VOTING FOR EQUITY: ESTIMATING SOCIETY'S PREFERENCES TOWARD INEQUALITY*

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Abstract

Economics often finds it difficult to make comparisons across economic policies based upon equity considerations. This paper uses a social welfare function à la Jorgenson and Slesnick incorporating both efficiency and equity to estimate society's preferences for inequality. The function is based upon a demographically modified demand system that delivers an interpersonally comparable measure of individual welfare that aggregates exactly in a social welfare function. To do so one must know to what degree equity matters to society. The innovation is the development of a voting scheme for compiling individuals' equity preferences into a social decision. It is found that while preferences across households are heterogeneous, the Colombian preferences towards inequality are polarized around a low and a high degree of aversion to inequality. By the majority rule, the Colombian society prefers equity to efficiency. However, the most prosperous and educated deciles and the households living in Bogota' do vote for efficiency.

Keywords: Aversion to inequality, voting, social welfare functions, interpersonal comparability

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1 Introduction

How much weight should be placed upon equity concerns in policymaking? Policy measures that can be shown to fail the Pareto efficiency criterion are difficult to defend. But in a given setting many alternatives will be efficient and the criterion gives no guidance about which of them should be chosen. An equity-based criterion might go further, delivering a unique policy recommendation that optimally redistributes welfare across members of a society.

Much of the recent literature on equity-based social welfare (and the model used in this paper) can be traced to Roberts (1980).[1] He proposed a (single-profile) social welfare function that takes cardinally fully comparable welfare levels as arguments and that incorporates both equity and efficiency concerns. According to this function, social welfare is enhanced when average individual welfare increases, but it is reduced when dispersion in individual welfare increases. What is more, the function captures in elegant fashion—through the use of a single "equity" parameter, ρ, describing the curvature of social welfare in welfare space—society's preferences toward inequality. Jorgenson (1990 and 1997) and Jorgenson and Slesnick (1983, 1987) have recently employed this function in measuring the effects of various economic policies upon average welfare and upon the level of equity-based social welfare. Conditional upon the value of ρ, the function can be used to make policy prescriptions, yielding an optimal value for the policy instrument in question.[2]

The purpose of the present paper is to extend that approach by *estimating* society's collective preferences regarding equity. Using a time series data set, from which a demographically modified demand system has been estimated, we develop a stylized policy regime under which a benevolent social observer envisions selecting a price policy so as to maximize a Jorgenson and Slesnick (1987) type social welfare function. This optimization takes the equity parameter as given. We devise a scheme that allows households—observations in our data set—to calculate their own preferred value for this parameter, ρ. We then define a voting scheme that selects the unique majority-rule winner from amongst the feasible values for ρ, and this winner we call society's optimal or preferred degree of aversion to inequality.[3]

It should be emphasized that the individuals in our model do not regard others altruistically. Rather, they consider only their own selfish interests when voting for equity. Households that would benefit under a policy regime that weights equity heavily prefer such a weighting. Those that would be harmed in this case prefer a policy criterion in which equity is unimportant. We find that while preferences across households are heterogeneous, the Colombian preferences towards inequality are polarized around a low and a high degree of aversion to inequality. By the majority rule, the Colombian society prefers equity to efficiency. However, the most prosperous and highly educated deciles and the households living in Bogota' do vote for efficiency.

The demand system upon which our welfare calculations rely is of interest for the technique by which demographic information is incorporated. The social welfare scheme requires full comparability of welfare across households, and so it is necessary to devise an interpersonally comparable money metric welfare measure. This is accomplished using adult equivalence scales incorporating the IB property (Lewbel 1989; Blackorby and Donaldson 1991) for constructing household expenditure functions and a measure of scaled income.

2 Interpersonally comparable individual welfare

Suppose that a household obeys a direct utility function of the form $U^*(q_k)$, where q_k denotes the n-vector of goods consumed by household k $(k = 1, \ldots K)$, available at prices p. Corresponding to U is a cost (or expenditure) function of the form $C^*(U, p)$, which yields the cost to the household of achieving utility level U at prices p.[4] Let d_k denote a vector of demographic variables (household size, schooling, and so on) specific to household k. Lewbel's modifying technique calls for construction of a new cost function of the form $C(u, p, d_k) = f(C^*(u, p, d_k), p, d_k)$. Lewbel (1985)presents conditions that must be satisfied by f in order for C to be a legitimate cost function.[5] Note that by construction C will take the value of household income y_k.

The modifying function approach is a generalization of a variety of specific approaches to the problem of incorporating demographic information into a demand system. These include the translating and scaling approaches, the Gorman (1976) approach that combines translating and scaling, and also reverse Gorman as developed in Pollak and Wales (1981, 1992). The demographic specification used in this study is the Barten (1964)approach.

Our aim in this paper is to use a measure of household welfare accompanying the cost function demographically modified *a la* Barten to compare the level of social welfare for various economic policies. For this purpose we shall need a household equivalence scale $m_0(p, d_k)$, depending on prices and demographic characteristics, that describes the number of equivalent adults in the household. This scale can be used to form a money measure of welfare that is comparable across households. A household's equivalent income is given by $y_k/m_0(p, d_k)$. If a two-adult household with income of \$60,000 has $m_0 = 1.5$, for example, then each of its members achieves the same level of utility as a single adult with income of \$40,000. Similarly, if a household with two adults and two children with income of \$60,000 has $m_0 = 3.0$, then each of its members achieves the same level of utility as a single adult with income of \$20,000.[6]

The scale m_0 can be written in this manner—without utility as an argument—only if it is independent of the base level of income (IB) chosen for comparison (Lewbel 1989). The IB property of equivalence scales permits interhousehold comparisons to be made in a theoretically consistent manner, and it generalizes the more restrictive property of homotheticity of preferences. (For a discussion of the related exactness property of an equivalence scale, see Blackorby and Donaldson 1991.)

Suppose that demand is specified as the almost ideal demand system of Deaton and Muellbauer (1980). The Barten demographically modified AIDS cost function, expressed in logarithms, is

$$\ln C(u, p, d_k) = \ln A(p, d_k) + B(p, d_k) \ln u. \tag{1}$$

This cost function is in the Gorman polar form (see Blackorby, Boyce and Russell 1978), from which the AIDS is derived using the Barten-Gorman demographic transformation. In (1), the $\ln A$, and B terms are expressions depending upon the parameters in a Barten demographically modified demand system

$$\ln A(p, d_k) = \alpha_0 + \sum_i \alpha_i \ln p_i^* + \frac{1}{2} \sum_i \sum_j \gamma_{ij} \ln p_i^* \ln p_j^*, \tag{2a}$$

$$B(p, d_k) = \beta_0 \Pi_i (p_i^*)^{\beta_i}, \tag{2b}$$

where $i = 1, \ldots n$ indexes the goods. In equations (2), $p_i^* = p_i m_i(d_k)$ is the price of good i scaled by the Barten (1964)commodity-specific scheme. The scaling demographic function is specified as $m_i(d_k) = \sum_r \delta_{ir} \ln d_k^r$. The parameters α_i, β_i, and γ_{ij}, and also δ_{ir}, are to be estimated using the following share demand system, derived from equation (1) and equation (2)

$$w_{ik} = \alpha_{ik} + \sum_j \gamma_{ij} \ln p_j^* + \beta_i \ln\left(\frac{y_k^* P^T}{A(p^*)}\right),$$

where $\ln y_k^* = \ln y_k$.

In order for the scale m_0 to be IB, it is necessary that the $B(p, d_k)$ term be independent of d_k. Let us suppose that it is. Then following Lewbel (1989), write the modified cost function

$$C(u, p, d_k) = m_0(p, d_k) G(p, u) \tag{3}$$

for some function G.[7] The separability of d_k from u in the two terms on the right side of (3) makes the IB property convenient. In the demographically modified AIDS framework we may write

$$\ln G_k(p, u) = \ln A(p) + B(p) \ln u,$$

which, combined with (3), yields the following money metric of utility describing the distribution of welfare (Lewbel 1989; Blackorby and Donaldson 1988)

$$\ln\left(\frac{C}{m_0}\right) = \ln A(p) + B(p)\ln u. \tag{4}$$

Equation (4) highlights an important feature of the interpersonally comparable nature of this setup. Note that everything specific to a household's preferences appears in the left side; the right is an affine transformation of utility levels u. Thus, it accords with Roberts' (1980) definition of cardinal full comparability (CFC) of utilities.[8] Once again employing the notation of the Barten-Gorman demographically modified AIDS framework, the equivalence scale m_0 may be written in log form as

$$\begin{aligned} \ln m_0(p, d_k) &= \ln A(p, d_k) \\ &= \alpha_0 + \sum_i \alpha \ln p_i^* + \frac{1}{2}\sum_i\sum_j \gamma_{ij} \ln p_i^* \ln p_j^* + \sum_i t_i(d_k) \ln p_i^*. \end{aligned}$$

Upon rearranging equation (4), the indirect utility function for household k may be written

$$\ln V_k(y_k, p, d_k) = \frac{\ln\big(y_k/m_0(p, d_k)\big) - \ln A(p)}{B(p)}, \tag{5}$$

where by definition $y_k = C(V_k(y_k, p, d_k), p, d_k)$.

3 Social welfare

Suppose that the welfare of society is determined according to the following social welfare function taken from Jorgenson and Slesnick (1983, 1987) and Jorgenson (1990 and 1997). Let U denote the K-dimensional vector of household utility levels, and let x denote the state of the world. The social welfare function takes the form

$$W(U, x \mid \rho) = \ln \bar{V} - \gamma(x)\left(\frac{\sum_k m_0(p, d_k)\cdot \mid \ln V_k - \ln \bar{V} \mid^{-\rho}}{\sum_k m_0(p, d_k)}\right)^{-1/\rho}, \tag{6}$$

where

$$\ln \bar{V} = \frac{\sum_k m_0(p, d_k) \ln V_k}{\sum_k m_0(p, d_k)},$$

and

$$\gamma(x) = \frac{\sum_{k\neq j} m_0(p, d_k)}{\sum_k m_0(p, d_k)}\left(1 + \left(\frac{\sum_{k\neq j} m_0(p, d_k)}{over m_0(p, d_j)}\right)^{-(\rho+1)}\right)\Bigg]^{1/\rho},$$

where $m_0(p, d_j) = \min_k m_0(p, d_k)$ is the scale for a reference household. In a time series application, like the one to follow, it is natural to let this reference household correspond to the household in period 1.

The first term in (6) is the average of money metric welfare across households. The second term is a measure of dispersion (or inequality) in money metric welfare. For a given level of average welfare, social welfare declines as the inequality in welfare increases. The $\gamma(x)$ term in (6) is constructed so as to permit the highest possible value that satisfies the Pareto principle. It is conceivable, for general definitions of $\gamma(x)$, that social welfare might fall as a result of an increase in one household's welfare level. As W is defined in (6), this cannot happen. With the definition for $\gamma(x)$ used here, the second term in (6) is as large as it can be while still ensuring that W never decreases as $\ln V_k$ increases for some household k.

The parameter ρ captures society's "degree of aversion to inequality" (Jorgenson 1990, p. 1025), which is the same thing as the degree of curvature of the welfare function in $\ln V$ space. It takes values on the interval $(-\infty, -1]$. If $\rho = -\infty$, then the second term in (6) disappears and the social welfare function becomes utilitarian. If ρ takes its maximum value of -1 then society places the greatest possible value upon equity. We turn now to a model of a social observer who is considering an economic policy that designed to maximize W given ρ, and the accompanying scheme for estimating the value for ρ that actually reflects society's attitudes toward equity.

4 Voting for equity

In this section we develop a scheme for recovering society's preferences toward inequality from demand behavior and demographic characteristics. The informational assumptions placed upon the problem are crucial. It is assumed that the social observer does not know the structure of individual welfare functions. Rather, the observer knows only how to use the computer program managing the solution algorithm for ρ. This constraint on the social observer information set excludes any possibility of manipulation from the social observer and explains the observer's decision to collect the households' votes over ρ. Each household knows only its own cost function, and it is also privy to the information it needs in order to make its selection in the voting scheme. Let $-_k$ denote the information held by household k.[9]

The voting for equity scheme is recursive in nature, comprising two parts. For any given ρ, the observer's goal is to set prices so as to maximize social welfare $W(U, x \mid \rho)$. Price policies are not uncommon in actual practice, of course, though in a market economy one would not expect to witness centralized selection of a complete vector of prices. It would be possible to adapt the model by incorporating alternative policy instruments—including quantity restrictions or income transfers. The first part, then, consists in the observer devising a table, each row of which corresponds to a value for ρ. The distance between ρ's may be as small as desired. The remaining entries in a row of the table consist of a price vector with the property that for the corresponding ρ, this price vector yields a maximum to $W(U, x \mid \rho)$.

In the second part of the scheme, the observer sends each household a copy of the table, and each household calculates its own level of welfare $\ln V_k$ at every price vector in the table. The household then returns a ballot on which it has recorded the value of ρ for which the corresponding price yields a maximum to $\ln V_k$. Let this report be denoted ρ_k^*. In the final step the K-vector of ρ_k^*'s are combined into a social choice, ρ^*. In this last step the median value of the ρ_k^*'s is announced as society's choice of aversion to inequality.

This scheme may be thought of as a constitutional convention for carrying out social policy. The social observer is nothing more than a computer for calculating, for any conceivable value of ρ, the price vector that maximizes $W(U, x \mid \rho)$ in (6). It only needs to be given the appropriate ρ parameter in order to choose its policy. The parameter itself is voted upon by society, with each household casting a single ballot on which it has noted its preferred value for ρ. We suppose that the winning ρ must be able to defeat all alternatives in a pairwise majority vote.

5 The social observer's problem.

The social observer is free to consider setting prices however it chooses, so long as $p_i > 0$ for each good i. Demands are homogeneous of degree zero in prices; it is assumed the prices are normalized by setting $p_n = 1$. Then the set of prices that are available—the social observer's "choice set"—is $\mathcal{P} = \mathcal{R}_{++}^{\setminus -\infty}$. The observer's decision problem is to maximize $W(U, x \mid \rho)$ on $\mathcal{P}$. Let $p^*(\rho)$ denote the solution to this problem:

$$p^*(\rho) = \mathrm{argmax}_{\mathrm{p}\in\mathcal{P}} \mathrm{W}(\mathrm{U}, \mathrm{x} \mid \rho). \tag{7}$$

We assume that the observer's table is finite in length. That is, there is some finite T sufficiently large so that $\mid \rho^* \mid < T$. The search, then, will take place on the interval $[-T, -1]$. Problem (7) is well defined only if W is strictly concave in p and achieves a unique maximum on $\mathcal{P}$. Numerical evidence suggests that W has this property (see Figure 1 below). Let us suppose that the observer's problem does indeed have a unique solution for each ρ.[10]

5.1 The households' problem.

Upon inserting $p^*(\rho)$ into its own money metric welfare function $\ln V_k$, household k can calculate its welfare as a function of ρ. The household's problem is to calculate the value of ρ at which its welfare level is maximized. Its informational resource - $_k$

limits the household to responding to the observer's query with its preferred level for ρ. Let $\rho_k^*(U, x \mid -\ _k)$ denote the solution to household k's problem.

$$\rho_k^*(U, x \mid -\ _k) = \operatorname{argmax}_{\rho_k \in [-T, -1]} \ln \mathrm{V_k}\big(\mathrm{y_k}/\mathrm{m_0}, \mathrm{p}^*(\rho), \mathrm{d_k}\big). \tag{8}$$

Note that ρ_k^* is a composite mapping that depends upon ρ indirectly through $p^*(\rho)$.

Because $\ln V_k$ is a continuous function defined on a closed set, it must achieve a maximum on $[-T, -1]$. If ρ_k^* achieves a maximum over an interval—if there are multiple values of ρ that yield the same level of welfare—then we assume that the household selects the one with the smallest absolute value.[11]

5.2 The voting for equity scheme.

Our scheme for deducing society's collective opinion concerning the level of equity that should be incorporated in policy making—the choice of ρ—involves compiling the individual ρ_k^* into a single value ρ^*. For this purpose we assume that majority rule is employed, with households now playing the role of voters.

Consider the K-vector $(\rho_1^*, \ldots, \rho_K^*)$ of optimal ρ's. We assume that in any pair-wise vote, each of the non-interactive households naively selects the value for ρ that is nearest ρ_k^* according to the Euclidean distance metric. Given this assumption, Black's (1948) median voter theorem guarantees that the median of the ρ_k^*'s will be a majority rule winner. Denote this median by ρ^*.

Define a *voting for equity scheme* $\mathcal{S}$ by (i) a set of individual money metric welfare functions $(\ln V_1, \ldots, \ln V_K)$; and (ii) the social welfare function W. We now provide a definition for a solution for $\mathcal{S}$. This definition requires simply that households choose optimally, that the majority rule winner is selected as society's optimal ρ, and that given this value the social observer selects a price vector according to (7).[12]

Definition. Given a voting for equity scheme $\mathcal{S}$, a **solution** is a pair (ρ^*, p^*) at which (i) households choose ρ_k^* according to (8) and ρ^* is the median of the ρ_k^*, and (ii) p^* solves (7) given ρ^*.

6 A cross section application: estimation of Colombia's degree of aversion to inequality

In this section we present the results of applying our voting for equity scheme to the 1985 Colombian urban expenditure survey. The sample is drawn from the *Encuesta Nacional de Ingresos y Gastos de Colombia*, 1984-85. The survey covers only urban areas. Both the daily and the less frequent expenditures were collected during weekly interviews using the "booklet method" with recall. After general checks for consistency, 25,644 households out of 26,485 have been selected to be included in the data set. The income distribution has not been trimmed. Goods have been aggregated into three large categories: Food comprising also food consumed away from home (WALIM), education (WEDU), and all other goods (WATR) such as housing, health,clothing for adults, clothing for children, energy and transportation. This high level of aggregation has been chosen with the aim of enhancing our capability to control the social welfare experiment. The set of demographic variables include the number of children below five years of age (NCH05); the presence in the household of a head with no level of education (EA), low level of education (EBC) and medium level of education (EDU); the presence of a household head with an occupation (TJ) as a white collar (O_WC) or a working wife (TS); and the household geographical location either in Bogota (R3) or in the urban cities located in Northern Colombia.

Prices are unit values. These ratios between expenditure and quantities are only partly informative about prevailing market prices at a certain location and time. Unit values also embed information about quality that is taken into account by the Barten construct. Estimation has been undertaken on a 16.7 percent random subsample that maintains the distributional features of the original sample. Table 1 contains summary statistics for the shares, log prices, log total expenditure and demographic variables included in the model.

No Obs.4294	Mean	Std.Dev.	Min	Max
WALIM	0.41420	0.18927	0.00116	0.96586
WEDU	0.08792	0.08206	0.00000	0.67645
WATR	0.45085	0.15813	0.00987	0.98053
LPFOODR	5.13814	0.35021	3.03273	8.14699
LPEDUR	6.77784	1.33535	0.51103	11.47603
LPATRR	7.56765	1.29469	4.46864	13.05961
NCH05	0.66572	0.87321	0.00000	6.00000
EA	0.04935	0.21662	0.00000	1.00000
EBC	0.57210	0.49483	0.00000	1.00000
EDU	0.29001	0.45381	0.00000	1.00000
TJ	0.84058	0.36611	0.00000	1.00000
TS	0.17547	0.38040	0.00000	1.00000
O_WC	0.38221	0.48598	0.00000	1.00000
R3	0.13383	0.34051	0.00000	1.00000
R12	0.22116	0.41507	0.00000	1.00000
LNXH	10.53782	0.74605	8.92431	12.45035

Table 1: Descriptive Statistics.

The estimation of the Barten demographically modified linear in y AIDS maximizes a concentrated likelihood function of the joint system of Food and Education shares. The system has been estimated imposing the theory requirements of symmetry and homogeneity, and the IB requirements for cardinal comparability (Lewbel, 1989) as maintained hypotheses. In order to calculate $m_0(p, d_k)$ a decision must be made regarding the reference household. We have chosen the childless couple as our reference household, and have calculated the vector of m_0 fixing the unit values at the reference household level.[13]

The estimated compensated price and expenditure elasticities are reported in Table 2. The interest here is mainly on the suitability of the estimated demand system for welfare analysis rather than the behavioral implications associated to the estimated elasticities. The sign of the own-price effects conform with the Slutsky requirements at the data means. Concavity, as verified by computing eigenvlaues at each observation, is maintained over a large region of the data. Therefore, the estimated demand system can be reasonably used to carry out the welfare analysis. This behavioral requirement is of special importance in the present study. A necessary, but not sufficient condition, for the Jorgenson-Slesnick social welfare function to be concave is the concavity of the individual welfare functions.

The sign and magnitude of the elasticities are reasonable and significantly different from zero and in line with the ones estimated for other studies based on Latin-American countries. The cross-price effects are sign consistent, as required, and show only substitution effects. The expenditure elasticities show that education is more of a necessity than food given the adopted level of aggregation.

	Food	Education	Other Goods	Expenditure
Food	-0.3061	0.0088	0.2973	1.0109
	(0.0041)	(0.0018)	(0.0037)	(0.0096)
Education	0.0427	-0.2801	0.2374	0.8281
	(0.0088)	(0.0100)	(0.0092)	(0.0217)
Other Goods	0.2470	0.0409	-0.2879	1.0205
	(0.0035)	(0.0018)	(0.0036)	(0.0078)

Table 2: Compensated Price and Expenditure Elasticities.

The marginal impact of the demographic characteristics included in the model presented in Table 3 is also in general significantly different from zero. This says that the Barten specification captures the sample heterogeneity effectively. As expected, the presence of young children has a positive impact on food and a negative one on the education share. Low education levels are associated to low level of expenditures on education, but have a positive effect on food consumption. A household with sure employment of the head has higher propensity to spend on both food and education. A working wife has a negative effect on food consumption in Colombia. Being employed as white collars does not have a significant impact. Living in Bogota, on the other hand, has a strong positive effect on the education share. In the Colombian Capitol the budget share allocated to food is relatively lower. As it will be shown later, heterogeneity is important in explaining the households' voting behavior.

	NCH05	EA	EBC	EDU	TJ	TS	O_WC	R3	R12
Food	0.014	0.214	0.139	0.032	0.023	-0.033	-0.016	-0.049	0.009
	(0.005)	(0.010)	(0.004)	(0.024)	(0.051)	(0.019)	(0.016)	(0.034)	(0.013)
Educ	-0.057	-0.242	-0.150	-0.059	0.038	0.059	0.010	0.185	0.009
	(0.016)	(0.033)	(0.013)	(0.012)	(0.025)	(0.009)	(0.011)	(0.023)	(0.009)
Othe	-0.002	-0.136	-0.090	-0.016	-0.026	0.017	0.012	0.009	-0.009
	(0.009)	(0.020)	(0.008)	(0.012)	(0.026)	(0.010)	(0.010)	(0.021)	(0.008)

Table 3: Demographic Impacts.

The calculations of $p^*(\rho)$ and the ρ_k^* were carried out numerically. From the perspective of a household, the program to calculate the solution to (6) is simply a subroutine. It specifies the mapping between ρ and optimal policies. We take values of ρ in the interval from -1 to -9, in increments of 0.04. The solution to (6) is calculated numerically for the 225 values of ρ in this grid. The program generates a 225×3 matrix, with row s containing a 3-vector (ρ^s, p_1^s, p_2^s), where the prices are relative prices because of the homogeneity property imposed and the general equilibrium set up of the problem.

Figure 1 contains a plot of the level curves of the observer's objective function W as it depends upon p_1 and p_2 with $\rho = -1$). This diagram shows clearly the location of the optimal choice which is a global optimum. In Table 4 we present the relationship between the prices and ρ. The difference between $\ln \bar{V}$ and W associated to the price policy scheme at each ρ is the value of the equity term in (6). When ρ reaches -9 the optimal policy ceases its movement. This is because at this level the equity term in (6) becomes negligible, and the observer's objective becomes the maximization of average welfare $\ln \bar{V}$.

A household, being interested only in its own welfare, does not care about social welfare but only about the relationship between ρ and its own $\ln V_k$. Using this fact, we solve each household's problem by calculating $\ln V_k$ for each ρ^s, using the corresponding price pair (p_1^s, p_2^s). The ρ^s corresponding to the maximum $\ln V_k$ is selected the household's choice. It has been denoted ρ_k^*, and equals the value that this household will write on its ballot in the voting for equity scheme.

Our next interest is to understand how the vote varies with the household demographic profile. How do preferences towards equity differ in poor and rich households, in households with a high and a low level of education, in large households versus small households? The graph proposed in Figure 3 show the surface densities relating to the distribution of votes ρ^s (on the z axis) by level

ρ	p1*	p2*
-1	0.1140	0.5307
-2	0.0361	0.5012
-3	0.0339	0.5010
-4	0.0338	0.5011
-5	0.0341	0.5013
-6	0.0340	0.5014
-7	0.0338	0.5009
-8	0.0342	0.5009
-9	0.0335	0.5009

Table 4: Optimal Price Policy.

of education (on the x axis) and expenditure quintile (on the y axis). The graph presents four panels associated to the conditioning variables "working condition of the spouse" (TS=1) and "geographical location" (R3=1 Bogota).

The surface densities show a main relationship which is independent of the conditioning variable. Households with low levels of education, independently of income, do want equity to matter very much. (Recall that $\rho = -1$ reflects the greatest possible considerations of equity.) Their welfare is maximized if, ρ is approximately -1.0, which ensures that equity is of great importance. Households with a high level of education, on the other hand, want equity to matter a great deal. Independently of the expenditure quintile they belong to, the educated households achieve their greatest level of welfare when ρ is approximately -9.0. The second panel clockwise shows that households living in Bogota, with a working spouse favor efficiency even when the head of the household is modestly educated. The comparison of the first and third panel of Figure 2 suggests that educated households living in Bogota with a non working spouse (first panel) matter about equity relatively more than educated households not living in the Capitol (third panel). Figure 3 shows that small households want equity to matter independently of the level of education of the household head. Larger and educated households clearly prefer efficiency to matter.

We summarized the relationship between the ballotted ρ^s, households characteristics and total expenditure estimating the conditional expectation of E(ρ—d,y) using robust standard errors to account for the presence of heteroskedasticity. To control for the effect of income distribution, a categorical variable $qui = /1, .., 5/$ has been used in lieau of total expenditure. The results describing the efficiency/equity voter profile are reported in Table 5.

Inspection of table 4 reveals that all but the coefficients associated to the expenditure quintile (QUI), the number of children (NCH05), and location in the North of Colombia (R45) are significantly different from zero at conventinal

$R^2 = 0.856$ rhovec	Coef.	Robust Std. Err.
qui	-.01861	.01770
nch05	-.03291	.02342
ea	6.7396	.09670
ebc	6.3331	.07080
edu	-.57339	.04617
tj	.71179	.07702
ts	-.39166	.07024
o_wc	-.23986	.04961
r3	-1.049	.10039
r45	.05825	.03810
_cons	-8.1801	.10433

Table 5: The Efficiency/Equity Voter Profile: Regression Results.

significance level. Note that a negative sign of the coefficients is correlated with stronger preferences for efficiency. The results clearly delineate the profile of the voter for efficiency. Large and educated households living in Bogota with a head employed as a white collar with a working spouse cast their vote for efficiency with little uncertainty.

Society's collective preferences about equity then depends on the distribution of voters favoring equity or efficiency. As shown in Figure 4, in Colombia this distribution is clearly bimodal and of Downsian memory (1957). The majority outcome, as given by the median, is

$$\rho^* = -1.$$

This is the equity value that society ultimately chooses, and that is used in selecting its ultimate price policy of $p^* = (0.114, 0.531)$. This result is the central finding of our study. The Colombian society of the eighties that we have examined does wish collectively for equity to matter very much to policy making. Under majority rule the more educated households living in Bogota constitute an unstoppable force in the political process determining ρ^*.

7 Conclusions

In this paper we have developed a scheme for assessing society's preferences regarding the age-old equity versus efficiency trade-off. The method uses a social welfare function due to Roberts (1980) and employed recently by Jorgenson (1990 and 1997) and by Jorgenson and Slesnick (1983, 1987). There, the function has been used to compare the efficiency and equity effects of various economic policies, and to measure changes in welfare over time. We have used the same welfare function to ask the next question, namely, *how much* does society wish for equity to matter? Our scheme is devised to harness households' selfish impulses, calculating their selfish interest in the degree of equity to be incorporated in setting policy, and then it polls society to arrive at an optimal collective level of equity.

The results indicate that there is considerable heterogeneity among households concerning their preferences toward equity. The Colombian preferences towards inequality are polarized around a low and a high degree of aversion to inequality. By the majority rule, the Colombian society prefers equity to efficiency. However, educated households do vote for efficiency.

The voting for equity scheme itself has desirable properties that have been treated lightly here. Evidently the scheme is incentive compatible in the sense that households cannot gain anything by misrepresenting their preferences in the vote. A formal analytical development of this result shall occupy us in future research, in which the voting scheme is itself formulated as a noncooperative game among households, the Nash equilibrium of which is also a dominant strategy equilibrium.

Can the values for ρ_k^* that we have obtained legitimately be called households' equity preferences? We argue emphatically that they can. It is true that households in our model have no concern for the welfare of others. People are interested only in themselves, and their preferred level of equity yields the greatest personal welfare. We feel that this is precisely the way one should view individual equity preferences. In a democratic society an entirely separate rule (such as the majority rule that we employ) should be used to extract collective equity preferences from a profile of individual preferences. It is no doubt true that individual concern for equity can also result from altruistic impulses, but in our view one of the virtues of our approach is that we are able to produce a collective concern for equity while retaining the utility-optimizing framework for individuals.

Other extensions of our work are also possible and would appear to be of interest. Using panel or cohort data, what we may learn is that, once welfare is made interpersonally comparable, people alive in the relatively distant past can be harmed at the expense of their children when intergenerational equity figures prominently in social policy. Stated another way, one could discover that current households, though their scaled incomes can be much greater than their forebears', gain by these equity considerations.

In general, our application using the Colombian cross-section data set permits a natural interpretation of the voting scheme itself, and provides insights concerning the interaction of contemporary agents and their equity preferences. Comparing results of this sort of study for different countries or for a variety of alternative economic policies would permit still another view of collective equity preferences.

ENDNOTES

[1] For an account of several comparability and cardinality notions, and their properties, see also Blackorby and Donaldson (1991).

[2] Buccola and Sukume (1993) employ two of the social welfare functional expressions due to Roberts (1980) in assessing the effect of equity considerations on agricultural policy in Zimbabwe. For several values of their equity parameter, Buccola and Sukume (1993) determine the range in which optimal producer prices fall. Their study does not consider the views of households toward the equity parameter itself.

[3] Two recent papers (Alesina and Rodrik 1994 and Persson and Tabellini 1994) provide results concerning a policy procedure that responds to the degree of inequality preferred by a median voter. Their papers both involve endogenous growth models, and both conclude that growth is negatively related to inequality over time.

[4] At the risk of some confusion, we suppress the index on the functions U^* and C^* and on their unstarred counterparts below. In rendering these functions interpersonally comparable we essentially make them the same for all households (so that only demographic make-up distinguishes households). Once this scaling has been achieved the k index becomes misleading.

[5] That is, C must be homogenous of degree one in prices, nonnegative, nondecreasing in prices, increasing in u, increasing in at least one price, and concave. See Lewbel (1985), Theorems 1–3.

[6] This example closely resembles the one presented by Blackorby and Donaldson (1991, p. 174). They write, "If we say that the number of adult equivalents in the household is 1.5, then we mean that the household is equivalent, for utility purposes, to two *single reference* adults with incomes of \$20,000 each (\$30,000 divided by 1.5)" (emphasis in original). The subtle but important distinction between our sentence and theirs is that Blackorby and Donaldson use the family, while we use an individual family member, as the reference unit. The distinction carries through to our empirical investigation where, as in Jorgenson (1990), an "equivalent household member" is the unit of comparison.

[7] Lewbel (1989) shows that the ability to write the cost function in this way is necessary and sufficient for a "cost of characteristics" index, $I_k = C(u, p, d_k)/C(U, p, d^0)$ to be IB, where d^0 is the demographic make-up of a reference household. If and only if the index is IB, an IB household scale exists.

[8] Lewbel (1989, p. 383) also provides a useful discussion of the various degrees of comparability with cardinal and with ordinal preferences. The CFC property is built into equation (4.4) in Jorgenson (1990), upon whose social welfare function we rely in the next section.

[9] In this paper the information held by households is limited. The incentive aspects of the scheme—whether households are able to or wish to behave strategically—inhere in this informational assumption, which we shall seek to

broaden in future work.

[10] Note that this definition does not require market-clearing. One may think of the economy moving toward a Walrasian equilibrium under the price policy, employing a rationing scheme to account for the temporary divergence between supply and demand. See Benassy (1982) or Gardner (1983).

[11] In the application presented in the following section, there are many households for whom there are multiple solutions to problem (8). Under our assumption that such a household chooses as its optimal ρ_k the minimum of (the absolute value of) these values, its problem may be written $\rho_k^*(U, x \mid \rho) = \max\{\text{argmax}_{\rho_k \in (-\infty, -1]} \ln V_k\}$.

[12] Given our informational assumption—that households do not know other households' $\ln V_k$—there is no scope here for strategic behavior. However, in future work the informational assumption we adopt here will be relaxed, permitting an exploration of the incentives facing households in the voting scheme and of the effects of strategic opportunities.

[13] Because m_o depends upon p, it is not unique. This delicate issue is important, for the optimal policy p^* depends upon the scale which, without fixing the prices in m_0, in turn depends on p^*. The choice of period 1 actual prices as the base price vector is in some sense arbitrary, but some choice like it is necessary in order to break this jointness between prices and the scale.

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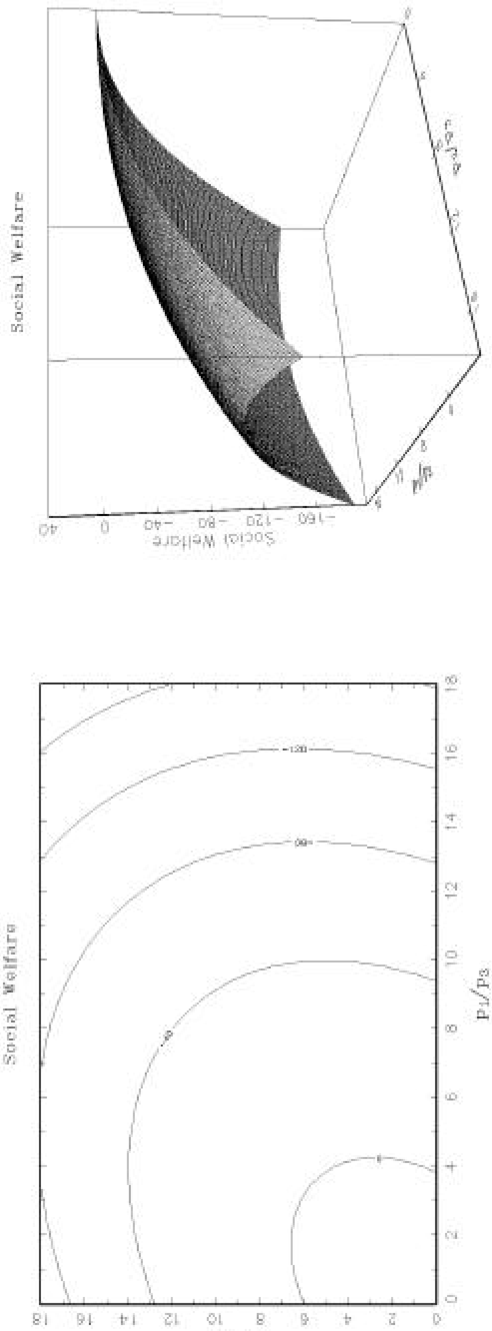

Figure 1: Concavity of the Social Welfare Function

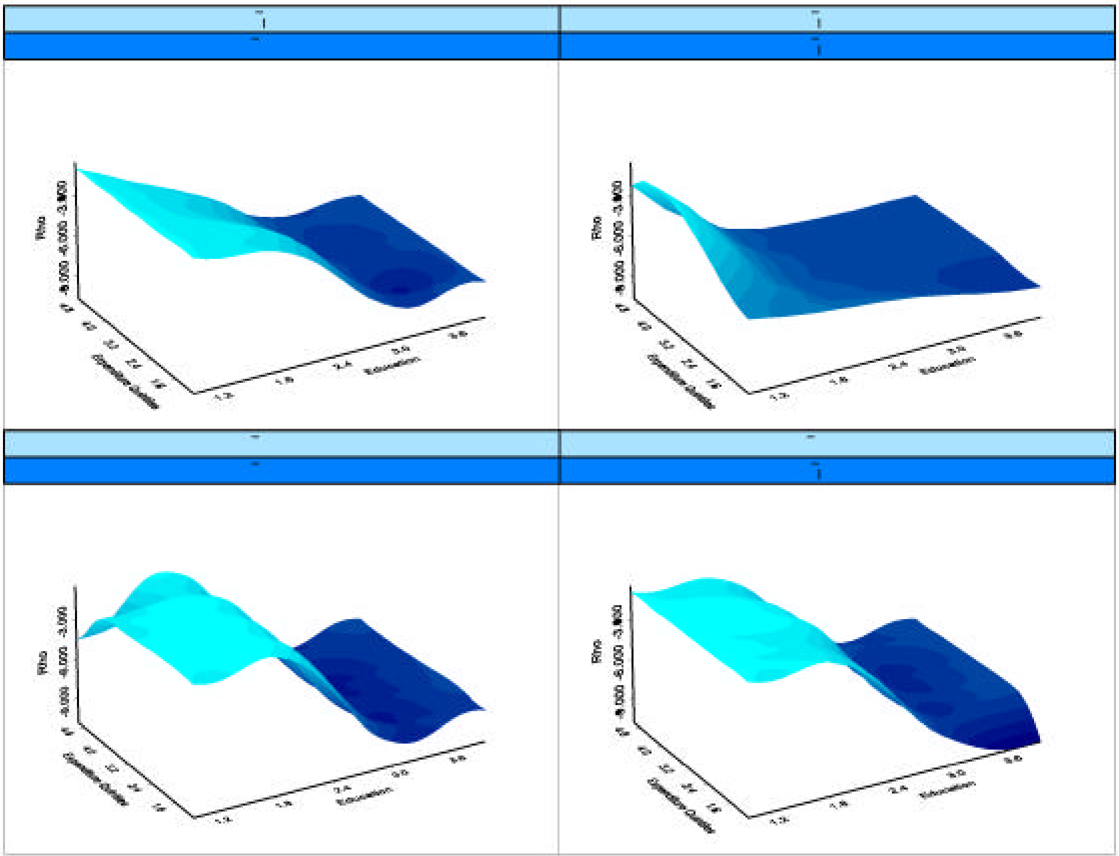

Figure 2: Preferences towards Equity conditioning on Level of Education, Income Quintile, Bogota and Working Condition of the Spouse

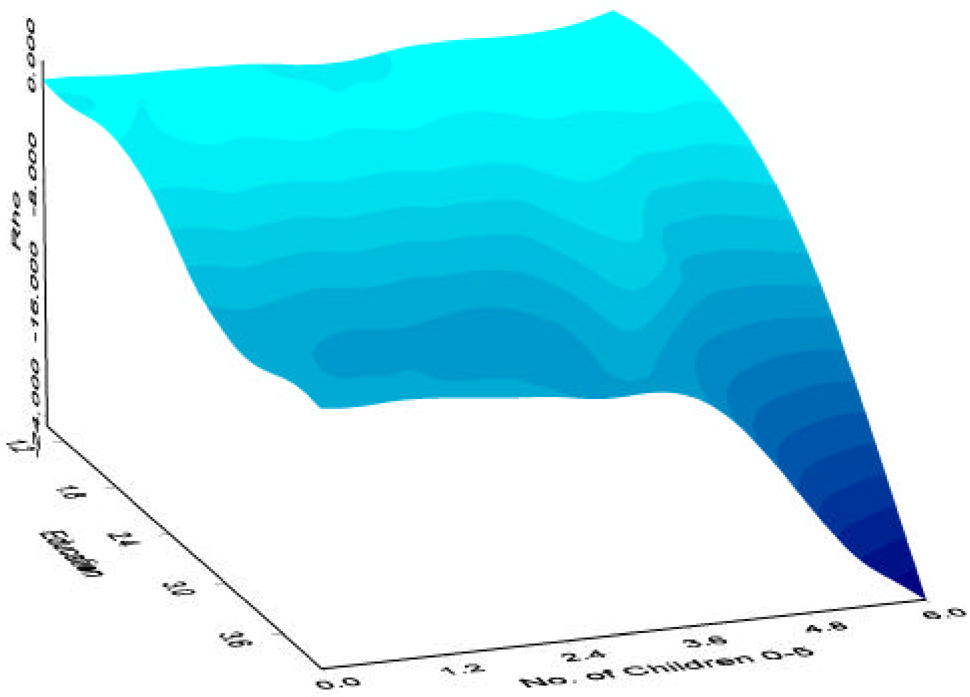

Figure 3: Preferences towards Equity conditioning on Level of Education and Number of Children

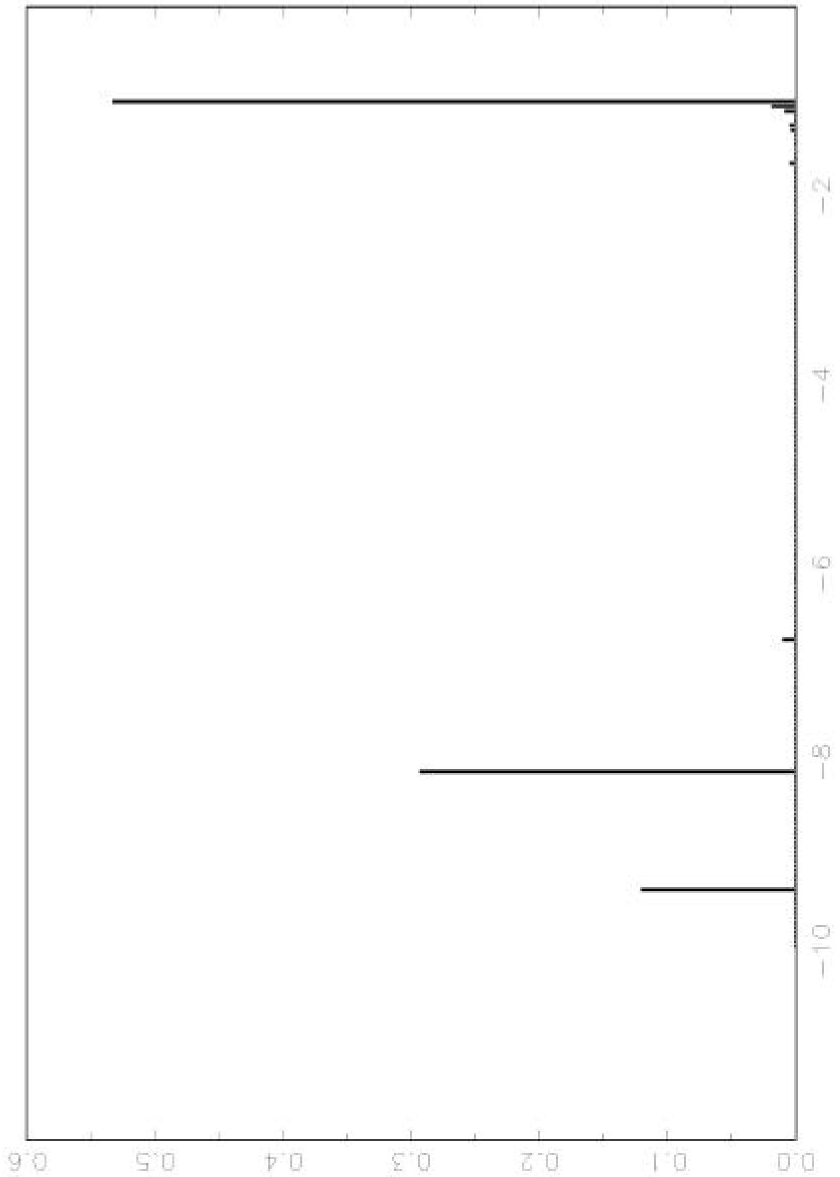

Figure 4: The Distribution of Votes