

Cross-Border Shopping: A Survey

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Abstract The aim of this paper is to undertake a review of the most important literature on the phenomenon of fiscally induced cross-border shopping. Following the presentation of the principal theoretical models, the study concentrates on applied literature. Firstly, the elements common to the diverse applications are described, and then, a detailed analysis of the research undertaken into cross-border shopping for alcoholic drinks, tobacco, fuel, and lotteries is provided, concluding with a reference to the interaction between cross-border purchases and those effected over the internet. The results achieved by the empirical research coincide and support the principal result of the theoretical literature: the tax differentials between neighboring territories induce consumers to purchase in the territory where taxation is lower, on the condition that the tax saving compensates for the transport costs associated with the travel made by the purchaser in order to take advantage of the lower taxation.

Keywords Cross-border shopping · Tax differences

JEL H31 · H32 · H73 · E62

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Introduction

The differences in the taxation of the same good or service between neighboring countries, neighboring regions, or municipalities in the same country encourage consumers to travel to the jurisdiction where taxation is lower to acquire that good or service, as long as the tax saving compensates for the costs of traveling from one jurisdiction to another. This behavior has consequences for tax revenue collection and economic activity in the affected jurisdictions and for the welfare of individuals in those territories.

This phenomenon, known as cross-border shopping, has been widely recognized and analyzed in the literature since at least the 1930s. The existence of cross-border shopping has been shown for various time periods, spatial areas (countries, regions, local authorities), taxes (general on sales or on specific products), and goods and services (food, clothing, alcohol, tobacco, fuel, lotteries, etc.). The importance of cross-border shopping increases as two trends in the world economy intensify. The first is the globalization of the economy, which substantially reduces the transaction costs associated with trade relations between territories. The second trend is the decentralization of tax-raising and expenditure powers towards intermediate levels of government within the same country, which significantly increases the number of jurisdictions with differentiated taxation of the same goods or services.

The aim of the present paper is to present a systematic review of the most important literature on cross-border shopping from a dual perspective, theoretical and applied. The theoretical works are presented in the second section of the paper and the applied works in the third. In order to reduce the review to a reasonable size, we shall concentrate exclusively on research directly related to cross-border shopping, leaving aside other subjects of undeniable importance to which that phenomenon is directly related, such as tax competition or tax incidence. Each of these topics could be the subject of a survey in itself, one more extensive than that offered here. Finally, we are not going to consider those border-crossing transactions that involve no payment of tax. They are referred to as *tax-not-paid (TNP) transactions*, being a well-known example of these the VAT carousel fraud.¹

Theoretical Works

On the theoretical plane, the standard work is by Kanbur and Keen (1993)². Although it must be noted that, as we shall see in the following section, some previously applied research had already been firmly grounded on standard models of economic theory (such as, for example, Fisher, 1980).

The partial equilibrium model supplied by Kanbur and Keen (1993) considers an open economy with a single good and comprised of two bordering countries—national and foreign—that differ in population size. The objective of the governments is to maximize revenue. The consumer will purchase the good if the price is

¹ TNP transactions are analysed by Keen (2002).

² Which the authors themselves relate to certain classic literature in fiscal federalism, such as Gordon (1983), Mintz and Tulkens (1986) and Lockwood (1993).

inferior or equal to its reservation price: this is v for the national resident and V for the foreigner. The price for the producer of the commodity is constant and the same in both countries, and thus, the consumer price can be identified with the tax paid in each territory; t in the country of residence and T abroad. Each store must charge the tax rate of the country in which it is located.

In this model, the national consumer faces the alternative of buying the good, mentioned above, in his or her own country or of traveling to the border and purchasing it in the neighboring country, incurring a cost of $\delta > 0$ per unit of distance, s . There are two necessary and sufficient conditions for cross-border shopping to occur: the surplus that the consumer enjoys by buying abroad exceeds that of doing so in the national market, that is to say $v - T - \delta \cdot s > v - t$, and this surplus is non-negative: $v - T - \delta \cdot s > 0$.

In a closed economy, cross-border shopping does not exist and each government fixes its taxation at the level which coincides with the reservation price of its residents. When moving from a closed economy to an open one, in a non-cooperative model, the smaller country will reduce its tax rates, which will cause the following: a reduction in the tax revenue collection of the larger country (caused by cross-border shopping); an increase in that of the smaller country, if the difference in their size is sufficiently high; and a reduction of the aggregate revenue. In the Nash equilibrium, the tax rate of the smaller country will be lower and the per capita revenue collection (but not absolute revenue) greater than the larger country.

Kanbur and Keen (1993) identified two strategies to achieve increases in welfare: an increase in transport costs (which permits taxation and revenue to be increased in the two countries, without modifying the volume of cross-border shopping) and the establishment of a minimum common tax rate, being the best strategic response of the larger country to ensure a sufficient level of cross-border trade from which the smaller country would also benefit. On the basis of the work of Kanbur and Keen (1993), the literature has been extended in many directions. While some studies maintain the emphasis on the difference in the population size of territories (Trandel 1994; Wang 1999), others assume that territories differ in their geographical size (Ohsawa 1999; Nielsen 2001, 2002). Some authors introduce diverse transaction costs (Scharf 1999; Nielsen 2001) or differences in the preferences for public goods (Haufler 1996; Nielsen 2002). In general, the results obtained by such research coincide with those of Kanbur and Keen (1993). A final group of studies is concerned with deriving optimal taxation rules for economies exposed to cross-border shopping, in various scenarios (Scharf 1999; Christiansen 1994, 2003). We present the most important results from this literature below.

Trandel (1994) confirms, for diverse hypotheses regarding the behavior of governments and firms, that the more densely populated country imposes a higher tax rate. Wang (1999) broadens the preceding models, since he considers that the more highly-populated region behaves as a Stackelberg leader.³ The results show that the tax rates and the revenue of both regions are greater than those which would correspond in the Nash equilibrium, and the reforms aimed at fiscal harmonization or rules of minimum rates are damaging for the smaller region, while they benefit the larger one.

³ See also Hvidt and Nielsen (2001).

Ohsawa (1999) introduces two modifications to the approach of Kanbur and Keen (1993). Firstly, the author extends the model to more than two countries to understand how the relative position of the countries affects equilibrium. Secondly, he assumes that the countries are of different geographical sizes. Both characteristics—positions and sizes of the countries—create differences in the market power, which in turn produces differences in tax rates and government revenue in the Nash equilibrium. The results confirm those of Kanbur and Keen (1993), since they show how small countries choose, in the Nash equilibrium, a lower tax rate than large countries, even though they collect more than its size-proportional share of total revenue. Ohsawa (1999) also proves that, if countries are of the same size, the equilibrium tax rates diminish gradually from the peripheral countries towards the central one.

Nielsen (2001) also locates the asymmetry between countries in their geographical extension. The results achieved confirm once more those obtained by Kanbur and Keen (1993). Nielsen (2001) incorporates two additional extensions to the preceding research. Firstly, he shows that the consideration to the transport costs for commodities (as well as persons) leads to higher taxes and, in the smaller country, to the existence of economic rents for sellers close to the border. The attempt to tax such rents will nevertheless reduce revenue collection in that country, due to the strategic reaction of the larger country. Secondly, Nielsen (2001) proves that the existence of border audits raises taxes in both countries and may increase the volume of cross-border trade.

Haufler (1996) introduces differences in the preferences for public goods. The author analyzes strategic taxation in a model with trade in only one private good, which is simultaneously imported by the consumers residing in a country with a high tax level and exported by its producers. If the differences between countries in their preferences for public goods are small, Haufler (1996) demonstrates the existence of the Nash equilibrium, in which the country with the greater preference for public goods has a higher tax rate. Subsequently, Haufler (1996) considers the two tax coordination measures examined by Kanbur and Keen (1993): a minimum tax rate and a coordinated increase in the transport costs, obtaining less conclusive results. Tax coordination in general benefits countries with high taxes, while the welfare of countries with lower taxes will be reduced if tax coordination reduces the tax rate in the other country. This last case may occur when tax competition in the initial equilibrium is moderate, due to the relatively high costs of cross-border shopping, or when the elasticity of substitution between private and public consumption is low in the high-tax country.

Following the methodology of his previous work, Nielsen (2002) shows that it is possible to generate cross-border shopping from small countries towards larger ones, as long as the marginal cost of public funds in the smaller country sufficiently exceeds that of the bigger one, whether because the citizens of the smaller country value public goods more highly than the citizens of the larger country, or because the taxes other than those on sales are more distorting in the smaller country. The wedge created in the marginal cost of public funds justifies, in his opinion, the different examples existing in the real world of cross-border shopping from small countries to large ones, such as from Canada to the United States or from Denmark to Germany.

As explained above, a final group of studies attempts to derive optimal taxation rules in diverse scenarios. Scharf (1999) proposes a model in which she considers

the existence of transaction and storage costs. Consumers incur fixed transaction and transport costs to access in the foreign market a perfect substitute good for the national good. The results show that the size of the optimal tax is inversely proportional to the volume of national transactions. This result permits Scharf (1999) to state that when there exist increasing returns to scale in tax avoidance with respect to the quantities traded, then smaller transactions must be taxed more heavily than larger ones.

Christiansen (1994) analyzes the effects of market structure upon cross-border shopping. In a competitive market, the traditional inverse elasticity rule (in this case, of domestic demand) represents a valid characterization of the optimal tax rate. When domestic supply comes from a foreign monopoly, a modified inverse elasticity rule is applied, due to the possibility that part of the tax burden may be shifted onto the owners of the firm. Lastly, the most predictable response to a rise in prices or taxes abroad will be an increase in domestic taxes.

Christiansen (2003) also investigates the implications of cross-border shopping for the tax structure of a high-tax country which is exposed to the purchases of its residents in a neighboring country. Firstly, the paper shows that taxes on products that generate externalities (such as excise duties on cigarettes, alcohol, or fuel) must be fixed at a level lower than that determined by Pigou's rule, in order to compensate for the inefficiencies derived from cross-border shopping. With regard to taxes established to collect revenue (such as general taxes on sales), Christiansen (2003) explains that the reduction of the rates imposed upon goods subject to cross-border shopping may not be an advisable policy, since it will produce distortions in the consumption of the remaining goods subject to taxation. Second, when it is considered that an individual may acquire several products at the same time in the neighboring country, Christiansen (2003) concludes that the most efficient way of containing cross-border shopping may be to reduce the tax on the products purchased both inside and outside the country.

Applied Research

General Aspects

Although, according to Mikesell (1970), interest in cross-border shopping induced from tax differences could already be detected in the United States from the mid 1930s onwards, the first applied research was performed between the 1950s and 1970s (Maliet 1955; McAllister 1961; Hamovitch 1966; Levin 1966; Mikesell 1970, 1971), and it established the fundamental methodological aspects which today are prevalent in this literature.

In its most general form, the following demand function is used:

$$S_r = S(P_r, P_{\bar{r}}, T_r, T_{\bar{r}}, Y_r, C_r, X) \quad (1)$$

In general, S_r are sales in territory r (being r a country, region or locality) of the product or products under analysis, although some studies use consumption as the endogenous variable. As explanatory variables, P_r and $P_{\bar{r}}$, T_r and $T_{\bar{r}}$ are, respectively, the prices and taxes of the products analyzed, in territory r and in its

neighboring territories, \bar{r} , Y_r is the income in territory r , C_r is the travel cost from this territory to its neighboring ones, and X is a set of additional control variables. The variables related to transport costs were not explicitly incorporated into the empirical models until the work performed by Fox (1986), though since then they have been habitual in them. With regard to the additional control variables, their inclusion is determined by the specific objective sought in each application: the number of Fridays in the month, to explain the sales of alcohol (Asplund et al. 2007); the stock of vehicles, to explain the sales of gasoline (Banfi et al. 2005); the expenditure on advertising of the tobacco companies, to explain the sales of tobacco (Coats 1995); and so on.

Usually, the specifications take a multiplicative form, which favors subsequent logarithmic transformation and a direct interpretation of the estimated coefficients in terms of elasticity. An illustration of this is provided by the work of Walsh and Jones (1988) which, despite being very simple, is also quite complete. These authors analyze the effect derived from a reduction of 3%, by one point annually, of the sales tax rate in the state of West Virginia in the 3 year period, 1980–1982. To do this, Walsh and Jones (1988) formulate the following multiplicative demand model:

$$S_{it} = A_i Y_{it}^a P_{it}^b C_i^c \quad (2)$$

with which they attempt to explain the impact upon per capita sales of taxed goods, S , of variables such as income per capita, Y , the after-tax price of goods in the county relative to that available in other adjacent locations, $P = \frac{p(1+T)}{p_o(1+T_o)}$, and the transport cost associated with the journey to purchase in other locations, C , measured as the average distance (in miles) of the residents of West Virginia with regard to the nearest commercial centre in an adjacent state. A is a multiplicative factor. Finally, i denotes the county and t the time period.

Walsh and Jones (1988) estimate Eq. 2 in logarithmic form, using a data panel of 46 counties between 1979 and 1984:

$$\ln S_{it} = \ln A_i + a \ln Y_{it} + b \ln P_{it} + c \ln C_i + u_{it} \quad (3)$$

Their results suggest that the residents of the counties that border West Virginia choose to purchase outside their state, in order to avoid the higher taxation which they would bear in their county of residence and display the opposite behaviour when faced with reductions in their own county taxes: a reduction in the tax rate of one per cent means an increase in sales of 5.9%. Walsh and Jones (1988) also demonstrate the absence of cross-border shopping in areas distant from the border.

The results obtained by Walsh and Jones (1988) are a perfectly representative example of those obtained unanimously by the literature on cross-border shopping:— the tax differentials between bordering territories induce consumers to purchase in those territories where taxation is lower, as long as the tax saving compensates for the transport costs associated with the journey of the purchaser to take advantage of the lower taxation. The magnitude of the impact of tax differences on sales is no small matter. Restricting ourselves, for the moment, to the general tax on sales and the taxation on food and clothing in the United States (a country which has available research which permits the understanding of the effects of its taxation on sales from the early 1950s until today, for diverse territorial areas and taxed products), the

estimations performed repeatedly reflect that an increase by one percentage point in the rate of tax reduces sales in the territory affected by, approximately, 6%.⁴ Naturally, this reduction in sales is not incompatible with an increase in tax revenue collection, due to the increase in the tax rate.

Alcohol, Cigarettes, Gasoline, Lotteries

Although the existence of the border effect—and its impact upon revenue—has been demonstrated for various goods, time periods and geographical areas,⁵ applied research has concentrated on testing the existence of cross-border shopping for some specific products: alcoholic drinks, cigarettes, gasoline and gambling. This section examines in detail a study devoted to each of these products, with the aim of emphasizing how the general model presented in the previous subsection is adapted to each specific problem.

Asplund et al. (2007) estimate, following the methodology of Walsh and Jones (1988), how the monthly sales of alcohol in Sweden, q , respond to prices in Denmark and Germany, P^F , taking into account at the same time the sensitivity of the distance to the border:

$$\Delta_{12} \ln [q] = b_0 + b_1 \Delta_{12} \ln [P^D] + g(d, D) \Delta_{12} \ln [P^F] + \beta \Delta_{12} X + \varepsilon \quad (4)$$

where P^D is the domestic price, $g(d, D) = d_0 + d_1 D + d_2 D^2 + d_3 D^3$ is the elasticity with regard to the prices abroad, which depends on the distance to the border, D , and finally X is a vector which represents the varying seasonal behavior of consumption: concretely, it lists the number of Fridays, the day on which most alcohol is traditionally sold. The exercise is performed using a panel of 287 municipalities, for the period between 1995 and 2004. The authors estimate Eq. 4 as a system of seemingly unrelated equations (SUR).

Asplund et al. (2007) conclude that the coefficients are, as a whole, significant; they display the expected signs and are plausible as regards magnitude. The results suggest that elasticity in border municipalities with respect to foreign prices is approximately 30%; this is reduced to 20% (10%) when the distance is widened to 150 (400) kilometers, thereby reflecting the decisive role of distance to the border in the extension of cross-border arbitrage. Furthermore, the lower level of German prices compared to Danish ones compensates for the greater cost of the journey to Germany, both in terms of time and outlays. The extra distance associated with buying in Germany instead of Denmark may be economically profitable for some consumers, especially those who purchase large quantities. The diversion of consumption towards the other Swedish border, that of Finland, demonstrates the

⁴ See Hamovitch (1966), Levin (1966), Mikesell (1970), Fisher (1980), Fox (1986), Mikesell and Zorn (1986) and Tosun and Skidmore (2007).

⁵ For example, Boisvert and Thirsk (1994) and Di Matteo and Di Matteo (1996) have empirically demonstrated the influence which the Canadian Goods and Service Tax plays in the decision of consumers in that country to travel to the United States border to purchase. Ferris (2000) shows that the greatest proportion of revenue lost in Canada due to cross-border shopping is derived from professional or organised smuggling. This is, in aggregate terms, three times higher than the decreases generated by private cross-border shopping. Fitzgerald (1992) provides evidence of cross-border shopping in Ireland, and Gordon and Nielsen (2001) do the same in the case of Denmark.

negligible influence of distance upon the sales of wine and beer, while the sale of spirits is highly sensitive to it. The elasticity in the Finnish border is greater than in the Danish one, given the absence of direct costs in crossing the border.

Lastly, the authors estimate that the reduction in Danish taxes on alcohol carried out in October 2003 may have produced a 2.2% reduction in the revenue collection of Sweden, with more than a quarter of that effect concentrated on the localities closest to the border.

The cross-border purchases of alcoholic drinks has also been tested by Crawford and Tanner (1995) and Crawford et al. (1999) for the United Kingdom, by Smith (1976) and Beard et al. (1997) for the United States and by Fleenor (1999) for Canada and the United States.

There are a great number of studies concerning tobacco cross-border shopping, especially in the United States, where smuggling of this product is a traditional concern of the authorities (Fisher 2007: 394–5). The existence of cross-border shopping has been demonstrated empirically by, among others, Wertz (1971), Warner (1982), Thursby et al. (1991), Coats (1995), Saba et al. (1995), Fleenor (1998), Alamar et al. (2003), and more recently, by Chiou and Muehlegger (2008). The results obtained by the literature consistently show that between 2% and 6% of the cigarettes consumed in the United States are smuggled.

Using microdata for cigarette consumption in the period 1992–2002 in the Metropolitan Statistical Areas (MSA) of the United States, Lovenheim (2008) develops and estimates a demand model for cigarettes, which explicitly incorporates the decision to purchase in a bordering state. The reduced form demand equation is as follows:

$$\begin{aligned} & \Pi_0 + \Pi_1 \ln(P_h) + \Pi_2(\ln(P_h) - \ln(P_b)) + \Pi_3(\ln(P_h) - \ln(P_b))^2 + \\ & + \Pi_4 \ln(D_i)(\ln(P_h) - \ln(P_b)) + \gamma X_i \end{aligned} \quad (5)$$

The dependent variable is alternatively the number of cigarettes smoked daily by smokers, the rate of participation of smokers, and the number of cigarettes smoked per day, including non-smokers. The explanatory variables of interest are the price and the tax, in real terms, in the state of residence (denoted by subscript h) and in the closest neighboring locality with a lower price or tax (subscript b) and the distance to this locality (D). Age, gender, salary, marital status, race, education, and employment situation are considered as demographic variables (X). A time trend and fixed spatial effects are also included.

The principal results obtained by Lovenheim (2008) are as follows. Firstly, the price elasticity of the state of residence (that is, the percentage change in the consumption of residents when the price in the state of residence changes by 1%) is, on average, indistinguishable from zero. This means that, in the presence of price differences between localities (and, therefore, of cross-border shopping), changes in the price of tobacco have no effect upon the consumption of this product. By contrast, and secondly, the total price elasticity (i.e. the percentage change in consumption when all the prices change by 1%, and thus, the incentives to smuggle are not modified) is negative and of a considerable magnitude, but inelastic. In accordance with this second result, state taxation of cigarettes would be a good instrument to reduce cigarette consumption and to obtain public revenue, if smuggling between states were eradicated.

Lovenheim (2008) estimates that cross-border purchases slightly increase tobacco consumption, and that between 13.1% and 25.1% of consumers in metropolitan areas participate in cross-border shopping for cigarettes.

Finally, Lovenheim (2008) warns that the average results given above hide considerable heterogeneity among states, derived from the geographical distribution of the population. To give just two examples, in Washington, D.C. (which is three miles from Virginia), 63.48% of consumers casually smuggle, and New Hampshire (which is the New England state with the lowest taxes) doubles its sales of tobacco due to smuggling.

With regard to cross-border fuelling, Banfi et al. (2005) estimated, using the data panel technique, the impact of gasoline price differences between the border regions of Switzerland and adjacent areas in Germany, Italy, and France have upon the demand for this fuel in the Swiss border areas. They propose the following specification:

$$\begin{aligned} \ln G_{it} = & \alpha_0 + \alpha_1 \ln(P_{Swiss})_{it} + \alpha_2 \ln\left(\frac{P_{For}}{P_{Swiss}}\right)_{it} + \alpha_3 \left[\ln\left(\frac{P_{For}}{P_{Swiss}}\right)_{it} \right] \left[\ln\left(\frac{N_{For}}{N_{Swiss}}\right)_{it} \right] + \\ & + \alpha_4 \ln\left(\frac{I_{Swiss}}{N_{Swiss}}\right)_{it} + \alpha_5 \ln\left(\frac{I_{For}}{N_{For}}\right)_{it} + \alpha_6 \ln(N_{Swiss})_{it} + \\ & + \alpha_7 \ln(N_{For})_{it} + \alpha_8 \ln(Comm)_{it} + \alpha_9 \ln(Cars)_{it} + \mu_{it} \end{aligned} \quad (6)$$

where G_{it} represents the demand for gasoline in the Swiss border regions -defined as those located less than five kilometres from Italy, Germany, or France- approximated by the sales of gasoline of the three principal oil companies (SHELL, BP and ESSO). $(P_{Swiss})_{it}$ and $(P_{For})_{it}$ are, respectively, the real prices of gasoline in the border regions of Switzerland and in the foreign counties adjacent to them. $(I_{Swiss})_{it}$ and $(I_{For})_{it}$, $(N_{Swiss})_{it}$ and $(N_{For})_{it}$ represent the income and population, respectively, of the Swiss and foreign border regions. Finally, $Comm_{it}$ represents the daily commuters who travel to Switzerland from the foreign countries' border regions and $Cars_{it}$ the stock of vehicles in each border region. The sub-index i denotes the three Swiss border regions and $t=1985, \dots, 1997$, the period under study.

The estimation permits the detection of an important cross-border effect since, in the case of a reduction of 10% in the Swiss price of gasoline, demand in the Swiss border areas would increase by almost 17.5%. Moreover, the authors also show with their results that if a proposed tax on CO₂ emissions were finally approved in Switzerland, this would eliminate a considerable part of car journeys caused by price differentials.

Rietveld et al. (2001) test the existence of cross-border fuelling between The Netherlands, Germany and Belgium; Doyle and Samphantharak (2008) and Manuszak and Moul (2008) do so for diverse regions of the United States, while Leal et al. (2009) undertake the same exercise among Spanish regions.

The last group of research we wish to concentrate on in this section is related to the cross-border shopping produced by the taxation of gambling. Garrett and Marsh (2002) undertake the first analysis in the United States, estimating the existence of cross-border lottery shopping among the border counties of Kansas and its neighboring states, using 1998 data corresponding to the 105 Kansas counties.

Garrett and Marsh (2002) propose a regression of per capita sales of lottery tickets in each county, using a dummy variable for each border state and a set of control

variables: income, education, religious affiliation, ethnicity, tourist infrastructure, number of miles of road in the county, urban population and the number of retail lottery sales outlets available in the county. They also include dummy variables indicative of the existence of casinos and parimutuel racetracks.

Estimating by ordinary least squares and by maximum likelihood, to correct for spatial correlation, Garrett and Marsh (2002) confirm the existence of cross-border lottery shopping, and calculate that this phenomenon entails losses for Kansas of approximately 10.5 million dollars or 5.4% of its lottery sales. Tosun and Skidmore (2004) and Skidmore and Tosun (2008) have also provided empirical evidence of cross-border lottery shopping.

Internet

The impressive development of trade over the Internet gives rise to very interesting challenges for applied research, since it widens the list of options available to purchasers. Internet purchasing is now an alternative to purchasing in the place of residence or in a border locality. Goolsbee (2000), Alm and Melnik (2005), and Goolsbee et al. (2007) analyze the effects of sales taxes upon the decision of an individual to buy in his or her locality or over the Internet; they find a positive and significant relationship between residence in a locality with high taxes and the probability of purchasing via Internet. Goolsbee (2000) estimates tax elasticity in the range of two to four, while Alm and Melnik (2005) calculate an elasticity of approximately 0.5.

Ballard and Lee (2007) combine the analysis of the effects of taxes upon Internet purchases with the analysis of cross-border shopping. To do this, and using data for the United States from the *Current Population Survey* for the years 1997 and 2001, they estimate a system with two probit equations, which includes a selection equation for access to Internet and another equation for Internet purchases. The specification of both equations coincides:

$$\begin{aligned}
 y_i = & \beta_0 + \beta_1 \text{HOMETAXPRICE}_i + \beta_2 \text{TAXRATIO}_i + \beta_3 \text{TAXBASE}_i + \\
 & + \beta_4 \text{LOGINCOME}_i + \beta_5 \text{FEMALE}_i + \beta_6 \text{WHITE}_i + \\
 & + \beta_7 \text{MARRIED}_i + \beta_8 (\text{FEMALE} * \text{MARRIED})_i + \\
 & + \beta_9 (\text{WHITE} * \text{MARRIED})_i + \beta_{10} (\text{FEMALE} * \text{WHITE})_i + \\
 & + \beta_{11} (\text{FEMALE} * \text{WHITE} * \text{MARRIED})_i + \beta_{12} \text{HIGHGRAD}_i + \\
 & + \beta_{13} \text{COLLGRAD}_i + \beta_{14} \text{PROGRAD}_i + \beta_{15} \text{NUMCOMP}_i + \\
 & + \beta_{16} \text{AGE15}_i + \beta_{17} \text{AGE20}_i + \beta_{18} \text{AGE30}_i + \beta_{19} \text{AGE50}_i + \beta_{20} \text{AGE60}_i + \\
 & + \beta_{21} \text{D2001}_i + \beta_{22} \text{CPICHANGE}_i + \text{COUNTYDUMMIES} + u_i
 \end{aligned} \tag{9}$$

The dependent variable y_i is a binary variable which reflects, depending on the equation estimated, whether the individual accesses Internet, and whether he or she purchases via Internet.

Among the explanatory variables of a fiscal nature, *HOMETAXPRICE* represents the sales tax rate in the county of residence; *TAXRATIO* reflects the ratio between the domestic rate and the lower tax rate in the bordering counties; *TAXBASE* measures the width of the taxable base of the state sales tax. *LOGINCOME* captures, in logarithms, family income, *NUMCOMP* the number of computers in the household, and *CPICHANGE* the percentage change in the Consumer Price Index. Additionally,

a set of binary variables are incorporated to reflect characteristics of demography (*FEMALE*, *WHITE* and *MARRIED*), education (*HIGHGRAD*, *COLLGRAD* and *PROGRAD*) and different ages (*AGE*(·)). Finally, *D2001* is a dummy variable which takes the value of one when the data correspond to 2001 and zero when they refer to 1997, and *COUNTYDUMMIES* controls for the existence of specific effects of the counties.

Ballard and Lee (2007) obtain two basic results. Firstly, a resident in a county with high tax rates is more likely to purchase via Internet than a resident in a county with low rates. Secondly, the resident in a county which borders another one with a lower tax rate or a narrower tax base is less likely to purchase via Internet, *ceteris paribus*. For Ballard and Lee (2007), these results are consistent with the interpretation that home-country shopping, cross-border shopping and Internet shopping are substitutes.

Discussion of the Literature and Economic Policy Implications

In light of the wide-ranging literature reviewed in the previous sections, three fundamental conclusions may be underlined. Firstly, the majority of theoretical literature appears to support, from a variety of methodological approaches, the results of Kanbur and Keen (1993), since they show how small countries select, in the Nash equilibrium, a lower tax rate on commodities than large ones, although they collect a percentage higher than that corresponding to their relative size. Secondly, the empirical literature follows the same basic strategy, namely of specifying and estimating a demand function whose essential arguments are the prices, taxes and income in the territories affected. The studies differ in the selection of the control variables which, logically, are adapted to the specific problem tackled in each application, and in the econometric technique employed, although the use of panel data estimation is predominant. Thirdly, the results achieved by empirical research clearly coincide and support the principal result of theory: tax differentials between neighboring areas induce consumers to purchase in that area where taxation is lower than, as long as the tax saving compensates for the transport costs related to the journey made by the purchaser.

These results have obvious economic policy implications, which cannot be ignored by governments when designing their tax policies. If a jurisdiction establishes a higher tax on commodities than other jurisdictions (especially those areas closest to it), part of the purchases which had previously been made in that jurisdiction will be diverted to others, and this will firstly affect revenue collection in the jurisdiction affected, due to this tax and to those which may, in turn, be charged upon those same purchases (such as, excise duties and VAT). The importance of these effects must not be underestimated. In the case of the United States, Manuszak and Moul (2008) have recently estimated that the area of Chicago, the territory with the highest gasoline taxes, is losing approximately 40% of the tax-raising capacity that would exist if taxes were equal throughout the region. In addition to the direct effects upon revenue collection, and as Fisher (2007) notes, the reduction in purchases may affect retail sales activity, employment and house prices in the jurisdiction and, consequently, tax revenue from property, income, and sales. Finally, as Keen points out (2002), cross-border transactions will also involve welfare effects.

As Crawford et al. (2008) state, the policy response appropriate to cross-border shopping will depend on the evaluation made of government behavior. If it is believed that governments have a natural tendency to excessive growth, attempts to impose some form of tax coordination that limits the effects of cross-border shopping will not be acceptable. By contrast, if it is considered that governments attempt to maximize social welfare, tax coordination among jurisdictions will be desirable. In this regard, the strategy of imposing a minimum tax rate, recommended by Kanbur and Keen (1993), has been adopted by the European Union for indirect taxation since the introduction of the Single Market, and is applied in some federal countries, such as Spain, in order to coordinate the exercise of the tax competencies of regional governments.

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References

- Alamar, B., Mahmoud, L., & Glantz, S. A. (2003). *Cigarette smuggling in California: Fact and fiction*. San Francisco: Center for Tobacco Control Research and Education, Tobacco Control Policy Making, University of California (<http://repositories.cdlib.org/ctcre/tcpmus/Smuggling2003>).
- Alm, J., & Melnik, M. (2005). Sales taxes and the decision to purchase online. *Public Finance Review*, 33(2), 184–212.
- Asplund, M., Friberg, R., & Wilander, F. (2007). Demand and distance: Evidence on cross-border shopping. *Journal of Public Economics*, 91(1–2), 141–157.
- Ballard, C. L., & Lee, J. (2007). Internet purchases, cross-border shopping, and sales tax. *National Tax Journal*, 60(4), 711–725.
- Banfi, S., Filippini, M., & Hunt, L. C. (2005). Fuel tourism in border regions: The case of Switzerland. *Energy Economics*, 27(5), 689–707.
- Beard, T. R., Gant, P. A., & Saba, R. P. (1997). Border-crossing sales, tax avoidance, and state tax policies: An application to alcohol. *Southern Economic Journal*, 64(1), 293–306.
- Boisvert, M., & Thirsk, W. (1994). Border taxes, cross-border shopping, and the differential incidence of the GST. *Canadian Tax Journal*, 42(5), 1276–1293.
- Chiou, L., & Muehlegger, E. J. (2008). Crossing the line: The effect of cross border cigarette sales on state excise tax revenues. *John F. Kennedy School of Government Research Working Paper Series RWP08-012*
- Christiansen, V. (1994). Cross-border shopping and the optimum commodity tax in a competitive and a monopoly market. *Scandinavian Journal of Economics*, 96(3), 329–341.
- Christiansen, V. (2003). Cross-border shopping and tax structure. *EPRU Working Paper Series*, 2003-04, Economic Policy Research Unit (EPRU), University of Copenhagen, Department of Economics.
- Coats, R. M. (1995). A note on estimating cross-border effects of state cigarette taxes. *National Tax Journal*, 48(4), 573–584.
- Crawford, I., & Tanner, S. (1995). Bringing it all back home: Alcohol taxation and cross-border shopping. *Fiscal Studies*, 16(2), 94–114.
- Crawford, I., Smith, Z., & Tanner, S. (1999). Alcohol taxes, tax revenues and the single European market. *Fiscal Studies*, 20(3), 287–304.
- Crawford, I., M. Keen and S. Smith (2008). Value-Added Tax and Excises. In *Report of a Commission on Reforming the Tax System for the 21st Century, Chaired by Sir James Mirrlees*. London: The Institute for Fiscal Studies.
- Di Matteo, L., & Di Matteo, R. (1996). An analysis of Canadian cross-border travel. *Annals of Tourism Research*, 23(1), 103–122.
- Doyle, J. J., Jr., & Samphantharak, K. (2008). \$2.00 Gas! studying the effects of a gas tax moratorium. *Journal of Public Economics*, 92(3–4), 869–884.
- Ferris, J. S. (2000). The determinants of cross-border shopping: Implications for tax revenues and institutional change. *National Tax Journal*, 53(4, Part 1), 801–824.

- Fisher, R. C. (1980). Local sales taxes: Tax rates differentials, sales loss, and revenue estimation. *Public Finance Quarterly*, 8(2), 171–188.
- Fisher, R. (2007). *State and local public finance* (3rd ed.). Mason: Thompson South-Western.
- Fitzgerald, J. D. (1992). The distortionary effects of taxes on trade in border areas: The Republic of Ireland-UK border. In G. Winckler (Ed.), *Tax harmonization and financial liberalization in Europe* (pp. 39–56). New York: St. Martin's Press.
- Fleenor, P. (1998). How excise tax differentials affect interstate smuggling and cross-border sales of cigarettes in the United States. *Background Paper*, 26, Tax Foundation.
- Fleenor, P. (1999). How Excise Tax Differentials Affect Cross-Border Sales of Beer in the United States. *Background Paper*, 31, Tax Foundation.
- Fox, W. F. (1986). Tax structure and the location of economic activity along state borders. *National Tax Journal*, 39(4), 387–401.
- Garrett, T. A., & Marsh, T. L. (2002). The revenue impacts of cross-border lottery shopping in the presence of spatial autocorrelation. *Regional Science and Urban Economics*, 32(4), 501–519.
- Goolsbee, A. (2000). In a world without borders: The impact of taxes on internet commerce. *Quarterly Journal of Economics*, 115(2), 561–576.
- Goolsbee, A. M., Lovenheim, M. F. & Slemrod, J. (2007). Playing with fire: Cigarettes, taxes and competition from the internet. *Policy Paper*; 07-002, Stanford Institute for Economic Policy Research.
- Gordon, R. H. (1983). An optimal taxation approach to fiscal federalism. *Quarterly Journal of Economics*, 98(4), 567–586.
- Gordon, R. H., & Nielsen, S. B. (2001). Tax evasion in an open economy: Value-added vs. income taxation. *Journal of Public Economics*, 66(2), 173–197.
- Hamovitch, W. (1966). Effects of Increases in Sales Tax Rates on Taxable Sales in New York City. In *Financing Government in New York City*, Graduate School of Public Administration of New York University Report to the Temporary Commission on City Finances (pp. 619–634). New York: New York University.
- Haufler, A. (1996). Tax coordination with different preferences for public goods: Conflict or harmony of interest? *International Tax and Public Finance*, 3(1), 5–28.
- Hvidt, M., & Nielsen, S. B. (2001). Non-cooperative vs. Minimum-rate commodity taxation. *German Economic Review*, 2(4), 315–326.
- Kanbur, R., & Keen, M. (1993). Jeux Sans Frontières: Tax competition and tax coordination when countries differ in size. *American Economic Review*, 83(4), 877–893.
- Keen, M. (2002). Some international issues in commodity taxation. *Swedish Economic Policy Review*, 9(1), 9–39.
- Leal, A., López-Laborda, J., & Rodrigo, F. (2009). Prices, taxes and automotive fuel cross-border shopping. *Energy Economics*, 31(2), 225–234.
- Levin, H. M. (1966). An Analysis of the Economic Effects of the New York City Sales Tax. In *Financing Government in New York City*, Graduate School of Public Administration of New York University Report to the Temporary Commission on City Finances (pp. 635–691). New York: New York University.
- Lockwood, B. (1993). Commodity tax competition under destination and origin principles. *Journal of Public Economics*, 52(2), 141–162.
- Lovenheim, M. F. (2008). How far to the border?: The extent and impact of cross-border casual cigarette smuggling. *National Tax Journal*, 61(1), 7–33.
- Maliot, L. D. (1955). *A Comparative Study of the Illinois Retailers' Occupation Tax and the Iowa Retail Sales and Use Taxes*. Unpublished Doctoral Dissertation, University of Illinois, Urbana.
- Manuszak, M. D., & Moul, C. C. (2008). How far for a buck? Tax differences and the location of retail gasoline activity in Southeast Chicagoland, *mimeo* (http://artsci.wustl.edu/~moul/pdf_drafts/chicago-gas-tax.pdf).
- Mcallister, H. E. (1961). The border tax problem in Washington. *National Tax Journal*, 14, 361–374.
- Mikesell, J. L. (1970). Central cities and sales tax rate differentials: The border city problem. *National Tax Journal*, 23(2), 206–213.
- Mikesell, J. L. (1971). Sales taxation and the border county problem. *Quarterly Review of Economics and Business*, 11, 23–29.
- Mikesell, J. L., & Zorn, C. K. (1986). Impact of the sales tax rate on its base: Evidence from a small town. *Public Finance Quarterly*, 14(3), 329–338.
- Mintz, J., & Tulkens, H. (1986). Commodity tax competition between member states of a federation. *Journal of Public Economics*, 29(2), 133–172.
- Nielsen, S. B. (2001). A simple model of commodity taxation and cross-border shopping. *Scandinavian Journal of Economics*, 103(4), 599–623.

- Nielsen, S. B. (2002). Cross-border shopping from small to large countries. *Economic Letters*, 77(3), 309–313.
- Ohsawa, Y. (1999). Cross-border shopping and commodity tax competition among governments. *Regional Science and Urban Economics*, 29(1), 33–51.
- Rietveld, P., Bruinsma, F. R., & Van Vuuren, D. J. (2001). Spatial graduation of fuel taxes; consequences for cross-border and domestic fuelling. *Transportation Research Part A: Policy and Practice*, 35(5), 433–457.
- Saba, R. P., Beard, T. R., Ekelund, R. B., Jr., & Ressler, R. W. (1995). The demand for cigarette smuggling. *Economic Inquiry*, 33(2), 189–202.
- Scharf, K. A. (1999). Scale economies in cross-border shopping and commodity taxation. *International Tax and Public Finance*, 6(1), 89–99.
- Skidmore, M., & Tosun, M. S. (2008). Do new lottery games stimulate retail activity? Evidence from West Virginia Counties. *Journal of Regional Analysis and Policy*, 38(2), 45–55.
- Smith, R. (1976). The legal and illegal markets for taxed goods: Pure theory and an application to state government taxation of distilled spirits. *Journal of Law and Economics*, 19, 393–429.
- Thursby, M., Jensen, R., & Thursby, J. (1991). Smuggling, camouflaging, and market structure. *Quarterly Journal of Economics*, 106(3), 789–814.
- Tosun, M. S., & Skidmore, M. (2004). Interstate competition and lottery revenues. *National Tax Journal*, 57(2), 163–178.
- Tosun, M. S., & Skidmore, M. (2007). Cross-border shopping and the sales tax: An examination of food purchases in West Virginia. *The B.E. Journal of Economic Analysis & Policy*, 7: Iss. 1 (Topics), Article 63 (><http://www.bepress.com/bejeap/ratingsystem.html>).
- Trandel, G. A. (1994). Interstate commodity tax differentials and the distribution of residents. *Journal of Public Economics*, 53(3), 435–457.
- Walsh, M. J., & Jones, J. D. (1988). More evidence on the ‘border tax’ effect: The case of West Virginia, 1979–84. *National Tax Journal*, 41(2), 261–265.
- Wang, Y. (1999). Commodity taxes under fiscal competition: Stackelberg equilibrium and optimality. *American Economic Review*, 89(4), 974–981.
- Warner, K. E. (1982). Cigarette excise taxation and interstate smuggling: An assessment of recent activity. *National Tax Journal*, 35(4), 483–490.
- Wertz, K. L. (1971). Cigarette taxation by the American States. *National Tax Journal*, 24(4), 487–492.