Financial Innovation and the Great Moderation: What Do Household Data Say?

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1. Introduction

The U.S. economy has been markedly more stable since the mid-1980s than it had been in the preceding couple of decades. The reduction in volatility is widespread, showing up in real GDP and most of its components as well as other measures of economic activity. The source of this "Great Moderation," as it has been labeled by some writers, has been the subject of considerable debate, with various papers arguing that volatility fell principally because of milder economic shocks, better monetary policy, or improved inventory management.

In a recent paper, we argued that financial innovation should be added to the list of likely contributors to the stabilization (Dynan, Elmendorf, and Sichel, 2006). Changes in financial markets and institutions—some driven by private market developments and some spurred by changes in government policy—have enhanced the ability of households and businesses to borrow funds and thereby to smooth their spending in the face of swings in income and cash flow. For example, we showed that aggregate consumer spending has become less responsive over time to contemporaneous shifts in aggregate income. However, aggregate data is intrinsically a blunt tool for testing our hypothesis. In this paper, we turn to data on individual households, and we demonstrate that their behavior has indeed changed in the way that we have suggested.

When using microeconomic data on income and consumption, one immediately confronts an apparent puzzle: Although aggregate economic activity has become *less* volatile over time, individual households appear to have faced *more* volatile economic circumstances over time. Indeed, commentators often assert that the economy has become more "dynamic" in recent years—that globalization, deregulation, and rapid

technological change have increased the amount of creative destruction and thus the competitive pressures and risks faced by individual workers and firms. Therefore, the first track of our investigation is to extend the growing literature on the volatility of earnings and income at the household level. Employing data from the Panel Study of Income Dynamics (PSID) and a methodology based on Gottschalk and Moffitt (1994), we confirm that households have faced greater uncertainty since the mid-1980s than before. We also show that a measure of aggregate income constructed from the PSID has become less volatile in line with the decline in volatility of aggregate income as measured in the national income accounts and used in previous research on the Great Moderation. Clearly, then, the covariance of income across households must have declined in the past few decades, and we document that phenomenon as well.

In the second track of our investigation, we estimate the response of spending to movements in income at the household level. We find that this response has been somewhat smaller since the mid-1980s than in preceding decades, which is consistent with the evidence on aggregate income and consumption that we presented in our earlier paper. Moreover, we estimate that the response of spending to negative income shocks is larger than the response to positive shocks—which is consistent with a role for liquidity constraints—and that the response to negative shocks fell more in the recent period than the response to positive shocks—which is consistent with financial innovation having diminished the extent of liquidity constraints.

The following section of the paper describes the channels through which financial innovation might have affected the volatility of output. Section 3 then presents our approach to measuring the variability of income and briefly reviews previous research

(which is described in greater length in an appendix). The fourth section provides our results on income variability at the household level and links these results to aggregate income variability. Section 5 presents our framework for exploring the changing effect of income on consumption and shows our results. Section 6 concludes.

2. Links between Financial Innovation and Economic Volatility

In a previous paper (Dynan, Elmendorf, and Sichel, 2006), we used a very stylized model and a cursory review of key changes in financial markets and institutions to catalogue the channels through which financial innovation might have affected the volatility of output. To set the stage for the analysis in this paper, we briefly summarize that earlier discussion about financial innovation and economic volatility as it applies to household income and spending.

Reduced Volatility of Economic Activity

McConnell and Perez-Quiros (2000) estimated that the quarterly growth rate of real GDP experienced a downward break in volatility in the mid-1980s. Subsequent investigations by these authors and others have confirmed a sharp decline in the volatility of GDP growth over in recent decades, and they have also documented declines in volatility of many other measures of aggregate economic activity. For example, the standard deviation of quarterly growth in real GDP was 4.4 percentage points between 1960:Q1 and 1984:Q4, but just 2.1 percentage points between 1985:Q1 and 2004:Q4; the standard deviation of four-quarter growth fell from 2.8 percentage points to 1.4 percentage points between those same periods. Volatility also declined for every major component of GDP, although the decline was much larger proportionally for

consumption expenditures and residential investment than for business fixed investment. The variability of gross domestic income, disposable personal income, compensation, and wages all decreased notably as well. Based on the analysis in our earlier paper, we use a dividing line of 1985:Q1.[1]

Financial Innovation

The financial system has evolved in many ways during the past 40 years. Some of this evolution has been market-driven, some owes to government policy, and some has arisen from changes in attitudes.

On the market-driven side, two key changes have been improved assessment and pricing of risk, and the greater use of markets rather than institutions to intermediate between borrowers and lenders. These and other market-driven changes have increased the fraction of households that have ready access to credit. Moreover, households that previously had some access to credit have likely gained improved access in terms of both the amount of credit and the consistency of its availability under different macroeconomic conditions. In terms of government policy, one crucial change was the phasing-out of Federal Reserve Regulation Q, which had set ceilings on interest rates that banks paid on deposits. According to the evidence in our earlier paper, with this regulation in place, increases in market interest rates sometimes led to sharp reductions in the supply of credit and sharp slowdowns in related spending. Without this regulation, increases in market interest rates pushed up the cost of funds but did not suddenly curtail

[1] We find the conclusion of a sharp drop in volatility puzzling because most explanations for the moderation in economic activity—such as improved inventory management or many aspects of financial innovation—would seem to imply a gradual evolution. Even if a structural change—for example, in monetary policy—occurred all at once, households' and firms' expectations might need to adjust before the new dynamics would be in place. Nevertheless, to analyze changes in volatility, choosing some date as a dividing line is useful.

their supply and therefore had a more muted effect on spending. Other policy changes have allowed banks to better diversify their risks, thereby fostering a steadier supply of credit. Households also seem to have become more willing to borrow, perhaps due to a greater familiarity with the process of obtaining credit and reduced stigma of being in debt.

It is important to note that the link between financial innovation and economic volatility depends not on the *average* amount of borrowing but on *marginal* borrowing that smoothes spending in the face of income fluctuations. As described in the preceding paragraph, financial innovation appears to have increased the marginal availability and use of debt in addition to the average availability and use. However, an important caveat is that, if households carry a lot of debt under good economic conditions, they might be unable or unwilling to increase their indebtedness when conditions deteriorate (see Carroll and Dunn, 1997).

Implications for Spending

Consider households that wish to borrow (perhaps because they are at an early stage of their lifecycle and their lifetime income path slopes up) but cannot; their spending equals their income and is equally volatile. An improved ability to borrow has two opposing effects on the variability of their spending: It allows households to better maintain their spending when their income experiences a transitory slump, but it allows them to boost their spending more sharply when their perceived permanent income increases. The former effect reduces the marginal propensity to consume and thus the multiplier effect, lessening the variability of demand and output. However, the latter effect augments the accelerator and thereby boosts the variability of demand and output.

Financial innovation has also had two opposing effects on the interest elasticity of household spending: The democratization of credit increases the share of spending that responds to changes in borrowing rates, while the tempering of disintermediation when market interest rates rise makes spending less sensitive to changes in rates.

Several recent papers have attempted to model various connections between financial innovation and the variability of economic activity. This rapidly growing literature includes work by Campbell and Hercowitz (2006), de-Blas-Perez (2004), Guerron (2006), Jermann and Quadrini (2006), and Mendicino (2005).

Previous Empirical Evidence

As noted above, financial innovation has changed household behavior in some ways that would damp fluctuations in economic activity and in some ways that would accentuate such fluctuations. Determining the sign and magnitude of the net effect is a matter for empirical investigation. Evidence in our earlier paper suggested that, on balance, financial innovation contributed to the reduction in aggregate economic volatility after 1984.

Other researchers have developed further empirical evidence regarding the effects of financial innovation on volatility. For example, Peek and Wilcox (2006) found that the development of the secondary mortgage market seems to have damped the response of housing investment to income and interest rates. In addition, Gerardi, Rosen, and Willen (2006) showed that the development of mortgage markets has enabled households to buy homes more in line with their long-term income prospects. Cecchetti, Flores-Lagunes, and Krause (2006) documented a reduction in the volatility of output growth during the past few decades in two-thirds of the countries they examine; they also find

that volatility declined more in countries where credit became more readily available. Morgan, Rime, and Strahan (2004) showed that state-level economic volatility—in particular, fluctuations in employment growth—appear to decline when interstate banking deregulation increases banks' integration with banks in other states. The International Monetary Fund (2006) constructed a financial index for advanced economies that captures the trend toward the use of markets rather than banks in the credit intermediation process; the analysis concluded that, "in financial systems characterized by a greater degree of arm's length transactions" (p. 2), households can better smooth consumption through unanticipated changes in income, and firms can better smooth investment through cyclical downturns.

3. Measuring the Variability of Income at the Household Level

In this section we describe a simple approach to measuring the variability of income at the household level. We begin with a basic accounting framework for income, then explain the data we use to estimate the elements of that framework, and lastly discuss the relationship between our analysis and that of previous researchers in this area.

A Simple Framework

Our framework incorporates a variety of types of shocks. We draw heavily on the work of previous authors, and especially on the pioneering studies of Gottschalk and Moffitt (1994, 2002) that we discuss below.

Suppose that:

$$y_{it} = e_{it}^{h} + e_{it}^{s} + x_{it}, \tag{1}$$

where y_{it} is income of household i in year t, e^h_{it} is labor earnings of the household head in that year, e^s_{it} is labor earnings of the spouse in that year, and x_{it} is other income of the household in that year (including potentially the labor earnings of other family members, transfer income, capital income, and a deduction for taxes paid). Also suppose that:

$$\ln(e^h_{it}) = a^h_{it} + b^h_i + n^h_t + d^h_{it}, \tag{2}$$

where a^h_{it} is predictable earnings based on age for the head of household i in year t, b^h_i is the average deviation over time between the head's earnings and the earnings predicted by his or her age, n^h_t is a transitory shock to earnings common to all earners, and d^h_{it} is a transitory shock to earnings idiosyncratic to the head. Similarly, for the spouse, let

$$\ln(e^s_{it}) = a^s_{it} + b^s_i + n^s_t + d^s_{it}. \tag{3}$$

Moreover, an analogous equation can be used for household income:

$$\ln(y_{it}) = a_{it} + b_i + n_t + d_{it}, \tag{4}$$

where each term now represents a value for each household as a whole.

We estimate the components of these equations in the following manner, using household income as an example. We begin by pooling the panel data and regressing log income on a quartic function in the average age of the household head and spouse:

$$\ln(y_{it}) = \alpha_0 + \alpha_1 age_{it} + \alpha_2 age^2_{it} + +\alpha_3 age^3_{it} + \alpha_4 age^4_{it} + \varepsilon_{it}, \tag{5}$$

The predicted values from this regression are the a_{it}'s in equation (4). Then we calculate the mean of the fitted residuals ε_{it} across years t for each household i. These means are the b_i's shown in equation (4), and we view them as the permanent portion of each household's income that is not related to age. Therefore, we use the variance of the b_i terms across households as a measure of permanent income variance.

Our next step is to use the b_i's to de-mean the fitted ε_{it}'s for each household to obtain transitory income. We regress the de-meaned residuals on a constant term and separate dummy variables for each year except the first one to split transitory income into aggregate and idiosyncratic components.[2] The estimated coefficients on the time dummies are the n_t's in equation (4), and the fitted residuals are the d_{it}'s in equation (4). Thus, the fitted values from this regression satisfy the following equation:

$$\hat{\varepsilon}_{it} - b_i = \beta_0 + n_2 T_2 + n_3 T_3 + \ldots + n_T T_T + d_{it}. \qquad (6)$$

We use the variance of the n_t's over time as a measure of the volatility of aggregate transitory shocks. We use the variance of the d_{it}'s over time to measure the volatility of idiosyncratic transitory shocks faced by a given household; note that the transitory shocks can have some persistence as long as the period of persistence is small relative to the time period used in estimating the equation. We use the average of these variances across households as a measure of the average idiosyncratic transitory volatility. Putting these pieces together, the average across households of the variance over time of n_t+d_{it} measures the average total transitory income variance.

In some variations, we calculate *changes* in the fitted residuals ε_{it} and follow the same procedures using these changes. These variations allow for individual-specific growth rates rather than individual-specific level effects. In addition, they are more comparable to the literature on aggregate volatility, which has focused on the volatility of growth rates.

This framework is, of course, highly stylized. Much more sophisticated models of permanent and transitory earnings have been estimated, and we briefly discuss some of

[2] Our procedure is essentially equivalent to adding time dummies and household fixed effects to equation (5).

the relevant literature below. However, our focus is not on the earnings and income processes per se, but on the ways that financial innovation might mediate between income and consumption. Therefore, we do not attempt to develop a more complex model but simply try to document any changes over time in the basic dynamics of individual earnings and family income. One virtue of this framework is its generality, so that it can be used for any measure of income, time period, or subgroup of the sampled population. We estimate these equations separately for our two time periods of interest—1967 to 1984 and 1985 to 2002—and present results for various subgroups of the population.

Data Sources and Construction

Estimating the preceding equations—and the changing extent of consumption smoothing as we describe later in the paper—requires time series on individuals' earnings and households' income and consumption. We use data from the Panel Study of Income Dynamics (PSID), which contains information about the income, spending, employment, and demographic characteristics of a panel of individual households. Data were collected annually from 1968 through 1997 and biannually thereafter. Data for the 1994 through 2003 waves are officially available only in "early release" form, which means they have undergone very limited processing and do not include all of the variables of interest. However, additional variables are available through supplementary files, and we use the "income plus" files for our income measures over this period. Income data correspond to the year before that in which the data were collected.

We use the term "household" for the principal unit of observation in this paper. The PSID uses the term "family unit," which is defined as a group of people living

together who are related by blood, marriage, or adoption—or who live together permanently and share both income and expenses. In other words, this group is an economic unit, which is appropriate for our purpose. When such units are headed by both a man and woman, the PSID arbitrarily labels the man as the household head and the woman as his wife. When such units are headed by a woman alone—living by herself or with children—then she is the head.

Our principal interest is in the income of the household and (later in the paper) the consumption response to movements in that income. The relevant measure of income includes the household head's labor earnings, the spouse's labor earnings, other market income, and government transfers and taxes. All of this information is collected in the PSID, and we intend to use it all in subsequent versions of this paper. However, the variables apart from head's and spouse's earnings are more problematic and require extra handling, and we are not sufficiently confident of our current handling to include those results here. Averaging across households in our sample, the earnings of head and spouse represent about 80 percent of pre-tax household income in both the earlier and later periods we study.

In some of the results presented later, we divide households into groups according to the gender of the household head, the education of the household head, the number of earners in the household, and the income quartile into which the household falls. For education, we classify households according to their status on a year-by-year basis. For example, if a household head with only a high school education receives a college degree in year T, we include them with the "high school only" group for years before T and with the "college" group for year T and later. For the number of earners, we consider a

household head to be an earner if he or she reports being in the labor force, regardless of whether he or she has any earnings, because losing one's job is one of the risks that we want to capture. Unfortunately, the same question has not been asked consistently of spouses, so we consider a spouse to be an earner if he or she reports working at least 100 hours in the year. For income, we sort households based on their average income in each period. In subsequent versions of the paper, we plan to sort households based on their incomes in the first years the households are in the sample.

Our analysis includes only households from the sample chosen to be nationally representative and not from any of the special samples.[3] We drop households whose head is under age 25 or is retired. We deflate nominal magnitudes into real magnitudes using the CPI for urban consumers. The PSID panel is not balanced, as some households leave the panel over time, and others join it. Accordingly, our calculations of average variances across households weight households by the number of observations of them in the dataset. The PSID has limited consumption data, and we follow a substantial body of literature in using food expenditures to explore consumer behavior under the assumption that utility is separable in food and other types of expenditures. We return to this issue later in the paper.

Some observations on earnings and income have been top-coded, which creates two complications for us. First, we cannot explore behavior at the very top of the income distribution. Such exploration would have been limited in any event because of the small sample size among very high-income households. Because the share of aggregate income accruing to these households is high, losing them from the sample weakens the

[3] Because of attrition over time, the remaining sample may not be completely representative. In subsequent drafts of the paper, we will apply the weights published by the PSID in constructing our estimates.

link between the sum of households' income as recorded in the PSID and aggregate income as recorded in the National Income and Product Accounts. Second, the existence of top-coding—and the fact that the share of the sample that is top-coded varies over time—might create a misleading picture of income dynamics. For example, income that is top-coded at the same level in consecutive years will appear more stable than it really is; in addition, the PSID truncates income at different points of the income distribution over time and that might make the distribution appear to change in ways that it did not. To address these problems, we calculate the largest share of households that have top-coded income in any year (which turns out to be roughly ½ percent) and drop that same share of households from the top of the income distribution in every year.

Reported earnings, income, and consumption undoubtedly contain a great deal of measurement error, although the magnitude of the problem is unclear. In one effort to validate the quality of the PSID data, Bound, Brown, Duncan, and Rodgers (1994) concluded that "individuals' reports of annual earnings are fairly accurate, [although] biases are moderately larger for changes in earnings." With measurement error distorting the year-to-year changes in income that we calculate, one should not take literally our estimates of the volatility of income changes or of the response of consumption to income changes. However, our interest is not principally in the *levels* of volatility or consumption responses, but in the *evolution* of those volatilities and responses over time. As long as measurement error has not trended up or down—and we know of no evidence that it has—then our interpretations about such evolution will be legitimate.

In subsequent drafts of this paper, we will also use data from the Consumer Expenditure Survey (CE). This survey has been conducted quarterly since 1980 and

includes 5000 households each quarter. Households are interviewed five times at three-month intervals before being rotated out and replaced with other households. Households are asked very detailed questions about their expenditures at the second, third, fourth, and fifth interviews, and they are asked less detailed questions about their income and demographic profiles primarily at the second and fifth interviews. The CE is less useful for exploring income dynamics than the PSID because it follows individual households for much shorter time periods, and it is less useful for examining the Great Moderation because the available data begin in 1980. However, the CE is a valuable complement to the PSID for studying the consumption response to income movements because it collects data on a much larger share of spending.

Relationship to the Earlier Literature

A sizable literature has examined the evolving variability of earnings, income, and consumption. The appendix reviews the principal findings of some of the key papers, and table 1 provides a brief summary.

One question addressed in the literature is whether individuals' earnings have become more volatile in the sense of bouncing around more from year to year. In terms of our simple framework, has the average variance of transitory shocks (n_t+d_{it}) increased over time? Gottschalk and Moffitt (1994) launched this line of recent research by estimating that one-third to one-half of the increasing cross-sectional variance of earnings between the 1970s and 1980s reflected greater volatility of transitory earnings. A number of other researchers have investigated this question using different datasets or empirical techniques.[4]

[4] Some researchers investigate only the part of individuals' transitory variance that enters the cross-sectional distribution of earnings (what we call d_{it}), while others investigate all of individuals' transitory

A related question is whether individuals' earnings have become more uncertain in a long-term sense. In our simple framework, has the variance of permanent shocks (b_i) increased over time? Because we control for nothing except age in constructing the b_i terms, the variance across them includes the return to education and other factors. To measure changes in the overall variance of earnings, including these effects is appropriate; to measure changes in the variance of earnings within education groups, one would naturally repeat this analysis separately for the various groups. Again, a number of researchers have investigated this issue using a variety of datasets and techniques.

A parallel set of questions concerns the variability of households' incomes. Tracking the changing dynamics of household income is less useful than tracking the changing dynamics of individual labor earnings for understanding developments in the labor market, but it is more useful for understanding the ways in which changes in resources affect consumption. Accordingly, the papers in this branch of the literature have focused on this latter connection. Because we want to gauge whether financial innovation has allowed households to smooth consumption to a greater extent than in the past, our paper fits best in this group, and we plan to focus on household income.

Our analysis builds on the work of previous researchers and extends it in several ways. First, we explore the contrast between the well-known results that aggregate economic activity has become less volatile over time and that individual households have faced more volatile economic circumstances over time. Although a few papers have addressed a possibly similar contrast for firms (see Comin and Philippon (2005), Comin and Mulani (2006), Comin, Groshen, and Rabin (2006), and Davis, Haltiwanger, Jarmin,

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variance (what we call n_t+d_{it}). However, the variance of n_t is much smaller than the variance of d_{it}, as we show later, so this distinction is not very important quantitatively.

and Miranda (2006)), no papers of which we are aware have investigated this conjunction of facts on the household side. Second, we use household data to estimate the change over time in the marginal propensity to consume out of income fluctuations. No papers of which we are aware have focused on this question; indeed, some papers assume away this possibility by assuming that households are, and always have been, able to fully smooth transitory fluctuations in income. Third, we exploit PSID data through the early part of the current decade. Almost no papers of which we are aware have used PSID data past the mid-1990s. Fourth, we study household income as a whole (although, as we noted above, we have not incorporated income beyond the head's and spouse's earnings in the current draft of the paper). Most papers of which we are aware focus more narrowly on individual earnings. Fifth, we include a wide range of households. Many previous papers have focused only on households with male heads.

4. The Changing Volatility of Income at the Household and Aggregate Levels

We begin with our results on income volatility for households, looking at the variances for both levels of income and growth rates of income. Then we link these results to income variability at the aggregate level.

Volatility of Levels of Household Income

Using the methodology discussed above, table 2 reports the average volatility of permanent and transitory components of household income during the 1967-1984 and 1985-2002 periods. As noted earlier, our measure of income in this draft of the paper is the sum of labor earnings by the household head and the spouse.

The variance of the permanent component of income is the variance across households of the b_i terms in equation (4). The variance of the transitory component of income is the average across households of the variance over time of the n_t+d_{it} terms in equation (4). We also calculated the average *idiosyncratic* transitory variance using the d_{it} terms only. However, the variance of the n_t terms averages around 1 percent of the variance of the d_{it} terms, so this alternative approach did not generate recognizably different results. This comparison of variances also shows that analysts should not be too puzzled that aggregate volatility has decreased while household-level volatility has increased: The variability of aggregate economic conditions is such a small share of the total variability confronting households that its evolution is fairly insignificant compared with the evolution of microeconomic factors.

The first line of the table shows results for all of the households in our sample.[5] Both the permanent and transitory components of household earnings showed a higher variance after the mid-1980s than before. The variance of the permanent component increased roughly 9 percent between the two periods, while the variance of the transitory component shot up more than 50 percent. As a result, the variance of the transitory component was about one-third that of the permanent component in the first period and about one-half that in the second period. Households appear to have faced notably more uncertainty in the past twenty years than in the preceding few decades.

To explore this phenomenon, we examine the extent to which it occurred in different slices of the population. The next block of rows in the table presents comparable calculations for households where the head has less education than a high

[5] With several thousand households each year, we have a total of roughly 40,000 observations in each of the two time periods we study.

school degree, where he or she has a high school degree but not a college degree, and where he or she has a college degree or more. Mirroring the results for all households, the variances of both the permanent and transitory components stepped up notably after the mid-1980s for all educational groups. For households with less than a high school degree, the volatility of permanent earnings rose much more than that of households with more education, and that volatility increased more sharply over time. Those households also experienced more volatility of transitory earnings than better-educated households, but the differential is smaller and the increase in variance between the two periods was roughly the same. Note that the percentage increases in both permanent and transitory variances for each education category exceeded the increases in variances for the population as a whole. The explanation is the marked decline in the share of the sample taken by the least-educated group, which has the largest variances.[6]

The following set of rows repeats the exercise for earnings quartiles. Once again, the variance of the transitory component of earnings increased appreciably between the 1967-1984 and 1985-2002 periods. In both periods, the volatility of transitory earnings declines a good deal as income rises. The variance of the permanent component of earnings increased for the upper three quartiles from extremely lower levels, while the variance of the lowest quartile declined somewhat from a higher level. These results may be surprising and warrant some explanation. The striking difference among the levels of permanent variance arises because we are analyzing *log* earnings. With this transformation, a shift from, say, $10,000 to $5,000 in earnings represents a much larger difference than a shift from $50,000 to $45,000; as a result, the logs of permanent

[6] Although educational attainment of the population undoubtedly increased over time, the magnitude of this shift surprises us, and we are investigating it more closely.

earnings in the bottom quartile are quite spread out relative to those in the other quartiles. Whether this transformation is the best way to measure volatility depends on the utility function one has in mind, and we intend to pursue this issue in subsequent versions of the paper. The decline in permanent variance in the lowest quartile may simply reflect the limitations of our methodology.

Next, we split the sample based on the gender of the household head. For male-headed households—the group studied by many other researchers—both the permanent and transitory variances of earnings were substantially higher after the mid-1980s than before. The transitory variance for these households was sizable relative to the permanent variance: about one-half as large in the first period and nearly three-quarters as large in the second period. For female-headed households, permanent and transitory variances were much higher than they were for male-headed households. Transitory variance for this group rose over time—although by a smaller amount in percentage terms than for male-headed households—and permanent variance declined a little. Our hunch is that female-headed households have become a little more like male-headed households in the past several decades and that the variances of their earnings have converged a little as a result.

Our final division of the sample involves the number of earners in a family. We find that both the permanent and transitory variances were higher after the mid-1980s for both single-earner and dual-earner households. In addition, the variances were consistently larger for single-earner households than for dual-earner households, which suggest that two-earner households can buffer risks better than single-earner households. However, these results alone do not prove this point, because people who end up in two-

earner households may be people who individually have more volatile earnings. In a subsequent version of the paper, we will examine the correlation between transitory shocks to the earners in two-earner families.[7]

In sum, the variance of the transitory component of earnings was quite a bit higher after the mid-1980s than in the preceding decades for our full sample and for all of the sub-samples we examined. The variance of the permanent component of earnings was also higher in the later period for the full sample and for nearly every sub-sample, although the increase was generally smaller in proportional terms than the increase for the transitory component. Both the permanent and transitory variances were consistently higher for less educated households than for more educated households, for households in the bottom income quartile than for households in higher quartiles, for female-headed households than for male-headed households, and for single-earner households than for dual-earner households.

Volatility of Growth Rates of Household Income

The estimates reported in table 2 refer to the *level* of log earnings, consistent with the previous literature on the volatility of earnings at the household level. However, the literature on the Great Moderation focuses on the reduced volatility of the *growth rate* of GDP and other measures of aggregate economic activity. Therefore, to link the evidence on household-level variability to the evidence on aggregate variability, we need to assess the volatility of earnings growth rates at the household level. As described earlier, we

[7] Cutler and Katz (1991) and the discussion following Gottschalk and Moffitt (1994) raised a variety of hypotheses about the correlations one might find. On one hand, a drop in earnings for the household head might reflect a weakening of a local labor market, which would also tend to reduce the earnings of other family members. On the other hand, if the household head loses his job, other family members might work harder, and if the household head's earnings rise, other family members might work less hard. The relevance importance of these forces might have changed over time. In addition, people have become more likely to marry people with more-similar education, which would tend to boost the permanent correlation between the earnings of family members.

employ the same procedure that we use for earnings levels, except that we work with the changes rather than the levels of the residuals from regressing log earnings on the quartic in age. Because PSID data are available only biannually after 1997, we use two-year differences throughout the sample (converted to annual rates).[8]

Table 3 reports the average volatility of permanent and transitory components of changes in household earnings during the 1967-1984 and 1985-2002 periods. These results are generally similar to the results for levels of household earnings. The variance of the transitory component of the change in earnings was much higher after the mid-1980s than before, whether one looks at our full sample or at sub-groups divided by education, income quartiles, gender of the household head, or the number of earners in the household. The variance of the permanent component was also higher in the later period for the full sample and all of the sub-groups. However, the increase was smaller proportionally than the increase in the transitory variance, in contrast with our estimates for earnings levels shown in table 2; we plan to explore this issue in a subsequent draft. Note that, for both the earlier and later periods, the variances of the transitory component are much larger relative to the variances of the permanent component than in table 2. The explanation presumably is the effect of the difference transformation, accentuated by measurement error.

Linking Household and Aggregate Volatility

The results in tables 2 and 3 show that the volatility of earnings for individual households was much higher after the mid-1980s than before—when measured either in levels, as in the literature focusing on household economic conditions, or growth rates, as

[8] Sample sizes are notably smaller for these estimates than for the estimates based on earnings levels because we lose the initial two observations for all households and also lose some households that leave the PSID or experience changes in their characteristics that cause us to drop them from our sample.

in the macroeconomic literature on the Great Moderation. However, this *increase* in variability at the household level offers a stark contrast to the *decline* in variability at the aggregate level. To connect these findings, we proceed in two steps.

We begin by comparing aggregate earnings from the National Income and Product Accounts (the NIPAs) and aggregate earnings based on our PSID sample. We construct PSID aggregate earnings by summing earnings across all households in the sample for each year and dividing by the number of households in that year to control for the varying size of the sample. Again, because PSID data are biannual after 1997, we use two-year differences (converted to an annual basis) to calculate growth rates. For this version of the paper, we use NIPA wage disbursements to match our use of household earnings; in a subsequent version, we will use a broader measure of household income from the PSID and a broader NIPA measure for comparison.

The first row of table 4 shows that the standard deviation of the log difference of NIPA earnings fell 31 percent between the 1967-1984 and 1985-2002 periods. This figure is consistent with the moderation in aggregate economic activity reported in previous papers. The second row of the table shows that the standard deviation of the log difference of PSID aggregate earnings dropped even more, by 46 percent. Because we have already shown that average volatility at the household level increased, this result implies that the covariance of earnings across households must have fallen substantially. Moreover, because the magnitudes of the declines for the two aggregate measures are in the same ballpark, exploring the relationship between aggregate and household-level PSID earnings appears to be a reasonable strategy for learning about the microeconomic dynamics underlying the aggregate findings.

Therefore, our second step is to decompose the variance of the log difference of PSID aggregate earnings into the variances of the log differences of earnings for selected sub-groups and the covariances across these groups. For example, the decomposition we use for the number of earners in a household is:

$$\text{var}(\Delta \ln Y_t) = s^2 \text{ var}(\Delta \ln Y_t^S) + (1-s)^2 \text{ var}(\Delta \ln Y_t^D) + 2s(1-s)\text{cov}(\Delta \ln Y_t^S, \Delta \ln Y_t^D), \quad (7)$$

where Y_t is aggregate earnings in our sample in period t, Y^S_t is aggregate earnings for single-earner households, Y^D_t is aggregate earnings for dual-earner households, and s is the average share of single-earner households out of all households in the sample. The covariance term can be decomposed further as:

$$\text{cov}(\Delta \ln Y_t^S, \Delta \ln Y_t^D) = \rho * sqrt(\text{var}(\Delta \ln Y_t^S)) * sqrt(\text{var}(\Delta \ln Y_t^D)), \quad (8)$$

where ρ is the correlation between aggregate earnings for single-earner and dual-earner households. We calculate the elements of this decomposition separately for the earlier and later periods. Then we examine whether the declining aggregate variance is due primarily to declining variances within sub-groups or to declining correlations across groups.[9]

Table 5 presents the results of the decomposition by educational status. The contributions of the variances for households with less than a high school education and households with only a high school education declined considerably between the 1967-1984 and 1985-2002 periods. The contribution of the variance for the college-educated group rose, but a little arithmetic demonstrates that the increase reflects the higher share of such households in the later period. Taken together, the declines in variances account for a decent chunk of the reduction in aggregate variance, but the decline in covariances

[9] We focus on correlations because the covariances of earnings will decline when variances decline even if the correlation in earnings movements is unchanged.

is even more important.[10] All three correlations between earnings movements across education groups fell substantially, with the largest declines involving the group with less than a high school education.

Table 6 provides comparable statistics for the decomposition by earnings quartile. The contribution of the variance for the lowest earnings quartile was much smaller in the later period than the earlier one, while the contributions of the variances for the other quartiles were only slightly smaller. As with the decomposition by education, the decline in the covariances across earnings quartiles had the largest effect on the aggregate variance. All of the correlations between earnings movements across the various quartiles dropped over time except for the correlation between the lowest and next-to-lowest quartiles.

The variance decomposition by gender of the household head is shown in table 7. The contribution of the variance fell for both groups. The contribution of the covariance decreased as well, but this decline owes entirely to the fall in variances. The correlation between earnings of male-headed households and female-headed households actually increased, which is consistent with our earlier supposition that female-headed households have become a little more like male-headed households in the past several decades.

Table 8 shows the decomposition by the number of earners in a household. Note first that the variance of the log difference of aggregate earnings in the first row of this table differs from the comparable figures shown in the preceding tables. Some households have no earners and other households do not report the information needed to calculate the number of earners, and we drop these observations from this table; in a

[10] Because our calculations do not allow for time-varying shares of households in different groups, an approximation error arises and is displayed in row 6.

subsequent draft of the paper, we will consider this issue further. The decomposition indicates that the variance terms and the covariance term each account for about half of the decline in the variance of PSID aggregate earnings.

Taken as a whole, these variance decompositions suggest that the decline in the variability of aggregate earnings can be attributed to declines in both the variability of earnings changes within demographic groups and the correlation of earnings changes among demographic groups. In particular, across groups with different education status, income level, and number of earners per household, movements in earnings have been less closely correlated in the past twenty years than in the preceding few decades. This weakening of the connections among groups appears to play an important role in reconciling the increase in household-level earnings volatility with the decrease in aggregate earnings volatility.

5. Responsiveness of Consumption to Income at the Household Level

We now turn to the relationship between income and consumption. In our earlier paper using aggregate data, we estimated a model of consumption in which the growth rate of real consumer spending depends on lagged spending growth, contemporaneous real income growth, the contemporaneous real federal funds rate, the contemporaneous change in the unemployment rate, and the lagged ratios to income of wealth, transfer payments, and consumer spending. Using rolling 40-quarter sample periods, we found that the marginal propensity to consume (MPC) declined notably over time. For consumer spending on nondurables and services, the estimated MPC fell from an average of 0.23 in the 1965-1984 period to an average of -0.02 in the 1985-2004 period. For total

consumer spending, the estimated MPC decreased from an average of 0.36 to an average of 0.05.

Based on that aggregate evidence, we argued that financial innovation had improved households' access to credit and thus their ability to smooth consumption. However, we also noted that data on income and spending by individual households would provide sharper tests of whether people now use borrowing more readily to cushion against temporary shortfalls in income. In this section, we use PSID data to conduct such tests.

Complications

One well-known limitation of the PSID is that spending on food is the only measure of consumption that has been collected for any length of time. However, this limitation does not appear prohibitive to us. First, the PSID's definition of food spending includes outlays at restaurants, so it captures not just the "necessary" spending on food at home (although even this amount, of course, may respond to income) but also spending that is likely to be rather sensitive to income. Second, we are interested in the change in the MPC over time rather than the level, and that change will be distorted only if the shortcomings in using food as a proxy for overall consumption have worsened over time.

Another limitation of the PSID for our purpose is that the number of observations with good data on food consumption is only about half as large as the number of observations we used for our estimates of income variability. Because the PSID did not collect information on food consumption in every year, growth in food consumption can be calculated only for 1976 through 1986 and after 1991. In addition, we dropped households where food consumption rose or fell more than 80 percent in a two-year

period, where consumption was imputed for one or more years, and where the household head or spouse had changed over the two years in question. Such restrictions are fairly common in the empirical literature that explores the dynamics of consumption at the household level.

Basic Specifications

We begin by estimating the following equation:

$$\Delta \ln C_{it} = \beta_0 + \beta_1 \Delta \ln Y_{it} + H_{it}\gamma_1 + T_t\gamma_2 + \varepsilon_{it}, \qquad (9)$$

where C_{it} is food consumption of household i in period t, Y_{it} is earnings of that household's head and spouse in that year, H_{it} is a set of household characteristics, T_t is a set of year dummies, and ε_{it} is an error term. β_0 and β_1 are coefficients, and γ_1 and γ_2 are vectors of coefficients. The household characteristics include the "food needs" variable constructed by the PSID based on family size and other factors, the age and age squared of the household head, and dummy variables for the household head's education level, race, and gender. These characteristics might affect the growth rate of consumption because they are correlated with parameters of the utility function or because they capture shifts in the utility function (such as the arrival of a new child).

We emphasize that β_1 should not be interpreted literally as the marginal propensity to consume out of income. In keeping with the literature that tests the excess sensitivity of consumption to income, the regression is estimated in logarithms, so the parameter reflects percentage responses rather than dollar responses. However, we are not interested in the level of this parameter but in its evolution. A broader problem is (possibly sizable) measurement error in earnings, which we discussed earlier. This noise will bias down the estimated response of consumption changes to income changes. But,

it will not distort any estimated changes in this response over time unless the extent of measurement error has changed over time, and we are not aware of any evidence that it has.

The results of this estimation are shown in the first column of table 9. The coefficient on earnings growth—the elasticity of food consumption with respect to income—is roughly 0.06 and highly significantly different from zero.[11] To see if the response of consumption to earnings has changed over time, we add an interaction term between the change in earnings and a dummy variable for the period since 1985 ($D85_t$):

$$\Delta \ln C_{it} = \beta_0 + \beta_1 \Delta \ln Y_{it} + \beta_2 D85_t \Delta \ln Y_{it} + H_{it}\gamma_1 + T_t\gamma_2 + \varepsilon_{it}. \qquad (10)$$

Parameter estimates are shown in the second column of table 9. The elasticity of food consumption with respect to earnings is roughly 0.08 in the period before the mid-1980s and only about 0.04 thereafter. Thus, data on individual households show a sizable drop over time in the average response of consumption growth to movements in earnings growth—just as we observed in aggregate data.

Specifications with Asymmetric Responses

A smaller effect of income fluctuations on consumption is consistent with an easing of borrowing constraints due to financial innovation. However, it is also consistent with an increase in the relative importance of transitory fluctuations in income and no change in households' ability to borrow. Suppose that all households followed lifecycle behavior and could smooth consumption freely. Under these circumstances, an increase in the importance of transitory shocks would lead to greater income volatility but would not generate greater consumption volatility—which would show up in our

[11] In this version of the paper, we report conventional standard errors. However, we use two-year changes that overlap for some observations, so we will calculate adjusted standard errors in a subsequent draft.

regression as a smaller response of consumption to income movements. Indeed, Blundell and Preston (1998) argued that an increase in the variance of income relative to the variance of consumption for British households in the late 1980s implied that a growing share of the income variance was attributable to transitory shocks.

To distinguish between these interpretations of our initial finding, we document an asymmetry in the response of consumption to positive and negative earnings shocks and in the evolution of these responses over time. Going back to equation (9), we split the variable for growth in earnings into one variable for earnings increases ($\Delta \ln Y_{it}+$) and one variable for earnings decreases ($\Delta \ln Y_{it}-$):

$$\Delta \ln C_{it} = \beta_0 + \beta_1(\Delta \ln Y_{it}+) + \beta_2(\Delta \ln Y_{it}-) + H_{it}\gamma_1 + T_t\gamma_2 + \varepsilon_{it}. \quad (11)$$

Parameter estimates shown in the third column of table 9 indicate that negative earnings changes generate a larger consumption response than do positive earnings changes. This result suggests that liquidity constraints have an important effect on consumption.

If changes in financial markets and institutions have relaxed these liquidity constraints by increasing households' access to credit, then the effect of negative earnings shocks on consumption should diminish more over time than the effect of positive earnings shocks. To test this hypothesis, we add interaction terms between the positive and negative changes in earnings and a dummy variable for the period since 1985:

$$\Delta \ln C_{it} = \beta_0 + \beta_1(\Delta \ln Y_{it}+) + \beta_2(D85_t \Delta \ln Y_{it}+) + \beta_3(\Delta \ln Y_{it}-) + \beta_4(D85_t \Delta \ln Y_{it}-) + H_{it}\gamma_1 + T_t\gamma_2 + \varepsilon_{it}. \quad (12)$$

As can be seen in the fourth column of table 9, the coefficient on positive earnings growth is roughly 0.04 lower after the mid-1980s than before, and the coefficient on negative earnings growth is nearly 0.06 lower in the later period. The larger drop in the effect of earnings declines than earnings gains is consistent with our hypothesized effect

of financial innovation. Moreover, this asymmetry is not implied by an increase in the importance of transitory earnings fluctuations relative to permanent ones.

6. Conclusion

Our analysis confirmed and extended earlier findings that households have faced greater economic uncertainty since the mid-1980s than before. We also showed that a measure of aggregate income constructed from the PSID has become less volatile in line with the decline in volatility of aggregate income as measured in the national income accounts. An important part of the explanation for the contrast between the household-level experience and the aggregate experience is a decline in the covariance of income movements across households. In addition, we estimated that the response of spending to movements in income at the household level has been somewhat smaller since the mid-1980s than in preceding decades. Furthermore, the response of spending to negative income shocks is larger than the response to positive shocks but has fallen more in the recent period than the response to positive shocks. These results are consistent with changes in financial markets and institutions having contributed to the Great Moderation.

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Table 1
Selected Micro-Data Studies of Income and Consumption Variability

Study	*Data Source and Specification Choices*	*Key Conclusions*
Analysis of Earnings Data Alone		
Gottschalk and Moffitt (1994)	PSID; 1970 to 1987; log earnings; white male household heads aged 20-59	Increase in cross-sectional variance of earnings between the 1970s and 1980s is due to increases in both permanent and transitory variances.
Haider (2001)	PSID; 1968 to 1992; log earnings; male household heads aged 25-60	Permanent income inequality increased during the 1980s, and transitory income inequality increased during the 1970s.
Hyslop (2001)	PSID; 1979 to 1985; log earnings; both spouses aged 18-60	For men, both permanent and transitory income variances increased notably in the first half of the 1980s. For women, the permanent variance was little changed and the transitory variance edged up.
Moffitt and Gottschalk (2002)	PSID; 1969 to 1996; log earnings; male heads of households aged 20-59	Permanent variance of earnings trended up from mid-1970s to late 1980s, while transitory variance rose sharply between mid-1970s and mid-1980s and then fell sharply in early 1990s.
Baker and Solon (2003)	Canadian tax records; 1976 to 1992; log earnings; males aged 25-58	Rising cross-sectional earnings inequality from mid-1970s to early 1990 reflects increases in both permanent earnings dispersion and transitory earnings fluctuations.
Comin, Groshen, and Rabin (2006)	PSID; 1970 to 1993; log earnings; household heads	Transitory variance of earnings increased between the 1970-79 period and the 1984-93 period.

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Analysis of Earnings, Income, and Consumption Data

Cutler and Katz (1991)	CPS and CE; selected years from 1963 to 1989; family income and consumption for the nonelderly	Primary workers' earnings and family income both experienced rising inequality, especially in the 1980s. Consumption inequality increased commensurately with income inequality.
Attanasio and Davis (1996)	CPS and CE; 1980 to 1990; male wage rate; consumption of households headed by men aged 23 to 59	Across cohorts, wage movements over long intervals have large effects on consumption, but wage movements over one and two-year intervals have little effect on consumption.
Dynarski and Gruber (1997)	PSID and CE; 1970 to 1991; log earnings and consumption; male household heads aged 20-59	Transitory changes in earnings increased substantially during the 1970s and 1980s. Variations in the earnings of household heads have only a small effect on consumption.
Blundell and Preston (1998)	British Family Expenditure Survey; 1968 to 1992; consumption of nondurables and services	Cross-sectional variance of income increased in 1980s, but cross-sectional variance of consumption increased by less. Income and consumption inequality were both greater for later cohorts.
Banks, Blundell, and Brugiavini (2001)	British FES; 1968 to 1992; total family earnings and transfers	Cohort-specific income risk had an important effect on cohort-specific consumption, and high-frequency movements in income also affected consumption.
Attanasio, Berloffa, Blundell, and Preston (2002)	British FES; 1978 to 1999; consumption of nondurables and services	Cross-sectional variance of income increased more than cross-sectional variance of consumption, especially during the 1990s. Income and consumption inequality were greater for later cohorts.

Table 2
Volatility of Earnings at the Household Level

	-------- Permanent Variance --------				*-------- Transitory Variance --------*				*# of obs. (thous.)*	
	1967-1984	1985-2002	change	% change	1967-1984	1985-2002	change	% change	1967-1984	1985-2002
All	.53	.57	.05	9	.19	.30	.11	58	40	45
Education										
Less than high school	.67	.87	.20	30	.25	.41	.16	65	10	5
High school only	.42	.49	.07	17	.17	.30	.12	72	21	25
College degree	.33	.39	.06	18	.15	.27	.12	81	9	16
Earnings quartile										
1st	.56	.50	-.06	-11	.38	.56	.18	47	10	11
2nd	.03	.04	.01	53	.18	.32	.15	81	10	11
3rd	.01	.02	.01	67	.11	.16	.05	42	10	11
4th	.05	.06	.01	21	.09	.18	.09	100	10	11
Gender of household head										
Male	.30	.39	.09	30	.17	.28	.11	66	34	38
Female	.81	.75	-.06	-8	.33	.43	.10	30	6	8
Number of earners										
Single	.47	.56	.09	19	.18	.32	.15	82	21	19
Dual	.19	.26	.07	34	.08	.19	.11	134	18	25

Note: As described in the text, the permanent variance for each sub-sample is the variance across households of the average over time of the residuals from a regression of log household earnings on a quartic in age. The transitory variance for each sub-sample is the mean across households of the variance over time of each household's transitory earnings.

Table 3
Volatility of Earnings *Growth* at the Household Level

	-------- Permanent Variance --------				*-------- Transitory Variance --------*				*# of obs. (thous.)*	
	1967-1984	1985-2002	change	% change	1967-1984	1985-2002	change	% change	1967-1984	1985-2002
All	.06	.09	.03	45	.26	.46	.19	75	30	33
Education										
Less than high school	.10	.20	.10	108	.34	.55	.21	60	7	3
High school only	.05	.08	.03	53	.24	.45	.21	86	15	18
College degree	.05	.06	.01	23	.20	.43	.23	117	7	12
Earnings quartile										
1st	.18	.24	.06	34	.57	.86	.29	50	6	7
2nd	.03	.06	.02	61	.26	.53	.27	105	7	8
3rd	.02	.03	.01	73	.17	.24	.08	46	8	9
4th	.01	.03	.02	129	.12	.28	.17	142	8	9
Gender of household head										
Male	.04	.06	.02	62	.24	.44	.20	83	26	28
Female	.18	.22	.04	21	.42	.57	.15	36	4	5
Number of earners										
Single	.07	.18	.11	150	.24	.45	.20	84	13	10
Dual	.04	.05	.01	35	.11	.32	.21	183	11	16

Note: As described in the text, the permanent variance for each sub-sample is the variance across households of the average over time of the first difference of residuals from a regression of log household earnings on a quartic in age. The transitory variance for each sub-sample is the mean across households of the variance over time of each household's transitory earnings growth.

Table 4
Aggregate Earnings Volatility in the NIPAs and PSID

	Standard deviation of log differences			
	1967-1984	1985-2002	change	% change
NIPA aggregate earnings	3.11	2.14	-.97	-31
PSID aggregate earnings	3.16	1.72	-1.44	-46
Memo:				
Variance of PSID aggregate earnings	9.99	2.97	-7.02	-70

Note: For the NIPA measure, the table shows the standard deviation of annual log differences (multiplied by 100) from 1967-1984 and 1985-2002; for the PSID measure, the table shows the standard deviation of two-year log differences (multiplied by 100) over the same periods. The NIPA measure is wage disbursements deflated by the CPI-U; the PSID measure is the sum across households of income in a year divided by the number of households in the sample in that year.

Table 5
Variance Decomposition of PSID Aggregate Earnings by Education

	1967-1984	1985-2002	change	% change
Total variance	9.99	2.97	-7.02	-70
Contributions of:				
Variance for less than high school	1.89	.22	-1.67	-88
Variance for high school	2.11	.89	-1.22	-58
Variance for college	.25	.41	.16	66
Covariance	6.04	1.18	-4.87	-81
Approximation error	-1.64	.19	1.83	
Correlations:				
Less than high school; high school	.90	.40	-.50	-55
Less than high school; college	.79	-.05	-.85	-107
High school; college	.93	.70	-.23	-25
Shares:				
Less than high school	.28	.13	-.16	
High school	.50	.54	.04	
College	.21	.33	.12	

Note: The variances refer to two-year log differences at annual rates. Because the methodology does not incorporate time-varying shares, an approximation error arises.

Table 6
Variance Decomposition of PSID Aggregate Earnings by Earnings Quartile

	1967-1984	1985-2002	change	% change
Total variance	9.99	2.97	-7.02	-70
Contributions of:				
Variance for 1st quartile	3.46	.78	-2.68	-77
Variance for 2nd quartile	.40	.30	-.10	-25
Variance for 3rd quartile	.45	.22	-.22	-50
Variance for 4th quartile	.29	.27	-.01	-4
Covariance	6.39	2.43	-3.96	-62
Approximation error	-1.00	-1.03	-.03	
Correlations:				
1st quartile; 2nd quartile	.73	.83	.10	14
1st quartile; 3rd quartile	.57	.51	-.06	-10
1st quartile; 4th quartile	.64	.44	-.20	-31
2nd quartile; 3rd quartile	.89	.46	-.43	-48
2nd quartile; 4th quartile	.91	.42	-.43	-48
3rd quartile; 4th quartile	.89	.63	-.27	-30
Shares:				
1st quartile	.25	.22	-.03	
2nd quartile	.25	.25	.00	
3rd quartile	.25	.26	.01	
4th quartile	.25	.27	.02	

Note: The variances refer to two-year log differences at annual rates. Because the methodology does not incorporate time-varying shares, an approximation error arises.

Table 7
Variance Decomp. of PSID Aggregate Earnings by Gender of Household Head

	1967-1984	1985-2002	change	% change
Total variance	9.99	2.97	-.07	-70
Contributions of:				
Variance for males	5.03	1.57	-3.46	-70
Variance for females	1.09	.36	-.73	-67
Covariance	2.68	1.08	-1.60	-60
Approximation error	1.19	-.04	-1.23	-103
Correlations:				
Males; females	.57	.72	.15	26
Shares:				
Males	.79	.79	.00	
Females	.21	.21	.00	

Note: The variances refer to two-year log differences at annual rates. Because the methodology does not incorporate time-varying shares, an approximation error arises.

Table 8
Variance Decomp. of PSID Aggregate Earnings by Number of Earners

	1967-1984	1985-2002	change	% change
Total variance	5.84	2.28	-3.36	-61
Contributions of:				
Variance for single earners	2.18	.72	-1.46	-67
Variance for dual earners	1.05	.63	-.43	-40
Covariance	2.35	.62	-1.73	-74
Approximation error	.26	.31	.05	
Correlations:				
Single earners; dual earners	.77	.46	-.31	-40
Shares:				
Single earners	.54	.45	-.10	
Dual earners	.46	.55	.10	

Note: The variances refer to two-year log differences at annual rates. Because the methodology does not incorporate time-varying shares, an approximation error arises.

Table 9
Responsiveness of Consumption to Earnings at the Household Level
(regressions of two-year growth in food spending on two-year growth in earnings)

	Equation (9)	Equation (10)	Equation (11)	Equation (12)
Constant	5.535 (1.392)	5.610 (1.391)	5.992 (1.406)	6.407 (1.411)
Δln(Y)	.056 (.003)	.083 (.005)		
D85*Δln(Y)		-.040 (.006)		
Δln(Y+)			.048 (.004)	.062 (.008)
D85*Δln(Y+)				-.022 (.009)
Δln(Y-)			.064 (.004)	.104 (.008)
D85*Δln(Y-)				-.058 (.009)
p-value for household characteristics	.00	.00	.00	.00
p-value for year dummies	.00	.00	.00	.00
R-squared	.07	.07	.07	.07
# of obs. (thous.)	43	43	43	43

Note: Standard errors are in parentheses.

Appendix: Selected Micro-Data Studies of Income and Consumption Variability

A sizable literature has examined the evolving variability of earnings, income, and consumption. This appendix briefly reviews the findings of some of these papers, and the table in the text provides a summary.

Analysis of Earnings Data Alone

Gottschalk and Moffitt (GM; 1994) launched the recent analysis of earnings volatility. They argued that the burgeoning literature on rising earnings inequality had implicitly assumed the source of that rise to be an increasing variance of permanent earnings, when, in fact, an increasing variance of transitory earnings also played an important role.[12] GM used the PSID to compare earnings patterns of white males in 1970-78 to 1979-87, and our methodology follows theirs in key ways. They concluded that one-third to one-half of the increasing cross-sectional variance of earnings between the 1970s and 1980s reflected greater volatility of transitory earnings.

GM also found increasing transitory earnings volatility within many categories of workers. In particular, they estimated increases for all age and education groups, within all industries (although a shift out of manufacturing, which had relatively stable earnings during their sample, accentuated the trend), within both unionized and non-unionized jobs (although a shift out of unionized jobs, which had relatively stable earnings during their sample, accentuated the trend), for full-time non-self-employed workers as well as part-time and self-employed workers (although a shift toward part-time and self-employment, which have relatively less stable earnings, accentuated the trend), and for people who stayed in the same job as well as for people who changed jobs. However, the biggest increases were for workers with lower permanent income and for job changers.

Haider (2001) also used PSID data from the late 1960s through the early 1990s, but he employed a somewhat different model than Gottschalk and Moffitt. Haider estimated that permanent earnings inequality increased during the 1980s and that transitory earnings inequality increased during the 1970s. For the period as a whole, he found that these two components contributed roughly equally to the increase in the cross-sectional variance of earnings.

Hyslop (2001) focused on the short period from 1979 to 1985, again using data from the PSID and estimating a model based on the covariance structure of intrafamily earnings. He found a considerable increase in the inequality of male earnings, which was attributable to increases in both the permanent and transitory variances. In contrast, he found only a small rise in the inequality of female earnings, which was attributable principally to a rise in the transitory variance.

Gottschalk and Moffitt (2002) extended their earlier analysis with data through 1996 and altered their methodology in several ways. Their paper used both simple correlations and an error components model of earnings dynamics.[13] They concluded

[12] GM also argued that, although skill-biased technical change might generate an increase in the variance of permanent earnings, it was unlikely to generate an increase in the variance of transitory earnings. Instead, they attributed rising instability to "the decline in regulation, the decline in unionization, the disappearance of administered prices, and general increases in competition within industries and from abroad" (pp. 218-219). Some of the discussion of the paper resisted this implication; for example, Larry Katz offered an explanation of how rising demand for skill could indeed boost income volatility.

[13] Their simple correlations seem to exclude common transitory shocks, but their model seems to include them.

that the variance of permanent earnings rose fairly steadily between the mid-1970s and the late 1980s and then leveled out, while the variance of transitory earnings rose sharply between the mid-1970s and mid-1980s, leveled off for several years, and then fell sharply in the early 1990s. The sharpness of the 1990s decline (in both the transitory component and in the total variance) was surprising to the authors, and they provided no convincing explanation of it.

Baker and Solon (2003) studied Canadian tax records from the mid-1970s to the early 1990s. Consistent with findings for the United States, they concluded that rising cross-sectional earnings inequality reflects increases in both permanent earnings dispersion and transitory earnings fluctuations. Because of the quality of their data, they were able to estimate a more flexible model of earnings dynamics than has been used in the U.S. context, and they concluded that incorporating these extra dynamics reduced the role of transitory volatility relative to permanent volatility.

Comin, Groshen, and Rabin (2006) returned to this question using the PSID from 1970 to the early 1990s.[14] They confirmed the GM result that workers experienced a higher volatility of earnings between 1984 and 1993 than between 1970 and 1979. This result held for all workers and also for the subset of workers who did not change employers, as well as for white males and for other workers.

Analysis of Earnings and Consumption Data

A related strand of research has analyzed the evolution of consumption variability along with income variability. Some of this work assumes that households can and do smooth consumption in the face of transitory income movements; under this assumption, changes in the variance of consumption provide information about the changing variance of the permanent and transitory components of income. Other work essentially turns this logic around, by determining the changing variance of permanent and transitory income from income data alone, and then using changes in the variance of consumption to infer the correct model of consumption or the welfare implications of changing income patterns.

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[14] The goal of Comin, Groshen, and Rabin (CGR) was to link rising earnings instability over the past several decades to a rise in the volatility of firm performance documented by Comin and Mulani (2006) and Comin and Philippon (2005). The latter papers argued that the volatility of firm-level performance—as measured by the profit-to-sales ratio or the growth rates of sales, employment, and sales per worker—has experienced a pronounced upward trend for the past 35 years. To explore the connection between these findings and the literature on transitory earnings volatility, CGR used the PSID, Compustat (with detailed firm information taken from corporate reports), and the Federal Reserve Bank of Cleveland's Community Salary Survey (with information on specific firms).

Note that Davis, Haltiwanger, Jarmin, and Miranda (DHJM, 2006) disagreed with the Comin et al findings that firm performance has become more volatile over time. Using the Longitudinal Business Database, which contains annual observations on employment and payroll for all U.S. firms, DHJM found a significant *decline* during the past few decades in the volatility of sales and employment growth at the firm level. In particular, they showed that volatility among publicly held firms has increased, as found in previous research using the Compustat data, but that volatility among privately held firms—which account for a larger share of private business employment—has declined. (They argued that results based on the Compustat sample are distorted by changes over time in the selection of firms that become public.) DHMJ also concluded that much of the decline in overall volatility reflects a decline in business entry and exit rates, as well as a shift of employment toward older and larger firms. Lastly, they suggested that greater wage flexibility can lead to smaller employment responses to demand shocks and thereby could "provide a unified explanation for the rise in wages and earnings inequality and the declines in aggregate volatility, firm volatility, and unemployment flows" (p. 26).

For selected years between 1963 and 1989, Cutler and Katz (1991) examined the distribution of income from the Current Population Survey (CPS) and the distribution of income and consumption from the Consumer Expenditure Survey (CE). They found that inequality in the earnings of primary workers increased in the 1980s and was the primary factor behind an increase in the inequality of family income.[15] They also found that consumption inequality is smaller than income inequality—consistent with consumption smoothing—but that it increased to a comparable extent in the 1980s. Cutler and Katz also documented two aspects of the relationship between income and consumption: At the household level, the correlation of income and consumption declined a little between the early 1960s and late 1980s, which would be consistent with greater consumption smoothing but also with other explanations; across demographic groups, the correlation of income and consumption movements over time was highly correlated.

Attanasio and Davis (1996) combined data from the Current Population Survey (CPS) and Consumer Expenditure Survey (CE) to construct earnings and consumption for synthetic age-education cohorts. Based on annual observations from 1980 to 1990, they found that low-frequency movements in wages generated large changes in the distribution of consumption, but that high-frequency movements had little such effect. The first result implies that between-group consumption insurance is very weak. The second result suggests that households can smooth consumption fairly well in the near-term.

Dynarski and Gruber (1997) used data from the PSID and CE. In line with the Gottschalk-Moffitt results, they estimated that transitory changes in earnings for male heads of households increased substantially during the 1970s and 1980s. Further, they found that variations in the earnings of household heads have only a small effect on those households' consumption.[16] However, they also found that the variance of consumption had increased over time in line with the variance of heads' earnings, which is surprising in light of their other results.

Blundell and Preston (1998) argued that an increase in the cross-sectional variance of income not matched by an increase in the cross-sectional variance of consumption implies that a larger share of the income variance is attributable to transitory shocks. Using the British Family Expenditure Survey (FES) for 1968 to 1992, they estimated that transitory inequality rose in the late 1980s because income variance rose more than consumption variance. This interpretation of the relative variance change is correct if households are lifecyclers. However, the same variance changes could arise if the relative importance of permanent and transitory shocks stayed the same and households became better able to smooth consumption—perhaps because of financial innovation.

Banks, Blundell, and Brugiavini (2001) used data on income and consumption from the British FES for 1968 to 1992. Although much of the work in this area has focused on the earnings of the household head, these authors included transfer payments

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[15] Cutler and Katz estimated that the earnings of secondary workers increased the dispersion of family income relative to the dispersion of earnings by primary workers, but that this effect diminished a little over time. In contrast, they estimated that non-labor income seems to have *decreased* the dispersion of family income (because of transfers), but also to have had a smaller effect in the 1980s.

[16] Dynarski and Gruber estimated that these responses are somewhat asymmetric: Drops in earnings appear to generate larger effects on spending than do gains in earnings.

and the earnings of other family members in order to capture the risk of non-participation in the labor force and the income that would result. They found that cohort-specific income risk had an important effect on cohort-specific consumption (confirming the Attanasio-Davis result) and also that high-frequency movements in income affected consumption (in contrast with Attanasio and Davis).

Attanasio, Berloffa, Blundell, and Preston (2002) extended the sample used by Blundell and Preston and made some methodological changes as well. Using FES data from 1978 to 1999, they confirmed that cross-sectional income variance increased faster than cross-sectional consumption variance, especially during the 1990s.[17] Of course, the same question of interpretation arises here as with the Blundell-Preston paper: This result could reflect either an increase in the relative importance of transitory income fluctuations or an improvement in households' ability to smooth consumption. The authors also showed that permanent inequality increased for later cohorts.

Fisher and Johnson (2006) combined consumption data from the CE with income data from the PSID, and they included people of all ages in their calculations. They estimated that income inequality increased considerably more than consumption inequality between 1984 and 1999.

Other Approaches to Assessing the Risk Faced by Households

Other sorts of data and analyses also bear on the evolution of the amount of risk faced by households.

One relevant question is whether employment has become less stable over time. Neumark (2000, p. 23) summarized a conference volume on this subject as follows: "My reading of the evidence is that the 1990s have witnessed some changes in the employment relationship consistent with weakened bonds between workers and firms. The magnitudes of these changes … indicate that these bonds have been only weakened, not broken. Furthermore, the changes … have not persisted long enough even to earn the label 'trends'." More recently, Farber (2005) found that the rate of job loss—using the Displaced Workers Survey with adjustments for methodological changes—was essentially unchanged, on balance, between the early 1980s and the early 2000s. However, because the unemployment rate fell considerably over that period, the gap between the job loss rate and the unemployment rate widened a good deal. On the other hand, Stevens (2005) concluded—based on data from the Retirement History Survey, the National Longitudinal Study of Older Men, and the Health and Retirement Study—that the prevalence of long-term employment relationships for men was stable over the 1969 to 2002 period.

Writings by non-economists and in the popular press often have suggested that households face much greater risk than in the past. In a recent book titled *The Great Risk Shift*, Hacker (2006, pp. 5-6) stated: "Over the last generation, we have witnessed a massive transfer of economic risk … onto the fragile balance sheets of American families. This transformation … is the defining feature of the contemporary American economy." Similarly, Warren (2005) wrote: "Over the past generation, an economic transformation has taken place in the heart of the middle class family. The once-secure family … has been transformed by current economic risk and realities." Addressing the

[17] So-called primary earners exhibited the same pattern of rising earnings variance, while so-called secondary earners had much higher variance on average but displayed little trend.

multifaceted discussions in these works is far beyond the mission of this appendix. However, it is worth noting that a number of the problems raised by these authors are rooted in the level, rather than volatility, of households' well-being, and thus are not directly related to the issues in this paper.

Some commentators have noted the contrast between greater macro stability and apparently greater micro instability. For example, Samuelson (*Washington Post*, 2/16/06, p. A27) considers some possible explanations for "why the economy has become increasingly stable while individual industries have become increasingly unstable." Other commentators appear to be conflicted about the extent of any increase in micro-level risk. For example, Mallaby (*Washington Post*, 10/31/05, p. A19) claimed: "The big economic argument today is … about the risks created by going gray [that is, aging] and going global at the same time—and about how much individuals can cope unaided." Yet, he admitted a few months later (*Washington Post*, 1/9/06, p. A19) that "[the assertion] of 'a brave new world of short-term employment,' sounds plausible, but the evidence for it is slight."