frac{1}{\left| \varepsilon_{D,Neighbor} \right|}.$$

This makes the joint revenue function equal to the tax revenue of the home and neighbor country minus the cost of border controls.

If border controls are inexpensive, then the 2 countries can ignore each other in setting their optimal tax rates. However, if border control enforcement is costly or impossible, then borders are open. Without tax

coordination, each country will be in tax competition and try to maximize their own tax revenue, given the other country's tax rate.

TAX COMPETITION

Considering that borders are open among states in the United States and nations among the European Union, each country must consider their bordering states as they set their maximizing revenue tax rate. Let the home country demand by denoted by a lower case v, while the neighboring country demand is denoted by an uppercase V. Then, each country must consider their own domestic demand in maximizing their revenue functions and take as given the tax rate of the border country. The maximizing tax rate becomes:

$$
2) \begin{cases} r(t,T) = tv(t,T) - tv(t,T)\left(\dfrac{t-T}{\delta}\right) & \text{if } t > T \\[2ex] r(t,T) = tv(t,T) & \text{if } t = T \\[2ex] r(t,T) = tv(t,T) + tV(t,T)\left(\dfrac{T-t}{\delta}\right) & \text{if } t < T. \end{cases}
$$

If the tax rate of the home country is higher than that of their neighbor, then some domestic citizens will shop abroad. Maximizing tax revenue, the home country's best response is:

$$
3) \quad \frac{\partial r}{\partial t} = \left[v(t,T) + t\frac{\partial v}{\partial t} + t\frac{\partial v}{\partial T}\frac{\partial T}{\partial t}\right] - \left[v(t,T)\left(\frac{t-T}{\delta}\right)\right] - t\left[\left(\frac{\partial v}{\partial t} + \frac{\partial v}{\partial T}\frac{\partial T}{\partial t}\right)*\left(\frac{t-T}{\delta}\right) + v(t,T)\left(\frac{1}{\delta} - \frac{1}{\delta}\frac{\partial T}{\partial t}\right)\right] = 0.
$$

Dividing both sides by v gives:

$$
4) \quad 1 + \varepsilon_{v,t} + \frac{t}{v}\frac{\partial v}{\partial T}\frac{\partial T}{\partial t} - \left(\frac{t-T}{\delta}\right) - \varepsilon_{vt.}\left(\frac{t-T}{\delta}\right) - \frac{\partial v}{\partial T}\frac{\partial T}{\partial t}\frac{t}{v}\left(\frac{t-T}{\delta}\right) - \frac{1}{\delta} + \frac{1}{\delta}\frac{\partial T}{\partial t} = 0
$$

From this, several conclusions can be drawn. First, the further the distance citizens leave from the border, the more tax revenues can be extracted by raising tax rates. Second, the larger the size of domestic demand, the greater tax revenues will be with higher tax rates. If the home country has a larger population, it is natural to think that the home country demand will be larger than the neighboring foreign country demand. As suggested by Kanbur and Keen (1993), in general a larger country should impose higher tax rates. However, unlike the results found in Kanbur and Keen, this is only true if consumer demand is not very elastic. The more elastic demand the lower tax revenues are if a country raises their tax rate.

Thus, if the tax rate of the home country is higher than the neighboring state then the tax revenue for the home country becomes dependent not only on the size and location of domestic shoppers, but also their elasticity of demand. If the demand is inelastic or shoppers are not very sensitive to an increase in price, then the home country does not lose many customers by raising their tax rates. It follows that for a large country that an increase in the tax rate should outweigh the reduction in the tax base, allowing for higher tax rates to generate higher tax revenues. However, if the home country is relatively small, then we might expect foreign demand to be greater than domestic demand. This will make an increase in the tax rate generate a large reduction in the tax base, reducing tax revenues.

Unlike that found in Kanbur and Keen (1993), if the demand elasticity is high, then regardless of a country's size, increasing the tax rate could reduce tax revenue by severely reducing home country demand. As Christiansen (1994) suggests it is the home country demand that influences the optimal tax rates.

So, what if the home country has a lower tax rate than their neighbors? If the country is relatively small, then the maximizing tax rate is generated in equation 5 from the first order condition with respect to the small country's tax rate.

$$5) \quad \frac{\partial r}{\partial t} = \left[v(t,T) + t\frac{\partial v}{\partial t} + t\frac{\partial v}{\partial T}\frac{\partial T}{\partial t} \right] + \left[V(t,T)\left(\frac{T-t}{\delta}\right) \right] + t\left[\left(\frac{\partial V}{\partial t} + \frac{\partial V}{\partial T}\frac{\partial T}{\partial t} \right) * \left(\frac{T-t}{\delta} \right) + V(t,T)\left(\frac{1}{\delta}\frac{\partial T}{\partial t} - \frac{1}{\delta} \right) \right] = 0$$

Since the country is relatively small, it is now easy to assume that foreign demand is greater than domestic demand. Dividing both sides by v gives:

$$6)\quad 1+\varepsilon_{v,t}+\frac{t}{v}\frac{\partial v}{\partial T}\frac{\partial T}{\partial t}+\frac{V(t,T)}{v(t,T)}\left(\frac{T-t}{\delta}\right)+\frac{t}{v}\left[\left(\frac{T-t}{\delta}\right)\frac{\partial V}{\partial t}+\frac{\partial V}{\partial T}\frac{\partial T}{\partial t}\left(\frac{T-t}{\delta}\right)+V(t,T)\left(\frac{1}{\delta}\frac{\partial T}{\partial t}-\frac{1}{\delta}\right)\right]=0$$

Again the benefits of lowering the home country tax rate depends on the size of cross-border shoppers and the price elasticity of demand. While this is similar to that found by Kanbur and Keen (1993), showing that a small country wants to undercut their neighbors tax rates to increase cross border shopping, it shows the added benefit of lower tax rates due to the increase in domestic demand. Examining cross-border shopping with monopoly power, Christiansen (1994) shows that it is domestic demand and not total demand that is important in developing tax policy. The more elastic domestic demand, the more you can increase tax revenue by lowering the tax rate.

This shows an even stronger incentive for small countries to undercut their neighbors then that found by Crombrugghe and Tulkens (1990) and Kanbur and Keen (1993). This creates an even faster "race to the bottom" with tax competition encouraging tax rates to be too low. When considering the potential tax revenue losses associated with e-commerce sales in states with no sales tax this is especially discerning. While this is in the best interest of tax revenues in a small country, it does reduce tax revenues in the bordering large county, which reduces the interdependent aggregate tax revenues. Any reduction in the joint revenue function is especially important considering that states in the United States and nations in the European Union may want to maximize the nation or Unions tax revenues, especially if there is any revenue-sharing. Assuming that the home country is smaller, the interdependent tax revenue function becomes very dependent upon the elasticity of demand and can be seen in equation 7.

$$7)\quad 2\left[1+\varepsilon_{v,t}+\left(\frac{t}{v}\frac{\partial v}{\partial T}\frac{\partial T}{\partial t}\right)\right]+\left[\left(1+\frac{V}{v}\right)*\left(\frac{T-t}{\delta}\right)\right]+\left[\left(\frac{Tt-t^2}{v\delta}\right)*\left(\frac{\partial v}{\partial T}\frac{\partial T}{\partial t}+\frac{\partial V}{\partial T}\frac{\partial T}{\partial t}\right)\right]+\frac{V}{v}\frac{t}{\delta}\left(\frac{\partial T}{\partial t}-1\right)$$

TAX COORDINATION

Similar to a cartel, it may be in the best interest of border states to collude and set higher tax rates in order to maximize joint revenues. For example, Stephenson and Hewett (1983) empirically show that the border states of Iowa and Missouri could increase their tax revenues by increasing their tax rates. While smaller states may first object to such a practice, if there are government transfers or revenue-sharing practices between states or nations, then collusion may be encouraged and sustainable.

There are generally three options to imposing tax coordination. The first option is the common practice of setting a tax maximum. However, there is little need to set a maximum tax rate when both countries have tax rates that are too low and not too high. Setting a maximum tax rate will have no effect on the "race to the bottom" observed under tax competition and thus will generate the same joint revenue functions.

The second of these options is to set a weighted-average of the tax rates. Since both countries impose the same tax rate, there is no price differential or incentive to cross border shop. Equation 8 shows that the home and foreign revenue functions respectfully become:

8) $r^* = tv(t)$ *and* $R^* = TV(T)$.

In this case, the tax revenue maximizing tax rate is given respectfully by:

9) $\dfrac{\partial r}{\partial t} = v(t) + t\dfrac{\partial v}{\partial t}$ *and* $\dfrac{\partial R}{\partial T} = V(T) + T\dfrac{\partial V}{\partial T}$.

Dividing both sides by v creates equation 10.

10) $1 + \varepsilon_{v.t.}$ *and* $1 + \varepsilon_{V.T}$.

From equation 10 it is clear to see that the joint revenue function depends almost solely on the elasticity of demand. While Crombrugghe and Tulkens (1990) find a Pareto improvement if both countries increase their tax rates, it is unclear what happens if the two countries use a weighted-average of

their tax rates in equation 10. Results of this study are similar to that of Mintz and Tulkens (1986), suggesting that the model is ambiguous. While the large foreign country no longer loses cross border shoppers, they do lose some of the domestic shoppers due to the income effects pricing them out of the market. Equation 11 shows that the revenue effects on the large country are unclear and again dependent upon the elasticity of demand.

$$11)\ \ 1+\varepsilon_{v.t.} \underset{\underset{-}{<}}{\overset{<}{=}} 1+\varepsilon_{v.t.} +\frac{t}{v}\frac{\partial v}{\partial T}\frac{\partial T}{\partial t}-\left(\frac{t-T}{\delta}\right)-\varepsilon_{v.t.}\left(\frac{t-T}{\delta}\right)-\frac{\partial v}{\partial T}\frac{\partial T}{\partial t}\frac{t}{v}\left(\frac{t-T}{\delta}\right)-\frac{1}{\delta}+\frac{\partial T}{\partial t}\frac{1}{\delta}=0.$$

Regardless, it is quite clear that if the home country is small they will lose tax revenue due to the loss of cross border shoppers and home country demand. In comparing the tax revenues between tax competition and a weighted-average of the tax rates in equation 12 shows:

$$12)\ \ 1+\varepsilon_{v,t} < 1+\varepsilon_{v,t} +\frac{t}{v}\frac{\partial v}{\partial T}\frac{\partial T}{\partial t}+\frac{V(t,T)}{v(t,T)}\left(\frac{T-t}{\delta}\right)+\frac{t}{v}\left[\left(\frac{t-T}{\delta}\right)\frac{\partial V}{\partial t}+\frac{\partial V}{\partial T}\frac{\partial T}{\partial t}\left(\frac{t-T}{\delta}\right)+V(t,T)\left(\frac{1}{\delta}\frac{\partial T}{\partial t}-\frac{1}{\delta}\right)\right].$$

Tax harmony at any tax rate will cause the small country to lose tax revenues due to the elimination of cross border shopping and the loss of domestic demand. Even if the there are net gains for the large country, it is highly unlikely that they will be substantial enough to offset the losses to the small country, making tax harmony an inferior solution.

MINIMUM TAX RATE

A third option for tax compliance is to impose a tax minimum set in between the two tax rates. While this may eliminate "the race to the bottom", it would not eliminate all cross-border shopping.

It is clear that the large country will benefit from a tax minimum. Since they will not change their own tax rate there will be no change in their

domestic demand and they will not lose as many cross border shoppers due to the increase in the smaller countries tax rate. A big country is a clear winner and would prefer a tax minimum to no tax coordination and most likely to a weighted-average of the tax rates.

Examining the small country shows that while they will lose some of their cross border shoppers and some domestic demand by increasing their tax rates to the minimum, it is preferable to tax harmony at a common rate. This is due to them keeping some of the cross border shopper and not losing as much of their domestic demand. However, since the small country losses some of its cross border shoppers and its domestic demand a minimum tax rate clearly generates less tax revenue than tax competition, creating an inferior solution.

While the small country clearly loses tax revenue, the large country clearly gains tax revenue. The size of their joint revenues depends almost entirely on the elasticity of demand in the small country. Assuming that the elasticity of demand is relatively small due to only a small increase in the tax rate, the damages may be minimal. Thus, while the small country will still set a lower tax rate equal to the tax minimum, they will be less quick in their race to the bottom as they are under no tax coordination. While the small country will experience a loss in their tax revenues, the higher tax revenues of the larger country potentially offset the loss of tax revenue in the small country. A small country may agree to impose a tax minimum to generate an increase in the joint revenue function, especially if there is revenue sharing. This is analogous to a small company in a cartel agreeing to increase price in order to increase the cartels total shared profits.

CONCLUSIONS

In general, results are very similar to that found by Kanbur and Keen, suggesting that a small country maximizes tax revenues by becoming a tax haven. Results also support their finding that a tax minimum is preferential to a tax average of the two country's tax rates. However, unlike Kanbur and Keen, results show that the elasticity of demand plays an important roll in determining the overall tax revenues.

While a large country will greatly benefit from a smaller border country increasing their tax rates, one must consider both the small country's loss in cross border shoppers, but also their loss in domestic demand. If the elasticity of demand were high, then it would not be beneficial for border countries to engage in tax compliance at all, even if they are sharing tax revenues. Like Christiansen (1994), results of this paper emphasis the importance of domestic demand and suggests that countries will be less willing to impose a minimum tax rate than Kanbur and Keen suggest.

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