School Finance, Spatial Segregation and the Nature of Communities: Lessons for Developing Countries?

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SCHOOL FINANCE, SPATIAL SEGREGATION AND THE NATURE OF COMMUNITIES: Lessons for Developing Countries?

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Abstract

While the issue of school finance has been studied extensively, relatively little effort has been devoted to understanding how school finance policies impact the nature of communities. This is peculiar in light of substantial evidence that public school quality – at least in the U.S. – has much to do with residential choices by households, and in light of increasing empirical evidence that residential segregation perpetuates income inequality. In a development context where rapid urbanization is only now taking place and cities are still taking shape, these U.S. findings might have important policy implications. Whatever housing patterns emerge during the development of urbanized communities are likely to retain their character for long periods of time. School finance policies during the process of development may therefore have even larger impacts on these communities than they do in developed settings. In this paper, I emphasize in particular the importance of considering not only the level of government that is funding public schools but also the role played by the private sector. Somewhat surprisingly, simulation results based on U.S. data suggest that, in terms of producing spatial income segregation, the role of centralization versus decentralization of public school financing is quite secondary to the role played by the private sector. Motivated by this insight, additional simulations involving explicit government support for private schools in the form of vouchers are reported. Finally, while it should be kept in mind that the simulations are based on U.S. data, I discuss implications of these results in a development context.

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1. Introduction

This paper attempts to anticipate the consequences of different school finance regimes on the development and evolution of neighborhoods and communities. Although it does not do so within a strictly "development context," it attempts to ascertain long run lessons for developing countries from a study of the consequences of school finance systems in a developed country. In the process, the following thesis is advanced: as populations urbanize and become more mobile, school considerations play an important role in determining such important aspects of an economy as neighborhood segregation, inequities in education spending and future social mobility as well as the political potential for education reforms in the future. If this thesis is correct, then the debates regarding school finance regimes in developing countries are currently missing an important element that could, in the long run, outweigh other considerations.

This paper's focus will be on one aspect of this thesis – how education finance policies may impact the spatial segregation of households by income. The issue is important as social science researchers are increasingly focusing on the impact of neighborhood effects on long run prospects for children. While some of the literature on neighborhood effects is still in its early stages and while the empirical problems in identifying such effects are still unresolved, there is widespread belief that such effects exist and are important contributors to long run inequality. In addition, research based on controlled experiments (which does not face the same empirical identification issues as more traditional social science research) increasingly supports this belief.[2] If this is indeed the case, then the impact of education finance policy on spatial segregation may be every bit as important for student outcomes as those factors within schools

[2] See Nechyba, McEwan and Older-Aguilar (1999) for a recent summary of the social science research on neighborhood effects.

that are studied more commonly. This paper attempts to demonstrate that education policy may indeed have such impacts.

1.1. The Central Issues in the School Finance Debate

Debates regarding education finance in developed countries tend to surround three general issues: first, the total level of public spending that is appropriate in different setting; second, the degree of centralization and equalization of spending that is called for; and third, the role parental choice ought to play in the system. The first of these issues generally involves discussions of the "publicness" of public education and the nature of the externalities surrounding it. This branch of the literature thus deals largely with questions of efficiency. Although efficiency considerations continue to play a role in the second strand of the literature (relating to centralization),[3] both researchers and policy makers in this tradition are generally more focused on issues of equity and school resource equalization (rather than the internalizing of externalities).[4] Finally, the debate on school choice still rests on many assumptions that have not been much tested, and the analysis typically involves both efficiency and equity considerations.[5]

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[3] In particular, the potential existence of interjurisdictional spillovers introduces an efficiency dimension into an otherwise largely equity focused debate. Fernandez and Rogerson (1998) also point out that, in a dynamic general equilibrium model, more complex intergenerational efficiency issues emerge. And MaCurdy and Nechyba (forthcoming) suggest that mobility of future tax payers may inhibit local governments from providing efficient levels of education because they cannot capture future rents generated by this education – another form of an interjurisdictional spillover.

[4] This is particularly true since the *Serrano vs. Priest* court decision in California, a decision that claimed that California's constitution required equal per pupil spending across all schools in California. Similar, though less severe, rulings have since happened in a number of other states thus focusing policy makers on issues related to equity. (See, for example, Murray, Evans and Schwab (1998) and references therein).

[5] Recent theoretical contributions to this literature include Epple and Romano (1998) and Nechyba (2000), while empirical analysis of various hypotheses include those of Hoxby (1994), Neal (1997), Figlio and Stone (1997), Rouse (1998), and McMillan (1999).

In the development context, however, much of the literature has focused almost exclusively on the first issue involving the appropriate size of the public investment in human capital formation. It is well established, for instance, that rates of return to education in developing countries are relatively high implying that the total quantity of education produced is too low (Psacharopoulos, 1988; Schultz, 1988; Strauss and Thomas, 1995). This literature is rich with both empirical and theoretical work, and I will have little to add to it here. Instead, my concern in this paper revolves around the likely long run impact of different systems of rationing scarce public funds for education, whatever they might be.[6] Put differently, my focus here will be on the impact of the method by which public funds are spent and not on the aggregate amount of education spending.

While data limitations lead me to calibrate preference and technology parameters in my model to U.S. data, I will argue that the resulting simulations still have relevance in a development setting. If, for instance, it can be demonstrated that different systems of school finance result in different levels of income segregation *in a fully developed economy*,[7] then it is even more likely that the same forces will be important in the development of housing markets and neighborhoods. More precisely, suppose that decentralized local spending on education in an urban economy with a mature existing housing stock leads to disparities in spending as high income households choose the "nicer" communities, as capitalization of good schools into house values erects implicit price barriers to lower income households and as more explicit means of

[6] To be more precise, I will typically assume in the analysis below that the total level of public spending is set by majority rule in a system where voters understand the rules of the game.

[7] For a recent empirical investigation of the Tiebout forces leading to such segregation, see Urquiola (2000) and references therein.

keeping out the poor (such as exclusionary zoning laws) are implemented in higher income communities. If anything, these forces will be larger in a context where housing markets are not yet mature, where high income households have an easier time molding the housing within their communities to their desires, and where zoning laws are not yet fully determined.

1.2. Plan for the Paper

Section 2 briefly motivates the basic features required of a model that is designed to shed light on the relationship between spatial income segregation and public financing of education. These features are incorporated into the model outlined in Section 3 where the model is also operationalized through the selection of specific functional forms and parameters. Section 4 begins policy simulations by comparing the degree of income segregation that arises endogenously under centralized versus decentralized public school financing. Furthermore, the role of an independent private school sector is explored, as is the way in which private school attendance differs between a centralized and a decentralized system of public school funding. Motivated by some of the more surprising results from this exercise, Section 5 explores the potential for public support of private schools through vouchers to impact spatial income segregation. Section 6 briefly comments on the difference between school segregation and residential segregation and demonstrates that the previous results are robust to alternative models of school quality. Finally, Section 7 explores implications of these results for developing economies, and Section 8 concludes.

2. What is Required in a Model?

Before laying out a model to analyze the core question posed in this paper, it is worthwhile to pause and ask precisely what features a model would have to have in order to serve as an effective tool for the proposed analysis. Given the important role of residential location and mobility in the exercise, one clearly must start with a model that contains a heterogeneous land/housing market, with some locations inherently more desirable (apart from school considerations) than others. Such heterogeneity in land is motivated not only by a desire to provide a realistic description of reality, but it also serves the useful role of guaranteeing that only a limited number of equilibria exist in the model even when schools are not a consideration.[8] Second, in order for a relationship between land/housing and school choices to emerge under certain types of school financing, the heterogeneous land properties must somehow be classified into different political jurisdictions. More precisely, it must be specified whether school finance decisions are made at the central level or more locally by regional or district governments; and it must be made clear how children gain access to particular schools (i.e. whether this is by living in a given jurisdiction or by some other rationing mechanism). Third, a meaningful analysis requires the model to incorporate different types of agents – where the important distinction between them for this paper's focus on inequality will be their levels of wealth. Fourth, an education production process must be formulated, a task made particularly challenging by the continuing disagreement in the literature regarding what matters in this process. And finally, the role or potential role to be played by private schools must be specified.

The challenge, then, is to construct a model with (1) heterogeneous land, (2) multiple

[8] With completely homogeneous land/housing, there is nothing in the model to tie down where, in the absence of other considerations, higher income and lower income agents are likely to settle. Thus, the multiplicity of equilibria in the model would make policy analysis difficult as "anything can happen" in regard to residential location.

jurisdictions describing how political choices regarding funding of public schools and admissions requirements are made, (3) households with different wealth endowments, (4) a specification of the education production process and (5) a description of the potential role for private schools. Section 3 describes such a model.

3. Model Set-up

The theoretical model on which this paper's simulations are based is essentially that presented in Nechyba (2000a,b), a model calibrated to data from the U.S. As mentioned in the introduction, the model was not explicitly formulated with an application to development economics in mind, but it generates results that might be of particular importance for policy purposes in that context. The model essentially builds a private school market into a well defined local public goods economy first explored in Nechyba (1997a), and policy implications from differing school finance systems are explored in that context. In other contexts (Nechyba 1999, 2000a,b), it has been most natural to interpret the model as one representing a fully developed urban economy in which the land market can equivalently be thought of as a housing market. Under this interpretation of the model, the housing stock is fully determined and not malleable – an assumption that seems artificial in a development context. As a result, this paper will continue to interpret the land market as just that – a market where some locations of plots of land are inherently more desirable than others.

The model takes as given the boundaries that divide a fixed set of land parcels into school districts and places no a priori restrictions on the mix of land and neighborhood qualities within and across these boundaries. While this allows the model to accommodate the empirically

important possibility of the coexistence of rich and poor "neighborhoods" within a single school district, it does not permit for a change in the inherent desirability of different plots of land as populations change nor does it permit political jurisdictions to change their boundaries. Furthermore, population in the model is held fixed, an obvious limitation when the model is applied to development where urban populations grow. In Section 8, I return to these issues.

Each household is endowed with a plot of land (which can be sold at the market price), a parental income level and an ability level for its one child. Parents take endowments as given and choose (i) where to live, (ii) whether to send their child to the local public or a private school, and (iii) how to vote in local or national elections (depending on the finance regime that is in place) determining the level of public school spending. Private schools hold an advantage over public schools in that they can set admissions requirements whereas public schools have to accept all students living within the district. A more formal exposition follows.

3.1. Community Structure and Households

A fixed school district and neighborhood structure

$$C = \{C_{dh} \mid C_{dh} \cap C_{d'h'} = \varnothing \ \forall\ (d,h),(d',h') \in D \times H \text{ s.t. } (d,h) \neq (d',h') \text{ and } \cup_{d \in D, h \in H} C_{dh} = N\}$$

is imposed on the set of land parcels which is represented by the unit interval N=[0,1].[9] This partitions land into a set of land/neighborhood types $H=\{1,...,h,...,H\}$ spread over a set of school districts $D=\{1,...,d,...,D\}$, where C_{dh} is the set of land plots of type h located in district d, or the set of land parcels in "neighborhood h" of community d.

[9] More precisely, the set of houses is defined as part of a measure space $(N,\mathbb{N},\mu)$ where μ is taken to be the Lebesgue measure. All subsets referred to are henceforth assumed to be measurable.

Households are endowed with income, a plot of land, a child with some exogenous ability level, and preferences over the consumption set. Both the income and the land endowment, however, can be viewed as private good endowment, except that the value of the land endowment is endogenous. More precisely, it is assumed that there is one and only one plot of land for each household in the model, and neither multiple residences nor homelessness are allowed. Thus, the unit interval N=[0,1] which represents the set of land plots also represents the set of households. Household n is initially endowed with land parcel n. Furthermore, a private good endowment function z:N$\rightarrow\mathbb{R}_+$ divides this set of households into a finite set of "income types."[10] Finally, each household n$\in$N has one child, and ability levels for that child are assigned via a function a:N$\rightarrow\mathbb{R}_+$ (which may or may not be correlated with household income.)

Each household is assumed to act as one utility maximizing agent with utility function u^n:$D\times H\times\mathbb{R}_+^2\rightarrow\mathbb{R}_+$ that takes as its arguments the district and neighborhood the agent lives in, his private good consumption c$\in\mathbb{R}_+$, and the perceived school quality level s$\in\mathbb{R}_+$ enjoyed by the household's child. In principle, few restrictions on utility functions are necessary for the existence of an equilibrium, inter-jurisdictional spillovers could be added, and preferences may vary across household types (Nechyba, 1997a). The model does not, however, incorporate the choice of whether or not to send a child to school.[11] Instead, parents who value schooling less have only the option of choosing a lower quality school which is cheaper.

[10] The assumption of finiteness of the number of income types is made for technical reasons related to the existence of an equilibrium. These issues are discussed in detail in Nechyba (1997a).

[11] In other words, the model assumes that education is compulsory, which then implies that the child's foregone labor income is a sunk cost and not an opportunity cost of going to school.

3.2. Public and Private School Markets

Both public and private schools face the same technology. They combine per pupil spending with average peer quality to produce the output s that enters the utility functions of the households. A child's peer quality $q^n:\mathbb{R}_+^2 \rightarrow \mathbb{R}_+$ is jointly determined by his parents' income level and his own ability,[12] and the school quality is given by a production function $f:\mathbb{R}_+^{k+1} \rightarrow \mathbb{R}_+$ that takes as its arguments per pupil spending as well as k moments of the distribution of household peer quality of the school population. In practice, the model that will be used in most of the simulations restricts itself to one moment of this distribution – the average peer quality. However, additional simulations in which the variance enters are presented in Section 6.

Before defining an equilibrium formally, the public choice process that determines x_d – the per pupil public school spending in district d – must be specified. Let $\eta \subseteq N$ be the subset of households that choose to send their children to public school. Then per pupil spending in district d under a system with at least some property tax revenue is

$$x_d = (t_d P(C_d) + AID_d) / \mu(\eta \cap J_d),$$

where t_d is the local property tax rate in district d,[13] AID_d is the total central government aid exogenously received by district d, and $P(C_d) = \Sigma_{h \in H} \mu(C_{dh})\, p(C_{dh})$ is the local property tax base. This base varies with the endogenously determined land price function $p:D \times H \rightarrow \mathbb{R}_+$ that gives rise to an equilibrium land price vector $p \in \mathbb{R}_+^{DH}$ and thus assigns a unique price to each land type in each district. The formula underlying AID_d may in principle contain a variety of matching and

[12] More precisely, a child is assumed to impact his peers in two ways: first, through his parents' income level and second through his own ability. The former of these captures the fact that parental involvement and monitoring of schools increases in household income (see McMillan, 1999)), while the latter captures spillovers within the classroom.

[13] Nechyba (1997b) shows that the use of property taxes is the dominant local tax strategy in this model.

block grant features which are taken into account by voters as they vote on local tax rates. In this paper, however, it is only used in the calibration of the model – all simulations consider only the extremes of local or central government financing.

While voters do take into account central government aid, they are otherwise assumed to be quite *myopic* - i.e. they take community composition and property values as given when going to the polls. Such voter myopia is technically convenient and thus relatively standard in the literature (Epple, Filimon and Romer, 1993), Rose-Ackerman, 1979). Furthermore, although the model assumes that voting takes place at the local government level over property tax rates (holding constant the exogenous state aid formula) whenever local funding is supplemented by some state/national formula, I assume that voting takes place at the national level over income tax rates t_s under a centrally funded system. In that case, per pupil spending in all districts is assumed to have been equalized – i.e.

$$x_d = x = (t_s z(N))/\mu(\eta \cap J_d), \forall\ d \in D.$$

In the absence of private schools, a voting equilibrium for a given partition of the population is then obtained relatively easily as myopic preferences over local tax rates are single peaked (Nechyba, 1997a). With private schools, however, preferences lose the single-peakedness property (Stiglitz, 1974) unless an additional myopia assumption -- that agents make the choice over private versus public education prior to voting -- is made (Nechyba, 1999).[14] In addition, the possibility of private schools requires voters to know what types of private schools would be

[14] Thus, preferences over taxes for those voters who choose public schools remain single peaked as before, and preferences for voters who chose private schools are single peaked with peak at t=0 (in the absence of state aid) or t<0 (under state aid). As pointed out in Nechyba (1999), this leads to the existence of trivial equilibria in which there are no public schools (and, given everyone attends private schools, no public schools arise). In the simulations, however, these trivial equilibria are reported only if there does not exist an equilibrium with public schools.

available to them, and at what cost. This is accomplished by assuming the private school market to be perfectly competitive, with each school able to select from its applicant pool. Given the education production technology, no private school can then have multiple types,[15] which implies that all households know that the optimal private school its child could attend is one that spends the household's most preferred amount per pupil (which is equal to tuition) and whose student population is composed of the same peer type. An alternative conceptual approach is to model private schools as clubs of parents who can choose to exclude others and who commit to sharing the cost of the club equally. Either conception – the club model or the perfectly competitive model – yields the same equilibrium (Nechyba, 1999).

3.3. Equilibrium

Given some exogenous national aid formula, an equilibrium must specify a list $\{J,t,s,p,\eta\}$ that includes a partition of households into districts and neighborhoods J, a tax vector $\mathbf{t}\in\mathbb{R}_+^{D+1}$ with a state income tax rate t_0 and local property tax rates $(t_1,...,t_D)$, local public school qualities $\mathbf{s}\in\mathbb{R}_+^{D}$, land prices $\mathbf{p}\in\mathbb{R}_+^{DH}$ and a specification of the sub-set of the population that attends public rather than private schools $\eta\subseteq N$. For the case of a decentralized system with central government aid supplements, we can define such an equilibrium formally as follows:

[15] This is demonstrated in Nechyba (1999). If a private school did have a mix of different types of students, then it would contain students who either had different abilities or had parents with different wealth levels. If the heterogeneity is in the ability dimension, then a new private school could enter, charge the same tuition but restrict its population to only high types. If, on the other hand, the heterogeneity arises from different wealth levels, then at most one household is receiving its most preferred level of per pupil spending. But then there is, once again, room for a new entrant that can cater to the other household. As a result, since there are not set-up costs to schools, a competitive equilibrium is characterized with each household having the option of attending a private school with the same peer type charging the most preferred tuition level for that household. Note that this implicitly also assumes that within any given private school, tuition is the same for all students. Otherwise, price discrimination on the basis of peer quality can arise (assuming that schools can observe peer quality prior to admitting students) (Epple and Romano, 1998).

Definition: A *decentralized equilibrium* is a list $\{J,\mathbf{t},\mathbf{s},\mathbf{p},\eta\}$ such that

(1) $\mu(J_{dh})=\mu(C_{dh})\ \forall\ (d,h)\in D\times H$ (every land parcel is occupied);

(2) Property tax rates $(t_1,...,t_D)$ are consistent with majority voting by residents;

(3) $s_d = f(x_d,q_d)$ for all $d \in D$, where $x_d = (t_d P(C_d)+AID_d)/\mu(\eta\cap J_d)$ (local budgets balance) and $q_d = ((Z(\eta\cap J_d)),(A(\eta\cap J_d)))$;[16]

(4) $\sum AID_d = t_0 Z(N)$ (the state budget balances);

(5) At prices $\mathbf{p}$, households cannot gain utility by moving and/or changing schools (market clearing); and

(6) No private school can enter and make positive profits (perfect competition).

The theoretical properties of this equilibrium are explored in detail in Nechyba (1999) where it is demonstrated that, under relatively weak assumptions, such an equilibrium is guaranteed to exist. Furthermore, with sufficient variation in mean land quality across districts, the equilibrium assignment of agents across neighborhoods and communities is unique with the exception of "trivial equilibria" in which there are no public schools. *Centralized* equilibria supported by state income taxes are defined analogously.

3.4. Functional Forms and Calibration

Several functional forms have to be assigned in order to operationalize this theoretical model computationally. These include: utility functions u, peer quality functions q, an education production function f, a wealth endowment function z and an ability endowment function a.

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[16] $Z(J_d) = \int_{Jd} z(n)\ dn$ and $A(J_d) = \int_{Jd} a(n)\ dn$ are the average income and the average ability level (respectively) of the population assigned to district d.

Unless otherwise specified, the following are the functional forms for the first three of these:

$$u^n(d,h,s,c) = k_{dh}\, s^{\alpha} c^{\beta} \quad \forall\, n \in N;$$

$$q(n) = (z(n)^{\theta}\, a(n)^{(1-\theta)})/7.5^{17};$$

$$s = f(x,q) = x^{(1-\rho)} q^{\rho} \text{ where } 0 \leq \rho \leq 1.$$

Given the lack of detailed micro data from a development setting, the model here is calibrated to data from the U.S.[18]

The income endowment function $z: N \rightarrow \mathbb{R}_+$ creates 20 income types and replicates a discretized version of the actual household income distribution observed in the data. Incomes in the model therefore range from 1 (corresponding to $10,000) to 20 (corresponding to $200,000), and the measure of agents with different levels of income is given by the observed household income distribution in the data. Each of these 20 income types is initially spread uniformly across all neighborhoods (in all school districts) when land endowments are assigned. This causes the initial set of 20 income types to become 300 endowment types, where the distribution of the value of the combined income and land endowments now more smoothly replicates the observed income distribution. Given that this is a static model calibrated to annual data, the "value" of land is defined as the annualized flow of land/neighborhood services from that land.[19]

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[17] The function is divided by 7.5 in order to make peer quality similar in magnitude to per pupil spending. This is of no consequence other than that is eases the interpretation of the parameter ρ in the next equation.

[18] The data set is composed of data on suburban districts in New Jersey, is similar to that in Nechyba (2000a) and is described in detail in Nechyba (2000b).

[19] For calibration purposes, "land" in the data is defined as improved land -- i.e. the land itself and housing that exists on that land. Furthermore, it is important to note that, while some low income households are endowed with high quality land, this does not imply that these low income households actually *live* on that land in equilibrium. Rather, on the way to determining the equilibrium, households buy and sell land on the market at market prices. Thus, those low income types that are endowed with expensive land will not remain on that land. The land endowments therefore are just like income endowments except that their value is determined endogenously. In practice, the value of these endowments (i.e. the value of the annual flow of services from these endowments) falls between 0.3 and 3.5 and thus simply serves to

Finally, ability endowments take on 5 different possible discrete values which are set to range from 1 to 10.[20] Empirical estimates of the correlation of parental and child income of 0.4 (Solon (1992), Zimmerman (1992)) are used as a proxy for the correlation of parental income and child ability;[21] i.e. I assign the five ability levels in equal measure but distribute them in such a way as to make the correlation between parental income and child ability equal to 0.4. Given the 300 endowment types specified above, this addition of ability levels generates a total of 1,500 types.

The final step in defining a CGE version of the theoretical model is to specify the following: the number of districts D and the number of land types H; the land quality parameters k_{dh}; the Cobb-Douglas preference parameters α and β; the peer quality function parameter θ; and the production function parameter ρ. For tractability purposes, D is set to 3 – giving a high, a middle and a low quality jurisdiction – and H is set to 5. The remaining parameters are calibrated according to the methodology outlined in Nechyba (2000b) with the goal of replicating the data. Table 1 presents the parameters used throughout the simulations (unless otherwise noted), and Table 2 compares some of the model's predictions to analogous features of the data.

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smooth out the discretized income distribution.

[20] These values are admittedly arbitrary, but sensitivity analysis has shown that changing either the mean or variance of these numbers has little qualitative or quantitative impact on the results presented in this paper.

[21] One can also interpret the correlation between parental and child income of 0.4 as an upper bound on the correlation between parental income and child ability because of the correlation of school quality and parental income. Sensitivity analysis with versions of the model that drive the correlation to 0, however, suggest this makes little difference for the results I report.

We begin our computational analysis by asking how school finance policies relate to the degree of residential (or spatial) segregation within and across regions. Central to the findings reported below is the role of capitalization of public choices into private property prices. This capitalization arises endogenously within the model and is essential for supporting an equilibrium in which the public sector is active. At the same time, it is the main driving force behind spatial segregation in the model. Private school markets lessen the power of this force by providing ways for households to de-couple their residential location choices from their school quality choice. Thus, private school markets are critical in the determination of the level of spatial segregation, and, as I discuss in Section 5, the fostering of private school markets can be a useful policy in fostering greater residential integration. Before that, however, I begin in Section 4.1 with a general discussion of public school finance and the role of private markets, and in Section 4.2 with a more detailed focus on the role of residential mobility in distinguishing forces leading to private school attendance under centralized and decentralized public school funding.

4.1. Centralization, Private School Markets and Segregation

Table 3 illustrates several measures of the degree of segregation induced by different types of school policies. In particular, pure local financing is compared to pure state financing of public schools, and the role of private schools is explored in each financing system. The general lesson that emerges from these numbers is that (1) state financing leads to slightly less residential segregation than local financing; and (2) the existence of a private school market results in substantial declines in residential stratification. While it might be expected that state financing will lead to less segregation than local financing, the relatively small magnitude of this

effect compared to the huge effect of private schools is surprising.

Consider the first two rows in Table 3. Simulation results in these rows arise from a purely locally financed public school system as well as a purely state financed system - both under the assumption that a private school market is prohibited. The first set of columns then reports average income levels in each of the three school districts, while the second set of columns reports the variance of income *within* each district. What is clear from the first set of columns is that average incomes in district 1 (the poor district) are higher under a state system than under a local system, and average incomes in district 3 (the wealthy district) are lower. Thus, the *inter*-jurisdictional variance of income, or the degree of residential segregation across school districts, is lower under state financing than under local financing, albeit not by much. The second set of rows then reveals the same through a slightly different lense: As the *inter*-jurisdictional variance in incomes declines between local and state financing, so the *intra*-jurisdictional variance within each district rises. Under state financing, we therefore observe an increase in residential mixing between different income groups. This is supported by slightly less variation in property values across jurisdictions (as reported in the last set of columns of Table 3).

The next two rows then report the same variables for simulations that differ from the previous two rows only in that now private school markets are permitted. While the same comparison between local and state financing can be made (again yielding slightly less variation in income across jurisdictions and slightly more within jurisdictions), the striking comparison is not between the local and state tax rows, but rather between these two rows and the previous two where private school markets were not permitted. In particular, the existence of private school markets results in a dramatic lessening of *inter*-jurisdictional variances in income, and a

substantial widening of the *intra*-jurisdictional income variance in each district. Similarly, property values in the poor district rise substantially as a result of private school markets, while they fall substantially in rich districts.[22]

Finally, the last row in Table 3 provides yet another angle yielding a similar insight. In this row, the simulation assumes no public funding (either local or state), with schooling now provided entirely by the private market. While this leads to a slight increase in residential segregation across districts, the resulting equilibrium is substantially *less* segregated than either of the pure public systems in the first two rows of the Table. Thus, if the degree of residential segregation were all one cared about in choosing between a purely public and a purely private system, these results suggest that one would have to choose the latter. More importantly, however, this set of simulations illustrates the rather powerful role public education policies have on residential location choices and market prices. The last row in Table 3 provides a scenario under which property prices are unrelated to public choices within districts and within the state overall (as there are no public schools and no local taxes) – and these are nearly 56 percent higher in the poor district and nearly 47 percent lower in the rich district than they would be under a purely public system without a private sector. Compared to a public system with a private sector, property values are 28 to 34 percent higher in the poor district and 11 to 19 percent lower in the rich district (depending on whether the system is a state or locally financed one) . This capitalization of public schools into property values is then an important part of the process by which segregation across communities is maintained.

[22] It is also the case that property values now exhibit greater inter-jurisdictional variation under state financing than under local financing (which is opposite to what happened when no private sector was allowed). We return to this issue in Section 4.2 below.

4.2. Private School Attendance, Mobility and Centralization

Next, we consider in some more detail the role of centralized versus decentralized public school finance in the presence of private school markets. As reported in Nechyba (2000b), it turns out that the very migration and general equilibrium forces that underlie the results in Table 3 can potentially produce somewhat counter-intuitive results on the degree of private school attendance observed under local and state financing. In particular, while the standard Tiebout literature would suggest that private school attendance will increase as public school spending becomes more centralized (and more equalized), the general equilibrium forces modeled here suggest the opposite might be true. While centralized school finance clearly does cause consumer options within the public sector to narrow, it should be kept in mind that this yields an improvement in schools in poor districts and a decline in rich districts. The first two columns therefore show an increase in private school attendance in the rich district and a decline in the poor district, as public spending (the second set of columns) and public school quality (the third set of columns) become more equalized. But it turns out that much of this change is not due to the changes in the quality of public schools in rich and poor districts but is rather due to the changes in the relative price of living in the poor district.

This is far from obvious at first. In the last set of columns of Table 3 (reproduced in the fourth set of columns in Table 4), I report the property values under both local and state financing – and these differences do not seem large enough to produce major changes in behavior. However, the opportunity cost of land in community i under local taxation is the actual land *plus* the tax payment that is associated with that land. Under state finance, on the other hand, the opportunity cost of the same land is simply the price of the land (because the state income tax has

to be paid regardless of the choice of land and is thus a sunk cost). The last two columns in Table 4 therefore report the opportunity cost of owning a land parcel of the same quality (i.e. of quality k_{dh}=0.93 – the only quality level that appears in all three districts (see Table 1)) in each of the three districts – under both local financing and state financing. The cost of such land in the rich community is therefore 122 percent as high as the identical land in the poor community under local financing, while it is only 60 percent higher under state financing. (Under no public financing, of course, those land parcels are equally priced in equilibrium). These magnitudes are certainly large enough to explain substantial differences in behavior of marginal households.

Indeed, it is precisely this change in relative prices when going from a decentralized to a centralized system of public education that explains the bulk of the change in private school attendance. Private school attendance in the poor community falls under centralization not so much because public school quality has improved but rather because some of those households who, under local financing, chose the poor community in order to get cheaper land and send their children to private schools now move to the richer community because it is substantially less costly under state financing. Of those who move, two thirds still choose private schools once they moved, thus explaining the bulk of the increase in private school attendance in the rich community. Overall, with the parameter values chosen as described in the previous section, the increase in private school attendance in the rich community is insufficient to offset the decline in private school attendance in the poor community – thus leading to the counter-intuitive decline in overall private school attendance under centralization. This also explains the greater segregation under no public financing than under public financing of schools with an independent private school sector. In particular, since property values are depressed in poor districts under a public

school system, those who choose to send their children to private schools can settle in the better houses in poor districts. When the capitalization effects vanish under a purely private system, on the other hand, no such incentive exists.

5. Fostering Private School Markets through Vouchers

Given the powerful role private markets have been shown to play in a system that is largely publically financed, I now turn to considering explicit government policies aimed at fostering private school markets. In particular, the role of private school vouchers, with particular focus on their potential to affect spatial segregation, is investigated. This analysis mirrors that conducted in Nechyba (2000a), but the starting point of the analysis is intended to be more reflective of real world school markets. While Nechyba (2000a) assumed that private school attendance is zero prior to the introduction of vouchers, the model here is specifically calibrated to reflect actual private school attendance rates in the data.

Table 5 reports simulation results for the poorest and richest districts (District 1 and District 3 in the model) as different kinds and different levels of vouchers are introduced into a locally financed public school system (where roughly 20 percent of parents are already choosing private schools prior to the introduction of the voucher policy). The first five rows of the table consider a policy under which all households are eligible for the private school vouchers. As suggested by the role private schools played in the model even without vouchers, the introduction of vouchers is indeed accompanied by a modest lessening of spatial segregation. The ratio of average income in the richest district to average income in the poorest district, for instance, falls from 2.13 in the absence of vouchers to 1.74 under a $2,500 voucher and then remains roughly the same for higher

voucher amounts. Similarly, the ratio of average property values in the rich district to those in the poor district falls from 2.39 prior to vouchers to 1.59 for a $2,500 voucher and further to 1.47 under a $5,000 voucher. For both property values and average incomes, however, the peak in the poor district occurs at a $2,500 voucher, with the ratios falling more moderately thereafter.

More striking, however, is the second part of Table 5 which reports simulation results for a voucher program targeted at only the poorest district. As noted in Nechyba (2000a), this type of voucher proposal not only divorces the link between the school and the residential location choice which typically disadvantages poorer households, but it creates a new link between residential location and private school voucher eligibility – and this new link is to the advantage of the poorest households when the voucher is targeted to low income districts. This is clearly reflected in the simulation results: The ratio of average income in the richest district to that in the poorest district declines from 2.13 in the absence of vouchers to 1.46 for a $2,500 targeted voucher and finally to 1.20 for a $5,000 voucher. Similarly, the ratio of property values falls from 2.39 to 1.48 and finally to 1.05 for the same three policy scenarios. This is particularly surprising given the significantly higher housing/land quality in the rich district relative to that in the poor district (see Table 1) – and it reflects the disappearance of the negative capitalization of District 1's poor public school quality prior to vouchers and the positive capitalization of voucher eligibility under targeted vouchers.

Table 6 replicates the exercise in Table 5 for the case of a centrally financed public school system. With some minor caveats, the story that unfolds is quite similar to that under local financing. The qualitative differences that do appear in Table 6 are primarily due to the more rapid emergence of private schools in rich districts under state financing than under local

financing (see the last column in Tables 5 and 6). Overall, the lesson that emerges from both these tables is that the design of even moderate private school voucher proposals can have important implications for the degree of spatial segregation that emerges in the economy.

A more thorough overall picture of how policies regarding public and private school financing can impact the degree of spatial segregation has now emerged. In Table 7, the ratio of rich to poor average district income and property values are provided for all the policy alternatives discussed above. The Table is arranged to generally reflect a movement from policies that produce great spatial segregation to policies that tend to reduce such segregation. In particular, the scenario under which private schools are not permitted to operate in a locally financed public school system produces the greatest degree of segregation, followed by a centrally finances public system that does not permit private schools. A dramatic drop in spatial segregation occurs as soon as private schools are allowed to form, with both local and centrally financed systems yielding similar results. A further drop in segregation occurs when general subsidies to private schools through school vouchers are introduced, and the last drop occurs with the introduction of targeted rather than general vouchers. In all these scenarios, the choice between local and central financing is quite secondary to the choice of how to treat private schools, with policies aimed at the private sector having substantially more impact on spatial segregation.

6. School Segregation versus Spatial Segregation

Since the main focus of this paper is the impact of school finance policies on spatial segregation, little attention has been paid thus far on the separate but related issue of school

segregation. School segregation is important in this model because peer effects, together with per pupil spending, is assumed to shape parental perceptions of school quality. Peer effects within schools are influenced, of course, by the characteristics of the student population, not by the characteristics of the spatial community within which the school is located. Thus, in the version of the model that was used throughout this paper it is assumed that parents prefer to have their children in schools that not only spend more per pupil but that also serve relatively higher ability children with relatively wealthier parents. In this section, I will discuss two issues that emerge from this way of modeling parental school choice: First, if school quality is indeed determined in this fashion, what is the implication for the distribution of school quality across students under different policies; and second and more importantly for purposes of this paper, to what extent are the main conclusions regarding spatial segregation altered when alternative models of school quality are introduced? We will treat each of these briefly.

6.1. School Segregation and the Definition of School Quality

On the school quality dimension, each policy has its winners and losers, and these are identified quite straightforwardly from the logic contained in the model. In particular, those switching to private schools as a result of a policy change tend to experience higher school quality after the policy is introduced, while those that are left behind tend to experience lower quality. At the same time, because much of the private school attendance results from migration into the poor district, the drop in public school quality tends to be disproportionately larger in rich districts than in poor districts (as the rich districts lose high peer quality students). Thus, inequality increases to the extent that private school students do better as private schools are

introduced, but inequality within public schools tends to fall as rich districts experience a greater loss in quality than poor districts. For moderate levels of private school attendance, these forces tend to be of roughly similar magnitudes thus causing overall inequality as measured by the variance in school outcomes to remain relatively unchanged, although that variance is typically higher under local financing than under central financing. As private schools become more dominant under high vouchers, however, inequality as measured by the variance in school quality tends to increase modestly as private schools are more differentiated than public schools, especially those that are state financed. But in all cases, the logic of the model dictates that the level of public school quality tends to fall as private school attendance increases (because private schools initially cater only to the high peer quality children).

As noted in Nechyba and Heise (2000), however, these results must be consumed with caution. Little is actually known about private school markets, parental perceptions of school quality and how both of these would change under greater private school competition. The modeling in this paper has therefore been cautious in that it has made the worst case assumptions about the process of private school competition. In particular, it is assumed that public schools are using their resources efficiently even in the absence of private school competition, that private schools "skim the cream" off the public schools, that neither public nor private schools innovate in a more competitive environment, etc. In Nechyba and Heise (2000) it is then demonstrated that different assumptions regarding these aspects of the model will yield substantially more favorable conclusions for the support of private schools. For example, if one assumed that a more homogeneous student population in a school allows for better targeting of resources, then vouchers are shown to increase both the overall level and decrease the variance

in school quality. As this is not the focus of our present analysis, I merely note that, while in the model specified in this paper the level of school segregation tends to remain constant or increase modestly with an increase in private school activity, this tendency can be reversed under different (yet plausible) assumptions regarding factors we know currently little about.

6.2. Definition of School Quality and Spatial Segregation

The natural next question, then, is to what extent do different assumptions regarding public and private school behavior impact the conclusions regarding spatial segregation - i.e. are the spatial segregation results regarding centralization of public school financing and support for private schools merely an artifact of the way school quality is modeled? Table 8 attempts to provide an answer to this by comparing results from the previous analysis to results obtained by altering the conception of school quality in the model. In particular, two different types of school quality notions are tested in the simulations. The first alters the way in which peer effects operate by assuming that both the mean and the variance of peer quality within a school matter, with lower variance permitting greater targeting of resources and thus providing higher quality schools. The second maintains the original conception of peer effects but assumes that, with private school competition, the marginal value of a dollar in the education production function rises. The magnitudes of the relevance of peer variance in the first conception of school quality and of school competition in the second is admittedly arbitrary, but it is set high enough to cause significant changes in school quality.[23] What is striking about Table 8, then, is that even with

[23] These magnitudes are similar to those used in Nechyba and Heise (2000) and are in both cases sufficient to reverse the present results relating to school quality -- i.e. they are sufficient to raise both the average and decrease the variance in school quality consumption as private school attendance rises.

these dramatic changes in the way school quality is modeled, the spatial segregation effects mirror those identified earlier (and replicated in the first portion of the Table). Thus, while different conceptions of private and public school quality are clearly important for analysis of the level and variance of school quality, very different conceptions of these lead to similar conclusions regarding the impact of policy on spatial segregation.

7. Population Growth and Endogenous Land Quality

While the results on centralization and decentralization as well as those involving private school markets are quite robust,[24] it has been acknowledged throughout that some dimensions of the model are more appropriate for the analysis of a developed urban economy than they are for investigating the development of such an economy. In particular, two features of the model stand out in this regard: First, the model is static and does not permit for the process of urban population growth that is important in developing countries; and second, the land/housing qualities are assumed constant. An incorporation of additional features that introduce dynamics in the population size or land qualities to an already complicated model is technically challenging and beyond the scope of this paper. I therefore limit myself in this section to a brief discussion of how such features could be expected to alter the results highlighted in the paper.

7.1. Endogenous Land/Housing Quality

If the k_{dh} parameters in the model are strictly and literally interpreted as capturing land

[24] In addition to the alternative models of school quality reported in the previous section, more standard sensitivity analysis involving the parameters of the model confirms this robustness.

quality (location, pollution, physical beauty, etc.), then one interpretation of the model is that housing is simply captured in the broader consumption variable, and local taxation is land taxation rather than property taxation. However, this interpretation of the model seems to allow housing to be too flexible, with agents being able to adjust housing consumption at any location in either direction. Housing, as is well known in the urban economics literature, is quite durable, and while improving the quality of a house is relatively straightforward, converting existing housing capital to other uses is more problematic. Nevertheless, this view of housing is not inconsistent with much of the local public finance literature, and it does permit the analysis of (land) capitalization effects that play such an important role in the model.

An alternative interpretation of the model is one I have primarily relied on in previous work (Nechyba 1999, 2000a,b). Under this view, the k_{dh} parameters capture both the house and the land quality at a particular location, and housing quality cannot be changed. Note that this is the opposite extreme of the previous view were housing quality was fully adjustable at all locations, and it is the interpretation used to arrive at the calibrated values for the k_{dh} parameters. Even in a fully developed urban/suburban economy, this assumption is restrictive as it does not permit, for instance, higher income residents from moving to lower income districts and renovating existing houses. As I have suggested elsewhere (Nechyba 2000a), however, results in the model would tend to be strengthened by such an extension of the model as it would actually remove one of the barriers to mobility currently embedded in the set-up. A similar argument holds for the results highlighted in this paper.

7.2. Population Growth

A more serious impediment to a straightforward application of this framework to developing economies is the assumption of a fixed population in a static setting. Development by its very nature is a dynamic process, and none of this is captured in the current exercise nor is there an obvious way in which it could be introduced in the technical set-up. More precisely, to convert this framework into one that is more dynamic would require a host of assumptions about non-education related policy making during the development process as well as a model of the underlying causes for the migration into cities. This is clearly beyond the scope of this model.

As a result, the reader is left to speculate on precisely how to translate the lessons learned from the static setting to a dynamic development context. The incentives that drive the current results are, after all, very much still present along a dynamic development path. A purely public system would necessarily entail the kind of capitalization effects that are central to the higher segregation predicted by the model, and private sector activity would sever the link between property values and public schools – thus lessening the incentive for agents to segregate. The direction of these forces is, therefore, quite similar. As population grows, however, not only is the nature of communities determined by who chooses to reside in the various jurisdictions, but new communities form on previously empty land. This process seems very much more unconstrained than the migration process modeled in this paper, but this should again make the forces I have modeled even stronger. As communities form, surely the community organizers are aware of the incentives that play a role in the static model, and one would think that community formation would thus respond to the same types of segregation forces that migration in developed communities responds to. In the U.S., it has been argued (Fischel 1985, forthcoming), this has led to active exclusionary zoning on the part of wealthier communities – precisely for

the purposes of protecting property values and improving local services such as schools. If such zoning is a major element of the development process, there is in fact considerably less freedom to alter local housing than might be imagined at first, and zoning itself becomes an instrument of income segregation motivated precisely by the forces that yield the results highlighted in this paper. If, on the other hand, zoning is not a part of the development process, the freedom to shape communities may well again cause estimates of segregation effects in this paper to be understated as a major barrier to mobility would have been removed. In either case, the forces identified in the simulations presented above, as well as the relative magnitudes, seem to be informative even in a setting other than that of a fully developed economy.

While it would be a stretch to argue that these factors make the current model ideal for the analysis of developing cities, the results obtained from a static analysis do shed light on what might be expected in the process of developing. Knowledge of the institutional setup of the education system – of how public education is financed and to what extent private schools are fostered – appears like a key ingredient to predicting how political interests and future homeowners are likely to behave, and what kind of equilibrium their behavior is likely to generate. Furthermore, once an institution is embedded, political interests may prevent policy changes that might be considered desirable. For example, if a purely public system has been established, it would be to the disadvantage of residents of the rich community (who would incur substantial capital losses) to permit a private sector to emerge in other districts or to promote vouchers to specifically foster private schools.

8. Conclusion

Education has been much studied in both developing and developed countries, with particular emphasis in developing countries paid to the overall level and prevalence of education. This paper has little to add to the bulk of this literature. Rather, the paper focuses on the connection between the institutional set-up of education and the degree of residential income stratification implied by that set-up in equilibrium. With increasing evidence suggesting that such segregation plays a key role in long-run inequality by subjecting children in poor households to adverse neighborhood effects, such an analysis must ultimately become part of the analysis of school finance as it may be every bit as important to eventual student outcomes as those factors within schools which are more typically analyzed.

While the results reported in this paper are derived from a static model with no population growth, the forces that are identified and the relative magnitude of policy impacts are nevertheless quite instructive. Public financing of schools – whether local or central – is inevitably associated with inflated property values in rich communities and depressed values in poor communities. This, in turn, supports an artificial degree of spatial income segregation. Public school finance, whatever its other virtues, therefore leads to substantially more such segregation than is predicted in the absence of schooling being a factor in residential location decisions. The unfettered operation of a private school market, on the other hand, weakens the spatial segregation caused by public schools, and explicit government support for private schools through vouchers can reverse the segregation outcome to one where school finance policies actually cause a lessening of the spatial income segregation that would be present in the absence of government involvement in education. Centralization of public school finance, on the other hand, accomplishes surprisingly little in terms of promoting greater integration than local

financing.

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Table 1: Parameters of the Model

Population	**District Size**	**Utility and Production Function Exponents**			
N	$\mu(C_{dh})$	α	β	ρ	θ
[0,1]	0.0667	0.22	0.650	0.475	0.5

d \ **h**	**Housing Quality Parameters (k_{dh})**				
	1	2	3	4	5
1	0.820	0.882	0.930	0.978	1.021
2	0.872	0.930	1.002	1.032	1.085
3	0.930	0.950	1.063	1.182	1.267

Table 2: Predictions versus Data

	Representative School Districts		
	Low Income (d=1)	Middle Income (d=2)	High Income (d=3)
Mean Land Value	$157,248	$192,867	$271,315
Predicted Mean Land Value*	$117,412	$205,629	$292,484
Median Household Income	$30,639	$45,248	$67,312
Predicted Mean Household Inc.	$31,120	$46,216	$65,863
Per Pupil Spending	$6,702	$7,841	$8,448
Predicted Per Pupil Spending	$6,652	$7,910	$8,621
Fraction Choosing Private S.	0.21	0.23	0.20
Predicted Fraction in Private S.	0.20	0.23	0.13
Fraction Raised Locally	0.52	0.77	0.87
Fraction Raised Locally in Model	0.52	0.77	0.87

*Calculated from static values assuming 5.5% interest rate.

Table 3: State vs. Local Financing and Segregation

	Public Financing	Average Income			Income Variance (expressed in multiples of 1,000)			Property Values*		
		Dist. 1	Dist. 2	Dist. 3	Dist. 1	Dist. 2	Dist. 3	Dist. 1	Dist. 2	Dist. 3
No Private Schools	Local Tax	$17,628	$39,647	$85,925	7,326	20,408	115,510	$5,301	$10,639	$20,457
	State Tax	$19,875	$42,250	$81,075	13,581	39,859	141,060	$5,322	$11,507	$20,204
Private Schools	Local Tax	$29,725	$50,262	$63,212	61,810	131,640	135,790	$6,424	$11,038	$15,370
	State Tax	$29,891	$51,309	$62,000	81,229	107,900	143,680	$6,177	$11,800	$16,490
	None	$25,700	$50,175	$67,325	29,221	127,710	141,820	$8,254	$11,844	$13,892

*Property Values here are expressed as annualized flows.

Table 4: The Link between Public/Private School Attendance and Migration

	Percent Private		Public School Spending		Avg. Property Values*		Opportunity Cost of House k_{dh}=0.93*	
Financing	Local	State	Local	State	Local	State	Local	State
District 1	30%	22.5%	$5,000	$7,195	$6,434	$6,177	$6,275	$6,775
District 2	20%	17.5%	$7,326	$7,195	$11,038	$11,800	$10,412	$9,632
District 3	10%	15%	$10,215	$7,195	$15,370	$16,490	$13,899	$10,841
Overall	20%	18.3%	$7,706	$7,195	---	---	---	---

*Property Values are expressed as annualized flows.

Table 5: Private School Vouchers under Local Public Financing

	Vouch. Amount	Average Income		Property Values*		Ratio: Dist. 3/Dist. 1		Percent Private	
		Dist. 1	Dist. 3	Dist. 1	Dist. 3	Income	Property	Dist. 1	Dist. 3
All Eligible for Voucher	$0	$29,725	$63,212	$6,424	$15,370	2.1266	2.3926	0.3000	0.1000
	$1,000	$31,925	$59,800	$7,122	$14,654	1.8731	2.0576	0.4000	0.1000
	$2,500	$33,425	$58,000	$9,097	$14,468	1.7352	1.5904	0.6250	0.2500
	$4,000	$33,125	$57,425	$8,256	$13,339	1.7336	1.6157	0.8750	0.3000
	$5,000	$32,900	$56,425	$8,027	$11,816	1.7150	1.4720	1.0000	0.3750
Voucher Targeted to District 1	$0	$29,725	$63,212	$6,424	$15,370	2.1266	2.3926	0.3000	0.1000
	$1,000	$34,050	$59,950	$7,124	$14,974	1.7606	2.1019	0.3750	0.1000
	$2,500	$37,125	$54,125	$9,979	$14,804	1.4579	1.4835	0.7000	0.1000
	$4,000	$43,275	$52,950	$13,741	$15,141	1.2236	1.1019	1.0000	0.1750
	$5,000	$44,624	$53,632	$14,282	$15,041	1.2019	1.0531	1.0000	0.1984

*Property values are expressed as annualized flows.

Table 6: Vouchers under Cental Public Financing

	Vouch. Amount	Average Income		Property Values*		Ratio: Dist. 3/Dist. 1		Percent Private	
		Dist. 1	Dist. 3	Dist. 1	Dist. 3	Income	Property	Dist. 1	Dist. 3
All Eligible for Voucher	$0	$29,891	$62,000	$6,177	$16,490	2.0742	2.6696	0.2250	0.1500
	$1,000	$33,375	$60,350	$6,215	$15,599	1.8082	2.5099	0.3000	0.2500
	$2,500	$34,188	$58,254	$6,431	$15,851	1.7039	2.4648	0.3500	0.2750
	$4,000	$33,500	$61,225	$7,710	$14,908	1.8276	1.9336	0.6250	0.3000
	$5,000	$28,775	$64,875	$8,327	$14,016	2.2546	1.6832	1.0000	1.0000
Voucher Targeted to District 1	$0	$29,891	$62,000	$6,177	$16,490	2.0742	2.6696	0.2250	0.1500
	$1,000	$33,400	$59,645	$6,242	$15,711	1.7858	2.5170	0.3000	0.1250
	$2,500	$39,326	$59,825	$6,720	$15,940	1.5213	2.3720	0.4250	0.1125
	$4,000	$43,202	$53,861	$8,652	$16,805	1.2467	1.9423	0.7000	0.1000
	$5,000	$44,225	$58,850	$12,509	$16,100	1.3307	1.2871	1.0000	0.3750

*Property values are expressed as annualized flows.

Table 7: Ratio of District 3 to District 1 Averages

	No Private School Markets Permitted		Private Schools Markets Permitted									
			No Vouchers		Non-Targeted Vouchers				Targeted Vouchers			
					Voucher=0.25		Voucher=0.50		Voucher=0.25		Voucher=0.50	
	Local	Cent.	Local	Cent.	Local	Cent.	Local	Cent.	Local	Cent.	Local	Cent.
Income	4.874	4.079	2.126	2.074	1.735	1.704	1.715	2.255	1.458	1.521	1.202	1.331
Property	3.859	3.796	2.392	2.667	1.590	2.465	1.472	1.683	1.484	2.372	1.053	1.287

Table 8: District 3/District 1 Variables for Different Assumptions regarding School Quality

	No Private School Markets Permitted		Private Schools Markets Permitted									
			No Vouchers		Non-Targeted Vouchers				Targeted Vouchers			
					Voucher=0.25		Voucher=0.50		Voucher=0.25		Voucher=0.50	
	Local	Cent.	Local	Cent.	Local	Cent.	Local	Cent.	Local	Cent.	Local	Cent.
School Quality as Modeled in this Paper (replicated from Table 7)												
Income	4.874	4.079	2.126	2.074	1.735	1.704	1.715	2.255	1.458	1.521	1.202	1.331
Property	3.859	3.796	2.392	2.667	1.590	2.465	1.472	1.683	1.484	2.372	1.053	1.287
Schools Become more Efficient through Curriculum Targeting												
Income	4.505	4.188	2.076	2.033	1.798	1.921	1.832	2.119	1.397	1.510	1.193	1.279
Property	3.791	3.586	2.222	2.512	1.553	2.213	1.394	1.762	1.427	2.181	1.081	1.231
Schools Become more Efficient through More Efficient Resource Utilization												
Income	4.771	3.892	2.231	2.100	1.751	1.691	1.802	2.387	1.424	1.478	1.249	1.414
Property	3.712	3.603	2.469	2.702	1.539	2.568	1.528	1.732	1.329	2.292	1.103	1.302