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THE MEASUREMENT OF ECONOMIC WELL-BEING IN NEED ANALYSIS MODELS

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TABLE OF CONTENTS

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ABSTRACT

The equitable distribution of aid funds is viewed in this paper as a problem in taxation according to ability to pay or economic well-being. This approach is emphasized because it is fruitful to consider the various financial need analysis models as systems of taxation which result in the parents' expected contribution to the postsecondary education of their dependents. However, this study deals with only the first step in the development of an equitable tax system, the construction and evaluation of an objective index of ability to pay or economic well-being. The definition of equal sacrifice and the specification of a well-being utility function are not discussed because the choice of a measure of economic well-being must precede other considerations in developing an equitable system of taxation. Accordingly, a simple two-step model is suggested for evaluating alternative measures of economic well-being. The first step is a comparison of the theoretical implications of competing measures. The second step is a comparison of the implications of each measure for the perceived distribution of economic well-being among aid applicant families. Such a comparison serves an important function. It provides an insight into the possible impact of various theoretical propositions upon the ranking of a group of families among whom exist complex financial and demographic interrelationships, and thereby expedites the generation of meaningful hypotheses. Indeed, in this regard, this study and future investigations of the consequences of using a given measure of economic well-being can help in bypassing some of the difficulties inherent in the construction of a well-being utility function, and facilitate the specification of an equitable tax system.

It is the conclusion of this study that received economic theory can be useful in analyzing the implications of measuring economic well-being in alternative ways. However, a theoretical investigation raises as many questions as it answers. The choice of a measure of economic well-being involves many arbitrary assumptions and value judgments. Received theory is valuable primarily in identifying the truly normative aspects of models used to assess economic well-being and in pinpointing the consequences of assumptions and value judgments.

THE MEASUREMENT OF ECONOMIC WELL-BEING IN NEED ANALYSIS MODELS

William J. Goggin

I. Statement of the Problem

The financing of postsecondary education is undergoing rapid change. The student, who has always borne a large part of higher education costs in the form of foregone income, will be required in the future to pay a larger part of the direct costs also. This will be true especially for students from middle- and upper-income families, since much of the direct aid to students from all levels of government will be based on need. Such predictions are sufficiently widespread in the literature of higher education finance as to require no documentation.

The impetus for the distribution of aid on the basis of need derives from the interaction of three dissimilar factors. First, equal access to postsecondary education has become an important goal of master planning at both the state and federal level. Second, there is broad agreement that the family should provide as best it can for the postsecondary education of its dependents. Third, financial aid funds are and will continue to be scarce. These phenomena taken together mandate the distribution of aid funds according to need. Simultaneously, the measurement of need becomes a task of central importance.

Most postsecondary students who apply for financial aid are classified as dependent students. These students are to be distinguished from self-supporting students in that the financial circumstances of the student's family (parents or guardians) are relevant in assessing the need of dependent students, that is, students who are not self-supporting. Although alternative definitions of the dependent and the self-supporting student exist, consensus definitions will probably emerge. The resulting definitions are likely to leave the majority of postsecondary students in the dependent category. Such students will continue to submit a parental (guardian) financial profile in order to qualify for aid. These profiles will be analyzed to ascertain the family's ability to contribute to the postsecondary education of the student. In a very real sense, the family will continue to be "taxed" for an educational contribution on the basis of ability to pay. This expected contribution will then be subtracted from the school's budget to determine need. Hence, the measurement of economic well-being and the implementation of principles of taxation will endure as major problems in need analysis.

An optimum need analysis model for computing the expected contribution of parents must be based necessarily on an appropriate measure of economic well-being and on sound principles of taxation. Accordingly, horizontal and vertical equity are cited often as characteristics, indeed requirements, of a fair need analysis system. Briefly, horizontal equity suggests equal treatment of equals. Vertical equity, on the other hand, usually refers to systematically unequal treatment of unequals which results in equal sacrifice. Both principles in unison require equal sacrifice of some sort for all families.

The achievement of equal sacrifice through taxation for an educational contribution presupposes the precise measurement of family economic well-being. Unacceptably large deviations from horizontal and vertical equity can result from inaccuracy in the assessment of economic well-being as well as from undesirable features of a practical system of taxation. Accordingly, the pursuit of equity in the distribution of aid funds should begin with the choice and the refinement of an index of economic well-being which exhibits promise in measuring the family's ability to contribute to the postsecondary education of its dependents.

The choice of such an index must be made with great care. Two indices, both of which seem consistent with received theory, need not have the same implications for the perceived distribution of economic well-being among families. In general, two major differences could emerge. First, the

rankings of families provided by each index could be identical, but the relative economic well-being of each family might be different. Second, the rankings themselves could differ significantly. Of course, if a change from one index to the other does not preserve the order of families, the economic well-being of each family relative to at least one family must change. In either case, a tax structure which succeeds in achieving horizontal and vertical equity in terms of one index will fail to do so for the other. The extended example that follows demonstrates these propositions.

Consider briefly the following data for five two-parent, one-child families for whom a measurement of economic well-being and a ranking is desired.

	Income	Net Worth	Age of Parents
A	$8,000	$30,000	46
B	8,250	25,000	49
C	8,500	20,000	52
D	8,750	15,000	55
E	9,000	10,000	58

Although the data above are hypothetical and have been constructed to dramatize the desired conclusion, one should keep in mind the fact that each profile approximates the financial position of large numbers of families that do indeed apply for financial aid for their children.

Next consider the following four propositions concerning the construction of a simple index of economic well-being.

1. Current yearly income is the appropriate measure of the relative economic well-being among the families above.

2. Current yearly income and current net worth separately are the appropriate measure of the relative economic well-being among the families above.

3. Current yearly income and current net worth combined by converting net worth to an income flow and adding the result to income is the appropriate measure of the relative economic well-being among the families above.

4. Current and future yearly income and current net worth combined by computing the present value of expected lifetime earnings and adding the result to net worth is the appropriate measure of the relative economic well-being among the families above.

Using the hypothetical data presented in the table, it is possible to assign a dollar value to each of these alternative measures of economic well-being for each family and inspect the ranking and the distribution of economic well-being to which each measure gives rise.

If a current yearly income alone is used to measure economic well-being, the value of the index for each family is identical to the income figure in the table and the ranking and distribution which results is given by:

(1a) $$\underset{.188}{A} < \underset{.194}{B} < \underset{.200}{C} < \underset{.206}{D} < \underset{.212}{E}$$

that is, A with .188 of the total well-being is worse off than B with .194, and so on. This notation will be used throughout the example and will include the symbol (=) when identical economic positions are to be identified.

On the other hand, if net worth is to be considered in the construction of the index of economic well-being, there are many procedures consistent with Propositions 2, 3, or 4 to construct such an index. For example, Proposition 2 calls for separate treatment of income and net worth. A two-dimensional index including the value of both income and net worth is consistent with this proposition. A problem arises, however, in assessing the absolute and relative economic well-being of each family in this case. In addition, ranking the families becomes difficult. If income is examined, the ranking and distribution (as before) which results is given by:

(2a) $$\underset{.188}{A} < \underset{.194}{B} < \underset{.200}{C} < \underset{.206}{D} < \underset{.212}{E}$$

However, examination of net worth results in the ranking and distribution:

(2b) $$\underset{.300}{A} > \underset{.250}{B} > \underset{.200}{C} > \underset{.150}{D} > \underset{.100}{E}$$

If both income and net worth are considered, it becomes impossible to rank the five hypothetical families. Similarly, the distribution of economic well-being is ambiguous. It should be noted at this point, that the proposition to consider income alone is really a special case under the proposition to consider income and net worth separately. Unlike

the former, however, the latter does not allow unambiguous economic well-being comparisons. If both income and net worth are to enter into the computation of economic well-being, some means, arbitrary or otherwise, of combining income and assets is needed.

The third proposition describes in general terms a method of incorporating net worth in the economic well-being index. The conversion of net worth to an income flow might be achieved by multiplying the net worth of each family by the same conversion factor—for example, .05. When the resulting income flow is added to income, the index of economic well-being assumes a value of 9,500 for each family, and the following ranking and distribution results:

(3a) A = B = C = D = E .
.200 .200 .200 .200 .200

This computation is identical to the computation of an annuity of infinite duration given a discount rate of 5%. It is interesting to note that use of a discount rate of 6% results in the following values for the index of well-being:

A 9,800
B 9,750
C 9,700
D 9,650
E 9,600 ,

providing the ranking and distribution

(3b) A > B > C > D > E ;
.202 .201 .200 .199 .198

while use of a discount rate of 4% gives the following values:

A 9,200
B 9,250
C 9,300
D 9,350
E 9,400

and the ranking and distribution

(3c) A < B < C < D < E .
.198 .199 .200 .201 .202

Another procedure consistent with the third proposition is the simple addition of family income and net worth to derive measures of economic well-being. This procedure, of course, is identical to assuming liquidation of net worth at full value in the current period. The resulting values are:

A 38,000
B 33,250
C 28,500
D 23,750
E 19,000

and the ranking and distribution

(3d) A > B > C > D > E .
.267 .233 .200 .167 .133

One last procedure to convert net worth to an income flow involves use of the data on age of parents. Using a discount rate of 5% and annuitizing *net worth* over the expected lifetime of the father (see appendix, Tables A1, A2) results in the values:

A 10,100
B 10,050
C 10,020
D 9,995
E 9,890

and the ranking distribution

(3e) A > E > B > D > C .
.202 .201 .200 .199 .198

Finally, the fourth proposition suggests combining income and net worth by computing the present discounted value of expected lifetime earnings and adding the result to net worth. A procedure for accomplishing this will be explained in detail in the following section. For now, it suffices to say that when this procedure is used along with census data, the following values emerge:

A 134,800
B 119,875
C 101,600
D 83,250
E 62,000 ,

providing the ranking and distribution

(4a) A > B > C > D > E .
.269 .239 .203 .166 .124

This result depends also on the assumption that the males are Caucasian and are high school graduates. By varying the race and educational level in the

Proposition	Procedure	Ranking	A	B	C	D	E
1	a	A < B < C < D < E	.188	.194	.200	.206	.212
2	a	A < B < C < D < E	.188	.194	.200	.206	.212
	b	A > B > C > D > E	.300	.250	.200	.150	.100
3	a	A = B = C = D = E	.200	.200	.200	.200	.200
	b	A > B > C > D > E	.202	.201	.200	.199	.198
	c	A < B < C < D < E	.198	.199	.200	.201	.202
	d	A > B > C > D > E	.267	.233	.200	.167	.133
	e	A > B > C > D > E	.202	.201	.200	.199	.198
4	a	A > B > C > D > E	.269	.239	.203	.166	.124

example, one could generate many different rankings and distributions.

The data above summarize the results. The data indicate that the four propositions give rise to many different rankings and distributions. Indeed, the third proposition alone results in four different rankings and distributions depending upon the procedure employed. This means, for example, that a tax of $1,000 levied on each of the families would achieve horizontal equity given Proposition 3 and Procedure a, but would fail to do so for all others. This conclusion is especially sobering when the reason for choosing the propositions in the example is revealed. Each proposition represents a competing view of the proper treatment of income and assets in need analysis. As such, each is a likely candidate to underpin need analysis systems in the future.

As the reader has probably surmised, the results in the example above depend on the nature of the hypothetical data used as well as on the techniques used to construct the measures of economic well-being. That is, the relationship among income, assets, and age of parents present in the hypothetical data has, in part, determined the various distributions. There is an important lesson to be learned from this. Analysis of the theoretical characteristics uncovers many arbitrary assumptions and value judgments inherent in each approach. It is important to investigate the effects of such features on the perceived distribution of economic well-being among a properly drawn sample of aid applicant families.

The purpose of the following sections is to discuss the theoretical and practical implications of various measures of economic well-being consistent with these propositions. The second section compares the propositions in light of received economic theory after modifying each proposition to include a simple family size correction. The third section presents the design and results of an empirical examination of the perceived distribution of economic well-being consistent with the measures developed in the second section, using financial and demographic data from 2,320 families. Finally, the last section discusses the limitations of the analysis in the context of directions for future research.

II. Some Alternative Measures of Economic Well-Being

As was suggested in section 1, the traditional approach to the equitable distribution of aid funds has two noteworthy characteristics. First, such distribution is viewed as a problem of taxation based on ability to pay. The tax involved is one that demands a contribution from parents to the financing of postsecondary education for their dependents. Second, the expenditure side of the budget is assumed to be given or determined by forces irrelevant to the determination of tax shares. Consequently, this approach ignores the possibility of identifying the benefits to recipients of post-secondary educational services or their families and allocating tax shares accordingly. In short, this approach emphasizes the distribution of the tax bill, in isolation, as a matter of equity and/or welfare economics. It is this approach, or more specifically, the first step in such an approach which is the focus

of this study—an objective index of ability to pay or measure of economic well-being. The construction of such an index must precede not only the consideration of its relationship to utility, but also the embodiment of any equal sacrifice principle in a specific tax schedule.

The purpose of this section is to analyze the advantages and disadvantages of three general frameworks for measuring the economic well-being of families of financial aid applicants. These frameworks entail measuring economic well-being from three different standpoints using different data and computational procedures. These general frameworks are—

1. current income adjusted for family size,

2. current income and current net assets combined adjusted for family size, and

3. current and future income and current net assets combined adjusted for family size.

The measures of economic well-being analyzed in this section are used in the third section to construct Lorenz distributions for a group of 2,320 families. These distributions are then compared in terms of overall inequality and the treatment of specific subsets of the families.

The reader should bear in mind that the discussion which follows centers upon the appropriateness of alternative measures of economic well-being with regard to a specific subset of the population—the families of financial aid applicants. The point that is being addressed is the ability of such families to contribute to the financing of post-secondary education for their dependents. Consequently, the various measures which receive attention in this paper provide glimpses of perceived economic well-being either at a point in time or over a very short time span. In addition, certain practical considerations constrain the measure of economic well-being to be a relatively simple one. First, there is the need for the measure to appear both understandable and fair to those who provide scarce aid funds as well as to those who apply for and receive the funds. Second, there is the need for administrative convenience in allocating the funds. To the extent that these two factors limit the amount and type of data which a measure of economic well-being can draw upon; the choice of the measure is likewise constrained.

Obviously, the most serious difficulties are encountered in the collection of valid and reliable financial data from the families of financial aid applicants. The parents (guardians) realize, of course, that the information provided serves as input into a need analysis model which determines their expected contribution. Consequently, the temptation to underestimate their income and/or assets under such circumstances is powerful indeed. Methods to increase the validity and reliability of such data are not within the scope of this study. However, it is important to note that the desire to collect good data has led to a delimiting of the amount and type of data gathered. For instance, the data used to compute net assets for 2,320 families in section 3 consist of—

1. financial assets minus debts against such assets;

2. home, farm, and/or business equity;

3. other assets including other real estate minus debts against such real estate and the value of trusts.

This type of data is typical of that which is required in all existing need analysis models. For instance, the information required from the family of a dependent student applying for a Basic Educational Opportunity Grant follows the outline above and adds only those net assets in the form of consumer durables and personal assets which are worth over $500 each. Certainly, the inclusion of such assets and debts, in theory, would cause the aggregate net asset figure to more closely approximate what economists refer to as Net Worth (exclusive of human capital). It is difficult for this writer to believe that valid and reliable data on consumer durables can be collected without extensive surveillance procedures. Because of these difficulties the reader is asked to bear in mind that the term net assets as used in this paper refers to a specific subset of nonhuman wealth which may or may not correlate highly with a more theoretically satisfying construct.

Given the specific purpose of the economic well-being measure and the desire for relative simplicity, there are certain basic theoretical characteristics which the measure must exhibit. Specifically, the measure must be a function which assigns a dollar value to the economic well-being of every conceivable family in the subset and thereby provides a cardinal ranking of families characterized by preference and indifference. That is, the function when evaluated for two families A and B must reveal A to be better off than B, B to be better off than A, or A and

B to equal in economic well-being. Furthermore, if family C is revealed to be better off than A, and A to be better off than B, then C must be revealed to be better off than B. The same must hold true for identical positions of economic well-being also.

Each of the measures considered in this chapter fulfills the practical and theoretical requirements given above. Indeed, it is these requirements which cause exclusion of one of the measures in the example in section 1—the treatment of current income and net assets separately. Such a measure does not provide a ranking with the desired characteristics.

It should also be pointed out again that this study employs for convenience a simple per capita family size adjustment. This, of course, ignores an important factor which seems relevant in the construction of such an adjustment. Specifically, a simple per capita adjustment ignores the relationship between family size and age distribution and the amount of total family satisfaction which can be wrung from a given dollar measure of economic well-being. Suppose, for example, that the dollar cost of providing a given level of satisfaction increased with family size but at a decreasing rate. In such a case, a per capita adjustment of family income would cause the measure of economic well-being to underestimate the economic well-being of larger families. Such underestimation of economic well-being could be further strengthened by the failure of the economic well-being measure to include any satisfaction derived from family size or age distribution.

The first measure of economic well-being to be considered in this study is current income per capita. The overriding advantages of employing income adjusted for family size as the measure of economic well-being are understandability and administrative convenience. Everyone is familiar with the concept of yearly income—or income averaged over a definite time period. Self-reported income data can be verified easily through the Federal Income Tax system—cheating notwithstanding.

A more subtle advantage of using current income adjusted for family size occurs if one makes the value judgment that the family's contribution to the financing of postsecondary education for its dependents should be financed from current income over the time span when those dependents are in postsecondary education. Although the allocation of current income to financing postsecondary education must affect a family's potential net worth position, one could minimize such effects by constructing a tax on current income adjusted for family size so as to allow a family to at least maintain its standard of living and net worth position over the appropriate time period. Since income as reported on the Federal Income Tax return in the most recent complete tax year is a good predictor of current income as eventually reported, measuring economic well-being using current income adjusted for family size may seem attractive.

The use of current income adjusted for family size is clearly more palatable when the income data used includes all accretions to and diminutions of nonhuman wealth. In this case, income would equal current consumption plus increase in net worth. This is not so, however, with total income as reported for Federal Income Tax purposes. Such income figures do not include unrealized accretions to and diminutions of wealth. For instance, an increase in the value of an asset from $100 to $200 does not affect taxable total income. Similarly, if a consumer durable has depreciated in the current period, total income for tax purposes is not affected. It is extremely unlikely that, for a given family and a given period, accretions and diminutions would cancel out. Furthermore, federal and state taxation of realized income is, in part, a function of the source from which it accrues. Of course, to the extent that they favor certain groups with regard to asset accumulation, loopholes make the ignoring of current asset holdings less acceptable. It should be pointed out that the considerations above refer to unfortunate characteristics of the data used to measure current income and the system under which it is taxed, rather than to an ideal measure of current income and an ideal system of taxation. Both of the objections above are overcome, in part, when current asset holdings are included with current income in the measure of economic well-being.

It is easy to use Musgrave's (1959) outline of characteristics of the accretion concept of income to discover more disadvantages of using current income on the federal tax forms adjusted for family size as the measure of economic well-being. One is the likely exclusion of various types of imputed income. An important source of imputed income for many families of financial aid applicants is that resulting from owner-occupied housing. Net rental income—the difference between rent on comparable housing and necessary expenses of ownership—is not included in total income as defined in the Federal Income Tax. Other important examples of imputed income are the flow of services rendered by consumer durables and services rendered by housewives. Once again, the inclusion of such items in current income would certainly make income

adjusted for family size more attractive as a measure of economic well-being. Of course, the inclusion of these items would seem to improve matters only to the extent that valid and reliable data could be collected on assets of all types. In addition, since the distinction between factor earnings and transfers seems of little relevance in determining family economic well-being, the income measure used should probably include all transfers including gifts. This is not the case with current income as reported for Federal Income Tax purposes.

Fluctuating incomes present a subtle problem in assessing the economic well-being of families of financial aid applicants to the extent that progression exists in the tax structure. Families with fluctuating incomes would be required to contribute more to postsecondary financing than families with stable incomes when total income throughout the period is identical. This is not, technically, an issue which relates specifically to the choice of an objective index of economic well-being. Rather, it pertains to the shape of the assumed economic well-being utility function and the nature of a resulting tax scheme. However, this problem can be attacked by constructing a measure of economic well-being which is an average over a specified time period—e.g., the years over which postsecondary attendance will occur or the life span of the parents of the applicant. Nevertheless, to the extent that averaging of income complicates data collection and verification procedures significantly, the disadvantage above becomes a significant one with regard to measuring economic well-being using only data on current income adjusted for family size.

Another point regarding the use of income adjusted for family size pertains to the use of income data which does not exclude the cost of acquiring income. The accretion concept of income is a net concept. As arbitrary as the decisions as to what to exclude must be, an attempt should be made to adjust data for such considerations.

Even if reported current income adjusted for family size corresponded perfectly with the accretion concept, many would still believe it to be an inadequate measure of family economic well-being. This position maintains that a system of taxation based upon such a measure would produce undesirable results since this measure ignores the stock of assets and/or the present value of expected future income. Consequently, it is argued, data on net assets, age, race, educational attainment, and sex should be considered.

The second framework to be discussed in this paper is one which requires the combining of current income and net assets into a measure of economic well-being for each family. Before analyzing alternatives to do this, it should be pointed out that one of the most important reasons for preferring the use of current income alone is skepticism pertaining to the validity and reliability of self-reported asset information and the difficulty of verification. This discussion will assume for the time being at least that valid and reliable data on assets can be obtained from the families of aid applicants. The question then becomes how to handle such data.

In their article in *The American Economic Review*, Weisbrod and Hansen (1968) discuss alternative methods for combining current income and net assets into a measure of economic well-being superior to current income alone. Their basic approach is the conversion of net worth into an income flow (annuity value) which can be added to current income to produce a more comprehensive but operationally feasible measure of economic well-being. Weisbrod and Hansen's suggested measure of a family's economic position becomes:

$$Y^*_t = Y_t + NW_t \cdot A_n$$

where Y_t is current income, NW_t is current net worth, and A_n is the yearly return in dollars on an n-year annuity the present value of which is one dollar. Multiplication of NW_t, current net worth, by A_n produces the incremental current income which would result if the family's net worth were converted to an annuity. In doing this, Weisbrod and Hansen are careful to distinguish conceptually between a theoretical method of summing current income and net worth, and the problem of actually converting net worth into an annuity. Their method suggests neither that people do convert net worth to annuities nor that they should; it simply suggests a new two-dimensional ranking device.

However, as Weisbrod and Hansen realize, their scheme is not free of value judgment and arbitrary assumption. This point can best be made by investigating the derivation of A_n—the conversion factor. Two assumptions must be made before A_n may be evaluated for each family. First, an assumption concerning the discount rate must be made. Second, an assumption must be made concerning the time period for which the annuity will be computed. Both of these assumptions will significantly affect the value of the measure of economic well-being for a given family, its ranking, and its relative economic well-being. Although consistent treatment seems to dictate the use of a common

discount rate and time period for each family, the choice of specific rates and time periods is arbitrary.

It could be argued that because the choice of the discount rate involves a limited range of alternatives—e.g., 5% to 10%—this is not a significant problem especially for families whose income and net worth are close to the respective means. However, the choice of the time period is less constrained in that any time span from 1 year to infinity can be chosen. Suppose, for instance, that one believed that some assets should be liquidated or pledged as collateral against a loan to finance current postsecondary education expenditures. In this case, the current period can become the relevant time span requiring the simple addition of income and some portion of net worth, the sum of which would be adjusted for family size. Or, at the opposite extreme, the annuity could be computed to last forever. In this case, to the extent that the current income figure used corresponded to the accretion concept of income, economic well-being would be measured by current income alone as in the first framework discussed in this section. In the more probable case that current income did not include all accretions (e.g., imputed net rental income from owner-occupied housing), this would involve multiplying net worth by the assumed discount rate and adding the product to current income.

Between these two extremes, of course, exist many alternative time spans to consider. Those that seem most relevant are the alternatives that define the expected lifetime of the consuming unit in different ways. For instance, the time period may be the average of the life expectancies of the father and mother or the period required to raise Y* to some level. The important point is that each alternative may give rise to a significantly different perceived ranking and distribution of families according to economic well-being. An allowance for an estate at the time of expected death complicates matters still further.

It is interesting to investigate more closely one of these procedures for converting net worth to an annuity, namely, that which assumes annuitization over the expected lifetime of the consumer unit. For simplicity, define this period as the life expectancy of the mother. Table A1 in Appendix 1 presents the value of A_n for various time spans. Table A2 presents life expectancy figures. Using these, it is easy to construct the following table.

Table 1 illustrates that A_n increases as age increases. This is caused by the impact of a shorter time span on the value of an annuity which could be purchased with one dollar of net worth. If the data in the table are used to construct measures of economic well-being for two families who differ only with regard to the age of the parents, it is clear that the "older" family will appear better off. Are they? It would seem to many that the family with the younger parents is better off. Indeed, this feeling might become stronger if one knew in addition that there was a strong positive relationship between age of parents and net assets among families of financial aid applicants. In summary, the treatment of families with older parents under the Weisbrod-Hansen-scheme could appear as a significant disadvantage regardless of what time period was chosen for annuitization of net worth. In addition, this framework ignores, as does using current income alone, the present value of expected future income and its relationship to age, race, and educational attainment.

TABLE 1

Net Worth Conversion Rates by Age of White Mothers

Age	Conversion Rate = A_n
40	.059
45	.062
50	.066
55	.072
60	.080

To the extent that periods preceding and following the period over which postsecondary education must be financed are deemed relevant to assessing economic well-being, both of the measures of economic well-being considered thus far are inadequate. Using income alone adjusted for family size obviously ignores past income history and, at best, assumes that current income is a good indicator of future income. Using income and net assets combined and adjusted for family size treats the past and the future in a rather peculiar fashion. The net asset position of a family is obviously a function of past income, consumption and investment expenditures. It might seem that including net assets helps to account for past income received. However, it also accounts for past expenditure patterns. Since families of identical size and age distribution may exhibit significantly different expenditure patterns over time even when income histories coincide, their net worth at any point in

time is likely to be different. This, of course, will affect significantly the amount of financial aid received by dependents from each family when net assets are included in the economic well-being measure. With regard to future periods, the inclusion of net assets provides solely for the effect of the present level of such on future income. This in no way handles the problem of incorporating estimates of future income in the measure of economic well-being.

Before a framework for incorporating expected future income in a measure of economic well-being is described, some remarks concerning the measurement of net worth are in order. If the data on assets are not rich enough to permit the construction of a good proxy for net worth, then use of income and net assets combined as the measure of economic well-being will discriminate among families not only according to total wealth but also according to the forms in which wealth is held. This is an important consideration since administrative convenience requires the collection of a manageable amount of asset data, while fairness requires that the data are valid and reliable indicators of the wealth position of the family. As has been mentioned previously, this trade-off can result in support of measuring economic well-being by current income alone adjusted for family size. It also can be used as an argument to support schemes which minimize the importance of assets by emphasizing current and expected future income. It is such a scheme to which this paper turns its attention.

The last framework for measuring the economic well-being of the families of aid applicants requires computing the present value of total resources and adjusting for family size. This approach has been recommended by Allan Cartter (1971), and others. Whereas, the emphasis in the last framework was to convert net worth, a stock, to a flow which could be added to current income, the present value approach requires estimating the present value of expected future earnings, a stock, and adding the estimate to net worth. The sum is then adjusted for family size. The crucial aspect of this process is the estimation of future expected income. Since it is not administratively feasible to estimate future income family by family, it is necessary to take an actuarial approach placing the family in a group of families each sharing important common characteristics. Conceptually, it is then necessary to assume that what applies to the group applies to each individual family assigned to that group.

Miller and Hornseth (1967) have prepared for the Bureau of the Census estimates of the present value of lifetime earnings based on 1959 data from the 1960 Census. Estimates are presented which allow for alternative assumptions regarding annual productivity increases and discount rates. The estimates are derived from cross-sectional data on actual average current year earnings of males in 1959 by age, color, educational level, and occupation. The derivation of the estimates assumes that the relationship existing between age and average current earnings within each subgroup is a good guide as to how earnings behave as one's working life progresses. The average earnings for each age within each subgroup are reduced for mortality rates using 1964 data. At this point, these average annual earning data may be adjusted for expected productivity and price level changes.

For a particular subgroup the present value of expected future income through age 64 can be computed for each age level. This requires simply the discounting of the implicit income stream given by the values of average current income for the subgroup over the appropriate time span. In addition, the resulting estimates of present value can be divided by average current income at each respective age to obtain ratios of present value to current income. Such ratios can then be used to convert current earnings to estimates of the present value of expected future income by simply multiplying current earnings (or a multi-year average of earnings) by the appropriate ratio for each family. Table A3 in the Appendix presents these ratios for males with earnings in 1959—by age, color, and educational level. The present value approach would also require breakdowns by occupation and sex. However, data on occupation was not rich enough to provide useful estimates, while income data by sex did not exist as of this writing.

The significant differences in the ratios reported in Table A3 seem to indicate the importance of considering the impact of age, color, and educational level upon expected future income and, hence, on perceived economic well-being. In general, Table A3 seems to suggest the following:

1. Age, not surprisingly, seems to have the greatest impact on the ratio of present value of future income to current income.

2. The impact of educational level upon expected future income varies inversely with age and is much more important for whites than nonwhites.

3. The ratios are significantly lower for nonwhites than whites for most age levels.

Before jumping to conclusions concerning the likely effects of employing estimates with the above characteristics, it is important to note that the impact of using the present value approach will be determined, in part, also by the complex interrelationships among financial and demographic variables which exist in the actual aid applicant population. This is the reason for deferring the generation of hypotheses until Section III in which distributions of economic well-being consistent with each framework are presented.

A major disadvantage of the present value approach appears to be its extraordinary dependence upon a data base rich enough to provide good estimates of expected future income, by age, color, educational level, sex, occupation, and other interesting categorizations. Since the two preceding approaches exhibit data problems also, it is not surprising that an approach which requires such estimates has even greater problems. However, it must be remembered that errors in the prediction of future income do not necessarily imply inequitable treatment of aid applicant families. The errors to be minimized are errors of horizontal and vertical equity. In this regard, the relevant consideration is the "appropriateness" of the present value approach relative to competing approaches.

As does the use of current income alone or current income and net assets combined, the present value approach to measuring the economic well-being of aid applicant families takes the past as given. As with the use of current income and net assets combined, there is the possibility that two families identical in all respects except for past consumption patterns will be treated differently because of different net worth positions. Unlike the previous framework, however, elderly parents are given an off-setting advantage since the present value of their expected future earnings will be small.

Lastly, a significant disadvantage of the present value approach is its complexity and sophistication. It is likely that a family, a financial aid administrator, even a congressman would find it hard to swallow the rather large dollar amounts parading as measures of family economic well-being. Even if these could be obscured in some way, the suggestion that a family is well off because of the income which will accrue to it through age 65 would still appear quite repugnant to many.

Implications for Family Consumption

Expenditures for postsecondary education, like expenditures for health care, have come to be considered investment in human capital. Although this framework seems appropriate when the recipient of such services is the purchasing agent, it is much less clear that it is useful in analyzing expenditures by parents on postsecondary educational services for their dependents. It seems to this writer that expenditures of this sort may fruitfully be considered consumption expenditures on the part of parents.

Although this study does not focus on the decision by the family unit regarding the amounts and types of educational services to purchase, the discussion up to this point has definite implications for the explanation of family expenditure patterns over its life cycle. It is important to note these briefly since an attractive alternative to distributing aid funds on the basis of perceived economic well-being is the efficient allocation of aid funds in order to impact in an optimal fashion the demand by the family for postsecondary educational services.

The framework of using current income alone adjusted for family size would seem consistent with the position that current family income is a very important determinant of family consumption expenditures. Indeed if it could be demonstrated that the demand for postsecondary educational services were primarily a function of income over the appropriate years, the policy implication would be to use current income alone adjusted for family size (or some average of recent income data) as the measure of economic well-being upon which to distribute financial aid. This would be both equitable *and efficient*.

However, use of a measure of economic well-being consisting of current income and annuitized net worth would seem to imply that the family's net asset position was also an important determinant of consumption expenditures—and vice versa. A direct implication would seem to be that changes in transitory components of current income—e.g., income of mother, windfalls, etc.—would affect consumption expenditures far less than changes in permanent income even if the propensity to consume out of the "annuity" portion of economic well-being were greater than one. That is, such transitory income would effect only modest changes in consumption expenditures since the "annuity" value of transitory income rather than its absolute value is relevant.

Lastly, if the present value approach is taken, the implication is that of a consumption behavior very similar to a "life-cycle consumption function." Changes in the level of current income would have little effect on consumption expenditures unless the expected future income stream was simultaneously

affected. This reduces the impact of current income upon consumption expenditures. However, unlike its counterpart in a true life-cycle consumption framework, transitory income in the present value approach presented in this paper seems to have a stronger impact on consumption expenditures since such income will change the current net worth position dollar for dollar.

In summary, it seems that the appropriateness of a given economic well-being measure might in part be determined by its success in "explaining" variations in family consumption.

Implications for Defining and Assessing the Progressivity of Taxes

Economists have long recognized that an important characteristic of a given tax structure is the resulting dollar burden stated as a function of dollar economic well-being. Since income has traditionally been used to measure economic well-being, economists have been interested in the behavior of the ratio of actual dollar burden to income as income increases. Terminology was thus created to describe three possibilities. A tax is referred to as progressive, regressive, or proportional depending on whether the ratio of tax paid to income increases, decreases, or remains constant as income increases. However, changing the dollar measure of economic well-being from income to some other measure seems to necessitate a change in the definition of progressivity, regressivity, or proportionality. Using the same framework above, it now seems clear that the appropriate ratio to consider is the ratio of tax paid in dollars to economic well-being in dollars, however measured.

Finally, when assessing the progressivity, regressivity, or proportionality of a tax based on income, or property, or some other variable, it seems appropriate to analyze the incidence of the tax in terms of what is regarded as the best measure of economic well-being available. If competing measures of economic well-being exist, it would seem useful to assess progressivity, for instance, in light of each.

It is the purpose of the next section to use financial and demographic data from 2,320 families of financial aid applicants to construct proxies for each measure of economic well-being considered in this section. The distributions of economic well-being are then presented and compared in order to generate a set of testable hypotheses. Finally, the effects of simple per capita income and wealth taxes upon the distributions are presented.

III. The Data, Computations, and Results

The following section has four parts. First, a brief summary description of the data source and the computation of the various economic well-being proxies is presented. Second, the perceived distributions consistent with each economic well-being construct are depicted and compared. Third, the changing rankings of specific cohorts by age, color, and educational level are investigated. Fourth, a note is made concerning the assessment of the progressivity of income and wealth taxes.

The data source for this study at The American College Testing Program is an exceptionally rich file of financial and demographic information from families of financial aid applicants. These data were generated as part of another study, the purpose of which was to estimate demand curves for education by low-income families. Consequently, the drawing of the sample was not random from the population of financial aid applicants. Instead, there occurred deliberate oversampling of the nonwhite applicant population. This, of course, means that conclusions must be interpreted with caution. On the other hand, it will become clear that the major purpose of this study is not the estimation of population parameters. Rather, this study will use the data to demonstrate what happens to the perceived ranking of a particular group of families and to the distribution of economic well-being among those families when alternative measures of economic well-being are employed. This will result in a series of interesting hypotheses which can be tested using a data source containing the necessary data elements and from which a random sample from all aid applicants can be drawn. Such a data base is not available at this time.

The data used in this study are drawn from 2,320 families in which at least one dependent had applied for financial aid. All data are self-reported and subject to the criticisms usually leveled at such data. However, the validity and reliability of the data, although extremely important considerations, are not at issue in this study. Rather, the issue is how

such data are used to measure economic well-being. To investigate this, it is not necessary to assume the data are accurate, only that the data serve as input to a need analysis model from which results a measure of economic well-being. A description of the families as a group in terms of the data elements used in the study is included in the appendix.

Using these data, various measures of economic well-being are constructed and analyzed to assess their impact on the perceived distribution of economic well-being. These measures of economic well-being fall into the three main categories discussed in section 2—

1. current income alone,

2. current income and current net assets combined, and

3. current and future income and current net assets combined.

Once these measures are constructed and evaluated for each family, the distribution of economic well-being is presented in two ways. First, a simple distribution by deciles is given. Second, the Lorenz distribution resulting from the use of each measure of economic well-being is presented. The distributions are then compared in terms of the degree of inequality characterizing the distribution and the differential "treatment" of specific cohorts by age, educational level, and color, where such comparisons seem appropriate.

The first measure of economic well-being for each family is income per capita. Once again, the data used to construct the distribution of income per capita are self-reported. Income is total family income reported on a financial aid application which is keyed to the Federal Income Tax 1040 form. The number used to adjust income is the number of persons in the family as reported on the same form. Assuming that such data are accurate, the distribution of family economic well-being as measured by income per capita is given in Table 2.

The data in the table can be used to construct a Lorenz distribution which shows the cumulative portion of total economic well-being accounted for by successively higher percentages of families ranked from low to high in terms of the economic well-being measure.[1] Figure 1 presents the Lorenz distributions of economic well-being as measured

[1]A perfectly equal distribution of economic well-being would produce a Lorenz distribution coincident with the 45° line.

TABLE 2

Distribution of Income Per Capita

Decile	Income Per Capita	Share of Total Income Per Capita
1	702	2.3
2	1,000	4.3
3	1,267	5.7
4	1,538	7.1
5	1,789	8.3
6	2,091	9.8
7	2,414	11.2
8	2,836	13.1
9	3,504	15.7
10	11,033	22.5

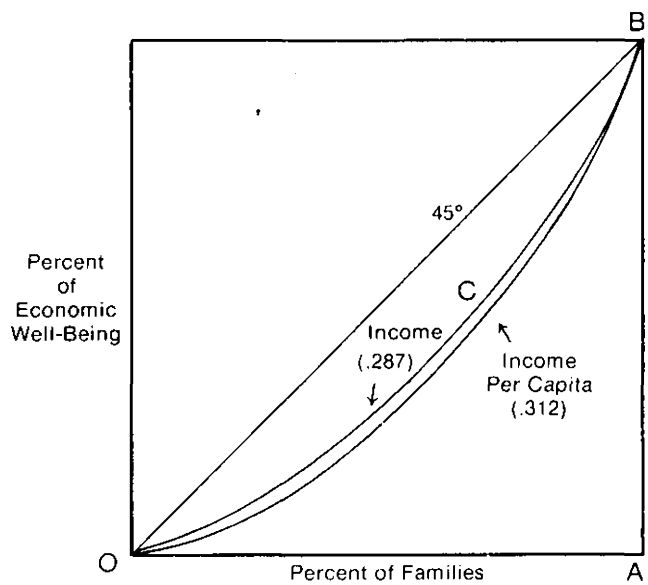

Fig. 1. Income Per Capita vs. Income.

by income per capita. An approximate measure of the degree of inequality of such a distribution can be computed using the following formula given by Kravis (1962):

$$R = \sum_{i=1}^{k} P_{i-1} Q_i - \sum_{i=2}^{k} P_i Q_{i-1}$$

where R is the approximate ratio of the area of concentration (OCB) to the area of maximum concentration (OAB), P is the cumulative percent of

families, Q is the cumulative percent of economic well-being accounted for by these families, and i is one of k economic well-being classes ordered low to high. The value of R for the distribution of income per capita is .31. This measure of inequality is based on the assumption that equal absolute differences in economic well-being at different points in the distribution are of equal importance.

Also included in Figure 1 is the Lorenz distribution of economic well-being as measured by income uncorrected for family size. Because of the overall tendency for lower incomes to be associated with higher family sizes, this distribution is characterized by a lower discrete concentration ratio of .29. In addition, inspection of the rankings indicates that larger families are perceived as being better off when income uncorrected for family size is used than when income per capita is used. For instance, when the measure of economic well-being is changed from income to income per capita, the number of families of five members or more lying below the median changes from 550 to 795—a change of about 45%.

The results above lead us to our first testable hypotheses concerning the total financial aid applicant population. These hypotheses will alert researchers to important considerations in building or modifying need analysis models.

Hypothesis I. The Lorenz distribution of economic well-being as measured by income per capita will exhibit more inequality than the distribution of income alone.

Hypothesis Ia. Larger families will appear to be appreciably poorer when the measure of economic well-being is income per capita than when income uncorrected for family size is used.

It should be noted that the simple family size correction used in this study is not typical of methods usually employed to adjust for family size. There are many competing approaches to measuring economic well-being given different family sizes, as well as different age distributions of the family members. Each will in general give rise to a different distribution of economic well-being among the families under study. Also, to the extent that competing adjustment schemes incorporate differential treatment of families of equal size but different age distributions, the use of each may well imply a unique ranking of a specific group of families—even if all such adjustments are monotonic increasing functions of family size.

The next set of economic well-being measures comes under the heading of current income and assets combined, for which alternative general approaches have been discussed in section 2. In this section each practical method used in constructing the economic well-being measures is explained briefly and the distributions are then presented. The simplest of these computations involves the addition of current income and net assets and division of the sum by family size. As was pointed out in previous sections, this is consistent with an assumption of liquidation of net assets in the current period. The distribution which results when this is done for each family is given in Table 3.

TABLE 3

Distribution of Income Per Capita + Net Assets Per Capita

Decile	Y + NA N	Share of Total
1	1,130	1.7
2	1,769	3.3
3	2,411	4.9
4	2,986	6.3
5	3,627	7.6
6	4,286	9.2
7	5,151	10.9
8	6,127	13.0
9	8,167	16.1
10	35,528	27.0

Once again the data in the table are used to construct the Lorenz distribution and compute the approximate measure of concentration. The concentration ratio for this distribution is .373 compared to .312 for the distribution of income per capita. This, along with Figure 2, demonstrates that the distribution of economic well-being as measured by income plus net assets (per capita) is more unequal than when the economic well-being measure is income per capita.

There are many factors which might contribute to the difference in inequality noted above. One of these is the degree of inequality in the distribution of net assets per capita. A concentration ratio of .544 shows the distribution of economic well-being as measured by net assets per capita to be more

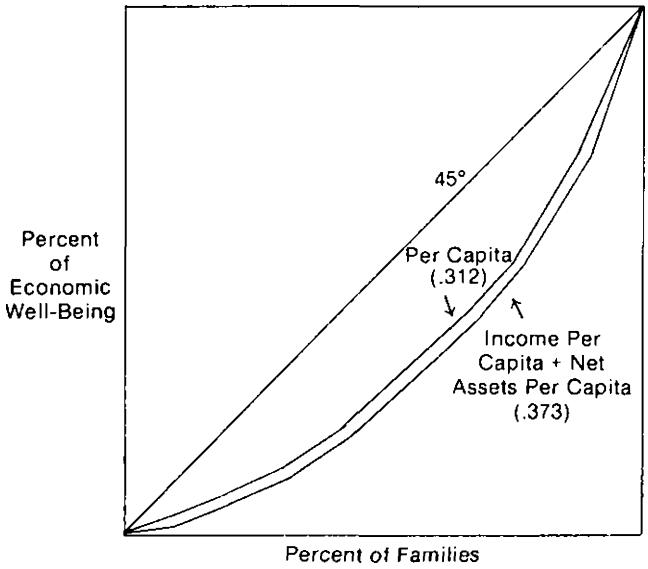

Fig. 2. Income Per Capita vs. Income Per Capita + Net Assets Per Capita.

unequal than any of the other economic well-being measures used in this study. This distribution is presented in Table 4, and the Lorenz distribution of net assets per capita appears in Figure 3. For purposes of comparison the distribution of income per capita is also presented again in Figure 3.

Once the assumption of full liquidation of net assets in the current period is relaxed, various techniques to combine income and net assets become available. The first considered here is the conversion of net assets to an incremental income flow by multiplying net assets by .05 and adding the result to income. As was stated previously, this is equivalent to computing the income stream in perpetuity which the net assets, if liquidated at full value, could purchase given a market interest rate of 5%. When this is done for each family, the distribution of economic well-being that results is that given in Table 5. The Lorenz diagram to which it gives rise is presented in Figure 4. The concentration ratio for this distribution is .317. Also included in Figure 4 for the sake of comparison is the Lorenz distribution of economic well-being as measured by income per capita plus net assets per capita. As was pointed out in section 2, the two approaches which result in the distributions depicted in Figure 4 are opposite extremes, in that the first implies a horizon of one period only, while the second implies an infinite horizon.

One last method of combining current income and net assets suggested by Weisbrod and Hansen (1968) is considered here. This method takes advantage of data on the age, color, and life expectancy of the main wage earner. In general, the essence of this technique of combining income and assets is that the annuity is computed to last over some definite time horizon between the current period and infinity. Alternative assumptions about the horizon are possible. For instance, in this study the time period is the number of years remaining until the expected

TABLE 4

Distribution of Net Assets Per Capita

Decile	Net Assets Per Capita	Share of Total
1	0	0.0
2	243	.3
3	667	1.9
4	1,114	3.8
5	1,600	5.8
6	2,100	8.0
7	2,833	10.5
8	3,733	14.2
9	5,167	18.8
10	34,529	36.7

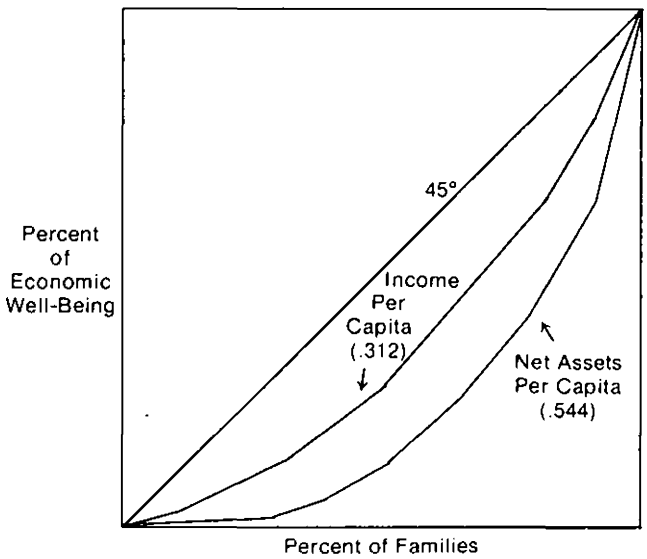

Fig. 3. Income Per Capita vs. Net Assets Per Capita.

TABLE 5

Distribution of Income Per Capita + .05 Net Assets Per Capita

Decile	$\frac{Y}{N} + .05\frac{NA}{N}$	Share of Total
1	750	2.4
2	1,081	4.4
3	1,377	5.8
4	1,640	7.1
5	1,903	8.4
6	2,200	9.8
7	2,555	11.2
8	2,962	13.1
9	3,690	15.5
10	11,117	22.3

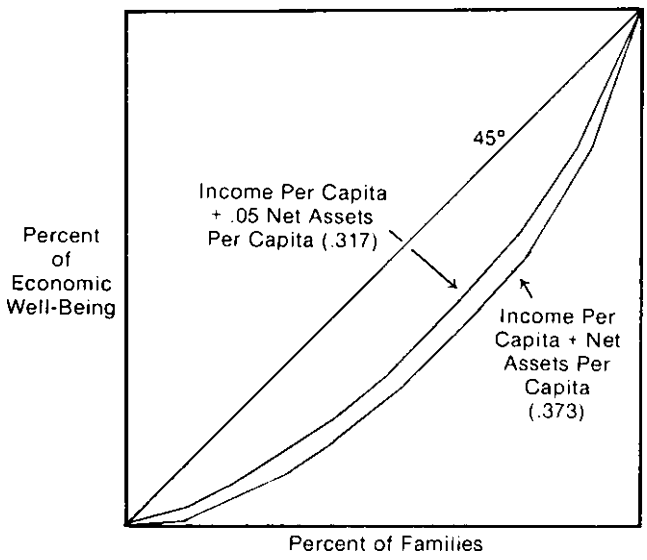

Fig. 4. Income Per Capita + .05 Net Assets Per Capita.

death of the main wage earner. Based on the age, sex, and color of the main wage earner, a conversion factor is computed using the following formula given by Weisbrod and Hansen (1968):

$$A_n = i[1 - (1 + i)^{-n}]^{-1}$$

where A_n is the income stream generated by one dollar's worth of assets at interest rate i for a time period n. This formula was discussed in section 2 and its derivation is presented in Appendix 2. Once the value of A_n is computed for each family, it is used to convert net assets to an income flow which is then added to current income. The sum is then deflated by family size. When this is done, the distribution of economic well-being is that given in Table 6 and Figure 5.

The reader will notice that this distribution is virtually the same as the distribution of economic

TABLE 6

Distribution of Income Per Capita + A_n Net Assets Per Capita

Decile	$\frac{Y + A_nNA}{N}$	Share of Total
1	76	2.4
2	1,101	4.4
3	1,397	5.8
4	1,669	7.1
5	1,949	8.4
6	2,244	9.8
7	2,599	11.2
8	3,009	13.1
9	3,742	15.5
10	11,137	22.3

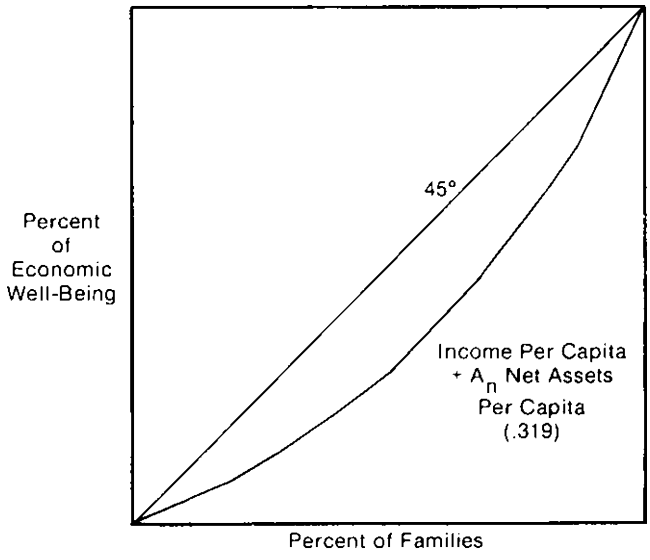

Fig. 5. Income Per Capita + A_n Net Assets Per Capita

well-being as measured by income plus .05 net assets. The concentration ratios are almost identical in Figures 4 and 5.

The preceding analyses lead to the second set of testable hypotheses concerning the perceived distribution of economic well-being among families of financial aid applicants. In general, different methods of combining income and assets do not result in identical perceived distributions of economic well-being among families. In particular the following hypotheses seem appropriate.

Hypothesis II. The distribution of economic well-being as measured by income per capita plus net assets per capita will exhibit more inequality than the distribution of income alone uncorrected for family size.

Hypothesis IIa. The distribution of economic well-being as measured by net assets per capita will exhibit more inequality than the distribution of income alone, income per capita, or any of the combinations of income per capita and net assets per capita presented previously.

Hypothesis IIb. The distribution of economic well-being as measured by income per capita plus net assets per capita will exhibit more inequality than the distribution of income per capita plus some portion of net assets per capita.

Hypothesis IIc. The distribution of economic well-being as measured by income per capita plus .05 net assets per capita will exhibit the same degree of inequality as the distribution of income per capita plus A_n net assets per capita.

The last measure of economic well-being to be discussed in this section involves the combining of current and expected future earnings and net assets. Whereas in previous examples, net assets, a stock, were converted to a flow which could be added to income, this measure of economic well-being calls for adding to net assets, a stock, the present value of future expected income. This approach, in general, has been discussed in section 2. The essence of this method, once again, is to compute the present value of future expected earnings for each main wage earner given his or her age, color, and educational level using data from a Bureau of the Census paper by Miller and Hornseth (1967). Then this amount is added to current income and the sum divided by family size. When this is done for each family, the distribution of economic well-being that results is that given in Table 7 and Figure 6. The concentration ratio is .359 for this distribution.

The results above lead to the following hypothesis.

Hypothesis III. The distribution of economic well-being as measured by the present value of resources per capita will exhibit more inequality than distributions of economic well-being which ignore future expected income.

TABLE 7

Distribution of the Present Value of Expected Income Per Capita + Net Assets Per Capita

Decile	Present Value Per Capita + Net Assets Per Capita	Share of Total
1	7,478	2.0
2	11,375	3.8
3	14,588	5.2
4	18,440	6.6
5	21,895	8.1
6	26,216	9.6
7	30,670	11.4
8	36,055	13.4
9	44,656	16.1
10	174,890	23.8

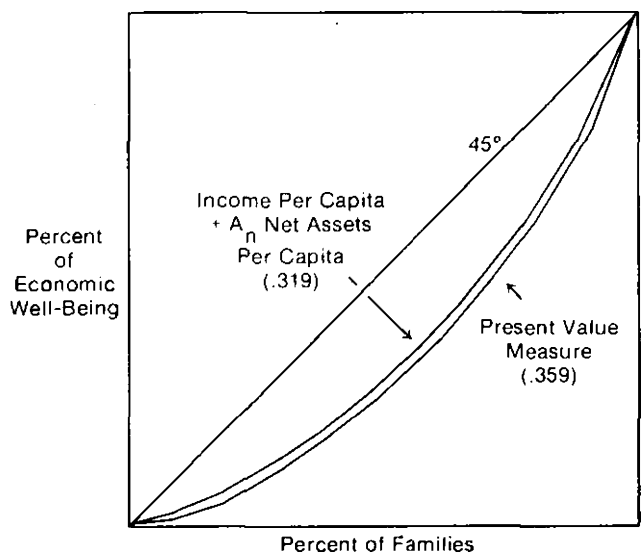

Fig. 6. Present Value Per Capita + Net Assets Per Capita vs. Income Per Capita + A_n Net Assets Per Capita.

The hypotheses generated thus far have dealt with the overall differences in the perceived distributions of economic well-being as measured by alternative indices. It is possible to look deeper into the distributions and generate hypotheses concerning the differential treatment of specific cohorts distribution by distribution. For the purposes of this study, families are grouped by age of main wage earner, educational level of main wage earner, and color. Then, the distribution of economic well-being of each cohort within the overall distribution is presented. This is done for the three distributions of economic well-being as measured by (1) income per capita, (2) income per capita plus A_n net assets per capita, and (3) the present value of resources per capita.

The first cohort to be considered is that of all families with main wage earners over 60 years old. The percentages of such families falling into various deciles in the three distributions are compared in order to generate hypotheses concerning the impact of changes in the economic well-being measure upon families with older parents. The main wage earners in most families who apply for financial aid are in their late forties to mid-fifties. Consequently, isolating those families with main wage earners age 60 or over should result in some preliminary notions in this regard. The results are given in Table 8. The following hypotheses seem to be suggested.

Hypothesis IV. Families with older main wage earners will be perceived as poorer when present value per capita is used to measure economic well-being than when income per capita or income per capita plus A_n net assets per capita is used.

Hypothesis IVa. The inclusion or exclusion of net assets per capita will have no appreciable effect on the perceived economic well-being of families with older main wage earners.

The second cohort to be considered here is that of nonwhite families. Table 9 presents data on the perception of economic well-being among nonwhite families within the same three distributions.

The results in Table 9 seem to suggest the following hypothesis.

Hypothesis V. The perceived distribution of economic well-being among nonwhite families will not change appreciably when net assets per capita and/or expected future income is included with income per capita in the economic well-being measure.

TABLE 8

Percent of Families with Main Wage Earner over 60 Years Old in Each Decile of Three Well-Being Distributions

Decile	$\frac{Y}{N}$	$\frac{Y}{N} + A_n\frac{NA}{N}$	Present Value / N
1	9.2%	9.2%	41.4%
2	10.5	7.2	27.0
3	9.9	9.9	15.1
4	9.9	9.9	7.2
5	10.5	8.6	4.6
6	5.9	7.9	2.0
7	10.5	11.8	1.3
8	11.8	11.2	0.7
9	7.9	10.5	0.0
10	13.8	13.8	0.7

TABLE 9

Percent of Nonwhite Families in Each Decile of Three Well-Being Distributions

Decile	$\frac{Y}{N}$	$\frac{Y}{N} + A_n\frac{NA}{N}$	Present Value / N
1	19.5%	22.6%	21.7%
2	17.3	15.8	16.7
3	11.7	12.4	11.5
4	12.4	12.1	12.1
5	9.2	8.3	10.5
6	7.1	7.0	6.7
7	5.9	6.4	6.8
8	5.8	5.3	5.6
9	6.4	5.9	5.9
10	5.0	4.2	4.4

The last cohort to be investigated is that of families whose main wage earner has at least a college education. The distribution of such families within the three overall distributions is presented in Table 10.

The results in Table 10 seem to suggest the following hypothesis.

Hypothesis VI. The distribution of economic well-being among families with main wage earners with

16 or more years of education will not change appreciably when net assets per capita and/or expected future income is included with income per capita in the economic well-being measure.

The last part of this section deals with assessing the progressivity, regressivity, or proportionality of income and asset taxes. It has been suggested in section 2 that the use of a measure of economic well-being other than current income requires a change in the way one defines progressivity. That is, for instance, if current income per capita plus some portion of net assets per capita is chosen as the measure of economic well-being, a tax is progressive if and only if the percentage of economic well-being sacrificed in taxes increases as economic well-being increases. The following analysis pertains to the overall effect of a per capita income tax and a per capita net asset tax on economic well-being defined in alternative ways.

A 10% tax on current income per capita will leave unchanged the distribution of economic well-being as measured by income per capita. However, it will change the distribution of economic well-being as measured by indices which include net assets and/or future expected income. Such is also the case when considering the progressivity of a per capita net asset tax. Table 11 presents the results of levying the specified tax on the distribution of economic well-being measured in alternative ways.

The table shows that a 10% per capita income tax is not a proportional tax when the measure of economic well-being is either income per capita plus A_n net assets per capita or present value per capita. For both measures of economic well-being, there are ranges where the percent of economic well-being paid in tax increases. Although an overall pattern is difficult to discern with respect to the 10% per capita income tax, this is not true for the 5% per capita net asset tax which exhibits a regressive character for the economic well-being measures under study. The table suggests that the inclusion of net assets per capita diminishes the regressivity of

TABLE 10

Percent of Families with Main Wage Earner with 16 or More Years of Schooling in Each Decile of Three Well-Being Distributions

Decile	$\frac{Y}{N}$	$\frac{Y}{N} + A_n\frac{NA}{N}$	Present Value / N
1	1.8%	1.8%	2.8%
2	4.0	3.7	3.7
3	7.4	8.6	6.8
4	8.6	5.8	8.3
5	9.2	10.5	7.7
6	12.3	12.3	9.8
7	9.8	9.8	11.4
8	12.9	14.8	16.6
9	16.3	15.1	12.9
10	16.9	17.5	19.7

TABLE 11

Percent of Economic Well-Being Paid in Taxes at Each Decile of Three Distributions

Decile	10% Per Capita Income Tax		5% Per Capita Net Asset Tax		
	$\frac{Y}{N} + A_n\frac{NA}{N}$	Present Value / N	$\frac{Y}{N}$	$\frac{Y}{N} + A_n\frac{NA}{N}$	Present Value / N
1	8.9%	1.8%	11.0%	6.1%	.8%
2	9.2	1.0	7.9	6.5	.5
3	9.4	0.7	7.6	6.4	.7
4	9.5	0.9	6.5	6.1	.7
5	9.1	0.9	6.4	6.1	.6
6	9.2	1.2	5.8	5.3	.8
7	9.3	1.0	4.7	5.6	.7
8	9.0	0.7	4.7	4.4	.4
9	9.4	0.8	4.2	4.6	.3
10	9.9	0.1	0.7	0.7	.05

the latter tax, as does the inclusion of expected future income. It should also be noted that the differences in the absolute sizes of the percents in the table are to be expected since different dollar values are involved with each measure of economic well-being.

IV. Summary and Concluding Remarks

The equitable distribution of aid funds is viewed in this paper as a problem in taxation according to ability to pay or economic well-being. This approach is emphasized because it is fruitful to consider the various financial need analysis models as systems of taxation which result in the parents' expected contribution to the postsecondary education of their dependents. However, this study deals with only the first step in the development of an equitable tax system, the construction and evaluation of an objective index of ability to pay or economic well-being. The definition of equal sacrifice and the specification of a well-being utility function are not discussed. It is the writer's opinion that the choice of measure of economic well-being must precede other considerations in developing an equitable system of taxation. Accordingly, a simple two-step model is suggested for evaluating alternative measures of economic well-being. The first step is a comparison of the theoretical implications of competing measures. The second step is a comparison of the implications of each measure for the perceived distribution of economic well-being among aid applicant families. Such a comparison serves an important function. It provides an insight into the possible impact of various theoretical propositions upon the ranking of a group of families among whom exist complex financial and demographic interrelationships, and thereby expedites the generation of meaningful hypotheses. Indeed, in this regard, this study and future investigations of the consequences of using a given measure of economic well-being can help in bypassing some of the difficulties inherent in the construction of a well-being utility function and facilitate the specification of an equitable tax system.

Limitations of the Analysis

This study is necessarily limited in scope. As was pointed out in section 2, only the first step in the construction of an equitable system to distribute financial aid, the construction and evaluation of an objective measure of family economic well-being, is considered. The choice and evaluation of such a measure is viewed as a problem in social policy—the minimization of inequity subject to administrative constraints. No attempt is made to specify the demand for postsecondary educational services on the part of the families of aid applicants. It seems that future research might be directed at explaining consumption patterns of these families, especially over the time span of postsecondary attendance. If consumption patterns can be explained most adequately in terms of one of the competing frameworks for measuring economic well-being, it would seem best to use that framework for distributing scarce aid funds.

Also this study is confined to the generation of testable hypotheses rather than the actual testing of hypotheses. This is necessary because an adequate data base does not exist to allow for proper sampling of the aid applicant population. In particular, such items as educational level of parents and color are not routinely collected by present need analysis systems. However, if such a data base becomes available the hypotheses generated in this paper will provide a framework for analyzing the perceived economic well-being of aid applicant families. Until such time, the data presented in section 3 should serve as warning to individuals responsible for revising present need analysis procedures. The form of each hypothesis is meant to alert researchers to the result expected by this writer. For instance, Hypothesis V suggests that the perceived distribution of economic well-being among nonwhite families will not change significantly when expected future income is included in the economic well-being measure. This is startling since the present value approach is supposed to sensitize the measure of economic well-being to the effects of color on expected future income.

It is the conclusion of this study that received economic theory can be useful in analyzing the implications of measuring economic well-being in alternative ways. However, a theoretical investigation raises as many questions as it answers. The choice of a measure of economic well-being involves many arbitrary assumptions and value judgments. Received theory is valuable primarily in identifying the truly normative aspects of models used to assess economic well-being and in pinpointing the consequences of assumptions and value judgments.

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APPENDIX 1

TABLE A1

Values of $A_n = [1 - (1 + i)^{-n}]^{-1}$ for i = .05 and n = 1, 2, ... 46

n	A_n[1]	n	A_n[1]
1	1.050	24	.072
2	.538	25	.071
3	.367	26	.070
4	.282	27	.068
5	.231	28	.067
6	.197	29	.066
7	.173	30	.065
8	.155	31	.064
9	.141	32	.063
10	.130	33	.062
11	.120	34	.062
12	.113	35	.061
13	.106	36	.060
14	.101	37	.060
15	.096	38	.059
16	.092	39	.059
17	.089	40	.058
18	.086	41	.058
19	.083	42	.057
20	.080	43	.057
21	.078	44	.056
22	076	45	.056
23	.074	46	.056

[1] A_n is the value of each of n yearly payments (interest and principal) which one dollar of net assets will generate, assuming an interest rate of 5%.

TABLE A2

Life Expectancy by Color, Sex, and Age

	Expectation of Life in Years			
	White		*Nonwhite*	
Age	Male	Female	Male	Female
30	40.8	47.1	35.3	41.3
31	39.8	46.1	34.4	40.4
32	38.9	45.1	33.6	39.5
33	38.0	44.2	32.8	38.6
34	37.0	43.2	32.0	37.7
35	36.1	42.3	31.2	36.9
36	35.2	41.3	30.5	36.0
37	34.3	40.4	29.7	35.2
38	33.4	39.4	28.9	34.3
39	32.5	38.5	28.1	33.5
40	31.6	37.6	27.4	32.7
41	30.7	36.6	26.6	31.8
42	29.8	35.7	25.9	31.0
43	28.9	34.8	25.2	30.2
44	28.0	33.9	24.4	29.4
45	27.2	33.0	23.7	28.6
46	26.3	32.1	23.0	27.9
47	25.5	31.2	22.3	27.1
48	24.7	30.3	21.7	26.3
49	23.8	29.4	21.0	25.6
50	23.0	28.6	20.3	24.8
51	22.3	27.7	19.7	24.1
52	21.5	26.8	19.0	23.3
53	20.7	26.0	18.4	22.6
54	20.0	25.2	17.8	21.9
55	19.2	24.3	17.2	21.2
56	18.5	23.5	16.6	20.5
57	17.8	22.7	16.0	19.8
58	17.1	21.9	15.5	19.2
59	16.5	21.0	15.0	18.5
60	15.8	20.2	14.5	17.9
61	15.2	19.5	14.0	17.3
62	14.6	18.7	13.5	16.7
63	14.0	17.9	13.0	16.1
64	13.4	17.1	12.5	15.6

Source.—Statistical Bureau of Metropolitan Life Insurance Co., 1968.

TABLE A3

Ratios of Present Value of Expected Lifetime Earnings to Current Earnings for Males with Earnings in 1959 by Age, Color, and Educational Level

	Educational Level					
	8 Years		*12 Years*		*16 Years*	
Age	White	Nonwhite	White	Nonwhite	White	Nonwhite
30	21.9	21.0	23.3	20.7	31.0	23.5
31	21.2	20.2	22.5	19.9	29.4	22.4
32	20.4	19.4	21.6	19.1	27.7	21.3
33	19.8	18.8	20.9	18.4	26.3	20.3
34	19.1	18.1	20.1	17.7	24.8	19.2
35	18.7	17.5	19.5	17.0	23.6	18.4
36	18.2	16.8	18.8	16.3	22.4	17.5
37	17.7	16.3	18.2	15.8	21.3	16.8
38	17.2	15.7	17.6	15.3	20.2	16.1
39	16.6	15.2	17.1	14.8	19.3	15.4
40	16.0	14.6	16.5	14.2	18.3	14.7
41	15.5	14.2	15.9	13.8	17.4	14.1
42	15.0	13.7	15.2	13.3	16.5	13.5
43	14.5	13.3	14.7	12.9	15.7	13.0
44	13.9	12.8	14.2	12.5	14.8	12.5
45	13.4	12.3	13.7	12.0	14.1	12.1
46	12.8	11.7	13.1	11.5	13.3	11.6
47	12.2	11.4	12.6	11.1	12.6	11.1
48	11.6	11.0	12.0	10.7	11.9	10.6
49	11.1	10.4	11.5	10.2	11.2	10.1
50	10.6	9.8	10.9	9.7	10.5	9.6
51	10.0	9.4	10.3	9.3	9.9	9.1
52	9.4	9.0	9.6	8.8	9.2	8.6
53	8.8	8.5	9.0	8.3	8.6	8.1
54	8.2	7.9	8.4	7.7	8.0	7.5
55	7.6	7.4	7.8	7.1	7.4	7.0
56	7.0	6.8	7.1	6.5	6.8	6.5
57	6.4	6.1	6.5	5.9	6.2	5.9
58	5.7	5.4	5.8	5.3	5.5	5.3
59	5.0	4.8	5.1	4.7	4.8	4.7
60	4.3	4.2	4.3	4.1	4.1	4.0
61	3.5	3.5	3.5	3.4	3.4	3.4
62	2.7	2.8	2.7	2.6	2.6	2.7
63	1.9	1.9	1.9	1.9	1.8	1.8
64	1.0	0.9	1.0	1.1	0.9	0.9

Source.—Miller and Hornseth (1967).
Note.—Table assumes a discount rate of 5% and annual productivity increases of 1%.

TABLE A4

Economic Well-Being Distributions

Decile	Y		Y/N		PVTR/N		HW/N		(Y + .05A)/N		(Y + A)/N		A/N	
	$	%	$	%	$	%	$	%	$	%	$	%	$	%
1	3,400	2.5	702	2.3	7,478	2.0	765	2.4	750	2.4	1,130	1.7	0	0.0
2	4,903	7.0	1,000	6.6	11,375	5.8	1,101	6.8	1,081	6.8	1,769	5.0	243	.3
3	6,127	13.0	1,267	12.3	14,588	11.0	1,397	12.6	1,377	12.6	2,411	9.9	667	2.2
4	7,500	20.4	1,538	19.4	18,440	17.6	1,669	19.7	1,640	19.7	2,986	16.2	1,114	6.0
5	8,770	29.2	1,789	27.7	21,895	25.7	1,949	28.2	1,903	28.1	3,627	23.8	1,600	11.8
6	10,000	39.4	2,091	37.5	26,216	35.3	2,244	37.9	2,200	37.9	4,286	33.0	2,100	19.8
7	11,400	50.9	2,414	48.7	30,670	46.7	2,599	49.1	2,555	49.1	5,151	43.9	2,833	30.3
8	13,074	64.2	2,836	61.8	36,055	60.1	3,009	62.2	2,962	62.2	6,127	56.9	2,733	44.5
9	15,429	79.5	3,504	77.5	44,656	76.2	3,742	77.7	3,690	77.7	8,167	73.0	5,167	63.3
10	33,700	100.0	11,033	100.0	174,890	100.0	11,137	100.0	11,117	100.0	35,528	100.0	34,529	100.0

TABLE A5

After Tax Distributions

Decile	PVTR/N − .10 Y/N		PVTR/N − .05 A/N		HW/N − .10 Y/N		HW/N − .05 A/N		Y/N − .05 A/N	
	$	%	$	%	$	%	$	%	$	%
1	7,340	2.0	7,415	2.0	697	2.4	718	2.4	625	2.1
2	11,257	5.7	11,320	5.7	1,000	6.8	1,029	6.7	921	6.2
3	14,489	10.9	14,488	10.9	1,266	12.6	1,308	12.4	1,171	11.8
4	18,278	17.6	18,302	17.6	1,510	19.7	1,567	19.5	1,438	18.7
5	21,696	25.6	21,770	25.6	1,771	28.2	1,830	27.9	1,674	27.0
6	25,907	35.3	26,000	35.3	2,038	37.9	2,125	37.6	1,969	36.7
7	30,372	46.7	30,453	46.7	2,357	49.1	2,453	48.9	2,300	48.0
8	35,819	60.1	35,920	60.1	2,740	62.2	2,877	61.9	2,700	61.2
9	44,291	76.1	44,529	76.1	3,390	77.7	3,571	77.5	3,357	77.1
10	73,787	100.0	174,807	100.0	10,038	100.0	11,054	100.0	10,950	100.0

APPENDIX 2

Derivation of A_n

The income stream A_n generated by \$1 worth of assets at a given interest rate i must satisfy the following equation:

$$\$1 = \frac{A_n}{(1+i)} + \frac{A_n}{(1+i)^2} + \ldots + \frac{A_n}{(1+i)^n} .$$

Let $Z = (1+i)^{-1}$, then

$$\$1 = A_n [Z + Z^2 + \ldots + Z^n] .$$

Adding and subtracting A_n and rearranging terms,

$$\$1 = A_n [1 + Z + Z^2 + \ldots + Z^{n-1}] - A_n + A_n Z^n .$$

Replacing the finite geometric series in the parentheses with its solution,

$$\$1 = A_n \left[\frac{1 - Z^n}{1 - Z}\right] - A_n + A_n Z^n .$$

Solving for A_n,

$$A_n = \frac{1}{\left[\frac{1 - Z^n}{1 - A}\right] - 1 + Z^n} .$$

Simplifying,

$$A_n = \frac{1 - Z}{Z(1 - Z^n)} .$$

Substituting $(1+i)^{-1}$ for Z yields the final result:

$$A_n = i[1 - (1+i)^{-n}]^{-1} .$$

APPENDIX 3

Description of the Student Sample

This appendix describes the sample of students responding to ACT's College Investment Decision questionnaire. Two of ACT's Research Service instruments, the Class Profile Report and the Profile of Financial Aid Applicants, were used to organize the data and provide comparisons to national norms in some cases. These data fall into six main categories: (1) general demographic information, (2) academic ability, (3) educational aspirations, (4) student personnel needs, (5) college attractions, and (6) family financial background. The following tables provide a brief summary of sample student characteristics in each of these areas, emphasizing comparison to national norms, when such are available.

I. GENERAL DEMOGRAPHIC INFORMATION

A. Number of Students in Sample—2,766

B. Age Distribution (%)

	Men	Women	Total
21 and over	9	6	7
19-20	88	88	89*
18 and younger	3	5	4

Mean age for sample—19

C. Sex Distribution (%)

	Men	Women
Sample	37	63
Norm	48	52

D. Race/Ethnic Distribution (%)

	Men	Women	Total
Afro-American/Black	19	25	22
American Indian	2	1	2
Caucasian Amer./White	71	66	68
Mexican/Span. American	7	6	7
Oriental American	2	1	1

*Small discrepancies may occur due to rounding.

II. ACADEMIC ABILITY

A. Mean Scores on ACT Assessment

	English	Math	Social Studies	Natural Sciences	Composite
Men	18.1	22.4	20.7	22.6	21.1
Women	19.7	19.5	19.5	20.7	20.0
Total	19.1	20.6	20.0	21.4	20.4
Norm	18.7	20.2	19.9	21.0	20.1

B. Percent of Students in Selected Composite Score Intervals

	1-15	16-20	21-25	26-36
Sample	21	25	32	22
Norm	20	32	33	15

C. Mean High School Grade Point Covering Areas above

	Men	Women	Total
Sample	2.89	3.09	3.01
Norm	—	—	2.68

D. Percent of Students in Selected Grade Point Intervals

	0-1.4	1.5-2.4	2.5-3.4	3.5-4.0
Sample	1	18	49	32
Norm	2	33	48	17

E. Percent of Students Graduating in High School Classes of Different Sizes

	1-24	25-99	100-399	400-up
Sample	5	27	40	27
Norm	4	19	45	33

F. Percent of Students Participating in Honors/Advanced Programs in High School—49%

III. EDUCATIONAL ASPIRATIONS

A. Percent of Students Proposing Various Educational Majors

	Sample	Norm
Educational	20	18
Soc./Religious	13	10
Bus./Pol.	17	18
Scientific	8	7
Agric./For.	2	3
Health	12	9
Arts/Human.	12	12
Engineering	6	8
Trade/Ind./Tech.	2	3
Undecided	8	11

B. Percent of Students Seeking Various Degrees

	Sample	Norm
Voc./Tech.	1	2
2-Year College	8	12
BA, BS, BD	47	47
MA, MS	26	23
PhD, EdD	14	12
Other	5	5

IV. STUDENT PERSONNEL NEEDS

A. Percent of Students Planning to Use Housing of Various Types

	Sample	Norm
College Housing	69	55
Off Campus	7	9
At Home/Relative	24	36

B. Percent of Students Planning to Bring Car—33% (Norm—47%)

C. Percent of Students Expressing Various Special Educational Needs (Reading Skills, etc.)—All Less than Average

D. Percent of Students Desiring to Participate in Various Honors/Advanced Programs and Extracurricular Activities—All Greater than Average

E. Percent of Students Expecting to Be Full Time—96% (Norm—93%)

F. Percent of Students out of High School One Year or More—5% (Norm—8%)

V. COLLEGE ATTRACTIONS

A. Percent of Students Indicating Various Items as Major Influences in Selecting College Shows Sample Students Placing More Weight than Average on Intellectual Reputation and Financial Considerations

B. Percent of Students Indicating Financial Considerations as Most Important—19% (Norm—11%)

VI. FAMILY FINANCIAL PROFILE

The average financial aid applicant in the sample comes from a family whose average income is $8,500,and has 2 brothers and sisters, 0 of whom are also in college.

The median incomes for different family members are as follows: the father earns $6,700, the mother earns $0, the single dependent applicant earns $550, the combined income of married dependent applicants is $1,250. The mean income for single independent students is $2,792, and the combined income of married independent students is $5,885.

Although the father of the typical dependent applicant is salaried or a wage earner (84%), 11% are farm owners and 5% are business owners. The average age of the main family earner is 49; the applicant's parents have net assets valued at $7,750; and if they own a home, it is valued at $12,804.

The average commuter need is $839, and the average resident need is $1,281. The typical applicant is single and dependent on parental support; 2.7% of the applicants are married; 5.0% are independent.

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