E C O N O M I C S B U L L E T I N

Do smokers behave differently? A tale of zero expenditures and separability concepts

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Abstract

A simple test is derived for a necessary condition for zero expenditures on tobacco to arise from corner solutions. This test coincides with a test for a new separability concept, which is closely related to demographic separability.

Financial support of this research by the Fund for Scientific Research − Flanders (contract FWO G.0327.97) is gratefully acknowledged. I would like to thank Anton Barten and Bart Capéau for helpful comments on an earlier version of this paper. Any errors remaining are my own.
Citation: Vermeulen, Frederic, (2003) "Do smokers behave differently? A tale of zero expenditures and separability concepts." *Economics Bulletin*, Vol. 4, No. 6 pp. 1−7
Submitted: January 23, 2003. **Accepted:** January 24, 2003.
URL: http://www.economicsbulletin.com/2003/volume4/EB−03D10001A.pdf

1 Introduction

In long-duration budget surveys, a large proportion of the households have zero expenditures on commodities like tobacco or alcoholic drinks. Since zeroes coming from infrequency of purchase can be ruled out for most commodities in that case, the two remaining plausible explanations for these zeroes are corner solutions and abstention. In the former case, the consumer cannot afford, say, tobacco products at current prices and current income. Alternatively, in the case of abstention, some consumers will not smoke even if tobacco products were available for free. The distinction between both concepts is important, because the estimation of a tobacco Engel curve asks for different econometric specifications depending on the source of the zeroes. While corner solutions are estimated by means of a tobit specification, abstention asks for extensions of the tobit model (see, e.g., Jones, 1989). Another important implication of the distinction between both sources of zero expenditures, is that if zeroes on tobacco are due to abstention smokers and non-smokers have different preferences. This should be taken into account when estimating Engel curves for the other commodities, in order to avoid inconsistent estimates. Abstention then, implies that tobacco is not an argument in a non-smoker's direct utility function, for the simple reason that tobacco does not 'generate' utility for this consumer. Contrary to the abstention case, a necessary condition for zeroes to represent corner solutions is that both smokers and non-smokers (in fact potential smokers) have the same preferences. Consequently, a rejection of the latter leads to a rejection of zeroes generated by corner solutions. Drawing on conditional demand (see Browning and Meghir, 1991 and Pollak, 1969 and 1971), a simple test is derived for this necessary condition for corner solutions. As will be seen, a rejection of corner solutions will coincide with a rejection of a new separability concept that is closely related to Deaton, Ruiz-Castillo and Thomas's (1989) demographic separability.

2 Conditional demand, corner solutions and consumer separability

Suppose that preferences, under the null hypothesis of zeroes on tobacco arising from corner solutions, are represented by the well-behaved direct utility function

$$u = v\left(\mathbf{q}, t, \mathbf{a}\right), \tag{1}$$

where t is tobacco consumption, $\mathbf{q}$ is the consumption vector of the other n commodities and $\mathbf{a}$ is a vector of household characteristics. Following Browning and Meghir (1991) a conditional cost function can be defined, where $\mathbf{p}$ is the price vector of the other commodities :

$$c\left(u,\mathbf{p},t,\mathbf{a}\right)=\min_{\mathbf{q}}\left(\mathbf{p}'\mathbf{q}|v\left(\mathbf{q},t,\mathbf{a}\right)=u\right). \tag{2}$$

Applying Shephard's lemma on equation (2) results in the following conditional compensated demand functions :

$$q_i=h_i\left(u,\mathbf{p},t,\mathbf{a}\right)\qquad\left(i=1,...,n\right). \tag{3}$$

Inverting equation (2) to obtain u in function of $\mathbf{p},t,\mathbf{a}$ and x_G (group expenditures on the other n commodities) and substituting this expression for u in equation (3) leads to conditional Marshallian demand functions :

$$q_i=g_i\left(x_G,\mathbf{p},t,\mathbf{a}\right)\qquad\left(i=1,...,n\right). \tag{4}$$

A necessary condition for zeroes on tobacco to correspond to corner solutions is that both smokers and non-smokers behave according to the above demand functions. The only reason then, for observing zero expenditures on tobacco for some consumers is that they are constrained to smoke, conditional on their current income and current prices. A simple test of the null hypothesis of corner solutions consists of testing whether the Marshallian demand equations (4) depend on a binary variable d which indicates whether positive ($d=1$) or zero ($d=0$) expenditures on tobacco are observed. If this conditioning binary indicator is significant in the demand for the other commodities, then smokers and non-smokers behave differently (in the sense of having different preferences). This rejects the null hypothesis of zeroes arising from corner solutions. Remark however, that the independence of conditional Marshallian demand from the binary indicator d, is not sufficient for rejecting the zeroes to be derived from abstention. It is possible that both smokers and non-smokers have the same (conditional) preferences on the rest of the commodity bundle (so that the null hypothesis would not be rejected), but that tobacco acts as an argument in a smoker's full utility function, which is not true for non-smokers in the case of abstention. Note further that the above test checks whether the binary indicator d is weakly separable from the consumption of the other commodities, which makes it closely related to the demographic separability test of Deaton, Ruiz-Castillo and Thomas (1989). Like in the case of Deaton et alii (1989), separability of $\mathbf{q}$ from d (call this consumer separability) implies that if one starts smoking, this only generates an income effect and no substitution effect on the rest

of the commodity bundle (apart from substitution effects if $\mathbf{q}$ is not separable from tobacco consumption t). Remark that there will be some effect anyway, because one does not receive a subsidy if one starts smoking. Consequently, more commodities will have to be consumed with the same income. We opt for the name *consumer separability* to distinguish from *demographic separability* for two reasons. First, demographic separability is defined on a direct utility function which has all the commodities as arguments. The new separability concept explicitly takes into account that some commodities may be no argument in the utility function of some consumers. This implies that it is impossible to test for consumer separability by means of the 'outlay equivalent ratios' approach of Deaton et alii (1989, p. 186). The second reason is that the variable d is a 'demographic' variable which is inherent in tobacco consumption. Contrary to this, the demographic variables focused by Deaton et alii (1989) are more closely related to the adjective 'demographic' and, more important, are independent from the consumption of certain commodities.

3 Empirical application

In this section, we will estimate Engel curves derived from an eleven-commodity conditional demand system and test whether the null hypothesis of zeroes generated by corner solutions can be rejected. This is done by means of the Belgian household budget survey of 1987-1988, which captures the expenditures of 3235 households made during a whole year.[1] We use the Engel curves of Banks, Blundell and Lewbel's (1997) Quadratic Almost Ideal Demand System (QUAIDS). Incorporating household characteristics, conditioning expenditures on tobacco $p_t t$ and possible heterogeneous preferences of smokers and non-smokers via d, the following conditional Engel curves are estimated $(i = 1, ..., 11)$:

$$w_i = \left(\alpha_{1i} + \alpha_{2i} d + \alpha_{3i} p_t t + \boldsymbol{\delta}_i' \mathbf{a}\right) + (\beta_{1i} + \beta_{2i} d) \ln x_G + (\lambda_{1i} + \lambda_{2i} d) (\ln x_G)^2 , \tag{5}$$

where $w_i = \frac{p_i q_i}{x_G}$ is commodity i's within-group budget share. The vector of household characteristics $\mathbf{a}$ consists of the type of municipality where the household lives, the number of adults, the numbers of older and younger children, the number of persons occupied in the household and the age and education level of the head of the family. Two (groups of) explanatory variables may be endogenous : the regressors associated with x_G (as the sum of

[1] Zero expenditures on tobacco are observed for 25% of the households. Zeroes on the other eleven commodities are negligible.

the expenditures on the eleven commodities) and the regressor $p_t t$. Therefore, we instrument group expenditures x_G by total expenditures and $p_t t$ by four dummy variables which capture the social state of the head of the family. Given the above parameterization, consumer separability (and thus the null hypothesis of zeroes arising from corner solutions) is rejected if the parameters associated with the binary indicator d are jointly significant in the Engel curves. To save space, only the results of this test are given in table 1. The table shows the F-statistics for the exclusion of the three variables with which the binary indicator d is associated. For 7 of the 11 commodities, the critical value of $F(3, 3220) = 2.6$ is exceeded. Consequently, consumer separability is rejected which simultaneously rejects the null hypothesis of zeroes generated by corner solutions.

Table 1 : F-tests for consumer separability

Commodity	F_{CS}
Food	5.49
Beverages	0.90
Clothing	3.55
Rent	5.45
Energy	1.58
Durables	4.22
Maintenance	2.28
Personal care	3.18
Transportation	4.78
Leisure activities	0.45
Services	6.10

4 Conclusion

In this paper, a simple test is derived for a necessary condition for zero expenditures on tobacco in long-duration budget surveys to arise from corner solutions. This test coincides with a test for consumer separability, which is closely related to demographic separability. The empirical application indicates that zeroes on tobacco are due to abstention, rather than corner solutions. This has important consequences on the econometric specification of an Engel curve for tobacco consumption and on the Engel curves of the other commodities.

References

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