ECO 751: Public Economics
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Fall 2007

Lecture 9: Estimating the Demand for Public Goods

Readings:

Bergstrom, Theodore and R. Goodman, "Private Demand for Public Goods," American Economic Review, June 1973:280-96.

Borcherding, T.E. and R.T. Deacon, "The Demand for Services of Nonfederal Governments," American Economic Review, 62, 1972:891-901

Wyckoff, T. James. "The Nonexcludable Publicness of Primary and Secondary Public Education," *Journal of Public Economics,* 1984:331-51.

1. Introduction

We examine three articles that focus on the demand for public goods. Critical to estimating the demand for these public goods is the fact that the public goods that they consider are essentially excludible (at least in some sense) and generally provided by local governments. Bergstrom and Goodman (1973) and Borcherding and Deacon (1972) provide similar analysis. In addition to estimating factors such as the income and price elasticity of demand, these studies also attempt to measure the extent of congestion "crowding" of these goods to address questions of optimal jurisdiction size. These studies have been frequently cited as evidence about economies of (or lack of) scale in the provision of public services. As the studies are quite similar, we focus on only one, Bergstrom and Goodman.

Wyckoff (1984) is a very different study. In this study Wyckoff attempts to discern the extent that public primary and secondary education provides benefits to others than the households with children in schools. He does this by examining voting patterns on of referendums on public education, relating an individuals vote to his or her family structure. He finds little "publicness" in primary and secondary education.

2. Private Demand for Public Goods

A. The Value of Estimating the Demand for Public Goods

From Bergstrom and Goodman (1973):

Knowledge of individual demand functions would be useful for many purposes. Such uses include:

1) Prediction of the outcomes of alternative political decision methods and tax structures in a particular city.

2) Computation of tax structures and expenditure levels which satisfy certain preference-based normative criteria, such as the Lindahl equilibrium. This would enable one to make statements about whether "too many" or "too few" public goods are actually provided and whether tax burdens are divided "equitably" relative to the norm employed.

3) Investigation of whether there are "scale economies" to city size in the production of public services.

4) Prediction of the effects *of* projected changes in values of economic and demographic variables on quantities of public goods to be supplied.

B. Assumptions underlying the Estimation

As an illustration of how this may be done, consider the following assumptions:

1. Units of measurement for a given municipally supplied commodity can be chosen in such a way that each municipality *j* is able to supply the commodity at constant unit cost q_j.

2. For each consumer *i* there is,a tax share T, such. that *i* must pay the fraction T_i of the total cost of municipal expenditures in his community. Consumer *i's* tax share may depend on his wealth, his income or other individual characteristics, but it does not vary with the size of municipal expenditures nor with the way in which he expresses his desires for municipal services.

3. Any consumer *i* living in municipality J is aware of his "tax price," $\tau_i Q_j$ and is able to determine the quantity of the municipal commodity which he would choose for the community given that he must pay the fraction r, of its total cost. To do so he needs only to maximize his own preferences subject to a linear budget constraint where his tax price for the municipal good is $\underline{P_i Q_i}$.

4. In each municipality, the quantity supplied of the municipal commodity is equal to the median of the quantities demanded by its citizens.

5. In each municipality the median of the quantities demanded is the quantity demanded by the citizen with the median income for that municipality.

If assumptions 4 and 5 are true, the quantity of municipal commodities chosen by any community is the amount which is desired by the consumer with the median income for that community.

C. Data and Estimation Procedure

Data and Sample

826 municipalities with 1960 populations between 10,000 and 150,000, located in 10 states. The

data are from the *Census of Population (1960)* and the *Census of Governments (1962)*.

Estimating Equation:

$\log(E) = c + \alpha \log(n) + \delta \log(\hat{\tau}) + \varepsilon \log(\hat{Y}) + \sum_{i=1}^{k} \beta_i X_i$ where:

E = the expenditures of a municipality on a specified category of municipal service. In particular, separate regressions were run for the following definitions of *E*.

(a) Police expenditures
(b) Parks and recreation expenditures
(c) Total municipal expenditures excluding education and welfare

n = number of households in a municipality;

$\hat{Y}$ = median income;

$\hat{\tau}$ = tax share of citizen with the median income.

This is determined by finding the property taxes on the house of median value and then determining what fraction this tax payment is of total property tax revenue. The same fraction is applied to all other municipal revenue.

Crowding

Let Z^* denote the usefulness of a facility to an individual and

$$Z^* = n^{-\gamma} Z$$

where Z is the quantity (expenditure) on public good and n is the number using the public good.

If $\gamma = 0$ it is a pure public good; $\gamma = 1$, a pure private good.

Then demand for the public service is found by

$$Max\ U^i(X_i, Z^*)$$
$$s.t.\ X_i + \tau_i q Z \le Y_i$$
$$or$$
$$s.t.\ X_i + \tau_i q n^{\gamma} Z^* \le Y_i$$

where q is price of unit of public good. Suppose it is a constant elasticity of income and price demand equation. Then demand for Z^* is

$$Z^* = c\left[\tau_i q n^{\gamma}\right]^{\delta} Y_i^{\varepsilon}$$

but since $Z = n^{\gamma} Z^*$ we have

$$Z = n^{\gamma}\, c\left[\tau_i q n^{\gamma}\right]^{\delta} Y_i^{\varepsilon} = cq\,\tau_i^{\delta} Y_i^{\varepsilon} n^{\gamma(1+\delta)}$$

Then in estimation we have

$$\alpha = \gamma(1+\delta) \text{ or } \gamma = \alpha/(1+\delta),$$

The "crowding" parameter, γ, can be indirectly estimated.

D. Results

- The estimates of the crowding paramter, γ, are close to unity for almost all goods and all states.
- The income elasticities are positive and generally statistically significant. Generally highest estimates are for parks and recreation then police and last is general expenditures.
- The price elasticities are generally negative but relatively small suggesting a relatively price-inelastic demand.

Table 1: Determinants Of Current General Expenditures Of Municipalities In 1962 (Excluding Education And Welfare)

Coefficients of other variables	California	Illinois[b]	Michigan	Minnesota	Missouri	New Jersey	New York	Ohio	Pennsylvania	Wisconsin
Income elasticity ϵ	0.28	1.73*	0.88*	1.29*	1.65*	0.79*	1.03*	0.80*	0.37	0.16
	0.17	*0.44*	*0.22*	*0.38*	*0.46*	*0.14*	*0.17*	*0.19*	*0.26*	*0.37*
Tax share elasticity δ	−0.39*	0.79*	0.41*	−0.25*	−0.25	−0.13*	−0.50*	0.21*	−0.15	−0.01
	0.08	*0.08*	*0.13*	*0.11*	*0.31*	*0.05*	*0.14*	*0.10*	*0.16*	*0.07*
Population elasticity α	0.67*	0.46*	0.58*	0.69*	0.94*	0.97*	0.75*	0.85*	0.99*	1.00*
	0.09	*0.12*	*0.14*	*0.19*	*0.33*	*0.06*	*0.15*	*0.11*	*0.12*	*0.11*
Crowding parameter $\gamma=(\alpha/(1+\delta))$	1.10	0.65**	0.98	0.92	1.25	1.11**	1.50**	1.08	1.16**	1.01
Percent population change (1950–60)	−0.06*	−0.10	−0.00	−0.03	−0.03	0.02	−0.03	−0.08*	0.03	−0.07*
	0.01	*0.07*	*0.02*	*0.02*	*0.03*	*0.01*	*0.17*	*0.02*	*0.02*	*0.03*
Employment residential ratio	0.11*	−0.08	0.22	−0.13	−0.02	0.24*	0.10	0.05	0.22*	0.12
	0.03	*0.12*	*0.13*	*0.11*	*0.36*	*0.04*	*0.05*	*0.05*	*0.07*	*0.15*
Percent owner occupied	−0.07	−1.56	−1.71*	−3.21*	0.05	−0.78*	1.68*	−0.58	−0.35	0.35
	0.22	*0.82*	*0.52*	*1.01*	*1.15*	*0.24*	*0.45*	*0.39*	*0.52*	*0.67*
Percent nonwhite	0.45	1.95*	−0.20	12.79	1.80	1.35*	−0.19	0.75	0.48	3.63
	0.46	*0.92*	*0.54*	*10.92*	*2.23*	*0.33*	*0.72*	*0.89*	*0.57*	*2.58*
Density	−0.07	0.05	−0.02	0.03	−0.30	−0.03	−0.22*	−0.15*	0.08	0.02
	0.05	*0.12*	*0.07*	*0.08*	*0.17*	*0.04*	*0.05*	*0.07*	*0.06*	*0.06*
Percent population 65+	1.69*	4.21	−1.35	1.49	8.55*	1.32	3.70*	0.37	1.10	−0.57
	0.81	*2.68*	*1.74*	*2.01*	*2.67*	*0.96*	*1.47*	*1.15*	*1.72*	*2.37*
Percent living in same house (1955–60)	−1.21*	−.57	0.90	−1.48*	−2.88*	0.08	−1.27	−0.79	−0.88	−0.60
	0.31	*0.88*	*0.58*	*0.66*	*1.60*	*0.43*	*0.64*	*0.51*	*0.56*	*0.75*
Intercept	3.02	−9.81	−1.48	−6.08	−11.45	−7.01	−1.68	−4.09	−4.56	2.68
Number of observations	160	62	70	36	33	120	74	106	124	41
R^2	.89	.80	.91	.89	.89	.94	.94	.87	.81	.96

Table 2: Determinants Of Municipal Expenditures On Police In 1962

Coefficients of other variables	California	Illinois[b]	Michigan	Minnesota	Missouri	New Jersey	New York	Ohio	Pennsylvania	Wisconsin
Income elasticity ϵ	0.26	1.89*	0.54	0.80	1.04*	0.94*	1.78*	1.08*	0.99*	0.95
	0.16	*0.34*	*0.62*	*0.41*	*0.28*	*0.14*	*0.22*	*0.17*	*0.41*	*0.86*
Tax share elasticity δ	−0.25*	−0.19*	−0.76*	−0.13	−0.19	−0.15*	−0.31	−0.18*	0.36*	−0.15
	0.07	*0.06*	*0.36*	*0.13*	*0.19*	*0.05*	*0.64*	*0.09*	*0.15*	*0.10*
Population elasticity α	0.75*	0.56*	0.26	0.83*	0.74*	0.81*	1.02	0.77*	0.67*	0.75*
	0.08	*0.09*	*0.40*	*0.20*	*0.21*	*0.07*	*0.70*	*0.10*	*0.18*	*0.25*
Crowding parameter $\gamma = (\alpha/(1+\delta))$	1.00	0.69**	1.08	0.95	1.04	0.95	1.48	0.94	1.05	0.88
Percent population change (1950–60)	−0.04*	0.06	−0.07	−0.04	0.01	0.04	2.73*	−0.01	0.06	−0.14*
	0.01	*0.05*	*0.05*	*0.02*	*0.02*	*0.03*	*0.77*	*0.02*	*0.03*	*0.06*
Employment residential ratio	0.08*	−0.04	−0.27	−0.10	0.06	0.21*	−0.14	0.06	0.20	0.19
	0.03	*0.09*	*0.33*	*0.12*	*0.22*	*0.04*	*0.23*	*0.04*	*0.12*	*0.36*
Percent owner occupied	0.19	−2.25*	−0.51	−3.61*	−0.81	0.65*	−1.16	−0.59	0.38	−0.08
	0.26	*0.62*	*1.47*	*1.10*	*0.71*	*0.24*	*2.07*	*0.35*	*0.81*	*1.57*
Percent nonwhite	0.69	1.53*	0.13	0.97	0.87	1.21*	2.32	1.43	0.04	−1.55
	0.42	*0.70*	*1.52*	*11.94*	*1.38*	*0.34*	*1.30*	*0.86*	*0.89*	*6.07*
Density	−0.02	0.01	0.03	0.05	−0.09	0.07	−0.46*	0.05	0.55*	0.20
	0.04	*0.09*	*0.21*	*0.08*	*0.10*	*0.04*	*0.23*	*0.07*	*0.09*	*0.15*
Percent population 65 +	0.99	−0.97	1.21	−0.85	1.16	0.55	10.38	−1.39	0.77	2.47
	0.74	*2.03*	*4.93*	*2.20*	*1.66*	*0.98*	*6.77*	*1.03*	*2.68*	*5.58*
Percent living in same house (1955–60)	−0.70*	0.53	0.06	−0.74	0.33	0.47	−9.11*	0.25	−1.50	−2.39
	0.32	*0.67*	*1.64*	*0.72*	*0.62*	*0.44*	*2.96*	*0.46*	*0.87*	*1.76*
Intercept	−0.80	−13.70	4.36	−5.59	−7.12	−9.24	−8.58	9.90	−11.31	−9.02
Number of observations	160	62	70	16	33	120	74	106	124	41
R^2	.89	.87	.57	.88	.93	.92	.69	.89	.69	.88

Table 3: Determinants Of Municipal Expenditures On Parks And Recreation In 1962

Coefficients of other variables	California	Illinois[b]	Michigan	Minnesota	Missouri	New Jersey	New York	Ohio	Pennsylvania	Wisconsin
Income elasticity α	0.10	3.54	1.25	2.19*	2.81*	2.28*	1.74*	1.50*	1.76*	−1.87
	0.44	*1.98*	*0.66*	*0.83*	*0.99*	*0.54*	*0.64*	*0.55*	*0.80*	*1.18*
Tax share elasticity β	−0.68*	0.01	0.25	−0.39	−0.24	−0.00	−0.81	0.49	0.02	−0.13
	0.26	*0.37*	*0.32*	*0.25*	*0.63*	*0.17*	*0.53*	*0.28*	*0.29*	*0.22*
Population elasticity α	0.67*	1.01	1.49*	0.74	1.11	1.28*	0.69	0.60	1.72*	1.19*
	0.21	*0.52*	*0.43*	*0.41*	*0.69*	*0.25*	*0.58*	*0.31*	*0.36*	*0.35*
Crowding parameter $\gamma=(\alpha/(1+\delta))$	2.05**	1.00	1.19	1.21	1.47	1.28	3.63**	1.18	1.69**	1.37
Percent population change (1950–60)	−0.11*	0.33	0.01	−0.02	−0.22*	−0.15	0.42*	−0.08	0.05	−0.44*
	0.02	*0.30*	*0.05*	*0.04*	*0.07*	*0.12*	*0.04*	*0.06*	*0.07*	*0.08*
Employment residential ratio	0.08	0.05	1.28*	−0.19	1.22	0.41*	0.35	−0.10	0.83*	−0.83
	0.09	*0.51*	*0.35*	*0.24*	*0.71*	*0.16*	*0.19*	*0.14*	*0.23*	*0.49*
Percent owner occupied	0.00	−4.03	0.25	−4.90*	4.08	2.06*	−3.48*	−0.27	0.23	2.46
	0.73	*3.64*	*1.56*	*2.20*	*2.39*	*0.91*	*1.72*	*1.13*	*1.58*	*2.15*
Percent nonwhite	−2.06	−6.06	0.33	−1.69	−0.59	2.31	1.66	3.03	−0.23	−5.41
	1.19	*4.09*	*1.61*	*23.95*	*4.61*	*1.28*	*2.25*	*2.62*	*1.74*	*3.35*
Density	0.05	0.49	−0.39	0.15	0.26	0.38*	−0.21	−0.31	0.35*	0.19
	0.13	*0.52*	*0.22*	*0.17*	*0.35*	*0.16*	*0.19*	*0.21*	*0.17*	*0.25*
Percent population 65—	1.22	25.87*	−8.23	8.99*	11.25*	3.92	14.27*	−2.33	7.11	−4.85
	2.10	*11.91*	*3.25*	*4.15*	*5.53*	*3.68*	*5.64*	*3.38*	*5.24*	*7.67*
Percent living in same house (1955–60)	−1.00	−0.92	0.81	−2.38	−9.27	−0.57	−3.14	−0.90	−4.77*	−5.29*
	0.92	*3.93*	*1.74*	*1.45*	*2.05*	*1.65*	*2.46*	*1.49*	*1.70*	*2.42*
Intercept	3.84	−40.84	−19.33	−15.99	−31.62	−23.20	−8.03	−12.99	−23.73	15.87
Number of observations	160	62	70	36	33	120	74	106	124	41
R^2	.67	.35	.63	.79	.83	.63	.67	.56	.60	.85

3. *The Nonexcludable Publicness of Primary and Secondary Public Education*
James H. Wyckoff, Journal of Public Economics, 1984.

A. Introduction

In this paper, Wyckoff is attempting to empirically determine the extent that public primary and secondary education yields external benefits. The determination of the external or "social" benefits has important implications for whether privatization, for example, would yield an efficient outcome. Wyckoff attempts to identify the social benefits by relating private and social benefits to the characteristic of the household. For example, a household with no children should only have social benefits. He then relates this to the preferred level of spending for households based on a survey in Michigan.

B. Social versus Private Benefits.

Wyckoff wants a measure of the "social" component of demand for education. He refers to the nonexcludable publicness coefficient or

$$NPC = \frac{\sum_{i=1}^{m} MEB_i}{\sum_{i=1}^{m} MEB_i + \sum_{i=1}^{n} MPB_i}$$

where *MEB* is the external or social benefits summed over the *m* households in the community. The *MPB* is the private marginal benefit summed over the *n* households who have private benefits. Graphically the *NPC* equals the ratio OS/OT

C. Individual Demand for Primary and Secondary Education

Each household *i* has the utility function

$$U_i = U_i(X_i, P_{1i},\ldots,P_{ki},S),\ i = 1,\ldots,m$$

where

- X_i is consumption of private good by household *i*;
- P_{ji} is the quantity of "private" characteristics of education for child *j* in household i;
- S is the total quantity of social characteristics of education in the community.

Let quantity of private and social characteristics depend on quantity of education (spending) per pupil (E_{ji}). Then

- $P_{ji} = f(E_{ij})$
- $S = g(E_{11},\ldots,E_{k1},\ldots,E_{km})$

where f(.) and g(.,.,.,.) are functions that transform units of educational quality into private and social characteristics (benefits). With a uniform and collectively determined quality of education we have

- $P_{ji} = f(E)$
- $S = g(n,E)$

where *n* is the number of students in the district.

The cost (taxes paid) for education by household is given by

$$T_i = qt_in$$

where T_i is tax price for i; q is the cost of a unit of education; t_i is the tax share for household i; and n is the number of students in the community.

For households with children, there are both private and social demands and their demand for education is given by

$$E_i^T = E_i^T(qt_i, n, r, M_i, k_i, f(.), g(.))$$

where

- M_i is individual income;
- r is price of X;
- k_i is the number of children in household i.

For households without children we have only a social demand

$$E_i^S = E_i^S(qt_i, n, r, M_i, g(.))$$

D. Estimation of Private and Social Demands for Education

Data

- Survey following a school referendum in Marshall Michigan.
- Referendum offered 6 levels of expenditures per student (875, 933, 1004, 1684, 1749, 1813).
- Survey has information on demographics, income, and information (property value) to calculate tax price.
- 192 useable responses

See *Table 1* for description of variables.

Estimation Technique and Equations

Since there are 6 choices he estimates an ordered probit -- assumes that ranking is ordered.

There are 2 equations. For those without children:

$$E^S = \beta_0 + \beta_1 P + \beta_2 Z + \varepsilon^S, \text{ social demand}$$

With children we want

$$E^P = \gamma_0 + \gamma_1 P + \gamma_2 Z + \varepsilon^P, \text{ private demand}$$

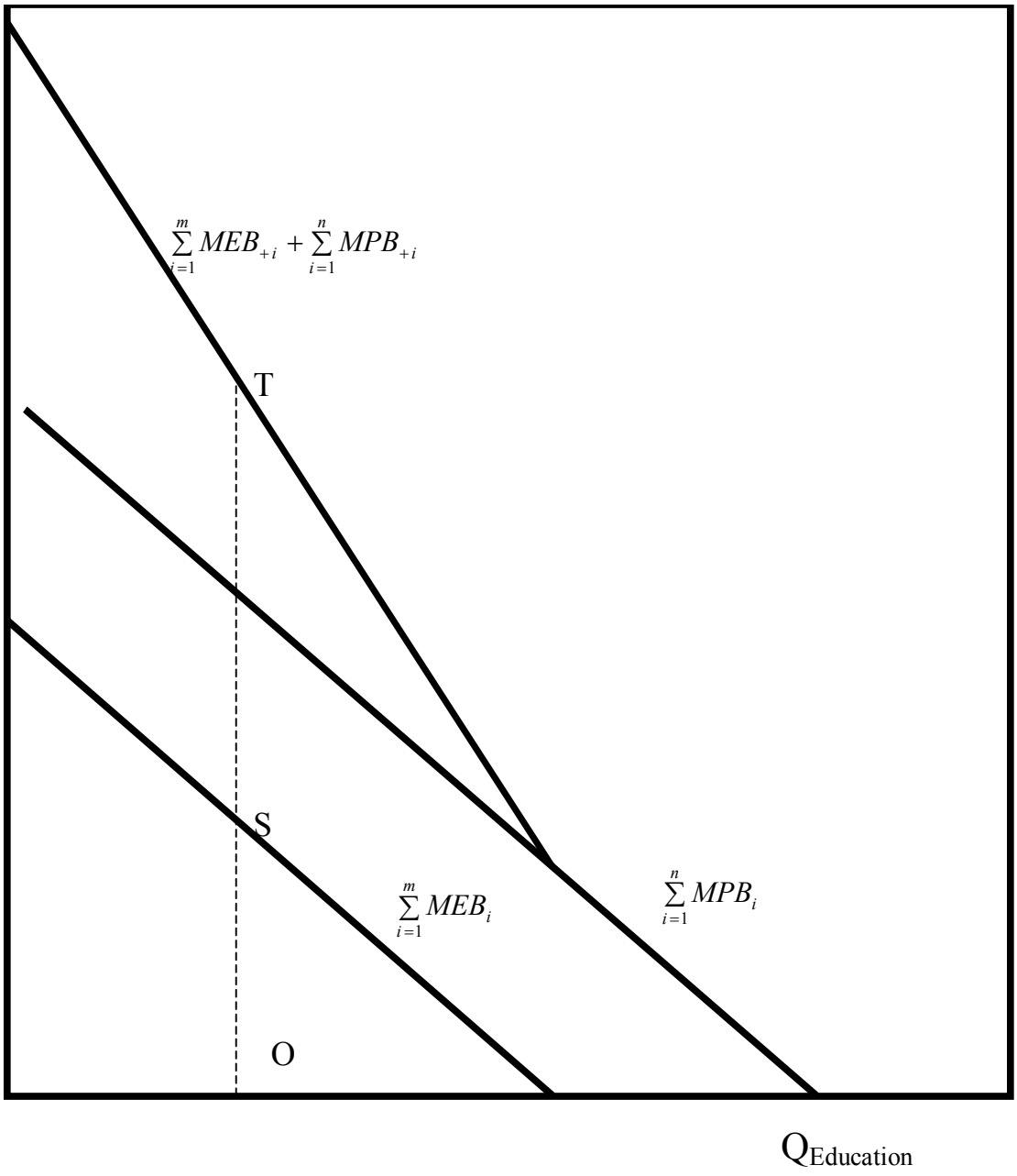
where

- P is tax price
- Z is vector of taste and preference variables
- ε are error terms.

We cannot identify private demand for households with children instead have total demand, private + social demand. This is given by

$$E^T = \beta_0 + \beta_1 P + \beta_2 Z + \alpha_O Y + \alpha_1 YP + \alpha_2 YZ + \varepsilon^T, \text{ private demand}$$

where Y is the number of children.



Results

In *Table 2*, model 2, the private and social demands are separated. The private demands in are the interaction terms with price, income, family size, and the coefficient on the number of children. The private benefits are relatively invariant to price and income. Note the very large coefficients on having children in public school suggests that private demand is a large component.

Wyckoff interprets the coefficients by considering different values for independent variables with others evaluated at means in *Table 4*. One indication of the private versus social value is the impact of having children in public schools on preferred level of spending. Note it is 25% greater with one child than none and 49% greater with two children.

E. Estimating Nonexcludable Publicness Coeffiicient

To find the *NPC* the demand equation must be inverted to give price (marginal benefit) as a function of quantity (spending per student). Thus we would have

$$MSB_i = \frac{1}{\beta_1}\left(E^s - \left(\beta_o + \beta_2 Z\right)\right)$$

and

$$MPB_i = \frac{1}{\gamma_1}\left(E^P - \left(\gamma_0 + \gamma_2 Z\right)\right)$$

Wyckoff estimates the *NPC* at 0.10. He notes that the price elasticity is critical here and it is not at all significant for the private demand so only have limited confidence in the estimate of the *NPC*.

Table 1

Definition of independent variables.

1. Gross tax price (dollars)	The calculated cost to the household of a $1 increase in expenditures per pupil gross of circuit-breaker property tax credits and federal income tax mortgage interest deductions.
2. Marginal tax price (dollars)	The cost to the household of a $1 increase in expenditures per pupil net of property tax credits and income tax mortgage interest deductions.
3. Income (1000's dollars)	Annual household income less estimated federal and state income taxes.
4. Household size	Number of individuals in the household.
5. Employed by school district	1 = respondent employed by the Marshall school district. 0 = otherwise.
6. Money affects quality — unsure	1 = respondent unsure whether moderate increases in school expenditures affect the quality of education. 0 = otherwise.
7. Money affects quality — yes	1 = respondent believes that moderate increases in school expenditures affect the quality of education. 0 = otherwise.
8. Agree with mix of expenditures — unsure	1 = respondent unsure whether the school board and administration would rank expenditure categories the same as the respondent. 0 = otherwise.
9. Agree with mix of expenditure — yes	1 = respondent believes school board would rank expenditure categories the same as the respondent. 0 = otherwise.
10. Children attended local schools	1 = youngest child once attended Marshall public schools but no longer does. 0 = otherwise.
11. Child graduated last 5 years	1 = youngest child attended Marshall public schools and graduated in last 5 years. 0 = otherwise.
12. White-collar occupation	1 = respondent or, if homemaker, respondent's spouse, is in a white-collar occupation (i.e. professional, manager, sales, or clerical). 0 = otherwise.
13. Blue-collar occupation	1 = respondent or, if homemaker, respondent's spouse, is in a blue-collar occupation (i.e. craftsperson, operative, laborer). 0 = otherwise.
14. Education after high school	1 = respondent has some post high school education. 0 = otherwise.
15. Sex	1 = respondent is male. 0 = respondent is female.
16. Age (years)	Age of respondent.
17. 1 child in local school	1 = one child in Marshall public school. 0 = otherwise.
18. 2 children in local school	1 = two children in Marshall public school. 0 = otherwise.
19. 3 or more children in local schools	1 = three or more children in Marshall public schools. 0 = otherwise.

Table 2

Ordered probit estimates of the demand for education in the Marshall school district

Independent variables	Model 1 benchmark	Model 2 Social	Model 2 Private
1. Constant	450.7 (1.00)	399.9 (0.92)	
2. Gross tax price	−344.8* (−2.04)	609.2* (−3.29)	−31.6 (0.11)
3. Income	1.54* (2.12)	3.55* (3.14)	−0.55 (−0.25)
4. Household size	−88.4 (−1.45)	−146.1* (−1.76)	41.9 (−0.25)
5. Employed by school district	992.8* (4.35)	554.2* (5.32)	
6. Money affects quality — unsure	147.2 (1.26)	162.2 (1.21)	
7. Money affects quality — yes	353.9* (3.29)	334.7* (3.17)	
8. Agree with mix of expenditures — unsure	397.3* (3.75)	413.7* (4.29)	
9. Agree with mix of expenditures — yes	271.1* (1.79)	334.0* (3.61)	
10. Children attended local schools	262.2* (1.84)	241.5* (1.89)	
11. Children graduated last 5 years	398.3* (6.86)	376.6* (5.22)	
12. White-collar occupation	222.4* (3.27)	709.8* (3.17)	
13. Blue-collar occupation	239.5 (1.00)	258.4 (1.09)	
14. Education after high school	17.6 (0.17)		188.0 (1.60)
15. Sex	61.9 (0.62)		
16. Age	−2.61 (−0.57)	2.02 (−0.45)	
17. 1 child in local schools	385.7* (2.57)		425.43 (1.14)
18. 2 children in local schools	756.3* (4.100		820.6* (2.79)
19. 3 or more children in local schools	394.9* (1.76)		413.28 (1.22)
20. Standard deviation	574.6* (10.74)	685.3 (7.76)	610.2 (0.19)
Sample size	192	192	
−2.0* log likelihood ratio		103.4*	

*The numbers in parentheses are asymptotic t-values calculated from the

Table 4

Predicted expenditure levels for various characteristics of independent variables with all other variables valued at their means.

Variable changed	Value of variable	Predicted expenditures $\bar{X} = \$1471$	Percent change
1. Gross tax price	25th percentile ($0.31)	$1552	
	75th percentile ($0.62)	$1423	−8
2. Income	25th percentile ($11,960)	$1420	
	75th percentile ($22,643)	$1592	+12
3. Household size	3	$1440	
	4	$1343	−7
	6	$1150	−14
4. Employed school district	No	$1364	
	Yes	$1918	+41
5. Money affects quality	No	$1318	
	Unsure	$1480	+12
	Yes	$1652	+11
6. Agree with mix of expenditures	No	$1321	
	Unsure	$1734	+31
	Yes	$1655	−5
7. Occupation	Retired	$ 950	
	Blue-collar	$1208	+27
	White-collar	$1660	+37
8. Age	20 years	$1522	
	40 years	$1481	−3
	60 years	$1441	−3
9. Children attended local schools	No	$1140	
	Yes	$1381	+21
	Last 5 years	$1516	+10
10. Child in local schools	0	$1222	
	1	$1532	+25
	2	$1907	+24
	3+	$1519	−20
11. Education after high school	No	$1417	
	Yes	$1596	+13
12. Interaction of household size (HH) and children in school (CS)	HH = 2, CS = 0	$1390	
	HH = 3, CS = 1	$1650	+19
	HH = 4, CS = 2	$1978	+20
13. Effect of recent graduation	1 child in school	$1532	
	1 child recently graduated	$1516	−1
	1 child graduated more than 5 years ago	$1381	−9