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INDIRECT TAX DISTORTIONS IN A  
EUROPE OF SHOPKEEPERS

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January 1995

Working Paper No. 56

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# **Indirect Tax Distortions in a Europe of Shopkeepers**

## **VAT Induced Distortions in a Two Sector Model of Integrated Economies**

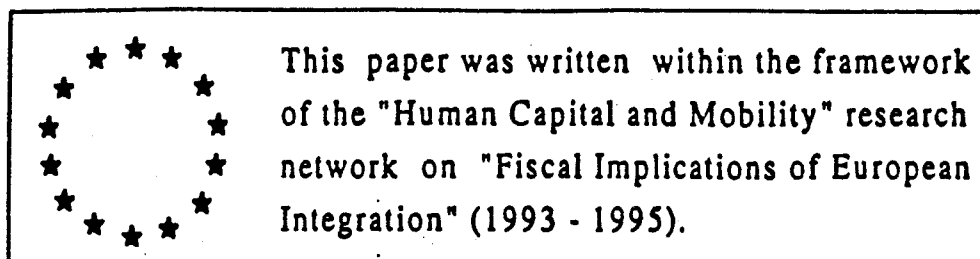
by

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**This Version: 23 January 1995**

The changed circumstances of the EU after 1992 have given rise to concern about possible indirect tax competition and related economic distortions. This paper develops a model, incorporating both a production and a retail sector, to examine the effects of different VAT regimes. This model is applied to data on consumer behaviour in the proximity of the Ireland-UK and the Denmark-German borders showing that the potential size of "border" areas, where distortion may be expected, is relatively small. The paper suggests that there are very limited incentives for governments to act strategically in choosing their indirect tax rates.

Keywords: VAT regimes, Indirect Tax Distortions, Cross-Border Shopping, Tax Competition.



Acknowledgements: The authors would like to thank Patrick Honohan of the ESRI and the participants at a seminar organised in Copenhagen as part of the EU funded network on "Fiscal implications of European Integration" for their comments. They would also like to thank Mick Keen of the University of Essex for helpful comments. The authors themselves remain responsible for any errors which remain.

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## Introduction

Prior to 1993 the VAT system in the EU operated on a destination basis with tax being levied in the country of residence of the consumer; exports were exempted from VAT which was levied in the country of destination. The exceptions to this regime were limited, including a restricted volume of cross-border shopping by consumers. The system minimised distortion to producer prices, promoting productive efficiency (Diamond and Mirlees, 1971).

From the beginning of 1993 the EU moved to an integrated market without border controls involving a change in the nature of the VAT system: the position of producers has remained roughly unchanged<sup>1</sup> but consumers are free to buy most goods wherever they wish within the EU, paying tax in the country of purchase, not their country of residence. This change in regime opens up the possibility of distortion as a result of the effects on prices of arbitrage by consumers who are free to shop and pay tax in jurisdictions with low tax rates; governments, in turn, may react by adjusting their tax rates. A number of papers have examined the nature of possible distortions from this *ad hoc* regime. While Cnossen, 1990, took a relatively benign view of the change, Sinn, 1990, reached the rather apocalyptic conclusion that

“Unless the VAT rates are sufficiently harmonised, massive waves of cross border purchases in low tax countries must be reckoned with.” Sinn, 1990, p.491.

He felt that this could lead to substantial misallocation of resources and movement of tax bases through the increased potential for cross-border shopping and fraud.

The current regime was intended as a purely transitional arrangement with the expectation that the EU would move to a revised VAT system after 1996. The nature of this revised or “final” VAT system is not yet determined. It was originally proposed that it should involve the levying of taxation in the country of origin with exports within the EU no longer being exempt from VAT. In the case of international trade within the EU, where the purchaser is a registered trader, the VAT paid in the country of origin would be credited to the purchaser in the destination country.<sup>2</sup> In practice, this system would be similar to a destination regime for producers because VAT would still be reclaimable on inputs wherever purchased.<sup>3</sup> As with the

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<sup>1</sup> From an administrative point of view the handling of the exemption of VAT on exports has changed to take account of the abolition of border controls.

<sup>2</sup> Exceptions to this would occur where the purchaser is exempt from VAT e.g. where the purchaser is a government or a financial institution. The ending of the VAT exemption on exports would also have cash-flow implications for producers and retailers. This method of crediting VAT is referred to as the invoice system.

<sup>3</sup> Alternative versions of the “origin” regime which would not allow producers full credit for foreign

current interim regime, consumers would pay VAT in the country of purchase. The proposed post 1996 regime would incorporate a clearing house to ensure that the revenues from VAT within the EU would be allocated between countries on the basis of where goods are finally consumed - hopefully mimicking the disposition of revenues under the destination regime (Bundesministerium der Finanzen, 1994).

To date analysis of the potential effects of different types of VAT regime has concentrated on models where there are two types of agents - producers and consumers. In practice there are three sectors or types of agents who will be affected in different ways by different VAT regimes: producers who sell to each other and to retailers (distributors), retailers who buy from producers and sell to consumers, and consumers. In this model transport costs are significant for consumers but are assumed to be insignificant for other players. The introduction of transport costs for consumers makes the location of retailers an important variable. All three sets of actors can buy goods either at home or abroad; in the case of producers and retailers these purchases are assumed to incur insignificant transport costs.

In this world of producers, retailers, and consumers changes in the VAT regime will affect the players in the market in different ways. This paper uses evidence from earlier empirical studies to examine the potential significance of distortions arising from different VAT regimes within the EU. It shows how the size of "border" regions is determined by the costs of travel for consumers. The size of the retail sector and the extent of "border" regions relative to interior regions in individual countries will determine the significance of the distortions arising from different tax regimes.

This paper first presents the model incorporating a retail sector and applies it to different VAT regimes to see how they are likely to affect the economy. We then examine the empirical evidence on the likely significance of distortions arising from the different regimes and we consider the implications for government behaviour.

## **The Model**

We assume a world of two countries where a number of different goods ( $n$ ) are manufactured within the production sector of each country. Let  $P_i^k$  be the price of product  $i$  produced in country  $k$  where  $k \in [H, F]$ ,  $H$  being the home country and  $F$  the foreign. The products are sold both to other producers and to retailers at home and abroad; no goods are sold directly by

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VAT paid would have a very different impact (Genser, Haufler and Sørensen, 1993).

producers to consumers. The retail sector adds its margin,  $P_r^k$ , to the price of the input. Free trade operates between the two countries. Producers, retailers, and consumers are free to buy goods in either country.

Transport costs are significant for consumers purchasing goods from retailers whereas they are assumed to be insignificant for trade between producers and other producers or retailers. As a result, producers may be located anywhere within each of the two countries “home” and “foreign”. Retailers may also be located anywhere within either country but their market or hinterland will be limited by the cost of transport for consumers. For those retailers located in border areas there is potential competition from retailers located in the other country. In such cases differences in tax regime between the two countries may give rise to distortionary trade by consumers.

The potential for distortion through action of consumers shopping across borders depends crucially on distance and the potential savings from such activity. This determines the size of border regions relative to the size of the “interior” regions of each country. Later in the paper we examine empirically the definition of a “border” region.

Production of good  $i$  in country  $k$ ,  $Q_i^k$ , takes place using two factors of production, capital,  $K$ , and labour,  $L$ :

$$Q_i^k = f_i^k(K_i^k, L_i^k) \quad \forall i, i = 1, n \quad (1)$$

The retail sector uses the same two factors of production, capital and labour. The production function for the retail sector,  $r$ , is given by (2):

$$Q_r^k = f_r^k(K_r^k, L_r^k) \quad (2)$$

Provided certain regularity conditions are satisfied (Diewert, 1974) cost functions exist, dual to the production functions (1) and (2). It is assumed that there is perfect competition in both the goods markets<sup>4</sup> and the retail market; there are constant returns to scale in the production of goods and in retailing; labour and capital are homogeneous factors of production; the goods producing industries and the retail sector are individually too small to influence the price of labour. Labour is assumed to be in fixed supply in each country but is mobile between sectors and regions within each country. As a result, the price of labour is identical in all sectors in country  $k$ ,  $P_L^k$ , and is determined by the aggregate demand for labour in the economy. This

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<sup>4</sup> Unlike the models of imperfect competition explored by Lockwood, 1992, and Christiansen, 1994, in this case none of the incidence of the tax can fall on producers (or retailers).

means that only labour can bear the incidence of taxation which falls on the factors of production.

Capital is assumed to be mobile between sectors and between countries ensuring that the long run rate of return is identical in all sectors, countries, or regions of countries and the price of capital in countries H and F is  $P_K^H = P_K^F$ . The price of capital is assumed to be determined in the (large) foreign country<sup>5</sup>.

The unit cost of producing good  $i$  is given by the unit cost function, equation (3), dual to the production function (1).<sup>6</sup>

$$P_i^k = c_i^k(P_L^k, P_K^k) \quad \forall i, i = 1, n \quad (3)$$

The unit cost of production in retailing, the retail margin per unit sold,  $P_r^k$ , is defined in equation 4.

$$P_r^k = c_r^k(P_L^k, P_K^k) \quad (4)$$

### Effects of Different VAT Regimes

We consider three different tax regimes: a "pure" destination regime, similar to that in force in the EU up to 1992; a mixed regime, as currently in force or likely to be implemented in the EU after 1996; and a pure origin regime.

#### *Destination Regime*

As travel costs are assumed to be insignificant for producers and retailers, arbitrage by producers and retailers buying inputs will ensure that producer prices are equalised across countries:

$$P_i^H = P_i^F, \quad \forall i \quad (5)$$

In this case relative producer prices being identical in the two countries, changes in taxation will not affect resource allocation within the productive sector; there is no tax induced shift in activity affecting this part of the tax base in either country under a destination regime.

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<sup>5</sup> Alternatively, it can be assumed that it is set in the rest of the world with both home and foreign countries being small.

<sup>6</sup> Under perfect competition the output price is equal to the unit cost of producing the good. In this model the goods prices are assumed to be determined in the large country, F. The price of retail services, which is non-tradable, is determined by the cost of production.



Under a pure destination regime consumers, if they do shop across the border, still pay the domestic VAT rate.<sup>7</sup> As a result, providing that the law is obeyed, arbitrage by consumers exerts little pressure for the harmonisation of tax inclusive prices for similar goods across the two countries.<sup>8</sup> Arbitrage by retailers (and producers) will ensure that the tax can not be passed back to the production sector.<sup>9</sup> Thus all of the incidence will fall on consumers. As a result, the retail margin will not be affected by differences in VAT rates between the two jurisdictions. The corollary is that the ratio of the net of tax price of retail services (the retail margin) to the output price of goods produced domestically will not change as a result of changes in VAT at home or in the foreign country.

### *Mixed Regime*

For the market in intermediate goods, where the destination principle holds, firms can reclaim any VAT on domestic material inputs and they can buy foreign inputs free of VAT. As a result, arbitrage by producers and retailers buying inputs will ensure that producer prices are equalised across countries as transaction costs are assumed insignificant for goods travelling in bulk. Thus there will be no allocative inefficiency within the productive sector as suggested by Sinn, 1990.

In the absence of transport costs, consumers pay the tax inclusive price in the country in which they buy the good. The rate of VAT in country  $k$  is  $t^k$ . In the absence of transport costs, arbitrage by consumers in border areas will then ensure that the *ex post* consumer price in the border regions of the two countries are equalised:

$$\left( P_i^k + P_r^H \right) (1 + t^H) = \left( P_i^k + P_r^F \right) (1 + t^F) \quad (6)$$

Given that the producer prices of the identical products produced in the two countries are equated through arbitrage, if  $t^H \neq t^F$  then all of the effects of arbitrage by consumers will be felt by the retail margin. From (6),

$$P_r^H = P_i^k \left[ \frac{(1+t^F)}{(1+t^H)} - 1 \right] + P_r^F \frac{(1+t^F)}{(1+t^H)} \quad (7)$$

$$p_r^H < p_r^F \text{ if } t^H > t^F$$

<sup>7</sup> Up to 1993 allowances were available to individual shoppers permitting them to purchase and import limited volumes of goods paying the foreign rather than the domestic VAT rate.

<sup>8</sup> The evidence for Ireland in the mid-1980s suggests that there was a significant volume of illegal cross-border shopping (Fitz Gerald, Quinn, Whelan and Williams, 1988).

<sup>9</sup> Christiansen, 1994, considers the case where producers are a foreign monopoly and they absorb some of the incidence of the tax.

In this case the retail margin in the home country will be less than in the foreign country if the tax rate in the home country is greater than in the foreign country - in the absence of transport costs, all of the incidence of the excess of the high tax rate over the low tax rate will initially tend to fall on the retail sector. In the long run, under perfect competition, with the price of labour and capital set elsewhere, retailers will have to close as they can not absorb the reduction in their margin.

However, consumers face significant transport costs in buying goods outside their normal hinterland (Fitz Gerald *et al.*, 1988). Here we assume that the cost to the consumer rises with the distance travelled and express it as the cost per unit of goods purchased<sup>10</sup>,  $\delta$ , times the number of kilometres travelled,  $d$ . In this case in the high tax country, H, the price of buying a good across the border rises with the distance of the consumer from the border. This will determine the price which retailers in the border region can charge. This price will be a function of the distance of the retailer from the border. The price which the retailer can charge then depends on whether or not the difference between the high domestic tax rate and the low foreign rate is greater than the cost of travel. Where

$$(1 + t^H) \geq (1 + t^F)(1 + \delta d) \quad (8)$$

arbitrage will determine the domestic price in each location according to equation (9).

$$\left( P_i^k + P_r^H \right) (1 + t^H) = \left( P_i^k + P_r^F \right) (1 + t^F)(1 + \delta d) \quad (9)$$

The retail margin at each location will then be a function of both the difference in tax rates and the cost of travel for consumers.

$$P_r^H = P_i^k \left[ \frac{(1+t^F)(1+\delta d)}{(1+t^H)} - 1 \right] + P_r^F \frac{(1+t^F)(1+\delta d)}{(1+t^H)} \quad (10)$$

$$t^F > 0, t^H < 0, d' > 0$$

The region in which equation 8 holds true is then defined as the "border" region.

On the assumption that the retail sector is perfectly competitive, the squeezing of the retail margin in the high tax country implied by (10) must result in a change in the price of at least one of the factor inputs or else the sector will close down in border areas. Given that the goods produced in each country are freely tradable, as discussed earlier, the prices of goods,

<sup>10</sup> As discussed later, in practice the cost to the consumer per unit of good purchased depends on the volume of goods purchased as well as the distance travelled. There are economies of scale in cross-border shopping.

which are inputs into the retail sector, will be equated through arbitrage. With mobility of capital between countries and between border and interior regions of the same country the returns to capital will be equated through arbitrage. This means that in the border regions the incidence of the tax can not fall on capital in the long run.<sup>11</sup>

With a competitive labour market, if labour is homogeneous and mobile between sectors, then the price of labour in the retail sector in border regions can not fall below that in the goods sector. If the retail sector tries to pass back the incidence of the tax to labour, wage rates may temporarily fall in the region. However, goods firms will then move to the region or labour will seek work in the interior restoring wage rates to the national norm.

In summary, arbitrage by consumers will prevent the border retailer passing the full impact of the higher tax rate on to consumers buying in the region. The free movement of capital and labour will prevent the retailer from passing back the incidence to these factors of production on a long-term basis. Arbitrage in the goods market will immunise goods producers from the incidence of the tax. As a result, under perfect competition, in the long run retailers in the affected region must shut down.

If there is a sector specific factor of production, such as land, then the incidence of the tax must fall on that factor in the long run. However, land itself will not have a zero opportunity cost and if the incidence of the tax proves greater than the difference between the rental value of the land in retail use and in its alternative use, the retailer will still close down.

In the short run, if the tax difference is not so great as to close border retailers, arbitrage will result in some of the incidence of the tax being passed on to consumers and some being borne by the retailer. The allocation of the incidence will depend on the proximity of the retailer to the border and the related cost of travel for the consumer living in the retailer's hinterland. At the border, where transport costs are minimal, all of the incidence will fall on retailers.

Where border retailers continue to survive in the short-run by absorbing some of the incidence of the tax cross-border shopping will not take place. However, in the long-run with perfectly competitive markets retailers will close down operations within the border region. The effect of potential cross-border shopping on the tax base in the high tax country will depend on: the magnitude of the tax difference; the cost of travel for consumers; the distribution of consumers

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<sup>11</sup> Because capital is quasi fixed in the short run changes in tax rates may result in some of the incidence falling temporarily on capital. However, in the long-term, as the capital stock can be varied, capital will move to seek higher returns.

within the country; and, in the short run, the cost structure of retailing.<sup>12</sup> It is only where the border retailers shut down that there will be a loss of tax base to the neighbouring low tax jurisdiction.

What will be the effects on the allocation of resources within each country? In the high tax country, outside the border region the ratio of the output price of the retail sector (the retail margin) to the output prices of the items produced in the goods sector will be unaffected by changes in the rates of tax. Within the border region the ratio will be changed resulting in a movement of resources out of retailing implying some loss of allocative efficiency. However, to the extent that the retailers remain in business in the long run (possibly because the incidence falls on a fixed factor, such as land) the allocation of resources will still be undistorted. It is only where retailers actually close that there will be a loss of efficiency. The significance of this distortion will obviously depend on the relative size of the border and the interior regions of the high tax country and on the relative size of the retail sector in the regional economy.

In the case of the low tax country, under perfect competition there will be no change in the retail margin but increased resources will be drawn into retailing in border areas to meet the increased demand for their services. If the distortion is small in the context of each economy the effects of the shift in demand for labour in border retailing on the price of labour will also be small.

If the EU proceeds with the clearing house approach, with the invoice method applied to cross border sales, the results will be similar to those outlined above for the current interim regime. Under such a regime producers and retailers will still be indifferent as to the source of their inputs so that all the incidence of the VAT must be shifted forward to consumers or retailers.

### *Origin Regime*

The economic impact of an origin regime would depend on the treatment of VAT payments on inputs bought in foreign countries. If full credit is given for VAT paid on inputs purchased by producers or retailers in a foreign jurisdiction then the situation will be similar to that of the

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<sup>12</sup> The retail margin in European retailing typically ranges from a low of around 15% in food to around 40% in clothing (Fitz Gerald and Knipper, 1993). At the low end in food the margin for absorbing tax differences, even in the short term, is small.

mixed regime outlined above. However, if full credit is not given for VAT paid on inputs purchased abroad<sup>13</sup> then arbitrage by producers and retailers will result in

$$(1 + t^H)P_i^H = (1 + t^F)P_i^F, \forall i \quad (11)$$

Provided that there is a single VAT rate or that the structure of VAT regimes is harmonised across countries, relative producer prices within each jurisdiction will be unaffected by international differences in tax rates (Genser, Haufler, and Sorensen, 1994). However, this does not mean that there will be no misallocation of resources within the productive sector. Such a conclusion hinges on the assumption underlying Berglas, 1981, Genser *et al.*, 1994, and Lockwood, de Meza and Myles, 1994, that there is only one factor of production.

If there are two or more factors of production and two or more goods, unchanged relative output prices (unit costs of production) will not prevent a misallocation of resources. In fact, unless the goods are produced with identical technologies, unchanged relative prices in the face of an origin based VAT regime will guarantee a reallocation of productive resources (Appendix 1).

The incidence of the tax on producers is passed back to the factor of production in elastic supply, labour, making the tax equivalent to a tax on labour. If individual industries differ from one another in their labour (capital) intensity a common percentage reduction in the producer price of all domestically produced goods as a result of a tax would imply differing percentage reductions in the price of labour in each sector and differing rates of taxation on labour.

However, as labour is free to move between industries within each country the price of labour received by employees will be equated between sectors. While the overall effect will be that labour pays the tax, the price of labour to employers will change in many industries leading to factor substitution in the production process; some industries which are labour intensive will see the price of labour fall while it will rise where capital intensity is greatest. This will introduce a distortion into the economy as factors of production are reallocated between sectors.

At the retail level the effects will be somewhat different from the case of the destination regime. Recalling equation 5, because the tax inclusive price of inputs is already equated by arbitrage, in the absence of transport costs equation 6 reduces to equation 12.

$$(1 + t^H)P_r^H = (1 + t^F)P_r^F \quad (12)$$

<sup>13</sup> For example, if the "international subtraction method" were used (Sinn, 1990, p.496).

and 
$$P_r^H = P_r^F \frac{(1+t^F)}{(1+t^H)} \quad (13)$$

When equation 12 is compared to equation 6 it is clear that the effects of arbitrage by consumers on the retail margin in the high tax country will be substantially smaller under such a pure origin regime than under the current mixed regime.

In addition, because the incidence of the tax in the productive sector falls on labour, the tax exclusive price of labour will fall as a result of an increase in the domestic VAT rate. This will mean that the unit cost of retail services (4) will also fall, further cushioning the possible effects on the retail sector. Unless the production technology is the same in the retail and the productive sectors there will be a change in relative output prices and there will be a reallocation of resources between the sectors. Depending on the nature of the production technologies in the production and the retail sector, it is even possible that the price of retail services in the high tax country could fall as a result of the tax. This would be the case if the retail sector were more labour intensive in its production process than the goods production sector. In this case there could even be a seemingly perverse development of shopping by consumers from the low tax country in the high tax country.

These conclusions are unchanged by the introduction into the model of transport costs for consumers. The size of the "border" region will be very much smaller under the such an origin regime than under the current regime. As with the other regimes there is likely to be a change in relative prices in border regions but in this case the border region will be much smaller implying a smaller distortion.

The presence of many goods with differing production technologies means that such an origin regime will result in a reallocation of labour across the different productive sectors wherever production is located. This result is rather different from that of Berglas, 1981, and Lockwood, de Meza and Myles, 1994 who suggested that in the presence of flexible wage rates or exchange rates an origin regime need not be distortionary.

### **The Size of "Border" Regions**

Two studies which examined cross-border shopping between US states with differing rates of sales tax were Fox, 1986 and Walsh and Jones, 1988. Using aggregate data for sales by county over time both of these studies concluded that there was significant cross-border shopping in border regions of the states examined. The most notable examples in the last decade of border

regions in the EU where cross-border shopping has been significant have been the cases of the Denmark-German border (Bygvra, Hansen, Restad and Soltoft, 1987) and the Republic of Ireland-UK border (Fitz Gerald, Quinn, Whelan, and Williams, 1988). However, cross-border shopping has occurred in other regions of the EU (Bode, Krieger-Boden and Lammers, 1994).

All of the evidence suggests that while the magnitude of the cross-border shopping may be significant in border regions it is small in the context of the overall size of the national economies examined. Table 1 shows the results of a series of studies using survey data covering a number of border regions in the EU where cross-border shopping was felt to be important. In the case of the Republic of Ireland - UK border the figures include an estimate of commercial smuggling.<sup>14</sup> For the Netherlands border region there was also a significant flow of cross-border shoppers into the region from neighbouring countries substantially offsetting the local economic impact of the cross-border shopping by residents. The counter-flows were much smaller in the case of Ireland. It is striking that even in these most extreme cases the national significance of this cross-border shopping by consumers is small.

Table 1: Extent of Cross-Border Shopping

Country	Border Region	Year	Proportion of Expenditure	
			Regional %	National %
Ireland	Border Counties	1986	10	2
Denmark	<50 kms	1985	3	1
Denmark	Sonderjylland	1991	5.7	0.9
Netherlands	Zuid-Limburg	1991	8.5	0.6

Source: Bygvra, Hansen, Restad and Soltoft, 1987, Fitz Gerald, Quinn, Whelan, and Williams, 1988, Bode, Krieger-Boden and Lammers, 1994.

There are a variety of factors driving cross-border shopping such as the potential for savings; the availability of different products; the entertainment value of visiting a different urban centre. Of these the most important factor is the possibility of saving money. As a result, the potential significance of cross-border shopping will depend on the magnitude of the difference in retail prices between the consumer's local retail outlet and the nearest retail outlet across the border; the size of the bundle of goods which a consumer will buy on a single expedition and the cost to the consumer of travelling to the retail outlet across the border. The cost of travel includes not only the cost of the car, bus, or train used to cross the border but also the

<sup>14</sup> Approximately two thirds of the total was due to cross-border shopping.

opportunity cost of the shoppers time which is likely to vary from country to country with variations in hourly earnings as well as cultural differences.

The studies discussed above generally show a pattern where the volume of cross-border shopping decays with distance. In the case of Denmark in 1985 80% of those living within 10 kms of the border shopped across it by car each week while only 17% of those living between 51 kms and 125 kms from the border did so (Figure 1). In the case of Ireland households living within 8 kms of the border made on average 0.37 trips across the border each week; over 49 kms this fell to 0.06 trips a week. This distance decay is reflected in the figures shown in Table 1 which clearly show that cross-border shopping is only really significant in border regions.

Figure 1

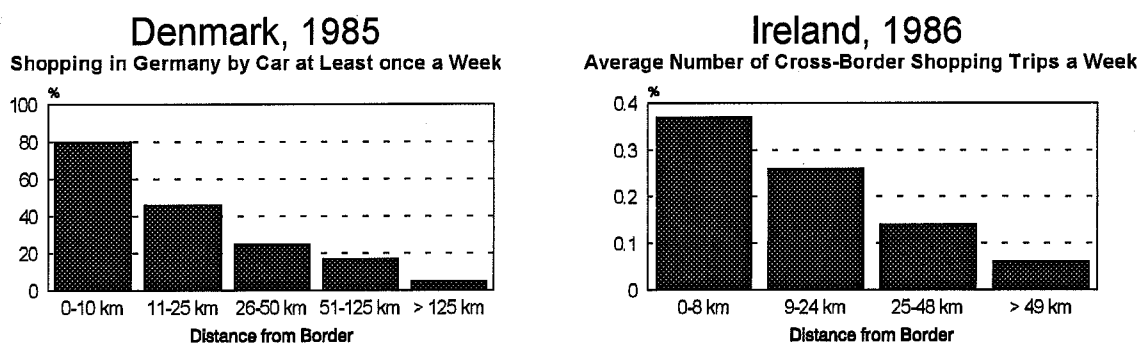
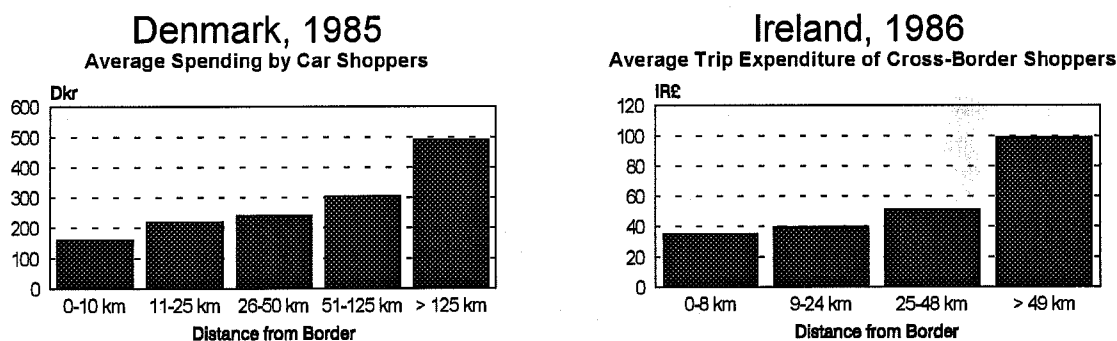


Figure 2



Because the cost of travel rises with the distance travelled the size of the average shopping bundle also rises; with increasing distance smaller shopping expeditions are no longer justified and consumers may vary their shopping pattern, increasing the size of the shopping bundle, to



maximise the potential savings. This is evident from the data for both Denmark and Ireland shown in Figure 2. The choice of items included in the shopping bundle is also heavily weighted towards those commodities with the greatest potential savings (often items subject to excise tax).

In general, it is the time costs which dominate the direct costs. Using data for Ireland we have estimated the total cost of travel for shoppers as the savings they require to justify travelling a given distance across the border. We undertook a sample survey of 2000 households living in Irish border areas at the beginning of 1987.<sup>15</sup> Using these data we have examined the importance of distance in determining the volume of cross-border shopping and, therefore, the size of the "border" region which is likely to be sensitive to differences in VAT rates and VAT regimes. While the data discussed here are based on an Irish survey, the similarity in behaviour between residents in Ireland and residents in the other border areas examined suggests that the results may have some wider application.

$$S = a_1 + a_2D + a_3C + a_4H + a_5A + a_6Y_1 + a_7Y_2 + a_8Y_3 + a_9Y_4 + a_{10}Y_5 + a_{11}Y_6 \quad (14)$$

Table 2: Estimation of Equation 14, Savings Necessary to Justify Cross-Border Trip

Coefficient	Value	t Ratio
$a_1$ - Intercept	5.56	
$a_2$ - Distance (miles)	0.42	16.4
$a_3$ - Car Ownership	-2.2	-2.1
$a_4$ - Number of Children	0.41	1.8
$a_5$ - Number of Adults	0.13	0.5
$a_6$ - Income £4160-5200	0.18	0.1
$a_7$ - Income £5200-6240	2.33	1.9
$a_8$ - Income £6240-7280	2.6	2.2
$a_9$ - Income £7280-9360	0.66	0.5
$a_{10}$ - Income £9360-12480	2.97	2.2
$a_{11}$ - Income >£12480	5.29	3.9
Number of Observations = 707	F = 33.76	R <sup>2</sup> = 0.32

The responses of the border households to a question on the level of savings necessary to make a typical trip to Northern Ireland worthwhile are treated as the dependent variable in

<sup>15</sup> The Border Survey was administered to a random sample of 2,000 households drawn from the 5 border counties of Donegal, Leitrim, Cavan, Monaghan and Louth and the adjacent county of Sligo. This sample was drawn from the Irish Electoral Register using a multi-staged clustered design. As distance decay considerations seemed, a priori, to be of paramount importance the sample was prestratified according to distance from the border. Full details of the questionnaire and procedures used are given in Fitz Gerald, Quinn, Whelan and Williams, 1988

equation 14. This variable,  $S$ , can be taken as a composite surrogate for the subjective evaluation of the households' opportunity cost of time and the effort involved in making the trip. The explanatory variables used are the shortest distance from the border,  $D$ , car ownership,  $C$ , numbers of children,  $H$ , and adults,  $A$ , in the household and 6 income dummies,  $Y_i$ . The results of estimating this equation using the data for Irish border households in 1986-7 are shown in Table 2.

The equation provides 32 per cent variance explanation. The important role of distance decay is evident with the average household requiring a saving of IR £0.42 per mile on a typical cross-border trip. The coefficient on car ownership is negatively signed suggesting that households owning a car need to make less of a saving (to the value of IR £2.20) to make a trip worthwhile compared to their non-car-owning counterparts. This is obviously due to the increased time, effort and transport costs facing non-car-owning households. The variable  $C$ , the number of children in the household, is just outside the 5 per cent level of significance, each child adding an extra IR £0.41 to the necessary level of savings to make a trip worthwhile. The number of adults is not significant. As might be expected, there seems to be a roughly positive linear relationship between level of necessary savings and household net income, even though  $INC2$  and  $INC5$  are not significant. The higher the income the higher the opportunity cost of time and the less the marginal utility of an increment in real disposable income.

Shoppers were also asked how much they spent on an average trip and a similar model was used to explain the answers. When the results are compared with those in Table 2 they imply that the savings shoppers say they needed to justify travelling were 25% of the expenditure they said they had undertaken at the same distance. As Irish prices were on average 20% higher<sup>16</sup> than in the UK at the time of the survey and as respondents bought items where the tax induced price difference was greatest, these results imply consistent responses on the part of those surveyed.

On the basis of equation 14, for different levels of potential savings it is possible to estimate the size of the border region within which the typical Irish household will shop across the border. In Table 3 we examine the thresholds at which border shopping will become profitable for different levels of saving on different sized shopping bundles. We present the results for a

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<sup>16</sup> Using PPP data from EUROSTAT.

person with a car, no children and a mid range income. Incomes and prices have been adjusted to current 1994 ECU's and distances have been converted to kilometres.

**Table 3: Maximum Distance Irish Shoppers Will Travel, Kilometres**

Size of Shopping Bundle, ECU's	Price Difference, %			
	2.5	5	7.5	10
100				
125				5
150			5	10
175			5	20
200			10	20
225		5	10	30
250		5	20	30
275		10	20	40
300		10	30	50

The data in Table 3 were derived from the response of Irish consumers in 1986-7 when purchasing power parity data showed Irish consumer prices to be around 20% higher than in the UK. However, the price difference was considerably larger for many items subject to excise taxes. As a result, it was not surprising that there was a considerable volume of cross-border shopping by those living in border areas. In 1985 when the survey evidence in Bygra *et al.*, 1987 was collected, prices in Denmark were over 15% above those in Germany.

However, what is striking in Table 3 is that even with quite large shopping bundles, for price differences of 5% or less consumers were only prepared to travel short distances to save money. For Irish consumers they would need to spend 250 ECU's (at current prices), saving 12.5 ECU's, before they would consider travelling an additional 5 or 10 kilometres across the border. If the only factor giving rise to price differences in the post Single Market EU were difference in VAT rates then a 5% difference would give rise to very little distortion through cross-border shopping. However, as discussed in Emerson, 1988, and Engel and Rogers, 1994, prices differ across borders (and within countries) for many reasons other than differences in taxation.

While such an analysis has not been carried out for Denmark the available data indicate a similar pattern of distance decay but they also suggest that the travel costs for Danish shoppers were about a half those for Irish shoppers implying a somewhat wider border region.

These results suggest that attention should focus on differences in excise rates as the primary potential factor which may give rise to distortionary cross-border shopping. If the major cause for concern is distortions due to differences in VAT rates then "border" regions, as defined in here, are small.

### **The Scope for Games**

The movement from the pure destination regime to the current mixed regime has introduced a new distortion into EU economies. As discussed in Section 3 of this paper, under the current regime consumers, driven by differences in tax rates between jurisdictions, can shop across borders changing relative producer prices in individual jurisdictions. Cross-border shopping will also result in a shifting of the tax base from high to low tax countries. However, the model presented in this paper indicates that the potential distortions are smaller than are suggested by Sinn, 1990. The loss of output is likely to be confined to the retail sector in border areas.

The possibility that consumers may be attracted to shop in low tax regimes leaves open the possibility that governments may react, in turn, by adjusting their tax rates to maximise their revenue. A number of papers have examined the possible behaviour of governments when faced with the possibility that the indirect tax base may leak to low tax jurisdictions. Kanbur and Keen, 1993, present a model of the behaviour of governments where one country is small and another is large.

On the assumptions of the Kanbur and Keen model there exists a Nash equilibrium where the small country strictly undercuts the large country by charging a lower rate of indirect tax. The results in the Kanbur and Keen paper depend on the assumption that if a good is given away free in one country all those living in the other country would derive positive surplus from travelling across the border to collect it. However, as shown in Table 3, even though there may be significant savings to be reaped by shopping in a low tax jurisdiction, the cost of travel is sufficiently high that it will not pay those living outside border regions to exploit the opportunity for arbitrage. The results in Table 3 indicate that when dealing with differences in VAT rates of under 10 percentage points the effective size of border regions can be very small. It may not be worthwhile for a Danish consumer to collect a free gift in Munchen because of the high cost of travelling such a distance.

The model also assumes that the large country only differs from the small country in terms of the density of population. The physical size of the two economies is assumed to be identical

with the distance from the border to the furthest reach of the home country being equal to that for the foreign country.<sup>17</sup> In practice European countries differ significantly in physical size; two important examples of pairs of countries where cross-border shopping has proved significant are Denmark and Germany and Ireland and the UK. In both these cases the large country is not only large because of a higher density of population but also because of its much greater area.

The high cost of transport for consumers means that Denmark and Germany are both large countries - the bulk of their population are immune from the likely temptation of any foreseeable difference in VAT rates in their neighbours. While Germany is much bigger than Denmark in terms of its population, the bulk of the population live far from the Danish border. Thus any attempt by Denmark to reduce its VAT rate below Germany's would attract only a small volume of cross-border shopping. The situation might be different if the two countries only differed in terms of population density as Kanbur and Keen assume. In that case the potential for cross-border shopping by Germans would be an order of magnitude greater than it actually is under current circumstances.

In the light of the data in Table 3 the Kanbur and Keen model is likely to have limited applicability. In terms of that model small means a country the size of Monaco, Andorra, or possibly Luxembourg. In these cases, unlike Denmark or Ireland, the potential shopping population living close to their borders in neighbouring jurisdictions may be many times greater than their native population. This may explain why some of these small (in absolute terms) countries have adopted low tax regimes while other (relatively) small countries have higher tax rates than their larger neighbours.

While the data in Table 3 suggest that it will not pay EU governments to play games with the VAT system, this may not be the case for specific products or for some goods liable to excise taxes. For example, the very high value of a car means that there are large potential savings to be made from shopping in a jurisdiction with a lower VAT rate. This means that the "border" region of a country such as Denmark, Ireland, or even France (Dupont, 1989) may be very large. This helps explain why a special tax regime was introduced for cars to avoid the possibility of tax competition.

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<sup>17</sup> They assume that the economies exist on the line -1,1 with 0 the border.

In the case of goods liable to excise taxes there is also the possibility that differences in tax rates will generate much greater percentage differences in price than in the case of VAT. Such price differences may also significantly increase the potential size of "border" regions compared to the case of goods only liable for VAT.

This increase in the size of border regions for specific products liable to excise taxes may be sufficient to induce a response by governments when their tax rates are substantially different from rates in their neighbours. For example, in the case of Ireland in 1984, loss of revenue from cross-border purchases of whiskey and TV sets (both liable to excise taxes) was sufficient to induce the government to reduce excise tax rates. However, Ireland was not sufficiently "small" to make it worth the government's while cutting taxes further to try to attract shoppers from the UK to buy whiskey in Ireland.

Finally, the model presented in this paper assumes perfectly competitive markets. Trandel 1992, and Christiansen, 1994 have examined cases where firms possess market power. Under such circumstances governments' strategic behaviour setting taxes may be altered.

## **Conclusions**

This paper has examined the effects of different VAT regimes where economies are assumed to include a retail sector. The incorporation of a retail sector into the model of the economy means that the potential distortion in the allocation of resources under the current mixed VAT regime is limited to that sector in border regions.

Using data for Ireland and Denmark the paper goes on to show that the size of the border regions in which such distortions may occur is quite small relative to the size of even some of the smaller EU members. As a result, there is no incentive for EU member governments to play games with the VAT regime. Their physical size is such that they can each determine their VAT rate independently of the decisions of their neighbours. It is only in the case of excise taxes or certain high value products that the spill-over effects of tax decisions by neighbours must be taken into account.

This paper has concentrated on the possible effects of cross-border shopping. However, if there were to be substantial fraud or evasion by commercial operators the size of "border" regions could be much larger than considered here and the conclusion that the mixed regime results in only small distortions would have to be reexamined.

## Appendix: Origin Based Tax with Two Factors and Many Goods

Assume that there are two factors of production: capital, K and labour, L. Goods are produced using a Cobb-Douglas technology where the parameters of the production function vary across the goods producing industries:

$$Q_i = AL_i^\alpha K^{(1-\alpha)} \quad (\text{A.1})$$

The unit cost function dual to this production function is:

$$c_i = C_i/Q_i = BP_L^\alpha P_K^{(1-\alpha)} \quad (\text{A.2})$$

where:

$$B = \frac{1}{A} \left[ \left( \frac{1-\alpha}{\alpha} \right)^\alpha + \left( \frac{\alpha}{1-\alpha} \right)^{(1-\alpha)} \right] \quad (\text{A.3})$$

Because producers are operating under perfect competition the incidence of any tax on the price of output must be passed back to labour, which is assumed to be in fixed supply domestically. The total cost of producing a unit of output, including the tax, will remain unchanged. However, from A.2, the price of labour received by employees will fall by the full amount of the tax levied on producers (A.4).

$$P_L = [B(1-t)c_i]^{\frac{1}{\alpha}} P_K^{\left(\frac{1-\alpha}{\alpha}\right)} \quad (\text{A.4})$$

In this case the tax on production is effectively a tax on labour.

$$\frac{\delta P_L}{\delta t} = -\frac{1}{\alpha} \quad (\text{A.5})$$

If a uniform tax is charged on all goods but the key coefficient in the production function,  $\alpha$ , differs across sectors the change in the price of labour received by employees (A.5) will also tend to differ. However, in the long run arbitrage in the labour market will ensure a common price of labour within the economy. While the assumptions of the model will ensure that all the incidence of the tax will fall on labour, the change the net of tax price of labour will depend on the individual demand functions of the different goods producing industries. The result will be that, with  $\alpha$  differing across sectors, the change in the price of labour will not be such as to leave the cost to the employer of employing a unit of labour unchanged. In some sectors, those which have a high  $\alpha$  (labour intensive) the tax inclusive price of labour to employers will fall and labour will be substituted for capital. In others (capital intensive) the price of labour

will rise and capital will be substituted for labour. The ultimate effect of a change in taxation under such a regime will be a reallocation of resources between industries in the economy.

The relative price of factors of production in individual industries will only be held constant if the taxes differ from industry to industry such that the change required in the price of labour received by the employee,  $A.5$ , is identical across all industries. It is only with such a differentiated tax that a reallocation of production resources can be avoided.



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