8-2012

A Theory of Vertical Political Interaction in Cigarette Taxation

Khawaja Mamun
Sacred Heart University, mamunk@sacredheart.edu

Recommended Citation
Mamun, Khawaja. "A Theory of Vertical Political Interaction in Cigarette Taxation." Indian Journal of Economics and Business 11.2 (2012): 261-269.

Indian Journal of Economics & Business, Vol. 11, No. 2, (2012) : 261-269

A THEORY OF VERTICAL POLITICAL INTERACTION IN CIGARETTE TAXATION

KHAWAJA A. MAMUN*

Abstract

This paper examines the political interdependence of federal and state cigarette tax rates. We develop a lobby group model where a state's endogenous reaction to a federal cigarette tax hike depends crucially on the political responses of the cigarette producer and anti-smoking lobby groups.

Keywords: *Vertical Tax Externalities; Cigarette Taxation; Fiscal Federalism; Lobbying; Political Economy*

JEL Classification: *R1; R5; H2; H7; D7*

I. INTRODUCTION

Recently, the literature on taxation has begun to examine the role of vertical tax interactions in federal systems.[1] However, this literature has largely ignored the role of important political economy forces such as lobbying by special interest groups, and policymakers that are not simple welfare maximizers but also value political support. In an empirical study of gasoline and cigarette tax in the U.S., Besley and Rosen (1998) incorporates the importance of the state tobacco and gasoline industries as controls. However, their analysis did not originated from any theoretical study. This paper seeks to fill this gap in the literature. In particular, we study theoretically the implication for the political determination of state cigarette taxes of changes in the federal cigarette tax rate. Our contribution will help understand and predict states' response to federal tax reforms (aimed, for example, at reducing teen smoking).

We develop a model where both a cigarette producer lobby and an anti-smoking lobby seek to influence the state government choice of the cigarette tax. The semi-benevolent state government values both social welfare and campaign contributions, and the lobbies offer prospective campaign contributions in return for a more favorable state tax rate. We find that a federal cigarette tax hike reduces the lobbying effort of both lobby groups, because their stake in the policy outcome declines as output falls. Moreover, an increase in the federal tax also influences how the states

* Department of Economics & Finance, John F. Welch College of Business, Sacred Heart University, Fairfield, CT 06518, *E-mail: mamunk@sacredheart.edu.*

address the welfare concerns of its citizens. Thus, the final result on the state cigarette tax depends on the *relative* size of these effects.

The rest of the paper is organized as follows. Section 2 presents the model. The theoretical results are described in Section 3. Section 4 provides a brief conclusion.

II. MODEL

Consider a federal system with n identical states. Each state is populated by two types of individuals: nonsmokers and smokers, denoted by j and i, respectively. The total population is normalized to one, out which a share λ are nonsmokers and a share $(1-\lambda)$ are smokers, respectively. We assume that both nonsmokers and smokers consume a numeraire good z, with price normalized to unity. In addition, smokers consume cigarettes at a price P. Every individual is endowed with a unit of labor, l. The numeraire sector requires labor input only. Assuming an input-output coefficient equal to one in the numeraire sector, the wage rate is fixed at unity.

Cigarette consumption is taxed by two levels of government (as is the case in the U.S.). (i) The *state* government imposes a cigarette tax equal to t^s. The resulting tax revenue is used to provide a state level public good, M^s, enjoyed by the state's entire population. (ii) The *federal* government imposes a cigarette tax, t^f, which is taken as exogenous by each individual state's citizens, as well the state lobby groups. The tax revenues are used to provide a federal-level public good. While it is well established that smoking has long-term health consequences, in this paper we focus on the determination of cigarette taxes by incumbent politicians with short time-horizons. Thus, we ignore (as do most politicians, see Farrelly *et al.* (2003) and Lien and Evans (2005) for a discussion on the revenue reasons behind state taxation) the effect of smoking on smokers' (and non-smokers') in-period health. We believe long-term health considerations are largely tangential to the selection of state cigarette tax rates in the U.S.

Each smoker i has a quasi-linear utility function

$$U^i = z + u^i(x^i) + M^S + M^f \tag{1}$$

where x^i is cigarette consumption, M^S is the level of the state government provided public good (such as local roads, e.g.), and M^f is the level of the public good provided by the federal government (such as national security, e.g.). Each nonsmoker j has a utility function given by

$$U^j = z - \theta \sum_i x^i + M^s + M^f \tag{2}$$

where θ represents the rate at which the nonsmokers suffer disutility from passive smoking. Cigarettes are assumed produced by a non-competitive industry using labor and a sector-specific factor.[2] Oligopoly firm k's output level equals q^k, and it has a cost function given by $c(q^k)$, where $c' > 0, c'' > 0$. Industry output equals $\sum_k q^k = Q$. The gross profit function of firm k (disregarding political expenditures) equals:

$$\pi^k = \left\{P(Q) - t^s - t^f\right\} q^k - c\left(q^k\right), \tag{3}$$

where $P(Q) - t^S - t^f$ equals the market price net of state and federal cigarettes taxes. From the FOC of (1), it follows that we may write $Q(t^S, t^f)$. Note also that $M^S = Qt^S$, and $M^f = nQt^f$.

Lobby Groups

We assume that two opposing lobby groups are (exogenously) formed in each state. First, all firms are assumed to form a cigarette manufacturing lobby (producer lobby), where each firm contributes equally to the lobby's attempt to influence the state government's decision on the state cigarette tax.[3] Second, a share η of the nonsmokers in each state is assumed able to overcome free-riding problems and form an anti-smoking lobby.[4]

We now turn our attention to the explicit political process. The state cigarette tax is determined by a two-stage extensive form game between the incumbent state government and the two lobby groups (see Grossman and Helpman, 1994). In the first stage, the producer and the anti-smoking lobbies offer prospective contribution schedules $\Lambda^F(t^S)$ and $\Lambda^N(t^S)$, respectively, to the state government in return for a more favorable tax policy, t^s. In the second stage, the government selects its optimal tax policy t^s and receives the contribution associated with the policy selected. It is assumed that all promises are kept (i.e. the lobby groups are assumed not to renege on their promises in the second stage). Given the cigarette tax, firms set their output level.

The firm lobby has an objective function that depends on aggregate profits, gross of campaign contributions,

$$\Omega^F(t^s) \equiv \sum_k \pi^k, \tag{4}$$

and the objective function of the anti-smoking lobby, gross of campaign contributions, equals

$$\Omega^N(t^S) = \lambda\eta(l - \theta Q + M^S + M^f) \tag{5}$$

The state government's objective function is the weighted sum of campaign contributions and aggregate social welfare:

$$G\left(t^s\right) = \Lambda^F\left(t^s\right) + \Lambda^N\left(t^s\right) + \alpha\Omega^A\left(t^s\right), \tag{6}$$

where aggregate social welfare is given by

$$\Omega^A(t^s) = \overbrace{\int_0^Q P(x)dx - P(Q)\ \ Q(t^s,t^f)}^{A} + \overbrace{\left[l + M^s + M^f\right]}^{B} \underbrace{-\lambda(1-\eta)\theta Q(t^s,t^f)}_{C} + \Omega^N(t^s) + \sum_k \pi^k(t^s). \tag{7}$$

Term A in (7) represents consumer surplus, term B represents labor income and public goods, and term C represents the aggregate disutility of the non-lobbying nonsmokers. $\alpha \geq 0$ reflects the government's exogenous weight on welfare relative to campaign contributions. Following, e.g., Schulze and Ursprung (2001), a larger α indicates a more honest government.[5]

The Political Equilibrium

From Lemma 2 of Bernheim and Whinston (1986) (see also Grossman and Helpman, 1994) it follows that for a subgame perfect Nash equilibrium $\left(\Lambda^{F^*}\left(t^{s^*}\right), \Lambda^{N^*}\left(t^{s^*}\right), t^{s^*}\right)$ the following necessary conditions are required to hold:

(I) $t^{s^*} \in \arg\max \Lambda^{F^*}\left(t^s\right) + \Lambda^{N^*}\left(t^s\right) + \alpha\Omega^A\left(t^s\right)$;

(IIA) $t^{s^*} \in \arg\max\left[\Omega^F\left(t^s\right) - \Lambda^{F^*}\left(t^s\right)\right] + \Lambda^{F^*}\left(t^s\right) + \Lambda^{N^*}\left(t^s\right) + \alpha\Omega^A\left(t^s\right)$; and

(IIB) $t^{s^*} \in \arg\max\left[\Omega^N\left(t^s\right) - \Lambda^{N^*}\left(t^s\right)\right] + \Lambda^{F^*}\left(t^s\right) + \Lambda^{N^*}\left(t^s\right) + \alpha\Omega^L\left(t^s\right)$.

According to condition (I), the equilibrium state tax t^{s^*} must maximize the government's objective function, given the offered contribution schedules. Condition (IIA) and (IIB) imply that t^{s^*} must also maximize the joint welfare of each lobby group and the government. Using conditions (I), (IIA) and (IIB), and performing the appropriate substitutions, we obtain:

$$\Lambda_t^{F^*}\left(t^{s^*}\right) = \Omega_t^F\left(t^{s^*}\right); \tag{8.1}$$

$$\Lambda_t^{N^*}\left(t^{s^*}\right) = \Omega_t^N\left(t^{s^*}\right). \tag{8.2}$$

Equations (8.1) and (8.2) imply that the contribution schedules are locally truthful.[6] Using (8.1), (8.2) and the first order condition of (I), we obtain the political equilibrium characterization:

$$\Omega_t^F\left(t^{s^*}\right) + \Omega_t^N\left(t^{s^*}\right) + \alpha\Omega_t^A\left(t^{s^*}\right) = 0. \tag{9}$$

III. VERTICAL TAX INTERACTIONS

In this section, we seek to determine the effect of changes in the federal cigarette tax on the state cigarette tax. We find the interaction between the federal and the state tax rates by first taking the partials of expressions (4), (5) and (6), and substituting the result into (9) to find an explicit equilibrium characterization (not shown). Next, total differentiation of the result and simple rearrangements yield

$$\frac{dt^s}{dt^f} = \frac{\overbrace{\underset{(-)}{\beta_1}}^{A} + \overbrace{\underset{(+)}{\beta_2}}^{B} + \alpha\overbrace{\left(\underset{(-)}{\beta_3} + \underset{(+)}{\beta_4} + \underset{(+)}{\beta_5} + \underset{(+)}{\beta_6}\right)}^{C}}{\underset{(-)}{D^{t^s}}}, \tag{10}$$

where D^{t^s} is the second-order condition of the state government's utility maximization in (7), and is required to be negative.[7] $\beta_1 < 0$ represents the *change* in the influence of the cigarette producer lobby group as the federal government raises t^f. Keeping $D^{t^s} < 0$ in mind, term A in (10) suggests that the producer lobby reduces its pressure for a lower tax rate. The intuition is that as output falls (with a hike in t^f), less is at stake for the producer lobby (the state tax applies to a lower output quantity), and it consequently scales back its political gift to the state government.[8,9] This has a positive effect on the tax rate (i.e. states increases tax rates in response to a federal tax increase). Next, since $\beta_2 > 0$, term B reflects the change in the pressure of the anti-smoking lobby, which results in a negative effect on the tax rate (with a reasoning similar to term A).

Term C is made up of four partial effects, as part of aggregate social welfare. From (10), the relative importance of term C is also determined by the degree of government honesty, reflected by α. $\beta_3 < 0$ and $\beta_4 > 0$ represent the change in the influence of the smokers and the non-organized nonsmokers. In particular, the state government cares less about the smokers as their consumption declines (i.e. less welfare attention to the smokers given as their numbers declines).[10] Similarly, a lower output leads to less disutility for the non-smokers and thus they also receive less government attention.

Moreover, the change in the government's attention to the state- and federal-tax financed public goods are represented by $\beta_5 > 0$ and $\beta_6 > 0$, respectively. A lower output level reduces the marginal incentive to raise state tax revenue. Without a revenue restriction, the state government's decision to tax cigarettes depends on the marginal utility delivered by the state public good, versus the effect on the marginal utility of smokers and non-smokers. With a lower output (due to the hike in t^f), the state tax raises less revenue. Finally, the federally provided public good is also a consideration of the state government. When the federal tax increases to provide public goods, the state tax is lowered as the federal and state public goods are substitutes.[11]

In sum, the net effect of the federal cigarette tax on the state tax depends on the lobby groups' reactions, as well as the change in the government's welfare considerations (weighted by honesty). Thus, the tax differences seen at the state level thus can be explained by these various forces acted differently in different states.[12]

IV. CONCLUSION

This paper represents a novel approach to understanding the nature of vertical externalities between different levels of government in the United States, particularly as regards cigarette taxation. We develop a lobbying model which identifies several sources of vertical tax externalities, chief among them are changes in the intensity of lobby group pressures, and the government's relative attention to the average citizen's social welfare.

Our theoretical model fills a void in the literature of strategic interactions of federal and state cigarette taxation. The earlier literature heavily drawn on empirical studies, reports a zero, negative or positive correlation between these cigarette taxes.[13] Our paper shed light on the difference in results by pointing theoretical possibilities of such outcomes based on lobby group efforts and government's welfare considerations. It is by now widely recognized in other strands of the literature that real world policymakers rarely behave as welfare maximizers. The literature on vertical tax externalities has until now largely ignored this reality, and thus we believe this paper offers a novel contribution.

Acknowledgement

*I would like to thank Per Fredriksson, Daniel Millimet, Samina Munawwar, Matthew Wilson, and seminar participants at Southern Methodist University for useful comments and suggestions. The usual disclaimers apply.

Notes

1. For theoretical and empirical contributions, see, for example, Flowers (1988), Boadway and Keen (1996), Besley and Rosen (1998), Boadway *et al.* (1998), Boadway and Hayashi (2001), Goodspeed (2000), Esteller-Moré and Solé-Ollé (2001), Hoyt (2001), Keen and Kotsigiannis (2002, 2003, 2004), Dalby and Wilson (2003), Rork (2003) and Fredriksson and Mamun (2008).
2. The tobacco market in the United States is oligopolistic, and is shared by four major companies, namely Philip Morris, R. J. Reynolds, Brown & Williamson and Lorillard. In 2002, these four companies controlled over 90% of total US market share. See *www.oligopolywatch.com* for further details. Also, see Barnett *et al.* (1995) for a discussion on the oligopoly structure of the US cigarette industry.
3. For simplicity, we assume that both tobacco and anti-smoking lobbies are lobbying at the state level only. For example, free-riding problems may make coordination at the federal level difficult. While incorporating lobbying at the federal level however raises interesting issues, this is beyond this paper's goals.
4. Anti-smoking lobbies are active through raising awareness of tobacco's effects and costs, helping people to quit smoking, encouraging and coordinating the product liability suits against tobacco companies, providing legislative information and pressure on the political office-holders, etc. Anti-smoking lobbies in the United States include the Campaign for Tobacco-free Kids, Tobacco Control Resource Center, American Cancer Society, American Heart Association, American Lung Association, American Dental Association, American Academy of Family Physicians, Americans for Nonsmokers Rights, American Legacy Foundation, Oral Health America, Partnership for Prevention, and Pharmacy Council on Tobacco Dependence (see, e.g., Carlisle, 2003).

5. Dixit (1996) assumes that government is subject to a constraint that social welfare does not fall below a certain level. He compares α with the Lagrange multiplier on this constraint. A large α then implies that the constraint is more restrictive.
6. Thus, each lobby sets its contribution schedule such that the marginal change in the contribution due to a small change in tax policy equals the effect of the tax on its gross payoff.
7. See Appendix for explicit expressions for D and $\beta_1 - \beta_6$.
8. More than two decades of tobacco literature reports a range for the price elasticity of cigarette demand between –0.30 and –0.50. Most empirical studies suggest that a cigarette tax hike results in a price increase *greater* than the rise in the tax. See Chaloupka (1991) and Becker *et al.* (1991, 1994), Barnett *et al.* (1995), Keeler *et al.* (1996), and Chaloupka and Warner (1999).
9. See Equation 3 and 4.
10. See term A of Equation 7.
11. Assuming both levels of government are on the left-hand sides of their Laffer curves.
12. For example, Florida has a $0.339 tax rate per pack since 1991, while the tax rate in Rhode Island increased 7 times during the same time period.
13. The empirical vertical cigarette tax externalities literature indicates mixed results. Besley and Rosen (1998) found that states response positively to a federal tax hike, while Devereux *et al.* (2007) points toward positive, negative and ambiguous response depending on the price elasticity of demand. Lastly, Fredriksson and Mamun (2008) found that states response negatively.

References

Barnett, P., T. Keeler and T. Hu (1995), "Oligopoly Structure and the Incidence of Cigarette Excise Tax." *Journal of Public Economics*, Vol. 57, No. 3, 457-470.

Becker, G., M. Grossman and K. Murphy (1991), "Rational Addiction and the Effect of Price on Consumption." *American Economic Review*, Vol. 81, 237-41.

Becker, G., M. Grossman and K. Murphy (1994), "An Empirical Analysis of Cigarette Addiction." *American Economic Review*, Vol. 84, No. 3, 396-418.

Bernheim, B., and M. Whinston (1986), "Menu Auctions, Resource Allocation, and Economics Influence." *Quarterly Journal of Economics*, Vol. 101, No. 1, 1–31.

Besley, T. and H. Rosen (1998), "Vertical Externalities in Tax Setting: Evidence from Gasoline and Cigarettes." *Journal of Public Economics*, Vol. 70, 383–398.

Boadway, R and M. Keen (1996), "Efficiency and the Optimal Direction of Federal-State Transfers." *International Tax and Public Finance*, Vol. 3, 137-55.

Boadway, R., M. Marchand, and M. Vigneault (1998), "The Consequences of Overlapping Tax Bases for Redistribution and Public Spending in a Federation." *Journal of Public Economics*, Vol. 68, 453-478.

Boadway, R. and M. Hayashi (2001), "An Empirical Analysis of Intergovernmental Tax Interaction: The Case of Business Income Tax in Canada." *Canadian Journal of Economics*, Vol. 34, 481-503.

Carlisle, J. (2003), "The Dangerous Anti-Smoking Lobby." *Organization Trends*, July. Capital Research Center, Washington, DC. At URL: *http://www.capitalresearch.org/pubs/pdf/x3781248450.pdf* (viewed 10/11/05).

Chaloupka, F. (1991), "Rational Addictive Behavior and Cigarette Smoking." *Journal of Political Economy*, Vol. 99, No. 4, 722-42.

Chaloupka, F. and K. Warner (1999), "The Economics of Smoking". In J. Newhouse and A. Cuyler (Eds.), *The Handbook of Health Economics*, 1539-1627. New York: North-Holland.

Dalby, B. and L. Wilson (2003), "Vertical Fiscal Externalities in a Federation." *Journal of Public Economics*, 87: 917-30.

Devereux, M., B. Lockwood, and M. Redoano (2007), "Horizontal and Vertical Indirect Tax Competition: Theory and Some Evidence from the USA." *Journal of Public Economics*, Vol. 91, No. 3–4, 451–79.

Dixit, A. (1996), "Special-Interest Lobbying and Endogenous Commodity Taxation." *Eastern Economic Journal,* Vol. 22, No. 4, 375–388.

Esteller-Moré, Á. and A. Solé-Ollé (2001), "Vertical Income Tax Externalities and Fiscal Interdependence: Evidence from the US." *Regional Science and Urban Economics*, Vol. 31, 247-72.

Farrelly M., T. Pechacek and F. Chaloupka (2003), "The Impact of Tobacco Control Program Expenditures on Aggregate Cigarette Sales: 1981-2000." *Journal of Health Economics*, Vol. 22, No. 4, 843-859.

Fredriksson, P. and K. Mamun (2008), "Vertical Externalities in Cigarette Taxation: Do Tax Revenues go up in Smoke?" *Journal of Urban Economics*, Vol. 64, No. 1, 35-48.

Flowers, M. (1988), "Shared Tax Sources in a Leviathan Model of Federalism." *Public Finance Quarterly*, Vol. 16, 67-77.

Goodspeed, T. (2000), "Tax Structure in a Federation." *Journal of Public Economics*, Vol. 75, 493-506.

Grossman, G. and E. Helpman (1994), "Protection for Sale." *American Economic Review*, Vol. 84, No. 4, 833–850.

Hoyt, W. (2001), "Tax Policy Coordination, Vertical Externalities, and Optimal Taxation in a System of Hierarchical Governments." *Journal of Urban Economics*, Vol. 50, 491-516.

Keeler, T., T. Hu, P. Barnett, W. Manning and H. Sung (1996), "Do Cigarette Producers Price Discriminate by State? An Empirical Analysis of Local Cigarette Pricing and Taxation." *Journal of Health Economics*, Vol. 15, 499–512.

Keen, M. and C. Kotsogiannis (2002), "Does Federalism Lead to Excessively High Taxes?" *American Economic Review*, Vol. 92, 363-70.

Keen, M. and C. Kotsogiannis (2003), "Leviathan and Capital Tax Competition in Federation." *Journal of Public Economic Theory*, Vol. 5, 177-99.

Keen, M. and C. Kotsogiannis (2004), "Tax Competition in Federations and the Welfare Consequences of Decentralization." *Journal of Urban Economics*, Vol. 56, 397-407.

Lien, D. and W. Evans (2005), "Estimating the Impact of Large Cigarette Tax Hikes: The Case of Maternal Smoking and Infant Birth Weight." *Journal of Human Resources*, Vol. 40, No. 2, 373-392.

Rork J. (2003), "Coveting Thy Neighbors' Taxation." *National Tax Journal*, Vol. 56, No. 4, 775–787.

Schulze, G. and H. Ursprung (2001), "The Political Economy of International Trade and the Environment" In: Schulze, G. G. and Ursprung, H., (eds.) *International Environmental Economics: A Survey of the Issues*. Oxford University Press.

Appendix

In expression (10), the following political pressures are represented:

Cigarette-producer lobby: $\beta_1 \equiv (1+\alpha)\frac{\partial Q}{\partial t^f} < 0$

Anti-smoking lobby: $\beta_2 = -(1+\alpha)\lambda\eta\left\{-\theta\left(\frac{\partial^2 Q}{\partial t^s \partial t^f}\right)+\left(1+\varepsilon_{Q_f t^s}\right)\frac{\partial Q}{\partial t^f}+\left(1+\varepsilon_{Q_s t^f}\right)\frac{\partial Q}{\partial t^s}\right\} > 0$

Smokers' pressure: $\beta_3 = \left\{\left(1+\varepsilon_{P_Q^d Q}\right)\left(\frac{\partial Q}{\partial t^f}\right)\left(\frac{\partial Q}{\partial t^s}\right)+\left(\frac{\partial^2 Q}{\partial t^s \partial t^f}\right) Q\right\}\left(\frac{\partial P^d}{\partial Q}\right) < 0$

Welfare consideration of the non-lobbying nonsmokers: $\beta_4 = -\left\{(1-\eta)n\left[-\theta\left(\frac{\partial^2 Q}{\partial t^s \partial t^f}\right)\right]\right\} > 0$

State revenue pressure: $\beta_5 = -\left\{(1-\lambda\eta)\left(1+\varepsilon_{Q_f t^s}\right)\frac{\partial Q}{\partial t^f}\right\} > 0$

Federal revenue pressure: $\beta_6 = -\left\{(1-\lambda\eta)n\left(1+\varepsilon_{Q_s t^f}\right)\frac{\partial Q}{\partial t^s}\right\} > 0$

Moreover, the explicit second-order of the equilibrium characterization (7) equals:

$$D^{t^s} = -(1+\alpha)\left(\frac{\partial Q}{\partial t^s}\right)+(\alpha+\lambda\eta)\left\{\left(t^s+nt^f-\theta\right)\left(\frac{\partial^2 Q}{\partial t^{s2}}\right)+2\left(\frac{\partial Q}{\partial t^s}\right)\right\}$$

$$+\alpha\left\{-\left(\frac{\partial^2 P^d}{\partial Q^2}\right)\left(\frac{\partial Q}{\partial t^s}\right)+\left(\frac{\partial P^d}{\partial Q}\right)\left(\frac{\partial^2 Q}{\partial t^{s2}}\right) Q+\left(\frac{\partial P^d}{\partial Q}\right)\left(\frac{\partial Q}{\partial t^s}\right)^2\right\}+\alpha\left\{\lambda(1-\eta)\left\{-\theta\ \frac{\partial Q}{\partial t^s}\right\}\right\} < 0$$