Horizontal and vertical indirect tax competition: Theory and some evidence from the USA

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Abstract

This paper provides a simple but general theoretical framework for analyzing simultaneous vertical and horizontal competition in excise taxes, which includes several previous contributions as special cases. It allows for both elastic individual demand for the taxed good, and cross-border shopping (and smuggling). It then estimates equations informed by the theory on a panel of US state and federal excise taxes on cigarettes and gasoline. The results are generally consistent with the theory, when the characteristics of the markets for the goods are taken into account. Taxes in neighboring states have a significant and large effect in the case of cigarettes. The possibility of smuggling cigarettes from low tax states also plays a role. In the case of gasoline, taxes in neighboring states do not play a significant role; however, there is evidence in this case of vertical competition.
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1. Introduction

This paper provides a simple theoretical framework for analyzing simultaneous vertical and horizontal competition in excise taxes, and estimates equations informed by the theory on a panel of US state and federal excise taxes on cigarettes and gasoline. The theory integrates existing models of vertical competition in indirect taxes (particularly Keen, 1998) with existing models of horizontal competition in indirect taxes generated by cross-border shopping (Kanbur and Keen,

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1993; Nielsen, 2001). The results are generally consistent with the theory, when the different characteristics of the markets for the goods are taken into account.

Our theoretical framework extends Kanbur and Keen (1993), Nielsen (2001) by allowing individual demand for the taxed good to be price-elastic, and conversely, extends Keen (1998) by allowing households to be mobile between different tax jurisdictions (states in what follows). The model allows considerable asymmetry between states: they can differ in size, population density, and the cost of cross-border shopping for the residents. Within this framework, we provide a comprehensive analysis of the signs and relative magnitudes of horizontal and vertical tax responses. The horizontal (vertical) tax response measures how a given state's optimal tax responds to a change in other states' taxes (the federal tax).

Our results are the following. First, under very weak conditions, the horizontal response is positive. This considerably generalizes the results of Kanbur and Keen (1993) and Nielsen (2001). On the other hand, as is already known from Keen (1998), the vertical response can be of either sign. But, there is interaction between vertical and horizontal tax competition: an increase in horizontal competition (lower mobility costs) makes it more likely that the vertical response is positive.

Moreover, we can say something about the relative magnitude of vertical and horizontal responses. When individual demand for the good is relatively price-inelastic, and incentives for inter-state arbitrage (cross-border shopping or smuggling) are strong, the tax set in any state is likely to be strongly positively responsive to taxes set in neighboring states, but unresponsive to the federal tax. Conversely, when individual demand for the good is relatively price-elastic, and incentives for inter-state arbitrage are weak, the tax set in any state is likely to be unresponsive to taxes set in neighboring states, and responsive to the federal tax, although this response may be positive or negative. As argued below, the first case describes the market for cigarettes in the US well, and the second case the market for gasoline.

The overall implication is that the correct empirical specification should allow the tax in any state to depend on both the federal tax and the (weighted average of) other state's taxes, with the relative size of these effects depending on the characteristics of the commodity. Existing empirical studies of US state excise taxes allow for either vertical tax responses (Besley and Rosen, 1998), or horizontal ones (Nelson, 2002; Rork, 2003), but not both, and thus, in our view, estimate mis-specified regressions.

This is confirmed by our empirical results. First, for cigarettes, we find that when the federal excise tax and a weighted average of other state taxes are both included as separate regressors in a system of equations simultaneously determining state excise taxes on cigarettes, then only the coefficient on the weighted average of other state taxes is significant, and it is positive. A one percentage point increase in the average of neighboring states' tax rates induces, in the long run, a 0.7 percentage point increase in state i's tax rate.

The case of gasoline is best characterized as one where demand for the good is somewhat price-inelastic, and incentives for inter-state arbitrage are weak. In this case, the theory predicts that the response of a state tax to taxes in other states and the federal tax is likely to be weak, and this is broadly what we find. The coefficient on the weighted average of other state taxes is generally insignificant, but there is some evidence that the vertical response is positive.

Finally, we extend our empirical analysis by modelling the occurrence of tax changes, rather than their magnitude. The nominal[1] rates of tax, both state and federal, are changed rather infrequently, and it is of interest to explain when a change occurs. We model this using a probit specification, where the probability of a change in the state tax can depend both on the federal tax and the weighted average of other state taxes. We find that the latter has a positive effect on the

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[1] In the main part of the empirical work, we use the real i.e. inflation-adjusted taxes.