



University of Cyprus
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Working Paper 04-2014

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Abstract

The effects of free of charge state education on income distribution are often studied by allocating government education outlays to households, assuming that these outlays equal the benefit which households attach to state schooling. This paper proposes a demand analysis approach to estimating the 'true' value of state education as perceived by consumers, and uses the results to assess the inefficiency of public provision. Empirical analysis based on data from Cyprus suggests that state schooling costs twice the amount households are willing to pay for. The implications of this finding for the equality and anti-poverty effects of state education are illustrated.

JEL classification: D12, H42

Keywords: Education, Inequality, Poverty, Consumer demand

1. Introduction

Influential intergovernmental organizations, such as the World Bank and OECD, constantly underline the relevance of public services for income inequality (e. g. OECD, 2011). Yet, the empirical academic literature - with few notable exceptions (Aaberge et al, 2010) - places relatively limited effort on expanding our knowledge about the 'true' welfare impact of public provision. Moving in the direction of remedying this negligence this paper: (i) proposes and estimates a money metric for valuing consumers' willingness to pay for substituting public for private education; (ii) compares this valuation with actual public expenditure on education to assess the inefficiency of freely provided state schooling; and (iii) uses the results to illustrate the implications of ignoring this inefficiency in examining the egalitarian effect of free state education. Unlike the production cost approach (Smeeding et al, 1993), which is used in most empirical studies (Verbist et al, 2012), the method proposed here is firmly rooted in economic theory; thus, yielding meaningfully interpretable empirical results. Furthermore, the empirical analysis can be performed using widely and readily available family expenditure data without having to conduct ad hoc consumer valuation (contingency) studies.

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2. Consumer's valuation of free schooling

The starting point of our analysis is that state education is provided free of charge at some minimum level (quality). Consumers not satisfied with this level can opt out of the state education system and enrol their children in private schools. Furthermore, we consider household consumption decisions to be taken in two stages: first, total expenditure is allocated among broad commodity groups, normally between non-durables and durables; at the second stage the budget of non-durables is allocated among commodities in this group.¹ In this context, the choice between state and private education is assumed to be decided at the upper stage so that the cost incurred by those opting for private education is estimated at the lower budgeting stage from parameters capturing observed shifts in consumer behaviour attributed to this cost.

The allocation of consumer expenditure at the lower stage is determined in the context of an integrable demand system based on the Quadratic Logarithmic (QL) cost function²

$$C(p, z_h, U_h) = a(p, z_h) + \frac{\beta(p, z_h)U_h}{1 - \lambda(p, z_h)U_h}, \quad (1)$$

where $p = p_1, p_2, \dots, p_n$ is a vector of commodity prices; $z_h = z_{1h}, z_{2h}, \dots, z_{kh}$ a vector of demographic and other broadly defined household characteristics affecting consumer demand; U_h the utility level of the h^{th} household h ; and $a(p, z_h)$, $\beta(p, z_h)$ and $\lambda(p, z_h)$ are linearly independent and homogeneous functions.

The Marshallian budget share for the i^{th} good is written as

$$\omega_{ih} = a_i(p, z_h) + \beta_i(p, z_h)[\ln X_h - a(p, z_h)] + \lambda_i(p, z_h)[\ln X_h - a(p, z_h)]^2, \quad (2)$$

where $a_i(p, z_h)$, $\beta_i(p, z_h)$ and $\lambda_i(p, z_h)$ are the price derivatives of the corresponding functions in (1) and X_h the level of aggregate consumer expenditure.

Expenditure on education is included in X_h , while the dummy variable indicating the choice between state and private schooling is included in z_h . Denoting the choice of state schooling by $z_{0h} = 0$, and $z_{0h} = 1$ otherwise, the cost of reaching a given level of utility, U^* , by households with school-age children opting out of state education relative to those not doing so is given by the equivalence scale

¹ This budgeting framework, invariably used in empirical demand analysis (e.g. Blundell et al, 1993), is tested in the empirical section.

² Integrability is mandatory for the derivation of welfare metrics from observed consumer behaviour. The QL is among the most general (rank-3) integrable demand systems (Banks et al, 1997).

$$S(z_{0h}; p, z_h, U^*) = c(z_{0h=1}; p, z_h, U^*) / c(z_{0h=0}; p, z_h, U^*) \quad (3)$$

and can be calculated using the parameters of (2) estimated subject to standard assumptions about the functional form of the $a_i(p, z_h)$, $\beta_i(p, z_h)$ and $\lambda_i(p, z_h)$ functions (Banks et al, 1997). Notably, (3) measures the cost of substituting state for private education, thus no issue about not accounting of externalities arise.

3. Empirical results

The empirical analysis uses data drawn from the 2009 Cyprus Family Expenditure Survey (FES), which consists of 2707 households and contains detailed information about income, consumption and many characteristics of the household. To avoid unnecessary sample heterogeneity, households with two adults plus two children and a non-retired head are selected. This reduces the sample size to 744 households.

In the absence of price variation, and assuming *Independence of Base* (IB)³ and linear effects for the household characteristics, (2) can be written as:

$$\omega_{ih} = a_i + \sum_k \delta_{ik} z_{kh} + \beta_i [\ln X_h - \varepsilon_0 - \varepsilon_1 z_{1h} - \varepsilon_2 z_{2h}] + \lambda_i [\ln X_h - \varepsilon_0 - \varepsilon_1 z_{1h} - \varepsilon_2 z_{2h}]^2, \quad (4)$$

where the parameters: a_i are constants; δ_{ik} show the effect of household characteristics; β_i and λ_i show the effect of (equivalised logarithmic) expenditure and expenditure squared, respectively; ε_0 is subsistence expenditure (fixed to the logarithm of average expenditure of the poorest 1% of households); ε_1 is the cost per child attending state school; ε_2 shows how ε_1 is modified by private school choice; and z_{1h}, z_{2h} are the number of children in state and private school, respectively.

Table 1 reports the parameters of interest, ε_1 and ε_2 , and the results of relevant diagnostic tests.⁴ The results suggest that, on average, a child in freely provided state education accounts for 12% of total household expenditure; and this cost doubles for households opting for paid out of pocket private education. This translates to household willingness to accept €5,048 (annually, in 2011 prices) per school-age child for substituting state for private education. The corresponding figure for government cost per school-age child is €10,276, suggesting that from the consumers' point of view the public provision of education in Cyprus is grossly inefficient.

³ IB is required for welfare comparisons between households to be independent of utility level (Banks et al, 1997).

⁴ The full results are available on request. Note that (4) is estimated as a system of three equations - food, services and other goods - as a more detailed commodity disaggregation reduces the degrees of freedom without offering an information advantage in the context of our analysis.

This finding is supported by evidence of excessive public spending on education related activities in Cyprus reported elsewhere.⁵

Table 1: Estimates of the consumer benefit from opting for state schooling

	Coefficient	t-ratio
Cost per child (ε_1)	0.122	2.97
Additional cost per child for private schooling (ε_2)	0.117	2.98
Objective	1.970	
Objective* Number of observations	1,466	
Separability test	LR= 16.91 (0.002)	
Non-IB test	LR= 8.01 (0.091)	
Willingness to pay for substituting public for private education	€5,048	
Per capita production cost	€10,276‡	

‡Ministry of Education and authors' calculations.

The results of testing separability (two stage budgeting) and non-IB are also reported in Table 1. Separability is tested as the joint significance of first stage commodity expenditures (durables, education etc) in the second stage budget shares; and non-IB as the disparity of the (utility) parameters β and λ between households with children in private and state schools. Separability is strongly rejected, yet this does not affect the size and significance of the parameters determining the inefficiency of public provision; while non-IB can be rejected at 5% significance.

Table 2 reports the redistributive effects of state education, as measured by changes in: (i) the Gini coefficient; (ii) two versions of the Atkinson index, differing in social inequality aversion - the higher parameter reflects more inequality aversion; and (iii) two measures of poverty, calculated by adopting a moving (Poverty1) and a constant (Poverty2) poverty line, respectively.⁶ These distributional effects are calculated by allocating the benefit of state education to households, first as perceived by consumers and estimated by demand analysis (columns 2 and 3); and, then, as implied by the production cost approach (columns 4 and 5).

Overall, the results in Table 2 suggest that the redistributive effect of state education is progressive delivering a considerable reduction in income inequality. Nevertheless, this progressivity is lower when the benefit to households is defined as perceived by consumers rather than as calculated from production cost. As regards poverty effects the results are

⁵ Teachers' and School Heads' Salaries and Allowances in Europe, 2012/13, European Commission. http://eacea.ec.europa.eu/education/eurydice/documents/facts_and_figures/salaries.pdf

⁶ The constant poverty line is fixed at 60% of the median of the pre-benefit income distribution, while the moving one is allowed to change with the added benefit - and increase in median income.

ambiguous and depend more on the choice of the poverty line rather than on the method used to calculate the household benefit from state education.

Table 2: Distributional effects of state education

Index	Without state schooling	With state schooling estimated from:			
		Demand analysis		Production Cost	
	(1)	Level (2)	%Change (3)	Level (4)	%Change (5)
Gini	0.259	0.245	-5.55*	0.241	-7.01*
Atkinson0.5	0.055	0.049	-9.78*	0.048	-11.99*
Atkinson1.5	0.115	0.103	-10.46*	0.099	-13.77*
Poverty1	0.133	0.115	-13.96*	0.133	-0.38
Poverty2	0.133	0.090	-32.15*	0.086	-35.29*

Source: Cyprus 2009 FES.

Notes: Asterisks denote statistical significance at the 0.05 level.

4. Conclusion

This paper proposes and estimates a money metric of freely provided state education as perceived by households. It then uses this metric to assess the inefficiency of state education, and the implications of ignoring this inefficiency for assessing the distributional effects of public schooling. The results, based on Cyprus data, suggest that the state cost per school-age child is twice the amount households would be willing to accept for substituting state for private education. This public sector inefficiency is probably due to teacher salaries in the public sector being very high compared to those in the private sector.

The analysis in the paper has methodological and policy implications. From the methodological standpoint it shows that the production cost approach can overestimate the egalitarian effects of state education, at least in countries prone to wasteful public spending. Policy-wise, the results suggest that combating inefficiencies in public provision can save resources while maintaining distributional neutrality. The freed resources can then be redistributed to low-income families with school-age children through targeted measures (e.g. reducing dropouts), thereby enhancing the progressivity of the system.

The analysis proposed here can be applied to investigate efficiency and equity aspects of other publicly provided private goods (health, child and long-term care etc), provided that a free market for these goods exists and individuals can choose between free public provision and private purchase. As long as unchecked reliance on assumptions about consumer preferences is avoided (e.g. independent of base utility comparisons), this approach can help identify areas of -

and suggest measures for - combating public spending inefficiency. This is a topical issue given the fiscal consolidation efforts currently underway in many countries.

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