Rising Income Inequality and Instability—Putting the Pieces Together

Peter Gottschalk, and Sisi Zhang*

April 2014–Preliminary Daft

Abstract

The increases in inequality and transitory fluctuations in head’s earnings and in family income are well documented. While these changes in head’s earnings surely contributed to the rise in family income inequality and instability, this is but one potential factor. The distribution of family income is the result of changes in the joint distribution of all sources of family income. This paper provides a consistent framework for estimating changes the marginal distributions of the permanent and transitory components of each income source and changes in the covariances across each pair of income sources.

We use the Panel Study of Income Dynamics 1970-2010 to estimate the covariance structure of head’s earning, spouses earnings and a residual category that includes other public and private non-labor income. The increase in the transitory component of head’s earnings was an important factor behind the rise in family income instability. However, the increase in the covariance across all income sources played a significant role that has been largely overlooked.

JEL Codes: D31, D63.

Keywords: Family Income Instability

1 Introduction

There is a wide consensus that the variability of both earnings and family income rose substantially since the early 1980’s, though the timing and magnitude of the change depends somewhat on the measure of used. Earnings variability, as measured by

*Peter Gottschalk: Department of Economics, Boston College, 140 Commonwealth Ave, Chestnut Hill, MA, 02467. Email: Gottschalk@bc.edu. Sisi Zhang: The Urban Institute, szhang@urban.org.

1 See Moffitt and Gottschalk (2011) for a recent review of this literature.
variance of the log of transitory earnings, increased substantially during the 1970’s and 1980’s, then stabilized at a new high level through the next two decades. In contrast, family income variability grew more slowly in the 1970’s and 1980’s, but continued to rise over the next two decades.

The variability of individual’s earnings and the variability of family income reflect very different economic processes that can have very different positive and normative implications. Specifically, increases in the variability of transitory earnings reflects changes in the dispersion of only one of several sources of family income. Increases in the variability of one source may be offset by changes in the variability of other sources of income. For example, increases in the variability of head’s earnings may be offset by a decline in the variability of spouses’ earnings or by an increase in the responsiveness of transfer payments to changes in head’s or spouses’ earnings. These changes all have normative implications if welfare is affected both by the variability of total family income and by the cost of insuring or self insuring against shocks. Understanding the factors behind the variability of family income is, therefore, important both in evaluating the normative implications of these changes and in isolating the reduce form causal forces behind these changes.

The framework we offer is an extension of the univariate framework used in much the literature (see Moffitt and Gottschalk (2011) for a recent overview). Family income variability is the result of changes in joint distribution of all income sources. Change in the marginal distribution of transitory earnings plus changes in the marginal distributions of all other sources of family income impact directly on the distribution of transitory family income. In addition family income variability reflects changes in the covariation across income sources. Family income variability could increase even if each of the sources of family income became more stable. This would occur if the dispersion of the shocks to the different income sources became smaller or
they become more highly correlated. Knowing that the variability of head’s earnings increased roughly as much as the variability of family income tells us little about the relative importance of the increase in the variability of head’s earnings. It could be the only factor driving family income variability or it could be a minor factor. The relative importance of changes in the marginal distribution of any one source can only be evaluated in terms of changes in the full joint distribution of all sources.

We provide a consistent framework for estimating changes in the joint distribution of transitory income from multiple income sources. This allows us determine the relative importance of changes both in the marginal distribution of each component and in the covariances between every pair of income sources. We also contribute to the literature by explicitly incorporating zeros. This is important since many families do not receive income from all sources.

The paper is organized into five sections. The first section places our paper in context of the existing literature. This is followed by a discussion of the methodological issues that have to be addressed when disaggregating the transitory variation in family income into its component parts. We then present the data and results. The final section draws the broader conclusions implied by our method and findings.

2 Normative Background

This section addresses two questions: (1) What are the normative considerations that lie behind the widespread academic and public concern about the rise in income instability? (2) Is the concern about the rise in instability of some components of family income, such as earnings, whether or not they lead to instability of family income? Or is the concern only about the net impact on family income instability?
Friedman (1957) classic permanent income hypothesis provides a clear argument that transitory fluctuations in family income should have little or no impact on consumption, only permanent incomes matter. The income concept used by Friedman and others is clearly family income. If the earnings of one family member become less stable but this is counteracted by changes in the earnings of other family members then consumption will not be affected in a unitary household. A massive literature over the subsequent five decades has followed, showing that consumption and saving respond differently to permanent and transitory changes in income. A recent contribution by Blundell et al. (ming), for example, argues that considerable consumption smoothing takes place in response to transitory shocks but much less for permanent shocks.

This argument about consumption is a special case of a more general concern implied by concave utility functions. Fluctuations in resources that cannot be smoothed generally impose welfare losses. Given the evidence that transitory fluctuations are more easily smoothed than permanent shocks, welfare losses are presumably smaller, the greater relative importance of transitory shocks versus permanent shocks. Here it is important to make the distinction between shocks to individual components of family income and shocks to family income, since transitory shocks to individual components can potentially be offset by changes in other components. Such off setting changes imply a negative covariance between the transitory shocks to different sources of income. If these covariances become less negative than this implies a welfare loss. The fact that the variance of transitory shocks to head’s earnings remained relatively constant while the variance of transitory family income shocks continued to increase implies either that other sources of income became more stable or that there was a decline in the ability to smooth by changing alternative sources of income, for example wives’ earnings.
A third reason for the interest in the transitory fluctuations in income comes out of the literature on inequality. One branch of this literature focuses on the impact of transitory shocks on social welfare (Atkinson and Bourguignon (1982); Cowell (Cowell); Gottschalk and Spolaore (2002); Sen (Sen)). Social welfare may depend on aversion to inequality and preference for mobility. Since transitory shocks have little impact on the inequality of lifetime incomes, a rise in the transitory variance of family income may have little impact on social welfare. Furthermore, if social welfare depends on whether it is possible for individuals to change their rank in the income distribution over their lifetimes then increases in the variance of permanent shocks, which move individuals farther apart in the distribution and hence makes changes in rank less likely imply a reduction in social-welfare. In contrast, transitory changes in income, which mixes up the distribution and results in more changes in rank are social-welfare-improving (Shorrocks (1978); Gottschalk and Spolaore (2002). All these arguments are implicitly based on family income.

A related reason for distinguishing permanent from transitory shocks is based on the well-known increase in cross-sectional inequality of earnings (Autor et al. (1998)). By definition, an increase in cross-sectional inequality has to arise from an increase in permanent shocks, transitory shocks, or both. The literature has put forth explanations for this trend in earnings inequality (e.g., skill-biased technical change) which all assume that permanent shocks have generated the cross-sectional increase in earnings inequality, yet, statistically, a rising cross-sectional variance could also result from an increase in the transitory variance. Explanations for rising transitory variance are likely to be quite different. For example, the increase in the transitory variance could have been caused by an increase in product or labor market competitiveness, a decline in regulation and administered prices, a decline in union strength, increases in temporary work or contracting-out or self-employment, and similar factors. In addition,
insofar as transitory fluctuations are more easily insured against than permanent fluctuations, as just noted, the welfare losses from increases in cross-sectional inequality might be smaller than would otherwise be supposed if transitory fluctuations have been an important source of the increase in cross-sectional inequality.

3 Methodology

The methodology used to estimate changes in the permanent and transitory components of a single source of income is well developed. However, there are two issues that must be confronted in order to generalize these methods to estimate the permanent and transitory components of the joint distribution of income sources that make up family income. The first issue is how to incorporate zero income since many families do not receive income from all sources. The second issue is how to allow for changes in the covariances across income sources.

3.1 Zeros

The early error components literature, and much of the recent literature estimates the parameters of the income process generating positive values of income. The constraint that zero incomes have to be dropped is seldom binding in studies of the covariance structure of earnings of male heads, since there are few male household heads with zero earnings. However, the exclusion of zeros is a potentially important limitation for our study of family income that includes income from other sources that are often zero.

This is particularly important when tracking changes over time. While the proportion of male heads with positive earnings has changed little over time, a growing proportion of spouses have entered the labor market. Including these spouses only
when they have positive income can affect both the trend and the level of the covariances used in the estimation.

Excluding zeros has two conceptually different implications. The first, and most commonly cited implication is the potential selection effect of excluding zeros. The mean (and other higher level moments) of the positive values of income from source $k$ can change solely through selection unless the expected income of people who start (or stop) receiving income from source $k$ is the same as the expected income of those already receiving income from this source, $E(y_{it}^k | y_{it}^k > 0) = E(y_{it}^k)$. For example, if the spouses who enter the labor market have lower mean earnings than spouses who are already in the labor market, then mean income from the earnings of spouses will decline when these spouses with below average earnings enter the labor market. The decline in mean spousal earnings between $t$ and $t + 1$ is not a consistent estimator of change in earnings of those in the labor market in both period. The fact that households have more income when spouses enter the labor market but mean household income declines is a direct result of this selection effect.

The second potential implication of excluding zeros occurs even if there is random selection. Suppose that the expected income from source $k$ for families who start receiving income from this source $k$ is the same as the expected income for families already receiving income from this source. So the families who start receiving income from source $k$ go from zero to the mean across all families receiving income from source $k$. The incomes of families who started with zero income clearly increases. Yet the average income of families receiving income from source $k$ does not increase.

The fact that zeros are usually excluded partially reflects the fact that the variance of log income, $\sigma^2(y_{it}^k)$ is the commonly used measure of dispersion. Defining $y_{it}^k$ as the log of income, however, has two important drawbacks for our focus on the joint distribution of multiple sources of family income. Not only does it require that all
families have positive income from all sources, but the amount cannot be very small since the variance of log income is sensitive to low values. As the amount of income from source \( k \) goes to zero for even one family, the variance of log income from source \( k \) goes to infinity.

An alternative measure of \( y^k_{it} \) is family \( i \)'s unlogged income from source \( k \) in year \( t \), \( Y^k_{it} \), relative to the mean income from that source in year \( t \) across all families, \( \bar{Y}^k_t \):

\[
y^k_{it} = \frac{Y^k_{it}}{\bar{Y}^k_t}
\]

(1)

\( Y^k_{it} \) can include or exclude families with zero income from that source. The variance of \( y^k_{it} \) is:

\[
\sigma^2 (y^k_{it}) = \frac{\sigma^2 (Y^k_{it})}{(\bar{Y}^k_t)^2} = c_v^2 \bar{Y}^k_{it}
\]

(2)

(3)

which is the squared coefficient of variation of income, another well known measure of dispersion, that can include or exclude zeros. The coefficient of variation also puts less weight on low values of income than the variance of log income so it mitigates the second disadvantage of the variance of log income.

The coefficient of variation for all families, including those with zero income from any source, is also decomposable since it can be written in terms of the coefficient of variation from source \( k \) for non-zeros, \( c_v^2 \bar{Y}^k_{it} \), and the proportion of families with non-zero income from this source, \( \pi^k \):²

\[
c_v^2 \bar{Y}^k_{it} = \frac{1}{\pi^k} [c_v^2 \bar{Y}^k_{zt} + 1 - \pi^k]
\]

(4)

²See Appendix A for derivation.
This identity provides a straightforward way of incorporating zeros without placing any restrictions on the process generating zeros. ³

3.1.1 Permanent and Transitory Components of Family Income

In this section we present the error components model that we use to model changes in the permanent and transitory components of the multiple income sources that add up to family income and provide conditions under which the key parameters are identified. This is followed by the methodology we use to estimate the parameters.

We start by briefly reviewing the well developed methodology used in the literature to model the permanent and transitory components of individual income sources. This is directly applicable to our problem since the $K$ sources of income that add up to family income in year $t$, come from the joint density $f(y^1_t, y^2_t, ..., y^K_t)$, whose marginal densities, $f_k(y^k_t)$ are the building block in the literature on individual income sources.

We use a generalization of the standard error components model for each individual income source. The income generating process for income from source $k$ is given by:

$$y^k_{it} = \alpha^k_{it} \mu^k_i + \beta^k_{it} \nu^k_{it} \tag{6}$$

where $y^k_{it}$ is family $i$’s income from source $k$ in period $t$. $y^k_{it}$ is composed of a permanent component, $\mu^k_i$, and a transitory component, $\nu^k_{it}$, each with its own individual specific time varying factor loadings, $\alpha^k_{it}$, and $\beta^k_{it}$. Family $i$ has a time invariant permanent income $\mu^k_i$ that determines its position in the distribution of permanent income from

³In contrast, if zeros were generated by the same process as non zero values this would imply that $y^k_{it} = 0$ only when

$$\nu^k_{it} = -\left(\frac{\alpha^k_{it}}{\beta^k_{it}}\right) \mu^k_i \tag{5}$$

The transitory shock in period $t$, $\nu^k_{it}$, would have to be just large enough to offset the permanent component, $\mu^k_i$, weighed by the negative of the loading factors in that period. We do not need to impose this highly restrictive constraint.
source $k$. However, the absolute level of $y_{it}^k$ depends on $\alpha_{it}^k$, which scales each family’s income up if $\alpha_{it}^k > 1$ or down if $\alpha_{it}^k < 1$. Similarly the transitory component, $\nu_{it}^k$, is scaled up or down by the factor loading $\beta_{it}^k$. These factor loadings act as unit prices for the unobservables.

The variances and covariances of income from source $k$ are given by:

\[
\sigma^2 (y_{it}^k) = (\alpha_{it}^k)^2 \sigma_{\mu_k}^2 + (\beta_{it}^k)^2 \sigma_{\nu_{kt}}^2 \\
\sigma (y_{it}^k, y_{is}^k) = \alpha_{it}^k \alpha_{is}^k \sigma_{\mu_k}^2 + \beta_{it}^k \beta_{is}^k \sigma_{\nu_{kt}\nu_{ks}}
\]

so increases in $\alpha_{it}^k$ increase the variance of $y_{it}^k$ as family’s incomes are scaled up proportionately by $\alpha_{it}^k$, with high income families receiving the largest absolute increase in $y_{it}^k$. Similarly increases in $\alpha_{it}^k$ or $\alpha_{is}^k$ increase the covariance across time in the permanent component of $y_{it}^k$. Increases in $\beta_{it}^k$ lead to increases in the variance and covariance across time in the transitory component of income from source $k$.

It is well known that it is not possible to separately identify the $\alpha’s$ from the $\beta’s$ with cross sectional data since cross sectional variances identify the sum of the permanent component plus the transitory component, not the individual components. The coefficients are identified with sufficiently long panel data. If the lag length $t - s$ is sufficiently long that $\sigma_{\nu_{kt}\nu_{ks}} = 0$ then the covariance between $y_{it}^k$ and $y_{is}^k$ includes only parameters of the permanent component.

\[
\sigma (y_{it}^k, y_{is}^k) = \alpha_{it}^k \alpha_{is}^k \sigma_{\mu_k}^2
\]

These off diagonal elements of the covariance matrix identify the $\alpha’s$ and $\sigma_{\mu_k}^2$ up to a scale factor, so we set $\alpha_{it}^k = 1$ The parameters of the transitory components are then
identified from the difference between the variances and these covariances.

**Multiple Sources of Family Income** Introducing multiple sources of income introduces an additional set of parameters that allow for correlation across income sources and change over time in this correlation. For example the distribution of the transitory component of family income depends not only on the marginal distributions of head’s transitory earnings and spouse’s transitory earnings but also on the covariances between these two sources of transitory income. The variances of both the marginal distributions of head’s transitory earnings and the marginal distribution of spouses’ transitory earnings may both increase, yet the variance of transitory family income will not increase if the covariance between the transitory component of these two income sources declines sufficiently to compensate for the increase in the variances of the marginal distribution. This will occur if spouses increase their transitory incomes enough to totally offset the decline their partners transitory income.

Income from sources $k$ and $j$ can again be written in terms of permanent and transitory components:

$$
y^k_{it} = \alpha^k_t \mu^k_{it} + \beta^k_t \nu^k_{it} \quad (10)
$$

$$
y^j_{is} = \alpha^j_s \mu^j_{is} + \beta^j_s \nu^j_{is} \quad (11)
$$

The covariance of income across sources $k$ and $j$ in periods $t$ and $s$ depends on the covariance between the permanent components of these two sources, $\sigma_{\mu k t \mu j s}$, and the covariance between the transitory components, $\sigma_{\nu k t \nu j s}$:

$$
\sigma (y^k_{it}, y^j_{is}) = \alpha^k_t \alpha^j_s \sigma_{\mu k t \mu j s} + \beta^k_t \beta^j_s \sigma_{\nu k t \nu j s} \quad (12)
$$

Note that these covariances across sources can themselves change across time. For
example, the covariance between head’s earnings in period $t$ and spouses earnings in period $s$ can increase or decrease regardless of whether the variances of these two components are increasing or decreasing.

Again we can write the covariance of the permanent component between these two income sources in period $s$ and $t$ as the time invariant baseline covariance, $\sigma_{\mu_k\mu_j}$ and a set of scaling parameters, $\gamma^k_t$ and $\gamma^j_s$

$$\sigma_{\mu_k\mu_j} = \gamma^k_t \gamma^j_s \sigma_{\mu_k\mu_j}$$  \hspace{1cm} (13)

Likewise, the covariation of the transitory component of these two sources depends on a baseline covariances, $\sigma_{\nu_k\nu_j}$, and a set of scaling parameters

$$\sigma_{\nu_k\nu_j} = \eta^k_t \eta^j_s \sigma_{\nu_k\nu_j}$$  \hspace{1cm} (14)

The covariance of income from these two sources is given by

$$\sigma \left(y^k_{it}, y^j_{is} \right) = \gamma^k_t \gamma^j_s \sigma_{\mu_k\mu_j} + \eta^k_t \eta^j_s \sigma_{\nu_k\nu_j}$$  \hspace{1cm} (15)

So changes over time in the $\gamma$'s and $\eta$'s capture the changes in the covariances across income sources.

The correlation across income sources is another commonly used measure of co-variation across income sources. Again it can be written in terms of baseline variances and covariances and weighting factors that change across time. The correlation in
the permanent components across income sources is given by

\[ p_{\mu_k\mu_j} = \frac{\sigma_{\mu_k\mu_j}}{\sigma_{\mu_k}\sigma_{\mu_j}} \]

(16)

\[ = \frac{\gamma_k^{k^j}}{\alpha_k^k \alpha_j^j} \frac{\sigma_{\mu_k}}{\sigma_{\mu_j}} \]

(17)

\[ = \frac{\gamma_k^{k^j}}{\alpha_k^k \alpha_j^j} p_{\mu_k\mu_j} \]

(18)

where \( p_{\mu_k\mu_j} \) is the baseline correlation across sources and \( \frac{\gamma_k^{k^j}}{\alpha_k^k \alpha_j^j} \) is the scaling factor that can change across time. Under the special case that

\[ \gamma_k^{k^j} = \alpha_k^k \alpha_j^j \]

(19)

the correlation across sources does not change over time.

### 3.2 Estimation

There are two sets of parameters that must be estimated. The first set includes the parameters of the \( K \) marginal distributions. Each marginal distribution is a function of the baseline variance of the permanent component, \( \sigma^2_{\mu_k} \), and the \( T - 1 \) factor loadings, \( \alpha_t^{k'} \). These can be estimated using standard methods in the literature on estimating changes in the parameters of the permanent and transitory components of a single income source.

Several methods, described in Moffitt and Gottschalk (2011), have been proposed in this literature. We build on what Moffitt and Gottschalk call their approximate nonparametric method, which imposes less structure on the distributions of the unobservables than in the fully parametric model since the parameters of the transitory component do not have to be estimated. What is required is that the covariances
between income in $t$ and income in $s$ be estimated over a sufficiently long lag, $t - s$, that the transitory components in $t$ and $s$ are independent.  

The second set of parameters affect the covariances across income sources. With $K$ sources of income there are $K(K - 1)/2$ such covariances. In our case $K=3$ so we must estimate 3 sets of covariances across sources –(1) the covariance of heads earnings and spouses earnings, (2) heads earnings and other income, and (3) spouses earnings and other income. Each of these covariances can again be written as a baseline covariance, $\sigma_{\mu_k \mu_j}$, and $(T - 1)$ factors that allow the covariance across sources to change over time.

We estimate the both sets of parameters by minimizing the sum of squared deviations between the empirical covariance matrix of income and the matrix implied by the model. We use the identity matrix as the weighting matrix. The empirical covariance matrix is adjusted for non-random selection using the standard Tobit assumption that those who do not have positive income from source $k$ come from the bottom of the distribution. Making the standard normality assumption used in Tobit models we infer $cov(y_{it}^k, y_{is}^l)$ from $cov(y_{it}^k, y_{is}^l | y_{it}^k > 0, y_{is}^l > 0)$ and $Pr(y_{it}^k > 0, y_{is}^l > 0)$.

For marginal distributions of each income source $k$, Tobit regressions are run within each year-age group cell (age groups are defined as 30-39, 40-49, 50-59), controlling for head’s age, age square, and age cubic. For joint distributions of income source $k$ and $s$, bivariate Tobit regressions are run by year for source $k$, year for source $s$, and age group. The covariance matrixes are generated using the predicted values from

---

4 An alternative is to place functional form assumptions on the time series properties of $\mu_i$ and $\nu_{it}$ and to derive the implied covariance structure. This procedure, followed by Haider (2001); Moffitt and Gottschalk (2011) Moffitt and Gottschalk (2002); Baker and Solon (2003); can be estimated by GMM using all covariances. A third, and simpler method developed in Gottschalk and Moffitt (1994) is to calculate the mean of income for each individual over a fixed window and use the variance of these means as an estimate of the permanent variance. The transitory variance is obtained as the variance of deviations from each individual’s means. While this more intuitive method has been used often, it has substantial limitations (see Moffitt and Gottschalk (2011))
Tobit and bivariate Tobit regressions.

The transitory component is obtained from the difference between the diagonal elements, that include both permanent and transitory components and the estimated permanent components from the long lags.

This model can be modified to allow different age cohorts to have different permanent and transitory variances. We allow the intercept to be age specific by adding age dummies that take the values of 35, 45, and 55. We also condition on a quadratic in lag length.

3.3 Data

We use data from 1970 through 2010 panels of the Panel Study of Income Dynamics (PSID). This is a longitudinal data set of a representative set of family units in 1968 and their descendants. From 1968 to 1996, the PSID conducted annual interviews,. Since 1997 data were collected biennially. While the PSID has been criticized as being non-representative on-going work comparing the PSID with the LEHD indicates that the general trends in the covariance structure of reported annual earnings in the PSID are broadly consistent with the covariance structure of earnings as reported in UI records.

We examine the covariance structure of total family income and three family income components: head’s earnings, spouses earnings, and all other income. The later is a residual category that includes capital income, public and private transfers, and other family members’ earnings. Our sample includes all families with a male head aged between 30 and 59. To reduce measurement error, we trim two percent at the top of each of the relevant distributions to ensures that all top-coded values are excluded. We do not trim at the bottom since we include zeros in our Tobit
adjustment.

4 Results

4.1 Impact of Using the Coefficient of Variation

In this section we show the impact of using the coefficient of variation rather than the variance of log income as our measure of dispersion. As explained earlier, the previous work has largely used the variance of log income as the measure of dispersion. This choice largely reflects the desirable properties of this measure. It is scale free and decomposable. It, however, rules out the inclusion of zeros since the log of zero is infinity which would drive the log variance to infinity. In practice, this measure is also very sensitive to small changes in incomes at the bottom of the distribution, even if zeros are excluded.

Figure 1a shows that our data and sample are consistent with previous studies. Like these studies we show a substantial increase in the variance of log earnings of male heads from the early 1970’s through the mid-1980’s and then a leveling off at this new high level through 2008. The fact that we can replicate earlier studies shows that findings in our study are not being driven by differences in the sample used.

Figure 1b shows the impact of using the coefficient of variation rather than the log variance as a measure of dispersion. In order to isolate the impact of differences in the measure of dispersion, we impose the same trim (1% at top) as in Figure 1a and continue to exclude persons with zero incomes. It is clear that the coefficient of variation increases throughout the full period while the log variance levels off after the mid-1980’s. As a result of the continuous steady growth throughout the sample period, the $cv$ had grown by a factor of 2.3 between 1970 and 2003. In contrast the
log variance increased only by a factor of 1.6. This difference is a result of the \textit{cv} placing higher weight than the log variance on changes at the top of the distribution and less weight on changes at the bottom.

Finally, we include zeros and trim only the top of the distribution since there are no outliers at the bottom. Figure 1c shows that these changes lower the growth in dispersion. But the patterns remain largely unchanged. Dispersion continued to increase steadily throughout the nearly four decades covered by the PSID.

4.2 Trends in CV of Family Income and It’s Components

In this section we show trends in the \textit{cv} of the marginal distribution of family income and three income components that add up to family income. These include heads earnings, the focus of much of the earlier literature, spouses earnings, and other income, a residual category. Figure 2a shows that the \textit{cv} of family income grew substantially more than the \textit{cv} of head’s earnings. This indicates that the rise in the dispersion of family income reflects more than the changes in labor market forces that affected male heads. There were either complimentary increases in the dispersion of the marginal distribution of spouses earnings or in the dispersion of other income. Alternatively, the rise in the \textit{cv} of family income may have been driven by an increase in the covariation. across income sources.

Figure 2b shows that changes in the dispersion of the marginal distributions of spouse’ earnings or other income are not the driving forces behind the rise in the \textit{cv} of family income. Spouses earnings became substantially more equal, as indicated by the sharp decline in the \textit{cv} of spouses earnings in Figure 2b. This reduction in the dispersion of the marginal distribution of spouses earnings largely reflects the decline in the proportion of spouses with zero earnings. This increase in labor force
participation of spouses reduced the density at the very bottom of the distribution.

Finally, changes in the dispersion of the residual source of family income is also not the driving force behind the rise in the \( cv \) of family income. The \( cv \) of this marginal distribution shows no clear trend.

The fact that the \( cv \) of family income grew substantially faster than the \( cv \) of head’s earnings and that changes in dispersion in the marginal distributions of spouses earnings and the marginal distribution of other income are not contributory factors indicates that the covariation across income sources must have increased. This is confirmed in Figure 3 that shows the covariances between the three pairs of income sources. While head’s earnings and other income were strongly negatively correlated in the early years, by 2010 the coefficient of covariation, \( c_{cv} \), was nearly zero. This indicates that public transfers and self-insurance, that had offset changes in heads earnings in the early years, were nearly neutral by 2010. Likewise, spouses’ earnings were negatively correlated with the residual source of income in the early years but the offsetting nature of the residual source of income actually became reinforcing in the mid-1980s and only returned to neutrality after 2000.

The covariation between head’s and spouses earnings shows a somewhat more complicated pattern. The covariation between these the two sources of family income was close to zero in 1970. It then grew through the mid-1980s indicating that either there was greater positive marital sorting or that there was less self-insurance against shocks. In either case, this increase in the covariation contributed to the rise in the \( cv \) of family income. However, the increase in the covariation between spouses earnings is substantially smaller than the increase in the other two covariances over the whole period.

In summary, the rise in the dispersion of family income could either reflect increases in the dispersion of the marginal distributions of the income sources that
make up family income, or an increase in the covariation. between these income sources. Clearly, the rise in the dispersion of head’s earnings is one factor contributing to the rise in the $cv$ of family income. But this cannot be the sole factor since the $cv$ of family income increased roughly 50 percent faster than the $cv$ of head’s earnings even while spousal earnings became more equally distributed and the $cv$ of other sources of income shows no trend. However, the increased covariation. across income sources clearly contributed to the rise in family income inequality.

4.3 Permanent and Transitory Components of Multiple Income Sources

In this section we decompose the observed changes in the variances of the three margin distributions and the changes in the covariances across these income sources into changes in the underlying permanent and transitory components. This allows us to see whether the changes in the variation and covariation. of observed income reflects changes in the weight put on unobserved permanent characteristics or increased variation or covariation. in the unobserved transitory components of the different income sources.. For example, does the recent increase in the dispersion of head’s earnings reflect greater weight put on unobserved permanent characteristics of head’s earnings, greater transitory variation in unobserved factors, or increased correlation of the permanent or transitory components with other income sources?

4.3.1 Family Income and Head’s Earnings

Figures 4 and 5 show that the faster growth in the $cv$ of family income than head’s earnings, shown in Figure 2a, reflects a more rapid rise in the permanent component of family income than head’s earnings . While the permanent component of head’s
earnings changes moderately over time, the changes are relatively small compared to the changes in the permanent component of family income, especially in the recent years. Figure 4 shows that the permanent component of family income and head’s earnings moved closely together through the early 1990’s. After that point the \( cv \) of head’s earnings grows only slowly. In contrast, the \( cv \) of family income in 2010 is more than twice its value in the mid-1990’s.

Figure 5 shows that the transitory component of head’s earnings is nearly identical to the transitory component of family income. While the two series show similar net growth between 1970 and the mid-1990’s, the patterns are largely different in the rest of the panel. The transitory component of head’s earnings continues to grow while the transitory component of family income takes a sharp drop after 2000. By the end of the panel the \( cv \) of the transitory component of family income is well below its level in the mid-1990’s.

To recap, the dispersion of head’s earnings and family income both grew over the period covered by the PSID. But the growth in inequality was larger for family income than for head’s earnings, especially after 1995. This rapid growth in the dispersion of family income reflects a rapid rise in the dispersion of the permanent component of family income. In fact, the dispersion of the transitory component shows no net growth between the mid-1990’s and the end of the panel. This is in sharp contrast to head’s earnings, whose growth in dispersion is almost solely a reflection of the growth in the transitory component.

These differences indicate that the dispersion of the permanent component of other sources of income must have grown rapidly or that the correlations across sources must have grown. We examine these two possibilities in the following section.
4.3.2 Changes in cv of other Sources of Family Income

Figure 6 shows the cv for the three sources of family income. Two patterns are clearly evident. First, the cv of head’s earnings is substantially smaller than the cv of either spouse’s earnings or other income. This is not surprising since zeros are much more prevalent for spouse’s earnings or other sources of income and the higher density at the bottom of the distribution does affect the cv, though not as much as it would affect the log variance.

The second clear pattern in Figure 6 and 7 is that none of the income sources show the same sharp increase in the cv of the permanent component as was found for the cv of family income. In fact, the cv of spouse’s permanent component of earnings and of other income both fell over time. This is particularly pronounced for spouse’s earnings, which is consistent with the know increase in labor force participation, which reduced the density at the bottom of the distribution. of spouses’ earnings.

In summary, changes in the variation of both the permanent the transitory components of family income are very different from changes in the corresponding permanent and transitory components of family income. This implies that changes in the co-variation across income sources must play a role in accounting tor changes in the permanent and transitory components of family income.

4.3.3 Changes in the Co-variation across Income Sources

This sharp increase in the cv of the permanent component of family income is consistent with the very sharp increase in the coefficient of covariation, \( ccv \), between the permanent components of head’s and spousal earnings, shown in Figure 8. Heads with high permanent earnings were increasingly likely to have spouses with high permanent earnings. This could reflect an increase in labor force participation of spouses with
high potential earnings or an increase in assortive mating. The importance of distinguishing between these two behavioral effects is clear implication of our descriptive work.

Figure 9 shows that the covariation between the transitory components of our three income sources increased steadily throughout the panel. The continued increase in the covariation during the 1980’s is consistent with the continued rise in family income instability during that period, in spite of the leveling off in the instability of head’s earnings. While the amplitude in the transitory shocks to head’s earnings stayed fairly constant, these shock were increasingly likely to be accompanied by reinforcing shocks in the other income components. This led to a continued increase in the transitory fluctuations in family income. which in turn led to continued increase in the $cv$ of observed family income.

5 Conclusion

We have shown the importance of changes in the covariation across income sources in accounting for changes in distribution of family income. The importance of focusing on the covariation, as well as the variation, in income sources is true not only for observed income but also for the permanent and the transitory components of family income. While each of the components of family income became less equal over the period we study, the increase in inequality of family income largely reflects an increase in the covariation across income sources. Families with low income from head’s earnings were increasingly likely to have low income from other sources. Likewise, the observed increase in instability of family income largely reflects an increase in the covariation in the transitory shocks across income sources.

The evidence in this paper shows that increase in the covariation across income
sources played a crucial role leading to the observed increase in family income inequality and instability. While this descriptive evidence does not provide the causal factors that led to these changes, it does point to the potentially important, but often overlooked place to focus attention in designing the behavioral models that can isolate the causal factors behind the increase in family income inequality and instability.

6 Appendix A

We incorporate zeros by exploiting the identity that the total variance of unlogged income, $Y$, is equal to the sum of the within group variances and the between group variance. In our application, there are two groups: households with positive income from source $k$ and those with zero income from this source. The total variance of income across both groups is given by

$$
\sigma_Y^2 = \left[ \pi \sigma_{nz}^2 + (1 - \pi) \sigma_z^2 \right] + \left[ \pi (\mu_{nz} - \mu_Y)^2 + (1 - \pi) (\mu_z - \mu_Y)^2 \right]
$$

(20)

(21)

where $\mu_Y$ and $\sigma_Y^2$ are the mean and variance of income across all households. $\sigma_{nz}^2$ and $\sigma_z^2$ are the within group variances. and $\mu_{nz}$ and $\mu_z$ are the corresponding means for our two groups. $\pi$ is the proportion of households with positive income. Since $\mu_z = 0$ and $\sigma_z^2 = 0$ this implies $\mu_Y = \pi \mu_{nz}$ so:

$$
\sigma_Y^2 = \pi \sigma_{nz}^2 + \pi \mu_{nz}^2 (1 - \pi)^2 + (1 - \pi) \pi^2 \mu_{nz}^2
$$

(22)

Dividing both sides by $\mu_Y^2 = \pi^2 \mu_{nz}^2$:

$$
\text{cv}_Y^2 = \frac{1}{\pi} \left[ \text{cv}_{nz}^2 + 1 - \pi \right]
$$

(23)
So the $cv^2$ of income across all households, including those with zero income, is a function of the $cv^2$ of income for households with positive values, and the proportion of such households $\pi$. This holds for each income source.

References


Figure 1a--Variance (In Heads' Earnings)

Note: Top and bottom one percent within year-age cell are trimmed, positive earnings only, weighted sum of all age groups.
Figure 1b--Variance (In Heads' Earnings) and CV(Head' Earnings) with and without zero earnings

Note: Top and bottom one percent within year-age cell are trimmed, positive earnings only, weighted sum of all age groups
Figure 2a--CV (Heads' Earnings) and CV(Family Income)
Figure 2b--
CV of All Income Sources

- Family Income
- Heads' Earnings
- Spouses' Earnings
- Other Income

1970=1.0
Figure 3-- Coefficient of Covariation between Income Sources
Figure 4--CV of Permanent Income--Heads' Earnings and Family Income

1970=1.0
Family Income
Heads' Earnings
Table 5--CV of Transitory Income
Heads' Earnings and Family Income
Figure 6--CV of Permanent Income by Income Source

- Heads' Earnings
- Spouses' Earnings
- Other Income
Figure 7--CV of Transitory Income by Income Source

- Heads' Earnings
- Spouses' Earnings
- Other Income
Figure 8-
Coefficient of Covariation between Income Sources
Permanent Income

- CV(Head, Wife)
- CV(Head, Other)
- CV (Wife, Other)
Figure 9-
Coefficient of Covariation between Income Sources
Transitory Income