



Unit tax versus ad valorem tax: A tax competition model with cross-border shopping



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ABSTRACT

Within the framework of spatial tax competition with cross-border shopping, we examine the choice of tax method between ad valorem tax and unit (specific) tax. This study shows that governments endogenously choose the ad valorem tax method not because of a classic welfare reason, but because it is a good strategy to compete for mobile consumers. Another key finding is that while governments are committed to the ad valorem tax method, the choice leads to inferior outcome; tax-cutting competition becomes more serious when countries adopt ad valorem tax, and competition in ad valorem tax results in smaller tax revenue than competition in unit tax.

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1. Introduction

More than 60 years have passed since economists first formally compared the effects of ad valorem and unit (specific) commodity taxes on a non-competitive market. [Suits and Musgrave's \(1953\)](#) path-breaking study presented a formal comparison in monopoly analysis to show that ad valorem tax is welfare superior to unit tax. Even prior to their analysis, [Cournot \(1838, 1960\)](#) had found that the two tax methods needed to be treated differently in analyzing an imperfect market and [Wicksell \(1896, 1959\)](#) affirmed the analogous argument of Suits and Musgrave: for any given tax revenue, prices in a monopoly market will be lower with ad valorem tax, indicating that ad valorem tax causes less distortion and is welfare superior to unit tax.¹ Researchers have reexamined and substantiated this argument through various intensive studies. Several studies have focused on the effects of unit tax and ad valorem tax on the equilibrium

characteristics in oligopoly and monopolistic competition, and most of them confirm that the Suits and Musgrave argument still holds, although some indicate the possibility of a countervailing.²

The purpose of this study is to provide further insights into this classic argument in a two-country framework. In most of the literature examining the effects of ad valorem and unit commodity taxes, comparisons are drawn within a single country framework, in which the consumers are forced to buy a domestic product irrespective of how high the prices and taxes are. Contrastingly, in this study, we explore the choice of a tax method by considering cross-border shopping in a two-country model. We argue that each country has incentives to adopt the ad valorem tax method not because of a classic welfare reason, but because ad valorem tax is superior to unit tax from the perspective of attracting cross-border consumers. In fact, we first show that governments choose the ad valorem tax method as a dominant strategy to compete for mobile consumers. Then, we elaborate that

² To mention but a few, [Delipalla and Keen \(1992\)](#), [Skeath and Trandel \(1994\)](#), [Myles \(1996\)](#), [Denicoló and Matteuzzi \(2000\)](#), [Anderson et al. \(2001\)](#), and [Blackorby and Murty \(2007\)](#) examined the non-equivalence between unit and ad valorem taxes in monopoly and oligopoly. A comparison of the two tax methods has also been made in the monopolistic competition market by [Schröder \(2004\)](#), [Jorgensen and Schröder \(2005\)](#), [Dröge and Schröder \(2009\)](#) and [Schröder and Sørensen \(2010\)](#). Furthermore, the analysis applied to the two-sided market by [Kind et al. \(2009\)](#), and the multiproduct market by [Hamilton \(2009\)](#) and [Lapan and Hennessy \(2011\)](#). See [Keen \(1998\)](#) for a general review.

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¹ A recent study by [Carbonnier \(2011\)](#) tests this theoretical hypothesis and finds that in the alcoholic beverages market in France, the shifting of per unit excise taxes was significantly larger than the shifting of ad valorem VAT.

the superiority of ad valorem tax in attracting cross-border consumers is at the root of significant tax-cutting competition, and that tax-cutting competition becomes more severe when a country is committed to ad valorem tax. This finding critically implies that lower tax revenues result from competition in ad valorem tax than in unit tax, and the governments are plunged into a prisoner's dilemma in the choice of tax method game.

The model developed in this study allows for cross-border shopping based on the established work of Kanbur and Keen (1993), which analyzed the outcome of spatial commodity tax competition under the unit tax method. The spatial tax competition models have developed uninterruptedly against a background in which cross-border activities have stronger effects on fiscal budget, compared to the earlier less-open economies.³ In the context of these spatial competition studies, which make the unit tax assumption hold, our analysis can be positioned as an extension dealing with the endogenous choice of tax instrument. This is however an important issue, because it is not clear why governments commit to use unit tax methods when competing for mobile consumers.

The endogenous choice of policy instruments has been attracting attention in international trade studies rather than in public finance literature.⁴ For example, Mayer and Riezman (1987), Hillman and Ursprung (1993), Rosendorff (1996) and Konishi et al. (1999) examined the endogenous choice of trade policy between a voluntary export restraint (VER) and a tariff. These studies advance the comparative studies of tariff and quotas/VER that originated with Bhagwati (1965).⁵ The study most relevant to ours is Lockwood and Wong (2000) which addresses the non-equivalence of unit and ad valorem tariff in a competitive market. Lockwood and Wong show that identical countries appear to choose ad valorem tariffs, making the trade war less severe. Under a different setup using a Hotelling-type spatial model of commodity tax competition, we show that the superiority of ad valorem tax does not always hold; compared with the unit tax method, ad valorem tax leads to severe tax-cutting competition and thereby renders both the countries worse off. Another related literature is Anderson et al. (2001). The study derives the comparative statics results for ad valorem tax and unit tax under a price-setting oligopoly market in a single country. Our study also assumes a price-setting oligopoly. Our focus, however, differs from Anderson et al. (2001): we extend a single-country framework to a two-country model with cross-border shopping, and fully solve the two-stage game to clarify the tax method that the governments endogenously select.

This paper is organized as follows. Section 2 introduces the basic model. The choice of tax rates is examined in Section 3. We derive the main propositions of the equilibrium tax method in Section 4. Section 5 presents the discussion of the model, which is extended to include the cooperative tax setting, alternative objectives of governments, and the elastic total demand. Finally, Section 6 concludes the paper.

³ See Braid (1993, 2000), Wang (1999), Ohsawa (1999, 2003), Cremer and Gahvari (2000), Nielsen (2001, 2002), and Ohsawa and Koshizuka (2003). See also Leal et al. (2010) for an extensive summary of tax competition analyses of cross-border shopping. Non-spatial models of interregional commodity tax competition, such as Mintz and Tulken (1986), de Crombrughe and Tulkens (1990), Lockwood (1993), Trandel (1994), Haufler (1996), Scharf (1999), Lucas (2004), and Moriconi and Sato (2009), are similar to this study in their tax competition structure but contrast with it in that they do not have a stake in the endogenous choice of tax method. One of the merits of using the spatial model is that it explicitly captures the distance which is empirically found to be a crucial factor in cross-border shopping behavior. See, for instance, Asplund et al. (2007) for a representative study.

⁴ In the study of capital tax competition, the choice between ad valorem tax and unit tax was examined in Akai et al. (2011), which shows that unit tax is superior to ad valorem tax, and selecting the unit tax method is a dominant strategy for governments.

⁵ Bhagwati (1965) demonstrated that the tariff-quota equivalence is necessarily obtained when perfect competition prevails in all markets. A large number of subsequent studies find a non-equivalence environment in imperfect competition models. See Levinsohn (1994) and Gervais and Larue (2007) for an overview of trade policy non-equivalence in imperfect competition models. See also Rodrik (1995) for the choice of trade policy.

2. Model

Our simple Hotelling economy, described in Fig. 1, consists of two symmetric countries, $i = 1, 2$. The location space of the economy is given by $\theta \in [-1/2, 1/2]$, divided into two countries at $\theta = 0$, the length of each country is therefore $1/2$. In each country, there is a single private firm at both ends, $x_1 = -1/2$ and $x_2 = 1/2$, where x_1 and x_2 are the location points of firms 1 and 2.⁶ The firms are fixed at their locations, and they sell their products at price p_i .

2.1. Consumers

The consumers in this economy are endowed with a utility function separable in money and the utility derived from a given product, and each one is required to buy one product unit. They differ with respect to location and are uniformly distributed along a unit interval. We represent a consumer's location as $y \in [-1/2, 1/2]$. The utility of a consumer located at y , having money m , and buying a product sold by firm 1 is given by $u_1 = v + m - p_1 - \tau(y - x_1)$, where v stands for the value of the product and $\tau(y - x_1)$ the transportation cost ($\tau > 0$).⁷ To ensure the condition that the market is covered, we assume that v is sufficiently large relative to τ and that all consumers are willing to buy a product. In a similar way, the utility of a consumer buying a product sold by firm 2 can be given by $u_2 = v + m - p_2 - \tau(x_2 - y)$.

Utility maximization means picking the minimum of $p_1 + \tau(y - x_1)$ and $p_2 + \tau(x_2 - y)$. As $x_1 = -1/2$ and $x_2 = 1/2$, the utility that a consumer residing at \hat{y} derives from buying a product of either of the two firms is the same, where $\hat{y} = 0.5(p_2 - p_1)/\tau$. Hence, the demand function that firm $i (= 1, 2)$ has to meet, D_i , can be expressed as

$$D_1(p_1, p_2) = \frac{1}{2} + \frac{p_2 - p_1}{2\tau} \quad \text{and} \quad D_2(p_1, p_2) = \frac{1}{2} - \frac{p_2 - p_1}{2\tau}. \quad (1)$$

2.2. Governments

Following Kanbur and Keen (1993), Ohsawa (1999), and Wang (1999), we begin by describing the government's objective in its simplest form, deferring discussions on generalization until later. In each country, there is a single revenue-maximizing government, raising revenue only through taxes on products; the government can choose either the unit tax or ad valorem tax method. If the government adopts the unit tax method, taxes will be imposed on the number of units sold, and if it selects the ad valorem tax method, taxes will be imposed on the amount of sales. If the government in country i selects the unit tax method, the tax revenue will be

$$R_i = T_i D_i, \quad (2)$$

where T_i denotes the unit tax rate. On the other hand, if the government imposes ad valorem tax, the tax revenue of country i will be

$$R_i = t_i p_i D_i, \quad (3)$$

where $t_i (< 1)$ denotes the ad valorem tax rate.

When we deal with two countries, we have four possible tax method combinations: in case (i), both the countries compete for mobile consumers in unit tax; in case (ii), both the countries compete in ad valorem tax; in case (iii), country 1 competes in unit tax and country 2 competes in ad valorem tax; and in case (iv), country 1

⁶ As long as the location is symmetric and exogenous, the assumption that the firms locate at both ends is not crucial. For instance, if the firms locate at the center of each country, $x_1 = -1/4$ and $x_2 = 1/4$, the firms would simply compete for consumers locating at somewhat short intervals $[-1/4, 1/4]$.

⁷ A linear transport cost makes the analysis tractable, which is familiar in the literature of spatial tax competition. See Kanbur and Keen (1993), Ohsawa (1999), and Wang (1999), among others.

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