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Spillovers from the beer market to U.S. cigarette demand☆

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ABSTRACT

We study the cross-effects of the beer market on U.S. cigarette demand. The extant literature has mainly focused on the cigarettes and (hard) liquor relationship with inconclusive findings on substitution or complementarity. Our results show cigarettes and beer serve as complements as supported through beer price (tax) and non-price (regulation) channels. We also find negative and elastic cigarette demand and positive income elasticity. Border effects, both intranational and international, as well as habit-formation effects are significant, while the effects of cigarette advertising and income inequality are insignificant. Policy implications are discussed.

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1. Introduction

The demand for addictive products has interested scholars and lawmakers for quite some time; in particular, cigarettes and alcohol have garnered quite a bit of attention in the literature.[1] Overtime, the literature has recognized the spillover effects associated with smuggling activities.[2] These spillovers, however, are potentially multidimensional. For instance, spillovers can be (i) geographic whereby smuggling (both casual and organized) takes place across jurisdictions to exploit price differentials (mainly due to excise tax differences); or (ii) they could be driven by cross-product effects, in which demand changes in one product, via tax/regulatory changes (Fleenor, 1998; Warner, 1982) or socio-economic factors (Aristei and Pieroni, 2009) have an impact on the demand for other products (via smuggling or substitution). Obviously, as noted by Lanoie and Leclair (1998), Gallet (1999), and Bates et al. (2015), lawmakers need a careful accounting of all spillovers in order to design effective cessation and taxation policies.

This study provides a state-level analysis of cigarette demand in the U.S., focusing on the spillovers from the beer market. This interdependence takes into account the abovementioned spillover effects. Specifically, we examine the cross-price elasticities of cigarette demand with regard to beer taxes/prices and the effect of border prices to account for geographic spillovers. The related literature has almost exclusively focused on the interdependence between cigarettes and hard liquor without a clear cut finding of substitution or complementarity across samples from various countries.[3] In contrast, the present work focuses on cigarette demand and its responsiveness to the beer market (i.e., prices and regulations).

In recent years, beer drinking in the U.S. has been increasing while consumption of hard liquor has been decreasing.[4] Furthermore, media advertising of beer seems more acceptable and prevalent than hard liquor advertising (although the Internet has undermined media restrictions). Finally, although both smoking and drinking are addictive, given the qualitative differences in their secondary effects, each face different regulations on consumption, sale/marketing, and transportation. For example, (i) unlike cigarettes, there are restrictions on the sale of alcohol as it may not be sold on a particular day or certain times during the day; (ii) the transportation of cigarettes is relatively free whereas beer/alcohol cannot be transported in opened containers or opened multipacks; and (iii)

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[1] See Gallet and List (1998), Chaloupka and Warner (2000), and U.S. Department of Health and Human Services (2000).

[2] See ACIR (1985); Baltagi and Levin (1986); Coats (1995), and Thursby and Thursby (2000).

[3] See Fogarty (2010) for a literature survey; Goel and Morey (1995) for the U.S.; Pierani and Tiezzi (2009) for Italy; and Tauchmann et al. (2013) for Germany; also see Clements et al. (2010).

[4] See http://www.gallup.com/poll/174074/beer-americans-adult-beverage-choice-year.aspx, https://www.brewersassociation.org/statistics/national-beer-sales-production-data/

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alcohol does not face government-mandated restrictions like the ban on cigarette broadcast advertising (see Gallet, 1999). Indeed, these regulations have differing effects on the demand for the two products and, consequently, on related spillovers.

Section 2 describes the model to be employed and the data. Section 3 discusses the empirical results while Section 4 provides concluding remarks.

2. Model and data

We begin by following the literature in specifying the basic model for cigarette demand (see, for example, Chaloupka and Warner, 2000), with the main novelty lying in consideration of beer market spillovers, in general form as follows:

$$C_{it} = f\left(P^{C}_{it},\ INC_{it}, P^{B}_{it}, BP^{C}_{it}, BP^{B}_{it},\ CANADA_i, MEXICO_i\right) \quad (1)$$

where i = 1,...,48 represents the 48 contiguous U.S. states and t = 2005,...,2014 denotes the time period of our analysis (Alaska and Hawaii are excluded because they do not have any U.S. contiguous states). Further, superscripts C and B, respectively, denote cigarettes and beer. Cigarette consumption, C, is cigarette sales (20-packs) per capita; cigarette price, P^C, is the average retail cigarette price (cents/pack); and INC denotes personal disposable income per capita in thousands of dollars. As such, it is hypothesized that higher cigarette prices lower consumption, while greater income makes cigarettes more affordable. In addition, related studies typically add one or two other controls depending upon their focus.[5] In our case the focus is on cigarette–beer demand interdependence and related border spillovers. Obtaining data on the beer market, however, is considerably more challenging. Therefore, in the absence of readily available cross-state retail beer prices, we proxy beer prices, P^B, by state beer taxes.[6] We use beer taxes, both own, P^B, and in border states, BP^B, to determine whether beer market price affects cigarette demand. Higher beer prices (taxes) would reduce cigarette demand if the two products are viewed as complements in consumption. In addition, given the somewhat stringent regulations in the beer market, some smokers who would normally consider beer and cigarettes as complements may be dissuaded from purchasing cigarettes due to the increasing transaction costs. We consider both the price and non-price (regulatory) effects of the beer market on cigarette demand.

The geographic effects are incorporated by including cigarette prices in border states, BP^C, and by identifying states with foreign borders. For instance, Maine shares its U.S. border with New Hampshire and international border with Canada.[7] Cigarettes are taxed at the federal, state, and sometimes even at the local level (Orzechowski and Walker, 2014). While federal excise taxes apply uniformly to all states, there are substantial cross-state differentials in other taxes and these differentials provide inducements for individual smokers and organized crime syndicates to engage in trafficking, as discussed by ACIR (1985), Fleenor (1998), and Warner (1982).[8] Higher border prices/taxes would increase a state's consumption or sales. The variables, BP^C and BP^B, are the spatial lags of P^C and P^B, respectively.[9] Following the spatial econometrics literature, we use two weight matrices based on geographic distance to define "neighborliness"—contiguity and inverse distance (Anselin, 1988). To construct the $N \times N$ (48×48) spatial weight matrix, we compute the ijth element for contiguous neighbors as $w_{ij} = 1$ if state i and j share a land border and zero otherwise, and inverse distance weights are calculated as $w_{ij} = \frac{1}{d_{ij}}$ where d is the Euclidean distance between state i and state j. The full weight matrix is an $NT \times NT$ block diagonal matrix with T (number of time periods) copies of the $N \times N$ matrix along the diagonal. Each $NT \times NT$ weight matrix is pre-multiplied by the variable of interest to create its spatial lag. Contiguity is likely to capture both casual (by commuters or consumers crossing state borders on weekends) and organized (by crime syndicates) smuggling, while inverse distance would mainly capture organized smuggling across more distant states.

CANADA and MEXICO, respectively, identify states sharing foreign borders with Canada and Mexico (Connelly et al., 2009). Specifically, CANADA is defined by a dummy variable equal to 1.0 for states bordering Canada: Idaho, Maine, Michigan, Minnesota, Montana, New Hampshire, New York, North Dakota, Vermont, and Washington. MEXICO is defined by a dummy variable equal to 1.0 for states bordering Mexico: Arizona, California, New Mexico, and Texas. The two foreign borders of the United States are somewhat qualitatively different with the Canadian border being substantially longer but much more porous.[10] As discussed previously, the broader literature on the cigarette–alcohol relation has failed to find a robust relation. Hopefully, our analysis will shed light on the interdependence.

The variables defined above were obtained from a variety of sources. The cigarette sales per capita and average retail cigarette price were obtained from the *Tax Burden on Tobacco*. Personal disposable income per capita is from the U.S. Bureau of Economic Analysis, 2014 and state beer tax representing price from the Tax Foundation, 2015. The border state prices for cigarettes and beer are constructed as noted above. Details about the variables, summary statistics, and data sources are provided in Table 1.

3. Empirical results

We use the two-step efficient GMM to estimate Eq. (1), which provides efficient estimates in the presence of unknown forms of heteroskedasticity (Baum et al., 2003). Because P^C and spatial lags (BP^B and BP^C) are likely endogenous, we instrument these variables using cigarette taxes, C^T, and spatial lags (up to the third order) of the exogenous variables, i.e., INC and C^T. Cigarette taxes are a significant component of cigarette prices and many states frequently raise these excise taxes to raise revenues and control smoking (Orzechowski and Walker, 2014). State cigarette tax data were obtained from *Tax Burden on Tobacco*. Rejection of the Kleibergen and Paap (2006) rk LM statistic and insignificance of the Hansen's J statistic support this instrument choice.

3.1. Price spillovers from the beer market to U.S. cigarette demand

Table 2 reports the baseline results associated with Eq. (1) along with two measures of border state spillover effects using spatial contiguity and inverse distance. Given the logarithmic form of key variables, the corresponding coefficients represent elasticities. Consistent with theory, the price elasticity of cigarette demand is negative, while the income elasticity is positive. The coefficient estimates are fairly stable

[5] See Chaloupka and Warner (2000) and U.S. Department of Health and Human Services (2000) for extensive literature reviews.

[6] In the absence of consistent state-level data on beer prices, we proxy beer prices with state beer taxes. Further, we follow the literature in taking cigarette sales to denote cigarette consumption. Finally, while the related data are available for additional years, our choice of the sample period is partly driven by capturing the post-WHO Framework Convention on Tobacco Control period (http://www.who.int/fctc/en/).

[7] Since Alaska and Hawaii do not have any contiguous U.S. border states, they were dropped from the analysis.

[8] In terms of non-price regulatory variations, some regulations such as requirements relating to health warning labels on cigarette packages and broadcast advertising bans are uniform across states, while public place smoking bans vary across states and in many instances are even imposed by local governments (see Goel, 2013).

[9] See Gallet (2006) for an alternate spatial focus that accounts for health information and supply aspects.

[10] We are considering only foreign land borders, although some smuggling from/to nations in close proximity to the United States (e.g., Bahamas and, with the lifting of the trade embargo, Cuba) might also be taking place.