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SOURCES OF INEQUALITY: MEASURING THE CONTRIBUTIONS OF INCOME SOURCES TO RISING FAMILY INCOME INEQUALITY

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We develop a simulation method for measuring the impact of changes in the distributions of the main income sources on growth in family income inequality. We simulate the entire distribution of family income under the counterfactual, "What if the distribution of each source had not changed?" The simulation method allows us to evaluate the impact of changes at any point in the distribution as well as with multiple measures of inequality. We incorporate married-couple and single-person families, appropriately accounting for changes in the proportion married. We apply the simulation method to investigate the impact of changes in male earnings, female earnings, and capital income on the distribution of family income in the United States between 1969 and 1999. We find that changes in the distribution of male earnings account for more of the growth in family income inequality than do changes in any other source of income. Changes in the distribution of female earnings have reduced family income inequality.

INTRODUCTION

The contribution of income sources to family income inequality is the subject of a substantial literature.[1] Most previous studies of the contribution of changes in the distributions of individual income sources to the rise in family income inequality have relied on decomposing summary measures of inequality. In this paper, we develop a new approach to measuring source contributions that has three advantages over inequality decompositions. First, our method is based on a clear counterfactual, "What would have been the change in family income inequality were it not for the change in the distribution of the income source?" Second, we simulate the counterfactual distribution of family income, allowing us to use multiple summary measures of inequality and to evaluate the impact at various points in the distribution (e.g. the 10th and 90th percentiles). Third, our method is able to appropriately incorporate married-couple and single-person families and account for changes in the marriage rate.

In the next section we develop the simulation method for measuring source contributions. We then apply the simulation method to data from the United States for the period 1969–99. In section II we describe the data and income trends. In section III we present results for three main income sources: male earnings, female earnings, and capital income. We also investigate changes in the distributions of husbands' earnings and wives' earnings. We find that changes in

[1]See Cancian and Reed (1998, 1999) for recent reviews of this literature.

the distribution of male earnings account for more of the rise in family income inequality than do changes in any other source of income. Changes in the distribution of female earnings have reduced family income inequality.

I. Measuring Source Contributions

We evaluate the impact of changes in the distribution of each main income source on the distribution of total family income by simulating the distribution of family income under the counterfactual, "What if the distribution of the source had not changed?" In what follows, we describe the methodology for measuring the impact of changes in the male earnings distribution. The simulations for other sources of income are analogous.

Let each prime-age male i have earnings w_i. We assign to each prime-age male a rank in the distribution R_i that gives the millicile of his earnings (i.e. ranks range from 1 to 1000).[2] We calculate the vector of real earnings associated with each rank as the mean of real earnings for all men sharing that rank: $\mu(r)$, where $r \in \{1, 2, \ldots, 1000\}$. We assign ranks separately for each year (year subscripts are suppressed for convenience). In this way, the entire distribution in each year is summarized by one thousand points, regardless of the population size. Using this approximation we can compare males at the same point in the distribution (same rank) in different years, even when there are different numbers of prime-age males.

Let q_f be a list of the earnings rank of every adult male in family f. Let the number of adults and the number of children in family f be n_f and c_f, respectively. Let I_f be the sum of family income from all sources other than prime-age male earnings. Adjusted family income F_f is calculated as

$$F_f = \left[\sum_{j \in q_f} \mu(R_j) + I_f \right] \times p(n_f, c_f) \tag{1}$$

where the function p translates family composition into an income needs adjustment ratio. The adjustment ratio is the poverty line for a family of four divided by the poverty line for a family of the given composition.[3] The distribution of F_f approximates the true distribution of adjusted family income so closely that the Gini coefficient is the same up to four digits.

We evaluate the distribution of adjusted family income across people as opposed to across families. Consider a society in which low-income people live in pairs in year 1 and in year 2 they live in single-person families, each with half the income of their former family. We do not consider this a 50 percent reduction in their already low income and a doubling of the number of poor families. By weighting at the person level and adjusting for income needs, the method we use only incorporates the loss of economies of scale from sharing resources.[4]

[2]Ties in earnings are assigned random ranking within the associated range. Our results are robust to changing the assignment of ties to be based on the sum of family income from all other sources or the inverse of that sum.

[3]We use the 1999 poverty lines. The poverty line for a family with two adults and two children was $16,895 in 1999.

[4]Person-weighting is implemented in the data by assigning to each family the sum of the weights of persons in that family.

We use equation (1) to simulate the distribution of family income in year 2 (e.g. 1999) if the distribution of male earnings had not changed since year 1 (e.g. 1969), all else equal.[5] Under the counterfactual, all elements of equation (1) are measured in year 2 except for the distribution of male earnings.

$$F_f^c = \left[\sum_{j \in q2f} \mu_1(R_j) + I_{2f} \right] \times p(n_{2f}, c_{2f}) \tag{2}$$

The vector F^c describes the entire counterfactual distribution of adjusted family income.

The counterfactual distribution of family income provides a reference distribution for evaluating the source contribution. For example, if the growth in family income inequality would have been 30 percent lower under the counterfactual, then changes in the distribution of the male earnings account for 30 percent of the growth. A reference distribution is necessary to meaningfully assess the contribution of an income source (Cancian and Reed, 1998).[6] As an alternative reference distribution, we consider the counterfactual, ''What if the change in the distribution of male earnings had been the only change?'' Under the alternative counterfactual all of the terms in equation (2) are measured in year 1 except for the distribution of male earnings which is measured in year 2.[7]

Using equation (2), we simulate the entire distribution of family income under the counterfactual. This allows us to evaluate the impact at various points in the distribution. We focus on the 10th, 25th, 50th, 75th and 90th percentiles. We also use multiple summary measures of income inequality: the Gini coefficient, the 75/25 ratio, the 90/10 ratio, the coefficient of variation (CV), Theil's entropy measure, mean log deviation (MLD) and the variance of the logarithm (VLN).

The simulation method allows us to separate the impacts of changes in source distributions from changes in the proportion of the population that is married.[8] Source decompositions typically do not distinguish between changes in the distribution of earnings among male heads and changes in the distribution of male heads across families. The typical approach is to assign a value of zero to represent the contribution of male earnings to the family income of a family without an adult male (i.e. a single woman). Thus, a decline in marriage leads to more families with zero male earnings and therefore enters the calculation as an increase in the inequality of male earnings. In contrast, using the simulation method it is straightforward to consider changes in the distribution of earnings among male heads. For

[5]For example, male heads at rank 500 (the median rank) are assigned the earnings at rank 500 in 1969 ($34,750) in place of the earnings at rank 500 in 1999 ($34,000). All dollar values are adjusted to real 1999 dollars.

[6]Cancian and Reed (1998) show that the components of the standard Gini decomposition have no implicit reference distribution. However, the decomposition equation for the coefficient of variation can be used to evaluate the change in inequality under counterfactual scenarios as done by Cancian, Danziger and Gottschalk (1993a, 1993b) and Cancian and Reed (1998, 1999).

[7]Cancian, Danziger and Gottschalk (1993b) make a similar point for the CV-squared decomposition—the order of the decomposition matters. Our main counterfactual is equivalent to evaluating changes in male earnings last, after all other sources. Our alternative counterfactual is equivalent to evaluating changes in male earnings first.

[8]Ryscavage, Green and Welniak (1992) use a weighting method to simulate the entire distribution of family income under counterfactual scenarios. However, the weighting method does not distinguish between changes in the distribution of earnings among wives and changes in marriage rates.

families without an adult male, family income will be unaffected under the simulation. The distinction between changes in distribution of an income source and changes in marriage is also important in evaluating the impact of changes in the distributions of female head earnings and wives' earnings.[9]

As with a standard source decomposition, the simulation methodology is an accounting exercise. We measure the impact of a change in the distribution of male earnings, holding all else equal. Accounting exercises provide an indication of the relative magnitude of single effects. They do not incorporate behavioral interactions such as changes in wife's earnings that lead to a change in husband's earnings. Similarly, this approach does not incorporate other interactions such as higher earnings leading to a decline in a family's welfare income.

The simulation methodology provides an alternative approach to the question addressed by source decompositions: "What is the contribution of changes in the distribution of each income source to the growth in income inequality?" As with most source decompositions, we do not use the simulation to understand the underlying factors leading to a change in the source distribution. For example, we do not disentangle the contribution of changes in participation, work effort (i.e. hours and weeks of work), and the wage structure to changes in the distribution of annual earnings among males or females.

II. Income Trends

We use income data from the March Current Population Survey to measure the contributions of income sources to changes in the distribution of family income in the United States between 1969 and 1999.[10] We include families in which the head and spouse, if present, are age 25 to 59.[11] Single adults are included as one-person families. The CPS reports pre-tax, money income which we categorize as male earnings, female earnings, capital income, and other income.[12] To limit biases in our measures of inequality due to changes in top-code procedures over the time period, we standardized the percentage top-coded

[9]Many existing studies avoid this problem by focusing solely on married-couple families. Cancian and Reed (1999) avoid this problem by using a decomposition equation for the CV-squared that separates population changes from source changes by decomposing inequality by income source and by population sub-group (i.e. married couples versus single persons). Similar to our simulation method, none of these studies addresses the interaction between changes in marriage and the distribution of earnings.

[10]We use public-use files for survey years 1970–2000. Each survey includes information on household and personal characteristics for the current year and income for the prior year. To limit confusion, we refer to information from each survey as information for the prior year (when income is measured).

[11]We use only cash income. Because non-cash benefits are substantial for Armed Forces families, we exclude families where the head or spouse, if present, is in the Armed Forces. We also exclude families with more than half of their income from farm or self-employment earnings because of the high variability in earnings and the difficulty in separately measuring income from earnings versus income from capital.

[12]Earnings includes wages, salary, farm income, and self-employment. Capital income includes interest, dividends, income from estates and trusts, and net rental income. Other income includes government benefits (social security, railroad retirement, supplemental social security, public assistance, welfare, veteran's payments, unemployment and workmen's compensation, and government pensions), private pensions, alimony, child support, regular contributions from persons not living in the same household, and other periodic income. Capital gains are not included.

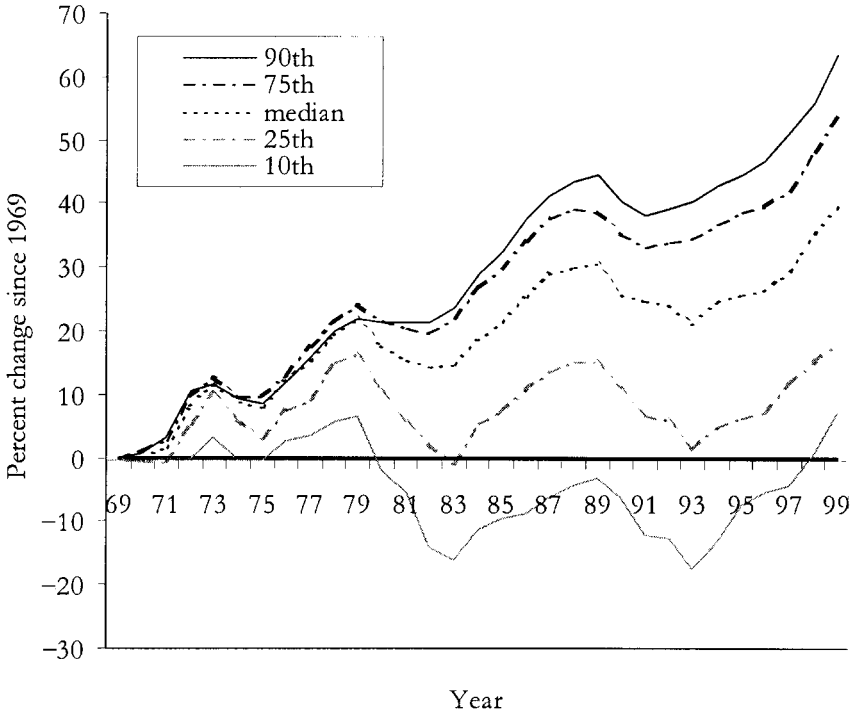

Figure 1. Percentage Change in Real Adjusted Family Income for Prime-Age Families by Income Percentile, 1969–99 (Authors' calculations from the March CPS (1970–2000). Statistics adjusted for inflation using CPI-U-X1. Family income adjusted for family size)

for each type of income over all survey years.[13] All income statistics reported in this study have been adjusted to 1999 dollars using the CPI-U-X1.[14]

Figure 1 shows the percentage change since 1969 in family income at the 10th, 25th, 50th (median), 75th and 90th percentiles. At the 10th percentile the figure shows substantial fluctuations in income during business cycle changes. In 1999, after six years of real growth, the 10th percentile was only 7 percent above its 1969 level. Trends were similar at the 25th percentile, with income in 1999 only 18 percent higher than in 1969. In contrast, for the 75th and 90th percentiles, the impact of the recessions of the early 1980s and early 1990s was smaller. In 1999, income at the 75th percentile was 53 percent higher than in 1969 and at the 90th percentile it was 63 percent higher.

Figure 2 shows trends in median family income and median earnings for males and females. The figure does not show trends for capital income and income from other sources because the medians were below fifty dollars in every year.[15]

[13]Increases in the magnitude of the top-code over the survey years can increase measured income inequality even when the true underlying distribution of income does not change.

[14]The CPI-U-X1, also known as the CPI-U, is calculated by the U.S. Census Bureau and is the most common price index used in studies of trends in the distribution of income in the United States.

[15]Medians for capital and other income measured among adults age 25 to 59. Medians measured at the family level are higher.

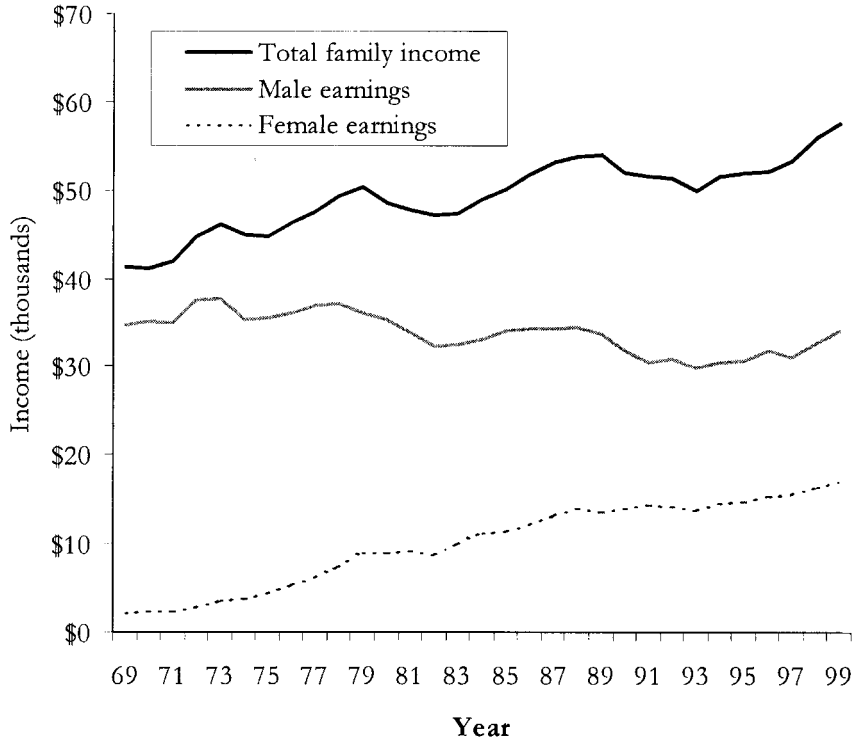

Figure 2. Median Income by Income Source for Prime-Age Individuals, 1969–99 (Authors' calculations from the March CPS (1970–2000). Statistics reported in real, 1999 dollars. Median earnings measured at the person level for prime-age males and females. For example, the reported median of male earnings is calculated among prime-age males rather than across all families. Family income adjusted for family size)

During the 1970s, median family income grew in most years, but during the past two decades it has fluctuated with the business cycle and shown little real growth. Over 70 percent of the growth in median family income between 1969 and 1999 can be attributed to growth in female earnings—the only income source that grew substantially. Median earnings among prime-age males fell by about $750 over the last three decades.

Family income inequality grew substantially between 1969 and 1999, with the Gini coefficient increasing from 0.319 to 0.387 (see Figure 3). Inequality of male earnings shows an upward trend over all three decades. Inequality of female earnings was high relative to the inequality of male earnings, but fell substantially over the period.[16] Capital income and residual income had the highest inequality, maintaining Gini coefficients in excess of 0.860 throughout the period (not shown). However, changes in the distribution of these sources have limited effects on family income inequality because they constitute only a small share of family income.

[16]The decline in female earnings inequality was driven by an increase in female labor force participation. Between 1969 and 1999 hourly wage inequality increased among females as well as males.

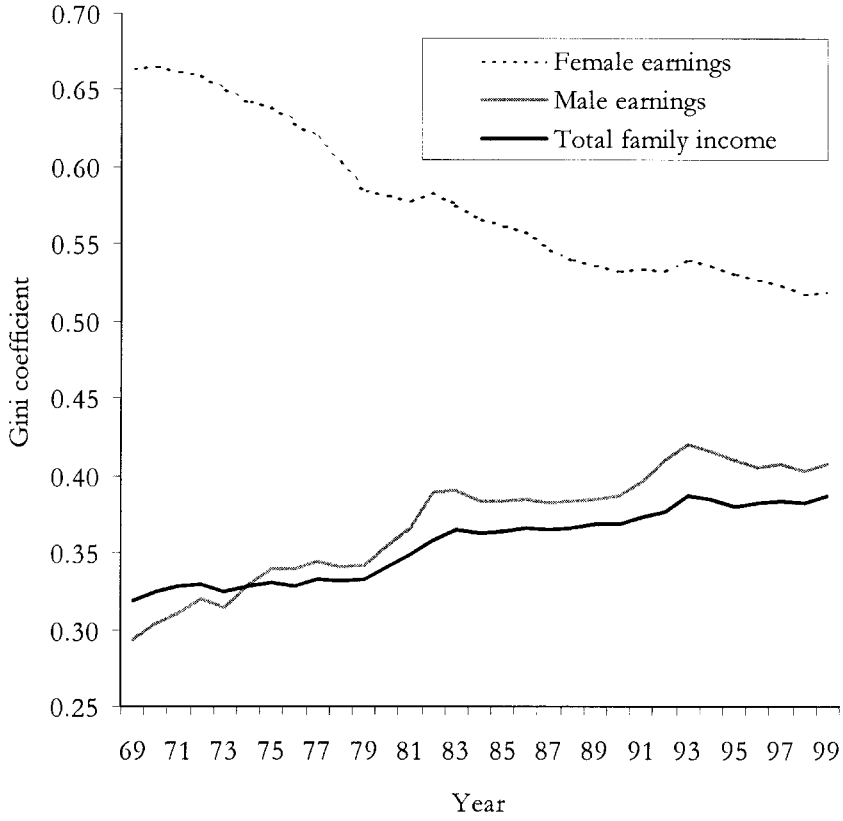

Figure 3. Gini Coefficient by Income Source, 1969–99 (Authors' calculations from the March CPS (1970–2000). Earnings inequality measured at the person level. For example, the reported Gini for male earnings is calculated among prime-age males rather than across all families. Family income adjusted for family size)

The distribution of family income depends not only on the distribution of individual sources, but also on the relationship of the sources to each other. Figure 4 shows selected relationships between male earnings, female earnings, and capital income. The first two panels are arranged by quintile of earnings of the male head for all families with a male head (i.e. single males and married couples). Panel A shows the increasing positive relationship between the earnings of male heads and their wives. In 1969, the middle quintile had the highest mean wives' earnings and the top quintile had the lowest. By 1999, mean wives' earnings rose monotonically with male heads' earnings: the top quintile had 52 percent higher mean wives' earnings than the bottom quintile. This change was driven by a disproportionate decline in the marriage rates of low-earning men and a disproportionate increase in the labor force participation of women married to high-earning men as well as an increase in the correlation of spousal earnings among working married couples (not shown).[17] All else equal, the pattern of greater

[17]See also Burtless (1996).

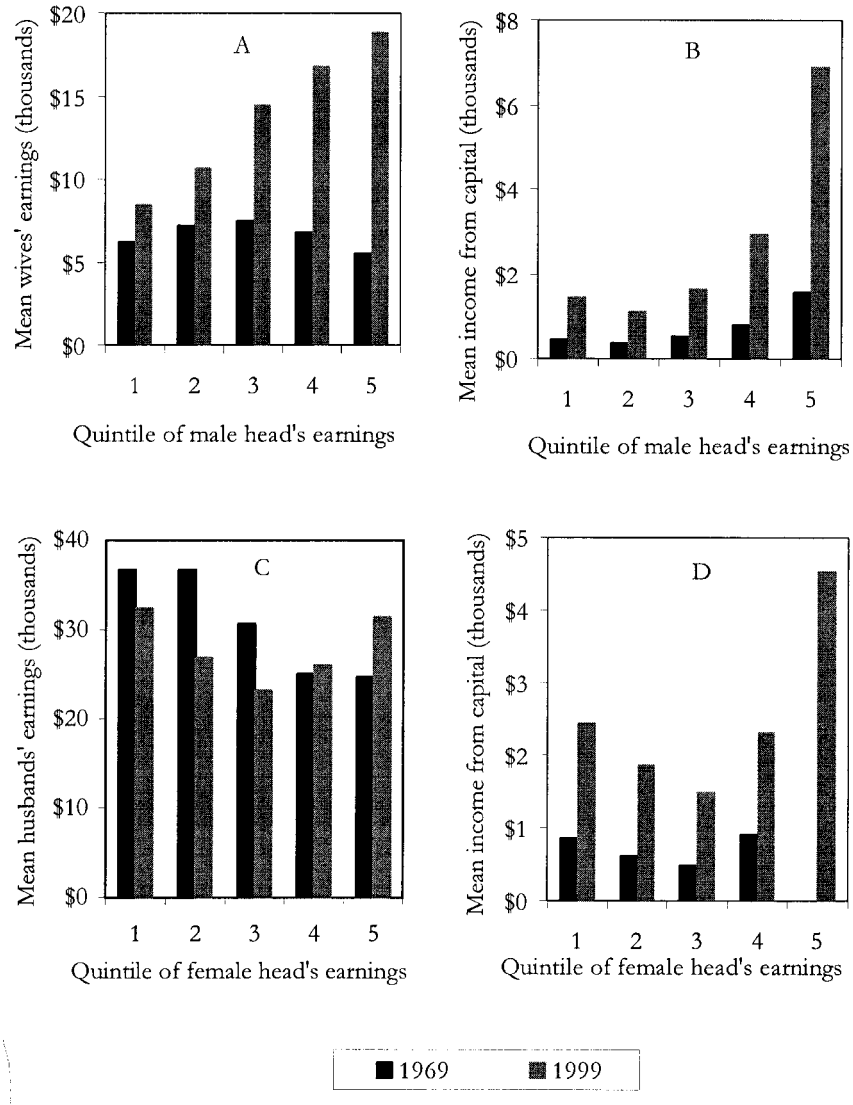

Figure 4. Relationship Between Income Sources, 1969 and 1999 (Authors' calculations from the March CPS (1970 and 2000). Panels A and B include families with male heads: single males and married couples. Panels C and D include families with female heads: single females and married couples. To emphasize differences across quintiles, each panel has a different scale for the vertical axis)

mean wives' earnings among families with higher male earnings will increase family income inequality.

The relationship between male and female earnings is also shown in panel C which shows mean husbands' earnings by quintile of female head earnings. In 1969 over 40 percent (i.e. the two lower quintiles) of female heads had zero earnings, and thus the bottom two quintiles had identical mean husbands' earnings.

Mean husbands' earnings were lower at higher levels of female head earnings over the remaining three quintiles. Between 1969 and 1999, husbands' earnings fell substantially in the first three quintiles. This reflects a change in the population from primarily wives with no earnings to a substantial proportion of low-earning single women (not shown).[18] By 1999 the negative relationship between female head earnings and mean husbands' earnings held only over the first three quintiles—mean husbands' earnings then rose with higher female head earnings.

The relationship between earnings and capital income is shown in the right-side panels of Figure 4. Between 1969 and 1999 income from capital has grown, but the relationship patterns remain similar. For male heads, mean capital income increases with earnings after the first quintile. For female heads, mean capital income is highest at the extremes of the earnings distribution and lower in the middle quintiles.

Figure 4 shows that the relationships between the main sources of family income became more positive between 1969 and 1999. Our simulation methodology does not assign the change in income correlations to a particular income source. However, we evaluate source contributions using both the 1969 and the 1999 relationships between income sources.

III. Source Contributions to Rising Family Income Inequality

How have changes in the distributions of the main income sources contributed to family income inequality? Table 1 reports the results of our simulations. The first row of the table summarizes the actual change in the distribution of family income between 1969 and 1999. The 10th percentile of family income grew by 7 percent over the period while the 90th percentile grew by 63 percent. The Gini coefficient grew by 21 percent.

TABLE 1

Percent Change in the Distribution of Family Income, Actual and Counterfactual, 1969–99

	10th	25th	Median	75th	90th	Gini	Source Contribution
1. Actual change	7	18	39	53	63	21	
Counterfactual: No change in the distribution of							
2. Male earnings	34	33	41	44	49	8	62
3. Husbands' earnings	22	24	35	42	48	12	42
4. Female earnings	–42	–14	10	28	42	33	–54
5. Wives' earnings	–8	2	20	32	44	23	–7
6. Capital income	6	16	37	50	57	19	11

Notes: Authors' calculations from the March CPS (1970 and 2000). In this and the following tables, the contribution of each source is calculated as the change in inequality that can be attributed to the source as a percent of the actual change in inequality.

[18]In 1969 there was a strong inverse relationship between marriage and female head earnings with 89 percent of the bottom quintile married compared to only 67 percent of the top quintile. By 1999, only 72 percent of the bottom quintile was married compared to 61 percent of the top quintile.

If the distribution of male earnings had not changed since 1969, the 10th percentile of family income would have grown by 34 percent (row 2, column 1) instead of only 7 percent. Likewise, income at the 25th percentile and at the median would have increased more substantially had the distribution of men's earnings remained as in 1969. On the other hand, incomes at the 75th and 90th percentiles would have increased less than they actually did—by 44 and 49 percent respectively, instead of the actual 53 and 63 percent. Because incomes at the bottom would have been higher, and incomes at the top lower, income inequality would have grown less in the absence of changes in male earnings. The Gini coefficient would have increased by only 8 percent compared to the actual increase of 21 percent. Thus, changes in the distribution of male earnings can account for 62 percent of the growth in the Gini between 1969 and 1999 (row 2, final column).

As an alternative to male earnings, we consider the impact of changes in the distribution of married men's earnings (row 3). The overall pattern of results is similar to that of all men: in the absence of changes in husbands' earnings, the incomes of families at the 10th and 25th percentiles would have been higher, and the incomes of those at the 75th and 90th percentiles would have been lower. Changes in husbands' earnings account for 42 percent of the growth in the Gini coefficient.

If the distribution of female earnings had not changed since 1969, family income at the 10th percentile would have declined by 42 percent instead of the actual growth of 7 percent (row 4). There would also have been declines in income at the 25th percentile and substantially less growth at the median (only 10 percent compared to the actual growth of 39 percent). Income growth would have been substantially lower at the 75th and 90th percentiles as well. In the absence of changes in the female earnings distribution, family incomes would have been lower at all levels, but particularly for families at the bottom of the distribution. As shown in the final columns, the Gini of total family income would actually have grown more—by 33 percent instead of the observed 21 percent—had female earnings not changed. Changes in female earnings did not contribute to the growth in the Gini. The contribution is negative and about half as great in magnitude as the actual growth in the Gini (i.e. negative 54 percent). Changes in the distribution of wives' earnings show a similar pattern, but had a more modest equalizing impact on family income with a contribution of negative 7 percent (row 5).

In the absence of changes in the distribution of capital income, growth in family income would have been lower, particularly at the top of the distribution. However, capital income constitutes only a small share of family income and changes in its distribution had only a small effect, accounting for only 11 percent of the growth in the Gini.

The results shown in Table 1 are based on the counterfactual distribution of family income that would result if the specified income source were distributed as in 1969, while all other sources were distributed as in 1999. As an alternative, we consider the counterfactual "What if the specified income source were the only source to change?" Under this alternative, we use the 1999 distribution of the specified source and the 1969 distribution of all other income as well as the 1969

relationships between income sources (e.g. as shown by the black bars in Figure 4). Under this alternative counterfactual we find a similar pattern of results but the percent change in the Gini that is accounted for tends to be higher. The contribution of changes in male earnings to growth in the Gini coefficient is 85 percent under the alternative counterfactual as opposed to 62 percent (as shown in Table 1). Changes in husbands' earnings contribute 72 percent under the alternative instead of 42 percent. The equalizing impact of changes in female earnings is smaller using this approach—negative 13 percent under the alternative compared to negative 54 percent. Using the alternative counterfactual, changes in the distribution of wives' earnings account for 9 percent of the growth in the Gini and changes in capital income account for 12 percent.

Each of the three decades in our time period shows a similar pattern of results as the full period. During the 1970s, earnings inequality grew substantially among men and fell substantially among women. In that decade, changes in the distribution of male earnings account for more than 100 percent of the growth in the Gini while changes in female earnings had a large inequality reducing effect

TABLE 2

Source Contributions to Change in Gini, Sub-periods (Percent)

	Full period 1969–99	Sub-periods		
		1969–79	1979–89	1989–99
1. Male earnings	62	143	46	55
2. Husbands' earnings	42	101	35	45
3. Female earnings	–54	–99	–32	–26
4. Wives' earnings	–7	–14	–6	9
5. Capital income	11	8	4	25

Notes: Authors' calculations from the March CPS (1970 and 2000).

(Table 2, column 1). Over the 1980s and 1990s, male earnings remained the most important source of rising family income inequality, but the relative contribution was smaller: 46 and 55 percent, respectively. During these decades, female earnings inequality fell less rapidly than in the 1970s and changes in the distribution of female earnings had a more modest equalizing impact. In the 1990s changes in wives' earnings actually accounted for 9 percent of the growth in the Gini. In each of the three decades capital income contributed modestly to growing inequality.

The results in Table 1 are fairly robust to the measure of income inequality. As alternative measures to the Gini coefficient, we evaluated the 75/25 ratio, the 90/10 ratio, the coefficient of variation (CV), Theil's entropy measure, mean log deviation (MLD) and the variance of the logarithm (VLN). By all of the measures, changes in male earnings and husbands' earnings have contributed substantially to the growth in family income inequality, changes in female earnings have had an equalizing impact, and changes in wives' earnings and capital income have had relatively small effects (Table 3).

For the two measures that emphasize differences near the bottom of the distribution, MLD and VLN, changes in source distributions are less important in accounting for the change in family income inequality. Changes in male earnings account for only 49 percent of the growth in the VLN of family income and changes in husband earnings account for only 23 percent (final column).

TABLE 3

SOURCE CONTRIBUTIONS TO CHANGE IN INEQUALITY, MULTIPLE MEASURES, 1969–99 (PERCENT)

	Gini	75/25	90/10	CV	Entropy	MLD	VLN
1. Male earnings	62	72	78	60	64	57	49
2. Husbands' earnings	42	54	59	39	44	36	23
3. Female earnings	–54	–59	–175	–49	–75	–163	–262
4. Wives' earnings	–7	1	–7	–8	–10	–14	–23
5. Capital income	11	6	10	14	12	1	–12

Notes: Authors' calculations from the March CPS (1970 and 2000).

Our results are consistent with those of Cancian and Reed (1999) who find that changes in the distribution of husbands' earnings contributed substantially to the increase in family income inequality while changes in wives' earnings have been equalizing. These results stand in marked contrast to those of Karoly and Burtless (1995) and Ryscavage, Green, and Welniak (1992). In these latter analyses, the impact of changes in wives' (or women's) earnings are not evaluated separately from changes in the proportion married. Because they use a value of zero for the contribution of wives' earnings to the family income of single men, declining marriage rates appear to increase the inequality of wives' earnings as well as the correlation of wives' earnings with other sources of income.

IV. SUMMARY

We have developed a method for evaluating the impact of changes in individual income sources on the distribution of family income. We simulate the entire distribution of income under the counterfactual, "What if the specified income source had not changed?" The simulation method allows us to evaluate the impact of changes at several points of the distribution and with multiple measures of inequality. Using this method we are able to properly isolate changes in the distribution of income sources from changes in family structure.

We find that were it not for changes in the distribution of male earnings, family income at the bottom of the distribution would have grown between 1969 and 1999. Changes in the distribution of female earnings account for most of the growth in family income throughout the distribution and disproportionately more growth at the bottom. Between 1969 and 1999, changes in male earnings account for over 60 percent of the growth in the Gini coefficient while changes in female earnings reduced family income inequality.

We find that changes in the distribution of male earnings account for more of the rise in family income inequality than do changes in any other source of income. The simulations suggest that researchers interested in understanding the growth in family income inequality in the US over the past three decades should focus primarily on the underlying causes of the rise in male earnings inequality.

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