

Alcohol Taxes and the Single European Market

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Preface

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1 Introduction

Taxes on alcohol in the UK are an important source of tax revenue. The UK has among the highest excise duties in the European Union and raises a higher proportion of total government revenue from taxes on alcohol than almost any other member state. In 1992, for example, 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. In this Commentary we examine some of the economic issues relating to the current system of alcohol taxation in the UK. Our interest has been motivated by the recent attention given to the increase in cross-border shopping following the completion of the Single Market and the relaxation of limits on importation of alcohol for personal consumption.

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. 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.

The plan of the Commentary is as follows. In Chapter 2 we discuss some of the economic reasons for imposing additional taxes on alcohol, and in the light of these we examine the present structure of excise duties. We then look at the incidence of alcohol taxation using household-level UK data.

Membership of the EU has affected the UK's autonomy in setting indirect tax rates. In Chapter 3 we discuss the European Commission's plans for harmonising tax rates across

the Union. The decision to specify only minimum rates has allowed considerable variation between the rates applied by member states to persist and has contributed to incentives for cross-border shopping.

In Chapter 4 we discuss some of the problems encountered by high-tax countries as a result of cross-border shopping. We present case-study evidence on the border effect for two other European countries - Denmark and Eire - and discuss possible implications for the UK. We cite some initial evidence on the extent of cross-border shopping between the UK and its close European neighbours.

One of the main problems facing the government of a high-tax country is the loss of tax revenue arising from cross-border shopping. Cutting tax rates would restore the level of domestic demand, but there would be a loss of revenue per unit. A key issue for the exchequer concerned with the effect of a tax cut on final revenues is the balance between these two effects. In Chapter 5 we set out a simple economic model of the relationship between indirect tax rates and tax revenues. We assess the likely effect of the Single Market on this relationship. In Chapter 6 we use evidence from the Family Expenditure Survey on spending on alcohol in the UK to apply some of the ideas we set out in Chapter 5. Chapter 7 concludes.

2 Alcohol Taxation in the UK

Taxes on alcohol are among the oldest in Britain. Norman kings claimed a proportion of all wine imports as payment for ensuring the traders' safe passage. In 1303 a monetary tax on wine was introduced by Edward I, while taxes on beer and spirits were levied by Parliament in 1642 to pay for the cost of the army during the English Civil War. The Gin Act of 1736 brought high taxes on spirits to curb what was perceived as excessive gin consumption - nearly four times the current UK average. In this chapter we discuss what economic reasons there might be for imposing taxes on alcohol in addition to a general VAT, and consider the current structure of alcohol taxes in the UK.

2.1 The Economics of Alcohol Taxes

Economic efficiency requires that taxes should distort the choices faced by consumers as little as possible and that therefore a system of indirect taxes ought not to affect relative prices. However, it is not possible to tax some goods - leisure in particular is hard to tax - and therefore even imposing the same rate of tax on all the goods that can be taxed still distorts the consumer's choice between consumption and leisure. One principle that might be used in the design of an efficient indirect tax system is the Ramsey Rule.¹ In essence, this proposes that a marginal increase in indirect taxes should reduce the demand for all commodities by the same proportion. In fact, given different assumptions, this principle can be translated into a rule to tax all goods in inverse proportion to the responsiveness of demand to price changes such that consumers' demand is little affected by the imposition of taxes, or into a rule which demands that goods should be taxed according to their complementarity with leisure, a result due to Corlett and Hague (1953).

Arguments for high alcohol taxes, however, do not tend to be derived from these general principles of indirect taxation - although the complementarity of alcohol consumption with leisure would require that alcoholic drinks should be taxed more heavily under the

1. Ramsey, 1927.

Corlett-Hague rule. Instead, they rely on instances of market failure particular to the nature of alcohol. The first justification is that individuals may not possess all the necessary information to make rational decisions about their consumption of alcohol (indeed, this ability may be inversely proportional to their consumption). They may not, for example, be fully aware of the harm that over-consumption of alcohol can cause, particularly since the 'benefits' are immediate while the negative consequences of over-consumption may be longer-term. In extreme cases, individuals may become alcoholics and lose all ability to reduce their level of consumption. Therefore there is a case for using alcohol taxes to reduce consumption to the level that individuals would choose if they were perfectly informed. While the consumption of alcoholics may not be price-responsive, imposing taxes on alcohol may prevent the level of consumption rising to levels at which people are likely to become dependent on alcohol. However, the government may be making a false assumption about individuals' behaviour - people may be aware of all the associated risks - and taxation in this case is suboptimal. Increasing the availability of information about the costs and benefits associated with alcohol consumption may be a more direct way of redressing information deficiencies.

The second justification is that there are external social costs associated with alcohol consumption which people do not take into account when choosing how much to consume. These might include the social cost of drink-driving and the cost of the medical treatment of alcohol-related illnesses, as well as the external effects on other household members such as children. Imposing optimal taxes will make individuals bear the full cost of drinking when they choose their desired level of consumption. These taxes should reflect the size of the social costs (and benefits) involved in alcohol consumption, although this will vary considerably between individuals, and may even vary with each drink. In practice, therefore, it is very difficult to measure precisely the marginal social cost of drinking. In principle, however, since it is the quantity of pure alcohol which causes the external harm, a system that taxes alcoholic drinks by the volume of alcohol would best reflect the social cost. Furthermore, since alcoholic beverages are substitutes for each other, a common basis for taxation is sensible.

2.2 The Current System

In the UK every alcoholic drink consumed attracts two types of taxes. The first is value added tax - an *ad valorem* tax of 17.5 per cent applying uniformly to beer, wine and spirits, and most other goods. The second is excise duty - a specific tax applied by volume varying by type of drink.² In the case of beer and spirits, each unit of alcohol is taxed directly. The taxation of beer was changed on 1 June 1993 and there is now a charge per hectolitre (hundred litres) of beer of £10.82 for every per cent alcohol by volume. The dutiable unit for spirits is the 'litre of alcohol' which attracts a duty of £20.60. The taxation of low-strength wine, on the other hand, does not apply a sliding scale to alcoholic content. Instead, still table wine is taxed at a uniform rate of £140.44 per hectolitre of finished product.³ For low-strength wines, therefore, the implied level of duty per unit of pure alcohol falls as alcoholic content increases. For wine of an alcoholic strength of 11 per cent, the implied level of duty per litre of pure alcohol is £12.77. For wine of strength 13 per cent, the implied duty level is £10.80.

Table 2.1: UK Excise Duties on Alcohol and Implied Tax per Unit Alcohol

	Specific duty	Implied tax per litre of pure alcohol
Beer ^a	£0.24	£10.82
Wine ^b	£1.05	£11.70
Spirits ^c	£5.77	£20.60

Notes:

Duties from 1 January 1995.

a. Tax per pint, typical strength 3.9%.

b. Tax per 75cl bottle, typical strength 12%.

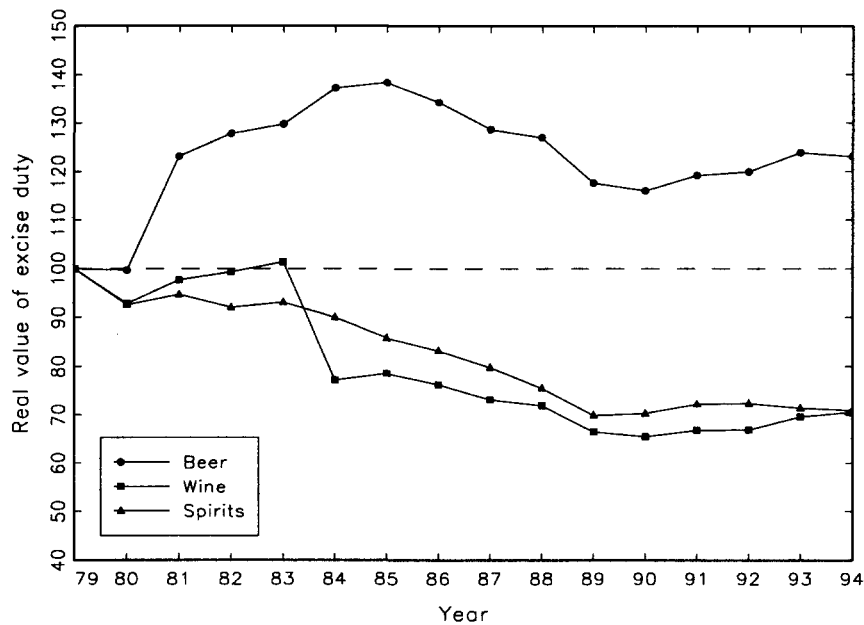
c. Tax per 70cl bottle, typical strength 40%.

2. Specific taxes are often preferred over *ad valorem* taxes since they give producers a greater incentive to manufacture goods of a higher quality; the higher is the pre-tax price, the lower is the specific tax as a percentage of the price.

3. Wine with over 22 per cent alcoholic content is taxed at £20.60 per litre of pure alcohol.

Table 2.1 shows that the current structure of duty rates does not link the amount of tax paid to alcoholic strength for wine, and nor does it do so for alcohol taken as a whole. The implied tax rates per unit of pure alcohol are not uniform between drinks and there is a substantial tax bias against spirits. The duty rate per unit of alcohol on spirits is nearly twice that on beer and wine.

**Figure 2.1: The Real Value of Excise Duties, 1979-94
(1979 = 100)**



Notes: Figures are given for May in each year. Hence the level of excise duties in 1994 reflects the changes introduced in the preceding November 1993 Budget, rather than the November 1994 Budget.

Source: HM Customs and Excise Annual Reports.

The current differences in the implied duty rates per unit of alcohol between types of drink persist despite significant real reductions in the duties levelled on wine and spirits over the last 15 years. Figure 2.1 shows the real values of UK excise duties on beer, wine and spirits since 1979.⁴ Over the period there has been a real increase in the duty on beer.

4. The sharp fall in the real value of wine duty in 1984 was the result of a ruling by the European Court that UK wine duties constituted protectionism.

From the discussion in the previous section, there is no obvious economic rationale for discriminating against spirits. If it is accepted that it is the alcoholic content of drink that is related to the extent of social harm, there is no economic reason for taxing spirits more highly than beer and wine. Arguments for higher taxes on spirits rely on the form in which alcohol is consumed making a difference as well as the pure alcoholic content. In particular, if the concentration of alcohol matters for the ease of consumption and hence the relative ease of consuming a 'dangerous' amount of alcohol, then spirits, which are the most highly concentrated form of alcohol, should attract the highest rates of duty. Clearly, alcohol in certain forms is more potentially harmful than in others; it is unlikely, for example, that liqueur chocolates are the cause of much drunken violence. However, we are not aware of any evidence of a higher incidence of alcohol-related harm being caused by spirits than by other forms of alcohol.⁵ More plausibly, as Baker and McKay (1990) suggest, the high levels of taxes applied to spirits may be a 'hangover' from the high taxes introduced in 1736 to curb over-consumption of gin. The lower excise duties on beer may reflect the government's concerns over the incidence of alcohol taxation; it is to this we turn in the next section.

2.3 Tax Incidence

Any discussion of taxation and tax reform raises issues of incidence. Since our interest in this Commentary is the possible reform of an indirect tax, we take as our measure of incidence the effect of the resultant price change on households' real total expenditure, deflated by the change in their cost of living.⁶ This effect may differ between households. Given a relative price change that is faced by all households, such as an exogenous change in an indirect tax rate, the only circumstance under which we can speak accurately about *the* cost of living is one in which expenditure patterns do not vary between households.⁷ The pattern of tax incidence, as measured by changes in real expenditure deflated by the

5. For further discussion, see Crooks (1989).

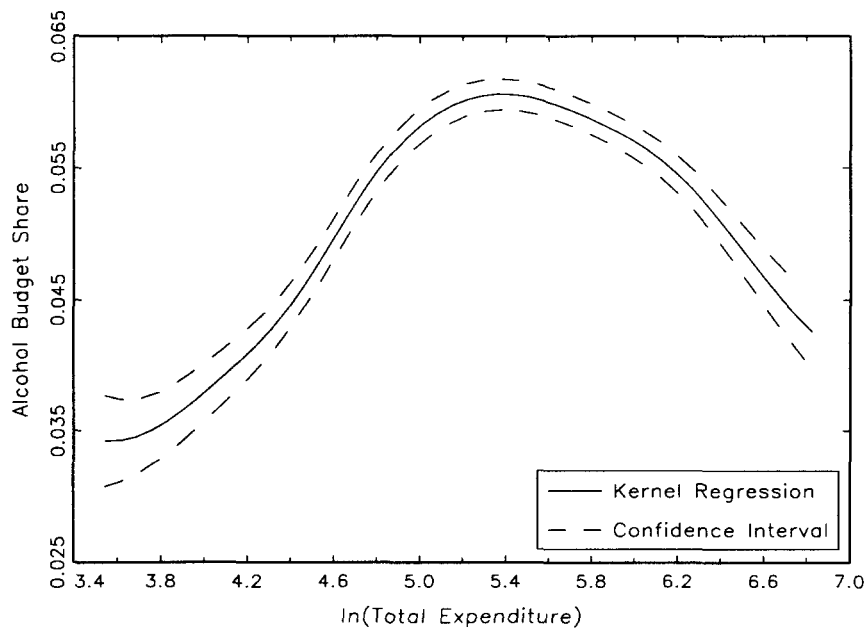
6. See Blundell and Preston (1994) for a discussion of income versus expenditure in the measurement of household welfare. Since indirect taxes are taxes on expenditure, it seems more natural to use an expenditure-based incidence measure here.

7. See Crawford (1994) for a recent survey of UK data.

household's cost of living, is therefore a function of expenditure patterns. In this section we present evidence on the patterns of expenditure on alcohol using data from the Family Expenditure Survey (FES).⁸

The first data on household expenditure patterns were presented by Engel (1895), who showed that the proportion of a household's total spending on food (usually called the budget share) typically declines as total expenditure increases. Graphs of budget shares against total expenditure are known as Engel curves. Downward-sloping Engel curves typically indicate goods that are necessities;⁹ upward-sloping curves are usually indicative of luxuries.¹⁰ Figure 2.2 shows the Engel curve for total alcohol expenditure with confidence intervals drawn using data from the 1993 FES. It is drawn using Kernel regression, a technique which does not force any particular shape on the relationship in the data.¹¹

Figure 2.2: The Engel Curve for Alcohol, 1993



8. Atkinson, Gomulka and Stern (1989) note the problems associated with under-reporting of alcohol expenditure in the FES.

9. Consumption forms a larger share of the budgets of poorer households than of those of richer households.

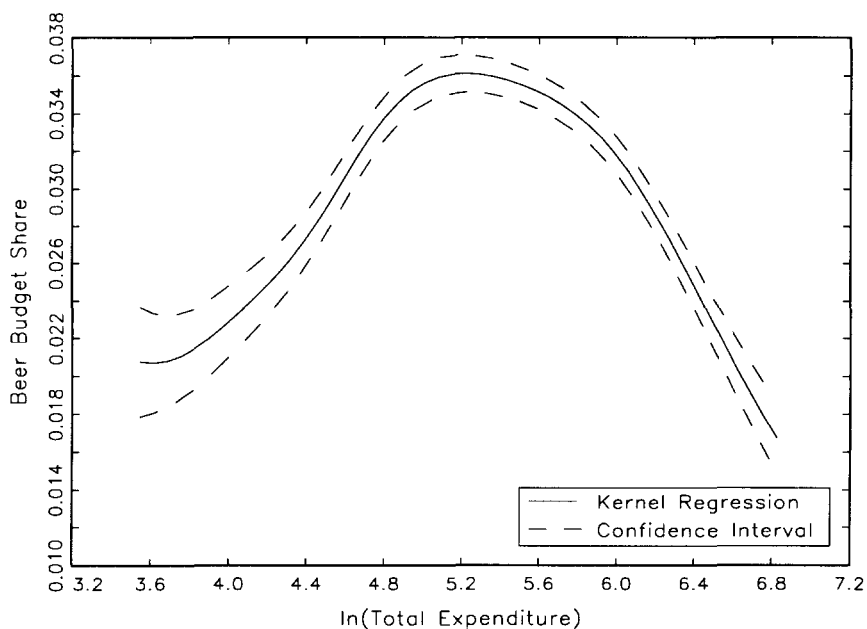
10. Consumption forms a larger share of the budgets of richer households than of those of poorer households.

11. Drawn using NP-REG. See Duncan and Jones (1992).

As noted by authors¹² who have previously used the FES to describe spending patterns, the Engel curve for alcohol in the UK is quadratic, i.e. it has an upside-down 'U' shape. Alcohol spending, therefore, has the characteristic of a luxury for households with lower total spending (typically poorer households) and of a necessity for higher-spending (typically richer) households. Tax incidence follows directly from the pattern of budget shares. The cost of living of households with higher budget shares will change more as a result of a tax reform that alters the relative price of alcohol than will the cost of living of households with smaller budget shares. From Figure 2.2 we can see that these are the households at the middle to upper end of the total spending distribution (and by implication also of the income distribution).

In Figures 2.3 to 2.5 we show the Engel curves for alcohol spending decomposed into its constituent parts.

Figure 2.3: The Engel Curve for Beer, 1993



12. See Banks, Blundell and Lewbel (1994).

Figure 2.4: The Engel Curve for Wine, 1993

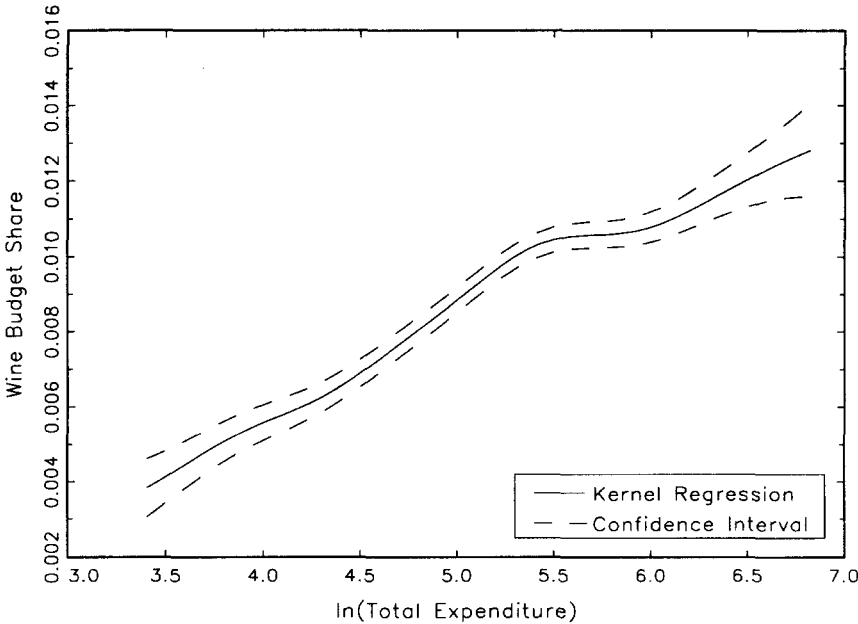


Figure 2.5: The Engel Curve for Spirits, 1993

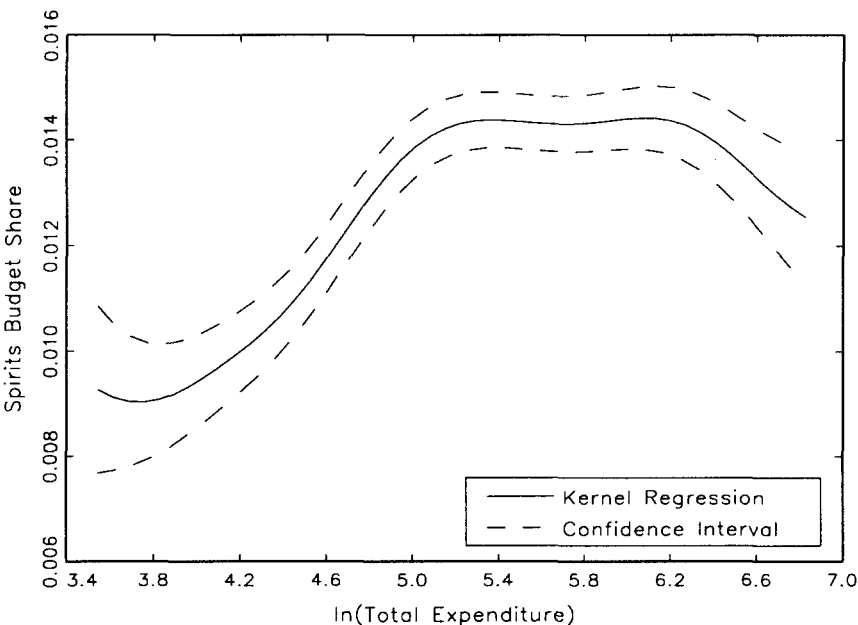


Figure 2.3 shows the Engel curve for beer. Since spending on beer is the largest component of total alcohol spending, it is not surprising that the curve is similar to that for alcohol as a whole. The upward-sloping portion, however, is smaller relative to that for total alcohol spending, indicating that the beer component is less of a luxury for poorer households than alcohol as a whole. The incidence of a tax reform restricted to beer duties alone will therefore be concentrated amongst households in the middle spending and income ranges.

Figure 2.4 shows the Engel curve for wine. Unlike that for beer, the Engel curve for wine is essentially linear and upward-sloping, indicating a good that is a luxury for households at all levels of total expenditure. Tax reforms that only affect wine duties will, therefore, be felt mainly by richer households for which spending on wine forms a greater proportion of their total budgets.

The Engel curve for spirits is shown in Figure 2.5. This provides some evidence that spirits are a luxury for poorer households. The curve flattens out amongst households with higher total spending. Overall, tax changes that affect the price of spirits will be felt by richer, rather than poorer, households.

In general, taxes on wines and spirits are progressive, taxes on beer are less so.

3 European Issues

Fiscal harmonisation across the EU forms part of the European Union Commission's programme to create a single, integrated market in Europe. The Commission's plans were laid out in the 1985 Commission White Paper, *Completing the Internal Market*. The document was aimed at tackling the wide range of frontier controls and obstructions to free trade that still remained within Europe even after the earlier abolition of tariffs and quantitative restrictions. Fiscal checks at frontiers represented, at the time, the principal remaining impediments to the free flow of goods and services across internal borders.

The Commission's proposals, however, went further than simply advocating administrative changes designed to speed up delays at frontiers. It was argued that completion of the internal market required not only administrative changes but also changes in both the rates and the structure of indirect taxes in member countries. In August 1987 the Commission published a series of documents on the 'approximation' of indirect tax rates. According to the Commission,¹³ its proposals were the 'minimum changes which must be made ... in order to achieve a sufficient degree of fiscal harmonisation'. These 'minimum changes' were not, in the end, adopted because the resulting budgetary changes would have been unacceptable to a number of countries.

The Commission recognised that there was no need to impose complete indirect tax uniformity across member states. Worries about distortions to the location of production were largely negated by the application of the 'destination principle' to VAT (whereby the rate of tax applied to a good depends on where it is sold, not where it is produced)¹⁴ and if

13. Document COM(87)320.

14. There are a few minor examples of cases where tax rates may affect the location of businesses. Davis and Kay (1985), for example, point out that financial institutions in the UK (which are partially exempt from VAT) can purchase newly constructed building without paying VAT at all; whereas continental companies (which are similarly VAT-exempt) cannot reclaim the VAT they pay on new building. This may provide an additional incentive to locate in London.

duty-paid goods were clearly identified, excisable goods taxed in one country could not be easily resold in another country where taxes were higher. Hence, different rates of VAT could continue to operate even after the abolition of fiscal checks.

The main reason the Commission advocated approximation of tax rates was in order to avoid the problem of cross-border shopping and 'unacceptable levels of distortion of competition, diversion of trade, and tax fraud'.¹⁵ At first sight it is not clear why cross-border shopping should be a matter of concern to the Commission. The costs of cross-border shopping include the resource cost of journeys across frontiers and revenue losses and lost sales to retailers on the high-tax side of the border. Countries that wish to set high taxes, therefore, see the cost of doing so falling largely upon themselves, and different levels of taxation would simply appear to be a legitimate reflection of national preferences for taxes. The Commission felt, however, that it was necessary to set a *lower* limit to tax rates, arguing that, without this, unrestricted cross-border shopping would force tax rates across the whole European Union down to the lowest common denominator, leaving many member states with tax rates lower than they would otherwise wish.

In 1989 the Commission set out proposals for a set of minimum rates that were to be levied in Europe from 1993 onwards. These minima were well below the existing duty rates applied in high-tax countries like the UK, but would have required significant increases in duties in France, Germany, Italy, Portugal and Spain. Differences in tax rates above these minima, however, were to be allowed to persist. Although the details of the 1989 proposals were not acceptable to all member states, the principle of minimum rates endured. During the course of meetings in June 1991, and July and October 1992, the Economic and Financial Affairs Council (ECOFIN) of the European Community haggled over the final rates to be adopted. These rates and those existing within member states on 1 January 1993 are given in Table 3.1.

The UK had, and still has, one of the highest sets of alcohol duties in the European Union. The duty differentials between the UK and its closest EU neighbours¹⁶ contribute towards

15. See Lee, Pearson and Smith (1988).

16. With the exception of the Irish Republic.

Table 3.1: Excise Duties on Alcohol on 1 January 1993

Member state	<i>ECUs</i>		
	Beer ^a	Wine ^b	Spirits ^c
Belgium	1.46	36.28	1,566.03
Denmark	8.43	86.10	3,662.13
France	0.25	3.30	1,174.32
Germany	0.79	0	1,315.95
Greece	0.95	0	549.12
Ireland	9.24	271.88	2,676.78
Italy	1.57	0	550.16
Luxembourg	0.79	0	1,011.14
Netherlands	2.89	48.51	1,433.96
Portugal	3.66	0	726.86
Spain	0.76	0	578.31
United Kingdom	1.46	165.89	2,484.66
EC minima	0.748	0	550

Notes:

a. Excise duty per hl per °Plato finished product.

b. Excise duty per hl finished product.

c. Excise duty per hl pure alcohol.

Source: Commission of the European Communities, 1994.

higher domestic prices relative to those abroad and, therefore, an incentive for cross-border shopping. In the next chapter we begin our discussion of cross-border shopping with a review of the evidence available. We discuss some relevant examples from other countries, and look at preliminary estimates of the level of cross-border shopping in the UK.

4 Cross-Border Shopping

4.1 The Problem

The differences in excise duties between the UK and other EU member countries offer a financial incentive for UK consumers to buy alcohol in neighbouring European countries. Against this must be set the costs of travelling to the continent, including the cost of reaching the border, the fare for crossing the Channel and the opportunity cost of the time involved. Recently, however, numerous examples¹⁷ have been provided that show that, provided sufficient quantities of alcohol are purchased, the price savings more than outweigh the costs of making the trip, and hence cross-border shopping can be quite profitable.

There are three principal reasons why cross-border shopping may be a matter of concern:

- **Inefficiency:** Cross-border shopping may result in an inefficient allocation of resources to the extent that consumers' purchase decisions are driven by tax differences rather than by underlying differences in producer prices. There are at least two possible dead-weight losses, as the following example will show. Suppose that beer is homogeneous and is cheaper to produce in the UK than abroad, but duty differentials mean that non-UK beer is cheaper for UK consumers. Assuming that British producers are not able to sell their product abroad, the extra resources allocated to the non-domestic production of beer for UK consumers, in addition to those that would be required to produce the same quantity of beer in the UK, represent a dead-weight loss. To the extent that domestic producers are able to sell their product in low-tax countries, this misallocation of resources in production is reduced. However, the resources spent transporting beer from factories in the UK to retail outlets elsewhere are wasted. In addition to this, the resources - time and money - spent by consumers in crossing the border are a further source of dead-weight loss.

17. See Treasury and Civil Service Committee (1994).

• **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 UK consumers will inevitably mean a reduction of on-licence sales in the UK, and a shift in revenue away from licensed sales, as well as a shift from domestic to non-domestic retailers.

• **Tax revenues:** Reduced domestic expenditure on alcohol will cause a loss of excise duty and VAT revenue to the domestic exchequer. The UK has traditionally imposed high rates of duty on alcohol as a matter of fiscal preference, as well as on health grounds. In our discussion of the economic rationale for imposing higher rates of tax on alcohol in Chapter 2, we focused on possible imperfections in the market for alcohol. In reality, however, 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. Excise duty revenues from alcohol have typically formed a larger proportion of total tax revenues in the UK than they do in any other EU countries with the exception of the Irish Republic, as Table 4.1 shows.

There is no mechanism within the European Union 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 may 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 fully reflected in increased non-domestic revenue and reduced domestic revenue.

Table 4.1: Alcohol Duty Revenues as a Percentage of Total Tax Revenues, 1989

Member state	Duty as a percentage of total tax revenues
Belgium	0.6%
Denmark	1.7%
France	0.5%
Germany	0.6%
Greece	0.3%
Ireland	4.6%
Italy	1.4%
Luxembourg	0%
Netherlands	0.8%
Portugal	0.5%
Spain	n.a.
United Kingdom	2.4%

Source: Revenue Statistics of OECD Member Countries, 1965-1990.

4.2 European Evidence on the Border Effect

There is a large body of evidence on cross-border shopping in other countries, which can be used to infer the likely consumer response to excise duty differentials in the UK and the effects of any government response to the problem. Much of this comes from the US where the ability of state governments to set sales taxes combined with the complete absence of interstate border controls has meant numerous opportunities for consumers living in high-tax states to cross state borders to shop. Perhaps of most relevance to the UK are two case-studies of cross-border shopping within the European Union. The first was a detailed study of shopping across the Danish-German border by the Danish Institute of Border Region Studies during the 1980s. The second was an analysis of cross-border shopping between Northern Ireland and the Republic of Ireland by the Economic and Social Research Institute. Both studies are examined further below.

- **Denmark**

There have long been substantial differences in tax rates and in retail prices between Denmark and Germany, particularly on petrol and alcohol. Prior to Denmark joining the EC in 1973, cross-border shopping was not a serious problem because of the operation of strict border controls. The importation of alcohol from Germany, for example, was completely prohibited for short-term visitors, and strictly limited for longer-term visitors. Although the Danish government obtained a temporary derogation from the EC harmonisation directive to impose a minimum travel duration on those wishing to import spirits, the scale of cross-border shopping increased significantly during the 1970s and 1980s following the removal of the bulk of the border controls. The problem of tax differentials was exacerbated by the Easter Package of July 1986 which introduced sharp increases in the duty rates on petrol. By 1989 the Danish Institute of Border Region Studies estimated that 1 per cent of total Danish expenditure was made in Germany.

The Institute monitored the level of cross-border shopping by conducting regular surveys of travellers. One main finding from these surveys was that the level of cross-border traffic can be used as a good proxy for the amount of cross-border trade. The Institute found that 95 per cent of Danes crossing the border made purchases in Germany, and that 70 per cent made the trip for the sole purpose of shopping. Second, proximity to the border was found to be an important factor: an estimated 50 per cent of all cross-border shopping was done by Danes living within 50 kilometres of the German border. Third, certain goods - beer, wine, cigarettes and petrol - were extremely popular purchases and acted as 'trigger goods' to motivate consumers to cross the border. All were goods that had very large tax differentials; the average difference in the retail price of a litre of beer between Denmark and Germany, for example, was 200 per cent in 1989. However, there is evidence to suggest that once consumers had been tempted to cross the border by the savings available on these trigger goods, they tended also to buy a wide range of products on which there were far smaller savings available.

In the early 1990s the Danish government decided to take action to limit cross-border shopping. The Easter Package was almost completely reversed, and between 1991 and 1992 duty rates on beer and wine were cut by 48 per cent. As a result, domestic consumption

of petrol and alcohol rose. Spending on beer increased by 4 per cent between 1991 and 1992, and that on wine by 21 per cent. However, these increases were not sufficient to compensate for the fall in tax revenue per unit, and government tax receipts from alcohol fell substantially. Compensating tax increases on other goods were required. However, by reducing the tax differentials on the trigger goods, the Danish Ministry of Taxation estimated that the level of cross-border shopping was cut back to half its previous level, and domestic demand for a whole range of other goods that consumers had also been buying across the border increased. Since then, indirect taxes in Germany have risen to partly pay for reunification, further reducing cross-border flows.

• **Republic of Ireland**

A study by FitzGerald, Quinn, Whelan and Williams (1988) analyses the effects of tax differentials between Northern Ireland and the Republic of Ireland on cross-border shopping using two main sources of evidence - the results of interviews with households on both sides of the border carried out during the six months up to January 1987, and time-series data on particular goods subject to excise duties. In the 1970s there was virtually no cross-border shopping between the Republic and Northern Ireland. In the 1980s, however, a combination of a sterling depreciation and indirect tax increases in the Republic led to an average price differential of 20.7 per cent in favour of Northern Ireland, and an increased incidence of cross-border shopping by consumers from the Republic.

The main findings from the survey evidence were broadly similar to those from Denmark. Again the volume of traffic crossing the border was found to be a good proxy for cross-border shopping: 89 per cent of all trips to the north were 'solely' or 'mainly' for shopping reasons. The survey data were used to run regressions on the number of shopping trips made, the average amount spent per trip and the household's perceived level of saving necessary to make such a trip worthwhile. The results showed that, as in Denmark, distance from the border is an important determining factor in cross-border shopping: 36 per cent of the observed variation in number of trips can be explained by distance from the border and the presence of a car in the household. Perhaps surprisingly, income and socio-economic status and the number of children, all of which might be thought to reflect the opportunity cost of cross-border shopping, were found to be insignificant.

As in Denmark, there was evidence that certain products acted as trigger goods. These tended to include goods subject to higher excise duty rates in the Republic, such as petrol and alcohol. Among the respondents who made cross-border shopping trips over the survey period, two-thirds of petrol consumed and almost all alcohol for home consumption was purchased in the North. However, respondents did report a very wide range of goods bought. The time-series data were used to explore the likely effects of changes in relative prices on the extent of cross-border shopping for particular goods. However, in the case of spirits, data on exports of bottled spirits from the Republic were used as a proxy for cross-border purchases. This may make any estimates unreliable since it assumes not only that the bulk of these exports are reimported by cross-border shoppers, but also that cross-border shoppers from Eire tend to buy home brands of spirits. The elasticity estimates obtained suggested that the cross-border trade in spirits was sensitive to price differentials, and that a substantial cut in the excise duty rate would be largely self-financing. In 1991 the rate of VAT in the Republic was reduced from 23 per cent to 21 per cent at the same time as the UK government raised the rate from 15 per cent to 17.5 per cent. Excise duties on many goods were also cut as a direct response to cross-border shopping. Overall, the effect of these changes on tax revenue was negative, and the government introduced an offsetting increase in excise duties on cigarettes.

• **Lessons for the UK**

It is clear from these case-studies that differences in retail prices can act as a strong incentive for cross-border shopping. It is also clear that certain goods, especially alcohol and petrol, can act as trigger goods, but that once motivated to cross the border, consumers often purchase a broad basket of goods on which there are smaller savings to be made. Distance from the border - and hence the cost of reaching the border - is an important factor in determining the extent of cross-border shopping. The government can reduce the extent of cross-border shopping by cutting tax rates on trigger goods, but in the case of Denmark and the Republic of Ireland, there was a price to be paid in lost revenue, and compensating tax increases were required on other goods.

There are three respects in which the UK might differ from both Denmark and Eire. First, while there are significant differences in excise duty rates on alcohol which are likely to act as a trigger for cross-border trade, the rate of VAT in the UK is lower than that in France, and consumers will not have the opportunity to make smaller savings on a broad basket of other goods. It is likely, therefore, that cross-border trade between the UK and France will consist almost exclusively of alcohol and cigarettes. Second, the Channel provides a natural barrier between the UK and the rest of Europe, and sets a minimum level to the cost of cross-border shopping which is not present for any other European country. The level of saving necessary to make a trip across the border worthwhile must, therefore, be correspondingly higher. Third, UK visitors to European countries enjoyed duty-free allowances prior to the completion of the Single Market, and therefore had a limited incentive to make cross-border shopping trips.

4.3 Evidence from the UK

There is little direct evidence on the extent of cross-border shopping in the UK since the completion of the Single European Market. The removal of border checks has made it difficult to monitor the precise volume of goods brought into the UK from other EU member countries. There are several studies, however, that use indirect evidence to assess the level of cross-border trade and to make estimates of the effect of excise duty differentials on alcohol demand. We discuss some of these below.

- **Cross-Channel traffic:** From the studies carried out in Denmark and Eire, it is clear that the volume of cross-border traffic could be used as a proxy for cross-border trade since the majority of trips across the border were carried out solely or mainly for shopping purposes. Two studies looked at recent trends in ferry crossings across the Channel.

Alcohol Concern, using figures from the Department of Transport, calculated the total number of passengers crossing the Channel each year since 1989.¹⁸ It found that there had been an increase of less than 4 per cent in the number of passengers between 1992 and 1993, compared with a 12 per cent rise the previous year. It concluded that higher incomes,

18. Memorandum submitted by Alcohol Concern to the Treasury and Civil Service Select Committee (1994).

improved ferry services and an intensification of competition in the run-up to the opening of the Channel Tunnel had caused a general rise in the volume of cross-border traffic and that the completion of the Single Market had had little impact.

London Economics estimated a model of demand for cross-Channel trips using data for 1987-94, and generated predictions for the volume of crossings based on figures on consumers' expenditure and the unemployment rate.¹⁹ Up to the first quarter of 1993 the model was fairly accurate, but it subsequently underpredicted the actual number of crossings. In addition London Economics estimated a model for domestic beer sales. From 1993 its model overpredicted domestic demand by 3-8 per cent of total domestic beer sales. On the basis of these data the researchers made a preliminary estimate of the loss of excise revenue on beer to Customs and Excise of £135 million. The cost of cross-border shopping to the industry as a whole was put at £1 billion in 1994.

- **Survey evidence:** The OPCS Omnibus Survey collects data on foreign travel and purchases abroad from a random sample of around 2,000 individuals every two months. Data collected between July 1993 and July 1994 were used by the Health Education Authority as evidence of the scale of cross-border trade following the completion of the Single Market.²⁰

During the period a total of 14,460 people were interviewed, of whom 8 per cent had visited EU countries within the previous two months. This subsample were asked questions about their purchases of alcohol and tobacco abroad. It was found that 28 per cent of travellers bought spirits, and the mean quantity purchased was 2.7 litres. Twenty-six per cent bought wine, mean purchase 11.1 litres, and 14 per cent bought other alcohol products (including beer), mean quantity 18.6 litres. The Health Education Authority concluded from this evidence that 'neither tobacco nor alcohol products are purchased on foreign journeys by

19. Memorandum submitted by Tesco Stores Limited to the Treasury and Civil Service Select Committee (1994).

20. Memorandum submitted by the Health Education Authority to the Treasury and Civil Service Select Committee (1994).

large numbers, or in large quantities'. The data are, however, likely to underreport the true volume of cross-border trade since those importing for illegal resale are unlikely to respond.

The Wine and Spirit Association conducted its own surveys at ports to collect information on the level of cross-border trade in wine and spirits.²¹ On the basis of these it made a preliminary estimate of the annual loss to the UK exchequer in excise, VAT and corporation tax of £285 million on wine and spirits alone. However, these estimates are based on a very small sample of interviewees.

• **UK excise duty revenues:** The government has produced its own estimates of revenue lost as a result of increased cross-border trade. These are based on the survey evidence collected by the OPCS. During the first year of the Single Market, HM Customs and Excise²² estimated that legitimate increases in cross-border shopping led to additional revenue losses of £200 million, of which £100 million was attributed to lost sales of wine, spirits and beer. Revenue losses on alcohol sales of £70 million were estimated for the previous year. In addition, a further £35 million was thought to have been lost because of 'bootlegging'. The level of such illegal activity is, of course, extremely difficult to measure; the government's estimates are extrapolated from the known values of seizures, assuming a 5 per cent detection rate.

Differences between the official and trade estimates are partly a result of differing underlying assumptions about the volume of cross-border trade considered 'additional' to that which would have been purchased in the UK. HM Customs and Excise assumes that half the alcohol imported from Europe represents additional consumption, and therefore has no implications for domestic excise revenue. The availability of cheaper alcohol will lead to some extra consumption since people's real incomes will increase as a result, although HM Customs and Excise stresses that its estimate of the extent of this is subject to a large margin of error.²³

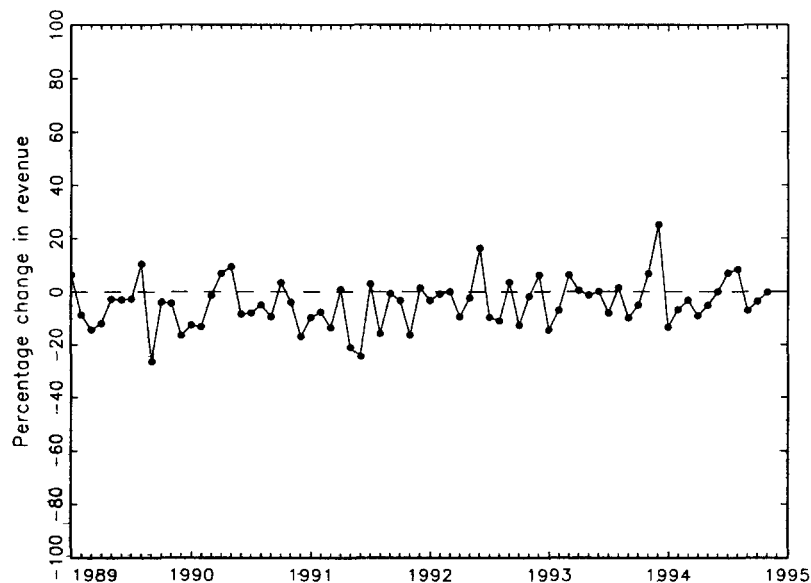
21. Memorandum submitted by the Wine and Spirit Association to the Treasury and Civil Service Select Committee (1994).

22. Volume 12 of the *Appropriation Accounts of the National Audit Office, 1993-1994* (HMSO, 1994).

23. Minutes of Evidence taken before the Treasury and Civil Service Select Committee (1994).

Further evidence to support the official - lower - estimates of the revenue loss from cross-border shopping comes from trends in revenue receipts. In spite of the greater opportunities for cross-border shopping, the first couple of years of the Single Market have seen increases in nominal revenue receipts ahead of recent trends. Receipts from duties on spirits rose from £1,677 million in 1992 to £1,727 million in 1993, although there was a slight fall in 1994 to £1,709 million. Beer receipts fell between 1992 and 1993, from £2,376 million to £2,230 million,²⁴ but increased in 1994 to £2,500 million. Receipts from wine rose steadily over the period: from £968 million in 1992 to £1,046 million in 1993 and £1,119 million in 1994.²⁵

Figure 4.1: Annual Changes in Revenue: Beer



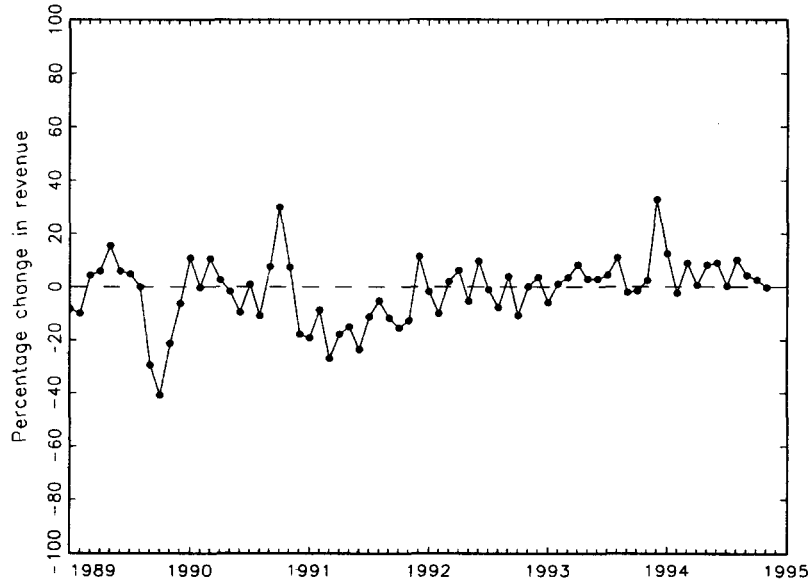
Source: *Financial Statistics*.

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24. Receipts in July 1993 were low because of the introduction of end product duty.

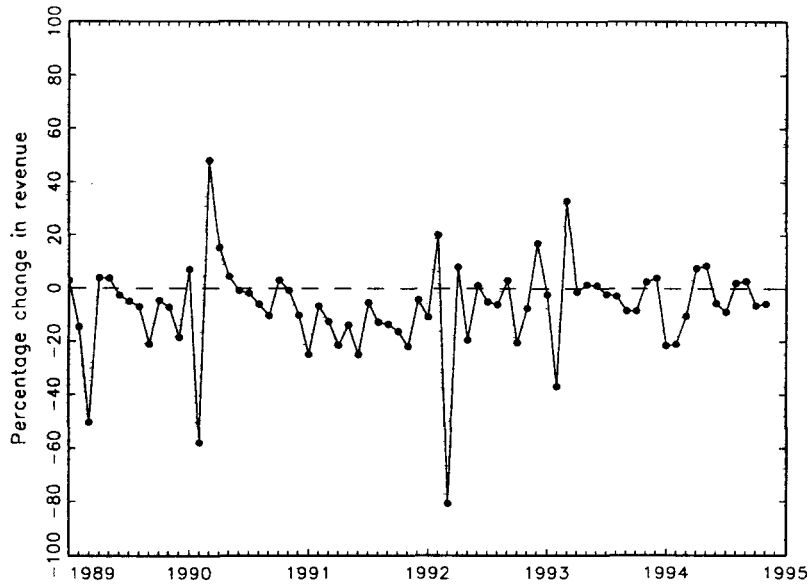
25. Figures taken from *Financial Statistics*, March 1995.

Figure 4.2: Annual Changes in Revenue: Wine



Source: Financial Statistics.

Figure 4.3: Annual Changes in Revenue: Spirits

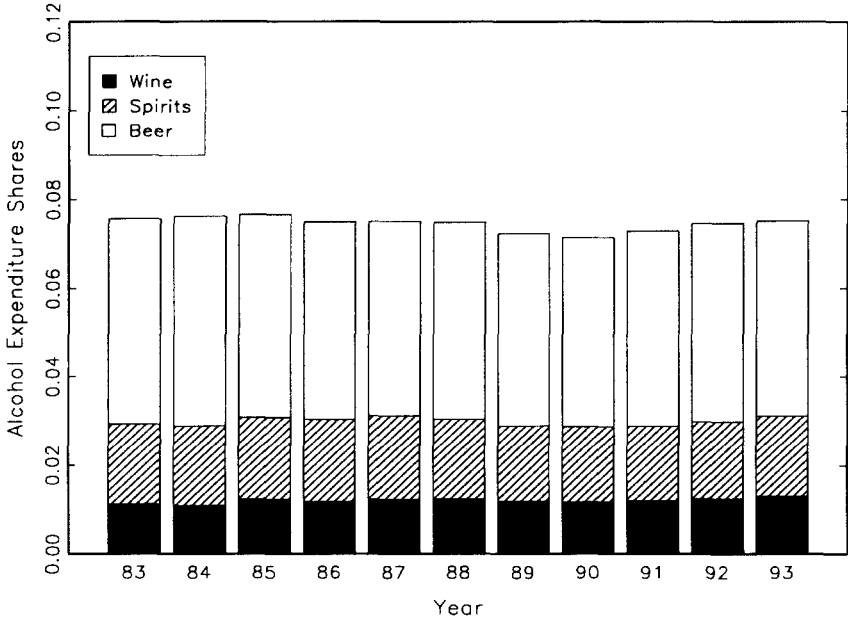


Source: Financial Statistics.

Figures 4.1 to 4.3 show annual percentage changes in real revenue receipts for beer, wine and spirits respectively. There has been considerable fluctuation in year-on-year receipts in all three cases, particularly for spirits, and clear trends are difficult to discern. However, there is little sign in 1993 and 1994 of the persistent negative numbers which might have been anticipated following the completion of the Single Market. This evidence confirms the robustness of excise duty revenue in the face of cross-border shopping.

- **Household survey evidence:** Trends in household spending on alcohol in the UK can be used to infer the impact of cross-border shopping. If cross-border trade accounts for a significant percentage of national expenditure, then it should show up as a downward trend in domestic sales since the beginning of 1993. In this section we use 10 years of data from the Family Expenditure Survey (1984-93) on household spending on alcohol in the UK to make a preliminary assessment of the extent of legitimate²⁶ cross-border shopping.

Figure 4.4: Expenditure Shares on Alcohol



Source: Family Expenditure Survey.

26. Using these data we cannot measure the impact on demand for foreign-bought alcohol that is smuggled across the border for illegal resale since there is no way of determining the origin of domestically-bought alcohol in the FES, or whether the consumer has paid VAT and excise duty.

For all consumers in Great Britain (i.e. excluding Northern Ireland) we calculate the mean expenditure shares on domestic alcohol as a proportion of total non-durable expenditure, and hence control for fluctuations in total demand. We plot these for 1984-93 in Figure 4.4. The figures for alcohol expenditure shares give little support to the claim that cross-border shopping has had a significant effect on domestic alcohol spending. Over the period as a whole, the expenditure share on alcohol has been broadly constant at nearly 8 per cent of non-durable expenditure. Beer (including stout, ale, shandy, cider and perry) comprised the largest share of spending on alcohol, with an expenditure share of around 5 per cent of non-durable spending. The expenditure share on spirits (including liqueurs) was fairly constant at around 2 per cent. Wine (including non-fortified wine) had the smallest expenditure share, of only 1 per cent, although there was a slight increase in spending on wine over the period. There was a dip in alcohol spending at the end of the 1980s, but this recovered at the beginning of the 1990s. If anything, the expenditure share in 1993 was greater than that in the previous year. There is no evidence that the share of total spending on domestic alcohol fell following the completion of the Single Market.

5 Tax Revenue Maximisation

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 implication from cutting tax rates - excise duty revenues. In this chapter we present a simple economic model of the relationship between tax rates and tax revenues and consider the government's best course of action if it were to seek to recoup the revenues lost to cross-border shopping.

As noted in Section 4.1, the UK government raises a greater proportion of its total tax revenue from excise duties than any other country in the EU except Eire. In 1992, for example, the total revenue yield from alcohol duties in the UK was over £5 billion, equivalent to 2 per cent on value added tax or 2.5 pence on income tax. 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. However, the government's ability to recoup lost revenues, or raise additional revenues, by altering the tax rate on alcohol has been affected by the Single Market and the relaxation of restrictions on personal imports of alcohol.

HM Customs and Excise estimates the loss of tax revenues due to additional legitimate cross-border shopping in 1993 at £200 million. 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 fall. In this chapter we consider the relationship between tax rates and revenue yield.

We are not concerned in this Commentary 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 may be 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. 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.

5.1 Theory

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 in Box 5.1.

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

Box 5.1

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,

$$R = \tau\pi q \quad (1)$$

where q is a function of the tax-inclusive price $p = \pi(1 + \tau)$.

Differentiating with respect to the tax rate τ we obtain.

$$\frac{\partial R}{\partial \tau} = \pi q + \pi\tau \left(\frac{\partial q}{\partial \tau} \right) \quad (2)$$

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

$$\partial p = \pi\partial\tau \quad (3)$$

and

$$\partial q = \varepsilon q \left(\frac{\partial p}{p} \right) \quad (4)$$

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

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

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).

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

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. $\epsilon = 0$), 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 demand is elastic (i.e. $\epsilon < -1$), tax revenues decline as tax rates are increased ($\partial R/\partial \tau < 0$).²⁷

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 the demand at 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.

Is the UK's current set of alcohol excise duties revenue-maximising? Suppose that it is; then $p = p^*$. Using equation (6) we can calculate the values of the current elasticities for wine, beer and spirits, i.e. $\epsilon^*|_{p=p^*}$, implied if the present price and tax structure is revenue-maximising. We label these the limiting elasticities and denote them by $\tilde{\epsilon}^*$. Table 5.1 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

27. 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)).

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.

Table 5.1: Elasticity Limits

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

Notes:

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

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.

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

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

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 curve²⁸ 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

28. Obviously with the exception of those with constant elasticity.

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 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 Chapter 6.

5.2 The Effect of the Single European Market

In the previous section we showed that the relationship between tax rates and tax revenues depends on the own-price elasticity of demand. In particular, we have shown that there is a well-defined relationship between taxes, final prices and the price elasticity which corresponds to the point of revenue maximisation. In this section we discuss what effect the Single European Market has on the relationship between tax rates and tax revenues, and whether it has any effect on the tax rate at which revenue is maximised.

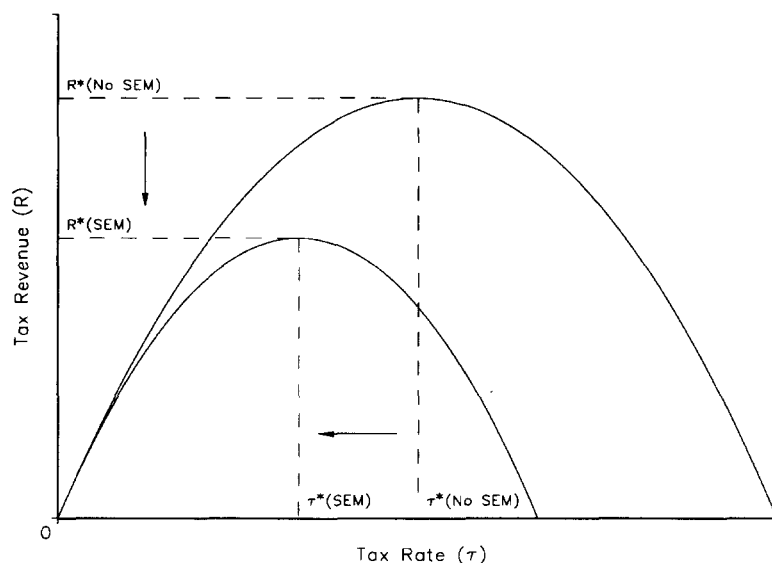
Intuitively, it is likely that the Single Market and the increased opportunities for cross-border shopping will have made domestic demand for alcohol more elastic: the increased availability of close substitutes that the Single Market has brought means that domestic consumers have a further degree of 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.²⁹

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 can be seen in Figure 5.1. 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 to cause a reduction in both the

29. See Crawford and Tanner (1995) for a more general model.

revenue-maximising tax rate 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.³⁰

Figure 5.1: The Effect of the Single Market on the $\tau:R$ Relationship



If, as a result of the Single Market, domestic demand does become more responsive, the revenue-maximising tax rate will fall. 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, $\tau^*(NoSEM)$ is no longer the revenue-maximising tax rate. At the pre-SEM tax rate, cuts in tax rates will cause revenues to rise. $\tau^*(SEM)$ 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 Single Market is to increase the domestic elasticity to an extent that $\partial R/\partial \tau$ changes sign is an empirical matter. In Chapter 6 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.

30. From equation (6): $\epsilon^* = \frac{-(1+\tau^*)}{\tau^*} \Rightarrow \frac{\partial \tau^*}{\partial \epsilon^*} < 0$.

6 Empirical Evidence

In this chapter we use 20 years of data from the Family Expenditure Survey (a sample of around 150,000 households) to examine some of the theoretical issues raised in Chapter 5. 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. Finally 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.

6.1 Revenue Maximisation

We derive our estimates of the own-price elasticities from single share equations of the demand for UK beer, wine and spirits.³¹ 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 System³² shown in equation (8).

$$w_i = \alpha_{0i} + \sum_k \alpha_{ik} Z_k + \beta_i \ln X + \sum_j \gamma_j \ln p_j + \delta_i S \cdot \ln p_i + \psi_i S \cdot SE \cdot \ln p_i + \phi_i \lambda_i + u_i \quad (8)$$

31. See Crawford and Tanner (1995) for a detailed description.

32. See Deaton and Muellbauer (1980).

For each good i the budget share³³ (w_i) is treated as a function of log real price ($\ln p_i$), log real total household non-durable expenditure³⁴ (X), instrumented by log real income,³⁵ and a vector of household characteristics (Z_k). These include 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 ($S \cdot \ln p_i$) and also interact this with a dummy variable for the South East ($S \cdot SE \cdot \ln p_i$), 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 which 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 6.1 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 the smallest proportional demand response for beer. By comparing these estimates against their limiting values in Table 5.1, we were able to test the null hypothesis that current excise duty rates are at their revenue-maximising level ($H_0: \hat{\epsilon} = \tilde{\epsilon}^*$) against the alternative that the rates are not revenue-maximising ($H_1: \hat{\epsilon} \neq \tilde{\epsilon}^*$). We report the results of our statistical tests in Table 6.1.³⁶

33. 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.

34. Since, as we have already shown, the Engel curves for alcohol are quadratic, we include higher-order terms in log expenditure.

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

36. A t-statistic larger than 1.96 means that we can reject our null hypothesis with a 95 per cent confidence level; one larger than 1.64 means we can reject at the 90 per cent level.

For beer and wine, therefore, we reject the hypothesis that duties are presently at their revenue-maximising levels. In the case of spirits we are unable to reject the null hypothesis that current duty rates on spirits are at their revenue-maximising level.

Table 6.1: Point Elasticity Estimates

	Estimated elasticity: $\hat{\epsilon}$	95% confidence interval	t-statistic $H_0: \hat{\epsilon} = \tilde{\epsilon}^*$
Beer	-0.668 (<i>0.238</i>)	[-1.134, -0.202]	10.68
Wine	-1.396 (<i>0.312</i>)	[-2.008, -0.784]	1.97
Spirits	-1.181 (<i>0.268</i>)	[-1.891, -0.471]	1.34

Note:
Standard errors are reported in italics.

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of final?

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 beer and wine 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 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. Given the functional form of our model we are unable to calculate by how much duties on beer can be increased. The estimated price parameters on the beer equation imply that the absolute value of the elasticity will never exceed minus one, however much we increase the price, and therefore, because of the functional form which we chose for our model, equation (6) can never be satisfied at any point on our estimated demand curve. For beer we simply record that $|\hat{\epsilon}| < |\tilde{\epsilon}^*|$ 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 6.2. It is important to note that these solutions are functions of estimated parameters of the relevant demand equation. To avoid giving a false impression of accuracy, therefore, 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 footnote to the table.

Table 6.2: Revenue-Maximising Prices and Tax Rates (1993 prices)

	Current ^a p, τ	Maximising ^b p*, τ^*	\pm one s.e.(ϵ^*)
<i>Wine</i>			
Price	290p	349p	[293p, 471p]
Tax rate	99%	139%	[101%, 223%]
<i>Spirits</i>			
Price	1112p	1450p	[832p, 2173p]
Tax rate	184%	271%	[113%, 456%]

Notes:

a. Source: HM Customs and Excise, 1994.

b. Authors' calculation.

ϵ^* : wine = -1.7199; spirits = -1.3691.

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% (from 290 pence to 349 pence in 1993 prices). However, our reported margins of error are very broad, 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. Furthermore, 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, unsurprising given that spirits are far more heavily taxed per unit of alcohol than other forms of 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^* .

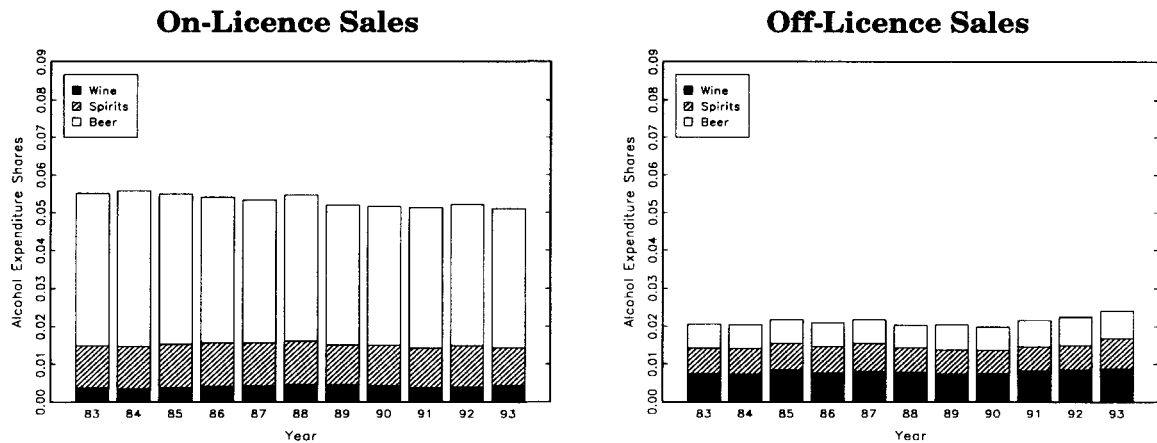
6.2 The Single Market

In Section 5.2 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 the characteristics of the goods themselves - and hence their substitutability with foreign products - and the characteristics of consumers.

- **Substitutability:** The size of the change in elasticity will be affected by the degree of substitutability between domestic and non-domestic forms of alcohol, and this 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 is shown in Figure 6.1.

Figure 6.1: Expenditure Shares on Alcohol, by Place of Purchase



Source: Family Expenditure Survey.

These figures 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.

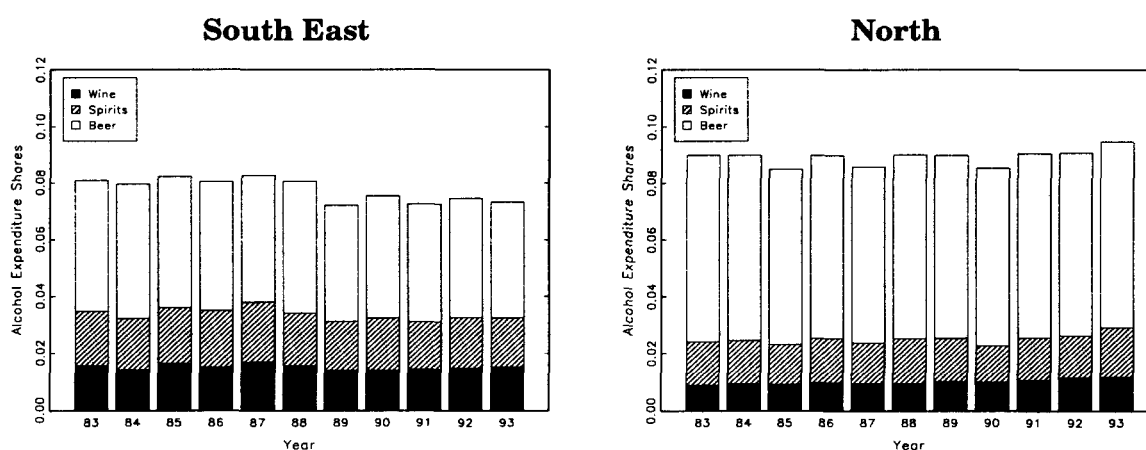
- **Household characteristics:** There are many factors that will affect the extent to which consumers will respond to price changes by shopping across borders and that will determine the size of the change in elasticity. In general we would expect that the response to increased opportunities for cross-border shopping would vary with the following: the distance from the border,³⁷ the presence of a car and/or van, the opportunity cost of time, the strength of individual preferences for the domestic over 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

37. See Kanbur and Keen (1991).

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 are indifferent between French and English alcohol, 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, North³⁸ and South East,³⁹ using data from the FES. These are shown in Figure 6.2.

Figure 6.2: Alcohol Expenditure Shares, by Region



Source: Family Expenditure Survey.

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 a clear fall in the size of the alcohol expenditure share in the South East, this did not happen 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.

38. Including Yorkshire and Humberside and the North West.

39. Including Greater London and East Anglia.

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 6.3 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 that there was no significant change in the elasticity for each good between 1992 and 1993. We report the t-statistics for the hypothesis test of no change in the final column of Table 6.3.

Table 6.3: Point Elasticity Estimates, 1993 and 1992

	Estimated elasticity, 1993	Estimated elasticity, 1992	t-statistic $H_0: \hat{\epsilon}_{92} = \hat{\epsilon}_{93}$
<i>Beer</i>			
UK	-0.668 (0.238)	-0.895 (0.125)	0.844
S. East	-1.285 (0.359)	-0.874 (0.150)	-1.058
<i>Wine</i>			
UK	-1.396 (0.312)	-0.703 (0.006)	-2.211
S. East	-2.543 (0.362)	-0.723 (0.005)	-5.032
<i>Spirits</i>			
UK	-1.181 (0.268)	-1.421 (0.073)	0.865
S. East	-1.572 (0.345)	-1.430 (0.075)	-0.403

Note:
Standard errors are reported in italics.

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 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 are higher than those in the UK as a whole. On the basis of these figures it would appear that, in the South East, 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.

7 Conclusions

The object of this Commentary is 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’.

In Chapter 2 we argue that externalities can provide an economic justification for imposing additional taxes on alcohol. Differing externalities, however, are unlikely to explain the current tax bias against spirits and we argue that a common base for the taxation of similar goods is sensible. Lower taxes on beer may, however, reflect the government’s desire to redistribute income in favour of poorer households. Looking at the incidence of alcohol taxes, we conclude that middle-income households would be most affected by changes in the level of taxes applied to alcohol. Richer households would benefit most from any decision to cut duties on wines and spirits.

Differing externalities are unlikely to explain the fact that taxes on alcohol are higher in the UK than in most other EU member countries. The decision of the Commission to only specify minimum rates means that variations in excise duty rates between member countries have persisted after the completion of the Single Market. These have contributed to an incentive for cross-border shopping by consumers in high-tax countries such as the UK, Denmark and Eire.

In Chapter 4 we identify three main problems with cross-border shopping: the dead-weight efficiency loss when the tax system causes firms and households to alter their behaviour, the damage to domestic alcohol sales and production, and the loss of tax revenues accruing to the high-tax government. Two European case-studies - Denmark and Eire - show that indirect tax differences do act as a real incentive for consumers to cross-border shop. However, there are three main differences between the UK and these countries that will potentially dampen the impact of the Single Market. First, the absence of major VAT differences between the UK and close low-tax EU countries will reduce spending on

non-dutiable items. Second, the cost of crossing the Channel sets a minimum to the cost of crossing the border. Finally, the existence of duty-free allowances prior to the completion of the Single Market meant that there was already a limited incentive to cross-border shop.

However, there are several studies that use indirect evidence on the volume of cross-Channel traffic and trends in government revenue to show that cross-border shopping may already be a problem. HM Customs and Excise uses survey data to estimate that, in the first year of the Single Market, additional excise revenue losses from increased legitimate cross-border shopping amounted to £200 million, of which £100 million was attributed to lost sales of beer, wine and spirits.

Increasing concern about cross-border shopping has led to calls for reductions in excise duties. For the exchequer, a key concern is the effect of such a policy on tax revenue. 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 is explored in Chapter 5, and we show 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 revenue-maximising following an increase in demand responsiveness. In this case, cutting taxes will increase tax revenues.

In Chapter 6 we use data from the Family Expenditure Survey to test some of these theoretical results. We estimate a model of domestic demand for beer, wine and spirits and we calculate the present level of demand responsiveness for each good. We test whether current excise duty rates are revenue-maximising, and we show that domestic demand for beer and wine is insufficiently price-responsive for current tax rates to be so. For spirits we cannot reject our hypothesis and we conclude that current excise duty rates on spirits could be at their revenue-maximising level. We therefore conclude 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 show, the scope for further real increases in duties is limited.

Finally, we test whether the Single Market 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 cannot detect any statistically significant change in the responsiveness of demand for beer and spirits. However, we do observe a significant increase in the price elasticity of wine between 1992 and 1993, although this is not sufficient to make the current excise duty rate on wine revenue-maximising. We have 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 find 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 Equation for Beer

Variable	Estimate	Standard error	t-statistic
<i>Dependent Variable is Share of Beer</i>			
ln(Expenditure)	0.08069	0.00937	8.611
(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
South East	-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:

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

Variable	Estimate	Standard error	t-statistic
<i>Dependent Variable is Share of Wine</i>			
ln(Expenditure)	0.04045	0.00764	5.292
(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
South East	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	-13904
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

Variable	Estimate	Standard error	t-statistic
<i>Dependent Variable is Share of Spirits</i>			
ln(Expenditure)	0.06027	0.01340	4.496
(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
South East	-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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