Appendix One:
Previous Research on Earnings Instability and Volatility Trends

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Research on economic mobility and volatility has experienced something of a boom in recent years, driven by growing concern that the structure of the U.S. political economy has changed fundamentally in a way that leaves workers and families at greater economic risk than in the past. Nevertheless, scholars have examined trends in short-term earnings fluctuations for nearly two decades. I organize my review of the literature according to the groupings laid out in the introduction. [1]

Research on Short-Term Relative Mobility

We can track relative mobility in earnings back to the 1930s thanks to invaluable research by Wojciech Kopczuk, Emmanuel Saez, and Jae Song. Analyzing restricted-use earnings data from the Social Security Administration, these researchers charted trends in the probability of remaining in the top two quintiles or the bottom two quintiles in consecutive years, and in the probability of rising from the bottom two quintiles to the top two quintiles or falling from the top to the bottom. [2] The figures in their charts are publicly available, and they can be used in combination to consider other measures of mobility.[3]

Figure 1 uses their estimates to show three trends—the percentage experiencing downward mobility from the top two quintiles from one year to the next, the percentage experiencing upward mobility from the bottom two quintiles, and the probability of experiencing either change. Non-directional mobility defined by this latter measure

declined dramatically from the mid-1940s until the early 1960s, rose through the mid-1970s, and then continued declining, ending at a low for the post-Depression era in the early 2000s. Upward mobility from the bottom shows a broadly similar trend. Downward mobility from the top, on the other hand, shows a smaller decline from the mid-1940s until the mid-1960s, with little secular change thereafter. There is evidence of a countercyclical pattern from the mid-1950s onward, with downward mobility temporarily increasing during recessions and upward mobility temporarily decreasing. These patterns mostly cancel each other out when looking at non-directional mobility.

In a newer version of their paper, Kopczuk et al. report trends since 1978 in the likelihood of moving down from the top percentile of earnings.[4] Downward mobility declined somewhat over the late 1970s and early 1980s, increased in the mid-1980s, then gradually declined through the early 1990s. It rose again over the rest of the decade before falling again after 2000. Over the entire period there was little change in downward mobility.

Maury Gittleman and Mary Joyce found that non-directional mobility among men and women declined a bit from 1968 to 1970, as measured by one minus the share remaining in their quintile in consecutive years or one minus the share either remaining in their quintile or moving into a neighboring quintile.[5] Mobility increased in the first half of the 1970s, and over the rest of the decade mobility was flat among men but continued to increase among women. Robert Moffitt and Peter Gottschalk, also considering movement out of an initial quintile, found that among 36-year-old white male heads in the Panel Study of Income Dynamics (PSID), mobility declined in the early 1970s,

increased briefly, then continued declining in the late 1970s. Mobility over a five-year period declined in the second half of the 1970s.[6]

Gary Fields and his colleagues considered several measures of relative mobility, once again using the PSID and looking at male earnings.[7] They found that the average centile change over five years rose from 1970-75 to 1975-80, indicating increasing mobility. Similarly, the share of men moving more than five centiles increased between these two periods, as did mobility measured as 1 minus the centile correlation coefficient or as 1 minus the rank correlation coefficient. Finally, when the men were classified into earnings deciles in both years, mobility measured as the negative of the chi-squared statistic for the ten-by-ten transition matrix also increased from 1970-75 to 1975-80.

Mary Daly and Greg Duncan examined the number of years in an eleven-year period in which a man remained in his original labor income quintile. They found higher mobility in the 1980s than in the 1970s.[8] According to Gittleman and Joyce, non-directional mobility among men and women declined a bit through the mid-1980s and then flattened. Richard Burkhauser and his colleagues found that the Spearman rank correlation coefficient for logged labor income between consecutive years in the PSID was constant between 1984 and 1988.[9] Moshe Buchinsky and Jennifer Hunt found that mobility declined during the 1980s, among both men and women, which is also consistent with Kopczuk et al., as is their finding that upward mobility from the bottom quintile declined more than downward mobility from the top quintile.[10] Moffitt and Gottschalk also found declines in wage mobility over consecutive years among male heads in the 1980s, but when they measured mobility using five-year windows they found little change. Daly and Duncan, too, found mobility declines among men, from the 1979-

89 period to the 1985-95 period. Finally, the measures used by Fields and his colleagues also show declines during the 1980s, which for the most part continue into the early 1990s.

In sum, it appears that short-term relative mobility declined during the postwar period, through the early 1960s, with downward mobility declining through the mid-1960s. Relative mobility then began increasing, probably reversing the early '60s decline, though there are inconsistent findings at the end of the decade. The patterns of non-directional relative mobility during the 1970s are inconsistent, but with the exception of Moffitt and Gottschalk's study, they generally find increases in mobility. Non-directional mobility declined during the 1980s and in the early 1990s before flattening out through the early 2000s. There is little evidence on trends in directional relative mobility. According to Kopczuk et al., upward and downward mobility followed cyclical patterns from the 1970s forward, with upward mobility trending downward from the mid-1970s to the early 2000s but downward mobility changing little beyond a drop in the early 1980s. Buchinsky and Hunt found declines in downward mobility from the top and upward mobility from the bottom over the 1980s for men and women. From this first approach to measuring earnings changes, then, it appears that there has been little detrimental change since the 1970s.

Research on Intertemporal Earnings Associations

The introduction noted that intertemporal earnings associations are best thought of as incorporating both relative and absolute mobility. As nondirectional mobility measures, they would be expected to follow trends in nondirectional relative and absolute

mobility more closely than separate trends in upward or downward mobility.[11] Most of these studies rely on the PSID. Many of the estimates come from correlation matrices included simply as descriptive statistics in research modeling earnings dynamics. Most are confined to men.

Kopczuk et al. computed rank correlations for commerce and industry workers and for men in particular, using SSA data.[12] They found that earnings mobility fell in the late 1930s, rose more strikingly in the first half of the 1940s, then fell just as sharply in the subsequent years. Mobility continued falling modestly over the 1950s before flattening out in the 1960s. It rose in the late 1960s but then fell beginning in the early 1980s (from the mid-1970s to the mid-1980s for men). It changed little from 1985 onward.

Michael Baker showed the correlation matrix for male heads' earnings over several years of the PSID.[13] Short-term mobility as measured by year-to-year correlations increased from 1969 through 1972. It fluctuated between 1972 and 1976 before declining through 1982. Overall, mobility changed very little from 1970 to 1980. Steven Haider's PSID correlations for men show little trend from 1968 to 1972, an increase in mobility through 1976, and a decline from 1978 to 1981.[14] Like Baker, he found little change over the 1970s as a whole. Moffitt and Gottschalk also examined male autocorrelations over the 1970s, which show different patterns depending on whether they are measured over one or five years but which both indicate declining mobility over the decade.[15]

On the other hand, Gittleman and Joyce found that mobility among men and women increased during both the first and second halves of the 1970s according to one-

year autocorrelations using the CPS.[16] Similarly, Daly and Duncan examined trends in autocorrelations using the PSID and found that male earnings mobility was higher in 1981 than in 1971.[17] Fields and his colleagues reported mobility increasing from the first half of the 1970s to the second half, using five-year correlations in male earnings.[18] Gittleman and Joyce, in a second paper, fit a quadratic trend through one-year wage and salary correlation coefficients within sex/age/education cells and within race cells in matched March CPS data.[19] Their regression coefficients indicated that mobility increased during the late 1960s and through the 1970s.

Turning to the 1980s, Haider reported little trend over the decade but slightly lower mobility in 1990 than in 1980. Similarly, Gittleman and Joyce (1996) estimated that mobility declined between 1980 and 1990, though the change was small. Gittleman and Joyce (1995) found a decline in mobility among men and women, concentrated between 1982 and 1986. Moffitt and Gottschalk found increases in mobility in the early 1980s followed by slightly bigger declines mid-decade. Fields and his colleagues also found declining mobility in the 1980s and through the early 1990s.

On the other hand, Baker found that male heads' mobility increased from 1982 to 1986 after several years of decline. Daly and Duncan's PSID autocorrelations also indicate an increase in mobility over the mid-1980s. In yet another study using the PSID, Dean Hyslop reported autocorrelations of husbands' and wives' hourly wages and earnings.[20] Wage and earnings mobility among husbands were higher in 1985 than in 1980. Among women, wage mobility changed little, while earnings mobility declined.

Finally, Bhashkar Mazumder used a unique dataset that consists of Survey of Income and Program Participation (SIPP) data matched to Social Security Administration

data on earnings. He reported that mobility as measured by year-to-year autocorrelations of logged residualized earnings among men declined from 1984 to 1990, increased from 1990 to 1992, and then declined from 1992 to 1997.[21]

The various estimates of intertemporal earnings association are remarkably inconsistent, particularly given that so many of them rely on the PSID and are focused on men. Baker, Haider, and Kopczuk et al. agree with one another that mobility increased in the late 1960s and declined in the 1970s, but they are contradicted by Gittleman and Joyce on both counts. In regard to the 1970s, Moffitt and Gottschalk side with Baker, Haider, and Kopczuk et al., but Daly and Duncan side with Gittleman and Joyce. In the 1980s, Haider's and Baker's trends conflict, as do those of Daly and Duncan and of Gittleman and Joyce, but Haider's agree with Gittleman and Joyce, as do those of Kopczuk et al. Mobility likely declined in the second half of the 1980s. Finally, Mazumder's results imply that mobility increased in the early 1990s before declining through the middle of the decade, ending lower in 1997 than in 1990. Kopczuk et al., on the other hand, find little change over the 1990s. There is too much uncertainty in these estimates to compare them against the estimates of non-directional relative mobility. However, Kopczuk et al.'s estimates are consistent with their relative mobility results indicating major declines in mobility prior to 1960.

Research on Short-Term Absolute Mobility

An alternative to looking at short-term relative mobility trends or trends in mobility as intertemporal association is to examine trends in absolute mobility. Beginning with downward absolute mobility, Molly Dahl, Thomas DeLeire, and

Jonathan Schwabish analyzed the restricted-use Social Security Administration (SSA) data to examine trends in the probability of experiencing large earnings drops going back to the early 1960s, though due to data limitations, the analyses were restricted to the bottom 40 percent of the wage distribution.[22] They found that for both men and women, downward wage mobility (experiencing a decline of either 25% or more or 50% or more over the course of a year) declined from 1961 to 1966 and increased from 1966 to 1971, consistent with trends in relative downward mobility from the SSA data. Absolute downward mobility was slightly higher in 1971 than in 1961, while relative downward mobility was significantly higher. The cyclical swings Dahl and her colleagues found in the 1970s among men and women also mirror the downward relative mobility trends for all workers. The similarity in downward mobility rates in 1970 and 1980 masks a sizable increase among men, with a smaller decline among women.

The work of Karen Dynan and her colleagues, using the PSID, shows that downward labor income mobility among family heads increased in the mid-1970s before falling again.[23] Jacob Hacker has also produced estimates of the likelihood of large drops in labor income using the PSID, and they also show downward mobility rising and falling cyclically in the 1970s.[24] Dynan et al. and Hacker each show a small increase over the decade.

In the 1980s, as with relative mobility trends based on the SSA data, Dahl et al. found that absolute downward mobility rose and fell early in the decade and then was relatively flat (slightly increasing), ending the decade lower than where it began. This was true for both men and women. From 1980 onward, the SSA data may be used to look at all workers, rather than having to trim the top three quintiles. Dahl et al. showed

that downward mobility increased from 1981 to 1982 (as in the trimmed data), then declined through 1985 among both men and women. The full SSA data shows a slight decline from 1986 to 1990, basically consistent with the trimmed results.

Dynan et al. also found continuing cyclical patterns in the first part of the 1980s, with downward mobility rising in the early 1980s before falling yet again. They found that downward mobility in the PSID was flat during the late 1980s. Hacker, too, found cyclical patterns through the early 1980s, and his trends for the rest of the decade are consistent with the other studies (and similar for men and women). Like Dynan et al. and Hacker, but in contrast to Dahl et al., Daly and Duncan's PSID results show higher downward mobility in the 1980s than in the 1970s, measured as the average across male workers of the number of years that a person experienced a 50-percent earnings drop in an 11-year period.[25]

Dahl et al.'s absolute mobility trends show a longer and stronger decline in the 1990s than the SSA-based relative mobility trends. Like the trimmed SSA data, the full data shows a small increase in downward mobility in 1991 before declining through the late 1990s. Finally, both samples show small increases in downward mobility from 2000 to 2003. As with the relative mobility trend, however, the downward absolute mobility trend ended near early-1990s levels.

Dynan et al. found that downward mobility in the PSID rose in the early and mid-1990s. It then declined for the next few years, increasing at the end of the decade. They show increasing downward mobility through 2002, with a small decline from 2002 to 2004. Again, the SSA and PSID patterns are cyclical and consistent, except that the PSID shows an upward secular trend after 1990. While the SSA results show downward

mobility in the early 2000s to be lower than its early 1980s levels and comparable to mid-1970s levels, Dynan et al. show it to be higher than any previous period.

Hacker's trends for the early 1990s are unique. He shows larger downward mobility increases among both men and women than in the other studies. Downward mobility then declined over the rest of the decade, increasing after 1998 among men. Hacker shows an increase from 2000 to 2002 among men and women, followed by an equally large decline among men from 2002 to 2004 (no change among women). Combining men and women, his results show a big increase in downward mobility followed by a decrease that is only a little less dramatic than the preceding increase.

Hacker has never presented trends in the likelihood of large earnings *gains*, but Dahl et al. and Dynan et al. have. Dahl and her colleagues found that from 1981 to 1987, the probability of a 25-percent or 50-percent increase in earnings decreased slightly for women and increased slightly for men (converging), but then it declined notably through 1991 for both. It then increased more shallowly through 1998 and decreased through 2002, ending up slightly lower than in 1991 for women and slightly higher for men. All of these patterns are similar to those for relative upward mobility in the SSA data.

Dynan et al., examining the likelihood of a 44% increase in earnings over two years among family heads (25% per year), confirmed a cyclical pattern from the 1970s forward. They found little change in upward mobility in the 1970s. Contrary to the SSA-based relative and absolute upward mobility results, Dynan and her colleagues found little decline in the 1980s, an increase in the 1990s where the SSA data shows none, and a big drop post-2000.

Two studies provide estimates of the probability of experiencing a large earnings change in either direction (up or down). Dahl et al.'s results imply a decline in the 1980s for men and women, with a flat trend in the 1990s through the early 2000s among men and a small decline among women. Once again, these trends conform with the trends in non-directional relative mobility. In contrast, the results of Dynan et al. indicate that the percent of family heads experiencing a large change in earnings increased steadily from the early 1970s through the 1990s, then declined somewhat.

In addition to these upward and downward absolute mobility studies, other research focuses on non-directional measures of absolute mobility. A recent paper by Shane Jensen and Stephen Shore measured "volatility" as the squared change (over two years) in logged residualized labor income, using the PSID.[26] It found that mean and median volatility among male heads increased from 1969 to 1975. Mean volatility showed little trend between 1975 and 1991 but then jumped through 1994 before falling through 2000. Median volatility declined from 1975 to 1976 but then showed little consistent trend through 2000. Both mean and median volatility jumped in 2002. The difference between the mean and median trends was driven by changes in large income swings – the trend in the 95th percentile of labor income volatility closely followed the trend in mean volatility.

Fields and his colleagues used the PSID to look at the mean of the absolute values of earnings changes.[27] Whether they measured earnings in terms of levels or logs, mobility increased during the 1970s and through the first half of the 1980s. Mobility in terms of levels was flat over the 1980s and then declined from the late 1980s through the early 1990s. Mobility in terms of logs declined from the early 1980s to the early 1990s.

It is difficult to generalize across these absolute mobility findings, but there is little evidence that earnings instability has recently become a new structural problem. Dahl et al. find that downward mobility declined during the first half of the 1960s and then increased, declining over the decade as a whole. Non-directional absolute mobility increased in the 1970s, apparently due to an increase in downward mobility among men. However, the 1980s featured little change in upward or downward mobility, or perhaps declines in one or both. The non-directional measures of absolute mobility are inconsistent, but only two out of six show increasing instability over the decade. Results from the 1990s are also inconsistent, but it appears that there was either little change or a decline in downward mobility at the same time that there was little change or an increase in upward mobility. The first years of the current decade, marked by the 2001 recession, featured increases in downward mobility and declines in upward mobility. As with directional measures of relative mobility, downward and upward absolute mobility show countercyclical patterns.

Research Examining the Dispersion of Earnings Changes

The studies in this line of research all focus on the variance or standard deviation of changes in earnings. In a paper devoted to estimating a formal model of earnings change, John Abowd and David Card presented variances of men's labor income changes for a number of years in the 1960s and 1970s, using two different surveys.[28] They found that dispersion in one-year earnings changes in the National Longitudinal Survey of Men 45-59 increased from 1967 to 1975 by about 75 percent when the variances are expressed

as standard deviations. In the PSID, dispersion of earnings changes declined between 1970 and 1974, increased through 1976, and declined again through 1979, ending about where it started.

Baker also presented PSID trends in the variance of male heads' labor income changes between consecutive years.[29] He reported that dispersion of changes increased from 1968 to 1972. It declined through 1974 and then increased through 1976 before declining again through 1980. Earnings-change dispersion increased from 1980 to 1986, ending at its highest level. Overall, when expressed as standard deviations, dispersion doubled between the late 1960s and 1986 (but increased by just 50 percent between the late 1960s and 1985).

Stephen Cameron and Joseph Tracy pursued a similar approach using interviews from March Current Population Survey respondents that were one year apart. They examined trends in the variance of changes in men's logged wage and salary income after adjusting for age, education, and industry.[30] Cameron and Tracy captured residuals from a model of the level of earnings in each year and then differenced the residuals from respondents' two interviews. They found that dispersion of earnings changes increased from 1967 to 1982, with cyclical spikes in the early 1970s and mid-1970s and an especially large increase from 1981 to 1982. From 1982 to 1996, dispersion declined somewhat, with a cyclical spike in the early 1990s. Expressed in standard deviations, dispersion increased about 20 percent from 1967 to 1996. The increase they found over the 1980s is at odds with the decline found in the SSA data.

Dynan et al. (2008) also relied on a similar measure.[31] When heads and spouses were pooled, the standard deviation of percent changes in earnings in the PSID declined

by 3 percent between the early 1970s and the early 2000s. However, while it declined by 15 percent among women (including both heads and spouses), dispersion of changes actually rose 70 percent among men. They found that dispersion among family heads increased steadily from the early 1970s to the early 2000s, by about 40 percent, though they noted that the increase since 1980 was smaller if they excluded those with a business interest, and their 2007 draft indicated that the increase fell to about 20 percent if those with a business interest were excluded, implying that self-employment earnings are more unstable than wages and salaries.[32] The increase in earnings-change dispersion was greater before 1985 than after, and the 2007 draft indicated it was confined to male heads. Dispersion among the spouses of family heads declined by about 15 percent over the period, spouses in the PSID being overwhelmingly women.

In another paper in this line of research, Donggyun Shin and Gary Solon computed the standard deviation of the two-year change in log earnings for male heads, after adjusting earnings for age.[33] They found that volatility increased in the 1970s but found little secular trend from the late 1970s to the late 1990s. Volatility increased from 1980 to 1983, then declined through the mid-1990s. It increased substantially after 1998, ending over 50 percent higher in 2004 than in 1971.

Moffitt and Gottschalk presented trends in the variance of two-year residualized earnings changes among male heads age 33 to 35, again using the PSID.[34] Dispersion increased in the first part of the 1970s, declining in the latter part of the decade. It then increased in the early 1980s before declining over the rest of the decade (with a big spike in 1986). This cycle repeated in the 1990s, with an increase early in the decade followed by a decline through 1998. Earnings-change dispersion rose from 1998 to 2002 and

declined from 2002 to 2004. Over the entire period, the increase from 1973 to 2004 was about 40 percent (expressed in standard deviations), again following a countercyclical pattern.

Moffitt and Gottschalk also examined the trend in the variance of *ten*-year earnings changes for 35- to 45-year-olds. The variance declined during the early 1980s, increased through the mid-1980s, and then declined over the rest of the decade. It then increased through the mid-1990s and declined through 2000. It increased from 2000 to 2002 and declined from 2002 to 2004. The increase from 1980 to 2004 was about 20 percent (versus no change when two-year changes were examined).

Another paper using the PSID also focuses on dispersion in residualized earnings. Susan Dynarski and Jonathan Gruber adjusted male heads' earnings for a number of demographic variables before looking at trends in the variance of the one-year change in male heads' logged earnings.[35] Expressing their results in standard deviations rather than the variances they present, dispersion rose about one-third from 1970 to 1991, though the trend clearly follows a countercyclical pattern.

Finally, Dahl et al. included time series for men and women using a measure based on dispersion in earnings changes.[36] Using the SSA data again, they found that the standard deviation of one-year percent changes in earnings declined 10 to 12 percent from 1981 to 1991 among both men and women. Updated figures show a roughly 10-percent decline from 1985 to 1991 among both groups.[37] The standard deviation of the difference in log earnings declined 8 percent among men and 18 percent among women from 1981 to 1991 (5 percent or less from 1985 to 1991). Dispersion of changes then increased slightly over the next few years, only to decline slightly over the rest of the

decade, ending lower than in 1990. It increased a bit among men between 2000 and 2003 and was flat among women. Dispersion was about 3 or 4 percent lower in 2003 than in 1985, for both men and women. Much of the pre-1991 decline in earnings-change dispersion may be due to a parallel decline in the number of workers who have no earnings in the year preceding or following a year in which they worked.[38]

In sum, Moffitt and Gottschalk, Dynan et al., Shin and Solon, Dynarski and Gruber, and Cameron and Tracy all find increases in male earnings movement during the 1970s, which is consistent with the research on relative and absolute downward mobility showing an increase among men. Abowd and Card as well as Baker indicate little change in earnings-change dispersion among men. Dynan et al. find a small decline for women, consistent with the CBO results for downward mobility of women.

Moffitt and Gottschalk (looking at two-year changes), Shin and Solon, Dynarski and Gruber, and Cameron and Tracy all find a big increase in male earnings movement during the early 1980s recession, followed by declines over the mid-1980s. Dynan et al. find a similar pattern among male heads and spouses, though their earlier results indicated a fairly steady increase in earnings-change dispersion among male heads over the first half of the 1980s and a leveling off during the last years of the decade. Shin and Solon show a deeper decline during the middle part of the decade than the other studies. According to Dynan et al.'s results, earnings movement among women declined steadily during the 1980s. These results for men and women are in some sense consistent with the SSA-based estimates, but the early-1980s increase in earnings movement is swamped by the decline over the rest of the decade in the SSA data, while the PSID studies—and

Cameron and Tracy—find an increase over the 1980s among men (except for Moffitt and Gottschalk). Dahl et al. find fairly steady declines among both men and women over the decade, consistent with their own findings on absolute mobility.

Shin and Solon and Dahl et al. find a sizable decline in earnings movement during most of the 1990s, with a small and temporary increase in the early 1990s, while Cameron and Tracy also show the increase. Moffitt and Gottschalk also found an increase followed by a decline, but they showed earnings-change dispersion rising over the decade. Dynan et al. find a bigger increase in earnings-change dispersion among heads and men in the early 1990s, followed by a smaller decline. They find declines among women, as in the Dahl et al. study.

Finally, Dahl et al. show a small increase in earnings movement among men after 2000, while Dynan et al. also find an increase among men. Neither study shows an increase for women. Shin and Solon report a large increase in earnings-change dispersion among male heads sometime after 1998. Moffitt and Gottschalk find a decline from 2000 to 2004.

Taken as a whole, the research on dispersion in earnings changes, contrary to the research on mobility, indicates that earnings changes continued increasing through the early 1990s, at least if one ignores the SSA-based research. It is unclear whether this increase is due to volatility or downward mobility becoming more severe or to a general increase in inequality or earnings growth, which would produce the same results. Different factors may have operated in different periods. On the other hand, the SSA-based research may be the most valid, in which case, dispersion in earnings changes has not increased over the past twenty years. The research generally agrees that earnings-

change dispersion, as with directional mobility, follows a countercyclical pattern, increasing during recessions and declining during expansions.

Research Summarizing Within-Person Earnings Dispersion across Years

The essence of the concept of volatility involves fluctuation within a short period of time. Various researchers have measured volatility as the typical dispersion of earnings individuals experience within some brief window of time. Nearly all of the studies in this line of research use the PSID. Peter Gottschalk and Robert Moffitt were the first to use the approach, and they introduced two measures that were subsequently adopted by others.[39] In one analysis, Gottschalk and Moffitt estimated trends in the average white male head's logged wage and salary income variance over a nine-year window. They found that from the nine-year period 1970-1978 to the nine-year period 1979-1987, volatility increased 42 percent (which would have been smaller if they had expressed the results as average standard deviations).

The second set of estimates was similar, except that they were based on a five-year window centered on a given year that moved over time. In any year, an individual's transitory variance was the variance of his earnings across the current year, the preceding two years, and the subsequent two years. This approach is more flexible in that one can construct a time series rather than comparing two discrete periods. Gottschalk and Moffitt reported that volatility increased 120 percent between 1974 and 1986 but provided no detail on the evolution of the trend. Recently, however, they updated these results.[40] They found that earnings volatility rose from the early 1970s to 1989, declined

through 1998, and then rose again between 1998 and 2000. There was very little change between 1990 and 2000. Over the entire period, volatility rose about 85 percent.

Gottschalk and Moffitt earlier presented similar results using the Social Security Administration's Continuous Work History Sample, estimated with the help of the Congressional Budget Office's Jonathan Schwabish.[41] Defining the window as spanning years *t*-7 to *t*, they found volatility declining from 1987 through the early 1990s, then flattening out before declining again in the late 1990s and early 2000s. The corresponding results using the PSID showed flat volatility from 1987 to the early 2000s, but rising volatility from the late 1970s to the mid-1980s.

Daly and Duncan adopted Gottschalk and Moffitt's first approach to examine volatility changes among men, defining volatility as the average within-person variance of deviations from permanent earnings measured over an eleven-year period.[42] Like Gottschalk and Moffitt, they found that volatility was higher in the 1980s than the 1970s.

Diego Comin and his colleagues also used Gottschalk and Moffitt's first approach to examine volatility changes among white male workers in general and among those that were continuously employed by the same firm.[43] They look at within-person dispersion of heads' ten-year hourly wages. Among male workers in general, volatility increased 67 to 72 percent between the 1970-79 period and the 1984-93 period. What is more, volatility increased 79 to 115 percent among those who did not change jobs, implying either that the measure is picking up mostly higher wage growth in the latter period or that volatility is increasingly significant even among steadily employed workers (due to greater fluctuation in hours, for instance).

Comin and his colleagues also looked at five-year windows instead of ten-year ones. They found that white male heads' earnings volatility increased 28 percent from the 1970-74 period to the 1975-79 period, increased 28 percent again from 1975-79 to 1980-84, declined by 1 percent from 1980-84 to 1985-89, and increased 20 percent from 1985-89 to 1990-94 (growing by 93 percent over the entire period). The changes were bigger for those staying in their jobs.

Comin et al. also adopted Gottschalk's and Moffitt's second approach, using overlapping five-year windows. In their most recent version of their paper, they extend these time series and also look at overlapping ten-year windows.[44] Using the five-year windows, they find that volatility increased over the 1970s and through the early 1980s. It then declined before increasing again in the late 1980s and early 1990s. Volatility then declined over the mid- to late 1990s. Using ten-year windows, volatility increased from the mid-1970s to the early 1980s, was flat over the mid-1980s, rose again in the late 1980s and early 1990s, then declined through the mid-1990s. The authors find essentially the same trends when women and nonwhites are included in their samples and when they restrict the sample to people who stayed in their jobs. Among all individuals, volatility increased 40 to 70 percent over the entire period.

Benjamin Keys also recently updated Gottschalk and Moffitt's findings based on their first approach, comparing transitory earnings in the 1970s, 1980s, and 1990s by looking at white male heads' within-person variance over each decade.[45] He found a 43 percent increase in volatility from the 1970s to the 1980s, a 4 percent decrease from the 1980s to the 1990s, and an overall increase of 38 percent from the 1970s to the 1990s. Volatility increased much more among black male heads (90 percent between the 1970s

and the 1990s), and less among female heads (9 percent among whites and 17 percent among blacks). Among black women, volatility was flat between the 1970s and 1980s and only then increased between the 1980s and 1990s.

Peter Gosselin and Seth Zimmerman computed the variance of individuals' earnings across four years in a seven-year window and then tracked changes in the average variance across individuals.[46] They found a ten percent increase in volatility from 1970 to 1998, concentrated in the second half of the 1980s, with a decline in the 1990s. There was little change over the entire period. The authors also tracked changes in volatility using the SIPP, computing individual variances over three-year windows. They found an increase of 10 percent from 1983 to 2001. If one compares years for which Gosselin and Zimmerman have estimates in both datasets, the PSID shows an increase of 22 percent between 1983 and 1996, while the SIPP shows an eight-percent increase.

Austin Nichols and Zimmerman, once again using the PSID, measured volatility as the within-person standard deviation of three years' of earnings.[47] They found that, using earnings levels rather than logs, the average standard deviation increased about 50 percent between the early 1970s and the early 2000s. The increase accelerated over most of the period, with the 1990s showing the largest increase and a decline in the early 2000s. The *median* standard deviation, however, increased just 15 to 20 percent over the thirty-year period. When the authors examined trends in *logged* earnings dispersion rather than trends using levels, they found that the median was flat over the period, while the mean increased just 10 percent. Results using other transformations of earnings (the neglog, inverse hyperbolic sine, and cuberoot) were consistent with the logged results.

A working paper by Nichols and Melissa Favreault uses the SIPP matched to Social Security Administration earnings data to estimate the mean within-person variance over five-year periods.[48] Nichols and Favreault find that mean volatility declined or was flat for five of six SIPP panels examined between 1977-81 and 1999-2003, though the trends across the panels defy any attempt to characterize the "true" trend for specific periods. Most panels showed large declines in volatility from 1977-81 to 1980-84 and increases in volatility between 1980-84 and 1999-2003. At the 75th percentile, volatility declined from 1977-81 to 1990-94 and then increased through 1997-2001, ending higher than it started.

Gosselin includes one other PSID analysis of earnings volatility, using a novel measure, in his recent book, *High Wire: The Precarious Financial Lives of American Families*.[49] Gosselin examines trends in the maximum absolute value of annual percent changes over a five-year window. He reports the 68th percentile, separately for men and women, of this maximum. Gosselin found that volatility increased among men from the early 1970s through the mid-1990s, accelerating in the early 1990s, before declining through 2002. From the early 1970s to the early 2000s, the 68th percentile of the maximum swing increased from about 26 percent to about 35 percent. Among women, volatility declined through the late 1980s, then mirrored the trend among men, finishing at 40 percent (versus about 48 percent in the early 1970s).

The studies in this line of research that follow Gottschalk and Moffitt's first approach are a bit difficult to compare to other studies, but the general finding that male volatility was higher in the 1980s than in the 1970s is consistent with other research.

Comin et al.'s finding that volatility was lower in the second half of the 1980s than in the first half and Keys's finding that male volatility was lower in the 1990s than the 1980s are also consistent with past research, with the sole exception of Dynan et al. (2008).

The results of Gottschalk and Moffitt and Comin et al., using Gottschalk and Moffitt's second approach, align with other studies in showing increasing volatility among men in the 1970s, and Comin et al. find the same early-1980s and early-1990s countercyclical increases. Both sets of authors' PSID-based findings of an increase in volatility in the 1980s aligns with PSID-based studies that look at the dispersion of earnings changes. Gosselin also shows rising volatility among men in the 1970s and 1980s. He finds a small increase over the 1990s and early 2000s, while Gottschalk and Moffitt find little change over the 1990s (or declines using the SSA data). Comin et al. find flat or declining volatility among white men over the 1990s. Finally Gosselin finds that women's earnings volatility changed little in the 1970s but declined in the following decades—generally consistent with the studies that examine dispersion in earnings changes.

The remaining studies combine men and women. Comin et al., Nichols and Zimmerman, and Gosselin and Zimmerman find increases in volatility in the 1970s. The 1980s estimates are all over the map. Comin et al. found an increase driven by cyclical patterns. Gosselin and Zimmerman found a flat trend followed by a late-1980s increase using the PSID but a slight decline over most of the decade using the SIPP. Nichols and Favreault found a decline over the decade. Nichols and Zimmerman found different trends depending on whether they looked at averages or medians and whether they considered earnings levels or logs. Nichols and Zimmerman, as well as Nichols and

Favreault, find increases in volatility in the 1990s, but Gosselin and Zimmerman find a decline using the PSID, and Comin et al. report flat or declining volatility. Nichols and Zimmerman and Nichols and Favreault find declines in the early 2000s. All in all, while volatility measured as within-person dispersion seems to have increased in the 1970s and perhaps in the 1980s among men, it is unclear whether it was higher in the early 2000s than in 1980, though there is evidence that it was among men, driven by increases through the 1980s or early 1990s.

Research Summarizing Across-Person Dispersion of Earnings Shocks

As noted in the introduction, a sizable literature models earnings dynamics as processes subject to "shocks", and dispersion in these shocks constitutes another measure of volatility. Nearly all of the research in this tradition focuses on male heads, and nearly all of it relies on the PSID. Once again, the innovators of this line of research were Gottschalk and Moffitt. Beginning with their 1994 paper, they developed simple models estimating transitory variances that were forerunners of the more sophisticated modeling that would follow.[50] After computing transitory earnings for the white male heads in their sample (as deviations from nine-year average earnings), they computed the cross-sectional variance of the individual transitory components in each year to look at how transitory variance changed from year to year. They found that while following a cyclical pattern, the transitory variance had trended upwards, doubling between 1973 and 1987.

In their next paper, Gottschalk and Moffitt adopted two new strategies.[51] In what I will call their variance decomposition strategy, they modeled log earnings in each year

as the sum of a permanent component (an individual fixed effect) and a transitory component essentially assumed to be a random shock occurring each year without persisting into future years. Under this very simple model, the details of which I discuss in Chapter Two, the transitory variance in any year may be estimated by subtracting from the overall earnings variance the covariance between overall earnings and earnings from some other year.

Gottschalk and Moffitt showed how trends in transitory earnings variances changed using spans of different years in estimating the covariance term. In this model, the size of the span should not matter because the covariance term should always estimate the variance of an unchanging permanent earnings distribution.[52] One can generalize the approach in a regression framework by using as individual observations covariances between current earnings and earnings in every other year.[53] Estimating regression models such as this one, Gottschalk and Moffitt found that permanent and transitory earnings among white male heads had grown by comparable amounts over time, that both were countercyclical, and that both grew more between 1981 and 1987 than between 1969 and 1980.

Gottschalk and Moffitt modified their variance decomposition strategy slightly in their later work.[54] Rather than specifying transitory income to be serially uncorrelated, they allowed shocks to cause deviations from permanent earnings that temporarily persist. But the revised model stipulated that if the span used in computing the covariance term was large enough, then the transitory components of earnings in the two years will be uncorrelated, so that the transitory variance may still be computed as the total earnings variance minus the covariance.

For reasons I describe in Chapter Two, Gottschalk and Moffitt no longer advocate this model, so in some sense the validity of all of their estimates that use the model might be discounted. Nevertheless, estimates using this model have figured prominently in the academic and political debates around volatility trends, so it is worth summarizing their most recent results.

Gottschalk and Moffitt's 2006 working paper indicates that volatility among male heads was flat during the second half of the 1970s, increased during the early 1980s, and declined during the rest of the decade, returning to its 1980 level (though an up-tick mid-decade interrupted the decline).[55] Volatility then increased again in the first half of the 1990s, fell below its 1990 level, and rose again during the latter 1990s and the early 2000s. Volatility was about 150 percent higher in 2002 than in 1974, or nearly 60 percent higher if expressed as standard deviations. A 2007 presentation by Gottschalk and Moffitt found trends generally consistent with the 2006 paper, except that after the early 1990s increase in volatility, there was little change through 1996 and a steady increase from 1996 to 2002.[56] The increase in volatility is about the same as in the 2006 paper from the early 1970s to the early 2000s.

The 2007 presentation included the only results using this model with a dataset other than the PSID. Specifically, they presented a volatility trend from the Social Security Administration's Continuous Work History Sample, estimated with the assistance of Jonathan Schwabish.[57] These results indicated a decline in volatility from 1980 to 1989, and increase between 1989 and 1993. After a smaller decline from 1993 to 1995, volatility was flat through 1999. It then increased through 2002 before flattening

out in 2003. Over the entire period, volatility was the same in 2003 as in 1980, contradicting the sizeable increases over this period in their PSID results.

The most recent results from Gottschalk and Moffitt are from a late 2008 working paper.[58] This time using a ten-year span to compute earnings covariances, and showing results for male heads age 30-39, they find an increase in volatility over the early 1980s, followed by a decline over the rest of the decade (with a large spike in 1986). Volatility then rose in the early 1990s before falling through the late 1990s. It rose again between 1998 and 2000 but then fell. The increase in volatility from 1980 to 2004 was less than 15 percent if expressed in terms of standard deviations—much lower than in their earlier PSID results for male heads age 20-59.

In a recent working paper, Gottschalk and Moffitt describe yet another variant on their variance decomposition strategy.[59] If permanent income is conceived of in terms of human capital levels and time-varying returns to human capital, then the covariance of incomes between two years is the product of the returns to human capital in the two years and the covariance of the permanent incomes in the two years. Taking the natural log of both sides provides an equation relating the log covariance of income to the sum of the logs of the returns to human capital and the log of the covariance of permanent income. One can estimate this equation with OLS using year dummies and approximating the last term using some function of age and lag length between incomes.[60] Using the estimated returns to human capital and the estimated covariance of permanent income between ages a and a-0 (i.e., the estimated permanent variance at age a), the product of the return to human capital at time t, the return to human capital at time t-0, and the covariance of permanent incomes measured at ages a and a-0 equals the permanent variance at age a in

year *t*. Subtracting this from the total earnings variance for adults of age *a* in year *t* gives the transitory variance of adults of age *a* in year *t*.

The trend in these transitory variances is rather different from the trend produced by simply subtracting the covariance of earnings 10 years apart from the total earnings variance. Volatility declined over the early 1970s, then increased unevenly through the mid-1980s. It showed no consistent trend during the second half of the 1980s but increased again in the early 1990s. Volatility then declined through 1998, increased through 2002, and declined between 2002 and 2004, ending almost 90 percent higher than in 1973.

The third strategy Gottschalk and Moffitt have adopted in their research is to estimate more complex error components models.[61] These models specify different structures relating the permanent and transitory components of earnings to their past values. In the model on which Gottschalk and Moffitt have settled, today's permanent earnings are specified to depend on the returns to human capital, which is itself dependent on yesterday's innovation to human capital, an individual's rate of steady human capital growth, and a shock to human capital. Today's transitory shocks persist into tomorrow, but weakening over time (at different rates from year to year), with the variance of the shocks varying over time. Technically, the model specifies that permanent earnings evolve by a random walk with a random growth factor and that transitory earnings—the variance of which changes over calendar time—evolve according to an ARMA(1,1) process.

Their most recent results indicate that among 30- to 39-year-old male heads, volatility declined in the early 1970s, then rose unevenly through the mid-1980s.[62] There

was little consistent trend over the rest of the 1980s, but volatility increased again in the early 1990s before declining through the late 1990s. It increased again between 1998 and 2002 and then declined from 2002 to 2004. From 1973 to 2004, volatility increased by about two-thirds when expressed in standard deviations, loosely following a countercyclical pattern.

The only subsequent research to use Gottschalk's and Moffitt's first strategy estimating transitory variances was Kopczuk et al. (2009). They measured volatility by computing deviations from a five-year average of earnings for each person, and then looking at the cross-sectional variance of deviations across people. They found that volatility rose in the early 1940s, fell through the early 1960s, and changed only modestly thereafter.

Similarly, only one other study has utilized Gottschalk's and Moffitt's second strategy. Jacob Hacker and Elisabeth Jacobs estimated covariance terms in each year using male heads' labor income measured four years apart and then subtracted the covariance from the earnings variance to estimate transitory variances.[63] They found an increase in volatility during the recession of the early 1970s, flat volatility the rest of the decade, and sharply increasing volatility during the early-1980s recessions. Volatility then declined through the mid-1980s before flattening out. The 1990s repeated this cyclical pattern, with a large increase in volatility followed by an almost equally large decline, followed by another sharp increase after 2000 and a smaller decline. The increase from 1974 to 2002 was even higher than Gottschalk and Moffitt's estimate: 210

percent, though that drops to around 75 percent if the results are expressed in standard deviations.

Most subsequent volatility research looking at dispersion of earnings shocks has relied on different versions of Gottschalk's and Moffitt's error components strategy. Nearly as oft-cited as Moffitt and Gottschalk's results are those of Steven Haider. Haider examined the transitory variance of white male wage and salary income from 1967 to 1991 using the PSID.[64] He found a doubling of volatility over that period. Like Moffitt and Gottschalk, Haider found an increase in volatility during the 1970s, though the trend along the way looks quite different. Haider found little change in volatility during the 1980s rather than an increase. Both studies found a sharp increase in volatility from 1990 to 1991. Overall, Haider's estimates imply a bigger increase in volatility than Moffitt and Gottschalk's do, largely due to a bigger increase in the 1970s. His results also show a strong countercyclical pattern.

A recent study by Mary Daly and Robert Valletta used Haider's model to estimate volatility trends in the U.S., Great Britain, and Germany.[65] Daly and Valletta found the same basic trend as Haider among American white male heads from 1979 to 1982, but while Haider found a slight decline over the 1980s, they found a slight increase. The increase accelerated in the early 1990s before volatility declined between 1992 and 1996. Overall, the increase from 1979 to 1996 was about 25 to 30 percent.

Ann Huff Stevens estimated trends in male heads' transitory wage variances using an error components model and the PSID.[66] She found that volatility declined in the early 1970s, increased from 1974 to 1976 before declining again, and rose from 1978 to 1983. Volatility then declined through 1987 before increasing through 1991. The trend

differs from Moffitt and Gottschalk's in that Stevens's estimates are relatively flat from 1972 to 1987 rather than increasing steadily. Again, however, a countercyclical pattern is evident.

While all of these error components models rely on the PSID, Bhashkar Mazumder estimated trends in transitory variances using several SIPP panels matched to Social Security Administration earnings data.[67] His model indicates that earnings volatility among men declined from 1984 to 1989 (with a spike in 1988), increased through 1995, and then was flat through 1997. Expressed in terms of standard deviations, the increase from 1984 to 1997 was about 25 percent. For comparison, Gottschalk's and Moffitt's estimates, as well as Daly's and Valletta's, show very little change between 1984 and 1997.

Rather than modeling trends in the volatility of annual earnings, as all of these studies do, Dean Hyslop looked at trends in the transitory variance of hourly wages.[68] Hyslop's analyses are confined to continuously married couples, but they include separate trends for men and women. The transitory variance of wages increased (unevenly) from 1979 to 1985 among both, rising just 15 percent among husbands but doubling among wives.

Marco Leonardi also estimated an error components model based on hourly wages, using the PSID and focusing on all male heads.[69] He found that the transitory variance of wages increased about 60 percent from 1969 to 1991, according to the line he fits to his estimates, which shows the transitory variance climbing at an accelerating rate from the early 1980s forward.

Finally, there are four studies that model earnings as subject to both transitory and permanent shocks. Costas Meghir and Luigi Pistaferri estimated a model using the PSID that attempts to distinguish the transitory component of earnings from measurement error.[70] Using estimates from previous studies, they assumed that measurement error accounts for 25 percent of the variance of the rate of earnings growth. Pooling all years, their model implies that measurement error overstates transitory variances by 27 to 62 percent (with the effect increasing with education). They found that the variance of transitory shocks was relatively flat from 1967 to 1970, rose from 1970 to 1972, and fell again in 1973 before increasing to a new high by 1975. Volatility then fell back to earlier levels by 1977. There was no trend from 1977 to 1981, but volatility jumped in 1982. It then declined through 1987 (to a new low). Volatility remained low through 1992. Over the entire period, volatility increased by 40 percent (expressed in standard deviations), though the increase is dwarfed by the swings over time.

Meghir and Pistaferri estimated that the variance of *permanent* shocks to earnings declined in the early 1970s, increased notably through the early 1980s, declined sharply through mid-decade, and increased somewhat over the late 1980s and early 1990s. From 1969 to 1991, the increase was 25 to 30 percent.

Shane Jensen and Stephen Shore also use the PSID to estimate a model with permanent and transitory shocks.[71] Their approach is unique in that it attempts to model variances of individuals' distributions of permanent and transitory shocks from which their actual shocks are drawn. They then report the mean and median of the individual variances. Their results imply that the mean variance of male heads' transitory earnings shocks rose in the early 1970s, then fell, rose, and fell again over the rest of the decade.

It rose in the early 1980s and showed little trend through 1991. After increasing in 1992, the transitory variance declined over the rest of the decade, rose between 2000 and 2002 and then fell again. Expressed in standard deviations, the increase from 1969 to 2004 was about two-thirds. On the other hand the median transitory variance was flat over the period, implying that the increase over time was driven by rising volatility among those with relatively high volatility.

The median variance of *permanent* shocks was also flat even as the mean variance increased. The trend in the mean variance of permanent shocks was roughly similar to that for transitory shocks, except that the increase over the 1980s was smaller and volatility of permanent shocks grew in the 1990s while transitory volatility shrank slightly. Over the entire period, the variance of permanent shocks increased by about 50 percent.

Fatih Guvenen's recent paper is unique in presenting trend estimates based on two distinct models, one of which has random effects in income trajectories (the heterogeneous income profiles, or "HIP", model) and one of which includes only individual fixed effects (the restricted income profiles, or "RIP", model).[72] Guvenen presented evidence that the HIP model is more appropriate. He found that according to the HIP model, among male heads the transitory variance shows little trend from 1968 through 1985 and then increases erratically between 1985 and 1992. The increase over the entire period was about 23 percent when volatility is expressed as standard deviations. According to the RIP model, the transitory variance increased unevenly from 1968 to 1992, with volatility rising 28 percent when expressed as standard deviations.

Permanent volatility, based on the HIP model, showed little trend through the late 1970s but rose through the early 1980s. It then declined through 1990 before increasing again, rising 15 percent between 1968 and 1992. The RIP model showed permanent volatility following little consistent trend through the mid-1970s, increasing through the mid-1980s, then declining through the early 1990s. Overall, the increase was 33 percent from 1968 to 1992.

The last paper with an error components model that includes permanent shocks examines volatility of hourly wages.[73] Jonathan Heathcoate and his colleagues estimate trends in the variance of shocks among men and women in continuously married households. Their estimates fluctuate annually but show an increase over the 1970s and 1990s, with little change during the 1980s. From 1967 to 2000, the transitory variance increased by about 50 percent, expressed in standard deviations. The variance of permanent earnings shocks also increased in the 1970s and 1990s, declined in the 1980s, and increased about two-thirds over the entire period.

While there are many inconsistencies across the studies in this line of research, some generalizations are possible. Volatility was either flat or increasing over the 1970s. Most studies find rising volatility in the 1980s, though several find a flat or declining trend. Most notably, two studies that use Social Security Administration data rather than the PSID show a decline over all or part of the 1980s (Gottschalk and Moffitt, 2007; Mazumder, 2001). The research generally agrees that volatility rose in the early 1980s recession and declined in the mid-1980s, though the transitory volatility estimates of Guvenen show the opposite pattern. The research also consistently shows that volatility

increased during the recession of the early 1990s and over the course of the decade. The evidence is inconsistent as to whether it increased in the early 2000s. Among the studies that span the years in the PSID, male earnings volatility increased by 33 to 165 percent from the early 1970s to the early 2000s (15 to 65 percent expressed as standard deviations. Kopczuk et al.'s results imply that volatility was higher before 1960 than it was in subsequent decades.

Other Approaches to Volatility Measurement

The papers by Buchinsky and Hunt, Kopczuk et al. (2009) and by Fields and his colleagues present estimates of short-term earnings mobility trends that have no equivalent in other research. Their measure is based on a comparison of inequality when a multi-year average of earnings is used versus the average inequality across each individual year. When there is substantial mobility from year to year, inequality will be smaller using a multi-year average than in any individual year. The measure formalizes this tendency in a single number. Kopczuk et al. report that earnings mobility for commerce and industry workers, and for men in particular, rose from 1940 to 1945, fell over the next few years, and then gradually declined until the early 1960s. It rose a bit over the next decade, but beginning in the early 1970s mobility gradually fell again, ending lower in the early 2000s than in any previous year.[74]

Fields and his colleagues found that male labor income mobility increased in the 1970s, was flat from the late 1970s to the early 1980s, and declined over the 1980s and early 1990s.[75] Buchinsky and Hunt found that mobility in hourly wages and in annual wage income declined steadily over the 1980s, except that when those with no wages

were included, mobility in hourly wages was flat or slightly increasing in the latter part of the decade.[76] The authors report that the results were similar for men and women.

Fields and his colleagues also used a second unconventional measure.[77] They computed for each male in their sample the absolute value of the change (over five years) in the individual's share of aggregate income and then reported the mean of this number across men. Short-term mobility defined in this way increased over the 1970s and through the early 1980s, was flat over the 1980s, and declined from the late 1980s to the early 1990s.

As part of their examination of mobility and volatility trends, Daly and Duncan used a measure that defined volatility as the median across workers of the within-person average over 11 years of year-to-year unsigned percent changes.[78] Consistent with their other measures, they found that labor income volatility among men was higher in the 1980s than the 1970s.

Summary of Previous Research on Earnings Mobility and Volatility

Summarizing the literature on directional short-term mobility, it appears that there were large declines in upward and downward relative mobility from the postwar years through the mid-1960s. Similarly, downward absolute mobility declined through the first part of the decade. In the late 1960s, relative mobility probably increased to its 1960 level, and downward absolute mobility also increased (still ending the decade lower than when it started).

From the 1970s onward, a countercyclical pattern in directional (relative or absolute) mobility prevailed, with downward mobility temporarily increasing during

recessions and upward mobility temporarily decreasing. During the 1970s directional mobility changed little among all adults, though this aggregate trend masks an increase in downward absolute mobility among men and a small decline among women.

In the 1980s, directional relative mobility declined, and absolute mobility either was unchanged or declined. In the 1990s, relative mobility changed little, and if anything, fewer people experienced downward absolute mobility while more had upward absolute mobility. The first years of the current decade saw little change in relative mobility but deterioration in absolute mobility, with increases in downward mobility and declines in upward mobility, thanks to the 2001 recession and the weak recovery. The research on directional mobility is fairly consistent then, and indicates no detrimental secular trend in earnings movements since the 1970s, and only among men in that decade.

Research on nondirectional relative and absolute mobility, on intertemporal earnings association, and on dispersion in earnings changes might be expected to show similar trends, since all of these measures summarize one-way movement between two points in time without regard to the direction of movements. Instead, the main consistency across these literatures is inconsistency within each research area. Only the research on nondirectional relative mobility shows internally consistent results over the last 40 years as a whole, indicating a probable increase in earnings movement over the 1970s followed by flat or declining trends in subsequent decades.

Only for the 1970s does the research across these literatures allow for a reliable conclusion about a decade, implying that the trend in earnings movement was increasing or flat for men. In the 1980s, there is fairly consistent evidence that earnings movements

declined at least later in the decade, and the weight of the evidence in all but the dispersion-of-changes literature indicates a decline over the decade (and that literature indicates that earnings movement declined for women over the decade). Research on male earnings movements for the 1990s and early 2000s in these four areas is either internally inconsistent (absolute mobility, intertemporal association for the 1990s), conflicting (relative mobility and dispersion of changes), or nonexistent (intertemporal association for the 2000s). The absolute mobility and dispersion-of-changes literature implies declines in earnings movement among women in the 1990s.

Perhaps a reasonable conclusion from this body of work is that at least since the 1980s, secular trends in nondirectional earnings movements among men have been small enough that different researchers—often using the same dataset and sometimes using very similar measures—have reached different conclusions. That would be the case if, for example, trends in upward and downward mobility have largely canceled each other out.

That said, if the Social Security Administration data is more reliable than the PSID, then the evidence implies that earnings movements declined in the 1980s and were then constant or declining through the 1990s among men, declining among women. In the early 2000s, it increased or was flat among men and was flat or declining among women. Whether one prefers the SSA data or the PSID, however, there is little evidence of detrimental trends in earnings movements after the 1970s.

The research on within-person earnings dispersion and on the dispersion of earnings shocks more clearly measures "volatility". Volatility as measured by within-person dispersion increased in the 1970s and probably increased among men through the

1980s or early 1990s. The trends across the 1980s and the 1990s are generally inconsistent however. Volatility probably declined in the early 2000s but likely remained higher than in 1980 for men. There is some evidence that among women volatility declined after 1980, though the research is sparse.

Volatility as measured by the variance of shocks to earnings increased or was flat during the 1970s. Most studies show an increase in the 1980s, though the research that uses the Social Security Administration data implies declines. Volatility increased further in the 1990s; the evidence for the early 2000s is inconsistent. As with the within-person-dispersion research, volatility levels were generally higher among men in the early 2000s than in 1980, though the research differs as to the timing of increases.

In sum, the 1970s appear to have been a bad decade for men in terms of downward earnings mobility and volatility, and volatility may have also increased among women. Since 1980, downward and upward mobility have followed a cyclical pattern, and the secular change in directional mobility has been minimal. However, volatility as measured by within-person dispersion of earnings or by dispersion of shocks to earnings appears to have increased between 1980 and the early 2000s.

This conclusion, however, relies on evidence that is or may be incomplete in several ways. First, the PSID-based studies—which constitute much of the research, which rely on a survey with a number of features that greatly complicate its use in research on volatility and mobility, and which often has produced findings that differ from those obtained from Social Security Administration data—may not accurately portray trends in earnings instability. This could be true either because of problems with the PSID data itself or with the methodological decisions past researchers have made.

My analyses in Chapter Two attempt to improve the methodological decisions used by previous researchers and to standardize them across different types of mobility and volatility measures.

The second question is whether the within-person dispersion measures typically used or the model-based measures of dispersion of shocks adequately differentiate between trends in earnings growth and trends in volatility per se. Finally, the existing research is sparse in certain aspects. Most obviously, there is much less research on trends among women than among men. Furthermore, for some measures there exist no time series that include estimates for men and women separately as well as combined. In addition, some of the literatures do not extend as far back as the data allows or as far forward. The estimates in Chapter Two are an attempt to fill in these gaps.

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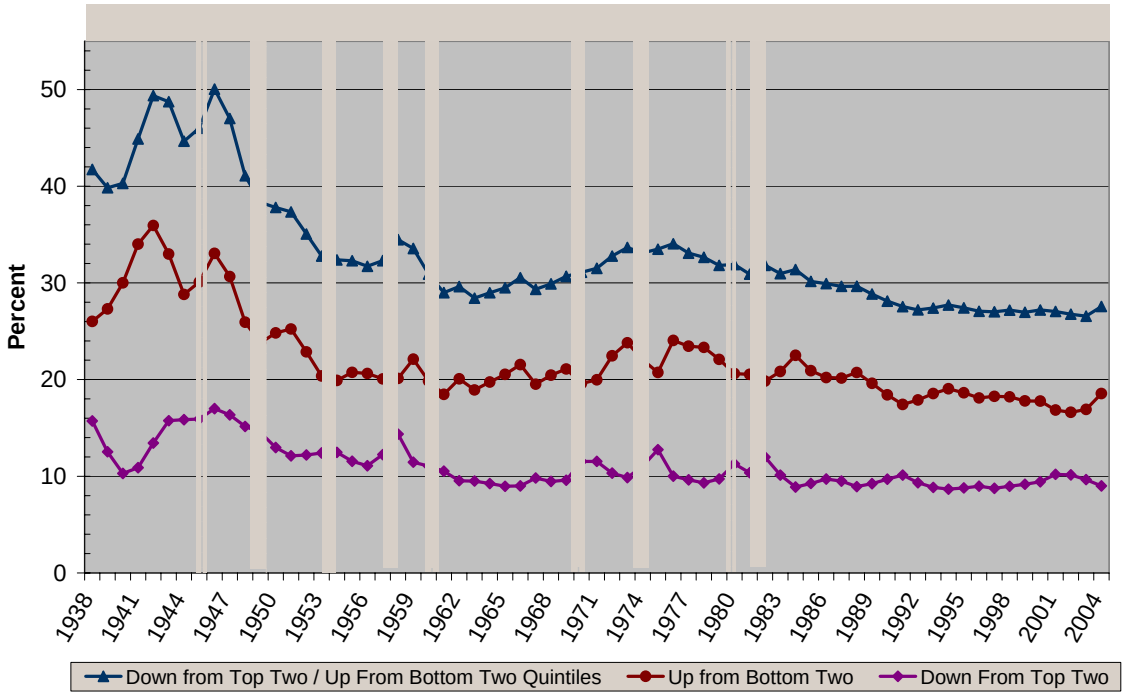
Figure 1. Relative Earnings Mobility, 1938-2004



Source: Kopczuk, Saez, and Song (2007). Lightly-shaded bands are NBER recessions. Figures are taken from http://www.columbia.edu/~wk2110/uncovering/ (Table 6A). The published numbers have been adjusted in two ways. First, I subtracted the proportions remaining in the quintiles from 1 to convert to the proportion moving. Second, I shifted all figures over by one year so that they show the probability of having moved in the past year rather than the probability of moving in the next year.

End Notes

[1] To make the discussion more manageable, I restrict my review to studies of volatility and instability in the United States. For international evidence, see Baker and Solon (2003), Beach et al. (2003, 2006), and Morissette and Ostrovsky (2005) on Canada; Gustavsson (2004a and 2004b) and Dahlberg and Gustavsson (2008) on Sweden; Dickens (2000a, 2000b), Ramos (2003), Kalwij and Alessie (2007), Daly and Valletta (2008) and Blundell and Etheridge (2008) on Great Britain; Buchinsky et al. (2003) on France; Cappellari (2004) on Italy, Daly and Valletta (2008) on Germany, and Alvarez De Pedro (2004) on Spain.

[2] Kopczuk, Saez, and Song (2007). Their sample includes all commerce and industry workers (70 percent of U.S. employees) between the ages of 18 and 70, excluding a small number of very-low-wage workers (and everyone with $0 in earnings) and all self-employment earnings.

[3] The complete set of figures for their charts and tables are available at http://www.columbia.edu/~wk2110/uncovering/.

[4] Kopczuk, Saez, and Song (2009). The methodological details are similar to their 2007 paper, except that the age restriction is tighter, excluding workers under 25 and over 60.

[5] Gittleman and Joyce (1995). These results are based on matched March CPS data, with the sample including workers age 25-59 in both years who were not self-employed. The structure of the Current Population Survey is such that every March, half the sample was also interviewed in the previous March survey. Gittleman and Joyce match households to their earlier data for each survey from 1968 to 1992. The measure of earnings is wage and salary income, and those without earnings are dropped, along with the top one percent of earners.

[6] Moffitt and Gottschalk (1995). The authors use PSID data from 1970 to 1988 to look at the probability of moving into another wage quintile over a 1-year period and over a 5-year period. Their sample consists of white men age 20-59 with positive wages and hours of work who are not students. They use the disadvantaged "SEO" oversample and weight their results. They trim the top and bottom 1 percent of wages within age-year cells and residualize wages by regressing log wages on education categories, stratified by age and year.

[7] Fields, Leary, and Ok (2000). The authors examine the labor income of men age 25-60 in the first year of each five-year period who were not students, retired, or self-employed. They also exclude those with nonpositive earnings in either year.

[8] Daly and Duncan (1997). The authors looked at the labor income of men in the PSID, including the disadvantaged SEO sample. They exclude men under 25 years old or over 44 years old in the first year of each of their eleven-year periods, those who had nonpositive earnings or less than 250 hours of work in the first year, and those who were self-employed. The number of years in which a man remained in his original quintile is expressed as a fraction of the number of years he was not self-employed.

[9] Burkhauser et al. (1997). They include the SEO sample of the PSID and weight the data. The authors dropped all workers with $0 in labor income in all years or who have a transition to or from $0 in any year, and only heads and partners between the ages of 25 and 55 are included in the sample.

[10] Buchinsky and Hunt (1999). The authors use the National Longitudinal Survey of Youth, 1979 Cohort to examine mobility in terms of hourly wages during the survey week and annual earnings in the previous year. Mobility is measured as one-year transition rates between quintiles. They examine all workers not enrolled in school, not in the military, and not self-employed. They trim earnings that are more than five times the maximum or less than one-fifth the minimum of a worker's earnings in other years, as well as wages below $1. Nonpositive earnings are excluded. Results are similar for hourly wages and annual earnings.

[11] Depending on how relative mobility is measured, downward and upward mobility may be constrained to mirror each other, in which case trends in nondirectional relative mobility would follow trends in directional relative mobility. For example, if upward mobility was defined as the probability of leaving the bottom half of the distribution and downward mobility the probability of leaving the top half of the distribution, and if the population of interest was fixed over time, no one could move up without someone moving down. Research generally does not measure directional mobility in such ways however. For example, upward mobility from the bottom quintile need not mirror downward mobility from the top quintile because there is also mobility into the top and bottom quintiles from the middle 60 percent of the

distribution. Furthermore, the population does not remain fixed over time – new households can enter the sample and households can leave the sample. Therefore, individuals' percentile rank can change even if their earnings do not, if other people experience earnings gains or declines.

[12] Kopczuk, Saez, and Song (2009). See note 4 for methodological details.

[13] Baker (1997). The author excludes the SEO sample and includes male heads 21-64 with positive labor income and hours. He dropped men whose hourly wage was more than $100 in 1967 dollars or whose hours were greater than 4,680. Earnings are first regressed on year dummies and a quadratic in potential experience (age minus education minus 5).

[14] Haider (2001). Haider excludes the SEO sample of the PSID and focuses on white male heads age 25 to 60 with positive earnings. Individuals must be observed at least twice from 1968 to 1992, and he excludes outliers in terms of hourly wages and observations with major imputations. He regresses log wages on a quartic in experience and displays the correlation matrix covering his sample years.

[15] Moffitt and Gottschalk (1995). The appendix to the paper includes a full correlation matrix by age and year. See note 6 for methodological details.

[16] Gittleman and Joyce (1995). The correlations are presented without conditioning on other variables, individually for each year. For additional methodological details see note 5.

[17] Daly and Duncan (1997). Autocorrelations are for earnings separated by two years. For additional methodological details, see note 8.

[18] Fields, Leary, and Ok (2000). See note 7 for methodological details.

[19] Gittleman and Joyce (1996). Gittleman and Joyce match households to their earlier data for each survey from 1968 to 1992 and compute correlation coefficients for those ages 25-54 in the first year. They exclude the self-employed and those who have nonpositive earnings in either year and trim the top 1% of wages within sex groups. In one set of analyses, correlation coefficients are conditional on sex, age, and education; in a second set they are conditional on race. These correlations are regressed on a number of variables, among them a quadratic in time.

[20] Hyslop (2001). Hyslop included the SEO. The sample includes husbands and wives age 18-60 in 1980 who were continuously married over the period, with no top-coded labor income data and no years with wages higher than $100 an hour. Both husbands and wives must have positive labor income and hours in every year. Hourly labor income and labor income were adjusted for inflation using the CPI and year-specific means were removed from individual earnings before computing correlations.

[21] Mazumder (2001). The author pooled the 1984, 1990, and 1996 waves of the matched SIPP data. His sample includes men who were 24-59 for at least nine consecutive years between 1982 and 1998 in which they also had positive earnings, but he drops the first and last years of earnings data, so sample members are 25-58.

[22] Dahl, DeLeire, and Schwabish (2007). The authors looked at workers age 22 to 59, using the Continuous Work History Sample of the Social Security Administration. Self-employment earnings and deferred compensation are not included, and workers with $0 in earnings in both years are also excluded. If a worker had $0 in the first year but not in the second, the increase was coded as 100 percent.

[23] Dynan, Elmendorf, and Sichel (2007). Mobility is measured as the share of heads experiencing an annual drop in labor income of 25% or more per year over a two-year period. In computing percent drops, the change in earnings between years *t* and *t*-2 is divided by the average of years *t*-2, *t*-3, and *t*-4. The sample includes individuals who were heads in both years, at least 25 years old and not retired, and individuals with farm income are excluded. Incomes are bottom-coded at $1, and top codes are applied to cap the same share of the sample in each year. In all numbers cited in this appendix, I refer to results when reports of $0 in earnings by the head are dropped. Dynan et al. do not include the disadvantaged "SEO sample" or the immigrant sample of the PSID.

[24] Hacker (2007). Hacker includes the SEO and immigrant samples, logs labor income, applies top codes to cap a common share of incomes in each year, and excludes those with nonpositive labor incomes. His mobility measure is the probability of experiencing a 50% drop in labor income over a two-year period. Individuals between the ages of 25 and 61 are included.

[25] Daly and Duncan (1997). See footnote 8 for methodological details.

[26] Jensen and Shore (2008). The authors include the SEO and applying survey weights. They focus on male heads age 22-60. Labor income is bottom-coded at $5,150 in 2005 dollars (1,000 hours at the 2005

minimum wage), and a common topcode is applied across all years (the minimum real topcode level across years). The log of labor income is residualized by regressing it on a cubic in age interacted with 8 educational attainment levels, a dummy for the presence infants, young children, and older children, the number of children in each group, the number of family members, and year dummies.

[27] Fields, Leary, and Ok (2000). See note 7 for methodological details.

[28] Abowd and Card (1989). The authors use the PSID and National Longitudinal Survey of Men 45-59. In the PSID, they show results including and excluding the SEO. The sample consists of males who were heads age 21-64 and reporting positive labor income and hours in every year from 1969 to 1979. It excludes workers with hourly wages over $100 an hour or hours greater than 4,680. In the NLS, the sample includes men under age 65 in 1975 and with nonzero earnings and hours in 1966, 1967, 1969, 1971, 1973, and 1975. In all analyses they regress the change in log earnings on time period indicator variables and potential experience (age-education-5).

[29] Baker (1997). For methodological details, see footnote 13.

[30] Cameron and Tracy (1998). The authors focus on men who are initially 18-63 and who are not in school nor primarily self-employed in either year. Workers with nonpositive weeks worked, nonpositive earnings, or earning imputations are excluded. The top and bottom 1.5% are trimmed in each year. The measure of volatility is computed by first regressing logged real wages and salaries on a quartic in age, four education groups, and six industry groups. The residuals are estimates of unobserved permanent income plus transitory income. The authors then subtract residualized wages in year *t*-1 from residualized wages in year *t*, which gives the change in the transitory component. They square the difference, then regress the squared differences on year dummies to get the mean squared difference for each year.

[31] Dynan et al. (2008). Methodological details are the same as for Dynan et al., 2007 with two exceptions. Rather than excluding heads reporting $0 in earnings, they exclude heads who report no earnings but who report over 120 hours of work in the previous year. The authors measure percent changes as the two-year change in earnings, divided by the average of the two years of earnings.

[32] Dynan et al. (2007). The authors measured percent changes as the two-year change in earnings, divided by the average of earnings 2, 3, and 4 years earlier. Increases were capped at 100 percent. For the sample pooling heads and spouses, in addition to dropping heads with $0 reports, they drop spouses with two successive years of $0 reports. For additional methodological details, see footnote 23. Dynan et al. (2008) also reported that volatility in family heads' earnings per hour increased between the early 1970s and the early 2000s, with the increase almost exclusively confined to the mid- to late-1970s and the early 1990s.

[33] Shin and Solon (2009). The authors regress the two-year change in log wages and salary on age and age squared, separately for each year. They then compute the mean square of the residuals for each year and use the square root of that to report results in standard deviations. They drop all observations with $0 in earnings and trim the top and bottom 1 percent of positive observations. Shin and Solon look at wage and salary income of male heads age 25-59 in both years. They exclude the SEO sample.

[34] Moffitt and Gottschalk (2008). The authors rely on the PSID, excluding the SEO sample. The sample consists of male heads age 30-59 who are not students, who have positive wage and salary income and who have positive weeks worked. They look at log wage and salary income adjusted for inflation using the CPI-U-RS and residualized on year, education, race, a polynomial in age, and interactions among these variables. They trim the top and bottom one percent of residuals within age/education/year cells.

[35] Dynarski and Gruber (1997). The authors regress the one-year change in log labor income on year dummies, a quartic in age, three education groups, marital status, change in marital status, change in family size and in the share under 18, and change in food needs. They then use the mean squared residuals for each year. Their sample includes male heads ages 20-59 who are not fulltime students, and they use the SEO sample and weight their results.

[36] Dahl, DeLeire, and Schwabish (2007). In computing percent changes, workers with no earnings in both years are excluded, and if one goes from no earnings to positive earnings, it is coded as a 100% increase. Workers with changes in earnings of 1000% or more are excluded. See footnote 22 for additional methodological details.

[37] Dahl, Schwabish, and DeLeire (2008). These updated results examine workers age 25-55 and use the average of years *t* and *t*-1 for the denominator in computing percent changes.

[38] Orszag (2008).

[39] Gottschalk and Moffitt (1994). The authors include the SEO sample of the PSID and weight the data. Their sample is restricted to white male heads not in school with positive wages and between the ages of 20 and 59. They trim the top and bottom 1 percent of wages within age/education/year cells. Prior to computing variances, they regress log wages on a quartic in age and individual fixed effects, and they use the age-residualized estimates in all computations.
[40] Moffitt and Gottschalk (2008). Volatility is measured as the mean within-person variance of earnings over a nine-year moving window. For additional methodological details, see note 34.
[41] Gottschalk and Moffitt (2007).
[42] Daly and Duncan (1997). For methodological details, see note 8.
[43] Comin et al. (2006). The authors include the SEO sample of the PSID and weight the data. They restrict their sample to heads and look at logged wages (earnings/hours). They adjust for inflation using the PCE deflator.
[44] Comin et al. (Forthcoming). The authors include the SEO sample of the PSID and weight the data. They restrict their sample to heads and look at logged wages (earnings/hours). They adjust for inflation using the PCE deflator. The results I cite use every other year within a window, so that the five-year variances use years t-2, t, and t+2, and the ten-year variances use years t-4, t-2, t, t+2, and t+4.
[45] Keys (2008). Keys includes the SEO sample of the PSID and weights the data. He restricts his sample to non-student heads age 20-59, regresses log earnings on a quartic in age and uses the residuals, and trims the top and bottom 1 percent of positive earnings.
[46] Gosselin and Zimmerman (2008). The authors include the SEO sample of the PSID and weight the data. They restrict the sample to adults between the ages of 25 and 64 and exclude those in households reporting $10 or less of income before out-transfers. Before estimating volatility, they regress log earnings on a quartic in age and use the residuals. Their within-person variance measure uses incomes in the current year and incomes two, four, and six years into the future.
[47] Nichols and Zimmerman (2008). The authors include the SEO sample and weight their results, and they include individuals age 25-61 years old. Their measures consider the mean and median of the within-person standard deviation in earnings over three years (t-2, t, and t+2). Sample members must have non-missing data in all three years.
[48] Nichols and Favreault (2009). The authors use the 1990-93, 1996, and 2004 SIPP panels, matched to the Summary Earnings Record and Detailed Earnings Record of the SSA data. The sample includes adults born 1936-1956 (21-41 years old in 1977, 48-68 in 2004). The largest one percent of variances are dropped. I thank the authors for providing me with the latest draft of their paper.
[49] Gosselin (2008). I determined many of his methodological details from http://www.latimes.com/business/la-fi-riskshift3oct10-method,0,7201216.story.
[50] Gottschalk and Moffitt (1994). For methodological details, see footnote 39.
[51] Moffitt and Gottschalk (1995). For methodological details see footnote 6 and the discussion in Chapter Two. Moffitt and Gottschalk (1998) later updated this paper with additional years of data.
[52] Assuming, that is, that one always looks at the same cohort of individuals, with no entry into or exit from the data over time.
[53] The covariances are regressed on a dummy variable indicating whether or not the element is a variance, a trend variable, and an interaction between the two. The trend coefficient indicates how covariances (permanent variances) are changing over time, while the interaction indicates how the transitory variances evolve.
[54] Moffitt and Gottschalk (2002), Gottschalk and Moffitt (2006), Gottschalk and Moffitt (2007), Moffitt and Gottschalk (2008). All of these analyses use the PSID. They all restrict the sample to prime-age male heads not in school with positive wages and either positive hours worked (2002) or positive weeks worked. All four analyses trim wages at the bottom and top of the distribution within cells defined by demographic characteristics, and all three residualize logged wages to remove the effects of demographic variables.
[55] Gottschalk and Moffitt (2006). In this paper the authors include the SEO sample and weight the data. They restrict the sample to male heads age 20-59 not in school with positive wages and positive weeks worked. The analyses trim the top and bottom 1% of wages within age-year cells, and regress logged wages (adjusted for inflation using the CPI-U-RS) on five education categories. Gottschalk and Moffitt use four-year spans to compute covariances.

[56] Gottschalk and Moffitt (2007). Most of the methodological details follow Gottschalk and Moffitt (2006), except that they residualize logged wages on age and year rather than education and year.
[57] Ibid. They residualize log earnings on age and year and trim the top and bottom 1% of observations.
[58] Moffitt and Gottschalk (2008). The authors group sample members into three age groups, and compute covariance matrices within each group. Moffitt and Gottschalk use a ten-year span in computing earnings covariances. For additional methodological details, see footnote 34.
[59] Ibid.
[60] The log of covariances at different lags (of length 10 and greater) is regressed on year dummies (which equal 1 if the year is included in a covariance) and second-order polynomials in age and lag length.
[61] Moffitt and Gottschalk (1995), Moffitt and Gottschalk (1998), Moffitt and Gottschalk (2002), Gottschalk and Moffitt (2006), Moffitt and Gottschalk (2008).
[62] Moffitt and Gottschalk (2008).
[63] Hacker and Jacobs (2008). The authors use the SEO sample and weights, and they restrict the sample to male heads between the ages of 25 and 62.
[64] Haider (2001). After regressing log wages on a quartic in experience, Haider fits his model, which includes an individual fixed effect, individual-specific slopes with respect to experience, a time-varying factor loading that applies to both, and a transitory component that evolves according to an ARMA(1,1) process. For additional methodological details see note 14.
[65] Daly and Valletta (2008). The authors use the Cross-National Equivalent File, a multi-country dataset that includes variables for the U.S. created from the PSID (see Burkhauser and Lillard, 2007). Daly and Valletta examine white male heads between the ages of 25 and 61. They exclude nonpositive earnings, as well as men with $0 reports between two years with positive earnings, and they trim the top and bottom 1 percent of positive earnings.
[66] Stevens (2001). Stevens first regresses log earnings on race, education, and potential experience. She uses the covariance matrix of the residuals to estimate the parameters in her model, which includes a person-specific fixed effect with a time-varying factor loading, and a transitory component that evolves according to an AR(1) process. She includes male heads age 24 to 64 with nonzero wage and salary earnings.
[67] Mazumder (2001). Mazumder de-meaned earnings in each year within each birth cohort. He then modeled de-meaned earnings as a function of a permanent component (featuring an individual fixed effect, an individual deviation from the birth cohort's growth rate, and a random walk) with a time-varying factor loading and a transitory component (following a first-order autoregressive process with innovations modeled as following a quartic in experience and with a time-varying factor loading on innovations). For additional methodological details, see note 21.
[68] Hyslop (2001). Hyslop also used the PSID, including the SEO sample. His sample includes continuously married couples age 18-60 in 1980 with no top-coded data and no wages higher than $100 an hour. Both must have positive earnings and hours in every year. Wages (labor income divided by hours worked) are adjusted for inflation using the CPI. Husbands' and wives' wages are modeled as functions of average wages for the population, individual-specific permanent components with time-varying factor loadings, time-varying transitory components subject to factor loadings, and measurement error. Transitory components are modeled as following a first-order autoregressive process, and husbands' and wives' permanent and transitory components are allowed to be correlated.
[69] Leonardi (2003). In his model, permanent earnings evolve by a random walk, with a time-varying factor loading, and transitory earnings evolve according to an AR(1) process, also with a time-varying factor loading. He first regresses earnings on a quadratic in experience. Leonardi excludes the SEO sample of the PSID, examines male heads 20-59 years old, and excludes students and the self-employed. He also excludes those with topcoded earnings, those with a wage less than half the minimum wage, and those working fewer than 520 hours or more than 5,096 hours.
[70] Meghir and Pistaferri (2004). The authors use the PSID to look at male heads' labor income volatility, focusing on those age 25 to 55 who have at least nine years of labor income data. They exclude individuals with missing values on covariates and who experience very large earnings changes. As a first step, they regress log earnings on year dummies, a quadratic in age, and race, region, and urbanicity dummies. These regressions are done separately for each of three education groups. They then use the residuals to fit their

model, which specifies that permanent income follows a random walk, that transitory income evolves by a MA(1) process, and that classical measurement error affects results in all years.

[71] Jensen and Shore (2008). Income is modeled as a function of (1) demographics, (2) a permanent component that is the sum of initial income plus past permanent shocks weighted such that their impact takes time to fully set in, and (3) a temporary component that is the sum of past temporary shocks weighted such that their impact gradually disappears. For additional methodological details, see note 26.

[72] Guvenen (2009). He uses the PSID, excluding the SEO sample. The sample includes male heads age 20 to 64 who (for at least 20 years) have positive labor income and hours, annual work hours between 520 and 5110, and an hourly wage equivalent to $2 to $400 in 1993. Labor income is modeled as a function of a cubic in potential experience that is common to all heads but time-varying, individual fixed effects, individual-specific linear income profiles, a component following an AR(1) process with an innovation that has a time-varying variance, and a transitory shock that also has a time-varying variance.

[73] Heathcoate et al. (2008). The authors use the PSID, excluding the SEO. They measure hourly wages as annual labor income divided by annual hours and adjust earnings using the CPI. The sample is confined to adults in married households where the husband is 25-59 and worked at least 260 hours, where both spouses earned more than half the minimum wage (if they worked), and where there is no self-employment income. Log hourly wages are modeled as a function of a permanent component that follows an autoregressive process, a transitory component, and measurement error.

[74] Kopczuk, Saez, and Song (2009). The authors compare the Gini coefficient using a five-year earnings average to the average of the five individual Gini's. For additional details, see note 4.

[75] Fields, Leary, and Ok (2000). Their measure is 1 minus the ratio of an inequality measure using the average of earnings over a window of six years to the average of the same inequality measure across the individual years within the window. The inequality measure is the Gini coefficient. For additional methodological detail, see footnote 7.

[76] Buchinsky and Hunt (1999). The measure of mobility is 1 minus the ratio of an inequality measure using the average of earnings over windows of different duration to the average of the same inequality measure across the individual years within the window. The inequality measure is a generalized entropy index that considers each person's share of total earnings against a perfectly equal distribution. For additional methodological details, see footnote 10.

[77] Ibid.

[78] Daly and Duncan (1997). For methodological details, see footnote 8.