An Optimal Internet Location Strategy for Markets with Different Tax Rates

by

Eric J. Levin, Department of Economics, University of Stirling, Stirling, Scotland FK9 4LA. (e.j.levin@stir.ac.uk)

Robert E. Wright, Department of Economics, University of Stirling, Stirling, Scotland, FK9 4LA; Centre for Economic Policy Research, 90-98 Goswell Road, London, England, EC1V 7DB; and Institute for the Study of Labour, Schaumburg-Lippe-Strasse 9, D-53113 Bonn, Germany

Abstract: The traditional view that a high sales tax rate reduces trade by driving a wedge between the purchase and sale price may not apply to internet commerce for two reasons. The first reason is that the sales tax paid by buyers purchasing via the internet is determined by the tax rate in the region of the buyer. The second reason is that a high sales tax may lower the before-tax price if sellers absorb part of the tax. Taken together, this implies that internet distributors may profitably target customers in regions with low tax rates by locating their selling addresses in high tax regions. Consequently the optimal marketing strategy for a global internet distributor may include siting selling locations in regions with high tax rates in order to target customers in regions with low tax rates. An empirical analysis of the European car market suggests that this is more than a remote theoretical possibility by demonstrating that the before-tax prices recommended by manufacturers for new cars are lower in high tax countries.

1. Introduction

Internet trading facilitates gains from cross-border trade arising from comparative advantage, specialisation and the division of labour. The internet lowers the cost of information about the existence of trading partners and the level of prices in geographically distant markets. The internet also enables buyers to order and pay for goods in distant markets at no incremental cost. Consequently the lower information and transaction costs associated with internet trading increase trade based on productivity differentials between regions.

Internet retailing may also be motivated by tax differentials between regions. There is a view that high tax rates generally reduce trade by driving a wedge between the purchase and sale price, and that sales in high tax regions are reduced by individuals patronising firms located outside of the high tax jurisdiction (Trandel, 1992). This view is supported by empirical studies, which find that a sales tax differential leads to a statistically significant but relatively small reduction in sales in the higher tax jurisdiction. (McAllister, 1961, Fisher, 1980, Fisher, 1988, Fox, 1986, Manchester, 1976, Mikesell and Zorn, 1985, Walsh and Jones, 1988). Furthermore, Delipalla and Keen (1992) show that the price of a taxed commodity might increase

by more than the amount of the tax in an imperfectly competitive market, while Besley and Rosen (1998) find empirical evidence of over-shifting. However, these theoretical and the empirical conclusions may not be relevant for internet trading.

This paper explores buyer and seller responses to taxation differentials between geographical markets and shows that the optimal marketing strategy for a global distributor may include siting internet selling location in regions with high tax rates in order to target customers in markets with low tax rates. The sales tax paid by buyers purchasing via the internet is determined by the tax rate in the region of the buyer. Consequently, the internet enables buyers from outside a high sales tax region to purchase at the before-tax price prevailing in the high sales-tax region. This implies that sales-tax differentials between regions on internet shopping malls may divert sales from internet sellers in low sales-tax regions to internet sellers in high sales-tax regions if sellers absorb part of the tax differential. In this case, profits from internet trading would be greater for internet sellers sited in high tax regions.

The remainder of this paper is organised as follows. The next section develops profit-maximisation models in order to explore how demand conditions determine whether the before-tax price set by a profit-maximising seller rises or falls with the tax rate of the region. Section 3 examines data from the European car market in an empirical application of this model that may explain the recent pattern of UK internet purchases of car imports from European retailers. A brief conclusion follows in Section 4.

2. Pricing in Markets with Different Tax Rates

In this section standard microeconomic theory is adapted to show how a profit maximising seller responds to an increase in indirect tax. The tax-included price is raised. However, the tax-excluded price is lowered in the case of a linear demand curve but raised in the case of a constant elasticity demand curve. Each of these cases is considered in turn below.

2(a) Linear Demand Curve

Consider a seller who faces constant marginal costs and a downward sloping linear demand curve in price (P) and quantity (Q): $P = a + bQ$. Profit (π) is equal to total revenue (TR) minus total cost (TC):

$$\pi = TR - TC \tag{1}$$

The before-tax price (P_S) received by the seller is related to the tax-included price paid by the buyer (P_B) by the sales-tax rate (t). That is:

$$P_S = \frac{P_B}{1+t} \tag{2}$$

Total revenue received by the seller is P_s multiplied by the quantity sold:

$$TR = \frac{P_B}{1+t} \cdot Q \qquad (3)$$

An inverse linear demand curve relates the quantity sold to the buyers' tax-included price:

$$P_B = a + bQ \qquad (4)$$

Substituting Eqs. (2), (3), and (4) into Eq. (1) and recognising that total cost is related to Q gives:

$$\pi = \frac{(a+bQ)}{1+t} \cdot Q - TC(Q) \qquad (5)$$

The profit-maximising price-quantity combination is derived by differentiating π with respect to Q and setting this derivative equal to zero:

$$\frac{d\pi}{dQ} = \frac{a+2bQ}{1+t} - \frac{dTC}{dQ} = 0 \qquad (6)$$

Solving for Q, the profit maximising quantity, gives:

$$Q = \frac{MC(1+t) - a}{2b} \qquad (7)$$

where MC is marginal cost (dTC/dQ). Substituting Eq. (7) into Eq. (4) gives:

$$P_B = \frac{a + MC(1+t)}{2} \qquad (8)$$

Substituting Eq. (2) into Eq. (8) gives:

$$P_S = \frac{a}{2(1+t)} + \frac{MC}{2} \qquad (9)$$

Finally, differentiating Eqs. (8) and (9) with respect to t gives:

$$\frac{dP_B}{dt} = \frac{MC}{2} \qquad > 0 \qquad (10)$$

$$\frac{dP_S}{dt} = \frac{-a}{2(1+t)^2} \qquad < 0 \qquad (11)$$

Eqs. (10) and (11) show that although the tax-included price P_B paid by the buyer rises for a rise in the sales tax rate, the tax-excluded price P_S received by the seller falls for a rise in the sales tax rate. A profit-maximising seller charges a lower tax-excluded price in a high tax region because it is profitable to accommodate part of the

tax. Consequently, buyers in low-tax regions are attracted by the lower tax-excluded price charged by sellers in high-tax regions where the tax liability is determined by the tax rate of the region of the buyer. Eq. (11) shows that the magnitude of the price advantage to a buyer in a low tax region purchasing from an internet distributor selling from a high tax rate region depends on the intercept of the demand curve (a), and the tax rate differential (dt).

2(b) Constant Elasticity Demand Curve

We repeat the analysis for a constant elasticity demand curve by showing the profit equation in Eq. (12) where profit is equal to total revenue minus total cost:

$$\pi = P_S(Q) \cdot Q - TC(Q) \tag{12}$$

Profit is maximised by differentiating profit with respect to quantity and setting this derivative to zero:

$$\frac{d\pi}{dQ} = P_S - \frac{dP}{dQ} \cdot Q - \frac{dTC}{dQ} = 0 \tag{13}$$

Rearranging this expression gives the standard profit markup result:

$$\frac{P_S - MC}{P_S} = \frac{-1}{\dfrac{dQ}{dP_S} \cdot \dfrac{P_S}{Q}} \tag{14}$$

Substituting Eq. (2) into Eq.(14) gives:

$$\frac{P_S - MC}{P_S} = \frac{-1}{\dfrac{dQ}{dP_B(1+t)} \cdot \dfrac{P_B}{Q(1+t)}} \tag{15}$$

A constant elasticity demand curve by definition implies that:

$$\frac{dQ}{dP_B} \cdot \frac{P_B}{Q} = k \tag{16}$$

where k is the absolute value of the constant price elasticity of demand. Substituting Eq.(16) into Eq.(15) gives:

$$\frac{P_S - MC}{P_S} = \frac{1 + 2t + t^2}{k} \tag{17}$$

The effect of an increase in the tax rate t on the before-tax price P_s received by the seller can be determined by differentiating Eq.(17) with respect to the tax rate t:

$$d \frac{\dfrac{P_s - MC}{P_S}}{dt} = \frac{2}{k} - \frac{2t}{k} \quad > 0 \qquad (18)$$

Therefore, the effect of an increase in the tax rate is to increase the before tax price.

2(c) Discussion

The analysis above demonstrates that the before-tax profit-maximising price generally differs between regions with different tax rates. Customers whose tax liability is determined by the tax rate of their own region will be attracted to regions with internet sites selling at the lowest before-tax prices. However, the analysis also shows that whether the before-tax price is higher or lower in high tax regions depends on the functional form of the demand curve, and this is an empirical issue. This has important implications the location decision of an internet distributor. For example, it would be more profitable for internet distributors to locate in high (low) tax regions if the before-tax price is lower (higher) in high tax regions. However, economic theory can only show that before-tax price are likely to differ between regions with different tax rates. As economic theory cannot determine the sign of this effect, this issue can only be resolved by an empirical investigation.

3. Indirect Tax Differentials and Car Prices in the EU

This section presents an empirical analysis that examines the relationship between before-tax prices and indirect tax rates applied to cars sold in Europe in order to ascertain if indirect taxes lower or raise before-tax selling prices. The data used in this analysis are manufacturers' recommended prices before and after tax denominated in Euros on 1-May-2000 for 70 car models sold by 23 manufacturers in 15 EU countries. These data were downloaded from the web-site of the *Competition Directorate-General of the European Commission* (http://europa.eu.int/comm/ competition/car_sector/price_diffs/).

These data were used to calculate 1003 manufacturer recommended before-tax prices and the corresponding indirect tax rates for the 70 car models that were on sale in the 15 EU countries on 1-May-2000. The mean sales tax rate is 44.2 per cent with a standard deviation of 41.3. There is considerable variation in the sales tax rates across these countries. For example, for an *Alpha Romeo Model 166* (2.0TS 16V BN 4P) the tax rates ranges 230 per cent from a minimum of 15 per cent in Luxembourg to a maximum of 245 per cent in Denmark.

These data were used to examine the sign of the effect of indirect taxation on the before-tax price by regressing the before-tax price on the tax rate (t). Quality difference price effects were controlled for using a fixed effect estimator:

$$P_{sij} = \alpha_0 + \beta t_j + \gamma OWN + \theta_i + \varepsilon_{ij}$$

where P_{sij} is the before-tax selling price of model i in country j, and t_j is the tax rate in country j. *OWN* is a dummy variable that is set equal to unity if the price P_{sij} refers to a model that is sold in its home country of its manufacturer (e.g. Fiats sold in Italy or

Renaults sold in France). The purpose of this variable is to control for any price effects caused by preferences for home produced vehicles. θ_i is a model-specific fixed effect that attempts to control for persistent price differences. ε_{ij} is a random error term.

3(a) Results

The above model was estimated separately for each of the 23 manufacturers and also for the combined sample. The results are shown in Table 1. The first two columns list the twenty-three manufacturers together with the "own country". The Foreign category in column one refers to nine manufacturers selling cars in Europe whose home country is not in Europe and for whom by definition there cannot be an "own country" effect on price.

The third column shows the tax effect of a one percentage point increase in the tax rate on the before-tax price. For example, using the "all" parameter estimate for the whole sample the effect of raising the sales tax rate by 41.3 percentage points (one standard deviation from the mean) would be to lower the before-tax price by 812 Euros, that is, 19.67 multiplied by 41.3. This would represent about 5 percent of the average before-tax price of 15,921 Euros. It is important to note that with one exception (Landrover), the sign of the tax effect is negative, and the t-statistics indicate that this finding is statistically significant at the one per cent level (or below) in nearly every case.

The fourth column shows that the parameter estimates indicate little evidence of an own country effect for each of the twenty-three manufacturers estimated separately. Landrover and Vauxhall are exceptions to this finding because significantly higher prices are charged in the UK after allowing for tax and model price effects. However, the variable *OWN* included in the *All* sample as a control variable shows that there is a significant positive own country effect on price, indicating a positive preference for domestic manufacturers. The fifth and sixth columns show the before-tax and after-tax prices for each maker averaged over the models sold by that maker.

The interpretation of these empirical results is clear. Car manufacturers respond to high tax rates by lowering the before-tax price in order to absorb part of the tax. The implication of this is that internet new-car sellers in high tax countries are able to undercut internet new-car sellers in low-tax countries. Consequently, new-car internet sellers located in high tax countries are likely to dominate the internet car market.

4. Conclusion

The profitability of internet trading might be influenced by tax differentials between regions. Theoretical economic analysis provides little guidance to internet sellers for their optimal location. The reason being that high tax rates may either raise or lower before-tax prices depending on the functional form of the demand curve. However, the empirical analysis of new car prices suggests that buyers in low sales tax regions are likely to place orders with internet sellers located in high sales tax regions. This enables customers in low-tax regions to benefit from lower before-tax

prices prevailing in high sales-tax regions without incurring high taxes because the indirect tax rate paid by a buyer using the internet is the tax rate applicable to the region of the buyer.

A number of issues that could alter this conclusion require further investigation. First, a significant amount of internet-induced demand from outside the high sales-tax region would alter the price elasticity of demand facing sellers in the high sales tax regions. This would affect before-tax price differentials between high and low sales-tax regions. Second, high taxation may raise production costs for high tax regions (Wong, 1996, Papke, 1991, Papke and Papke, 1986, Wallace, 1993). If high taxation raises production costs that in turn raise before-tax prices in high tax regions, buyers may be diverted away from away from high tax regions. However, this issue is likely to be more relevant for manufacturers than internet sellers. Third, the internet may alert buyers to lower after-tax prices in low tax areas, and buyers may respond by physically travelling to the low tax area to make their purchases at the lower local tax rate. In this case the conclusion may be reversed and internet sellers in low tax regions would be relatively advantaged.

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Country	Maker	Tax Effect (euros)	Own Country effect (euros)	P_S (euros)	P_B (euros)
France	Citroen	-28.54 (6.4)	+119 (0.2)	13,208	18,735
	Peugot	-20.41 (5.6)	-118 (0.2)	12,583	17,649
	Renault	-21.93 (4.5)	-114 (0.2)	12,915	17,758
Germany	Audi	-16.68 (4.4)	-222 (0.3)	23,769	35,227
	BMW	-12.48 (2.3)	0 (0.0)	31,110	46,516
	Mercedes	-6.65 (1.3)	-1,130 (1.1)	35,321	53,617
	Volkswagen	-23.89 (3.7)	+330 (0.6)	12,031	16,738
Italy	Alfa Romeo	-34.17 (7.0)	+580 (0.6)	18,324	26,257
	Fiat	-19.94 (4.7)	-105 (0.2)	8,991	12,436
	Lancia	-35.32 (7.3)	+1,190 (2.2)	16,801	22,765
Spain	Seat	-14.68 (5.0)	-327 (0.7)	8,790	13,196
Sweden	Volvo	-21.78 (4.5)	+307 (0.4)	19,000	28,686
United Kingdom	Landrover	+32.17 (2.8)	+11,978 (6.6)	31,838	46,819
	Vauxhall	-24.92 (7.8)	+3,989 (7.4)	15,157	21,561
Foreign	Daihatsu	-11.30 (1.8)	--	8,574	11,748
	Ford	-18.52 (4.1)	--	11,150	15,701
	Honda	-36.18 (3.7)	--	15,423	21,640
	Mazda	-35.32 (7.3)	--	13,070	18,399
	Mitsubishi	-25.24 (4.6)	--	12,842	17,738
	Nissan	-25.43 (4.9)	--	11,781	16,366
	Subaru	-37.28[1] (2.1)	--	17,638	27,004
	Suzuki	-17.23 (3.3)	--	9,217	12,618
	Toyota	-23.22 (4.6)	--	11,556	16,007
All		-19.67 (15.6)	+961 (4.1)	15,921	22,915

Notes: 1) OLS estimate. Too few observations for fixed effects estimation.