Central versus local education finance: A political economy approach

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Abstract

This paper models voters' preferences over central versus local education policies when there are private alternatives. Education is financed by income taxes and individuals are mobile between communities. Public education levels are chosen by majority vote. Contrary to conventional wisdom, centralisation may benefit the rich and poor, while the middle class prefer decentralised education. The model is also extended to include peer effects. Peer effects increase the support for central school finance, even in the community with good public schools.

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1 Introduction

In industrialised economies, education is an eminently political topic. Since the fate of these countries in a globalised world depends upon the skills of their labour forces, the design of education policies has received increasing attention in recent decades. Recent test score results from large international studies such as TIMSS and PISA have made great impact in most countries and intensified discussions about political reforms.

Among the questions which are sometimes hotly debated is whether public education should be provided by local or central governments. It is interesting to note that the involvement of central government in education policy varies greatly even among relatively similar countries. For instance, the share of central government funds towards primary and secondary education in OECD countries ranges from less than 10 percent in Switzerland, Canada, Germany, and the US to 90 percent or more in the Netherlands, Ireland, Greece, Portugal and New Zealand (OECD, 2004). Explaining this variation would be an interesting task for a positive economic theory.

The literature has mainly analysed how decentralisation can affect efficiency or equity. Important questions here are how student performance and the distribution of resources are affected by decentralisation. For instance, greater accountability of local school districts is often thought to lead to a more efficient provision of education, and local politicians are often considered to tailor policies more closely to the needs of their constituents. On the other hand, central exit examinations may be an effective tool to improve student achievement (Jürges *et al.*, 2005). Moreover, local school finance may lead to segregation which adversely affects the opportunities faced by the poor.

The positive economic literature on centralisation of education finance is less developed. This paper develops such a positive model. The model is a two community model with public and private schools, where individuals differ by income. Public schools are financed by income taxes within communities, and individuals are mobile between communities. With centralised school finance, both communities get the same amount of per capita spending on schools.

While the political economy of centralising public service provision has been studied before, the analysis reveals that the existence of private alternatives has a significant impact on this problem. The conventional wisdom is that decentralised public spending leads to segregated communities, and that centralisation yields policies which are farther away from the local median voters (Bolton and Roland, 1997; Borck, 1998). Those who benefit from centralisation are the voters in the middle of the distribution while voters at the edges are bound to lose. With a private alternative, this need not be the case. In particular, I show, using numerical simulation with parameters calibrated to match US outcomes, that at the contrary, it may be the poorest and richest voters who benefit from centralisation because they then pay lower taxes than under decentralisation. This is due to the fact that public education with private alternatives may result in an "ends against the middle" coalition. Centralised finance leads to relatively low taxes and spending levels, and this benefits the rich (who use private schools) and the poor who use public schools but have a relatively low preference for education.

This paper builds on two strands of the literature. On the one hand, Alesina and Spolaore (1997), Bolton and Roland (1997), Borck (1998), and others have analysed the political economy of centralising public good provision. The basic result here, as alluded to before, is that centralisation may generate positive efficiency effects, yet lead to policies which are "far away" from parts of the local electorate. There is also a growing literature on centralised versus decentralised school finance. For instance, Bearse *et al.* (2001), Nechyba (2003a,b) and Fernandez and Rogerson (2003), study different versions of education policies, which include local and central school finance. They focus on private school attendance, income segregation and equity and efficiency aspects of different regimes. Fernandez and Rogerson (2003) study voting over different finance regimes in a model with perfect sorting and a purely public school system. The present paper, on the other hand, builds on Bearse *et al.* (2001) who analyse central versus local school finance with private alternatives. While they focus mainly on the effects on spending levels and inequality, the present paper explicitly analyses voters' choice between regimes.

The paper proceeds as follows. The next section presents the model setup, starting

with a description of the centralised equilibrium. Section 3 lays out the decentralised equilibrium, while the voting choice between the two regimes is analysed in section 4. Section 5 presents some results from numerical simulations. In section 6, I extend the model to incorporate peer group effects. Finally, the last section concludes.

2 The model

Consider an economy populated by a continuum of individuals who differ solely by income. A family will be identified by its income level y which is distributed according to the cumulative distribution function $F(y)$. Population size is normalised to one, so average income equals aggregate income, $\bar{y} = \int_0^\infty y dF(y)$.

Families have preferences over current consumption c and and their children's future income, which for simplicity is taken to equal education spending, e. There is no discounting. Preferences will be assumed to be of the CES type:

$$u = \frac{1}{1-\sigma}(c^{1-\sigma} + \delta e^{1-\sigma}), \delta > 0, \tag{1}$$

where $1/\sigma$ is the elasticity of substitution between consumption and education. I will assume throughout this paper that $\sigma > 1$ so the elasticity of substitution is less than one. An important implication is that the price elasticity of demand for education is smaller than the unitary income elasticity in absolute terms.

The reason for focussing on this case is twofold. First, it follows the case examined by, e.g., Epple and Romano (1996), Bearse *et al.* (2001), and Fernandez and Rogerson (2003).[1] Second and somewhat surprisingly, a decentralised equilibrium may not exist when $\sigma < 1$ with the same parameters as used for the unitary equilibrium by Epple and Romano (1996)(see the Appendix for a demonstration).

Education is provided publicly, but individuals have the choice of opting out of public

[1] Using numerical simulations and regressions, Fernandez and Rogerson (1999) find a value of σ between 1.05 and 1.25, while Cohen-Zada and Justman (2003) argue that the evidence is most consistent with σ of about 0.6.

education and obtaining private education at market prices instead. Public education is financed by a proportional income tax at rate t on all incomes, while the price of private education is normalised to one. Note that individuals who obtain private education must finance public education nonetheless.

The utility level of an individual with income y who obtains public education E is:

$$V^S(t, y, E) = \frac{1}{1-\sigma}\left(((1-t)y)^{1-\sigma} + \delta E^{1-\sigma}\right). \tag{2}$$

If instead, this individual purchases private education, she maximises (1) subject to the private budget constraint $c = (1-t)y - e$, which gives the optimal amount of private education $e(t, y) = \delta^{1/\sigma}(1-t)y/(1+\delta^{1/\sigma})$ and indirect utility level

$$V^P(t, y) = \frac{1}{1-\sigma}(1+\delta^{1/\sigma})^{\sigma}((1-t)y)^{1-\sigma}. \tag{3}$$

The individual will choose private education if and only if $V^P > V^S$, and her indirect utility will be $V(t, y, E) = \max\{V^S(\cdot), V^P(\cdot)\}$. Let $\tilde{y}(t, E)$ be the income of the voter who is just indifferent between public and private school attendance. Then, all families with income $y > (<)\tilde{y}$ send their children to private (public) school (see Epple and Romano, 1996). The fraction of the population attending public school is then given by $N = F(\tilde{y}(t, E)$.

Let us now look at the centralised voting problem. An individual will maximise utility subject to the government budget constraint:

$$NE = t\bar{y}. \tag{4}$$

As shown by Epple and Romano (1996), an equilibrium may not exist since preferences satisfy neither single-peakedness nor single crossing.[2] To see why single crossing fails, consider figure 1. The figure shows indifference curves V', V'' in (t, E) space for two voters with incomes y', y'' where $y'' > y'$. Differentiating (2) and (3), the slope of such an indifference curve is given by

$$\left.\frac{dt}{dE}\right|_{\bar{V}(\cdot)} = \begin{cases} \infty & \text{if} \quad E < \hat{E}(t, y) \\ \frac{((1-t)y)^{\sigma}}{(1-\sigma)yE^{\sigma}} & \text{if} \quad E > \hat{E}(t, y) \end{cases}, \tag{5}$$

[2]Failure of single peakedness in this problem was already noted by Stiglitz (1974).

where $\hat{E}(t,y)$ is implicitly defined by $V^S(t,y,\hat{E}(t,y)) = V^P(t,y)$. It is easily established that $\hat{E}(\cdot)$ is downward sloping and increasing in y (Epple and Romano, 1996). In the range where an individual uses public schools, the slope of the indifference curve is increasing in y since $\sigma > 1$. This is due to the fact that the unitary income elasticity of education demand exceeds its price elasticity. Together, these facts imply that indifference curves have the shape shown in Figure 1. Since the indifference curves cross twice, single crossing fails and an equilibrium cannot be shown to exist in general.[3]

An equilibrium, if it exists, must satisfy the necessary condition (Epple and Romano, 1996):

$$F(\tilde{y}(t(y_d))) - F(y_d) = \frac{1}{2}, \tag{6}$$

where y_d is the income of the decisive voter, and $\tilde{y}(\cdot)$ is the voter who, given the optimal tax rate $t(y_d)$ chosen by the decisive voter, is just indifferent between public and private education. The intuition is that all voters with income above $\tilde{y}$ choose private education and hence vote for zero taxes; all voters with income below y_d prefer a lower tax rate and all those with income $y \in (y_d, \tilde{y})$ prefer a higher tax rate than $t(y_d)$. Hence, there is no majority for a marginal increase or decrease of spending.

There is, however, the additional problem that condition (6) is necessary but not sufficient for a voting equilibrium: due to the failure of single crossing, other tax rates/public education packages may win a majority of votes against this candidate. Hence, in the numerical simulations, I check by hand whether the equilibrium candidate found by solving (6) wins against a dense grid of alternative tax rates. As Epple and Romano (1996), I find that this is always the case in the example.

As a look ahead, consider the equilibrium tax rate under centralisation. If it is positive, it must satisfy the condition that the slope of the decisive voter's indifference curve equals

[3]See Gans and Smart (1996) for a general exposition of the single crossing property and its use in majority voting models. An equilibrium does exist if one assumes that individuals choose between public and private schools prior to voting on public provision. In this case, standard conditions imply single peaked preferences (Nechyba, 1999).

the slope of the budget constraint, which, from (4), is given by

$$\left.\frac{dt}{dE}\right|_{GBC} = \frac{N}{\bar{y}}\frac{1+\varepsilon_{N,E}}{1-\varepsilon_{N,t}}, \tag{7}$$

where $\varepsilon_{N,E}$ and $\varepsilon_{N,t}$ are the elasticities of the fraction of public school attendees with respect to public school spending and the income tax. Since both of these are positive, the slope of the GBC exceeds what it would be if public school attendance were fixed. Since the price elasticity of demand for education is lower than one, the decisive voter's optimal tax rate is decreasing in $\bar{y}$ and increasing in N, while the opposite holds for public spending on education. Moreover, for given N and $\bar{y}$ the optimal tax rate and spending are decreasing in the elasticities $\varepsilon_{N,E}$ and $\varepsilon_{N,t}$. The same reasoning will hold in the decentralised equilibrium, since once individuals have chosen their place of residence, population is fixed and the voting game has the same structure as under central finance.

3 Decentralised equilibrium

Consider now the model with two communities, each providing its own bundle of tax rates and public education to its residents. Individuals are completely mobile and obtain education at their place of residence. I assume the following sequence of events: First, individuals choose their place of residence; second, within communities, tax rates and public education levels are chosen by majority vote; and third, in each community, voters choose between public and private schools and, if in private school how much schooling to consume.

The voting game within communities has exactly the same structure as in the centralised case (since population is given at this stage). Consider now the residence choice by individuals. Without loss of generality, suppose that $t_1 < t_2$. For community 2 to be populated, it must be true that $E_2 > E_1$, otherwise no one would want to live there. Therefore, suppose that we have an equilibrium where $t_1 < t_2, E_1 < E_2$. Note that individuals cannot live in community 2 and go to private school since by moving to community 1 and choosing private school they would pay lower taxes and hence be better off. A residential

equilibrium, if it exists, must have the following properties (Bearse *et al.*, 2001):[4]

Proposition 1 *All individuals with $y' < y < y''$ live in community 2 and send their children to public school; all individuals with $y < y'$ live in community 1 and choose public school while all individuals with $y > y''$ live in community 1 and choose private school, where*

$$y' = \frac{\delta(E_1^{1-\sigma} - E_2^{1-\sigma})}{(1-t_2)^{1-\sigma} - (1-t_1)^{1-\sigma}} \tag{8}$$

$$y'' = \frac{\delta E_2^{1-\sigma}}{(1+\delta^{1/\sigma})^{\sigma}(1-t_2)^{1-\sigma} - (1-t_1)^{1-\sigma}}. \tag{9}$$

The equilibrium is depicted graphically in Figure 1. The figure shows indifference curves of the two individuals who are just indifferent between community 1 and 2, denoted C_1 and C_2. Individual y' is just indifferent between choosing public school in community 1 or 2; her indifference curve is labelled V'. Then, all individuals with $y' < y < y''$ have steeper indifference curves and therefore prefer to live in community 2 and choose public school, while all individuals with income $y < y'$ have flatter indifference curves and live in community 1 and choose public school there. Individual y'' with indifference curve V'' is indifferent between choosing public school in community 1 and living in community 1 and choosing private school; therefore, since $\hat{E}(t, y)$ is increasing in y, all families with higher incomes live in community 1 and also choose private school.

In the computational model, I will use the following procedure to find an equilibrium (see also Bearse *et al.*, 2001): (i) select income levels y', y'' and then assign each jurisdiction the population corresponding to the income intervals as described in Proposition 1, (ii) given this, solve for the voting equilibrium within each jurisdiction as described in the previous section, then check whether the population actually sorts into jurisdictions as prescribed in step (i); if not, repeat until an equilibrium is found.

[4]There is also the possibility of an equilibrium with zero taxes and spending in one community. Moreover, if both communities have the same taxes and spending, this is always an equilibrium since no individual would want to move.

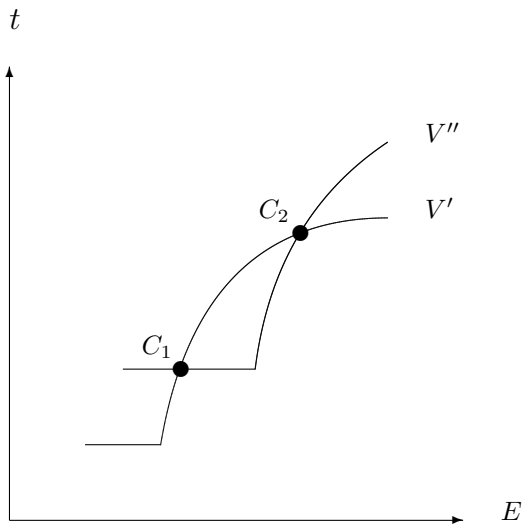

Figure 1: Decentralised equilibrium

4 Voting on centralisation

Consider now the choice between central and local education finance. Denote a voter's indirect utility under centralisation by V^C and the indirect utility in the decentralised equilibrium by V^D. A voter will vote for centralised finance if and only if $V^C > V^D$.

Who will benefit from centralisation? The conventional wisdom on the political economy of centralisation is that it benefits the middle class at the expense of rich and poor voters (Bolton and Roland, 1997; Borck, 1998). The reason is that in models without private alternatives to local public goods, local policies lead to segregated equilibria: in a two community model, all the rich live in one community and all the poor in the other. Therefore, centralisation moves policy closer to voters in the middle of the distribution and farther from those at the edges. Here, however, things are more complicated. In fact, even the richest voters may benefit from centralisation.

In the numerical simulations, a typical result is that public education spending is similar in the centralised equilibrium and in community 1 in the decentralised equilibrium, with the centralised tax rate being slightly lower. A typical result is also that community 2 has higher taxes and education spending in the decentralised equilibrium than in the

centralised equilibrium. To grasp the intuition for these results, it is instructive to consider the equilibrium values shown in the example in Table 1. In community 2, there is no private school attendance in equilibrium, and, therefore, the decisive voter has relatively high income. Equilibrium taxes and public school spending in community 2 therefore exceed the corresponding values in the centralised equilibrium. To compare the decentralised equilibrium in community 1 with the centralised equilibrium, note that community 1 has a lower income of the decisive voter, which works towards a low tax rate. So does the low percentage of public school attendance. On the other hand, lower average income works towards a higher tax rate than under centralization. And finally, the elasticities $\varepsilon_{N,E}, \varepsilon_{N,t}$ are positive in the centralised equilibrium while they are zero in the local equilibria. This follows from the fact that in the decentralised equilibrium, no individual is indifferent between public and private school *in the own community*. Therefore, public school attendance is not affected by a marginal increase in the tax rate, for fixed population. This implies a more favourable trade-off between taxes and spending. Taken together, the equilibrium in community 1 is characterised by a higher tax rate and somewhat lower spending than the centralised equilibrium.

Hence, all rich voters in community 1 prefer centralisation, since they use private schools anyway. All poor residents in community 1 likewise prefer centralisation, since they have a preference for relatively low taxes and education spending is similar in the two regimes. On the other hand, there are some voters in community 2 who prefer centralisation (namely, those voters who are relatively rich and choose private school under centralisation and those who are relatively poor and choose public school under both regimes), while the voters in the middle of the distribution prefer decentralisation. These are voters with a relatively high preference for education who, however, mostly do not opt for private schooling.

This result illustrates a further interesting property of publicly provided goods with private alternatives. In particular, it may well be that rich and poor voters benefit from centralised school finance. In the next section I will use numerical simulations to demonstrate the possible empirical content of this result.

Table 1: Simulation results

	t_i	E_i	% Public	$\bar{y}_i$	y_i^d	$\tilde{y}_i$	% Central
$\delta = 0.0204, \sigma = 1.54, \mu = 3.36, v = 0.68$							
Nation	0.051	2.100	88.04	36.278	23.404	64.084	**56.39**
Community 1	0.052	2.071	80.92	32.106	13.736	NA	**100.00**
Community 2	0.072	2.858	100.00	39.652	36.620	NA	**21.12**
$\sigma = 1.34, v = 0.68$							
Nation	0.039	1.548	90.93	36.278	24.631	71.429	**51.92**
Community 1	0.040	1.551	81.58	31.776	13.016	NA	**100.00**
Community 2	0.051	1.984	100.00	39.094	35.533	NA	**21.83**
$\sigma = 1.54, v = 0.75$							
Nation	0.049	2.158	86.44	38.140	22.197	65.710	**59.55**
Community 1	0.051	2.152	80.83	34.302	13.472	NA	**100.00**
Community 2	0.072	3.033	100.00	42.053	38.879	NA	**18.30**

5 Simulation

5.1 Baseline results

In this section, I simulate the model numerically. Following Epple and Romano (1996), I use the following parameters for the utility function: $\delta = 0.0204, \sigma = 1.54$. Income is measured in 1,000s and the distribution is assumed to be lognormal: $\ln y \sim N(\mu, v)$. For the benchmark case, $\mu = 3.36$ and $v = 0.68$ which gives mean income $\bar{y} = 36,278$ and median $28,789$. The parameters were chosen by Epple and Romano (1996) to yield key outcomes which closely match those observed in the US – in particular, public education spending and private school attendance.[5]

The simulation results are displayed in the upper part of Table 1. In the decentralised

[5]As an aside, this result of the calibration exercise assumes central school finance. Indeed, under local finance, equilibrium values will differ from those actually observed.

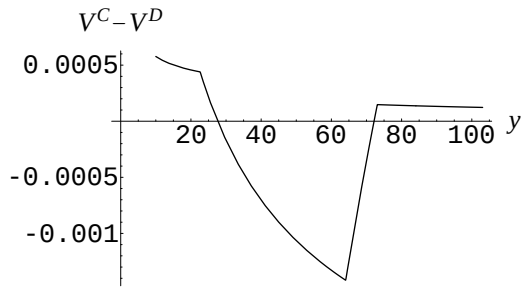

Figure 2: Preferences for centralised education

equilibrium, 55% of the population live in community 2 and send their children to public school. In community 1, 19% of all families choose private schools. This is higher than the 12% choosing private schools under centralisation (though in absolute terms, of course, more people use private school under centralisation). The decentralised equilibrium yields better public education and higher taxes than the centralised equilibrium for community 2, while community 1 residents realise higher taxes and lower public education expenditures than under the centralised equilibrium.

Obviously everyone in community 1 prefers centralisation. In community 2, voters get better education in the decentralised equilibrium but at a much higher tax rate. Consequently, some voters are better off under centralisation (the relatively rich and poor) but most (79 %) prefer the decentralised equilibrium.

Figure 2 shows the preferences for centralised against decentralised education. This nicely illustrates the previous section's finding. In particular, centralisation benefits the rich and poor against the middle class. This is, of course, due to the failure of single crossing.

5.2 Sensitivity analysis

The model generates political support for centralised education policies as a function of its parameters, in particular, the elasticity of substitution, $1/\sigma$, the preference parameter δ

and the moments of the income distribution, μ and v. It is therefore of interest to analyse how changing those parameters affects the support for centralisation.

This section presents experiments on the variation of σ and v. The latter is directly related to a change in the skewness of the distribution: increasing v will make the distribution less equal by decreasing the relation between median and mean income. The results are in the second and third part of Table 1.

Lowering σ decreases individuals' optimal tax rates, other things equal. This can be seen in the first column of Table 1. Although tax rates are lower, the lower σ works to favour public education so that, in equilibrium, private school attendance is lower than with $\sigma = 1.54$. Unlike in the previous example, local public education spending in community 1 is now higher than central spending. However, this difference is not large enough to induce any community 1 voter to prefer centralisation. The percentage vote share for centralisation in community 2 increases somewhat, but, since a larger fraction of the population now live in community 2, the overall vote share for centralisation actually falls.

Increasing v increases inequality: while median income stays the same, the increased variance increases mean income. Other things equal, this would decrease individually optimal tax rates (since $\sigma > 1$) and increase the individually optimal level of public education. The combined effect is to increase private school attendance under centralisation. Public spending rises both under central and local finance, and rises most in community 2 under local finance. As a result, community 2 voters are now less favourable to centralisation. But since community 2 is smaller than with $v = 0.68$, the percentage of votes for centralisation in the entire voting population rises.

6 Peer group effects

An important feature of education is the existence of peer group effects. Indeed, there is strong evidence that the quality of education depends not only on resources spent but also on the abilities of fellow students, or peers. Therefore, I now introduce peer group externalities in a simple way. In particular, I assume that average peer quality in a school

type is given by the average income of the school's families.[6] At first sight one might expect that this reinforces the results. In particular, suppose for the sake of the argument that the partition of individuals into communities and private and public schools as well as taxes and spending were to remain unaffected. Then, individuals in the public school in community 1 would gain from the improved peer quality if they were to share public schooling with the richer individuals using public schools in community 2. These, however, would lose even more from centralisation since their average peer quality would drop. But the general equilibrium effects are more complicated since one has to account for differences in spending, private school attendance and community composition. As it turns out, the general equilibrium effects imply somewhat different results.

Educational quality is now assumed to be a multiplicative function of per capita spending and peer quality. Hence, education in public and private schools under central provision are given by (the expressions for local finance are analogous):

$$e^P = e\bar{y}_P^{\theta}; \quad \bar{y}_P \equiv \int_{\tilde{y}}^{\infty} y dF(y)/F(\tilde{y}) \tag{10}$$

$$E^S = E\bar{y}_S^{\theta}; \quad \bar{y}_S \equiv \int_{0}^{\tilde{y}} y dF(y)/(1-F(\tilde{y})), \tag{11}$$

where $\theta \geq 0$ is a parameter measuring the productivity effect of peer quality, and $\tilde{y}$, the income of the individual who is indifferent between public and private school, is implicitly defined by:

$$\tilde{y} = \frac{a\delta^{\frac{1}{1-\sigma}} E^S}{(1-t)(a-b^{1-\sigma})^{\frac{1}{1-\sigma}}}, \; a \equiv \delta^{-\frac{1}{\sigma}} \bar{y}_p^{-\frac{(1-\sigma)\theta}{\sigma}}, \; b \equiv a^{1-\sigma} + \delta \bar{y}_p^{(1-\sigma)\theta}. \tag{12}$$

Note that the assumption here is that in private school, all individuals benefit from the same level of peer quality, but they obtain different levels of education. That is, richer individuals obtain the same peer quality for each hour of education although they purchase

[6]There are several reasons for this assumption (see,e.g, Nechyba, 2003a): first and foremost, parental income and child ability are correlated; second, higher income parents may monitor schools more closely; and third, high income parents may contribute privately to public school budgets. According to the empirical estimates of Solon (1992) and Zimmerman (1992), the correlation between fathers' and sons' income is approximately 0.4.

Table 2: Simulation with peer effects

	t_i	E_i	% Public	$\bar{y}_i^S$	$\bar{y}_i^P$	% Central
			$\theta = 0.0$			
Nation	0.051	2.100	88.04	NA	NA	**56.39**
Community 1	0.052	2.071	80.92	NA	NA	**100.00**
Community 2	0.072	2.858	100.00	NA	NA	**21.12**
			$\theta = 0.1$			
Nation	0.045	1.898	85.76	27.563	88.761	**60.92**
Community 1	0.046	1.988	77.94	15.457	97.191	**100.00**
Community 2	0.064	2.501	100.00	38.911	NA	**23.98**
			$\theta = 0.2$			
Nation	0.040	1.720	83.39	26.711	84.315	**65.90**
Community 1	0.041	1.891	75.03	15.791	91.120	**100.00**
Community 2	0.057	2.184	100.00	38.136	NA	**28.03**

Note: Other parameters are: $\delta = 0.0204, \sigma = 1.54, \mu = 3.36, v = 0.68$.

more hours. In essence, I neglect the possibility that peer quality per hour might depend on exactly how many hours of education different individuals obtain. For instance, one might think of a positive learning environment created by the peer group of a school, which is the same for all pupils regardless of how many hours together with which other pupils they go to school.

All the general results of the previous analysis still go through; what does change is the quantitative effect of central versus local finance, since there is now an additional impact on educational qualities via peer effects.

The simulation results with peer effects are displayed in table 2. The first part reproduces the benchmark simulation, which corresponds to the case $\theta = 0.0$. The table shows that the overall percentage of voters in favour of centralisation increases as peer effects become more important. Thus, with strong peer group effects, central school finance is

more likely to be politically feasible. Moreover, the percentage of voters who favour centralisation in community 2 rises as well, despite the fact that peer quality for these voters is lower when under centralisation they share public schools with the poor community 1 individuals. At least part of the answer for this result seems to lie in the fact that private school attendance rises with the importance of peer effects. This is natural since it is the richer individuals who use private school, and, hence, the attractiveness of private schools rises with the importance of peer effects. Therefore, the share of community 2 individuals who use private school under centralisation rises as well. These individuals then prefer the central allocation with relatively low taxes, where they take advantage of the higher peer quality in private schools.

7 Conclusion

The present paper has examined the political economics of central versus local school finance. The main message is that when one considers private schools as alternatives to public schools, some unexpected results may emerge. In particular, I have used numerical simulations (with parameters calibrated to yield results which match key US outcomes) to show that it may be the rich and poor who are most likely to benefit from centralised financing. The poor because they may obtain better education at low taxes, the rich because they prefer lower taxes since they use private schools anyway.

In a model with income-related peer group effects, political support for central school finance rises with the importance of these peer effects in the numerical simulations. Some poor individuals gain because there is less segregation in public schools under central finance. Some relatively rich individuals who use public school under local finance also gain because they use private schools with higher peer quality under central finance.

The paper has analysed one particular form of education finance, namely pure local versus pure central finance. An interesting extension would be to study alternative finance systems such as the power equalising schemes analysed by Fernandez and Rogerson (2003). Another interesting extension would be to allow for a dynamic evolution of incomes, since

then segregation may lead to self reinforcing inequality, and studying the effects of different finance regimes would lead to interesting effects (see Bearse *et al.*, 2001).

Appendix

A Nonexistence of equilibrium with $\sigma < 1$

In this section, I briefly explain the problem of non-existence of equilibrium when $\sigma < 1$. Recall that in this case optimal tax rates are non-increasing in income. Therefore, if, say, $t_1 < t_1, E_1 < E_2$, there will be an individual $\tilde{y}$ such that all $y > \tilde{y}$ live in community 1 and all $y < \tilde{y}$ live in community 2: Furthermore, the median income earner is decisive within each community (Epple and Romano, 1996). Howver, with the parameters used in the baseline example for the income distribution, it can be shown that no equilibrium of such a type can be found.

To see why, note first that given that preferences with $\sigma < 1$ satisfy the single crossing property, for a given partition of the population into communities, within each community the median income earner is decisive. Suppose then that as in section 5, we have the following parameters: $\mu = 3.36, v = 0.68$; additionally, as in Epple and Romano (1996), let $\delta = 0.1111$ and $\sigma = 0.79$. Take an equilibrium candidate partition, say, $\tilde{y} = 34.000$. The median incomes are given by $y_1^m = 50.817, y_2^m = 20.089$, and the means by $\bar{y}_1 = 60.109, \bar{y}_2 = 20.166$. As can be seen, the distribution in the rich community 1 is much more skewed than in the poor community 2. As a consequence, the median voter in community 1 has a higher preference for public education than the median in community 2. Hence, we find that with this partition, the preferred tax rates of the median income earners satisfy $t(y_1^m(\tilde{y}), \bar{y}_1(\tilde{y})) > t(y_2^m(\tilde{y}), \bar{y}_1(\tilde{y}))$, which violates the necessary condition for existence of an equilibrium. Proceeding likewise over a dense grid of possible partitions, it can be shown that an equilibrium does not exist.

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