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ABSTRACT

This paper compares self-reported changes in families' financial status to actual changes based on annual time-series data calculated from the PSID. The results indicate that the Consumer Price Index does a reasonably accurate job reconciling self-reported changes in financial status with measured changes in real income. Earlier work by Nordhaus (1998) reached a different conclusion because it did not account for changes in the shape of the income distribution.

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I. **Introduction**

In a clever and influential paper, Nordhaus (1998) provides an estimate of the extent of bias in the Consumer Price Index (CPI) by comparing the net proportion of families that report an improvement in their financial situation to changes in real median income. Specifically, he bases his analysis on time-series data collected by the University of Michigan's Institute for Social Research (ISR) in the Survey of Consumers. Among other things, this survey, which is used to measure consumer confidence, asks respondents if their families' financial situation improved or worsened in the past year. Nordhaus reasons that if real median household income rises in a particular year, more respondents should report becoming better off than worse off, and if real median income falls, more respondents should report becoming worse off than better off. In this view, constant real median income should be associated with an equal number of families reporting financial gains and losses. Nordhaus estimates the implied bias in the CPI by determining the growth rate of real median income that is associated with an equal number of families reporting an improvement and decline in their financial situation. His point estimate suggests that the CPI is biased upwards by 1.5 percentage points. This is a novel approach to deriving an independent estimate of any bias in the CPI.

Nordhaus's method makes sense if the entire distribution of income moves with the median. But if the distribution of income changes in ways that are not related to the median, this approach could understate or overstate the bias in the CPI. The following hypothetical example illustrates this point. Suppose the income distribution consists of five families that are ranked in order of their income in the base year. Further suppose that the bottom family experiences a decline in (correctly measured) real income, the next two families experience no change in real income, and the top two families experience real income growth. In this scenario -- which might roughly mirror the U.S. income distribution over the last two decades -- the median income is unchanged, so Nordhaus's reliance on the median would imply an equal number of families with real income gains and losses.[1] However, 40 percent of families experienced a gain in real

[1] Between 1974 and 1994, the percentage change in average household income for each quintile was: -7 percent for the lowest quintile, -3 percent for the second quintile, 1 percent for the middle quintile, 9 percent for the fourth quintile, and 31 percent for the top quintile, using the CPI-U-X1 to deflate income (see Census Bureau, Historical Income Tables).

income and 20 percent experienced a decline, so on net 20 percent more families would report that their financial situation improved than worsened if the ISR survey question elicits accurate responses. In this case, a constant median real income would be correctly associated with an increase in the net proportion of families that reported being better off, not an equal proportion better off and worse off. Thus, in this example, using the median family income to predict the net fraction of financial gainers will lead one to conclude the CPI is biased upward, even if it is unbiased. More generally, when the shape of the income distribution changes, the change in the median is not a sufficient statistic for the net number of families that experienced income gains or losses.

Another potential problem concerns lifecycle income effects. The Census Bureau's estimate of household income is from the March Current Population Survey (CPS), which has a rotation-group design that should reflect the experience of repeated cross-sections of households. In contrast, the ISR question asks respondents to reflect on their experience in the past year, so it is inherently longitudinal. If income rises over the lifecycle for most families, the Census median income figure will understate the longitudinal growth in income, which would lead Nordhaus's method to overstate the bias in the CPI.

In this paper we extend Nordhaus's analysis by using the Panel Study of Income Dynamics (PSID) data set to calculate the actual fraction of families that experienced measured real income increases and decreases each year from 1968 to 1991. With longitudinal data, we can calculate a variable that, in principle, is more closely related to the ISR survey data on self-reported changes in financial well being. If income is deflated properly, a regression of the self-reported net fraction of families that reported becoming financially better off on the actual fraction as estimated from the PSID should yield an intercept of zero and a slope of one. Moreover, we can use alternative assumptions about the possible bias in the CPI to deflate real income in the micro data, and then test to see which assumption yields results that are closest to the "no bias" benchmark of a zero intercept and unit slope.

The remainder of the paper is organized as follows. In the next section we replicate Nordhaus's findings with median income data. We also explore the sensitivity of his results to using different percentiles of the cross-sectional income distribution, to using median income derived from the PSID, and to an alternative measure of the CPI. This analysis finds that Nordhaus's results can be replicated and are

generally robust. In Section III we present new estimates based on the actual fraction of families whose income increased or decreased. Perhaps surprisingly, these results indicate that using the CPI to deflate family income provides an unbiased estimate of the fraction of families who report a net improvement in their financial situation. The conclusion considers the implications of our findings.

II. Replication of Nordhaus (1998)

Each month, ISR's Survey of Consumers contains the following question:

We are interested in how people are getting along financially these days. Would you say that you (and your family living there) are better off or worse off financially than you were a year ago?

Better Now Same Worse Don't Know

In August 1997, for example, 45 percent of respondents reported that they were financially better now, 31 percent reported they were the same, and 24 percent reported they were worse.

Following Nordhaus, we subtract the percent of families that report a worsening in their financial situation from the percent that report an improvement, and create an annual series by averaging each 12 calendar months of data.[2] The resulting figures, which are reported in the Appendix Table, are henceforth referred to as "*the net percentage of families whose financial situation improved.*" Nordhaus regresses the net percentage of families whose financial situation improved on the percentage change in median real household income, using the CPI-U to deflate income. The regression model is:

$$(1) \quad Y = a + bX$$

where Y is the percentage of families that report an improvement in their financial situation minus the percentage that report a worsening, and X is the percentage change in median household income from the CPS deflated by the CPI-U. The ratio -a/b is an estimate of the percentage change in measured real income that is associated with an equal number of families reporting an improvement and worsening in their financial well being, which Nordhaus interprets as an estimate of the bias in the CPI.

[2] To be precise, we calculated a weighted average where the weights were the sample size each month. See the Data Appendix for details of these calculations.

The first column of Table 1 reports our replication of Nordhaus's estimates. As Nordhaus found, the implied bias in the CPI is 1.5 percentage points in this specification. A scatter diagram of the relationship between these two variables is provided in Figure 1, along with the fitted OLS regression line. The X-intercept of the regression line in the figure corresponds to -a/b. Standard errors were calculated using the "delta method".

The BLS has introduced several changes into the official CPI in past years. Although the BLS does not retroactively change the official CPI, it has produced the CPI-U-X1, which adjusts the historical data for subsequent changes in the measurement of housing prices, and therefore more closely reflects current procedures used in calculating the CPI-U. Nordhaus deflates income growth by the CPI-U, which is appropriate for estimating the bias in the historical data. Deflating by the CPI-U-X1 probably provides a better guide for the bias in the present-day CPI, however. Consequently, in column 2 of Table 1 we re-estimate the same model as in column 1, now using the CPI-U-X1 to deflate median income growth. These results imply a smaller, but still substantial 1.2 percentage point per year bias in the CPI.

The PSID family income data are only available on a consistent basis from 1967 to 1991 as of this writing, so we are forced to restrict our sample period in the analysis below. To examine whether the narrower time period substantively affects the estimates, in column 3 we re-estimate equation (1) with the CPS income data for the 1968-91 period. This minor change in the time period hardly affects the results, with the implied annual bias around 1.1 percentage point.

For comparison, we have also calculated median real family income each year based on the PSID, using the CPI-U-X1 to deflate nominal income. The CPS and PSID income series are displayed in Figure 2. The two median real income measures have a correlation of .82 in levels, and the annual percent changes in these two measures have a correlation of .80. Column 4 of Table 1 reports an estimate of equation (1) using the percentage change in real median family income from the PSID as the explanatory variable. The results indicate an even larger implied bias in the CPI – nearly 2 percentage points per year. Thus, the PSID and CPS median income figures yield broadly similar results, with the PSID median income data suggesting an even greater bias than the Census income data.

In Table 2 we re-estimate equation (1) using as the explanatory variable the inflation-adjusted percentage change in selected income quintile cutoffs and in the median.[3] If the shape of the log income distribution remained constant over time, these estimates would all provide the same estimate of bias. The magnitude of the implied bias (a/b) varies monotonically with the income percentile that is used as the explanatory variable, with a greater bias estimated for lower percentiles of the income distribution. For example, if real income growth for the bottom 20th percentile of the distribution is used the implied overstatement in the CPI is 1.69 points per year, and if the 80th percentile is used the implied bias is .63 points. These findings are not surprising in view of the well document changes in the income distribution, but they do suggest that changes in the income distribution could present a problem for interpreting the regression on the change in median income.

We tried two final alternatives to probe the robustness of Nordhaus's results. First, we estimated a multiple regression of the net percentage of families that reported an improvement in their financial situation on the percentage change in nominal median household income and the percentage change in the CPI-U-X1. Nordhaus's bivariate specification essentially imposes that these two explanatory variables have equal but opposite signed coefficients. We reject this restriction at the .001 level, although the percentage change in nominal income does have a positive coefficient (1.90) and the percentage change in the CPI does have a negative coefficient (-4.42). Second, because the model in equation (1) is primarily descriptive, we can estimate the X-intercept by regressing X on Y. In other words, the intercept from a regression of the percentage change in real median income on the net percentage of families that report an improvement in their financial situation provides an estimate of the bias in the CPI (i.e., a direct estimate of -a/b). When we estimate such a reverse-regression model with the data in column 3 of Table 2, the intercept is -0.37 (with a standard error of .36), indicating a smaller overstatement of the CPI than the earlier regressions. Both of these extensions tend to weaken Nordhaus's findings, although they do not overturn his central conclusion that the CPI overstates inflation.

[3] The income data are based on the CPS and reported in Current Population Reports, Series P-60. Notice that because an additional year of data is available, the equations in Table 2 were estimated with a longer sample of data than used in Table 1.

III. Comparing Reported Changes in Financial Well Being to Measured Changes in Financial Well Being with Longitudinal Data

In principle, the net percentage of families reporting an improvement in their financial situation as measured by the ISR survey (denoted Y) should equal the percentage of families that actually experienced an increase in real income minus the percentage that experienced a decline in real income. We denote this variable Z. If the following regression of Y on Z is estimated:

$$(2) \quad Y = a' + b'Z,$$

and if income is properly deflated, we would expect to find a' =0 and b' =1. A joint test of these coefficient restrictions provides a more robust test of bias in the CPI than Nordhaus's regression of Y on median real income growth because the coefficient restrictions should hold even if the shape of the income distribution changes over time. In addition, both measures reflect the lifecycle income profile.

To carry out this test, we used the PSID to calculate the percentage of families that experienced a rise or fall in income each year from 1968 to 1991. Each year, the sample consisted of all families who had positive income in year t or year t-1.[4] We first deflated income by the CPI-U-X1, and then calculated the percent of families that experienced a rise or decline in income. The variable Z is the difference between these two percentages; this variable is reported in the Appendix Table.[5] These data provide the right-hand-side variable for the regression model in equation (2), and the ISR data on self-reported changes in financial well being used earlier form the dependent variable. Regression results are reported in the middle row of Table 3 (which is highlighted in bold type), and the relationship is depicted in the scatter diagram in Figure 3. Notably, the linear relationship seems to have an intercept close to 0 and a slope close to 1; a formal joint F-test of these two coefficient restrictions has a p-value of .954, which is far from rejecting.

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[4] The PSID income data pertain to the previous calendar year, so the data collected in the 1992 survey wave would apply to 1991. See the Data Appendix for details of these calculations.

[5] The observations were weighted by the PSID composite family weights in year t, which in principle should make the sample representative of the population. Because we cannot determine whether income rose or fell for families with top coded income in consecutive years, we deleted these observations from the sample. However, because the PSID top code is relatively high most years, these families make-up less

The process of estimating this equation was repeated several times, using different hypothetical assumptions about bias in the growth of the CPI to deflate the micro PSID data and calculate the aggregate time-series variable. In particular, we added or subtracted 0.5, 1, 1.5 or 2 percentage points from the CPI each year to see which implied bias best satisfied the coefficient restrictions (see Table 3). To our surprise, the assumption of no bias (i.e., using the unadulterated CPI-U-X1) was furthest from rejecting the restrictions a'=0 and b'=1. If we subtracted 1.5 points from the annual growth in the CPI, however, the p-value for a joint test of a'=0 and b'=1 was .004 – a sound rejection of the no-bias restrictions. Interestingly, over the range of hypothetical biases reported in Table 3, the slope coefficient is never very different from 1.0, while the intercept varies considerably depending on the assumed bias; the intercept term is responsible for the rejection of large positive and large negative CPI bias assumptions.

Because the fitted regression line contains the mean of the dependent and independent variables, and because we expect an intercept of 0 and slope of 1, another indication that the unadjusted CPI squares the data quite well is the fact that, over the 24 years studied, the average difference between the percent of families with annual income growth and annual income declines is 5.7 percent in the PSID and 5.3 percent in the self-reported ISR data. By contrast, if the bias in the CPI were 1.5 points per year, the PSID data would indicate that 12.3 percent of families experienced rising income in the average year. Because the slope coefficient is close to 1 when this variable is the explanatory variable, the intercept must be far from 0.

To more closely examine the value at which the no-bias restrictions best fit the data, we performed a grid search in which we varied the assumed annual bias in the CPI by +/-0.10 between –2 and +2 percentage points, recalculated the right-hand-side variable from the PSID micro data for each of these adjusted CPI's, and then re-estimated equation (2) 40 times using each of these variables in turn as the explanatory variable. Figure 4 displays the p-value for the joint F-test of the restrictions a'=0 and b'=1 from each of these regressions.[6] The F-test is least likely to reject the restrictions if the CPI understates inflation by .10

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than 0.10 percent of the sample. We also eliminate a small fraction of families whose income is bottom coded in consecutive years; the PSID bottom code for income is $1 per year.

[6] This technique can be viewed as a two-step version of the Fieller (1954) method for calculating confidence intervals. In the Fieller method, a 95% confidence interval is calculated by finding all the possible values of the null hypothesis that are not rejected by the data at the 5% level. Here, imposing alternative null hypotheses about the bias in the CPI requires us to re-derive the variable Z from the micro PSID data, and then perform the joint hypothesis test on the intercept and slope.

percentage points per year, although the p-values are generally quite high within +/- 0.5 percentage points, and the regression model would have difficulty distinguishing among biases in this range.

We tried three extensions to check on the robustness of the estimates based on the PSID. The first extension is motivated by the fact that about 30 percent of families in the ISR Survey of Consumers report that their financial situation is the same as in the previous year. We performed the same analysis as in Table 3, treating all families whose real income changed by less than +/-10 percent as having the same financial situation. The 10 percent figure was chosen because this encompasses roughly 30 percent of the sample. If Figure 4 is recalculated with these assumptions, the peak of the curve is at 0.3 percent, instead of 0.1 percent, suggesting a slightly greater understatement of price increases. The peak of the curve also becomes somewhat flatter (i.e., more platykurtic) if we require a 10 percent real income threshold for assigning a change in real income.

Second, to allow for possible money illusion, we used the PSID to create a new variable measuring the net percentage of families with nominal gains in income.[7] We included this measure along with net percentage of families with real gains in income (deflated by the CPI). Interestingly, one cannot reject a unit slope for the real variable in this regression. The net percentage of families with nominal income gains, however, has a coefficient of -1.02 with a standard error of .21. These results suggest that the public does not misperceive nominal income gains as leading to increased financial status, conditional on real income gains.

Lastly, we estimated the reverse regression of Z on Y; that is, we regressed the PSID measure of net percentage with income gains on the ISR measure. Because, apart from measurement errors and sampling errors, the two variables should be equal if the CPI is unbiased, we would still expect a zero intercept and unit slope from this reverse regression. However, when we estimate such a regression we reject the zero intercept and unit slope. Moreover, if we assume either a large negative bias in the CPI or a large positive bias in the CPI we continue to strongly reject the zero intercept and unit slope. The reason for this rejection is that the time-series variability in the ISR measure is considerably greater than the variability in the PSID measure, even though the means of the two variables are similar when the CPI is used to deflate the PSID data. The lower dispersion in the PSID measure over time holds regardless of whether the CPI minus two points or plus

[7] See Shafir, Diamond and Tversky (1997) for recent evidence on money illusion.

two points is used to deflate income. Why the PSID generates lower time-series variability in the net income changes is unclear, but this finding suggests the PSID and ISR variables may be measuring different concepts. For example, for reasons discussed below, swings in the ISR self-perceived measure may reflect more factors than just changes in real income.

IV. Conclusion

Unlike most past research, the estimates in this paper suggest that changes in the CPI provide an unbiased estimate of changes in the cost of living.[8] Would we go so far as to conclude that the CPI provides an unbiased estimate of the cost of living? No. For one thing, our estimates are imprecise, so we could not reject a bias on the order of plus or minus 0.5 points per year. And our estimates notwithstanding, there is a strong presumption that the CPI overstates the cost of living, if for no other reason than substitution bias. Much evidence also suggests that the CPI may inadequately adjust for quality changes in health care and other goods. However, measuring changes in the cost of living is complex, and in practice requires strong assumptions that may not be met, such as the absence of demand shifts. For these reasons, it is worth considering ways of gauging the plausibility of bias estimates in the CPI that do not rely heavily on imposed assumptions about economic behavior. Nordhaus (1998) provides an ingenious way to gauge bias in the CPI by comparing public opinion regarding financial well being and measured changes in real median income. We think our approach, which uses a more appropriate variable to measure changes in real income, is an improvement over Nordhaus's pioneering effort. These new results, however, provide little evidence that the CPI overstates inflation.

Pollak (1998) argues that, because professional conventions are required to calculate the CPI, the credibility of the CPI depends critically on the public's perception that it is "not being manipulated as a policy instrument." If this is the case, then using public opinion data to gauge possible bias in the CPI may be quite valuable. On the other hand, economists' reliance on revealed preference has a lot to be said for itself. One may question whether comparing measured income to public opinion data such as those collected

[8] See U.S. Department of Labor (1993), Moulton (1996), Boskin, et al. (1996), and Shapiro and Wilcox (1996) for discussions of possible biases in the CPI and relevant evidence. See esp. the papers in Bresnahan and Gordon (1997) for evidence on new goods.

by the ISR Survey of Consumers provide a valid test of bias in the CPI, in both Nordhaus's approach and our approach. In particular, perceived changes in financial well-being may be influenced by more factors than just changes in (correctly measured) annual real income. For example, changes in family size, expectations of future earnings or asset growth, expectations of indebtedness, college tuition costs, and home mortgage interest rates, may also influence perceived financial well being. Furthermore, self-reported changes in financial status may be confounded by other non-economic factors that affect the national outlook, such as a military conflict or successful mission to Mars. If these other possible influences on self-reported changes in financial well being are correlated with changes in the proportion of families who experience real income gains, then the simple model in equation (2) would yield a biased estimate of the extent to which the CPI under or over states changes in the cost of living. If these factors amount to additive white noise in the dependent variable, however, equation (2) will continue to yield unbiased estimates.

Data Appendix

This paper uses data from the Institute for Social Research, the Census Bureau, and the Michigan Panel Study of Income Dynamics.

The "net percentage of families whose financial situation improved," which is the dependent variable in all the regressions in this paper, is constructed using data from the Institute for Social Research's (ISR) Survey of Consumers. In this ongoing survey, the ISR asks a sample of roughly 500 families per month a series of questions on their views concerning various economic issues, such as their current and expected future financial situation and current and future business conditions. The specific ISR question we use is, "Would you say that you (and your family living there) are better off or worse off financially than you were a year ago?" Each quarter, ISR reports an index which equals the percentage of families reporting themselves better off financially than a year ago minus the percentage of families reporting themselves worse off, plus 100. We compute the yearly net percentage as the average of the four calendar quarters of the index, weighted by the number of observations per quarter, minus 100.

We also use Census Bureau data on income. Median household income is obtained from table H-5 of the historical income tables for households; quintile income is obtained from table H-1. We also use the CPI-U and CPI-U-X, which we take from table B-60 of the 1997 Economic Report of the President. In replicating Nordhaus' results, for example, we take nominal median household income from table H-5, deflate it by the CPI-U, and then compute the percentage change from year to year.

Lastly, we use data from the Michigan Panel Study of Income Dynamics (PSID) to compute the net percentage of families with higher real income from year to year. As there is no way to directly track families from one year to the next, we look at families with the same head in consecutive years. The variables that we use from the PSID family data are the interview number, total family money income[9], and family weight (we use the core weights for the sample which excludes the new Latino sample for 1990-92; V18943 in 1990). We also use the 1968 ID number, individual number, interview number,

[9] Total family money income (V16144 for the 1988 data set) is "the total of all members' earnings, transfers, and asset income from the prior calendar year." For 1988, this is the sum of V14911-18, V14922 through V14925, V14928, V14930, V14932, V14933, V14943, V14946, V14947, V14949, V14952, V14954, V14956, V14957, V14959, V14961, V14963, V14964, V14967, V14968, V14970, V14973, V14975-77, V14979, V14981, V14983, V15061, V15066, V15071, V15076, V15081, and V15089-99.

status, and relation to head variables from the PSID individual data.

The 1968 ID number and the individual number were concatenated to create unique individual ID numbers so that we could track individuals over time. We then merge the family and individual data year by year using the interview number and keep only the family heads' observations using the status and relation to head variables (an individual is a head if relation to head=1 for 1968, status=1 and relation to head=1 for 1969-1982, and if status=1 and relation to head=10 for 1983 to 1992). This leaves us with a data set that for each year includes total family money income, the family head's individual ID number, and the family weights. We then compare real total family money income from one year to the next for each family using the head's individual ID number to match families. These data are used to compute the net percentage of families with higher real income in year t compared to year t-1, using the CPI-U-X1 (plus or minus up to 2 percent) to deflate nominal income each year.

We are forced to eliminate some family heads because of income censoring. Total family money income is top-coded at $99,999 from 1968-1979 (1967-1978 income) , $999,999 in 1980 (1979 income) and $9,999,999 thereafter. We eliminate observations (observation meaning a comparison a family in year t with that same family year t-1, not that family for all years) where total family money income is above $99,999 in consecutive years from 1968-1979 and where income is top-coded in 1979 and above $99,999 in 1980 in 1979 dollars (we deflate 1980 nominal income by the CPI-U-X1), as we are unable to determine if those families' real income rose or fell over those years. (Note that if, for example, a family's income is top coded in 1976 and 1977 but falls below $99,999 in 1978, we eliminate that observation when performing our 1977-1976 comparison, but count them as having lower real income when performing our 1977-1978 comparison.) Total family money income is bottom-coded at $1 in all years, so we also eliminate observations for which total family money income is reported at $1 in consecutive years as we are unable to determine if those families' real income rose or fell.

We also must exclude some observations because the family's head changed from year to year. If, for example, the head is different in 1976 than in 1977, but remains the same in 1978, we eliminate that family from the 1977-1976 comparison, as we are only tracking the household head, but we include that family in the 1978-1977 comparison.

References

Boskin, Michael, Ellen Dulberger, Robert Gordon, Zvi Griliches, and Dale Jorgenson, "Toward a More Accurate Measure of the Cost of Living," Final Report to the Senate Finance Committee, December 4, 1996.

Bresnahan, Timothy F., and Robert J. Gordon, eds., The Economics of New Goods, Chicago, IL: University of Chicago Press, 1997.

Fieller, E.C. "Some Problems in Interval Estimation, "Journal of the Royal Statistical Society, vol. 16, no. 2, 1954, pp. 175-85.

Moulton, Brent, "Bias in the Consumer Price Index: What Is the Evidence?" Journal of Economic Perspectives, vol. 10, no. 4, Fall 1996, pp.159-77.

Nordhaus, William, "Quality Changes in Price Indexes," forthcoming Journal of Economic Perspectives, vol. 12, no. 1, Winter 1998.

Pollak, Robert, "The Consumer Price Index: A Research Agenda and Two Proposals," forthcoming Journal of Economic Perspectives, vol. 12, no. 1, Winter 1998.

Shafir, Eldar, Peter Diamond, and Amos Tversky, "Money Illusion," The Quarterly Journal of Economics, vol. 112, no. 2, May 1997, pp. 341-374.

Shapiro, Matthew, and David Wilcox, "Mismeasurement in the Consumer Price Index: An Evaluation," in Ben Bernanke and Julio Rotemberg, eds., NBER Macroeconomics Annual 1996, Cambridge, MA, MIT Press, 1996, pp. 93-142.

U.S. Department of Labor, Monthly Labor Review, vol. 116, no. 12, December 1993.

Table 1: Regression of Percentage Better Off Minus Percentage Worse Off on Percentage Change in Real Median Income

	Explanatory Variable			
	CPS Median Household Income Deflated by			PSID Median Family Income Deflated by CPI-U-X1
	CPI-U	CPI-U-X1	CPI-U-X1	
Intercept (a)	4.87	3.87	3.60	4.25
	(1.35)	(1.54)	(1.72)	(2.03)
Slope (b)	3.36	3.31	3.30	2.20
	(0.54)	(0.66)	(0.70)	(0.72)
a/b	1.45	1.17	1.09	1.93
	(0.47)	(0.56)	(0.52)	(1.20)
R-squared	0.61	0.50	0.51	0.30
Avg. of dep. var.	5.20	5.20	5.30	5.30
Avg. of indep. var.	0.10	0.40	0.52	0.48
Sample period	1968-1994	1968-1994	1968-1991	1968-1991

Standard errors in parentheses.

Table 2: Regression of Percentage Better Off Minus Percentage Worse Off on Percentage Change in Selected Deciles of Household Income

	Percentage Change in Selected CPS Decile Income Deflated by CPI-U-X1				
	Second (20%)	Fourth (40%)	Median (50%)	Sixth (60%)	Eighth (80%)
Intercept (a)	4.23	4.41	3.91	3.31	2.14
	(1.70)	(1.54)	(1.50)	(1.66)	(1.80)
Slope (b)	2.50	3.12	3.33	3.20	3.41
	(0.64)	(0.64)	(0.63)	(0.72)	(0.80)
a/b	1.69	1.41	1.18	1.03	0.63
	(0.87)	(0.61)	(0.46)	(0.63)	(0.61)
R-squared	0.37	0.48	0.52	0.43	0.41
Avg. of dep. var.	5.52	5.52	5.52	5.52	5.52
Avg of indep. var.	0.51	0.36	0.48	0.69	0.99
Sample period	1968-1995	1968-1995	1968-1995	1968-1995	1968-1995

Standard errors in parenthesis. Sample size is 28.

Table 3: Regression of Net Percentage of Families Better Off From ISR Survey of Consumers on Net Percentage of Families With Higher Real Income From PSID (Deflated by CPI-U-X1)

CPI Adjustment Factor	Constant	Slope	R-squared	P-value for joint test of constant=0 & slope=1	Mean of Net Proportion of Families With Increasing Real Income from PSID
2.0	8.15	0.91	0.35	0.001	-3.13
	(2.10)	(0.26)			
1.5	6.25	0.91	0.35	0.012	-1.04
	(1.95)	(0.27)			
1.0	4.22	0.90	0.34	0.125	1.20
	(1.97)	(0.27)			
0.5	2.20	0.91	0.34	0.595	3.40
	(2.15)	(0.27)			
0.0	**-0.05**	**0.94**	**0.35**	**0.954**	**5.70**
	(2.49)	**(0.27)**			
-0.5	-2.48	0.97	0.37	0.384	7.99
	(2.89)	(0.27)			
-1.0	-5.08	1.02	0.39	0.049	10.21
	(3.32)	(0.27)			
-1.5	-7.51	1.04	0.40	0.004	12.29
	(3.81)	(0.27)			
-2.0	-10.12	1.07	0.42	0.000	14.45
	(4.30)	(0.27)			

Note: Mean of dependent variable is 5.30. Sample consists of annual observations from 1968 to 1991.
Standard errors in parentheses.

Appendix Table

Year	Net Percentage of Families Better Off From ISR Survey of Consumers	Percentage Change in Median Real Income from PSID	Estimated Percentage Better Off Minus Percentage Worse Off from PSID			Number of Families
			CPI	CPI-1	CPI+1	
1968	16.42	5.92	21.67	25.32	16.72	4130
1969	12.38	2.68	15.04	18.46	11.52	4170
1970	5.98	-0.19	6.57	11.18	2.44	4388
1971	1.31	-0.21	9.54	13.78	5.03	4568
1972	17.11	4.83	18.63	22.37	14.62	4784
1973	4.33	2.23	7.51	11.55	3.19	4988
1974	-10.04	-4.50	-4.14	-0.56	-8.27	5213
1975	-10.26	-2.27	-3.86	0.34	-9.34	5358
1976	2.14	1.84	11.51	15.81	7.47	5513
1977	6.63	3.28	8.58	14.64	3.00	5671
1978	3.39	1.93	11.46	16.46	7.87	5812
1979	-9.43	1.05	1.52	6.45	-3.62	5965
1980	-15.74	-5.42	-4.96	-0.64	-9.77	6157
1981	-10.24	0.57	0.81	4.93	-3.63	6253
1982	-9.75	-1.76	1.92	5.71	-2.27	6321
1983	4.74	1.55	6.89	10.76	2.54	6417
1984	20.24	3.00	11.43	16.34	7.06	6449
1985	15.00	1.31	5.02	9.37	0.24	6557
1986	20.25	1.34	8.61	13.37	3.60	6571
1987	18.06	0.61	2.89	8.51	-1.88	6613
1988	19.49	-0.76	5.61	10.51	1.54	6673
1989	16.00	-0.26	0.90	6.67	-3.78	6702
1990	9.50	-5.11	-3.22	1.47	-8.06	6827
1991	-0.25	-0.21	-3.01	2.23	-7.50	6867
1992	-4.01	NA	NA	NA	NA	NA
1993	5.26	NA	NA	NA	NA	NA
1994	11.76	NA	NA	NA	NA	NA
1995	14.25	NA	NA	NA	NA	NA
1996	15.50	NA	NA	NA	NA	NA
Mean (1968-91)	5.30	0.48	5.70	10.21	1.20	--
Std. Dev. (1968-91)	11.46	2.83	7.20	7.06	7.38	--

The CPI used to deflate income is the CPI-U-X1.
NA not available.
Number of families pertains to columns 4-6.

Figure 1

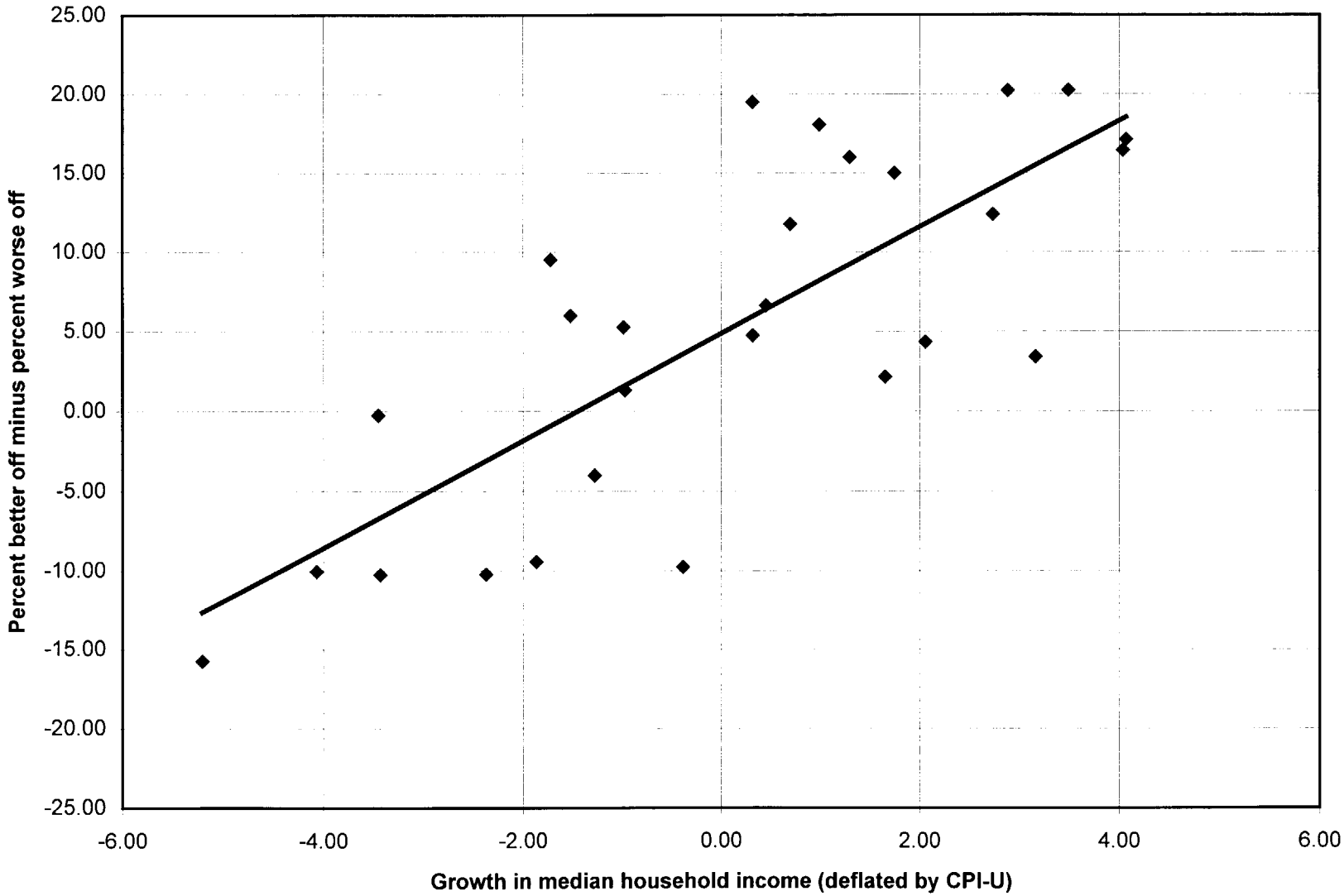
25.00
20.00
15.00
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00
-25.00
Percent better off minus percent worse off
-6.00
-4.00
-2.00
0.00
2.00
4.00
6.00
Growth in median household income (deflated by CPI-U)

Figure 2: Median Real Household Income from CPS and Median Real Family Income from PSID, 1968-91

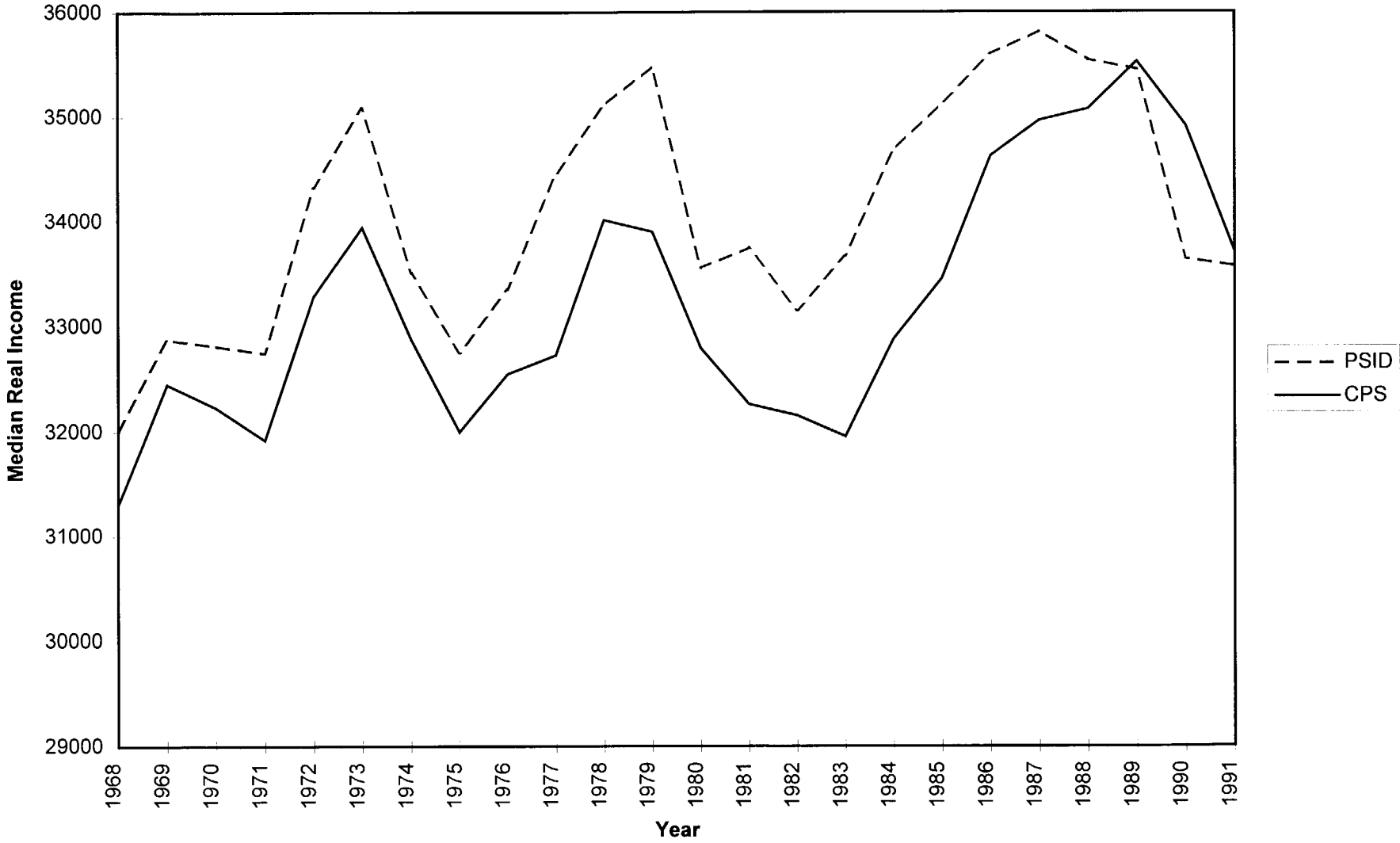

Figure 3

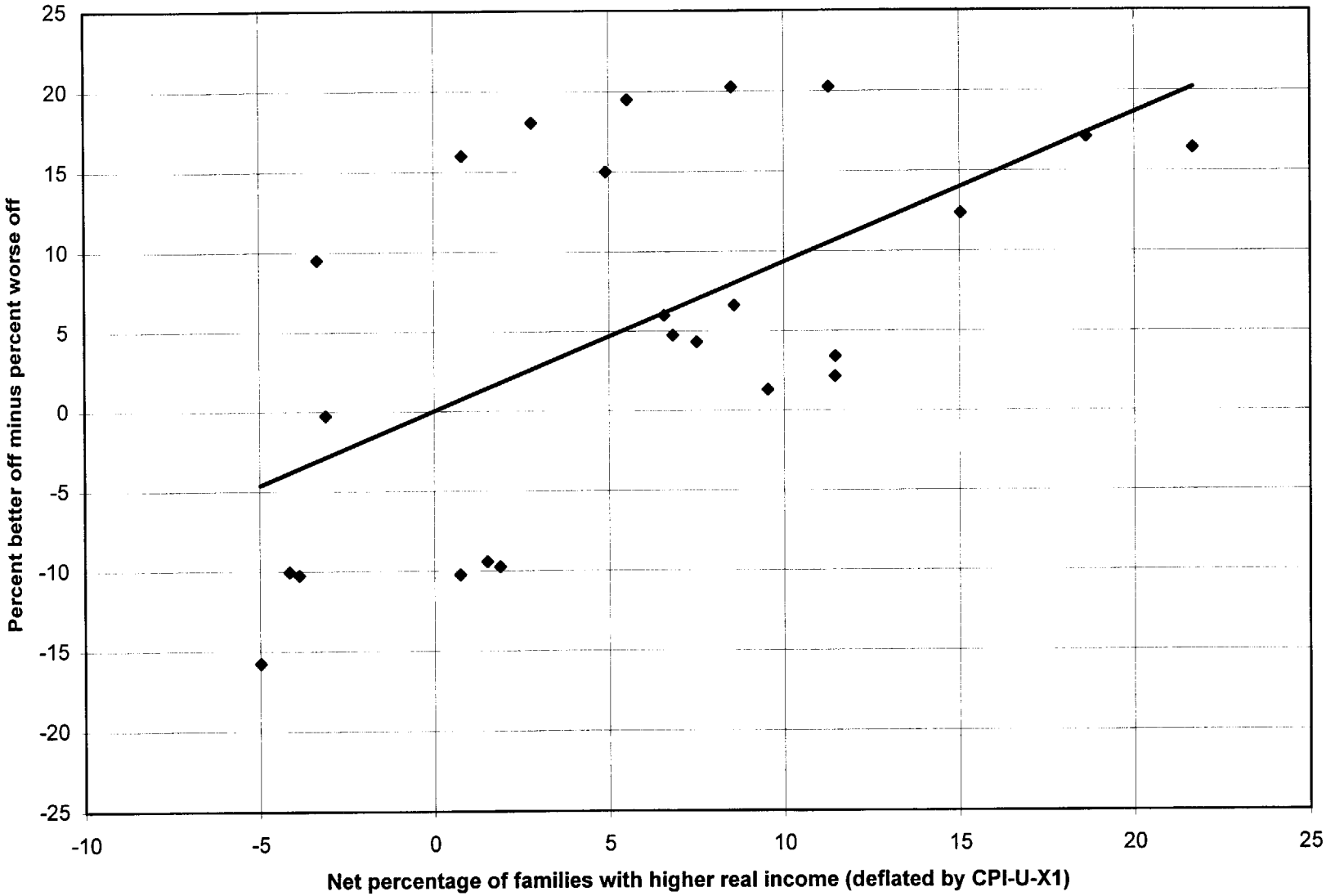
Percent better off minus percent worse off
25
20
15
10
5
0
-5
-10
-15
-20
-25
-10
-5
0
5
10
15
20
25
Net percentage of families with higher real income (deflated by CPI-U-X1)

Figure 4
P-Value for Joint Test: a'=0 & b' =1