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EDUCATION, SOCIAL COHESION
AND ECONOMIC GROWTH

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ABSTRACT

Education, Social Cohesion and Economic Growth*

Analysis of the contribution of education to growth through its role in promoting a common culture indicates that when different cultural groups separately determine the social content of their school curricula excessive polarization can result, with less than optimal growth. The optimal trajectory involves a gradual, reciprocal convergence of school curricula towards the middle ground. This may, however, be difficult to implement in a political context in which all agents are identified with one group or another. When curricula are determined by legislative bargaining, centralization of schooling may result in overly rapid homogenization in some cases, and – perhaps surprisingly – excessive polarization in others.

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NON-TECHNICAL SUMMARY

The absence of a common culture inhibits the ability of economic agents to interact with each other and undermines the efficiency of production and exchange. The economic advantages of reducing cultural distances in society are illustrated by empirical evidence from a variety of sources. Recent evidence shows that ethnic heterogeneity is the source of poor economic performance in African countries, indicating that it is associated with low school achievement, reduced labour productivity and slow growth. Similar effects have been observed in studies of local communities in the United States, which find that racially heterogeneous communities tend to spend less on productive public services, including education. In addition, experimental evidence suggests that ethnic differences increase mistrust among individuals, which reduces the efficiency of economic transactions.

Education generates economic benefits not only by building human capital but also through its socializing effect, which reduces transaction costs by shrinking the 'social distance' between individuals in the economy. This view of public education as a socializing force accords with historical experience: the emergence of government intervention in schooling in the eighteenth and nineteenth century was closely tied to its socializing role. Autocratic rulers in eighteenth century Prussia and Austro-Hungary used it to strengthen their subjects' allegiance to the state. In nineteenth-century France and Germany, centralized schooling contributed to the forging of unified national identities. In Great Britain, the ruling elites viewed socialization of the working classes through compulsory primary education as a necessary concomitant of the extension of the franchise, in the late nineteenth century. In the United States, public schooling contributed significantly to the cultural and economic assimilation of immigrants. More recently, education has played an important role in efforts to forge new national identities in the multiethnic developing countries that emerged in the second half of the twentieth century.

The socializing role of education provides a key to understanding the positive political economy of public schooling – explaining the ubiquitous role of the public sector in the provision of primary and high school (K-12) education. Several recent efforts that focus on the instrumental contribution of schooling to human capital implicitly attribute the extensive involvement of the public sector in education to its advantages in internalizing the external benefits of education, relaxing credit constraints, and redistributing income. These advantages could, however, largely be realized without direct administrative intervention in the schooling process, e.g. through the use of subsidies. The socializing role of education indicates a need for more direct intervention, inasmuch as cultural content is difficult to monitor at arm's length without the direct controls of public administration.

In this Paper we consider the relation between social cohesion, education and growth in the context of a dynamic model in which the productivity of economic transactions is a declining function of the social distance between the transacting agents, from a certain point onwards. This distance is determined by the social orientation of the schooling with which parents provide their children. Parents can contribute to their children's material well-being by providing them with an education which brings them closer to the 'cultural centre', but only at the cost of weakening their children's ties to the traditional values with which they themselves were raised.

It follows that parents' decisions on the social orientation of their own children should also have external effects on the productivity of other children, indicating that without centralized intervention social polarization may be excessively large and growth excessively slow. This suggests that there is scope for Pareto improvement through a concerted acceleration of the rate of convergence of all ethnic groups to the middle ground. Implementation of such an improved trajectory, however, poses substantial difficulties. A dynamic contract between distinct social groups that regulates the cultural content of their respective school systems may be difficult to enforce except through the political process. Our analysis of several modes of political implementation of centralized schooling through representative democracy reveals that it may lead to excessive polarization in some cases and overly rapid homogenization in others, depending on the nature of the political framework within which it is implemented. This suggests that caution is in order when recommending centralized intervention in schooling, and careful attention should be paid to the political conditions that constrain implementation.

Another policy implication of our analysis is that the design and assessment of school reforms such as education vouchers must take into account their impact on the socializing role of education, in addition to their effect on scholastic achievement. Popular support for vouchers is most often based on their offering better access to high-quality education, especially to children of disadvantaged families. Their impact on social cohesion may, however, be no less important: gains from improved scholastic performance may be outweighed by losses from increased social fragmentation.

This Paper differs from earlier work on the economics of public education in two respects. First, it integrates accumulation of instrumental human capital with the evolution of social orientation in a single model, enabling us to link decisions on the social orientation of the education system to economic performance. Second, our analysis draws attention to the political constraints that bear on the relative effectiveness of centralized versus decentralized education.

Education, Social Cohesion and Economic Growth

Mark Gradstein and Moshe Justman

1 Introduction

Increased recognition of the central role that human capital plays in economic growth has heightened our appreciation of the contribution of education to growth but may have biased our understanding of *how* education contributes to growth.[1] By emphasizing the instrumental role of education in transmitting knowledge, studies in this vein ignore the effect of education on growth through its role as a socializing force. A better understanding of this role can shed light on the positive political economy of public schooling and provide normative indications for the design of education systems in multicultural societies.

The economic benefits of education as a socializing force are realized in various ways. Instilling civic virtues from an early age, through education, can reduce the cost of enforcing desirable social norms.[2] Relatedly, when society is divided along ethnic or religious lines, uniform schooling in a common culture can lessen the potential for redistributional conflict among distinct social groups.[3] The present paper focuses on a third

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[1] Barro (1991) and Mankiw, Romer, and Weil (1992) are seminal empirical analyses of the effect of human capital on growth.
[2] Grossman (1991, 1993) explicitly models this cost, and Grossman and Kim (1997) elaborate on the role of education in reducing it.

conflict among distinct social groups.[3] The present paper focuses on a third benefit of common socialization: the role of state schooling in reducing transaction costs by shrinking the "social distance" between individuals in the economy. As Lazear (1999) points out, the absence of a common culture inhibits the ability of economic agents to interact with each other and undermines the efficiency of production and exchange. While some degree of cultural diversity may in general be beneficial for economic performance, we focus here on the detrimental effect of excessive cultural polarization.[4]

The economic advantages of reducing cultural distances in society are illustrated by empirical evidence from a variety of sources. Easterly and Levine (1997) argue that ethnic heterogeneity is the source of poor economic performance in African countries, finding that it is associated with low school achievement, reduced labor productivity and slow growth. Alesina et al. (1999) observe similar effects in their study of local communities in the United States, finding that racially heterogeneous communities tend to spend less on productive public services, including education. Knack and Keefer (1997) and Temple and Johnson (1998) find a positive association between social capital and growth in a cross section of countries; inasmuch as cultural cohesion promotes the creation of social capital this, too, supports our hypothesis. Finally, Fershtman and Gneezy (2000) and Glaeser et al. (2000) present experimental evidence on a negative relationship between ethnic heterogeneity and trust, the former explicitly focusing on its adverse effect on the efficiency of economic transactions.

In this paper we consider the relation between social cohesion, education and growth in the context of a dynamic model in which the productivity of economic transactions

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[3] This aspect of education—its role in reducing social tensions and consequent rent-seeking activities between different ethnic groups—is examined in Gradstein and Justman (2000).

[4] Metcalfe (1994) draws on an evolutionary model of biological diversity to highlight the advantages of technological diversity for economic performance, whereas Weitzman (1992) explores the microfoundations of diversity, showing that it may be advantageous or detrimental. Here we focus on the negative impact on economic performance of people lacking the means to communicate effectively with each other.

depends on the social distance between the transacting agents, and expected individual income decreases as a function of average social distance from one's cohort. These cultural distances are determined by the social orientation of the schooling that parents provide their children. Parents can contribute to their children's material well-being by raising them in the mainstream, common culture, but only at the cost of diluting the traditional values in which the parents themselves were raised, and thus weakening the bond between parent and child.

This implies that parents' decisions on the social orientation of their own children have external effects on the productivity of other children, indicating that without centralized intervention social polarization may be excessively large, and growth excessively slow. Thus there is scope for a Pareto-improving concerted convergence of the social content of school curricula that reduces transaction costs in the next generation and increases growth: the added psychic cost to parents of a widened generation gap is offset by the added economic resources their children derive from others drawing closer to them. The optimal mode of government intervention involves regulation of multi-cultural education in such a way that social differences are smoothed out reciprocally and gradually.[5]

However, implementation of such an optimal trajectory poses obvious difficulties. A dynamic contract between distinct social groups that regulates the cultural content of their respective school systems may be difficult to formulate and monitor, and impossible to enforce except through the political process. Our analysis of several such modes of implementation, through representative democracy, reveals that it may lead to excessive polarization in some cases, and overly rapid homogenization in others, depending on the nature of the political framework within which it is implemented. This suggests that caution is in order when recommending centralized intervention in schooling: careful attention should be paid to the political conditions that constrain implementation.

The socializing role of education also provides a key to understanding the positive political economy of public schooling—explaining the ubiquitous role of the public sector in the provision of primary and high school (K-12) education. Several recent efforts that focus on the instrumental contribution of schooling to human capital implicitly attribute the extensive involvement of the public sector in education to its advantages in internalizing the external benefits of education, relaxing credit constraints, and redistributing income.[6] However, these advantages could largely be realized without direct administrative intervention in the schooling process, e.g., through the use of subsidies or vouchers.[7] The socializing role of education indicates a need for more direct intervention, inasmuch as cultural content is difficult to monitor at arm's length without the direct controls of public administration (Kremer and Sarychev, 1998).

This emphasis on socialization as a driving force of public education also accords with historical experience. The emergence of government intervention in schooling in the eighteenth and nineteenth century was closely tied to its socializing role (Good and Teller, 1969, Green, 1990). Autocratic rulers in eighteenth century Prussia and Austro-Hungary used it to strengthen their subjects' allegiance to the state. In nineteenth-century France and Germany, centralized schooling contributed to the forging of unified national identities. In Great Britain, the ruling elites viewed socialization of the working classes through compulsory primary education as a necessary concomitant of the extension of the franchise, in the late nineteenth century (Dicey, 1914). In the United States, public schooling contributed significantly to the cultural and economic assimilation of immigrants (Edwards and Richey, 1963). More recently, education has played an important role in efforts to forge

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[5] We focus here on government's role in the determination of school curricula, abstracting from other important modes of intervention, e.g., in school finance.

[6] Papers which focus on the political economy of education finance include Bénabou (1996, 2000), Fernandez and Rogerson (1999), Glomm and Ravikumar (1992), Saint-Paul and Verdier (1993). Some of these papers (e.g., Bénabou, 1996, 2000) emphasize the adverse effect of heterogeneity in incomes.

[7] Education does not have the technical attributes of a public good: it is largely appropriable and divisible.

new national identities in the multi-ethnic developing countries that emerged in the second half of the twentieth century. Singapore is a successful example in this regard (Thomas, et al., 1980); the African experience has been less fortunate (Easterly and Levine, 1997).

Earlier work by economists on the socializing role of schooling includes the seminal work of Bowles and Gintis (1976), the more recent work by Lott (1990), and methodologically closest to the present paper, Kremer and Sarychev's (1998) dynamic model of ideological evolution in which a majority of voters have reason to prefer a state school system. We extend Kremer and Sarychev's contribution in two regards. First, our model combines accumulation of instrumental human capital with the evolution of social orientation, enabling us to link decisions on the social orientation of the education system to growth performance. Second, our analysis draws attention to the political constraints that bear on the relative effectiveness of centralized versus decentralized education. This second contribution of our paper is related to recent work by Coate (1997), Besley and Coate (1998) and Ellingsen (1998) who similarly point to the possible negative effects of centralization in other contexts.

In the following section we set out the basic definition of our model. We characterize the decentralized equilibrium in Section 3, and compare it to the social optimum in Section 4. Section 5 examines the problem of political implementation. Extensions are discussed in Section 6, empirical applications in Section 7, and Section 8 concludes.

2 Definition of the model

We assume an OLG economy[8] in discrete time t populated by a continuum of households of unit measure indexed by i and represented by the unit interval, each consisting of a parent and child. The income of parent i in period t is denoted y_{it}, and we assume that initially all parents

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[8] A nation, or other political entity capable of implementing an education policy.

are exogenously endowed with the same income y_0. Individuals also have social characteristics—language, culture, ideology—which we assume can be captured by a single parameter $0 \leq p_{it} \leq 1$ that denotes the social orientation of parent i in period t. We assume for simplicity that generation 0 comprises two uniform social groups of equal size, "reds" and "greens", with initial social characteristics $p_{r0} < p_{g0}$ located symmetrically in the unit interval, $p_{r0} = 1 - p_{g0}$. The initial degree of social polarization is then $\Delta_0 = p_{g0} - p_{r0}$.

Parents make all household decisions. In each period they divide current income y_{it} between consumption c_{it} and instrumental investment in their children's human capital h_{it+1}; and they choose the social orientation of their children's schooling p_{it+1},[9] thus determining the child's social social distance from its parent, $|p_{it} - p_{it+1}|$, and from other individuals j in its cohort, $|p_{it+1} - p_{jt+1}|$. The distance from the parent determines the degree of alienation between parent and child, $C(|p_{it} - p_{it+1}|)$, which directly reduces parental utility.[10] We assume that C is increasing and convex with $C(0) = 0$.

The social distance between an individual and others members of its cohort affects the productivity of its instrumental human capital. This is captured by the metric $D(|p_{it+1} - p_{jt+1}|) \geq 0$ that represents the expected productivity of a transaction between i and j. It can be thought of as a function of two opposing forces: the probability that given the opportunity to cooperate, i and j will effect a successful transaction between them, which we assume to be a decreasing function of the cultural distance that separates them;[11] and of the advantages of cooperation when a transaction has been successfully concluded, which may increase with cultural

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[9] We assume that the choice of orientation is costless. One might think of h as the number of hours of weekly instruction in, say, mathematics, and of p as the language in which it is taught. Of course, other assumptions are also possible and could be incorporated in the model. Uniformity of cultural orientation might reduce schooling costs through economies of scale, or schooling costs might be an increasing function of the change in social orientation.

[10] See Bisin and Verdier (1997) and references therein for a more detailed economic perspective on the disutility of having a child different from oneself.
[11] Greif (1993) and Kotkin (1992) document the high intensity of economic activity within ethnic groups and its economic benefits for group members.

diversity. (We develop the microfoundations of D in more explicit detail in the Appendix.) We set $D(0) = 1$, and while allowing that D may increase with cultural distance at low levels of polarization, require that it is decreasing from some point on, i.e., when $|p_{it+1} - p_{jt+1}|$ exceeds some threshold level $\underline{\Delta}$. As we show in the Appendix, this is equivalent to assuming that, where D is decreasing, the elasticity of the probability of a successful transaction with respect to cultural distance is smaller in magnitude than the elasticity of the productivity gain from cultural diversity once a transaction has been effected. We further assume that D is twice differentiable and concave with respect to social heterogeneity, which holds when the advantages of cooperation increase at a decreasing rate while the probability of effecting a successful transaction, as a function of cultural distance, decreases at an increasing rate; this implies that $\underline{\Delta}$ is a global maximum of D. Finally, to focus our analysis on cases of excessive polarization we posit that the initial level of polarization is such that $\Delta_0 > \underline{\Delta}$.

Individual i's output in period t is assumed to result from numerous chance encounters with other individuals in its cohort that create opportunities for economic cooperation so that the productivity of its human capital is closely approximated by the expected value of D.[12] Let $\Pi(p_{it}; \mathbf{p}_t)$ denote individual i's average value of D in period t vis-a-vis other members of its cohort

$$\Pi(p_{it}; \mathbf{p}_t) = \int D(|p_{it} - p_{kt}|) \, dF_t(k) \tag{1}$$

where $\mathbf{p}_t$ represents the social orientation of all individuals in the cohort and F_t is the

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[12] For simplicity, we assume here an equal chance of encountering any member of one's cohort. One could develop a theory of social exclusion on the premise that encounters with members of one's own group were more likely than encounters with members of other groups. This is briefly discussed in the Appendix.

cumulative distribution function of cultural orientation in period t.[13] Individual expected

income y_{it} is then jointly determined by the product of this average value and instrumental

human capital:

$$y_{it} = A\, h_{it}\, \Pi(p_{it};\, \mathbf{p}_t) \tag{2}$$

where A is an exogenous technology parameter to which all individuals have access.

The utility of the parent of household i in period t is an increasing function of current

household consumption c_{it} and of the expected income of its child in the next period y_{it+1},

contingent on the anticipated social orientation of the next generation; and a decreasing function

of the social distance between parent and child, $C(|p_{it} - p_{it+1}|)$:[14]

$$U(c_{it}, |p_{it} - p_{it+1}|, y_{it+1}) \;=\; \log(c_{it}) \;-\; C(|p_{it} - p_{it+1}|) \;+\; \delta \log(y_{it+1}) \tag{3}$$

where $0 < \delta < 1$ reflects the extent of parental altruism. It is maximized by each parent subject to

the budget constraint:

$$y_{it} = c_{it} + h_{it+1} \tag{4}$$

3 Decentralized education

Under *decentralized* (or *sectoral*) *schooling* there exist separate schools for the members of

the two groups, and all educational decisions are made communally within each group,

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[13] Esteban and Ray (1994) develop an axiomatic approach to the measurement of polarization that could also be
used to justify equation (1).

[14] We discuss the implications of a more general specification of the utility function in section 6.

independently of the other group. This implicitly assumes that the groups are able to successfully overcome internal free riding incentives, and we further assume that they are constrained to provide all members of the group with the same schooling.[15] Hence, as both groups are initially uniform they remain so in subsequent periods, and we denote by p_{rt} and p_{gt} their respective social orientations in period t. In each period, the parents of each group choose h_{jt+1} and p_{jt+1}, $j=r,g$ so as to maximize their respective utilities anticipating the choice of the rival group, and we require that in equilibrium these anticipations are realized

To complete the characterization of the household's optimization problem note that it is subject to two additional implicit constraints stemming directly from the assumption that polarization is harmful in the relevant range where D is decreasing. In this range, it can never be optimal for parents to choose for their children a social orientation more extreme than their own as this would be twice harmful, increasing the generation gap between parent and child and decreasing the child's future income. By similar reasoning, households never reduce the level of social polarization below $\underline{\Delta}$, the level at which productivity is maximal. Therefore (see Figure 1)

$$p_{rt} \leq p_{rt+1} \leq \frac{1}{2} - \underline{\Delta} \leq \frac{1}{2} + \underline{\Delta} \leq p_{gt+1} \leq p_{gt} \tag{5}$$

.

INSERT FIGURE 1 ABOUT HERE

The degree of social polarization in period t, $\Delta_t = |p_{gt} - p_{rt}|$, is then non-increasing over time. Moreover, because the social orientation of the two groups is initially symmetric around $\frac{1}{2}$ the same also applies in all subsequent periods, so that Δ_t fully determines p_{rt} and p_{gt}: $p_{rt} = \frac{1}{2}$

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[15] This implies that an individual's instrumental human capital and social orientation are exclusively determined

$-\frac{1}{2}\,\Delta_t$ and $p_{gt} = \frac{1}{2} + \frac{1}{2}\,\Delta_t$; and $|\,p_{jt} - p_{jt+1}\,| = \frac{1}{2}\,(\Delta_t - \Delta_{t+1})$ for $j = r, g$.

Maximization of (3) with respect to h_{jt+1} and p_{jt+1}, subject to constraints (4) and (5) yields the following first order conditions at interior points along the equilibrium transition path:

$$h_{jt+1} \;=\; [\delta/(1+\delta)]\,y_{jt} \qquad\qquad\qquad\qquad\qquad (6)$$

$$C`(|\,p_{jt} - p_{jt+1}\,|) \;+\; \delta\,\Pi`(p_{jt+1};\,\mathbf{p}_{t+1})\,/\,\Pi(p_{it+1};\,\mathbf{p}_{t+1}) = \; 0 \qquad\qquad j = r,\,g \qquad (7)$$

From equation (1) we obtain

$$\Pi(p_{jt+1};\,\mathbf{p}_{t+1}) \;=\; \frac{1}{2}\,[1+ D(\Delta_{t+1})] \qquad\qquad\qquad j = r,\,g \qquad (8)$$

$$\Pi(p_{jt+1};\,\mathbf{p}_{t+1}) \;=\; \frac{1}{2}\,D`(\Delta_{t+1}) \qquad\qquad\qquad j = r,g \qquad (9)$$

as long as education is uniform within each group. Next period income is then identical across individuals, and equals

$$y_{t+1} = A\,[\delta/(1+\delta)]\,\frac{1}{2}\,[1 + D(\Delta_{t+1})]\,y_t \qquad\qquad\qquad (10)$$

We say that the economy is in a steady state when the degree of social polarization is stationary, i.e., when $\Delta_t = \Delta_{t+1}$. The monotonicity of Δ_t along the equilibrium path, from (5), implies that the economy must converge to a steady state. Equation (10) implies that the growth rate, $\lambda_t = y_{t+1}/y_t$ is declining in the degree of social polarization. Hence, along the equilibrium transition path, before the economy is in steady state, social polarization is decreasing and the growth rate is increasing. Combining (7), (8) and (9) yields the following implicit characterization of the evolution of social orientation along interior points on the equilibrium

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at school. We briefly discuss the possible influence of individual parental output in Section 6.

transition path, where $\Delta_t > \Delta_{t+1}$:

$$C`(\text{½}(\Delta_t - \Delta_{t+1})) + \delta D`(\Delta_{t+1}) / [1 + D(\Delta_{t+1})] = 0 \qquad (11)$$

A steady state is characterized by setting $\Delta_t = \Delta_{t+1}$ in (11)

$$C`(0) + \delta D`(\Delta) / [1 + D(\Delta)] = 0 \qquad (12)$$

which condition is both sufficient and necessary provided $\underline{\Delta} > 0$,[16] and provided Δ_0 is too large to be a steady state, which holds when

$$C`(0) + \delta D`(\Delta_0) / [1 + D(\Delta_0)] < 0 \qquad (13)$$

Uniqueness then follows by differentiating (11), from which $0 < d\Delta_{t+1}/d\Delta_t < 1$.[17] Under these conditions the steady state is unique, and does not depend on initial conditions.

Proposition 1. If $\Delta_0 > \underline{\Delta} > 0$ and Δ_0 is not a steady state then

(a) Social differences diminish and the growth rate increases along the equilibrium path.

(b) The equilibrium path converges to a unique steady state.

(c) Steady-state growth is inversely related to social differentiation in the steady state. [18]

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[16] Only if $\underline{\Delta} = 0$ and $C`(0) + \delta D`(0) / 2 \leq 0$ the economy converges to a non-interior steady state at $\Delta = 0$ without social differentiation.

[17] $d\Delta_{t+1}/d\Delta_t = C'' / [C'' - 2\delta(D''(1 + D) - (D')^2) / (1 + D)^2]$. Strict inequalities hold if C is strictly convex and D is strictly decreasing.

[18] Note that although the model we use generates endogenous growth, this is not essential for the core of the analysis. By setting the elasticity of output with respect to human capital less than one, a similar model could be formulated in which polarization had an inhibiting effect on transitional growth rates and steady state output.

Proposition 1 recalls Bénabou's (1996) analytical result that heterogeneity in productivity under decentralized schooling can be detrimental to growth. It is also related to Borjas' (1992) empirical finding, that human capital accumulation is affected by ethnic externalities. Drawing on these findings, Proposition 1 suggests the testable hypothesis that educational and wage differentials among different ethnic groups diminish across generations.

Total differentiation of equation (12) implies that the degree of polarization in the steady state is inversely related to the incremental psychic cost of the distance between parent and child and varies directly with the incremental material cost of the social distance between members of the same cohort. This suggests that religious differences, which have a strong personal significance, but generally have less impact on economic transactions, are more likely to be preserved in separate school systems, while language differences, which are of greater economic significance, and possibly of less personal significance, are more likely to be erased.

Note that in taking individual productivity as determined by an average measure of social heterogeneity we implicitly assume that all interactions in the economy are equally likely. But this might not always be the case. In the extreme, under complete social exclusion, individuals might be constrained to deal only with members of their own group, in which case there would be no incentive for cultural convergence and children would fully retain their parents' cultural identities. This raises an important set of issues on the relation between economic and social incentives for social integration or segregation, for openness or exclusion.[19] While these issues lie outside the scope of this paper, our approach provides a convenient framework for their consideration, as we indicate in the Appendix.

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[19] For some papers dealing with these issues see Borjas (1995), Cutler and Glaeser (1997), Lazear (1999) and the references therein. On the importance of ethnic ties as a determinant of international trade see Greif (1993) and Kotkin (1992).

4 Efficiency

We next examine the welfare implications of decentralized schooling. As an efficiency benchmark, consider the Pareto–optimal trajectory of social orientation of schooling, p_{it+1}, and investment in instrumental human capital, h_{it+1}, subject to a balanced budget constraint in each period. Because of the inherent symmetry between the two groups and the uniformity of households within groups we limit our attention to Pareto-optimal allocations that have these properties, i.e., that are uniform within social groups and symmetric around ½. All individuals will then have the same amount of instrumental human capital in each period, and income will evolve according to the following equation:

$$y_{t+1} = A\, h_{t+1}\, \Pi(p_{rt+1},\, p_{gt+1}) \;=\; A\, h_{t+1}\, [1 + D(\Delta_{t+1})]\, /\, 2 \tag{14}$$

Note that one's utility is affected by the actions of other individuals in one's cohort, but not by the future actions of the next generation.[20] This absence of intertemporal dependence implies that efficient allocations can be characterized by independent maximization of utility in each period,

$$U_t = \; \log(c_t) - C\,(½\,(\Delta_t - \Delta_{t+1})) \;+\; \delta\log(y_{t+1}) \tag{15}$$

subject to (4) and (14). Solving this, we obtain that socially optimal accumulation of human capital is given by:

$$h_{t+1} = [\delta/(1+\delta)]\, y_t \tag{16}$$

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[20] This would not be the case if individuals derived utility from the utility of their offspring, in which case utility could only be derived as the solution of a differential equation (cf. Loury, 1981). Our assumption that individuals

and the intertemporal evolution of social orientation at interior points is given by

$$\tfrac{1}{2}\, C`(\,\tfrac{1}{2}\,(\,\Delta_t - \Delta_{t+1}\,)\,) \;+\; \delta D`(\Delta_{t+1}) \,/\, [1 + D(\Delta_{t+1})] \;=\; 0 \qquad\qquad (17)$$

Comparing the socially optimal solution to the equilibrium transition path under sectoral schooling we observe that polarization is reduced more slowly under sectoral schooling. Thus under sectoral schooling polarization is excessive and hence growth is slower in each period, compared to the optimal path. Employing the same mode of analysis used in the previous section, and recalling (11), we find that the optimal steady state, Δ^*, is unique (provided $\underline{\Delta} > 0$ and Δ_0 is too large to be a steady state) and characterized by:

$$\tfrac{1}{2}\, C`(0) \;+\; \delta D`(\Delta^*) \,/\, [1 + D(\Delta^*)] \;=\; 0 \qquad\qquad (18)$$

where $0 < \Delta^* < \Delta_0$. Comparing this to the steady state under decentralized schooling reveals that the optimum steady state is characterized by less polarization and stronger growth.[21]

The reason for the inefficiency of decentralized schooling is that each community when making its educational decisions disregards the benefits to the rival community of achieving less polarization in the next generation. The optimal path described by (17) can be interpreted as a regime of coordinated decentralized schooling, in which a varied curriculum reflecting the respective social preferences of the two communities is centrally regulated so as to avoid excessive polarization. To sum up,

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derive utility from their offspring's income greatly simplifies the exposition, and is commonly used in political economy analyses of educational systems.

[21] When $\underline{\Delta} = 0$, schooling is uniform in the optimal steady state $(\Delta^* = 0)$ if $-C`(0) / D`(0) < 2\delta$. Thus we have that decentralized schooling system converges to a polarized steady state though uniformity in the steady state is socially optimal when $2\delta > -C`(0) / D`(0) \geq \delta$. The opposite cannot hold: if the decentralized steady state is uniform then that is also the steady state of the optimal trajectory.

Proposition 2. If $\Delta_0 > \underline{\Delta} > 0$ and Δ_0 is not a steady state then decentralized schooling results in excessive polarization and slower growth in each period than could optimally be achieved through coordination, and the decentralized steady state is characterized by excessive polarization and slower growth compared to the optimum.

5 Political implementation

The above analysis indicates an important normative role for government education policy in coordinating a reciprocal homogenization of sectoral school systems; however, this may be difficult to achieve. One type of difficulty, which we do not explicitly pursue here, arises because agreements between sectors regarding the dynamic evolution of curriculum content must be difficult to formulate and monitor with any precision.[22] Here we focus on another type of difficulty that arises in a polarized context in which all agents are identified with one group or another: the absence of an impartial enforcement agency. When this is the case, the cultural orientation of the education system is shaped by political action reflecting the balance of political power as it is mediated by institutional factors.[23] This leads us to ask specifically how might the parameters of the political process shape education policy under representative democracy with legislative bargaining, and compare its results to decentralized schooling and to the Pareto–optimal trajectory absent political constraints.

Clearly, much depends on the details of the political process, and these can be modeled in more than one way. One approach in the literature on legislative bargaining has

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[22] In this light, the common decision of governments to provide socially uniform schooling, rather than coordinated sectoral diversity, might be viewed as a "second-best" response within these constraints. A related difficulty arises when the central government is too weak to control a centralized school system. The relatively recent emergence of modern regulation of schooling by the state, in the second half of the 18th century, can be viewed as a by-product of the emergence of strong central governments.

[23] The evolution of educational structures in Europe in the 19th century is telling in this regard, frequently marked as it was by bitter struggles between church and state (Green, 1990).

the ruling coalition—say, the winning majority—gaining maximal power and capturing the entire surplus (e.g., Riker, 1962, and Baron and Ferejohn, 1989). In contrast, Weingast et al. (1981) develop a "universalist" framework in which the minority retains some bargaining power and is able to secure some of the surplus. We examine the potential benefits and failings of centralized education under both sets of assumptions. The reduced form approach to legislative bargaining adopted below follows that of Coate (1997) and Besley and Coate (1998), who employ it to study issues in fiscal federalism.

5.1 A formal framework

Assume there is a government that decides the size of the education budget and the social orientation of the two sectoral school systems in each period. In this approach, state schooling is perceived as an alternative to pure sectoral schooling as described in the previous section.

Let τ_t denote the tax rate in period t. Then if all tax revenues are used to provide a uniform level of schooling, it follows immediately from our assumption of logarithmic preferences that all households desire the same tax rate $\tau_t = \delta/(1+\delta)$. Assume further that government consists of a representative of each of the two groups, and that decisions on the orientation of schooling are reached through a bargaining process between them in which the first move is a policy proposal comprising a pair of social orientations—one for schools of the proposer's own constituency, another for those of the rival constituency. The outcome of the process will then depend on the relative bargaining power of the two sides, and more specifically on the ability of the first mover to impose her will on the other side. We examine two extreme possibilities in this regard: first, that she has the coercive power to force the other side to accept her proposal; then that she possesses no such power, so that the rival sector can opt out of the public school system, receive a tax credit and set up a school system of its own. The equal size of the two groups leads us to assume that ex ante each representative has an equal

probability of being the first mover.

5.2 The proposer has coercive powers

Assume the proposer has coercive powers, and can impose the policy of her choice on the other side. Clearly, she will then select her own social orientation for her own school system, and offset the social orientation of the other group so as to maximize its productivity; say the proposer represents the red community, then she will set $p_{rt+1} = p_{rt}$ and $p_{gt+1} = p_{rt} + \underline{\Delta}$. Ex ante, there is equal probability that the social orientation of the economy in the next period will be p_{rt} or p_{gt}. The expected utility of all parents is therefore the same, and equals[24]

$$U_t^c = \log[y_t/(1+\delta)] - \tfrac{1}{2} C(\Delta_t - \underline{\Delta}) + \delta \log[A (\tfrac{1}{2} + \tfrac{1}{2} D(\underline{\Delta})) y_t \, \delta / (1+\delta)] \tag{19}$$

Clearly, once adopted, centralized education is preferable to the decentralized system in all future generations. However, for the parent generation making the switch it involves, ex ante, the risk of a greater generation gap than it would have chosen under the decentralized system. This sacrifice is worthwhile if the added psychic loss is outweighed by the material gain to the next generation. Comparing (19) with utility under decentralized schooling described by (11) we observe that centralization maximizes children's income but inflicts a greater psychic cost on parents. This loss is further exacerbated by political uncertainty. All parents would be better off if they could agree that whoever makes the first move proposes school curricula symmetrically located at a distance of $\underline{\Delta}/2$ from the midpoint of the unit interval. Utility would then equal

$$U_t^m = \log[y_t/(1+\delta)] - C(\tfrac{1}{2}(\Delta_t - \underline{\Delta})) + \delta \log[A y_t (\tfrac{1}{2} + \tfrac{1}{2} D(\underline{\Delta})) \, \delta/(1+\delta)] > U_t^c \tag{20}$$

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[24] As $p_{rt} = \tfrac{1}{2} - \tfrac{1}{2} \Delta_t$ the red first-mover sets $p_{gt+1} = \tfrac{1}{2} - \tfrac{1}{2} \Delta_t + \underline{\Delta}$, and as $p_{gt} = \tfrac{1}{2} + \tfrac{1}{2} \Delta_t$, $p_{gt} - p_{gt+1} = \Delta_t - \underline{\Delta}$.

where the inequality follows from the convexity of *C*. Compared to the optimal path without political constraints derived in Section 4, the centralized solution induces overly rapid convergence to complete uniformity thus imposing excessive psychic cost on the parents.[25] Summing up,

Proposition 3. When the government has coercive powers centralization leads to more uniform schooling and faster income growth than under decentralization, but this is achieved only through greater expected psychic cost for parents, compounded by the disadvantages of political uncertainty. Hence, ex ante, centralization with coercion is strictly inferior to the unconstrained Pareto optimum and may or may not be preferred to decentralized schooling.

5.3 The proposer lacks coercive powers

At the other extreme, assume that the second mover can reject the first-mover's proposal, receive a tax credit and set up a school system of its own. In this case, we must further specify the type of uncoordinated equilibrium that obtains after rejection. Suppose, first, that upon rejection of the offer the two groups revert to the decentralized equilibrium described in section 3. Logarithmic preferences imply that the accumulation of human capital proceeds independently of the chosen social orientation and is determined as in (6). Furthermore, since decentralized education is the worst outcome guaranteed, centralization must perform better in this case, implying that in each period expected social polarization must be smaller than it would be under decentralization.

      Now consider an alternative setting, in which the first-mover's constituency is committed to the social orientation it proposed even when its offer is rejected and the rival group

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[25] This follows from (20) because U_t^m is less than the utility achieved in the symmetric Pareto efficient solution.

establishes its own sectoral school system. The first mover then makes her proposal anticipating the optimal response of the other side. The outcome in this case will consist of a pair of social orientations that are in Stackelberg equilibrium in each period. To fix ideas, assume the red representative is the leader and the green representative is the follower. Utility maximization by the green representative yields the following first order condition:

$$C`(p_{gt} - p_{gt+1}) + \delta D`(|p_{gt+1} - p_{rt+1}|) / [1 + D(|p_{gt+1} - p_{rt+1}|)] = 0 \qquad (21)$$

which implicitly determines her reaction function to the choice of social orientation by the red representative, $p_{gt+1}(p_{rt+1})$. Differentiation reveals that $0 < dp_{gt+1} / dp_{rt+1} < 1$.[26] Maximizing the utility of the reds with respect to their choice of social orientation, while taking the green response into consideration, yields:

$$C`(p_{rt+1} - p_{rt}) + \delta D(|p_{gt+1} - p_{rt+1}|) [1 - dp_{gt+1}/dp_{rt+1}] / [1 + D(|p_{gt+1} - p_{rt+1}|)] = 0 \quad (22)$$

Equations (21) and (22) jointly determine the equilibrium choice of social orientations, p_{rt+1} and $p_{gt+1}(p_{rt+1})$. Comparing this solution to the decentralized outcome in (11), we observe that the psychic cost incurred by the red parents is smaller, and the psychic cost incurred by the green parents is larger than that incurred by both types of parents under decentralized education. It should also be obvious that red parents' utility is higher than under decentralization (they could mimic the decentralized outcome, but prefer not to); and green parents' utility is smaller than under decentralization because of the adverse effect of the more polarized position taken by the reds.

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[26] $dp_{gt+1} / dp_{rt+1} = \delta [(D'' (1+D) - D`^2] / [-C''(1+D)^2 + \delta(D''(1+D) - D`^2]$

Ex ante—not knowing whether one's group will move first or second—this type of centralized solution provides households with less expected utility than does decentralized schooling. To see this, note that if the red parents have the first move they will position their children closer to their own orientation than in a decentralized equilibrium. Analysis of the reaction function then reveals that the green parents will respond by also moving closer to the position of the red parents, but since $dp_{gt+1}/dp_{rt+1} < 1$, the net result of these moves will be an increase in social polarization. Therefore social polarization in each period must be higher under centralization than under decentralized schooling. This implies that in terms of expected utility the decentralized solution is welfare superior even under linear utility; as the utility function is concave, the political uncertainty associated with centralization further reinforces this conclusion. To sum up,

Proposition 4. When the proposer lacks coercive power, the comparison between decentralized and centralized education systems hinges on the ability to precommit. In the absence of pre-commitment, centralization leads to a less polarized society and is welfare superior to decentralized schooling. However, when the first-mover is able to precommit, centralization results in a more socially divided society and is ex ante inferior to decentralization.

6 Extensions

In this section we consider the implications of relaxing some of our simplifying assumptions. We first allow the two groups to be of different size, then examine the case of non-logarithmic utility and finally consider the effect of incorporating private education.

6.1 Different group sizes

Suppose that the two communities differ in size, so that, say, the green group is bigger. Let q_g denote the size of the green group, and let $q_r = 1 - q_g$ be the size of the red group. All other assumptions are unchanged. Following the line of analysis in Section 3, we obtain that in equilibrium under decentralized schooling,

$$\Pi(p_{jt+1}; \boldsymbol{p}_{t+1}) = q_j + (1 - q_j) D(\Delta_{t+1}) \tag{23}$$

Next period income is then identical within each group, but—in contrast to the fully symmetric case—differs between groups:

$$y_{jt+1} = A \, [\delta/(1+\delta)] \, [q_j + (1- q_j) D(\Delta_{t+1})] \, y_t \qquad\qquad j = r,g \tag{24}$$

The derivative of utility with respect to social orientation is now:

$$dU_t / dp_{jt+1} \;=\; C`(| p_{jt} - p_{jt+1}|) \;+\; \delta(1\text{-} q_j)D`(\Delta_{t+1}) \, / \, [q_j + (1- q_j) D(\Delta_{t+1})] \quad j = r,g \tag{25}$$

As the second term in (25) is a decreasing function of q_j, it follows from the convexity of C that the more populous a group the fewer social concessions it will make towards the rival group, and the closer will be the social content of its curriculum to parental social orientation. First-order conditions determining the evolution of social orientation, are given by:

$$C`(| p_{jt} - p_{jt+1}|) \;+\; \delta(1 - q_j)D`(\Delta_{t+1}) \, / \, [q_j + (1- q_j) D(\Delta_{t+1})] \;=\; 0 \qquad \text{for } j = r,g \tag{26}$$

In contrast to the symmetric case, the larger green group may reach a culturally stationary point

while the red group continues to move towards it, if

$$C`(0) + \delta(1-q_g)D`(\Delta_{t+1}) \leq 0 = C`(|p_{rt}-p_{rt+1}|) + \delta(1-q_r)D`(\Delta_{t+1})/[q_r+(1-q_r)D(\Delta_{t+1})] \qquad (27)$$

The two groups are in steady state in terms of their social orientation if

$$C`(0) + \delta (1- q_j)D`(\Delta_{t+1}) / [q_j + (1- q_j) D(\Delta_{t+1})] \leq 0 \qquad \text{for } j = r,g \qquad (28)$$

Total differentiation of the first order conditions reveals that social polarization (in the next period) is maximal when the two groups are of equal size.[27] Combining this with (24) we find that the growth rate

$$y_{t+1}/y_t = A[\delta/(1+\delta)] [q_j^2 + (1- q_j)^2 + 2q_j(1- q_j)D(\Delta_{t+1})] \qquad (29)$$

is slowest when the two groups are of equal size.[28] Similarly, when the two groups are in steady state, satisfying equation (28), polarization is again inversely related to differences in group size, so that in the steady state, too, polarization is maximal and growth minimal when the groups are of equal size.[29] Thus, we have

Proposition 5. Under decentralized schooling when the groups differ in size, polarization in each period is smaller and growth is faster than when they are of equal size, and a similar conclusion holds for the steady state.

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[27] $d\Delta_{t+1}/dq_j = 0$ when $q_j = \frac{1}{2}$. Detailed derivations are available on request.

[28] Differentiation of (27) yields $d(y_{t+1}/y_t)/dq_j = 2A[\delta/(1+\delta)] [(1 - 2q_j) (D(\Delta_{t+1}) - 1) + q_j(1- q_j)D`(\Delta_{t+1})d\Delta_{t+1}/dq_j]$, which equals zero when $q_j = \frac{1}{2}$.

[29] Esteban and Ray (1999) prove a similar result in a related setting.

With unequal groups as with equal groups, there are external benefits to homogenization which are not taken into account in a decentralized school system. Consequently, here too, decentralization is inefficient, in the sense that a coordinated decrease in social polarization would benefit everybody, thus generalizing Proposition 2.

6.2 Non-logarithmic utility

Consider the implications of relaxing the assumption of logarithmic utility, positing instead a constant elasticity of substitution. Let

$$U(c_{it}, |p_{it} - p_{it+1}|, y_{it+1}) = (c_{it})^a/a - C(|p_{it} - p_{it+1}|) + \delta(y_{it+1})^a/a \tag{30}$$

for some $a \leq 1$; when $a > 0$ the elasticity of substitution less than one, and when $a < 0$ it is greater than one.[30] Substituting the budget constraint and using abbreviated notation we have, say for the red community:

$$U_{rt} = (y_{rt} - h_{rt+1})^a/a - C(|p_{rt} - p_{rt+1}|) + \delta(A\,\Pi(|p_{rt+1} - p_{gt+1}|))h_{rt+1})^a/a \tag{31}$$

from which it is clear that the choice of h_{rt+1} is no longer independent of the choice of p_{rt+1}.

Drawing a parallel with models of private investment, we can think of h as investment expenditure, $1/A\Pi$ as the price of investment goods, and $A\Pi h$ as the quantity of investment goods. Greater polarization, which raises the price of investment, then increases investment expenditure h when $a > 0$, and reduces it when $a < 0$. But increased polarization has an unambiguously negative effect on the quantity of investment $A\Pi h$, and hence a negative

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[30] The limiting case $a = 0$ is the logarithmic case considered in preceding sections.

effect on next period income. Thus the qualitative relation between polarization and growth is retained—more polarization implies less growth—but the quantitative relation is modified: the detrimental effect of polarization on growth is reinforced when $a < 0$, and dampened when $a > 0$.

6.3 Parental input

For simplicity, we have disregarded the interaction between centralized schooling and parental input in shaping the child's cultural orientation. In general, cultural orientation is a function both of values transmitted through formal schooling and of the home environment. To illustrate, consider household i in group j, and assume for simplicity that D is everywhere decreasing. Let s_{jt+1} denote the system of values transmitted through the curriculum of the formal educational system, and h_{it+1} the social orientation imparted by the home environment, with the child's social orientation an increasing and weakly concave function of both these two inputs:

$$p_{ijt+1} = f(s_{jt+1}, h_{it+1}) \tag{32}$$

It is reasonable to assume that the social content of the formal system, s_{jt+1}, is determined collectively, while the value system imparted through the home environment, h_{it+1}, is independently determined by individual parents. In general, the influence of the home environment will depend on the degree of complementarity or substitutability between the two inputs in shaping the child's cultural identity, that is, on the sign and magnitude of the cross-partial derivative $\partial^2 p_{ijt+1} / \partial s_{it+1} \partial h_{it+1}$. For example, when the two inputs are substitutes,[31] so that $\partial^2 p_{ijt+1} / \partial s_{it+1} \partial h_{it+1} < 0$, the influence of the home environment is likely to retard cultural

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[31] In the context of normative education, substitutability of communal and parental inputs—i.e., that cultural instruction in the home reduces the marginal impact of cultural instruction at school—seems at least as plausible as complementarity, which is commonly assumed with regard to instrumental schooling, where home instruction is assumed to increase the efficiency of school instruction (cf., Bénabou, 1993).

convergence as parents strive to instill their own culture heritage in their offspring. In particular, in the extreme case of uniform centralized education (i.e., when $s_{rt+1} = s_{gt+1}$), parents compensating for the excessive uniformity of public schooling by educating children in their own values will slow down the intertemporal convergence of values.

7 Notes on empirical application

While the empirical measurement of social interactions raises substantial issues (Manski, 2000), there is a significant body of systematic, quantitative evidence that attests to their economic impact: studies that develop explicit operational measures of social ties, trust, voluntarism and social participation, and relate them to economic performance.[32] One branch of this burgeoning literature uses cross-country regressions to identify a positive effect on growth of such dimensions of social capital as participation in voluntary associations, the degree of trust, and corruption (Knack and Keefer, 1997; Temple and Johnson, 1998; La Porta et al., 1998; Zak and Knack, 1998; among others). Another strand more closely related to the present analysis specifically focuses on the role of cultural diffraction within a society, and the destructive effects of ethnic strife. Contributions in this vein typically regress performance variables on measures of ethnolinguistic diversity, such as the percentage of a country's population belonging to its largest ethnic group, or the probability of two randomly drawn individuals belonging to different groups. Mauro's (1995) cross-country analysis finds that such heterogeneity adversely affects the quality of services provided by the central government and generates political instability. Easterly and Levine's (1997) analysis of a cross-section of countries similarly finds that it promotes corruption and rent seeking, and leads to inefficient policies resulting in poor infrastructure, a lack of financial institutions and low educational achievement. They estimate that a one-standard-deviation decrease in ethnic heterogeneity increases productivity per

worker by half a standard deviation, and growth by one third of a standard deviation, inducing a lag of more than 2% between the growth rates of the most heterogeneous and most homogeneous countries, Tanzania and Japan. This leads them to conclude that ethnic heterogeneity is the main source of backwardness in Africa, a finding which Easterly's (2000) more recent work corroborates, with the qualification that good institutions can mitigate its adverse effects.[33]

Other studies examine the effect of ethnic heterogeneity on the provision of public education—among other public goods—in a cross-section of U.S. communities, and find it has a negative impact (Alesina et al., 1999; Goldin and Katz, 1999). Poterba (1997) among many others, finds that racial heterogeneity negatively affects local public spending on education. Alesina and La Ferrara's (2000) evidence indicates that racial composition reduces the degree of participation in social activities, while Luttmer (1998) finds that welfare benefits are negatively related to racial heterogeneity. More directly, Glaeser et al. (1995) find that racial heterogeneity negatively affects US city growth; and DiPasquale and Glaeser (1996), using both U.S. and international data, show that ethnic diversity is a significant determinant of urban unrest.

Our emphasis on polarization implies that operational measures of the extent of ethnic fragmentation should reflect not only the ethnic distribution of the population ("the probability of two randomly drawn individuals being in the same group") but also the cultural distance between different groups.[34] When fragmentation is linguistic, the extent to which different

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[32] This work is strongly influenced by the conceptual work of Coleman (1988), Fukuyama (1990 and Putnam (1993), among others.

[33] These findings are also supported by detailed case studies of the African experience that voice concern over the inadequacy of education in ethnically diverse African countries (Babs Fafunwa and Aisiku, 1982). More recently, Miguel (1999) reports that primary schools in ethnically diverse districts in western Kenya are sharply underfunded and have poor facilities. On the importance of institutions for mitigating ethnical strife see also Collier (1998).

[34] In this spirit, Wu's (1999) analysis of growth in sub-Saharan Africa replaces the standard measure of ethnolinguistic fragmentation based on the *Atlas Narodov Mira* (1964; reprinted in Taylor and Hudson. 1972) with a measure of ethnic fractionalization based on work by Morrison et al. (1989) that takes into account the degree of cultural differences between groups. She finds that this measure has a statistically significant effect on growth where the previously used measure does not. The axiomatic approach of Esteban and Ray (1994) yields

languages are mutually intelligible is significant—compare the close affinity between Russian and Ukrainian to the dissimilarity between Russian and Estonian—as is the proportion of people sharing an external common language, say, English in India. When fragmentation derives from religious differences, distance might be measured by the severity of religious strictures that limit social contact between the groups, such as dietary laws, dress codes, rules of personal hygiene or other factors. In a more general context, the extent of intermarriage between groups might be used as a measure of social proximity (cf. Bisin and Verdier, 2000), as might the extent of residential integration.

8 Concluding remarks

Public education has been, since its inception, an important socializing force. Working to build common norms, it facilitates interaction between members of a society who differ in their cultural or religious backgrounds. As such, it has often played a key role in forging national identities and establishing centralized governments. Empirical research that ties economic performance to political stability and social homogeneity suggests that this has important economic implications, which we examine in this paper analytically.

We define a model of endogenous growth in which education plays a dual role: building human capital and determining social orientation. These two dimensions interact in that the productivity of human capital is adversely affected by social polarization. We show that decentralized education in which different social groups operate independent, uncoordinated school systems, and separately determine the social content of their school curricula, leads to excessive polarization and hence less than optimal growth. The optimal trajectory involves a gradual, reciprocal convergence of social orientation towards the middle ground.

a set of polarization measures that are sensitive to the degree of cultural preferences, which have not yet been

We recognize that such a trajectory may be difficult to implement in a political context in which all agents are identified with one group or another, and examine the possible outcomes of legislative bargaining over curriculum content in a representative democracy. In this context, we show that centralization of schooling may result in excessive polarization in some cases and overly rapid homogenization in others, depending on the coercive powers of government and on its ability to precommit. Thus while centralized schooling holds out a potential for Pareto–improvement of welfare, the ability to realize its advantages is not assured and depends on political circumstances.

There are several avenues for further extension and application of this approach, which we touch upon briefly here. Possible theoretical extensions include endogenizing the segregation of social groups, and adding institutional detail to the political process. Empirically, the current approach can be applied to better measurement of the contribution of education to growth, by conditioning it on cultural and religious divisions; and to positive analyses of observed patterns of public involvement in education. It suggests a shift in emphasis from diversity to polarization, looking not only at the number and size of different ethnic groups but also at the cultural distance between them. In addition, several testable hypotheses have been indicated regarding the narrowing of ethnic wage differentials form one generation to the next, and the indication that religious divisions are more likely to persever in the steady state than cultural divisions. On a normative plane, our analysis indicates that the design and assessment of school reforms must take into account their impact on the socializing role of education, in addition to their effect on scholastic achievement. Education vouchers are a case in point. Popular support for vouchers is most often based on their offering better access to high-quality education, especially to children of disadvantaged

applied empirically, to the best of our knowledge.

families.[35] However, their impact on social cohesion may be no less important, else gains from better scholastic performance may be outweighed by losses from increased social fragmentation.

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[35] See Chubb and Moe (1990) for a comprehensive argument in favor of vouchers, and Frey (1992) for an opposite view. Fears that widespread use of vouchers will promote racial segregation are often voiced, however Coleman (1990) observes that segregation is greater in public schools, and Petersen (1999) argues that vouchers have the potential to improve socioeconomic and racial integration, if they are sufficiently generous and prohibit discrimination in admissions. West (1997) surveys the international evidence on vouchers.

Appendix: Microfoundations of productivity under cultural diversity

Here we add formal detail to the microfoundations of the productivity function $\Pi(p_{it}; \mathbf{p}_t)$ described in more general terms in the text. It is based on the premise that the likelihood of cooperation between individuals is a decreasing function of the cultural distance between them, though the benefits of cooperation, once achieved, may increase with the diversity of their cultural backgrounds.

To fix ideas, assume that individual production requires successful economic transactions with randomly encountered individuals in one's cohort, and that each period comprises a large number N of opportunities for such encounters. Success in these encounters depends on the cultural distance between individuals: for any two individuals i and k, $\theta(|p_{it} - p_{kt}|)$ denotes the conditional probability of a successful transaction between them, having encounteres each other, where $\theta(0) = 1$ and $\theta(1) = 0$, and θ is decreasing and concave. Denote by F_t is the cumulative distribution function of social orientation in period t . Then $\int_0^1 \theta(|p_{it} - p_{kt}|)dF_t(k)$ is the probability of individual i conducting a successfully transaction in any given opportunity, which is generally less than one, indicating a positive probability that i does not take advantage of all of its opportunities to produce output.

In a successful encounter between i and k each invests $1/N$ of her human capital in producing a common output $A\ \phi(|p_{it} - p_{kt}|)\ (h_{it} + h_{kt})\ /\ N$, where ϕ is a weakly increasing, concave function with $\phi(0) = 1$ to which we shall refer as the conditional productivity of a transaction between i and k. As all individuals within a cohort are endowed with the same amount of human capital, h_t, it is reasonable to posit that i and k divide their joint output

equally, each obtaining $\phi(|\ p_{it} - p_{kt}|)\ Ah_t\ /N$ from their successful encounter.[36] When the number of opportunities in each period is large, individual i's output in period t is closely approximates by its expected output:

$$y_{it} = \int_0^1 \theta(|\ p_{it} - p_{kt}\ |)\phi(|\ p_{it} - p_{kt}\ |)dF_t(k)Ah_t \tag{A1}$$

The product $\theta(|\ p_{it} - p_{kt}\ |)\phi(|\ p_{it} - p_{kt}\ |)$ corresponds to the function $D(|p_{it} - p_{kt}|)$ in the text, and the integral $\int_0^1 \theta(|\ p_{it} - p_{kt}\ |)\phi(|\ p_{it} - p_{kt}\ |)dF_t(k)$ to the function $\Pi(p_{it};\mathbf{p}_t)$. Thus productivity reflects a balance between two opposing forces: the probability of a successful transaction, which is decreasing in social distance, and its conditional productivity, which may be increasing. The derivative of D is

$$D' = \theta'\phi + \theta\phi' \tag{A2}$$

which is negative if and only if the elasticity of the probability of a successful transaction as a function of social distance is smaller in magnitude than the elasticity of the conditional productivity gain from cultural diversity. We assume that this holds in the relevant range. (It follows from (A2) and from our assumptions on θ and on ϕ that $D'(1) < 0$, so it must be negative for sufficiently large values of social distance.) Taking the second derivative of D, we have

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[36] For example, assuming CES production in which the differentiation of inputs varies directly with social distance, we can write $y_{it} + y_{kt} = A[(h_{it}\ /\ N)^{1/\ g(|p_{ik} - p_{kt}|)} + (h_{kt}\ /\ N)^{1/\ g(|p_{ik} - p_{kt}|)}]^{g(|p_{ik} - p_{kt}|)}$ for some increasing g such that $g(0) = 1$. Then $h_{it} = h_{kt} = h_t$ implies that $y_{it} = A2^{g(|p_{it} - p_{kt}|)-1}h_t$ and if $g''/g' < - \ln2$ then y_{it} is an increasing, concave function of $|\ p_{it} - p_{kt}\ |$.

$$D'' = \theta''\phi + 2\theta'\phi' + \theta\phi'' \qquad\qquad (A3)$$

which must be negative from our assumptions on θ and ϕ. Thus D is a concave function of cultural distance. With the population divided into two equal groups with social distance Δ_t between them,

$$y_{it} = \tfrac{1}{2}\,Ah_t\,[1+\,\theta\,(\Delta_t)\phi(\Delta_t)] = \tfrac{1}{2}\,Ah_t\,[1+D\,(\Delta_t)] \qquad\qquad (A4)$$

These microfoundations can also provide a framework for an explicit analysis of social exclusion. While a full-fledged analysis deserves a separate paper, some simple principles can be illustrated here. Equation (A1) gives the value of output under full social integration, when individuals are equally likely to encounter individuals of either group. When complete segregation permits individuals only to interact within their own social group the level of individual output is

$$y_{it} = Ah_t \qquad\qquad (A5)$$

Comparing (A4) and (A5), we note that social integration leads to a higher level of output when $\theta\,(\Delta_t)\phi(\Delta_t) > 1$, which is more likely to be satisfied when polarization is small than when it is large, suggesting that when social divides are especially sharp, physical separation may offer economic advantages. From a dynamic perspective, initial conditions in which $D(\Delta_0) < 1$ pose households with a choice between segregation immediately increasing average productivity to $D(0) = 1$, and the short term productivity loss and dilution of cultural identity necessary to achieve gradual convergence to a higher rate of productivity at some steady state where $D(\Delta) > 1$.

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FIGURE 1: The dynamics of social orientation under decentralized schooling