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Bringing It All Back Home: Alcohol Taxation and Cross-Border Shopping

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I. INTRODUCTION

Taxes on alcohol are among the oldest in the UK and are still an important source of tax revenue. In 1992, for example, just prior to the completion of the Single European Market, revenues from excise duties on alcohol totalled over £5 billion, equivalent to 2 per cent on value added tax or 2.5 pence on income tax. Recently, the future of this source of revenue has become uncertain with the relaxation of limits on personal imports of excisable goods by domestic consumers and the increase in cross-border shopping. In this paper, we investigate the effect of increased cross-border shopping on the revenue return to alcohol taxation.[2]

A degree of fiscal harmonisation was an important part of the European Union's programme to establish a market without internal barriers. As part of this programme, the Commission specified a set of minimum tax rates to be applied to alcohol and other taxed goods. The idea of the minimum rate was to avoid cross- border shopping between high- and low-tax countries driving tax rates down towards the rate applied in the lowest-tax country and thus leaving

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[2] In an article of this length, it is inevitable that the issues are discussed relatively briefly. They are addressed in detail in Crawford and Tanner (1995).

many member states with taxes lower than they would otherwise wish. Above these minimum rates, however, variation in tax rates persisted.

TABLE 1

Percentage Variations from Needs Assessments: Non-Metropolitan Districts

Fiscal year	*Average variation from SSAs (%)*	*Standard deviation of percentage variations*	*Number of capped authorities*
1981–82	12.44	22.44	—
1982–83	0.24	23.44	—
1983–84	–1.82	22.08	—
1984–85	3.30	23.34	—
1985–86	3.15	21.04	4
1986–87	–3.72	19.41	2
1987–88	12.19	29.67	4
1988–89	13.01	26.89	4
1989–90	15.99	29.19	1
1990–91	18.36	33.78	2
1991–92	0.01	25.90	21
1992–93	1.64	21.11	162
1993–94	4.97	15.08	168
1994–95	1.89	10.93	122

Table 1 shows the minimum rates adopted for alcohol and those existing in member countries on 1 January 1993. The UK had, and still has, one of the highest sets of alcohol duties in the EU. Such duty differentials contribute towards higher domestic prices relative to those abroad and, therefore, an incentive for cross-border shopping.

There are a number of arguments for taxing alcohol more heavily than other goods, and they can be grouped into two classes. One class relies on instances of possible market failure. First, individuals may not possess all the necessary information to make rational decisions about their consumption of alcohol (this ability may be inversely proportional to their consumption). Second, there are external social costs associated with alcohol consumption which are not taken into account when individuals choose how much to consume, including the social cost to other family members or violent crime. Both would justify raising taxes on alcohol higher than those applied to other goods.

The second class of arguments stems from the efficient indirect tax literature and uses special cases of the Ramsey Rule.[3] One such argument is that, in an

[3] Ramsey, 1927.

efficient indirect tax system, a marginal increase in taxes should reduce demand for all goods by the same proportion, and thus (given some simplifying assumptions) goods should be taxed in inverse proportion to their price elasticities. The demand for alcohol has usually been thought of as relatively price-inelastic justifying a relatively high rate of tax. A second argument follows from the Corlett–Hague result and uses the complementarity between alcohol consumption and leisure to justify additional taxation.[4]

Of course, none of the reasons given above provides a particularly strong explanation as to why alcohol taxes in the UK should be higher than in most other EU member states. The UK has traditionally imposed high rates of duty on alcohol as a matter of fiscal preference, as well as on health grounds. National preferences over the taxation of different goods act strongly in determining relative tax rates; the fact that excise duties are higher in the UK than in most other European countries obviously does not reflect greater negative externalities of alcohol consumption in the UK, but instead a national preference for raising tax revenue by means of taxes on alcohol, rather than on food or on children's clothing, say, which are subject to VAT in every other EU country.

Cross-border shopping is a problem for high-tax countries such as the UK, the Irish Republic and Denmark[5] for three reasons. The first is to do with economic inefficiency. To the extent that consumers' purchase decisions are driven by tax differences rather than by underlying differences in producer prices, cross-border shopping causes an inefficient allocation of resources. The second reason concerns domestic production and sales. If domestic producers are not able or willing to sell their product in low-tax countries, cross-border shopping may mean significant reductions in domestic sales, reduced profits and job losses. If home producers are able to compete in low-tax countries, this effect will be mitigated. However, the domestic industry will not be completely unaffected since additional non-domestic off-licence sales to domestic consumers will inevitably mean a reduction of domestic on-licence sales, and a shift in revenue away from licensed sales, as well as a shift from domestic to non-domestic retailers. Finally, there is the loss of domestic tax revenues. Reduced domestic expenditure on alcohol will cause a loss of excise duty and VAT revenue to the domestic exchequer.

There is no mechanism within the EU for setting excise duty rates that would achieve the maximum revenue yield for the Union as a whole. If there were room for the UK to co-operate with its European neighbours and receive side payments through the EU budget to compensate for lost revenue caused by tax differentials, cross-border shopping might not pose a problem for the domestic exchequer. At present, however, EU member countries are involved in, at best, a zero-sum game, and any shift in alcohol spending away from the UK will be

[4] See Corlett and Hague (1953).
[5] See London Economics (1994) and FitzGerald, Quinn, Whelan and Williams (1988).

fully reflected in increased non-domestic revenue and reduced domestic revenue. HM Customs and Excise estimates the loss of tax revenues due to additional legitimate cross-border shopping in 1993 at £200 million.

Excise duties, particularly on alcohol, appear to be the government's currently preferred method for raising lost tax revenues. This is evident from the 1994 mini- Budget which was designed to replace the revenue shortfall resulting from the government's inability to introduce the second phase of VAT on domestic fuel. In this paper, we focus on the problem of raising tax revenue through taxes on alcohol which now faces the UK government after the completion of the Single Market. We argue that the Single Market and the relaxation of restrictions on personal imports of alcohol have changed the relationship between tax rates and tax revenues. This will affect the government's ability to recoup lost revenues, or raise additional revenues, by altering the tax rate on alcohol.

We are not concerned with estimating the overall 'optimal' level of alcohol taxes in the sense of a tax structure that maximises some social welfare function subject to a revenue constraint. While this is naturally interesting to academic economists, it is of secondary importance to the general policy debate. It is difficult to think of examples where policy has been guided principally by the desire to maximise social welfare. It is relatively easy to think of examples of taxes introduced to raise revenues. Alcohol taxation is one such example. It should be noted, however, that were it to be the case that cutting tax rates could increase revenues, then such a tax reform would also be welfare-improving.

The plan of the paper is as follows. In Section II, we present a simple model of the relationship between tax rates, tax revenues and the price elasticity of demand. We then discuss the likely effect of the Single Market on this relationship. In Section III, we use estimates of the demand for beer, wine and spirits to give some empirical content to the economic model set out in Section II. Section IV concludes.

II. TAX RATES AND TAX REVENUES

Growing concern over cross-border shopping following the completion of the Single Market has led to calls for UK excise duty rates to be cut. In *A Real Alternative* (1994), the Brewers and Licensed Retailers Association argued that a 50 per cent reduction in the excise duty on beer would stimulate sales and employment and would generate net revenue of more than £1 billion by 1999. We focus on one area where there is a clear revenue consequence from cutting tax rates — indirect tax revenues. In this section, we present a simple economic model of the relationship between tax rates and tax revenues and consider the effect of the Single Market on this relationship.

If cutting excise duties does reduce the volume of cross-border trade, it will restore the tax base on which excise duties are levied, although the revenue yield

per unit will be reduced. A key question for the exchequer, therefore, is which effect will predominate; in other words, whether a cut in tax rates will cause revenue to rise or to fall.

It has long been recognised that there is a non-linear relationship between tax rates and tax revenues. Adam Smith (1776) hinted at it, and Dupuit (1844) stated it explicitly: 'If a tax is gradually increased from zero up to a point where it becomes prohibitive, its yield is at first nil, then increases by small stages until it reveals a maximum, after which it gradually declines until it becomes zero again'.

Wherever a tax is raised, be it upon labour, capital or goods and services, the tax base tends to disappear as companies, households and individuals seek to minimise the incidence of the tax. In the case of goods and services, the tax base is domestic demand and, if the law of demand holds, increases in tax rates that are passed on to consumers as price rises will cause domestic demand to contract. What drives the non-linear relationship between the tax rate and tax revenues which Dupuit described is the rate at which changes in the tax rate cause changes in the tax base (domestic demand) and hence lead to changes in tax revenues. The key to this relationship between the tax rate and tax revenue (and hence the key to the problem of revenue maximisation) is the own-price elasticity of demand. This is shown formally below.

Consider the demand for a single taxable good. Denote the tax rate by τ, tax revenue by R, the quantity demanded by q and the tax-exclusive price by π; then the tax revenue function is given by

$$R = \tau\pi q \tag{1}$$

where q is a function of the tax-inclusive price $p = \pi(1+\tau)$. Differentiating with respect to the tax rate, t, we obtain

$$\frac{\partial R}{\partial \tau} = \pi q + \pi\tau \frac{\partial q}{\partial \tau}. \tag{2}$$

By definition, assuming $\partial\pi = 0$,

$$\partial p = \pi\partial\tau \tag{3}$$

and

$$\partial q = \varepsilon q \frac{\partial p}{p} \tag{4}$$

where ε is the own-price elasticity of demand of the taxed good; then, by substitution,

$$(5) \qquad \frac{\partial R}{\partial \tau} = \pi q(1+\frac{\tau}{1+\tau}\varepsilon) = \pi q(1+\frac{p-\pi}{p}\varepsilon).$$

Set $\partial R/\partial\tau = 0$ for a maximum, and solve for the price elasticity of demand and the corresponding tax-inclusive price at which tax revenue is maximised (denoted ε* and *p** respectively).

$$(6) \qquad \frac{\partial R}{\partial \tau} = 0 \Leftrightarrow \varepsilon^* = -\frac{p^*}{p^*-\pi}.$$

If demand were perfectly inelastic across the whole range of possible prices (i.e. the quantity demanded did not respond to price changes at all), then taxes could be increased *ad infinitum* without erosion of the tax base. In this case, an increase in the tax rate will always lead to an increase in revenue and there is no tax rate at which revenue will be maximised. If demand is responsive to price changes, then increases in tax rates that are passed on to consumers as price rises will cause the tax base (demand) to shrink. However, if for all price levels demand falls by proportionately less than prices rise, there is again no limit to the tax rates the government can introduce to increase revenues, since the tax base will not shrink by enough to offset the increase in the tax rate per unit. For example, for a necessary good such as bread for which demand is relatively inelastic, tax rates could be raised very high before demand started to fall substantially. However, in the case of other goods for which demand is more responsive to price changes, tax revenues will decline as tax rates are raised.

These results can be shown formally from equation (5). If demand is completely inelastic (i.e. $\varepsilon = 0$), then the marginal change in revenue for a marginal change in the tax rate is positive ($\partial R/\partial\tau > 0$) over the whole range of tax rates. If, however, demand is elastic (i.e. $\varepsilon < -1$), tax revenues decline as tax rates are increased ($\partial R/\partial\tau < 0$).[6]

Equation (6) gives the relationship between the own-price elasticity and the tax- inclusive and tax-exclusive prices that must hold at the point of revenue maximisation. Note that for any positive tax rate, ε* (the elasticity of demand at

[6] Note that our model generalises easily to include cross-price effects. However, these are usually very poorly determined in demand systems so we concentrate on the direct effects (see Blundell and Robin (1994) on the estimation of cross-price elasticities).

the point of revenue maximisation) must be strictly less than –1. The more responsive demand is to price changes, the sooner tax revenues will start to decline.

TABLE 2

Elasticity Limits

	Tax-exclusive price (pence)	*Tax-inclusive price (pence)*	*Elasticity limit,* $\tilde{\varepsilon}^*$
Beer	98.5	143	-3.21
Wine	146	290	-2.01
Spirits	391	1,112	-1.54

Notes: Beer is defined as bitter, bought on licensed premises, 3.9 per cent alcohol. Wine is still table wine with less than 15 per cent alcohol. Spirits refers to whisky at 40 per cent alcohol.
Typical prices and taxes (in pence) are from HM Customs and Excise (1994, Table D1).

What would demand have to be like for the UK's current set of alcohol excise duties to be revenue-maximising? Suppose that taxes are revenue-maximising; then $p = p^*$. Using equation (6), we can calculate the values of the current elasticities for wine, beer and spirits (i.e. $\varepsilon^*|_{p = p^*}$) implied if the present price and tax structure is revenue-maximising. We label these the limiting elasticities and denote them by $\tilde{\varepsilon}^*$. Table 2 shows these limiting elasticities for beer, wine and spirits calculated using 1993 values for the tax-inclusive and tax-exclusive prices. The interpretation of these figures is straightforward: if the current tax rate is revenue-maximising, then the current own-price elasticity of demand for beer must be –3.21; for wine the current price elasticity would have to be –2.01, and for spirits –1.54. Note that these limiting elasticities are large, particularly for beer and wine.

If actual elasticities are not equal to their limiting values, then it follows from equation (6) that tax rates are not set at their revenue-maximising level. It is therefore possible to increase revenue by altering the tax rate. Equations (7a) and (7b) give the relationship between changes in the tax rate and tax revenue implied if actual elasticities, ε, do not equal their limiting values, and hence the direction in which the tax rates must be changed in order to increase tax revenue.

$$(7a) \qquad |\varepsilon| < |\tilde{\varepsilon}^*| \Rightarrow \frac{\partial R}{\partial \tau} > 0$$

$$(7b) \qquad |\varepsilon| > |\tilde{\varepsilon}^*| \Rightarrow \frac{\partial R}{\partial \tau} < 0$$

From equation (7a), if demand is less elastic than the limiting value, then raising tax rates will increase revenue. From equation (7b), if demand is more elastic

than the limiting value, however, cutting tax rates will increase revenue. For many classes of demand curve,[7] the own-price elasticity varies according to the point along the curve at which it is evaluated. For normal goods, if prices tend to zero, demand tends to infinity and the elasticity tends to zero. The elasticity tends to (minus) infinity as the price tends to infinity and the quantity demanded tends to zero. Hence, given an estimated demand curve, we can vary prices from their current values and move along the demand curve until the point where equation (6) is satisfied. This is the point at which the marginal revenue response to a marginal increase in the tax rate changes sign from negative to positive. It is then possible to calculate the tax rate at which tax revenue is maximised. We implement these results empirically in Section III.

So far we have looked at the relationship between tax rates and tax revenues, and shown that it depends on the price elasticity of demand. How does the Single European Market affect this relationship? The increased availability of close substitutes that the Single Market has brought means that domestic consumers have a further degree of freedom with which to respond to domestic price changes. Before the relaxation of import restrictions, consumers could only reduce their domestic consumption (or the quality of their consumption) in response to a price increase; now they can maintain both quality and consumption by shopping abroad. Therefore it is likely that one effect of the Single Market and the increased opportunities for cross-border shopping will be to make domestic demand for alcohol more elastic.

If opportunities for cross-border shopping do affect the elasticities for beer, wine and spirits, the relationship between the excise duty rates and revenue yields will change as a result. This is illustrated in Figure 1. The graph shows the relationship between tax rates and revenues before and after the completion of the Single European Market (SEM), assuming that there has been an increase in the domestic demand elasticity. The result of increased opportunities for cross-border shopping is a reduction in both the revenue-maximising tax rate[8] and the maximum revenue yield. The increased elasticity causes the tax base of domestic demand to erode more quickly for a given increase in tax rates and also leads to a reduced maximum revenue yield.

As a result, if excise duties on alcohol were revenue-maximising prior to the completion of the Single Market, any increase in the domestic elasticity in the presence of cross-border shopping will mean that they are no longer so. This is illustrated in the diagram. Following an increase in demand elasticity, τ^*(No SEM) is no longer the revenue-maximising tax rate. At the pre-SEM tax rate, cuts in tax rates will cause revenues to rise. τ^*(SEM) is the new revenue-maximising tax rate corresponding to more elastic demand. Of course, if the rates were not revenue- maximising before, whether or not the effect of the

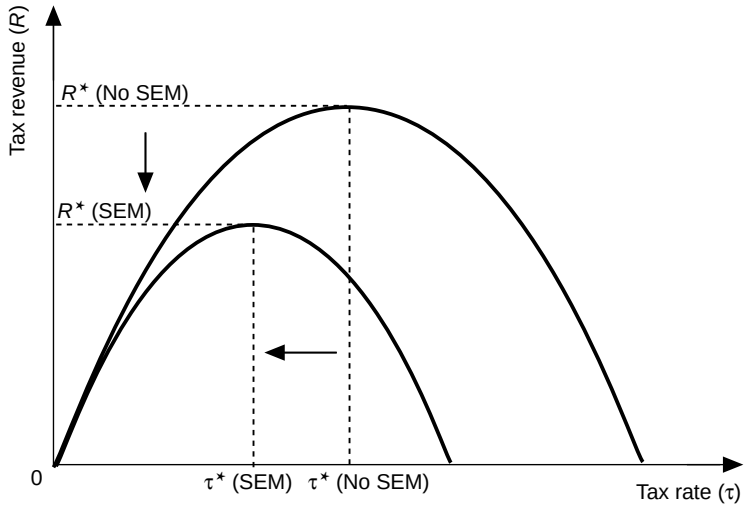
[7] Obviously with the exception of those with constant elasticity.

[8] Since, from equation (6), $\varepsilon^* = -(1+\tau)/\tau^* \Rightarrow \partial\tau^*/\partial\varepsilon^* < 0$.

Single Market is to increase the domestic elasticity to an extent that $\partial R/\partial\tau$ changes sign is an empirical matter. In the next section, we examine this issue further by modelling alcohol demand, and we present estimates of the own-price elasticities of demand for beer, wine and spirits in 1992 and 1993 which are designed to capture the effect of the Single Market. We also present evidence on regional patterns in demand.

FIGURE 1

The Effect of the Single Market on the τ:R Relationship



III. EMPIRICAL EVIDENCE

In this section, we use 20 years of data from the Family Expenditure Survey (FES)[9] (a sample of around 150,000 households) to examine some of the theoretical issues raised in Section II. There we showed that the relationship between tax rates and tax revenues depends on the responsiveness of demand to price changes — the own- price elasticity of demand of a good — and that there is a relationship between the price elasticity, final prices and tax rates that must hold at the point at which revenue is maximised. By obtaining empirical estimates of the domestic own-price elasticities of demand for beer, wine and spirits and comparing them against their calculated limiting values, we can infer whether the current tax rates are revenue- maximising, or if they are too high or low. We also argued that unrestricted cross-border shopping will increase the

[9] See Atkinson, Gomulka and Stern (1989) for a discussion of the difficulties of using the FES for alcohol analysis.

domestic price elasticity. We can compare elasticity estimates before and after the completion of the Single Market to assess whether the increased opportunities for cross-border shopping have had any impact on domestic demand responsiveness.

We estimate the own-price elasticities from single share equations of the domestic demand for beer, wine and spirits. Following Gorman (1976), we assume two-stage budgeting, i.e. we assume that individuals make a prior allocation of income to broad categories of expenditure before they decide how much to spend on individual items within these categories. We model household expenditures on beer, wine and spirits using a generalisation of the Almost Ideal Demand System (AIDS)[10] shown in equation (8).

$$(8) \qquad w_i = \alpha_{0i} + \sum_k \alpha_{ik} Z_k + \beta_{1i} \ln X + \beta_{2i} (\ln Z)^2 + \sum_j \gamma_j \ln p_j + \delta_i . S . \ln p_i + \psi_i . S . SE . \ln p_i + \varphi_i \lambda_i + u_i$$

For each good i, the budget share[11] (w_i) is treated as a function of log real price ($\ln p_i$), log real total household non-durable expenditure[12] (X), instrumented by log real income,[13] and a vector of household characteristics (Z_k), including age, number of adults, number of children and number of cars. We also include a monthly trend and cohort dummies to control for broad changes in drinking habits over time. To capture the effect of the Single European Market, we include a dummy variable (S) interacted with the price term ($S.\ln p_i$) and also interact this with a dummy variable for the south-east ($S.\mathrm{SE}.\ln p_i$), reflecting the fact that the lower transport costs of those living near the border may make demand more responsive. In our model, we also attempt to control for zero shares that arise from corners, i.e. people who never consume alcohol whatever the price, rather than infrequency of purchase. We do this by using the two-step estimator of Heckman (1979), assuming that the proportion of females affects the participation decision, but not the share equation, and we include the Mills ratio (λ_i) in the regression equation. The full results are reported in the Appendix.

From this model, we obtain estimates of the own-price demand elasticities for beer, wine and spirits in 1993. These are reported in Table 3 with standard errors and 95 per cent confidence intervals. Beer has the least elastic demand and wine the most. Thus for any given proportional price rise, we would expect to observe

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[10] See Deaton and Muellbauer (1980).

[11] Expenditure on beer, wine or spirits in the UK as a proportion of total non-durable expenditure. Note that we are unable to address the issue of quality change in response to price changes with these data.

[12] Since the Engel curves for alcohol are quadratic, we include higher-order terms in log expenditure (see Crawford and Tanner (1995)).

[13] This serves as an instrument for the top stage of the two-stage budgeting process and any measurement error in total expenditure.

the smallest proportional demand response for beer. By comparing these estimates against their limiting values in Table 2, we are able to test the null hypothesis that current excise duty rates are at their revenue-maximising level (H_0: $\varepsilon\hat{} = \tilde{\varepsilon}^*$) against the alternative that the rates are not revenue-maximising (H_1: $\varepsilon\hat{} \neq \tilde{\varepsilon}^*$). We report the t-statistics in Table 3. For beer and wine, we reject the hypothesis that duties are presently at their revenue-maximising levels with a 95 per cent confidence level. For spirits, we are unable to reject the null hypothesis.

TABLE 3

Point Elasticity Estimates

	Estimates elasticity, $\varepsilon\hat{}$	*95% confidence interval*	*t-statistic* H_0: $\varepsilon\hat{} = \tilde{\varepsilon}^*$
Beer	-0.668 (0.238)	[-1.134, -0.202]	10.68
Wine	-1.396 (0.312)	[-2.008, -0.784]	1.97
Spirits	-1.181 (0.268)	[-1.891, -0.471]	1.43

Note: Standard errors are reported in parentheses.

Where we can clearly reject the null hypothesis that the current duty rates are revenue-maximising, we want to know whether they are too high or too low from the point of view of revenue maximisation and whether revenue could be increased by raising or lowering taxes. For this purpose, we can use equations (7a) and (7b). Since for both wine and beer the absolute values of the current elasticity estimates are smaller than the absolute critical values, we can infer that current duty rates are below their revenue-maximising level: duties could be raised further without the rate of revenue erosion being sufficient to cause revenues to decline nationally.

However, we can say more than simply whether current duty rates are too high or low from the point of view of revenue maximisation. Using estimates of the parameters of the demand curve, it is possible to find the point of revenue maximisation at which equation (6) is satisfied for wine and spirits. It is a feature of the particular functional form of AIDS-type models such as the one we estimate that elasticities along the demand curve approach minus one asymptotically from above and below. Since for our beer equation we start from an elasticity of (absolutely) less than minus one, the absolute value of the elasticity will never exceed minus one, however much we increase the price, and equation (6) can never be satisfied at any point on our estimated demand curve. For beer, we simply record that $|\varepsilon\hat{}| < |\tilde{\varepsilon}^*|$ and hence that current duties are lower than their revenue-maximising levels. For wine and spirits, however, we are able to find the point of revenue maximisation and from this we can calculate the corresponding revenue- maximising elasticity and price level (ε^*, p^*) and infer the revenue-maximising tax rate (τ^*). The solutions are reported in Table 4. It is

important to note that these solutions are functions of estimated parameters of the relevant demand equation. To give an impression of the sensitivity of these solutions to the parameter estimates they are based on, we also report (in square brackets) the values for the revenue- maximising price and tax rate consistent with a solution for ε* one standard error either side of the point solution for ε* given in the note to the table.

We therefore calculate that the tax rate applied to wine can be increased by 40 percentage points in real terms before it becomes revenue-maximising. This corresponds to a real increase in final prices of 20 per cent (from 290 pence to 349 pence in 1993 prices). However, two points should be noted. First, the sensitivity of the results to the parameter estimates is clearly quite high, and it is hard to draw firm conclusions from these figures about the *exact* duty rates that should be imposed in order to maximise tax revenues. Second, the solutions are defined relative to our assumptions about the current price of a bottle of wine and a litre of spirits, which we take to be the 'typical' prices in 1993 reported by HM Customs and Excise. Thus, assuming a higher value for the current prices, the corresponding solutions for the revenue-maximising prices will be proportionately higher. Nevertheless, it is clear that for spirits, the current price lies within the interval for p^*. This is, perhaps, not surprising, given that spirits are far more heavily taxed per unit of alcohol than other alcoholic drinks, and is consistent with our inability to reject the hypothesis that the current estimated elasticity of demand for spirits is equal to its limiting value. The typical price for wine lies just below the interval for p^*.

TABLE 4

Revenue-Maximising Prices and Tax Rates (1993 prices)

	Current[a] p, τ	Maximising[b] p^*, τ^*	$\pm$ *one s.e.* (ε^*)
Wine			
Prices	280p	349p	[293p, 471p]
Tax rate	99%	139%	[101%, 223%]
Spirits			
Price	1112p	1450p	[832p, 2173p]
Tax rate	184%	271%	[113%, 456%]

[a] Source: HM Customs and Excise
[b] Authors' calculation.
Note: ε*: wine = -1.7199; spirits = -1.3691.

In Section II, we argued that the likely effect of the completion of the Single Market on alcohol demand would be to increase consumer responsiveness to changes in domestic prices, and hence to increase the own-price elasticity of demand for beer, wine and spirits. In practice, we would expect the size of any

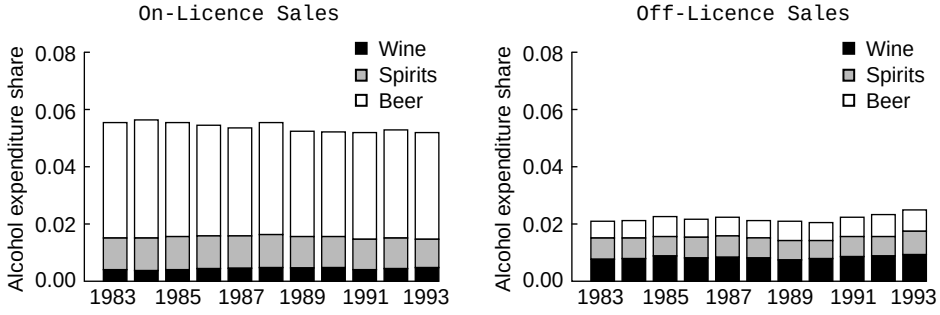
change in the demand elasticity to be affected by a number of factors. The first is the degree of substitutability between domestic and non-domestic forms of alcohol, which may mean that the effect across the drinks market as a whole is far from uniform. For example, we would expect the elasticity of demand for real ales to be somewhat less affected than the demand for other forms of beer, since non-domestic products are less direct substitutes for domestic ones. Similarly, to the extent that alcohol bought from on- and off-licensed premises are different goods, we would expect non-domestic products to be a much closer (legal) substitute for the latter. We would therefore expect a greater change in the elasticity of alcohol bought in off-licensed than on-licensed premises.

Using data from the FES, we can calculate average expenditure shares for beer, wine and spirits by place of purchase. From 1983, expenditure on alcohol was broken down according to whether the drinks were bought and consumed away from home (at pubs, clubs and other on-licensed premises) or bought from off- licensed premises and consumed at home. This breakdown is used in Figure 2.

These graphs show that pubs were facing a problem of falling demand well before the completion of the Single Market. Although sales from licensed premises are still far larger than those from off-licences, and this is particularly so in the case of beer, there are signs of a shift in the late 1980s and early 1990s away from pubs and clubs towards consuming alcohol at home. Whilst we might expect off-licence sales to suffer more from cross-border trade as a closer substitute for non-domestic purchases, the trend in off-licence sales has clearly been upwards; the expenditure share on alcohol bought from off-licences increased between 1992 and 1993, although it is not possible to tell on the basis of these figures alone what might have happened in the absence of any Single Market effect.

FIGURE 2

Expenditure Shares on Alcohol by Place of Purchase



Source: Family Expenditure Survey.

Demand responsiveness will also be determined by the distribution of household characteristics. There are many factors that will affect the extent to which consumers will respond to price changes by shopping across borders and that will determine the size of the change in elasticity. In general, we would expect the response to increased opportunities for cross-border shopping to vary with the following: the distance from the border,[14] the presence of a car and/or van, the opportunity cost of time, the strength of individual preferences for the domestic good over the foreign good (if there are qualitative differences between the two), the individual's preferred pattern of purchases and availability of credit and hence whether the individual can make the bulk purchases necessary to cover the fixed cost of crossing the border. To take an extreme example, we would expect to observe the largest increases in elasticity among van-owning unemployed residents of Dover who prefer French alcohol to English, and who have unlimited access to credit.

To gain some idea of the effects of one of these factors — region — on the level of cross-border shopping, we compare trends in alcohol expenditure shares (out of total non-durable expenditure) in two regions in the UK — north[15] and south-east[16] — using data from the FES. These are shown in Figure 3.

From these graphs, it is possible to detect broad differences in the expenditure patterns of the two areas: alcohol comprises a larger share of non-durable expenditure in the north than in the south-east, and beer forms a larger proportion of alcohol spending. There is also evidence that there were divergent trends in alcohol expenditure in the north and south-east in the late 1980s and early 1990s: while there was an apparent fall in the size of the alcohol expenditure share in the south-east, this was not so in the north. However, on the basis of these figures alone, it is not possible to conclude that lower transport costs in the south-east have meant a higher degree of cross-border shopping.

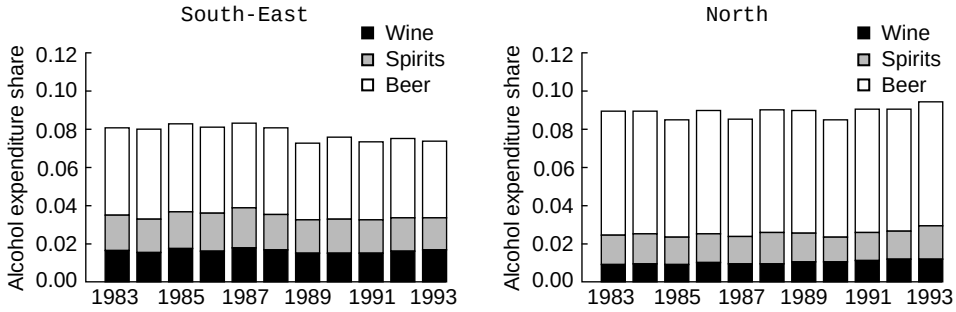
Simple data description can be interesting and informative, but it does not allow us to disentangle the various forces at work. Using estimates of the own-price elasticities of demand for beer, wine and spirits in 1992 and 1993, however, we can formally test whether increased opportunities for cross-border shopping have had any effect on the domestic elasticity. Because we are interested in the effect of cross- border shopping, and because from the data description it appears that the effect of cross-border shopping may be felt more strongly in the south-east because of lower transport costs, we also estimate demand elasticities for consumers in the south-east only. Table 5 reports the elasticity estimates for 1992 and 1993 for the south-east and the UK as a whole with their standard errors. Using these figures, we can test the null hypothesis

[14] See Kanbur and Keen (1991).
[15] Including Yorkshire and Humberside and the north-west.
[16] Including Greater London and East Anglia.

that there was no significant change in the elasticity for each good between 1992 and 1993. We report the t-statistics in the final column of Table 5.

FIGURE 3

Alcohol Expenditure Shares by Region



Source: Family Expenditure Survey.

For the UK as a whole, we cannot reject the hypothesis of no change in the elasticity for beer and spirits. For wine, however, we do reject the null hypothesis and conclude from these figures that there was a significant increase in demand elasticity between 1992 and 1993. Comparing the estimates for the

TABLE 5

Estimated Number of O Level and CSE Grade 1 Passes Obtained by 1974

Individual and household characteristics	*Estimated results*
Base case: male with no part-time job at 16, attending a comprehensive school, in 3rd ability quartile at age 11 and having no siblings. Household income is £47 per week. Father is working but mother is not. Mother and father left school aged 14–15.	3.0
As for base case but individual worked 6–9 hours per week at age 16.	2.7
As for base case but individual worked 15+ hours per week at age 16.	1.7
As for base case but individual was in 4th ability quartile at age 11.	4.4
As for base case but father left school aged 18–19.	3.5
As for base case but individual attends an independent school.	4.3
As for base case but father is not working.	2.5
As for base case but individual has one sibling.	2.8

Note: The table uses the equation shown in Table 4 to estimate the number of O level and CSE grade 1 passes that would be achieved by an individual with the 'base' characteristics, and shows how the estimated number of passes changes when a change is made to the value of some of the variables that have significant coefficients in Table 4.

south-east with those for the UK as a whole, it can be seen that while the elasticities were broadly similar prior to the Single Market in 1992, there was a stronger increase in elasticities in the south-east for all goods between 1992 and 1993. This was particularly true for wine. Generally, the elasticities in the south-east in 1993 are higher than those in the UK as a whole. On the basis of these figures, it would appear that in the south-east (although not in the country as a whole), tax revenues could be increased by cutting tax rates. However, charging different rates of duty in different parts of the country may be practically unfeasible and would simply have the effect of moving the border inland from Dover.

IV. CONCLUSIONS

The object of this paper was to examine the current system of alcohol taxation in the light of what the Chancellor referred to in his last Budget Speech as 'one of the most widely publicised effects of the Single Market ... the increase in legitimate cross-border shopping in alcohol'. Alcohol taxation has historically been a major source of revenue for UK governments, but this source may be less plentiful in the future due to cross-border shopping.

While a tax cut may restore domestic demand, it will entail a loss of revenue per unit. The overall impact on revenue will depend on the balance between these two effects. The relationship between tax rates and tax revenues was explored in Section II, and we showed that the revenue response to a change in tax rates depends on demand responsiveness. However, the Single Market is likely to have had an effect on the relationship between tax rates and the revenue yield: the relaxation of limits on importation for personal consumption will tend to increase the domestic price responsiveness of the demand for alcohol. If tax rates were revenue- maximising prior to the completion of the Single Market, they will no longer be so following an increase in demand responsiveness. In this case, cutting taxes will increase tax revenues.

In Section III, we used data from the Family Expenditure Survey to test some of these theoretical results. We estimated a model of domestic demand for beer, wine and spirits and calculated the present level of demand responsiveness for each good. We tested whether current excise duty rates are revenue-maximising and showed that domestic demand for beer and wine is insufficiently price-responsive for this to be so. For spirits, we could not reject the hypothesis that current excise duty rates are at their revenue-maximising level. We therefore concluded that a policy of cutting tax rates on beer and wine is likely to cause revenues to fall, although, as our estimates of the revenue-maximising duty rate for wine showed, the scope for further real increases in duties is limited.

Finally, we tested whether the Single Market has had the anticipated effect of increasing the responsiveness of domestic demand by comparing estimates of the own-price demand elasticity for beer, wine and spirits in 1992 and 1993. We

could not detect any statistically significant change in the responsiveness of demand for beer and spirits. However, we did observe a significant increase in the price elasticity of wine between 1992 and 1993, although this was not sufficient to make the current excise duty rate on wine revenue-maximising. We had prior reason to believe that the effect of the completion of the Single Market was likely to be non- uniform across the country because of differences in travelling costs, and, as expected, we found stronger increases in the demand elasticities between 1992 and 1993 for the south-east than for the UK as a whole for all goods.

APPENDIX: SHARE EQUATIONS FOR BEER, WINE AND SPIRITS

Share Equation for Beer

Dependent variable is share of beer

Variable	*Estimate*	*Standard error*	*t-statistic*
Ln(expenditure)	0.08069	0.00937	8.611
$(\text{Ln(expenditure)})^2$	0.02427	0.00203	11.976
Ln(beer price)	0.00793	0.00947	0.838
Ln(wine price)	0.01287	0.00650	1.982
Ln(spirits price)	0.00581	0.00908	0.640
S.ln(beer price)	0.01688	0.01422	1.187
S.SE.ln(beer price)	–0.04166	0.01996	–2.088
Age	–0.00126	0.00055	–2.300
Age^2	–0.00023	0.00014	–1.661
SE	–0.00646	0.00066	–9.859
No. of cars	–0.01043	0.00038	–27.561
No. of adults	0.00602	0.00052	11.637
No. of kids aged 0–1	–0.01015	0.00075	–13.534
No. of kids aged 2–5	–0.00854	0.00092	–9.315
No. of kids aged 6–10	–0.00646	0.00048	–13.392
No. of kids aged 11–16	–0.00736	0.00104	–14.983
Cohort1	–0.00394	0.00285	–1.381
Cohort2	–0.00061	0.00232	–0.263
Cohort3	–0.00074	0.00180	–0.410
Monthly trend	0.01183	0.00586	2.017
Mills ratio	–0.01117	0.00035	–32.314
Constant	0.14464	0.01227	11.788

Notes to Appendix tables: *S* is a dummy variable to capture the effect of the Single European Market.
SE is a dummy variable for the South East.
Cohort1, Cohort2 and Cohort3 are dummy variables indicating cohort, where cohort 1 comprises households with heads born before 1925, cohort 2 those born 1925–44 and cohort 3 those born 1945–64.

Share Equation for Wine

Dependent variable is share of wine

Variable	*Estimate*	*Standard error*	*t-statistic*
Ln(expenditure)	0.04045	0.00764	5.292
$(\text{Ln(expenditure)})^2$	0.00605	0.00190	3.190
Ln(beer price)	0.04056	0.00642	6.320
Ln(wine price)	0.01003	0.00412	2.433
Ln(spirits price)	–0.02476	0.00626	–3.948
S.ln(wine price)	–0.02343	0.01082	–2.165
S.SE.ln(wine price)	–0.03985	0.01392	–2.863
Age	0.00056	0.00036	1.575
Age^2	0.00045	0.00010	4.708
SE	0.00379	0.00041	9.225
No. of cars	0.00286	0.00028	10.147
No. of adults	–0.01184	0.00049	–23.956
No. of kids aged 0–1	–0.00538	0.00060	–9.005
No. of kids aged 2–5	–0.00296	0.00067	–6.612
No. of kids aged 6–10	–0.00559	0.00041	–13.503
No. of kids aged 11–16	–0.00777	0.00041	–18.816
Cohort1	–0.00349	0.00183	–1.904
Cohort2	–0.00289	0.00149	–1.937
Cohort3	0.00093	0.00115	0.810
Monthly trend	–0.01317	0.00382	–3.541
Mills ratio	0.00243	0.00036	6.834
Constant	0.11853	0.00831	14.269

Share Equation for Spirits

Dependent variable is share of spirits

Variable	*Estimate*	*Standard error*	*t-statistic*
Ln(expenditure)	0.06027	0.01340	4.496
$(\text{Ln(expenditure)})^2$	0.01695	0.00345	4.915
Ln(beer price)	–0.01554	0.00862	–1.799
Ln(wine price)	0.01317	0.00601	2.192
Ln(spirits price)	–0.02230	0.00862	–2.587
S.ln(spirits price)	0.01273	0.01417	0.898
S.SE.ln(spirits price)	–0.01951	0.01938	–1.007
Age	0.00146	0.00055	2.659
Age^2	0.00111	0.00015	7.287
SE	–0.00167	0.00062	–2.708
No. of cars	–0.00177	0.00035	–5.019
No. of adults	–0.00508	0.00052	–9.732
No. of kids aged 0–1	–0.00248	0.00104	–2.375
No. of kids aged 2–5	–0.00296	0.00101	–2.927
No. of kids aged 6–10	–0.00254	0.00064	–3.957
No. of kids aged 11–16	–0.00413	0.00056	–7.384
Cohort1	–0.00411	0.00270	–1.522
Cohort2	–0.00031	0.00224	–0.137
Cohort3	–0.00144	0.00178	–0.809
Monthly trend	0.00972	0.00541	1.796
Mills ratio	–0.00255	0.00065	–3.911
Constant	0.11111	0.01438	7.726

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