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ABSTRACT

The accuracy of 3 measures of future income was investigated for a sample of families filing Parents' Confidential Statements with the College Scholarship Service (CSS). Measures were: parents' reports of current (1968) income; parents' estimates of 1969 income; and predictions of 1969 income made by application of least squares regression parameters to parents' estimate of income. Two types of accuracy were considered: that of prediction assessed by the correlation between current or estimated income and the actual 1969 income. Analysis indicated that the best single predictor was estimated income, followed closely by current income. The accuracy of each income measure was also investigated by assessing median discrepancies between parents' contribution associated with each income measure and the contribution associated with actual 1969 income. Current and estimated income result with about equal frequency in substantial undercalculations of parents' contribution. But use of current rather than estimated income would result in substantial overcalculations for approximately 31,000 CSS families. Needs analysis procedures relying on current or estimated income, therefore, place low income families at a disadvantage by overstating their future year income. (JS)

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Estimating Parents' Contribution to College Costs: The Accuracy of Three Measures of Succeeding Year Family Net Income

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College Scholarship Service

ESTIMATING PARENTS' CONTRIBUTION TO COLLEGE COSTS: THE ACCURACY OF THREE MEASURES OF SUCCEEDING YEAR FAMILY NET INCOME

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ESTIMATING PARENTS' CONTRIBUTION TO COLLEGE COSTS: THE ACCURACY OF THREE MEASURES OF SUCCEEDING YEAR FAMILY NET INCOME

Abstract

The accuracy of each of three measures of future income was investigated for a sample of families who filed Parents' Confidential Statements with the College Scholarship Service in two consecutive years. The three income measures investigated were: (1) parents' reports of current (1968) income, (2) parents' estimates of 1969 income, and (3) predictions of future year (1969) income made by application of least squares regression parameters to parents' estimate of income. Two types of accuracy were considered. The first was the accuracy of prediction assessed by the correlation between the predictors (current or estimated income) and the criterion (actual 1969 income). This analysis indicated that the best single predictor of actual income was estimated income, with a validity coefficient of .86, and was followed closely by current income, with a validity coefficient of .83. The accuracy of each income measure was also investigated by assessing the median discrepancies between parents' contribution associated with each income measure and the contribution associated with actual 1969 income. Current and estimated income result with about equal frequency in substantial (>$100) undercalculations of parents' contribution; but use of current rather than estimated income would result in substantial (>$100) overcalculations for approximately 31,000 additional CSS families. In addition, needs analysis procedures that rely on either current or estimated income place low income families at a disadvantage by overstating their future year income. This study suggests least squares regression as one possible approach to remove this inequity.

ESTIMATING PARENTS' CONTRIBUTION TO COLLEGE COSTS: THE ACCURACY OF THREE MEASURES OF SUCCEEDING YEAR FAMILY NET INCOME

Introduction

The College Scholarship Service (CSS), an activity of the College Entrance Examination Board, is primarily concerned with the standardized determination of financial need of applicants for financial aid. The CSS instrument used for the collection of family financial data is the Parents' Confidential Statement (PCS), a carefully developed form designed to elicit financial information for the previous calendar year, the current calendar year, and the succeeding calendar year.

Parents who file the PCS are instructed to provide an estimate of their succeeding year's income and expenses, as well as their current assets and liabilities. CSS has, since its inception, based its calculations of parents' contribution on parental estimates of future year net income. The rationale for this approach has been the belief of financial aid officers that the determination of financial need should be based on income earned during the year in which college expenses are incurred. The use of parental estimates of future year income to measure family financial strength has been criticized, however. The major criticism is that parents' estimates of future year net income are inaccurate. To the extent that estimates of income are inaccurate, CSS calculations of parents' contribution, and thus financial need, are inaccurate. Several studies have been conducted which indicate that parents tend to be conservative in their estimates of succeeding year income.

Smith (1964) studied the differences between parents' estimates of succeeding year net income and reports of their net income from the Retail

Credit Company (RCC). He found an average difference of $282 between reports to CSS and those of RCC, which suggested that parents tend to underestimate their net income on the PCS. In a similar study, Gannon (1967) found that RCC reports tend to credit parents with greater income than is reported to CSS.

In a study of renewal PCSs filed in 1968-69 by families who also completed the 1967-68 PCS, it was found that parents at each of three income levels underestimated their succeeding year's effective income (Horch, 1970). The mean difference between estimated effective income and actual effective income reported the following year was $512. Orwig and Jones (1970) have published data which suggest that parents tend to be conservative in their estimates of future year income. A comparison of estimates of income made by parents who filed the 1968-69 Family Financial Statement and the actual income reported by these parents on the 1969-70 FFS showed an average difference of $630; that is, the parents in this self-selected sample underestimated future income by an average of $630. The studies cited above, which assumed that reports of actual income were accurate, suggest that use of parental estimates of income in needs assessment procedures may result in undercalculation of parents' contribution.

The overall purpose of the present study was to determine the comparative accuracy of parents' contribution when calculated from each of three alternative measures of future year income. The alternative income measures explored in this study were (1) parents' reports of current income, (2) parents' estimates of future year income, and (3) predictions of future income made from linear regression equations.

Method

The population studied consisted of all parents who filed a Parents' Confidential Statement with CSS between October 1968 and September 1969 and who filed a second PCS between January and August 1970. Every sixth family who filed PCSs in consecutive years--that is, those who met the above criteria--was selected from the alphabetical tape files. Families whose actual 1969 net income, as reported in 1970, exceeded $19,999 were excluded from the sample in order to obtain a relatively symmetrical distribution of actual net income. This study employed least squares statistical procedures which made it desirable to avoid skewed distributions where the extreme scores tend to dominate and distort the resulting statistics. Also excluded from the sample were all families for whom CSS was unable to calculate a parents' contribution because of "unusual conditions." Since the names of the families were not associated with any data in this study, the confidentiality of all information provided by parents was assured. The following income data were assembled for each family in the sample:

(1) 1968 net income (current year net income) reported to CSS in 1968-69

(2) Estimated 1969 net income reported to CSS in 1968-69

(3) Actual 1969 net income reported to CSS in 1970.

From information supplied by the sample families in 1969-70, they were classified, for purposes of this study, by actual 1969 net income into four income classes.

Data supplied by the sample families in 1968-69 were used to classify them by occupation, family status, unusual condition, and pattern of income estimate (optimistic, pessimistic). Separate analyses were conducted for

groups within each of these categories because of the unique rationale for estimating their parents' contribution (except for groups based on pattern of income estimate).

Once all data were assembled for the sample families, multiple linear regression equations were developed to find the best predictor composite of actual future year income. The resulting regression parameters were applied to each family in the sample, and a prediction of each family's actual future year income was made. Following application of the regression parameters to the sample, four parents' contribution figures were calculated for each family. The four contribution figures resulted from calculations based on current (1968) income, estimated (1969) income, predicted (1969) income, and actual (1969) income.

In this study two types of accuracy were considered. First, the accuracy of prediction for an individual was determined by the correlations between the predictors (current and estimated income) and the criterion (actual income). Second, the accuracy of prediction made for a group was assessed by comparing group averages on the predictors and the criterion. The two types of accuracy are not necessarily related. A measure could accurately predict mean group income but not the income of any individual within that group. On the other hand, a measure could correlate highly or even perfectly with individuals' income but under- or overpredict all individuals' income by a given constant.

Because the crucial variable in need analysis is parents' contribution, the accuracy of current, estimated, and predicted income was also assessed

in terms of parents' contribution differences. For example, if a certain income measure, such as estimated income, was perfectly accurate for individuals and groups, then the parents' contributions calculated from it would be exactly the same as those calculated from actual income. In this context, the relative accuracy of a given income may be defined as the extent to which its parents' contribution calculations differ from those of actual income.

Three parents' contribution differences were calculated for each family in the sample by subtracting the contribution based on actual income from the contribution based on current, estimated, and predicted income. These differences were distributed separately for the total group and for each of several subgroups. Parents' contribution median differences were then calculated. These median differences provided the primary method for assessing the group accuracy associated with each of the three alternative income measures.

Results

Comparison of Sample with the 1968-69 CSS Pre-freshman Population

Because the sample for this study consisted of families who filed PCSs in consecutive years, the possibility existed that it might not be representative of the entire population. In general, the group of consecutive year PCS filers may be thought of as renewal candidates who are reapplying for financial aid received during the last academic year (1969-70). Due to the process of selection, it would be expected that the income of renewal candidates' families would tend to be lower than that of pre-freshman aid

applicants. Table 1 presents a comparison of the income distributions of sample families with all pre-freshman CSS families.

From this table it is apparent that a selection process is operative, and that this process results in a greater proportion of families whose estimated income is below $10,000. Further inspection of Table 1 indicates that the sample consisted of proportionately more families with income of $0 to $4,999 and $5,000 to $9,999, fewer families with income between $10,000 and $19,999, and because of deliberate exclusion, no families with income over $20,000. The percentages of business owners, farmers, and

Table 1

Comparison of Estimated 1969 Net Income of Sample Families and Families Who Filed Pre-freshman PCSs with CSS in 1968-69

Estimated 1969 Net Income	Pre-freshman PCS Filers	Sample Families
0 - 4,999	13.5%	16.1%
5,000 - 9,999	39.0	46.6
10,000 - 14,999	32.2	30.4
15,000 - 19,999	11.1	6.9
20,000 - over	4.5	---
Total	100.0[a]	100.0%

[a]Because of rounding, the sum of the percentages is not exactly 100.0.

other families in the sample are compared, in Table 2, with the corresponding percentages in the total CSS pre-freshman population.

Table 2

Percentages of Business Owners, Farmers, and Others in CSS Sample and in CSS Pre-freshman Population

	Sample Families	Pre-freshman Population
Business Owners	8.2%	7.8%
Farmers	8.3	6.2
Others	83.4	86.0
Total	100.0%	100.0%

The sample consisted of a slightly higher percentage of business and farm families and a slightly lower percentage of "other" or nonbusiness/farm families. The percentage differences, however, are minimal.

Prediction of Future Year Income

If the premise is accepted that need analysis should be based on the most accurate indicator of future income, then the question becomes, "What is the most accurate indicator?" The overall purpose of this study was to determine which measures or combination of measures would be the most accurate predictors of actual future income.

In attempting to predict future year income a number of alternative measures were considered. The two major ones were current (1968) year income and estimated (1969) income. Three other variables were considered, but only peripherally. Current income tax, assets, and debts were analyzed in order to determine whether they add any unique information to current or estimated income in the prediction of future income. The intercorrelations of the five variables and their correlation with actual income are presented in Table 3.

Table 3

Intercorrelations of Five Predictors of Actual Income

and Their Correlation with Actual Income

Variables	Estimated	Current	Tax	Assets	Debt	Actual
Estimated						
Current	.89					
Tax	.69	.75				
Assets	.07	.09	.04			
Debt	-.03	-.02	-.06	.89		
Actual	.86	.83	.67	.06	-.04	
Mean	9,040	9,161	768	17,735	3,566	9,784
SD	3,976	4,112	711	27,969	12,845	4,261
Skewness	.17	.15	.44	.72	.75	.07

It can be seen that the best single predictor of actual income is estimated income, with a validity coefficient of .86, and is followed closely by current income with a validity coefficient of .83. From the practical point of view the difference of .03 between the two variables is neither meaningful nor significant. The near-zero correlations of assets and debt with actual, current, and estimated income is probably a function of their highly skewed distributions. It can be seen from Table 3 that the standard deviations of assets and debts are larger than their respective means. The large standard deviations are the result of a few extreme cases at the upper end of each of the two distributions. For example, there were 11 families with assets over $500,000 and nine families with debts amounting to more than $250,000. The Pearson product-moment correlation coefficient becomes attenuated when two distributions being correlated are of unequal shape. On the other hand,

actual, current, and estimated income are not significantly skewed and are therefore appropriately related through Pearson's r. The high correlation (.89) between estimated and current income suggests that these two measures are providing very little unique information about actual future income.

Although it is clear from the results presented in Table 3 that estimated and current income are the only valid single predictors of actual future income, an attempt was made to find the best predictor composite by combining all five predictor variables in multiple linear regression. The backward test selection procedure was used to find how much each predictor contributes to the multiple correlation. The procedure began with the computation of a multiple correlation based on all five predictors. At each successive step the predictor with the lowest partial correlation with the criterion was eliminated and a new multiple correlation was computed. Table 4 indicates the order in which the variables were dropped (1= dropped first) and the multiple correlation resulting at each iteration. It is evident that current income, tax, debt, and assets add virtually nothing to the predictive validity of estimated income. There are several possible explanations for this result. First, multiple linear regression assumes normal distribution of observations and assets, debt, and tax do not meet this assumption. Second, the high validity of estimated income (.86) leaves little room for improvement.

Table 4

Backward Test Selection of Five Predictors of Actual Income

Order of Elimination	Variable	R
1	Assets	.87
2	Debt	.87
3	Tax	.87
4	Current Income	.87
5	Estimated Income	.86

The analysis conducted up to this point indicates that actual future income can be estimated by parents to produce an accurate rank ordering of families' incomes. In addition, preliminary analyses indicated that both current and estimated income overstated the actual income of low income families, and both understate the actual income of middle and higher income families. The first result supports the use of estimated income in needs analysis procedures; the second result suggests that a technique for adjusting parents' reports of income should be investigated.

A predicted income was calculated for each family by computing least-squares parameters for the regression of actual on estimated income within each of the four income groups. These parameters were applied to each family's estimated income to produce a predicted income. Tables 5 and 6 compare the mean current, estimated, and actual income by occupational group and by income level. Notice that the predicted and actual means in Table 6 for the four income groups and the total sample are identical. The reason for this is that the prediction weights were calculated to produce a distribution of income which would have a mean identical to that of actual income.

Table 5

Comparison of Current, Estimated, Predicted, and Actual

Net Income Means by Occupational Group

Occupational Group	N	Current Income	Estimated Income	Predicted Income	Actual Income
Business Owners	3,192	8,910	8,751	9,344	9,266
Farm Families	3,271	7,141	6,915	7,718	7,679
Others	32,582	9,388	9,282	10,035	10,046
Total Sample	39,045	9,161	9,040	9,784	9,784

Table 6

Comparison of Current, Estimated, Predicted, and Actual

Net Income Means by Income Level

Income Level	N	Current Income	Estimated Income	Predicted Income	Actual Income
0 - 4,999	5,509	4,041	3,907	3,220	3,220
5,000 - 9,999	15,029	7,397	7,272	7,672	7,672
10,000 - 14,999	13,581	11,100	10,962	12,198	12,198
15,000 - 19,999	4,926	14,922	14,878	16,916	16,916
Total Sample	39,045	9,161	9,040	9,784	9,784

Also worthy of note is the fact that the means for current and estimated income of all occupational and income groups are lower than the means for actual income, with the exception of the lowest income group. Families in this category tended to overestimate their future year income. Their mean current year income was also higher than their mean actual future income. Apparently, these families experienced a real decline in income from 1968 to 1969.

Comparative Accuracy of Alternative Measures of Future Income

A fundamental question which this study has attempted to answer is whether it really makes any difference which of the three alternative measures, current, estimated, or predicted income, are used in need analysis. Statistically significant differences between the measures in predicting actual income are not very meaningful because the large sample size would make even small differences statistically significant. Furthermore, the crucial variable in need analysis is not income, but the total parents' contribution to college costs. Where there are no financial complications, parents' contribution is derived from net income and number of dependent children. Thus, there is a high but not necessarily perfect relationship between family income and parents' contribution.

In order to make a meaningful comparison of the relative accuracy of the three alternative measures of actual future income, each family's current, estimated, and predicted income was converted to total parents' contribution. The conversion was made by formulas currently employed by CSS. Table 7 compares the parents' contribution of actual income subtracted from estimated, current, and predicted income by medians for each occupational group.

Table 8 presents similar information by income level. It can be seen that relatively large distortions of median parents' contributions derived from current and estimated income occur with the "others" occupational group and with the higher income groups. The overall median parents' contribution is about $80 less than what it should be based on the criterion of actual reported income. Those with incomes of $10,000 to $19,999 are typically undercontributing by more than $200 when using either of these two alternative measures to derive their contributions. Parents' contribution calculated from predicted income, on the other hand, results in a median overcontribution of only $26.

Table 7

Comparison of Parents' Contribution Median Differences

by Occupational Group

Occupational Group	N	Current Less Actual	Estimated Less Actual	Predicted Less Actual
Business Owners	3,192	6	1	35
Farm Families	3,271	17	11	34
Others	32,582	-102	-95	24
Total Sample	39,045	-82	-80	26

Table 8

Comparison of Parents' Contribution Median Differences

by Income Level

Income Level	N	Current Less Actual	Estimated Less Actual	Predicted Less Actual
0 - 4,999	5,509	52	51	45
5,000 - 9,999	15,029	- 1	- 3	7
10,000 - 14,999	13,581	-201	-201	16
15,000 - 19,999	4,926	-368	-342	34
Total Sample	39,045	- 82	- 80	26

It may have been noted that while predicted less actual mean income for the four income groups and for the total sample is zero, the corresponding parents' contribution median differences are not zero. This apparent inconsistency can be explained by the fact that income and parents' contributions are not linearly related; e.g., a $10,000 income with three dependents results in a $770 contribution, whereas a $5,000 income with three dependents results in zero contribution. Because the parents' contribution distributions were highly skewed, median rather than mean differences were used to compare parents' contribution derived from actual income with the contributions derived from the three alternative measures of actual income.

Table 9 compares the accuracy of three alternative measures of actual income by unusual condition. Considering current and estimated income, the only underestimation of parents' contribution occurs with the group reporting

that their tax for 1968 is less than 80% of their standard tax. This condition may indicate large tax-deductible expenses for the year, or it may mean that a family has reported only its tax payments in excess of withholding. Considering the three unusual condition groups, there do not appear to be very great differences among the three alternative measures.

Table 9

Comparison of Parents' Contribution Median Differences by Unusual Condition

Unusual Condition	N	Current Less Actual	Estimated Less Actual	Predicted Less Actual
No tax reported	5,239	18	18	41
Tax < 80% Std. tax	9,679	- 9	-14	35
Tax > Std. tax by 20% or more	5,472	18	13	41

A comparison of three alternative measures of actual income in estimating parents' contributions by family status is indicated in Table 10. The use of current and estimated income results in a significant underestimation of parents' contribution for the largest group, the one with two parents who are not separated or divorced.

Table 10

Comparison of Parents' Contribution Median Differences

by Family Status

Family Status	N	Current Less Actual	Estimated Less Actual	Predicted Less Actual
Parents not separated or divorced	33,385	-114	-113	19
One parent--father deceased	516	12	10	37
Parents separated or divorced--mother sole support	2,860	30	27	48
Father disabled	2,250	21	24	50

Table 11 compares the accuracy of the three alternative measures of actual income in estimating actual parents' contribution for two different patterns of estimating actual income. It was hypothesized that with those whose estimated future income was equal to or less than their current income (pessimistic families) there would be a greater undercalculation of parents' contribution than with those whose estimated income was greater than their actual income (optimistic families). This hypothesis is confirmed. On the other hand, if CSS were to base its calculations on current income, greater accuracy would be achieved for the pessimists and significant distortions would result for the optimists. The reverse is true when calculations are based on estimated income.

Table 11

Comparison of Parents' Contribution Median Differences

by Pattern of Estimate

Pattern of Estimate	N	Current Less Actual	Estimated Less Actual	Predicted Less Actual
Optimistic	18,407	-172	- 59	29
Pessimistic	20,638	1	-110	24

The preceding comparisons suggest that there is little difference in terms of group accuracy between need analysis procedures based on current or estimated income. In general, parents' contributions calculated from predicted income were more accurate for most groups than those calculated from current or estimated income.

Another approach used to evaluate the three alternative measures of actual income was to compare the percentage of families for whom parents' contributions were over- or underestimated. Table 12 presents these percentages. Examination of the percentages for current and estimated income reveals that nearly equal percentages of undercalculations result for each interval. Worthy of note is the fact that very substantial overcalculations of parents' contribution ($400 or more) would result for an additional 2% of the population if CSS were to base its calculations on current income. Two per cent of the CSS population is roughly equivalent to 20,000 families. The distributions shown in Table 12 have been collapsed

Table 12

Percentages of Families for Whom Parents' Contributions Were Under- or Overcalculated by Alternative Measures of Income

(Total Sample)

Measure	Size of Undercalculation in Dollars					Size of Overcalculation in Dollars					
	401- over	301- 400	201- 300	101- 200	1- 100	0- 99	100- 199	200- 299	300- 399	400 Over	Total Per Cent
Estimated Income	17.8%	7.4%	10.4%	11.6%	11.5%	30.5%	2.7%	2.4%	1.6%	4.2%	100.0
Current Income	17.9	7.5	10.8	11.5	10.2	28.2	3.1	2.7	1.9	6.3	100.0
Predicted Income	5.5	5.3	9.3	9.5	10.4	31.7	9.3	9.2	4.7	5.0	100.0

in Table 13 to show the percentages of families whose contribution is under- or overcalculated by $100 or more when each income measure is used as the base for the calculation. Substantial undercalculations

Table 13

Percentage of Families Whose Contribution Is Under- or Overcalculated by $100 or More (Total Sample)

Income Base Used to Calculate Parents' Contribution	Undercalculation > $100	Overcalculation ≥ $100
Current Income	47.7%	14.0%
Estimated Income	47.2	10.9
Predicted Income	29.6	28.6

of parents' contribution result in 47.7% of the cases when based on current income, and in 47.2% of the cases when based on estimated income. Calculations based on either of these income measures operate to the disadvantage of financial aid officers with about equal probability. Substantial undercalculations result in only 29.6% of the cases, however, when predicted income is used.

On the other hand substantial overcalculations result for 14% of the families when current income is used, compared with 10.9% when estimated income is used. Stated differently, if CSS were to base its calculations on current rather than estimated income, these calculations would operate to the disadvantage of an additional 31,000 families. The lower probability of undercalculation associated with predicted income is offset by the

higher probability of substantial overcalculation. Its use in needs analysis procedures would result in substantial overcalculations for an additional 177,000 families.

Conclusions

The accuracy of three alternative measures of succeeding year family net income was determined for a large sample of families who filed Parents' Confidential Statements in two recent years. It appears that the study sample is sufficiently similar to the pre-freshman population in terms of occupational and income distribution to warrant generalizations to the entire CSS population.

Estimated income is the measure which is currently used to calculate the amount that each family is expected to contribute toward the education of the college applicant. The results of this study indicate that CSS families underestimate their actual succeeding year income by an average of $744. This is equivalent to median parents' contribution underestimate of $80.

Estimated income, however, is an accurate predictor of actual future income in terms of income rank-order ($r = .86$). It is not very different in accuracy from current income which correlates .83 with actual income and underestimates actual income by an average of $644. Information on a family's current tax, assets, and debts does not add to the predictive validity of estimated income when combined with it in multiple linear regression.

While both current and estimated income result in underestimation of actual income and parents' contribution for the total sample, this was not the case for the income group in the range of $0 - $4,999. This group's averages for both current and estimated income exceeded its average actual income. With the higher income groups the size of underestimation of actual income is directly related to the amount of income--the higher the income the larger the average underestimation. This latter finding applies to both current and estimated income.

A predicted income was computed for each family by calculating least squares parameters for the regression of actual on estimated income. Since the mean of the predicted and actual total income distributions were computed to be identical it was expected that parents' contributions calculated from predicted income would be more accurate for groups of families than those calculated from current or estimated income. In general, this expectation was confirmed by the results, although it is important to note that predicted income results in a poorer estimation of parents' contributions for certain groups. It is not recommended, however, that predicted income be given consideration for replacement of estimated income for determining parents' contributions without replication of this study. In any event the use of predicted income would first have to be evaluated in terms of factors not included in this study. Predicted income may be highly dependent on factors associated with the trend in the economy in 1968-69. It remains to be seen whether predicted income as computed in the present study will produce similar results on data collected in another year.

The results of this study do not support the contention that greater accuracy in calculations of parents' contribution would be achieved if current year income is utilized. While current and estimated income result with about equal frequency in substantial (> $100) parents' contribution undercalculations, the use of current rather than estimated income would result in substantial overcalculations for approximately 31,000 additional CSS families. An important problem in the estimation of parents' contribution to college costs has been uncovered in this study. Needs analysis procedures which rely on either current or estimated income place low-income families at a disadvantage by overestimating their succeeding year income. This study suggests least squares regression as one possible approach to remove this inequity. Further research, however, is needed to make the measurement of future income more equitable for low-income financial aid applicants.

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