Accounting for Changing Earnings Inequality in Costa Rica, 1980-1999

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(Tables and Figures are at the end of the paper.)

Summary: After declining from the mid-1970s to the mid-1980s, inequality in monthly earnings in Costa Rica stabilized from 1987 to 1992 and then increased from 1992 to 1999. In this paper we use recently-developed techniques to measure the extent to which these changes in earnings inequality were the result of changes associated with the distributions (or "quantities") of personal and work place characteristics of workers, and the earnings differences (or "prices") associated with those characteristics. We present evidence that the most important cause of the fall in inequality prior to 1987 was a decline in returns to education (the earnings differences between more- and less-educated workers). Inequality stopped falling in Costa Rica in the 1990s in part because returns to education stopped falling. The most important cause of rising inequality in monthly earnings the 1990s was an increase in the inequality of hours worked among workers. Inequality in hours worked increased because of an increase in the proportion of workers working a non-standard work week (part-time or over-time).

I. Introduction

Costa Rica has consistently exhibited lower levels of income and earnings inequality than most other countries in Latin America, and has a well-known reputation for growth with equity. Consistent with this perception, Cespedes (1979) presents evidence that inequality fell in Costa Rica from the early 1950s to the mid-1970s. Our results show that falling inequality continued through the 1970s and into the mid-1980s. Then, in the mid-1980s this pattern of falling inequality changed, stabilizing from 1987 to 1992 and then increasing from 1992 to 1999. This change in the evolution of inequality

[1] We are grateful to the Costa Rican Institute of Statistics and Census and the Institute for Research in Economic Science of the University of Costa Rica for permission to use the household surveys analyzed in this paper. A substantial part of this work was completed while Gindling was visiting the University of Costa Rica with funding from a Fulbright lecture/research award. Financial support was also provided through a DRIF grant from the graduate school of the University of Maryland Baltimore County. We would also like to thank Albert Berry, Gary Fields, M. Inez Saenz, Harriet Komisar, Wendy Takacs and the participants of seminars at the University of Costa Rica and the University of Maryland Baltimore County

in Costa Rica corresponded to the implementation of a comprehensive structural adjustment program.[2]

In this paper we identify several causes of the changes in earnings inequality in Costa Rica in the last 20 years of the 20th century. We use techniques recently developed by Gary Fields (Fields, 2003) and Myeong-Su Yun (2002) to measure the extent to which changes in earnings inequality were the result of changes associated with the distributions (or "quantities") of personal and work place characteristics of workers, and the earnings differences (or "prices") associated with those characteristics. These decompositions allow us to examine the potential impact on inequality of a larger number of personal and work place characteristics than in previous studies of the causes of changing inequality in Costa Rica. We measure the impact on the change in earnings inequality of changes in the quantities and prices of: education, experience, gender, number of hours worked, and where the worker is employed (which industry, public or private sector, and small or large firm). We find that the most important measurable cause of falling earnings inequality in Costa Rica in the early 1980s was a decline in the earnings gap between more-and less-educated workers (returns to education). Inequality stopped falling in Costa Rica in the 1987-1992 period in part because returns to education stopped falling. The most important cause of rising inequality in monthly earnings in the 1992-1999 period was an increase in the variance of hours worked among workers.

II. Evolution of Earnings Inequality, Data and Results

a. Data

To examine earnings and inequality we use the Costa Rican Household Surveys for Multiple Purposes, conducted in July of each year from 1976 until the present (except for 1984) by the Costa Rican Institute of Statistics and Census. The Household Surveys

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[2] The package of reforms in Costa Rica was in many ways similar to that introduced in other Latin American and developing countries in the 1980s and 1990s, and has included trade liberalization, exchange rate liberalization, fiscal discipline, financial market deregulation, capital account liberalization, and the encouragement of foreign direct investment. Some components of the "Washington consensus" structural adjustment policies were not implemented in Costa Rica. In particular, there were no reforms liberalizing labor markets over the period we study. If anything, worker protection increased with increased protection for striking workers and a new law (in 1990) mandating parity in employment and wages between men and women.

ask questions about many personal and work-place characteristics. The surveys are country-wide household surveys of approximately 1% of the population. These surveys are the only source of comparable yearly data on the earnings and personal characteristics of all workers (self-employed and paid employees, rural and urban) that is available in Costa Rica.

Several idiosyncratic characteristics of the surveys are important to take into account when interpreting the data on changes in inequality over time. First, the comprehensiveness of the income and earnings measures has increased. From 1976 to 1979 only the earnings of paid employees are reported. From 1980 to 1999 earnings are reported for all workers (paid employees and self-employed workers). In this paper we concentrate on an analysis of the distribution of earnings among all workers, for which data is available from 1980 to 1999. Where appropriate (such as in Figure 1 and Tables 1 and 2), we also use the data from salaried employees only, available since 1976, to reinforce our results using data from all workers.

Second, there were substantial changes in the survey sample, design and questionnaire between 1986 and 1987. The sample was changed to be consistent with the results of the 1984 census. The questionnaire was changed in consultation with input from international experts. In addition, a new team began to administer the surveys. One focus of the new team was a stronger effort to obtain data from initially non-responding households by repeatedly returning to those households until data could be obtained.[3] Although it should be possible to construct consistently-defined variables in the pre- and post- 1986 surveys, in practice the values of many of the variables change in unrealistic ways. One such variable is education; measured average levels of education fall between 1985 and 1987 (because of a coding problem, the education variable is not available in the 1986 survey). Another is inequality in earnings; measured inequality in the surveys increases substantially between 1986 and 1987. This increase does not occur when we examine changes over the same time period using data from other surveys (see Trejos, 1999). Also, there are no dramatic macroeconomic or policy changes between

[3] We expect such households to be over-represented both at the very high end and very low end of the income distribution. The evidence supports this interpretation; between 1986 and 1987 the proportion of total income going to the highest decile increased (from 27% to 33%) while the proportion of income going to the lowest decile fell (from 2.2% to 1.8%).

1986 and 1987 that we would expect to result in such a dramatic increase in inequality. For these reasons, we argue that the data on inequality in the pre-1986 and post-1986 periods are not strictly comparable, and we are careful not to base any of our conclusions on this 1986-1987 change. In the graphs and tables that we present, we generally will not include the 1986-1987 changes.

b. Evolution of Earnings Inequality, 1976-1999[4]

Figure 1 and Table 1 present the changes in two commonly used measures of inequality over these three periods, the variance of the logarithm of earnings and the Gini coefficient. The variance of the logarithm of earnings is sensitive to changes at the bottom of the distribution and the Gini coefficient is most sensitive to changes in the middle. From Figure 1 we can identify two different long-term trends in the evolution of earnings inequality in Costa Rica: 1976-1986 and 1987-1999. Between 1976 and 1986 inequality fell. Then, after a discontinuity in data between 1986 and 1987 caused by changes in the survey, this fall in inequality slowed and eventually reversed. Inequality continued to fall, although more slowly than before, from 1987 to 1992, and then increased from 1992 to 1999. Within the first period (1976-1986), we can also identify a temporary increase in inequality that corresponds to the recession of 1980-1982, followed by a return to the previous falling trend with the recovery of 1983-1986. The long-term change in the inequality trend that occurred the mid-1980s corresponds to the beginning of a comprehensive structural adjustment program in Costa Rica.

[4] All results in this paper (including the regression results) that use the Household Survey data are weighted by the expansion factors given in the surveys. In 1999 there survey weights were changed to make the sample more representative of the actual urban/rural distribution in the population. This change might affect the appropriateness of comparing the results from 1999 to other years. To address this issue we also calculated the decompositions for the period between 1992 and 1998. Generally, these results are qualitatively and quantitatively similar to the results presented in the body of this paper: that is the directions of the changes are the same and the relative magnitudes of the changes associated with each explanatory factor are also similar (we discuss an exception in footnote 14). In the appendix we also present, where possible, results for every year from 1980 to 1999.

Summarizing the changes in inequality shown in Figure 1 and Table 1[5]:

(1) From 1976 (or 1980) to 1986 there was a clear fall in earnings inequality, accompanied by significant increases in real earnings. All measures of inequality fell. Within this period, there was a temporary increase in inequality during the recession (1980-1982). Inequality then fell and returned to trend with the recovery (1982-1985).

(2) From 1987 to 1992 earnings inequality continued to fall, although at a slower rate than in the previous period. These changes occurred in an environment of falling real earnings and hourly wages.

(3) From 1992 to 1999 real earnings rose substantially, with increases in real earnings being larger for each successively higher decile in the distribution. Therefore, all of our measures of inequality increased.

Before discussing the causes of the longer-term trends identified above, we will briefly mention the causes of the temporary increase in inequality during the recession of the early 1980s. This period has been the focus of previous research, and consequently much of what happened in the labor market during this period is well-known. Mean real earnings fell by over 30% between 1980 and 1982, and then recovered most of this amount between 1982 and 1985. The rapid decrease in average real wages in the first two years of the decade led to an "added-worker" effect, whereby family members not usually in the labor force entered in order to help to maintain family incomes. These added workers had, on average, less human capital than those already in the labor force, mostly found work in the low-paying informal and rural sectors, and often worked less than full time. Gindling (1993) shows that during the recession there was an influx of less-educated women into the informal sector. This influx increased the unadjusted male-female wage gap (although the wage gap adjusted for education and experience did not change). Table 2 shows that labor force participation rates increased from 1980 to 1982, and then fell from 1983 to 1983, varying more for women than for men. The proportion of women and non-household heads in the labor force increased from 1980 to 1982, and then fell from 1982 to 1985. With the recovery, these women left the labor force.

[5] Unless otherwise noted, the source for all tables and figures are author's calculations from the Household Surveys of Multiple Purposes of the Costa Rican National Institute of Statistics and Census.

Another group of added workers entering the labor force during the recession were grade school and secondary school students of both sexes. As a result, the average level of education among workers increased much more slowly during the recession than before or after.

Funkhouser (1999) shows that the fall in earnings during the recession of 1980 to 1982 was the primary determinant of falling enrollment rates in secondary schools during this period. These students did not return to school after the recession, and enrollment rates in secondary schools did not return to pre-recession levels until later in the 1980s. During the recession, as these added workers entered the work force at less than full time in the informal sector, the average hours worked fell, the variance of hours worked among workers increased, and the proportion of workers in informal sector increased. These patterns reversed themselves with the recovery (1983-1985).

Other evidence of an added worker effect comes from studies that interviewed poor families to find out how they coped with the recession (Cordero and Gamboa, 1990). These studies conclude that the main coping mechanism of poor families during the recession was to send housewives and school-age children to work in whatever employment could be found, generally in the urban informal sector or to the farms of relatives.[6]

III. Decomposition of the Changes in Earnings Inequality—Techniques

a) Fields Decomposition Technique

To guide our examination of the causes of the different patterns of change in inequality in Costa Rica in the three periods of interest (1980-1985, 1987-1992 and 1992-1999), we begin by decomposing the changes in the inequality of monthly earnings into components attributable to changes associated with the personal and work place characteristics of workers. To decompose the changes in inequality we use the technique developed by Fields (Fields, 2003) and extended by Yun (2002).[7]

[6] Further evidence in favor of this explanation is that, although inequality in the distribution of earnings increased during the recession, and fell after, inequality in the distribution of household (labor) income did not deviate from its downward trend in the first half of the 1980s.

[7] The technique developed in Fields (2003) was applied to Korean data in Fields and Yoo (2000).

The Fields decomposition technique is based on the estimation of a standard log-linear earnings equation,

(EQ 1) $$\ln Y_{it} = \Sigma_j B_{tj} * X_{itj} + E_{it} = \Sigma_j B_{tj} * Z_{itj}$$

where $\ln Y_{it}$ is the log of monthly earnings for individual i in year t, the X_{itj} are variables j associated with person i in year t that might affect earnings. The residual, $E_{it,}$ is the part of the variation in earnings among workers that cannot be explained by variation in the other variables included in the earnings equation. Z_{itj} is a vector that includes both $X_{itj} + E_{it}$.

Fields (2003) illustrates the derivation of the Fields decomposition using the variance of the log of earnings as the measure of dispersion. Given the log-linear earnings function (EQ 1), the variance of the logarithm of earnings can be written as

(EQ 2) $$\text{Var}(\ln Y_{it}) = \text{Cov}(\ln Y_{it}, \ln Y_{it}) = \text{Cov}(\Sigma_j B_{tj} * Z_{itj}, \ln Y_{it}) = \Sigma_j \text{Cov}(B_{tj} * Z_{itj}, \ln Y_{it})$$

Dividing equation (2) by the variance of the logarithm of earnings,

(EQ 3) $$1 = \frac{\Sigma_j \text{Cov}(B_{tj} * Z_{itj}, \ln Y_{it})}{\text{Var}(\ln Y_{it})} = \Sigma_j S_{t,j}$$

The $S_{t,j}$ measure the proportion of the variance in the logarithm of earnings explained by each variable j in year t. Shorrocks (1982) showed that if one can describe income (or the logarithm of income) as the sum of different components, then the $S_{t,j}$ measure the contribution of each variable j to inequality for a large number of inequality measures (not only for the variance), including the Gini coefficient.[8]

While one can use the $S_{t,j}$ to measure the contribution of each variable j to the level of inequality, in order to measure the impact of each variable to changes in inequality we need to use more than $S_{t,j}$. This is because the magnitude of the change in inequality (and at times the direction of the change) will depend on the measure of

[8] The decomposition works only if the variables are entered linearly. This excludes the possibility of interactions between the right-hand-side variables.

inequality that we use. To measure the contribution of each variable to the change in inequality, one must multiply the $S_{t,j}$ in each period t by the measure of inequality in that period. Specifically, if I(t) is the measure of inequality in period t, the change in inequality between periods 1 and 2 can be written as

(EQ 4) $$I(2) - I(1) = \Sigma_j \{I(2)*S_{2,j} - I(1)*S_{1,j}\}$$

Equation 4 can be used to measure the contribution of each variable to the change in inequality between any two periods.

b) Yun Decomposition Technique

Changes in each variable can contribute to changes in overall inequality because of changes in the prices/coefficients (the B_j) of these characteristics or because of changes in the dispersion of these characteristics (changes in the distribution of the Z_j). It would be useful to distinguish between changes caused by changes in the prices/coefficients and changes caused by changes in the distribution of each Z_j. Yun (2002) derives an extension of the Fields decomposition of the log variance of earnings that does this. Yun (2002) accomplishes this by constructing, following the logic of Juhn, Murphy and Pierce (1993), and "auxiliary" distribution using the Bs from time 2 and the Zs from time 1[9],

(EQ 5) $$\ln Y_{i,aux} = \Sigma_j B_{2j}*X_{i1j} + E_{i1} = \Sigma_j B_{2j}*Z_{i1j}$$

The change in the variance in the log of earnings can then be written (suppressing the subscript i) as:

(EQ 6)

$$\text{Var}(\ln Y_2) - \text{Var}(\ln Y_1) = [\text{Var}(\ln Y_{aux}) - \text{Var}(\ln Y_1)] + [\text{Var}(\ln Y_2) - \text{Var}(\ln Y_{aux})]$$

$$= \Sigma_j \{[S_{aux,j*}\text{Var}(\ln Y_{aux}) - S_{1,j*}\text{Var}(\ln Y_1)] + [S_{2,j*}\text{Var}(\ln Y_2) - S_{aux,j*}\text{Var}(\ln Y_{aux})]\}$$

[9] An alternative decomposition can be derived if the auxiliary distribution is defined as: $\ln Y_{aux} = \Sigma_j B_{1j}*X_{i2j} + E_{i2} = \Sigma_j B_{1j}*Z_{i2j}$. We also calculate the distribution in this way. The results, presented in the appendix Table A5, are almost identical to the results presented in the body of the paper.

which can be re-written as

(EQ 7)

$$\text{Var}(\ln Y_2) - \text{Var}(\ln Y_1) =$$

$$\Sigma_j [B_{2j}*SD(Z_{1j})*Corr(Z_{1j,}\ \ln Y_{aux})*SD(\ln Y_{aux}) - B_{1j}*SD(Z_{1j})*Corr(Z_{1j,}\ \ln Y_1)*SD(\ln Y_1)]$$

$$+ \Sigma_j [B_{2j}*SD(Z_{2j})*Corr(Z_{2j,}\ \ln Y_2)*SD(\ln Y_2) - B_{2j}*SD(Z_{1j})*Corr(Z_{1j,}\ \ln Y_{aux})*SD(\ln Y_{aux})]$$

where $SD(Z_{tj})$ is the standard deviation of variable j in time t, B_{tj} is the coefficient on variable j in time t, $Corr(Z_{tj,}\ \ln Y_t)$ is the correlation coefficient between variable j in time t and earnings in time t, and $Corr(Z_{tj,}\ \ln Y_{aux})$ is the correlation coefficient between variable j in time t and the "auxiliary" distribution of earnings. The first line of equation 7 is the contribution to the change in the variance of the log of earnings due to changes in each of the coefficients while the second line is the contribution of changes in the variance of each of the Zs.[10]

The earnings equations that we estimate include right-hand-side variables that capture the phenomenon that might affect earnings or the distribution of earnings. These include variables that reflect the human capital of the worker such as years of education (EDUCATION) and potential experience (EXPERIENCE and EXP-squared), gender (MALE), and variables associated with the job of the worker such as the log of hours worked per week (LOGHOUR) dummy variables that are one if the worker works in

[10] Fields (1998) also derives an approximate decomposition of the percent change in the log variance into price/coefficient and quantity effects under the assumption that such changes are infinitesimal and that the variables Z_j are orthogonal. The decomposition is approximate because variables Z_j are not orthogonal and real world changes are not infinitesimal. Fields notes that if the right-hand-side variables in the earnings equation are orthogonal, then we can write S_{jt} in the following way:

$$S_{t,j} = \frac{B_{tj}^2 * \text{Var}(Z_{itj})}{\text{Var}(\ln Y_t)}$$

Taking logarithms, taking derivatives with respect to time, summing over j, and substituting $\sum_j \log(S_j) = 0$ and $\sum_j Sj = 1$, Fields (1998) derives

$$\%\Delta\{\text{Var}(\ln Y)\} \cong \sum_j \%\Delta\{B_j\}*S_j*2 + \sum_j \%\Delta\{\text{Var}(Z_j)\}*S_j$$

Where $\%\Delta\{\theta\}$ is the percentage change in θ. Although approximate, equation 6 has intuitive appeal. The first term on the right-hand-side of equation 6 measures the contribution of the change in the price/coefficient j as the percentage change in the coefficient weighted by $2*S_j$. The second term measures the contribution of the change in the distribution of each variable Z_j. As the percentage change in the variance of Z_j weighted by S_j. We report the results of this approximate decomposition in Gindling and Trejos (2001). The results of these approximate decompositions are similar in both sign and relative magnitudes to the results of the Yun decompositions described here.

urban areas (URBAN), the public sector (PUBLIC), or a firm with more than 5 workers (LARGEFIRM). We also include 9 dummy variables that equal one if workers belong to one of 9 industries (INDUSTRY). These work place characteristics partially capture the impact of the structural adjustment occurring in Costa Rica. Trade liberalization, especially in the 1987-1992 period, led to a shift towards traditional export agriculture (coffee, beef and bananas) and non-traditional exports (cut flowers, ornamental plants and tropical fruits and vegetables). We might expect these shifts in production to affect both the proportion of workers in rural and urban areas and rural/urban earnings differentials. We might also expect that large firms will be better able than small firms to take advantage of the new export markets favored by structural adjustment, and that therefore any change in the coefficient on the variable that is one if the worker is in a large firm could reflect changes due to structural adjustment. Another component of the structural adjustment program was a reduction in the size of the public sector (captured by changes in the distribution of PUBLIC) and a reduction in the rate of growth of public sector salaries (captured by changes in the coefficient on PUBLIC). Trade liberalization might also be expected to affect the composition of employment between industries, as well as inter-industry earnings differentials (Robertson, 1999 and Koujianou Goldberg and Pavcnik, 2001). If such changes are important determinants of changes in income inequality, they should be reflected in changes in the variance and coefficients on the industry dummy variables. In summary, we expect the direct effect of structural adjustment and trade liberalization will be reflected by changes associated with URBAN, LARGEFIRM, PUBLIC or INDUSTRY.

The Fields and Yun decompositions calculated in this paper have an important advantage over other recently-developed regression-based techniques to measure "quantity" and "price" effects such as those of Bourguignon, Fournier and Gurgand (2001) and Gindling and Robbins (2001). While the Bourguignon, et. al. and Gindling/Robbins decompositions are, like the Fields and Yun decompositions, based on the estimation of earnings equations for each year, unlike the Fields and Yun decompositions, these other decomposition use simulation techniques. The Bourguignon, et. al. and Gindling/Robbins decompositions of the change in inequality between two years (year 1 and year 2) are based on simulations which start with the distribution for

year 1 and then substitute (one at a time) the distribution and price of each characteristic from year 2 into the earnings equation for year 1, measuring the change in inequality in the resulting distribution of earnings in each case. The change in inequality in the simulated distributions resulting from changing the price and quantity of each variable is then interpreted as the contribution of that price or quantity to the change in inequality. A limitation of these simulation-based techniques is that the results of these simulations will be different depending on the order in which the variables are substituted, a problem that Bourguignon, et. al. (2001) calls "path dependence." Therefore, the researcher cannot be sure of the contribution of each variable to the change in inequality unless the results from all possible "paths" are calculated (and are of similar signs and magnitudes). Calculating the distributions using every possible path becomes very cumbersome if the number of variables that one wishes to consider is large. For example, Bourguignon, et. al. (2001) and Gindling and Robbins (2001) consider only two variables, education and experience. The Fields and Yun decompositions do not have this path dependence problem, making it possible to simultaneously consider the relative impacts of a much larger number of variables on changes in inequality.

IV. Decomposition of Inequality in Monthly Earnings--Results[11]

a) Fields Decomposition[12]

Table 3 presents the results of the calculation of equation 4, the Fields decomposition of the contribution of changes associated with each right-hand-side variable to the change in inequality, for the three periods 1980-1985, 1987-1992 and 1992-1999. (The file for the 1986 Household Surveys for Multiple Purposes does not contain information on education nor size of firm, therefore we cannot estimate the decompositions for 1986, and must compare 1980 to 1985.) A negative number in Table

[11] When Costa Ricans refer to earnings, the earnings referred to are almost always monthly earnings. Yearly earnings for Costa Rican paid employees include 12 months of pay plus a legally-required 13th month bonus (*aquinaldo*), which is paid in December. Self-employed workers are obviously not paid this bonus. This will create some non-comparability between the reported monthly earnings of paid employees and self-employed workers. Another source of non-comparability is that the reported earnings of self-employed workers are likely to include returns to capital as well as labor.

[12] We report the results of decompositions of the distribution of earnings among all workers for 1980-1999. We also calculated the decompositions using data from salaried workers only and data from 1976-1999. The results of these decompositions yield the same conclusions as those made in the body of this paper.

3 indicates that changes in the variable in question contribute to a fall in earnings inequality, a positive number indicates that changes in the variable in question contribute to an increase in earnings inequality. For example, if only the distribution and returns to education had changed between 1980 and 1985, then the Gini coefficient would have fallen by 0.027 (that is, by more than the actual fall in inequality). As another example, if only the distribution and returns to hours worked had changed between 1992 and 1999, then the Gini coefficient would have risen by 0.023 (representing 77% of the total increase in inequality between 1992 and 1999).

From 1980 to 1985 earnings became more equally distributed (the Gini coefficient fell by 0.023 and the variance in the logarithm of real earnings fell by 0.043). Recall that a negative number in Table 3 indicates that the variable in question contributes to a fall (an equalization) in earnings inequality. The largest negative number in the 1980-1985 columns of Table 3 is associated with education, indicating that changes related to education were the most important causes of falling inequality in the 1980-1985 period in Costa Rica. Other negative numbers in the 1980-1985 columns of Table 3, indicating that these variables also contributed to the fall in inequality between 1980 and 1985, were quantitatively less important changes associated with (in order of importance) public sector workers (PUBLIC), gender (MALE), hours worked (LOGHOUR) and the distribution of workers between large and small firms (LARGEFIRM).

After 1987 the fall in inequality slowed from 1987 to 1992, and then inequality increased from 1992 to 1999. In this paper we focus on explaining why the fall in inequality in the 1980-1985 period did not continue in the 1987-1992 and 1992-1999 periods. Therefore, we are especially interested in which variables have a disequalizing impact on earnings in the 1987-1992 and 1992-1999 periods (indicated by a positive number in Table 3).

Two variables, education and hours worked, which had had an equalizing effect on earnings in the 1980-1985 period, have a disequalizing effect in the 1987-1992 period (all other variables have an equalizing effect in the 1987-1992 period). The largest positive number in the 1987-1992 columns in Table 3 is associated with hours worked, indicating that this variable was the quantitatively most important disequalizing

phenomenon in the 1987-1992 period. Although small compared to the effect associated with hours worked, the disequalizing effect of education in the 1987-1992 period is a significant change from the 1980-1985 period, when education had a large equalizing effect on earnings. Thus, the results from Table 3 indicate that the slowdown in the fall in inequality in the 1987-1992 period (compared to the 1980-1985 period) was caused by changes associated with two variables: education and hours worked.

Changes associated with education and hours worked continue to exert a disequalizing effect on earnings in the 1992-1999 period. As in the 1987-1992 period, the largest disequalizing effect is associated with hours worked (the largest positive number in the 1992-1999 columns is for hours worked). In addition to education and hours worked, changes associated with differences among male and female workers also contributed to the increase in inequality in the 1992-1999 period.

The last row of Table 3 presents the impact of changes in the earnings equations residuals. The residuals capture the effect of phenomenon not measured by the variables in the earnings equation such as unmeasured labor market phenomenon, errors in the variables measured in the surveys, and changes in the household surveys. The results of the Fields decompositions indicate that the residuals contributed to a disequalization of earnings in the 1980-1985 period, then contributed to an equalization of earnings in the 1987-1992 period, and finally contributed to rising inequality in the 1992-1999 period.[13] Clearly, changes associated with residuals did not contribute to the slow-down of the fall in inequality in the 1987-1992 period. However, residuals were responsible for part of the rise in inequality between 1992 and 1999.[14]

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[13] The importance of changes in the residual is probably over-stated because of limitations inherent in the Fields decomposition technique. Specifically, in order to measure the separate effects of each variable, we cannot include interaction terms in the earnings equations. Gindling and Robbins (2001) report the results of the Juhn, Murphy and Pierce (1993) decompostion, where the right hand side variables include experience, education, and full interactions among these two variables. When including these interactions, the measured influence of the residual on changes in inequality is much smaller than when not including such interactions.

[14] We suspect that the disequalizing effect of residuals from 1992-1999 was due to a change in the household surveys in 1999. Between 1992 and 1998 the contribution of the residuals is equalizing (this is not shown in Table 3). It is only between 1998 and 1999 that the contribution of residuals to earnings was disequalizing. This implies that the disequalizing impact of residuals between 1992 and 1999 was due wholly to changes between 1998 and 1999, when there was a re-weighting of the sample. This suggests that the re-weighting might explain the increasing contribution of residuals (which capture the impact of unmeasured phenomena) to inequality.

In summary, the results of the Fields decomposition suggest that the fall in inequality from 1980 to 1985 was primarily associated with the equalizing effect of changes associated with education. The rapid fall in inequality in the 1980-1985 period did not continue in the 1987-1992 and 1992-1999 periods because of the impact of the residuals and changes in two variables: hours worked and education.

b) Yun Decompositions—Price and Quantity Effects

The important changes in earnings inequality associated with education and hours worked could have been due to changes in the wage gaps associated with these characteristics or with changes in the dispersion of these characteristics among workers. Table 4 presents the results of the Yun decomposition of the change in the variance of monthly earnings into the separate effects of changes in the coefficients (prices or returns) on each characteristic and to changes in the variance of each characteristic. A negative number in Table 4 indicates that changes in the coefficient or variance of the variable in question contributes to a fall in earnings inequality, a positive number indicates that the changes in the coefficient or variance of the variable in question contributes to an increase in earnings inequality.

The Fields decomposition suggested that the fall in inequality in the 1980-1985 period occurred largely because of changes associate with education. The Yun decomposition results reported in Table 4 suggests that the equalizing effect associated with education in the 1980-1985 period was due to a fall in the coefficient on education (which measures returns to education or the "price" firms pay for more-educated workers). The results presented in Table 4 suggest that the fall in returns to education was the most important phenomenon contributing to the fall in earnings inequality from 1980 to 1985. We conclude this because the largest negative number in the 1980-1985 columns of Table 4 is associated with is associated with changes in the coefficient on education (-0.056). On the other hand, the contribution of changes in the distribution of education among workers (holding returns to education constant) contributed to a disequalization of earnings in the 1980-1985 period. We conclude this because the contribution of changes in the variance of education to the change in inequality is reported as a positive number (0.003) in Table 4.

Changing returns to education, which was the principle cause of the fall in inequality from 1980 to 1985, has a disequalizing impact on earnings in the 1987-1992 period. We conclude this because the contribution of changes in returns to education (measured as the coefficient on EDUCATION) is a positive 0.002. As is shown in Figure 2, returns to education in Costa Rica fell from 1980 to 1983, and then remained relatively stable from 1983 to 1999. Thus, one reason why the fall in inequality from the 1980-1985 period did not continue into the 1987-1992 period is that returns to education stopped falling. Changes in returns to education continued to be disequalizing in the 1992-1999 period.[15]

The Fields decompositions suggested that changes associated with hours worked had the biggest disequalizing impact on earnings in both the 1987-1992 and 1992-1999 periods. The Yun decompositions suggest that in the 1987-1992 period both changes in returns to hours worked and changes in the distribution of hours worked had disequalizing effects on earnings.[16] However, from 1992 to 1999 the entire disequalizing hours worked effect occurred because of an increase in the variance of hours worked among workers. Indeed, from 1992 to 1999 the increase in the variance of hours worked was the quantitatively most important cause of the increase in earnings inequality. We

[15] The causes of the change in the evolution of returns to education from the 1980-1985 and 1987-1992 periods have been identified in previously published articles. Funkhouser (1998) and Robbins and Gindling (1998), using the framework developed in Katz and Murphy (1992), both examine whether changes in returns to education were caused by: (1) changes in the relative supply of educated workers, (2) changes in the relative demand for educated workers, or (3) institutional factors. Robbins and Gindling (1998) present evidence that the data are consistent with a supply-driven explanation for falling returns to education in the pre-1986 period, while increases in relative demand and falling rates of growth of relative supply caused returns to education to increase in the post-1986 period. Funkhouser (1998) also identifies a more rapid increase in relative demand for more educated workers as cause of the change in the pattern of growth in returns to education between 1983 and 1992. Funkhouser (1998) divides the increase in relative demand into changes due to between-industry shifts and a more general technological change component common to all industries. He presents evidence that the more general technological change component explains more of the increase in relative demand than do between industry shifts. Robbins and Ginding (1998) present evidence that the increases in returns to education were not correlated with exports or trade deficits, but were correlated with increased levels of investment, a complement to skilled-labor. They argue that the increase in demand, and in particular the role played by increasing investment, are evidence in favor of a skill-enhancing trade argument, "whereby trade liberalization induces an acceleration of physical capital imports, which through capital-skill complementarity raises relative demand" (p. 152).

[16] The increase in returns to hours worked occurred because of a one-year increase in the coefficient on hours worked from 1987 to 1988 (see tale A2 in the appendix). From 1988 to 1992 there was little change in the coefficient on hours worked in the earnings equations. This suggests that 1987 may be an outlier in the 1987-1992 period. For this reason, we do not stress increasing returns to hours worked in the explanation of the causes of the change in inequality between 1987 and 1992.

conclude this because the largest positive number in the 1992-1999 columns of Table 4 is that associated with changes in the variance of the log of hours worked.

Table 4 also shows that the contribution of changes in the distribution of education (holding returns to education constant) were disequalizing in all periods. Our results are consistent with the analysis of Knight and Sabot (1983), who distinguish between a "wage compression effect" and a "composition effect" of educational expansion on inequality. The wage compression effect is the decline in returns to education as the supply of more educated workers increases (holding the distribution of education among workers constant). The composition effect of educational expansion occurs when one examines the impact of increasing the proportion of workers with more education while holding returns to education constant. The first row of the last three columns in Table 4 measures the composition effect of educational expansion on earnings inequality. The impact of the composition effect on earnings inequality is ambiguous. In the context of educational expansion between two education levels, the composition effect of educational expansion will be disequalizing if begun from a situation where the more-educated group us relatively small, and will be equalizing if begun from a situation where the more-educated group is relatively large. This is a manifestation of the well-known Kuznets' effect (Kuznets, 1955, Robinson, 1976). Our results indicate that Costa Rica is on the disequalizing part of this curve, where increases in the proportion of the work force with more education (holding returns to education constant) will cause inequality to increase, and more rapid increases will cause inequality to increase faster.

The Fields decomposition suggested that changes associated with differences among male and female workers also contributed to the increase in inequality in the 1992-1999 period. The Yun decomposition reported in Table 4 suggest that the disequalizing effect of gender in the 1992-1999 period was the result of both rising male-female wage gaps (the coefficient on MALE fell in both the 1980-1985 and 1987-1992 periods but rose in the 1992-1999 period) and changes in the distribution of men and women in the work force (which had an equalizing effect on earnings in the 1980-85 period but a disequalizing effect on earnings in the 1987-1992 and 1992-1999 periods).

In summary, the Fields and Yun decompositions suggest that changes in inequality between 1980 and 1999 in Costa Rica were caused largely by two

phenomenon: changing returns to education and increases in the variance of hours worked among workers.[17] The fall in returns to education was the most important factor causing falling earnings inequality in the 1980-1985 period. Earnings inequality stopped falling after 1987 in part because returns to education stopped falling. From 1987 to 1999 the variance of hours worked among workers in Costa Rica increased. This increase in the variance of hours worked was the most important cause of increasing earnings inequality from 1987 to 1999. Although changes in returns to education have been identified previously as a primary cause of changes in inequality in Costa Rica (Gindling and Robbins, 1999, Trejos, 1998) and in Latin America (Inter-American Development Bank, 1998), to our knowledge no one has previously identified changes in the distribution of hours worked as an important cause of the increase in inequality in Costa Rica or any Latin American country.[18] In the next section we explore in more detail why the variance of hours worked increased in Costa Rica from 1987 to 1999.

V. Changing Variance of Hours Worked

From the first column of Table 5, which presents the variance of hours worked among workers by gender and sector in 1980, we can see that the variance of hours worked is greater for women than men, and is greater in the private small firm sector than in the private large firm or public sectors (for both men and women). From 1987 to 1999 the proportion of women in the work force increased from 29% to 32%, while the proportion of workers in the small firm sector increased from 47% to 50% (see Table A4). This suggests that at least part of the reason for the 1987-1999 increase in the variance of hours worked was the increase in the proportion of women in the work force

[17] Another potential explanation for the increase in inequality from 1992 to 1999 is the influx of Nicaraguan immigrants. Unfortunately, we cannot identify Nicaraguan immigrants in the household survey data until 1997. After 1997 we can identify immigrants, and according to the household surveys Nicaraguan immigrants account for 4 to 8 percent of the work force in those years (depending on the year and the precise way in which we identify Nicaraguan immigrants). To examine the possibility that the increase in earnings inequality occurred because of the influx of Nicaraguan migrants, for 1997, 1998 and 1999 (years in which we can identify Nicaraguan immigrants in the household surveys) we re-calculated the variance in the logarithm of earnings excluding Nicaraguan migrants from the sample. The variance of earnings is identical to two decimal points whether we include Nicaraguan migrants or not. We interpret this as meaning that the distribution of earnings among Nicaraguan immigrants employed in Costa Rica is similar to the distribution of earnings among native Costa Rican employees.

and/or the increase in the proportion of workers in the private small firm sector.[19] On the other hand, the last column of Table 5 shows that from 1987 to 1999 the variance of hours worked increased for both men and women in the private sector in both large and small firms. This suggests that another part of the reason for the 1987-1999 increase in the variance in hours worked were increases in the variance in hours worked within genders and sectors.

To measure the relative impact on the variance of hours worked of changes in the gender and sector composition of the work force (changes between genders and sectors) compared to changes in the dispersion of hours worked within genders and sectors, we decompose the changes in the variance in the log of hours worked into the proportion due to changes between genders/sectors and changes within genders/sectors. Specifically, the variance of the log of hours worked (V) can be decomposed as follows:

$$\text{(EQ 8)} \qquad V = \Sigma_k P_k * V_k + \Sigma_k P_k [H_k - H]^2$$

$$= \text{within} + \text{between}$$

where V is the variance of the log of hours worked among all workers, V_k = the variance of the log of hours worked for gender/sector k, P_k is the proportion of the sample in gender/sector k, H_k is mean of the log of hours worked in gender/sector k, and H is the overall mean of the log of hours worked. The second term in this equation measures the part of the total variance due to differences between genders and sectors, while the first term measures the part of the total variance due to the variance in hours worked within each gender and sector. When we calculate this decomposition, it shows that most of the increase in the variance in the log of hours worked between 1987 and 1999 occurred because of changes within genders and sectors. Specifically, changes in the variance in hours worked within genders and sectors accounts for 75% of the increase in the log of hours worked between 1987 and 1999, with only 25% of the increase in the variance of

[18] Although changes in the distribution of hours worked has been shown to not be an important determinant of the increase in inequality in the United States, it does seem to have played a role in the increase in inequality in Canada (Wong and Picot, 2001).

[19] Trejos (2000) presents evidence that these two phenomenon were related because many of the new female entrants to the work force found work in the private small firm sector.

the log of hours worked accounted for by changes in the gender and sector composition of the work force.[20] This suggests that to explain the increase in the variance of hours worked we should focus on the causes of the increase in the variance of hours worked for men and women in the private small and large firm sectors (the variance of hours worked did not change for men and women in the public sector).

For men, within-sector increases in the variance of the log of hours worked occurred because of an increase in the number of men working more than full-time in the private large firm and small firm sectors. The proportion of men working more than full-time in the private large firm and small firm sectors increased from 32% (large firms) and 36% (small firms) in 1987 to 43% (large firms) and 40% (small firms) in 1999 (while the proportion of men working full-time and part-time in both sectors fell).[21] For women, within-sector increases in the variance of hours worked occurred because of increased dispersion of hours worked in the private small firm sector (the only sector where there was a substantial increase in the variance of hours worked). Unlike for men, the increase in the variance of hours worked by women occurred because of an increase in the proportion of women working less than full-time. The proportion of women in the private small firm sector who work part-time increased from 41% in 1987 to 53% in 1999 (while the proportion working full-time and more than full-time fell). The increase in part-time work among women was especially pronounced among women working very few hours—the proportion of women in the small firm sector working less than 20 hours a week increased from 5% to 30% while the proportion of women working less than 10 hours a week increased from 2% to 14%.

In summary, our results suggest that the most important causes of the increase in the variance in hours worked in Costa Rica between 1987 and 1999 were increases in the dispersion of hours worked in the private sector, which in turn were caused by an increasing proportion of women working part-time and an increasing proportion men

[20] In1987 the variance of the log of hours worked was 0.188, of which 0.178 was due to variance within genders and sectors while 0.010 was due to difference between genders and sectors. In1999 the variance of the log of hours worked was 0.330, of which 0.285 was due to variance within genders and sectors while 0.045 was due to difference between genders and sectors.

[21] The standard work week in the private sector is 48 hours, although many who work 40 hours a week consider this full-time also. We consider anyone working between 40 and 48 hours, inclusive, as full-time.

working more than full-time.[22] Our results suggest the need for further research into the determinants of the length of the work week for men and women in the private sector in Costa Rica.

VII. Conclusions

Earnings inequality in Costa Rica declined from the mid-1970s to the mid-1980s. Then, from the mid-1980s to the end of the century earnings inequality increased, stabilizing from 1987 to 1992 and increasing from 1992 to 1999. To examine the causes of the changes in earnings inequality in Costa Rica we use techniques recently developed by Fields (2003) and Yun (2002) to measure the extent to which changes in earnings inequality were the result of changes associated with the distributions of, and earnings differences associated with, the personal and work place characteristics of workers.

We show that the most important cause of the fall in earnings inequality in the early 1980s was a decline in returns to education. If returns to education had not declined, earnings inequality in Costa Rica would have increased over this period.

The two most important phenomena accounting for the end of the trend of falling inequality in the 1987-1999 period were an end to the trend of falling returns to education and increases in the variance of hours worked. The most important cause of the increase in inequality from 1992 to 1999 was a further increase in the variance of hours worked among workers. The variance in hours worked increased in Costa Rica between 1987 and 1999 because of an increasing proportion of men working more than full-time and an increasing proportion of women working part-time.

[22] To examine the possibility that the increase in the dispersion of hours worked occurred because of the influx of Nicaraguan migrants, for 1997, 1998 and 1999 (years in which we can identify Nicaraguan immigrants in the household surveys) we re-calculated the variance of hours worked excluding Nicaraguan migrants from the sample. The variance of hours worked for men and women is identical to two decimal points whether we include Nicaraguan migrants or not. We interpret this as meaning that the distribution of hours worked among Nicaraguan immigrants employed in Costa Rica is similar to the distribution of hours worked among native Costa Rican employees, and that therefore the influx of Nicaraguan immigrants in the 1990s was not responsible for the increase in the dispersion of hours worked form 1987-1999.

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Figure 1:
Costa Rica: Changes in Inequality in Monthly Labor Earnings, 1976-1999

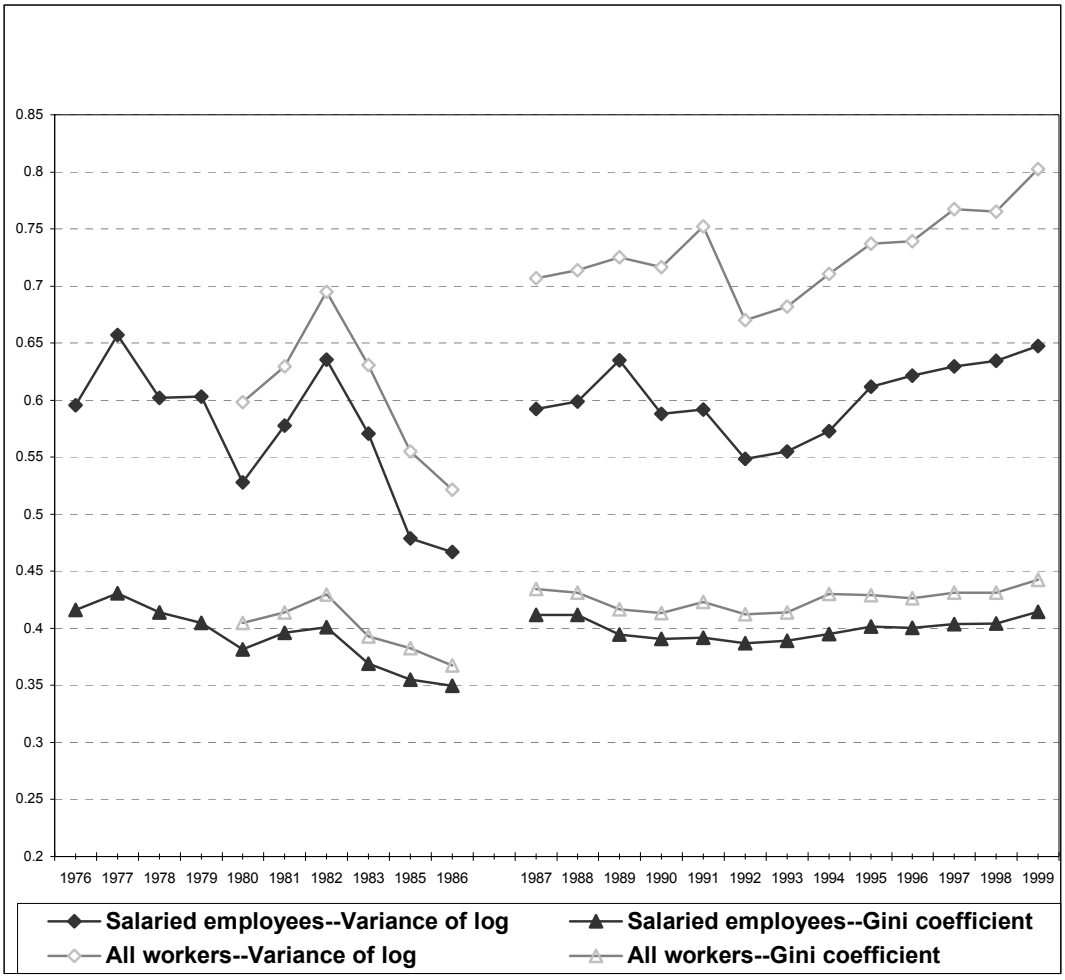

Table 1: Changes in Inequality in Monthly Labor Earnings: 1976-1986, 1987-1992 and 1992-1999

Indicator	A. Inequality Among Paid Employees			B. Inequality Among All Workers		
	1976-86	1987-92	1992-99	1980-86	1987-92	1992-99
Changes in Inequality in the						
Variance of log	-0.129	-0.044	0.099	-0.077	-0.037	0.132
Gini coefficient	-0.066	-0.025	0.028	-0.037	-0.022	0.030
Growth rate (%) in the mean real earnings in each decile						
decile 1	34.3	6.0	1.1	8.1	-2.9	3.2
decile 2	41.1	7.1	7.4	9.6	-1.0	6.9
decile 3	37.6	4.7	11.7	11.0	-0.2	12.6
decile 4	35.4	1.0	16.4	9.1	-2.2	17.2
decile 5	36.2	-1.9	17.5	11.7	-4.5	19.1
decile 6	31.6	-3.1	18.9	6.6	-5.9	21.1
decile 7	27.2	-3.4	17.9	2.6	-6.4	20.8
decile 8	23.5	-3.7	19.0	2.7	-6.5	22.3
decile 9	19.5	-1.4	23.1	0.6	-6.0	30.0
decile 10	6.1	-9.3	28.3	-9.9	-12.7	31.5

Source: Author's calculations from the Household Surveys for Multiple Purposes of the Costa Rican National Institute of Statistics and Census

Table 2: Selected Labor Market Indicators, 1976-1986

Year	Mean Real Earnings		Labor Force Participation Rate		Hours Worked		Composition of the Labor Force (%)		Proportion of Workers	Mean
	Paid Employees	All Workers	Female	Male	Mean	Standard Deviation of Log	Female	Not Household Head	Informal Sector (< 6 employees)	Education of Workers
1976	1061	na	20.52	75.06	47.3	0.36	22.5	46.7	na	5.69
1977	1199	na	22.39	7.51	48.0	0.36	23.5	47.2	na	6.03
1978	1314	na	24.30	75.98	47.5	0.36	25.1	47.5	na	6.39
1979	1401	na	24.83	75.39	47.0	0.37	25.8	48.6	na	6.53
1980	1346	1357	24.36	75.96	46.4	0.37	24.8	51.3	0.416	6.48
1981	1141	1161	25.86	74.43	45.9	0.41	26.4	52.4	0.490	6.59
1982	956	899	27.01	76.74	45.9	0.45	26.2	53.3	0.471	6.54
1983	1030	1051	25.22	75.93	45.6	0.41	24.5	52.1	0.452	6.96
1985	1162	1223	25.50	75.63	46.7	0.38	26.1	51.8	0.443	7.20
1986	1230	1286	25.79	75.06	45.9	0.37	27.3	51.5	na	na

Source: Author's calculations from the Household Surveys for Multiple Purposes of the Costa Rican National Institute of Statistics and Census

Table 3: Fields' Decomposition, Contributions of Each Variable to the Change in Inequality

	Contribution to the Change in the Gini Coefficient			Contribution to the Change in Variance in the Log		
	1980-85	1987-92	1992-99	1980-85	1987-92	1992-99
TOTAL	**-0.023**	**-0.022**	**0.030**	**-0.043**	**-0.037**	**0.132**
EDUCATION	-0.027	0.004	0.003	-0.041	0.006	0.021
MALE	-0.004	-0.003	0.002	-0.006	-0.006	0.006
URBAN	0.001	-0.004	-0.002	0.001	-0.007	-0.004
LOGHOUR	-0.004	0.023	0.023	-0.007	0.037	0.052
PUBLIC	-0.007	-0.004	-0.003	-0.011	-0.005	-0.004
LARGEFIRM	-0.002	-0.001	-0.002	-0.004	-0.002	0.003
EXPERIENCE	0.000	-0.007	-0.001	0.000	-0.011	-0.001
INDUSTRY	0.004	-0.003	0.000	0.005	-0.006	0.003
Residual	0.016	-0.027	0.008	0.019	-0.046	0.054

Notes:
(a) A negative number in table 3 indicates that changes in the variable in question contribute to a fall (an equalization) in earnings inequality, a positive number indicates that changes in the variable in question contribute to an increase in earnings inequality.

(b) Description of Variables:

EDUCATION=years of education
MALE=gender (1 if male, o if female)
URBAN=1 if urban, 0 if rural
LOGHOUR=log of hours worked per week
PUBLIC=1 if public sector, 0 if private sector
LARGEFIRM=1 if the firm has more than 5 workers, 0 otherwise
EXPERIENCE=years of potential experience
INDUSTRY=a set of dummy variables representing 9 industries

Table 4: Yun Decomposition, Contributions to the Change in the Variance of the Log of Monthly Earnings of Changes in the Coefficients (B) and the Variance of Each Explanatory Variable (Z)

	Contribution of the Change in the Coefficient on each variable to the change in the variance of the log of earnings			Contribution of the Change in the Variance of each variable to the change in the variance of the log of earnings		
	1980-85	1987-92	1992-99	1980-85	1987-92	1992-99
EDUCATION	-0.056	0.002	0.008	0.013	0.004	0.012
MALE	-0.004	-0.009	0.002	-0.002	0.003	0.003
URBAN	0.000	-0.007	-0.003	0.001	0.000	0.000
LOGHOUR	-0.010	0.019	-0.001	0.003	0.018	0.053
PUBLIC	-0.012	-0.006	-0.001	0.001	0.000	-0.002
LARGEFIRM	-0.005	-0.003	-0.003	0.001	0.001	0.005
EXPERIENCE	0.003	-0.009	-0.004	-0.002	-0.003	0.003
INDUSTRY	0.006	-0.003	0.000	0.000	-0.001	0.002

Notes:

(a) A negative number in table 4 indicates that changes in the coefficient or variance of the variable in question contributes to a fall (an equalization) in earnings inequality, a positive number indicates that the changes in the coefficient or variance of the variable in question contributes to an increase in earnings inequality.

(b) Description of Variables:

EDUCATION=years of education
MALE=gender (1 if male, o if female)
URBAN=1 if urban, 0 if rural
LOGHOUR=log of hours worked per week
PUBLIC=1 if public sector, 0 if private sector
LARGEFIRM=1 if the firm has more than 5 workers, 0 otherwise
EXPERIENCE=years of potential experience
INDUSTRY=a set of dummy variables representing 9 industries

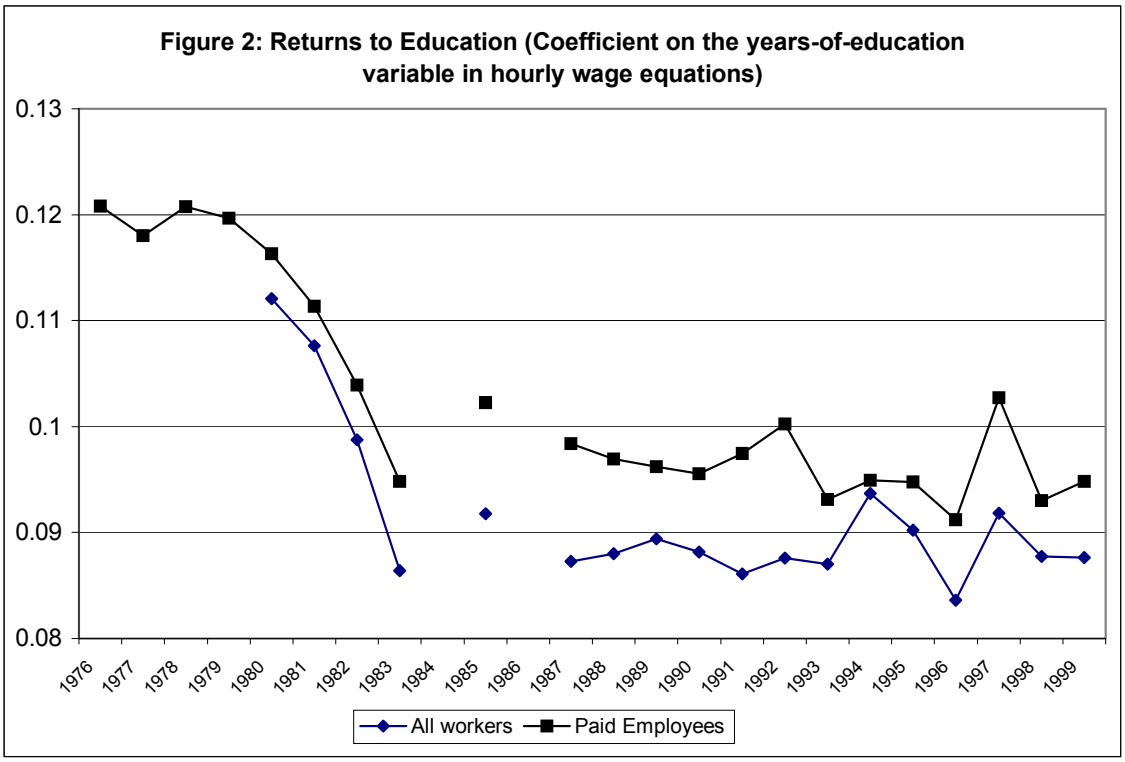
Figure 2: Returns to Education (Coefficient on the years-of-education variable in hourly wage equations)
0.13
0.12
0.11
0.1
0.09
0.08
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
All workers
Paid Employees

Table 5: Changes in the Variance of the Log of Hours Worked, by Gender and Sector

	Level in 1980	Average Annual Changes Between 1980-1985	1987-1999
All Workers	0.14	0.003	0.012
Male	0.11	0.003	0.006
Female	0.22	0.000	0.019
Male			
private small	0.15	0.006	0.009
private large	0.07	0.002	0.002
public	0.06	-0.001	0.000
Female			
private small	0.45	-0.007	0.023
private large	0.05	0.005	0.001
public	0.08	-0.001	0.000

Source: Author's calculations from the Household Surveys for Multiple Purposes of the Costa Rican National Institute of Statistics and Census

Table A1: The Sjs from the Fields' Decomposition, Proportional Contributions of Each Variable to Inequality in Each Year

	1980	1981	1982	1983	1985	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
EDUCATION	0.274	0.257	0.188	0.180	0.220	0.172	0.172	0.177	0.185	0.173	0.191	0.184	0.205	0.202	0.178	0.194	0.188	0.185
MALE	0.031	0.031	0.035	0.038	0.023	0.026	0.021	0.024	0.022	0.023	0.020	0.019	0.020	0.022	0.015	0.020	0.025	0.024
URBAN	0.020	0.016	0.020	0.011	0.024	0.022	0.017	0.015	0.013	0.009	0.013	0.010	0.013	0.008	0.015	0.015	0.015	0.007
LOGHOUR	0.088	0.092	0.090	0.099	0.082	0.081	0.110	0.160	0.129	0.163	0.140	0.150	0.133	0.159	0.135	0.176	0.201	0.182
PUBLIC	0.035	0.064	0.054	0.041	0.019	0.037	0.039	0.045	0.036	0.046	0.030	0.036	0.022	0.028	0.033	0.026	0.035	0.021
LARGEFIRM	0.051	0.063	0.063	0.079	0.049	0.067	0.054	0.067	0.061	0.077	0.068	0.045	0.048	0.056	0.052	0.058	0.058	0.059
EXPERIENCE	0.032	0.033	0.042	0.032	0.035	0.025	0.019	0.019	0.013	0.013	0.009	0.010	0.012	0.015	0.009	0.016	0.010	0.006
INDUSTRY	0.014	0.013	0.013	0.011	0.026	0.026	0.030	0.020	0.029	0.023	0.021	0.022	0.034	0.024	0.035	0.022	0.022	0.020
Residual	0.451	0.425	0.482	0.503	0.519	0.536	0.522	0.461	0.503	0.468	0.500	0.507	0.508	0.481	0.491	0.467	0.434	0.483

Table A2: Coeficients from the Earnings Equations

Variable	1980	1981	1982	1983	1985	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
EDUCATION	0.111	0.107	0.098	0.087	0.090	0.086	0.087	0.089	0.088	0.087	0.087	0.085	0.093	0.091	0.084	0.092	0.087	0.090
MALE	0.351	0.339	0.381	0.355	0.300	0.327	0.279	0.270	0.278	0.243	0.232	0.219	0.262	0.264	0.253	0.260	0.261	0.262
URBAN	0.105	0.086	0.117	0.070	0.118	0.136	0.106	0.103	0.090	0.071	0.086	0.071	0.086	0.066	0.102	0.101	0.111	0.061
LOGHOUR	0.555	0.500	0.473	0.512	0.500	0.485	0.569	0.601	0.570	0.556	0.581	0.563	0.541	0.564	0.530	0.571	0.596	0.575
PUBLIC	0.195	0.320	0.312	0.240	0.108	0.251	0.242	0.286	0.231	0.303	0.206	0.249	0.166	0.217	0.260	0.216	0.275	0.199
LARGEFIRM	0.229	0.254	0.280	0.309	0.224	0.309	0.259	0.293	0.279	0.330	0.297	0.220	0.242	0.266	0.260	0.271	0.256	0.284
EXPERIENCE	0.043	0.045	0.047	0.040	0.040	0.041	0.037	0.036	0.035	0.034	0.033	0.033	0.035	0.034	0.031	0.035	0.031	0.028
EXP2	-0.001	-0.001	-0.001	0.000	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
INDUSTRY	sig	sig	sig	sig	sig	sig	sig	sig	sig	sig	sig	sig	sig	sig	sig	sig	sig	sig
R-squared	0.549	0.575	0.518	0.497	0.481	0.464	0.478	0.539	0.497	0.532	0.500	0.493	0.492	0.519	0.509	0.533	0.566	0.517
N	8570	7301	6954	7723	6994	9204	9572	9107	9758	9370	10485	10526	11524	12155	11459	12573	13950	13094

Note: All coefficients are significant at the 1% level of significance

Table A3: Variance of the Independent Variables

Variable	1980	1981	1982	1983	1985	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
EDUCATION	15.2	15.1	15.0	16.1	16.7	15.8	15.7	15.6	16.0	15.2	15.7	16.3	16.1	16.1	15.9	15.9	16.8	16.4
MALE	0.184	0.191	0.192	0.190	0.194	0.205	0.205	0.208	0.206	0.212	0.209	0.212	0.209	0.212	0.208	0.214	0.217	0.218
URBAN	0.250	0.250	0.250	0.250	0.249	0.250	0.248	0.248	0.248	0.247	0.247	0.248	0.249	0.249	0.248	0.247	0.247	0.250
LOGHOUR	0.135	0.172	0.206	0.171	0.148	0.181	0.183	0.247	0.215	0.288	0.212	0.258	0.248	0.273	0.271	0.313	0.327	0.323
PUBLIC	0.163	0.163	0.153	0.163	0.230	0.146	0.154	0.146	0.147	0.136	0.140	0.138	0.131	0.127	0.127	0.123	0.123	0.113
LARGEFIRM	0.243	0.247	0.249	0.248	0.247	0.249	0.247	0.248	0.247	0.250	0.247	0.248	0.249	0.249	0.250	0.250	0.250	0.250
EXPERIENCE	235	227	234	225	209	210	215	219	209	209	204	203	210	211	204	214	212	206

Table A4: Mean of the Independent Variables

Variable	1980	1981	1982	1983	1985	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
EDUCATION	6.56	6.68	6.60	7.07	7.36	7.10	7.18	7.13	7.25	7.20	7.37	7.57	7.47	7.68	7.71	7.72	7.86	7.79
MALE	0.76	0.74	0.74	0.75	0.74	0.71	0.71	0.71	0.71	0.70	0.70	0.69	0.70	0.70	0.71	0.69	0.68	0.68
URBAN	0.49	0.51	0.49	0.52	0.53	0.48	0.45	0.45	0.46	0.45	0.45	0.45	0.46	0.46	0.46	0.45	0.45	0.49
LOGHOUR	3.79	3.76	3.75	3.76	3.78	3.78	3.77	3.74	3.76	3.70	3.76	3.75	3.76	3.74	3.75	3.73	3.72	3.73
PUBLIC	0.21	0.21	0.19	0.21	0.22	0.18	0.19	0.18	0.18	0.16	0.17	0.17	0.16	0.15	0.15	0.14	0.14	0.13
LARGEFIRM	0.58	0.56	0.53	0.55	0.56	0.53	0.55	0.54	0.56	0.52	0.55	0.55	0.52	0.53	0.51	0.49	0.51	0.50
EXPERIENCE	21.2	21.4	21.2	21.0	20.7	20.8	20.9	21.4	21.1	21.8	21.5	21.2	21.7	21.8	22.1	22.5	22.3	22.3

Table A5: Yun Decomposition, Contributions to the Change in the Variance of the Log of Monthly Earnings of Change in the Coefficients (B) and the Variance of Each Explanatory Variable (Z), Alternative Path (auxiliary distribution uses B1, X2 and e2)

	Contribution of the Change in the Coefficient on each variable to the change in the variance of the log of earnings			Contribution of the Change in the Variance of each variable to the change in the variance of the log of earnings		
	1980-85	1987-92	1992-99	1980-85	1987-92	1992-99
EDUCATION	-0.062	0.002	0.008	0.019	0.005	0.013
MALE	-0.005	-0.010	0.002	-0.001	0.004	0.003
URBAN	0.001	-0.007	-0.002	0.001	0.000	-0.001
LOGHOUR	-0.010	0.022	-0.002	0.003	0.015	0.054
PUBLIC	-0.014	-0.005	0.000	0.004	0.000	-0.003
LARGEFIRM	-0.005	-0.002	-0.002	0.001	0.000	0.004
EXPERIENCE	0.000	-0.012	-0.008	0.001	0.000	0.007
INDUSTRY	0.007	-0.003	-0.001	-0.001	-0.002	0.002