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CHAPTER 1

A Brief Overview

The conception of social justice held by many, perhaps most, citizens of the Western democracies is that of equality of opportunity. Exactly what that kind of equality requires is a contested issue, but many would refer to the metaphor of 'leveling the playing field,' or setting the initial conditions in the competition for social goods so as to give all, regardless of their backgrounds, an equal chance at achievement. A central institution to implement that field leveling is education, meaning education that is either publicly financed or made available to all at affordable costs. Currently the political institution of choice is democracy, which is implemented by competitive political parties, ones that may freely form and enter that competition, representing different interest groups in the polity.

It is thus incumbent upon a social scientist who is concerned with inequality to ask: Will democracy succeed in organizing political competition around the issue of public education, so as to implement, over time, policies that will engender equality of opportunity? This publication asks whether the central contemporary measure of *social justice* will be achieved through the main contemporary *political mechanism* through its manner of financing the *educational institution*.

The two main sources within a country of inequality of opportunity are the different family backgrounds from which children come, and their differential native abilities. Here I wish to concentrate upon social inequalities, and so in the models that I examine, it is assumed that all children have the same native talent. Differences in the achievements of children when they become adults will be due solely to two factors:

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their different family backgrounds, and the quality of education that they enjoy (which will have been publicly funded through taxation). To be more precise, I will address the formation of human capital, or income-earning capacity, in children through educational investment.

The data for the models that I study must specify the following: the distribution of endowments of families, the technology of education, the preferences of citizen-voters, the institutions of political competition, and the concept of political equilibrium.

A family will consist of an adult and a child, and it will be characterized by the *level of human capital*, or wage-earning capacity, of its adult member. That is its sole endowment. Thus, a society at any given date is characterized by a distribution of human capital of its adult members. It will be assumed that each adult cares about two quantities: the consumption level of the family and the future human capital of his or her child when he or she has finished the educational process and becomes an adult. In particular, adults do not value leisure, and so it will be assumed that every adult produces a fixed income, independent of what taxation will be imposed, equal to the adult's level of human capital. We will in fact assume that adults have simple, Cobb-Douglas preferences over these two quantities, consumption and the future human capital of the child.

We will study two different educational technologies. First, we postulate that the level of human capital a child will come to have is an increasing function of two variables: his parent's level of human capital and the amount invested in his education. We think of the influence of parental human capital as occurring through 'family culture,' something that we do not model in any more detail. With this first technology, the earning capacity of a child is thus determined entirely locally – by family background and investment in the child. (Later, we will examine a technology in which there are external [global] effects.) Because of the influence of family culture on the future earning capacity of the child, if one wished to equalize the earning capacities of children from different families, more would have to be invested in the education of children from poorer families. We take an optimistic view, that such equality of outcomes could always be achieved with a sufficiently large investment in the education of the more disadvantaged child. In

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particular, we will assume that the educational technology is also of the Cobb-Douglas form, with respect to the two inputs of parental human capital and educational investment; it is given by

$$h' = \alpha h^b r^c,$$

where h is the human capital of the parent, r is the educational investment in the child, and h' is the level of human capital the child will come to possess.

The political institution that we model is party competition, where parties form endogenously to represent the two elements of a partition of the polity. Indeed, we assume that there will be only two parties, one representing all those citizens whose human capital is below some value, and the other, all other citizens. Thus, democracy is modeled as a competition between the (relatively) poor and the (relatively) rich. Parties compete over the size of the budget used to fund education, the allocation of that budget to the education of children classified by their 'type,' that is, the human capital of their family, and the redistribution of post-tax income among families.

The main innovation of this publication is its attempt to model political competition as 'ruthless,' or having very few restrictions on the proposals that parties can make with regard to these policies. Denote by h the human capital of the adult in a family, and suppose that the support of the distribution of human capital, at the date in question, is the positive real line, and that h is distributed according to a probability measure F whose mean is μ. Then a policy will consist of two functions, $r : \mathbb{R}_+ \to \mathbb{R}_+$ and $\psi : \mathbb{R}_+ \to \mathbb{R}_+$ where $r(h)$ is the amount to be invested in the child from an h family, and $\psi(h)$ is the after-tax income of an h family. The sole restrictions on these functions is that they be continuous and satisfy:

$$\int X(h)dF(h) = \mu \tag{1.1}$$

$$0 \le X'(h) \le 1 \tag{1.2}$$

where $X(h) \equiv r(h) + \psi(h)$. Equation (1.1) is the society's budget constraint, and Equation (1.2) puts restrictions on the upper and lower bounds of the derivative of the 'total resource bundle' going to families,

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when these derivatives exist. Thus, parties are not restricted to choose affine consumption or investment policies, or indeed policies restricted to be of any parametric form.

We adopt this approach of working on a very large policy space (one which is infinite dimensional) in order to model the idea that there are no holds barred in the competition between citizen coalitions represented by parties, except those stated by the continuity of these policy functions, and the limitations on the derivatives of Equation (1.2). We do this because our interest is in examining *democracy*, and that examination would be truncated if artificial restrictions were to be placed on democratic competition. Indeed, what emerges from our analysis is that the policies proposed by parties in equilibrium are *piece-wise linear* ones, and this accords very well with reality because tax policies in almost all advanced democracies are, indeed, piece-wise linear.

The conceptual problem that we face is to propose a theory of political equilibrium in which equilibria will exist, when parties do compete on such large policy spaces. The classical model of political competition (due to Harold Hotelling and Anthony Downs) only possesses equilibria for two-party competition when the policy space is *uni*dimensional. So something else is needed. Here, we use a modified version of the *party-unanimity Nash equilibrium* that I introduced in earlier work (see Roemer, 1999, 2001). This equilibrium concept is introduced in Chapter 2. Parties are modeled as consisting of factions that bargain with each other in the face of competition from the other party. The factions represent the conflict between those who wish to use the party as a vehicle to winning power (the 'Opportunists') and those who view it as an instrument for representing constituency interests (the Reformists and Militants, or Guardians). An equilibrium is, roughly speaking, a pair of policies – one for each party – each of which is a solution of the bargaining problem facing the factions in one party, *given* the policy being proposed by the other party. Indeed, this equilibrium concept uses two ideas of John Nash – his bargaining solution and his non-cooperative equilibrium concept.

The fortuitous result is that, because of the divided interests of those who formulate party policy (that is, the various factions), equilibria exist in the party-competition game, even though the policy space is very large. Thus, our approach 'solves' the problem afflicting the

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Hotelling-Downs model of the non-existence of equilibrium for multi-dimensional policy spaces. Indeed, there are *many* equilibria of our model – too many, one might say – a two-dimensional set (or manifold) of them. Each equilibrium is associated with a different pair of numbers that summarize the relative strengths of the bargaining factions in the two parties. Thus, we may view the model's missing data as the relative bargaining powers of the internal party factions. How we deal with this multiplicity of equilibria will be described below.

Let us suppose, for the moment, that we can single out a unique equilibrium at a certain date, given the data of the problem, which consist of the distribution of human capital across families (their adults), adult preferences over policies, and the technology of education. We can then state our full problem as follows. Suppose that time begins, at date zero, with an initial distribution of human capital, F^0. Parties form, and an equilibrium in the party-competition game exists – by supposition, we have chosen one uniquely. According to the model, one party wins the election, but this is a stochastic event because the equilibrium concept only specifies the probability that each of the two parties wins the election. The victorious party implements its policy, including, in particular, its policy of education finance. Thus, for example, if the Poor and Rich parties proposed equilibrium policies (r^P, ψ^P) and (r^R, ψ^R) and party P wins, then it implements its educational finance policy, which means it invests, after taxation, amount $r^P(h)$ in every child from an h-human capital family, and this for every h.

Chapter 3 is devoted to the definition and characterization of the set of equilibria of the political model at a single date. This is where it is shown that, in equilibrium, parties always propose piece-wise linear functions for the policy components.

Once we have specified a particular educational finance policy, then, via the educational technology, we have determined (with no random element) the human capital of every child when he or she becomes an adult. Thus, the distribution of human capital at date one is determined, call it F^1, subject only to the stochastic element of which party wins the election. Now the same model tells us what happens at date one. Parties form, an equilibrium in policies occurs, which determines (subject to the stochastic election element) a winner, and hence the distribution of human capital at date two, F^2.

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We now assume that this process continues for a very long time. This is a 'stochastic dynamic' process, leading to an infinite sequence of distributions of human capital: F^1, F^2, F^3.... Our question is: What happens to the degree of inequality of human capital over time? Does this sequence converge to an 'equal' distribution of human capital, or not? Does democracy eliminate the inequality associated with the different social backgrounds from which members of these dynasties come? This is the topic of Chapter 4.

We measure the degree of inequality in a distribution by its coefficient of variation, the standard deviation divided by the mean. Thus, if the coefficients of variation of the sequence $\{F^t\}$ approach zero as a limit, we say that democracy engenders equality in the long run. Indeed, we are interested in what happens to the ratios of human capital in any two dynasties. If these ratios *all* converge to unity, then equality of opportunity holds in the long run, in the sense that the imprint of the family background upon the human capital of future members of any dynasty eventually disappears.

Here I avoid the question of how we choose, at each date, a unique equilibrium from among the large set of equilibria that exist. I must be more specific at this point. One way of specifying a particular equilibrium is to specify where the *pivot* lies, which separates the polity into the poor and rich, and into the two parties, and once that is done, to specify the degree of *opportunism* or *partisanship* that characterizes the political competition. To study the dynamical question, I examine two intertemporal sequences of equilibria. In both sequences I fix the pivot at each date to belong to a single dynasty – for example, the dynasty that has the median value of human capital at all dates. I must remark that, in these dynamic processes, the rank of any given dynasty in the distribution of human capital remains fixed forever. Thus, if Smith occupies the median rank of human capital at date zero, then in all equilibria of the model, all of Smith's descendents will also occupy the median rank. Because children are modeled as all having the same internal talent, rank-switching over time never occurs in this model.

Having fixed a rank to characterize the pivot dynasty, I now examine two sequences of equilibria, which I call A and B. In the A sequence

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political competition is as opportunistic as it possibly can be, and in the B sequence it is as partisan as it possibly can be. That is, in A, the Opportunists are the ones who dominate in intra-party bargaining, and in B, the Militants or Guardians dominate in the bargaining. Indeed, in A, it turns out that at every date, both parties propose the same policy in equilibrium, that policy which is the ideal policy of the pivot voter. In B, parties propose policies that are different – indeed, as different as they ever will be in equilibrium.

It turns out that in both the A and B sequences, the coefficients of variation decrease monotonically over time. At least we can say that democracy has an equalizing effect on the distribution of human capital. But the results beyond this are quite different. In the A sequence, we prove that the limit coefficient of variation is always positive, that is, democratic competition will never entirely eliminate inequality of opportunity.

Analysis of the B sequence is more difficult; I do not have complete analytical results. However, simulations are useful, and indicate that the following is true: if the initial distribution F^0 is sufficiently skewed, then there is a *positive probability* that the limit coefficient of variation of the dynamic sequence is zero. If the initial distribution is not sufficiently skewed, then we prove that the coefficient of variation surely converges to a positive number. Indeed, strongly skewed means precisely the following: at date zero, if h^* is the human capital of the pivot, then the following is true:

$$\log h^* < \int \log h \, dF^0(h).$$

In sum, there is never a guarantee that democracy will engender equality of opportunity in the long run. The most we can say is that such an outcome will occur with positive probability if two conditions hold: that (1) political competition is sufficiently partisan as opposed to opportunist, and that (2) the initial distribution of human capital is 'strongly skewed.'

Analysis of the problem with the large policy space described here is difficult, relatively speaking, and so it is worthwhile to ask how different the result would be if we restricted competition to occurring on

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a unidimensional policy space, and used the classical Hotelling-Downs model of equilibrium, where both parties propose the ideal policy of the voter with median human capital. It turns out that this analysis is quite simple (see Chapter 4). The theorem is: If the original distribution of human capital is strongly skewed (in exactly the above sense), then the coefficient of variation converges to zero. If it is not strongly skewed, then it converges to a positive number.

Thus, the Downsian model supports a starker, less subtle result than the model of ‘ruthless competition.’ Downsian competition is of the opportunist kind: both political parties are completely dominated by opportunists in the sense that parties do not represent constituents at all, but desire only to maximize the probability of winning the election. With the unidimensional policy space and Downsian politics, we have that, with initial strong skewness, political competition always leads to equality in the long run, while in the model of ruthless competition, opportunist politics *never* leads to equality in the long run. Moreover, even with *partisan* competition in the model with the large policy space, convergence to equality is never a sure event, but it occurs with positive probability with initial strong skewness. We conclude that the Downsian model provides a misleading prediction of the nature of democratic politics – and this, if anything, justifies our study.

These results are somewhat pessimistic if one harbored the thought that democracy would, at least in the long run, eliminate differentials in human capacity due to family influence. In Chapter 5 we study what happens over time to inequality if the educational technology is of the form

$$h' = \alpha h^b r^c \bar{r}^d, \tag{1.3}$$

where $\bar{r}$ is the average educational investment in the entire cohort of children. With this technology, we have an external effect: a child’s human capital is determined not only by what is invested in him or her, but what is invested in all children. This can also be called a model of endogenous growth.

There are several interpretations of the process that would engender this kind of technology. One is that children learn from each other, so there are positive external economies to increasing average

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investment. A second is that technological change is fostered by increasing total investment, which raises wages, which, in our model, are the same as human capital.

Intuitively, the larger is the elasticity d and the smaller is the elasticity c in (1.3), the more voters have an interest in large investments in education on average, and the less they will care about how much is invested in their own children. What we show in Chapter 5 is a rigorous version of this intuition: if the ratio d/c is sufficiently large, then, even in the opportunist political equilibria, the coefficient of variation of the dynamic sequence of human capitals converges to zero.

Chapter 6 is the sole empirical effort in this study. We attempt to measure the elasticities b, c, and d from US data. We derive quite precise estimates of b and c, but are unable to estimate d. We therefore cannot tell if the size of d/c is as large as is required for the convergence results of Chapter 5 to hold. Perhaps a researcher more econometrically astute than the present author could reach more definitive conclusions.

A footnote should be added at this point. In the analysis of Chapter 4, I assume that $b + c = 1$. We find, however, in Chapter 6, that $b + c < 1$. The justification of my assumption in Chapter 4 is that, when $b + c = 1$, technology *as such* will not cause the coefficient of variation of human capital to converge to zero. By this I mean the following: when $b + c = 1$, then in the absence of any redistributive state action, and when individual families finance privately the education of their children, the coefficient of variation will remain *constant* over time. However, when $b + c < 1$, even in this laissez-faire case, the coefficient of variation of human capital *will* converge to zero. Therefore, the assumption that $b + c = 1$ allows us to neatly separate the (economic) effect on convergence of *technology* from the (political) effect of *democracy*. It is the appropriate assumption for one who, like myself, is concerned with studying the effect of democracy on equality.

If one were to assume that $b + c < 1$ in the model, then one would have to ask the question: Under what circumstances will democracy cause the distribution of human capital to converge to equality *more rapidly* than it would under laissez-faire? Admittedly, this is an important question. It is presumably a more difficult question to answer than the one I have worked on, but one hopes that the results that I

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present are indicative of what the results would be in that empirically more realistic case.

Suppose that it turns out that, empirically, the ratio d/c is too small to induce convergence of the distribution of human capital to equality. Is there anything else we can say? I believe so. The assumption on voter preferences that I make throughout the study is one of self-interest: each voter is interested only in his or her own dynasty (present consumption and the human capital of his or her child). If voters were altruistic, in the sense of being interested in the children of other families, then that would act very much like the external effect in the technology (1.3) earlier. With sufficient altruism, it would therefore be the case that the convergence of human capital to equality would occur over the long run. This is not surprising.

Thus, we can summarize our results by saying that if voters are only locally altruistic (care only about their own children), and there are no external effects in the educational technology, then convergence of the distribution of human capital to equality (the achievement of equal opportunity in the long run) never occurs for sure, but only with positive probability, and that, indeed, only under special conditions on the initial degree of skewness and the nature of political competition. If, however, voters are either globally altruistic or there are substantial external effects in education, then democracy will eliminate inequality of opportunity based upon differential family backgrounds.

The final chapter presents a number of caveats concerning the analysis.

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