Income Gains and Month-to-Month Income Volatility:

Household evidence from the US Financial Diaries[1]

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Abstract

The US Financial Diaries track the finances of a small sample of low and moderate-income households over a year. The households faced substantial swings in income from month to month. On average, they experienced 2.5 months when income fell more than 25 percent below average, and 2.6 months when income was more than 25 percent above average. The volatility is summarized by an average coefficient of variation of monthly income (within year, averaged across households) of 39 percent. The CV is greatest (55 percent) for households below the poverty line, but the CV remained relatively high (34 percent) and steady for households with income from 100 percent of the poverty line up to 300 percent. Thus, in the non-poor sample, greater income did not imply notably greater income stability.

1. Introduction

Income is seldom completely steady over the year. For many Americans though, the bumps are hardly noticed: the ups and downs are small and households have enough saved up to provide a financial cushion. But not everyone has a good cushion, and many households experiences large spikes and dips.

[1] The U.S. Financial Diaries Project (www.usfinancialdiaries.org) was designed and implemented by Jonathan Morduch (NYU Wagner, Financial Access Initiative), Rachel Schneider (Center for Financial Services Innovation), and Daryl Collins (Bankable Frontier Associates). Morduch and Schneider are the Principal Investigators for the ongoing analysis, and this study develops ideas in Jonathan Morduch and Rachel Schneider, *Spikes and Dips: How Income Uncertainty Affects Households* (US Financial Diaries Issue Brief, October 2013). Leadership support for the U.S. Financial Diaries Project is provided by the Ford Foundation and the Citi Foundation, with additional support from the Omidyar Network. We thank Rachel Schneider, Tim Ogden, and Julie Siwicki for valuable input. Views and errors are those of the authors only. Contact: Jonathan Morduch – jonathan.morduch@nyu.edu.

Spikes and dips (and their consequences) are hard to see in the typical data, which tend to be collected too infrequently to reveal the ups and downs. Most surveys are collected only once ever, while others are collected yearly. The yearly surveys can reliably report conditions at a moment in time, but they do not reveal much about what happens between surveys. Recognizing that a different approach is needed to see changes from week to week and month to month, the US Financial Diaries (USFD) project was designed to capture high-frequency volatility faced by working Americans (Morduch and Schneider 2013b).

The US Financial Diaries data set provides an unusually-detailed and comprehensive view of the economic conditions of low-income and moderate-income households in ten sites in four US regions (Northern California, New York City, Eastern Mississippi, and the Kentucky/ Ohio border). The sample is not representative of the US, but it reflects important parts of working America. A common concern when analyzing income volatility is that the evidence is colored by noisy data (e.g., Dynan et al. 2012), and the US Diaries methodology incorporated a series of data quality checks that deliver relatively clean (though still not perfect) data.

Households have multiple goals when seeking economic improvement. Most hope for mobility -- the chance to move up the income ladder. At the same time, households also seek stability and a greater sense of control over their economic lives. When asked in a Pew national survey about which they feel is more valuable, 92 percent of respondents opted for financial stability over moving a rung up the income ladder (Pew Charitable Trusts 2015b, Fig. 5). The two goals are not necessarily at odds: moving up the economic ladder and gaining steadier, more predictable income often go together. In the same way, low-paid work is often unreliable work too. Yet increases in household income and reductions in income volatility need not be linked. Even without a change in annual income, households can improve their lives by finding more stable earnings.

The paper explores these issues by first establishing the extent of within-year income volatility. The households faced substantial swings in income from month to month. On average, they experienced 2.5 months when income fell more than 25 percent below average, and 2.6 months when income was more than 25 percent above average. In the sample, we find a within-year, within-household coefficient of variation of income of 39 percent. Alternative income definitions lead to an average coefficient of variation as low 32 percent, a figure which is still relatively high and aligns with similar evidence on low-income Americans found in national monthly data in the Survey of Income and Program Participation (SIPP). When analyzing labor earnings only, the evidence shows an average coefficient of variation of 46 percent within the year and within households. Labor earnings are more volatile than total household income at the average since non-labor income tends to reduce overall volatility.

Second, we investigate the degree to which volatility falls with average income, exploring how economic mobility and income volatility vary together. In the Diaries sample, volatility is greatest in households below the poverty line. Poor households thus do not have relatively stable

incomes thanks to government benefits. Nor do we find that, among non-poor households, volatility falls sharply with increasing income. Instead, beyond the poverty line, income volatility remains relatively high even as income increases. The data show that, between 100 percent of the poverty line and 300 percent of the poverty line (where we observe household income ranging from $10,729 to $129,675), income volatility does not notably diminish. Mobility in terms of income thus does not imply substantial mobility in terms of stability.

Third, we explore relationships between the volatility of income earned by adults within the household and the volatility of the overall household. We examine whether the adults in households buffer each other through employment choices, reducing the income volatility of the whole. We first consider negative correlation: whether the month-to-month earning swings of a given adult offsets income swings of other adults in the household. In contrast, the evidence shows that movements in labor earnings tend to vary positively across adults within a household. We distinguish adults by gender as well as by earnings-share within the household, and each analysis yields similar results. Still, even with positive correlation, there is helpful diversification. The evidence shows that the coefficient of variation of male labor earnings is 17 percent higher on average than that of their households, indicating that female labor earnings tend to reduce male earning volatility, though by a relatively small portion compared to the total volatility faced. From a woman's perspective, the reduction is similar. The results are similar when distinguishing adults by earnings share.

2. Related Literature

Most studies of volatility focus on swings from year to year with an eye to trends over time and differences across individuals. In summarizing the literature, Jonathan Latner (2014) shows that all of the major studies find climbing year-to-year volatility in national surveys. One of the earliest (Gottschalk and Moffit 1994) shows a steady rise in income volatility that can be connected to increases in income inequality. Dynan et al. (2012) find a 30 percent increase in income volatility in the Panel Study of Income Dynamics (PSID) between 1971 and 2008, where volatility is measured by the standard deviation of percent changes in annual income across two-year spans.[2] A 2015 analysis of the PSID between 1979 and 2011 finds that, in a given two year period, nearly half of households had a gain or loss of 25 percent of more (Pew Charitable Trusts 2015a, Figure 2). The Pew study finds that in 2011, the chance of a gain or loss of 25 percent or more was roughly equal (21 percent for a gain versus 22 percent for a loss). Looking back to households whose income dropped by more than 25 percent in 1994, a third had not recovered to previous income levels a decade later (Pew Charitable Trusts, p. 3).

[2] A notable exception to these findings is Dahl, DeLeire, and Schwabish (2011), who find that income volatility is flat between 1984 and 2004 in national administrative data on labor earnings.

Income volatility has limited effect on household consumption if households can adequately smooth ups and downs through borrowing, saving, or insuring. Gorbachev (2011), however, shows that the upward trends in income volatility are echoed by upward trends in the volatility of household consumption. Using the PSID, she estimates that household consumption volatility rose by 21 percent between 1970 and 2004 (Gorbachev 2011).

The year-to-year swings imply that some households must experience major swings within a year. At the same time, some households might experience substantial ups and downs within a year that are masked when within-year income is aggregated to form annual income. Farmers, for example, can experience major seasonal variation in income even when their annual income remains fairly steady over time.

Few data sets contain sufficient within-year income data to compute swings from month to month. The main source used by researchers is the Survey of Income and Program Participation (SIPP). Using the SIPP, Bania and Leete (2009) find that month-to-month income volatility in poor households grew substantially between 1992 and 2003, and that monthly income volatility is highest for the poor. A subsequent Urban Institute study finds a similar disparity in month-to-month volatility across income quintiles in the SIPP, observing households for five months within a 17-month time-frame; the lowest quintile is estimated to have a coefficient of variation of 0.499 for monthly household income, while the middle quintile has a CV of 0.32 (Mills and Amick 2010, Table 2). A 2014 analysis of the SIPP by researchers affiliated with NYU Steinhardt (Morris et al. 2014) shows increasing volatility of monthly income between 1984 and 2008 in analysis restricted to the lowest income decile (i.e., just the very poorest households in the sample).

The SIPP is the best source for nationally-representative surveys, but researchers worry about recall bias and seam bias. Households are surveyed every three months, and they're asked to report on the previous four months, which is a relatively long stretch when income and spending are both volatile, and when, for the poorest especially, many transactions are in cash. Seam bias is a second problem in the SIPP: Seam bias exaggerates volatility, and is manifested as an implausibly large change in income from the end of one survey cycle to the start of the next one. The problem has been addressed in recent waves.[3]

[3] Imagine that data are collected in November with questions about the preceding 4 months: July, August, September, and October. The next survey then would happen in March with questions about November, December, January, and February. Seam bias occurs when the answers about the 4 months in a given cycle are fairly uniform, but when there's an unusually large jump between responses from one cycle to the next – i.e., from October to November. An effort to address seam bias is now in place: Households are reminded of previous responses before being asked for current income data. This tends to lead to smoother responses. We appreciate input from Luke Shaefer about SIPP survey methodology. See also Mills and Amick (2010).

A different approach relies on self-reported assessments of income volatility. In the 2013 Federal Reserve Survey of Household Economics and Decisionmaking, a national sample of 4,134 respondents was simply asked about volatility in their monthly income (Federal Reserve 2014).[4] Two-thirds of the respondents reported that their income was fairly steady from month-to-month.[5] In answering the same question, 21 percent of respondents reported that they experienced some unusually high or low months, and another 10 percent reported that their income "often varies quite a bit from one month to the next."

Figure 1 shows that conditions are more variable in lower-income households. Using Federal Reserve SHED data, we show that, among households that bring in less than $25,000 for the year, 18 percent of respondents said that income "often varies quite a bit from one month to the next." The portion falls to 9 percent among households with $25,000 to $49,999 in annual income, and decreases again to 5 percent among those with household income of $50,000 or more (Federal Reserve, 2014).

Volatility in labor earnings are highlighted in a number of the studies. In the 2013 Federal Reserve SHED after asking households about their monthly income volatility, a follow-on question finds that the biggest culprit is an irregular work schedule (see Figure 2).[6] The earlier 2012 study by Dynan et al. finds that climbing levels of income volatility are due to increases in the volatility of both work hours and wages per hour. Looking at the SIPP data, Bania and Leete (2009) find that the positive trend in month-to-month volatility among poor households is mostly due to a shift from relatively steady government benefits to reliance on relatively volatile labor earnings. As we discuss below, the US Financial Diaries data show high labor earnings volatility across income levels, while the reduction in volatility from total non-labor income sources is relatively small.

[4] The Federal Reserve ran the *Survey of Household Economics and Decisionmaking* in September 2013 to get a sense of how a broad cross-section of American households are doing today. A companion study comparing US Financial Diaries to the SHED is being prepared. We appreciate Julie Siwicki's assistance in relating the USFD sample to national statistics and national poverty thresholds. The SHED focuses on adults over age 18. An online panel of 50,000 individuals was sampled randomly and 6,912 were asked to take the survey. About 60 percent (4,134) agreed. The survey was quick (19 minutes was the median time), but covered a lot of ground (p. 5). The relatively-low response rate means that it's unclear who agreed to answer, so the claim to representativeness is unclear. The report is accompanied by an appendix which slices the data by subsamples.

[5] Question C.85, p. 87; 4,134 observations.

[6] Federal Reserve, 2014. Question C.86, p. 87. This question was asked only of those who said either that income "varies quite a bit from one month to the next", or is "roughly the same in most months, but some unusually high or low months during the year."

3. Data: The US Financial Diaries

The US Financial Diaries is a research project tracking the financial lives of 235 low- and moderate-income households over the course of 12 months. In this paper, we analyze a slightly broader sample of 244 households that reported income data for at least 8 full months (see below for further discussion of sample choice).

The financial diaries are not actual diaries filled out be respondents. Instead the method involves traditional methods of data collection by field researchers. The term "diaries" is used to reflect the high-frequency nature of the data collection and the intent to capture as many details as possible, especially those that are not easy for outsiders to see.

The US Financial Diaries aimed to go beyond the usual focuses on income and assets, and close attention was also paid to within-year cash flows (see Morduch and Schneider 2013a). Over the course of the study, 316,763 cash flows were collected in an attempt to capture every dollar spent, earned, borrowed, saved and shared. The data are not perfect, but a series of unusual steps were taken to ensure data quality (described below). Most important, we met with the households every 2-4 weeks, to minimize reliance on long periods of recall. The regularity of the meetings helped build trust, and it gave a chance to fill in gaps as the study proceeded.

Households were sampled in four research sites – New York City, Ohio/Kentucky, Eastern Mississippi, and San Jose/Central California. Together, the samples represent a variety of household characteristics and environments, but the households are not a random sample. They were chosen to reflect typical elements of working America, not to form a representative population. The data are not weighted to reflect national population shares.

Attrition from the USFD sample during the main survey period contributed to different households having different lengths of data collection. Of the 268 households that reported their income, 91 percent (244 households) have at least 8 full months of income data, which is the sample that we analyze in this paper. Of these 244 households, 67 percent reported 12 or more full months of income data. In the discussion on robustness, we compare results across different sample sizes.

To focus the analysis in this paper on the typical experiences within the sample, we exclude the 5 percent of households with the most volatile income. These are households that have a coefficient of variation of monthly household income greater than 89 percent.

To focus on "normal" ups and downs, we remove tax refunds from income. In a section on robustness, we show how volatility increases when we add tax refunds back in.

To normalize the data across regions, we compare household income to the supplemental poverty measure (SPM) that holds in a given location (United States Census Bureau 2010). We thus

express income as a percentage of the SPM, with households with income under 100% of the SPM being labeled as poor.

4. Challenges to accurately measuring volatility

There are good reasons that scholars have had difficulty measuring income volatility (and month-to-month income volatility especially):

1) *Little data.* The first and biggest challenge is that there is little data on income from month to month, and the national-level data depend on recall. The Survey of Income and Program Participation (SIPP) is the best source for nationally-representative surveys. Households are surveyed every four months, and they're asked to report on the previous four months, which is a long stretch when income and spending bounce around. These problems were one motivation for the US Financial Diaries to collect data at a high (2-4 week) frequency.

2) *Noisy data.* Problems with recall create noise in the data, and the noise can exaggerate impressions of volatility. Misremembered timing may also create the appearance of spikes and dips: Households may forget when exactly income was received or when spending occurred, so cash flows may get clumped together in self-reported data, creating the false appearance of spikes. Misremembering is worst in households where there is greater dependence on cash (because fewer records are kept) and where income is patched together from varying sources with irregular payments (due to part-time work, self-employment, irregular hours, over-time, etc.). These households tend to be poorer, and the noise can give an exaggerated impression that poorer households have more volatile income. Below we detail efforts taken to minimize noise.

3) *Time units.* To the extent that volatility is measured within a year, the focus is usually month-to-month variation. Months go from the 1st to the end of the month, but if an end-of-month paycheck is delayed by a few days (or a beginning-of-month paycheck hits early), it can look like there's more volatility than households actually feel. Similarly, steady weekly earnings can translate into choppy monthly earnings: When workers are paid weekly, some longer months will include 5 paychecks, and thus will have 25 percent more income than months with just 4 paychecks. But from the households' perspective things are steady week by week. We address these in the analysis below, by redefining the time units and spreading the irregular monthly income associated with week-based payment schedules.

4) *Trends.* When income is steadily rising or steadily falling over a time frame, measures of volatility can give the impression that there are ups and downs. This is because households spend substantial time below their mean for the period and then substantial time above their mean (or the opposite). The problem is biggest when measuring

volatility from year to year, and it matters less when viewing volatility within a year. Although we see significant positive or negative trends over time in monthly income (within households), we find that income around these trends is as volatile as income around the (flat) average.[7]

US Financial Diaries steps to reduce noise in the data

1. During data collection, as field researchers learned more about the households' financial situations, they revised upcoming surveys to capture the new information.
2. During data collection, we tracked inconsistencies in inflows, outflows, and balances of cash in each household, which prompted follow-on questions, especially about cash income.
3. After the main period of data collection ended, we entered a 6-month follow-up period. We went back to the households and asked them about times when income (or spending) seemed unusually high or low. We could then determine if the spikes and dips made sense to the respondents and could probe which cash flows were missing or mis-recorded. Our focus was on big outliers that could easily skew the picture, especially values 50 percent above or below the household's median monthly income.
4. In the follow-up period, we also checked on unusually big or small values of tax refund flows, sales of physical assets, and withdrawals from retirement accounts.
5. A similar process was carried out to detect typos and mistaken duplicates of information.
6. As a cross-check, we then turned to data collected on the form of transaction and on financial mechanisms. Household by household, we checked income inflows against mode and deposit data to determine the net amount of the income inflow.
7. We checked summaries of the end data set to detect outliers and patterns that appeared inconsistent with our understanding of the households or the sample.

5. Results

Preferences for financial stability

We asked the US Financial Diaries sample the same question asked in the 2014 Pew national survey: Which is more important: financial stability or moving up the income ladder? Among the 7,845 Pew respondents, 92 percent opted for financial stability (Pew Charitable Trusts 2015b, Figure 5). This choice is reflected in the USFD sample as well. The portion of USFD households giving the same answer to this question is 78 percent, which is lower than the national portion, though it shows a large majority prefer financial stability.

[7] The slope and intercept of each household's income trend are those estimated in an ordinary least squares regression of the household's monthly income on time (where the month is the unit of time).

In the USFD sample, the data show a similar result across the income spectrum, ranging from households below the poverty line, where still 67 percent chose financial stability, to households between 200-300 percent of the poverty line, of which 79 percent chose financial stability. Within the range of the USFD sample, financial stability becomes more important as households gain more income.

Perceived Income uncertainty

Uncertainty complicates choices over jobs, budgeting, making appointments and personal plans, and deciding to borrow or save. Early in the USFD study, households were asked: "How easy was it to predict total household income during the month?" Households could choose from five answers that range from "very easy" to "very difficult." Comparing the answers across income groups, we find that those who say income is easier to predict tend to be better off, while households who reported more difficulty predicting income tended to have lower average income relative to their poverty threshold (see Table 1). We normalize income by dividing by the regional Supplemental Poverty Measure (SPM) produced by the Census Bureau. Those who perceive their income as "very difficult" to predict have an average income of 96% (relative to the poverty line at 100%). Those who see the least certainty have an average income of 165%.

The survey guided households by providing monetary benchmarks: The survey suggested that "very easy" equates to income that could be predicted to the nearest $100, while "easy" corresponds to the nearest $200, "not easy" is the nearest $500, "difficult" is the nearest $1000, and "very difficult" is the nearest $2000. To analyze the answers, we divide the unit at which income is predictable (i.e. $100 to $2000) by the household's average monthly income over the following year, such that we capture roughly the portion of average monthly household income that is unpredictable by the respondent.

Across households on average the choice of difficulty implies that 15 percent of income is unpredictable during the month. Unpredictability by this measure is greatest below the poverty line, where 26 percent of income cannot be predicted easily, up from 15 percent among households that are between 100 percent and 150 percent of the poverty line. Among households between 200-300 percent of the poverty line (which is around the household's median area income), 9 percent of income is not easily predictable (Table 2).

Spikes, dips, and mismatch

A starting point in measuring income volatility is to count the number of months in a year when income is far from its average. Looking this way, we see that high spending months often do not align with high income months.

We follow Morduch and Schneider (2013b) in defining an income spike as a month when income is more than 125 percent of the household's average. Similarly we define an income dip as a month when income is less than 75 percent of the household's average.

On average, households have seven months out of the year when income is within 25 percent of the household's monthly average, leaving most of the household's volatility concentrated in an average of five months, when income ranges beyond 25 percent above or below the household's average. In these months the data show the average high (or spike) in income is in fact 55 percent above the household's average income, while in a low (or dip) the income is 45 percent less than average income.

During the year, on average households had 2.6 income spikes and an average of 2.5 income dips in 12 months.[8] Pooling spikes and dips, households had on average 5.2 spikes or dips in 12 months. Figure 3 shows a skew to the right tail in the distribution of households across spikes and dips experienced per 12 months.

Figure 4 shows that the number of spikes and dips is greatest for the poorest part of the sample. Below the poverty line, the average number of income spikes is 3.6 over the year, and the average number of dips is 3.4. The averages above the poverty line are considerably reduced, but the highest income group in our sample (with income over twice the poverty line), nevertheless experience 2 spikes and 2 dips per year.

Following similar definitions, we compare spikes and dips in spending with those in income. During the year households averaged around 2 spending spikes and 3 spending dips. Figure 5 shows the distribution of households across the number of months where spending was above 125 of average (a spike) or below 75 percent of average (a dip), again with a slight skew to the right.

Looking at the timing of spending and income, 61 percent of spending spikes happen when there is no income spike, and 33 percent of the spending spikes happen when income is below the average level. This mismatch between income and spending levels is more common above the poverty line, even though households in each income group tend to have as many spikes as dips in income (see Figure 6). For the poor, spending tends to track income more closely, suggesting fewer options to de-couple spending and income.

Overall, the correlation of monthly income and monthly spending is 0.43, which falls for better-off households to 0.36, down (by about a third) from 0.53 among the poor. This suggests that poor households are much more likely to delay spending until income is available, or to find extra income when spending is needed.

[8] In the analysis of spikes and dips, we annualize the number of spikes or dips observed assuming that households that reported 8, 9, 10, or 11 months of income data gave a representative sample of their year.

Coefficient of Variation (CV)

To summarize income volatility within the year (and to compare our results to previous studies), we measure the coefficient of variation (CV) of monthly income, which is the standard deviation of the household's monthly income divided by the average of the household's monthly income. Across USFD households, we find an average CV of income of 0.39, with robustness checks indicating a minimum average CV of 0.32. As an intuitive example, a CV of 0.39 would be seen in monthly income that is the same as the household's average for half of the year, then alternates from about 50 percent above the household's average in one month to about 50 percent below in the next month, back and forth, throughout the remaining six months.

The most comparable result (of which we are aware) is the volatility observed in similar income groups in the national 2001 SIPP panel, where the average CV in the lowest three quintiles is between 0.32 and 0.50.[10] An analysis of the SIPP (Bania and Leete, 2009) shows the median level of volatility, which ranges from 0.28 just below the poverty line to 0.18 above 150 percent of the poverty line. The median CV of income in the USFD sample is higher at 0.34.

The disaggregated data allow us to see that households vary in their level of volatility (Figure 7). The standard deviation of the coefficient of variation of income is 0.19, within a right-skewed distribution. The bulk of households (68 percent of them) have volatility (CV) of income distributed close to uniformly between 0.15 and 0.45, with decreasing incidence on either side of this range. No households have a CV below 0.10. The exception to the large group of households is the long, right tail, where 18 percent of households center between a 0.60 and a 0.90 CV of income. (Figure 8 shows that the same general pattern holds when the data are restricted to households which field researchers believed were to be of the highest quality.)

Income Volatility across Income Levels

In the USFD data, we see that household income volatility is greatest below the poverty line, where the average CV of income is 0.55. Among households between 100-300 percent of the poverty line, the CV of income is roughly flat, staying near an average CV of 0.34 (see Table 3 and Figure 9, a non-parametric regression of the CV on average annual income).

Similar trends in income appear in the national SIPP data, where Mills and Amick (2010, Table 2) estimate that the CV of income in the first quintile is 50 percent, up from 37 percent in the second quintile, which is up from 32 percent in the third quintile.

In labor earnings, we find a similar trend in average income: Earnings volatility falls on average with the level of average income relative to the household's poverty threshold (see Table 4 and

[10] In Mills and Amick, 2010, seam bias was avoided by including only the month of data that immediately preceded interviews, effectively observing five months of household income spread out over a 17-month span.

Figure 10). The steepest difference in earnings volatility is across the poverty line, while the differences are smaller across income groups above the poverty line.

Earnings are less steady than the total income during the year, and the difference is greatest for lower-income households (Table 4). A simple comparison at the average reveals that non-labor income tends to help steady households at each income level – even though non-labor income itself is extremely volatile. Examples of non-labor income are: food stamps, child support, social security for disabilities or old age, safety-net support from religious institutions and non-profits, and gifts from friends or family. The effect from non-labor income is especially large for lower-income households, where the CV of income from jobs is greatest compared to the CV of total income.

Hedging and Diversification in Labor Earnings

Nichols and Zimmerman (2008) use annual data to argue that the volatility of family income increased over time as men's and women's incomes have become more correlated. We cannot address changes over time in the Diaries, but we can investigate diversification within households. We turn now to adult labor earnings. In the sample, labor earnings are on average 70 percent of a household's income during the year. Tax refunds and credits are on average 9 percent of total income for the same sample. (Further down we examine the role of non-labor income overall in reducing household income volatility.)

Adults in a household may be able to significantly reduce their combined earnings volatility by diversifying their labor income. First, we ask whether there is evidence of a systematic negative relationship between one adult's earnings and those of another, within a household. Instead, we find a positive correlation on average between these earnings.

Across households, the average correlation in labor earnings between a man and a woman in the same household is 0.17, with a relatively large standard deviation of 0.34 within a left-skewed distribution. The median correlation is slightly higher, at 0.20.

In the sample, women tend to be the secondary earners in terms of income. However, this is not always the case. We distinguish the labor earnings share of the worker from their gender, though we find similar results in either analysis. Across households, the average correlation between the primary earner and the secondary earner is 0.14, still with a relatively large standard deviation of 0.34 within a left-skewed distribution. The median correlation is slightly higher at 0.16.

We continue to a more comprehensive measure of the effects of size and covariance in adults' earnings. Here we measure the overall extent to which the earnings of one adult reduce the volatility of the other adult in the same household. Our measure is the difference between the earnings volatility of one adult and that of the entire household.

The evidence shows that a man's coefficient of variation of labor earnings is on average 17 percent higher than the coefficient of variation of labor earnings of the household. This implies a substantial role of the woman's earnings in reducing the household's volatility. Still the drop in volatility is only a bit less than a fifth, leaving 83 percent of the volatility in male labor earnings to translate into volatility in total household earnings. Similarly, a woman's coefficient of variation of labor earnings is on average 26 percent higher than that of the household, which also suggests that the steadying effect from men's and women's earnings is roughly equal on average.

The evidence shows that the coefficient of variation of earnings from the primary earner is just 5 percent higher than that of the household, due to the labor income of the secondary earner, which indicates relatively little volatility-reduction from secondary workers on average.

The results by gender and earnings-share differ from each other slightly. A simple comparison shows that the damping by the woman's earnings owes largely to the portion of households where the woman is the primary earner. In general, the data show that primary earners, while they obtain higher labor earnings during the year, also have much steadier labor earnings. So it is not surprising that women's earnings tend to act strongly against the volatility from the male secondary in the same household, while the effect tends to be smaller when women are the secondary earners.

In our analysis of adults so far, we do not highlight the marriage status of adults. Similar to national figures, the USFD sample shows that working men and women who are married account for about half of the total number of households where working men and women cohabitate. We compared the main results here to the results for married couples and found little difference. The average correlation in labor earnings between married couples is 0.12, down from 0.17 in the full sample. The standard deviation is still relatively large at 0.34 within a right-skewed distribution. The median is lower, at 0.05. While this comparison suggests a slightly lower correlation generally among spouses, the difference is relatively small and the correlation still tends to be positive (rather than distinctly negative).

Upward and Downward Variation

Income volatility can reflect beneficial and detrimental events in the household, in addition to the uncertainty that it often brings. In the current analysis we take a simple approach to compare conditions across households. We separate total household variance into its additive upward and downward components, where downward variance is the sum of squared, negative deviations from the mean. Dividing this sum by the total variance of monthly income in the household, we arrive at the percent of variance that is downward, which is comparable across households.

As household income rises, on average there may be less downward variation, though this trend is shallow, and it is not clear among the high-grade households. Overall, households average 46 percent downward variation, suggesting that volatility from good times, or large boosts in

income, are nearly as large as volatility from bad times, or large drops in income, on average (Table 4, top panel).

6. Robustness

Table 5 shows a series of robustness checks.

Robustness of Average Volatility

a. *Tax refunds:* Tax refunds generally account for the largest spikes in income. Removing these from household income totals allows us to separate the impact of income tax policy from other sources of income volatility. When tax refunds are included, the average CVof income rises substantially, to 0.51, up from 0.39.

b. *Data quality:* Among the 125 highest-quality, "high-grade" households, where the respondent tended to know more about the precise details of their household's cash flows, the average CV of income is lower, as we would expect. However, the difference is small: the average CV falls by just three points, to 0.36. Here, adding tax refunds increases the average CV to 0.45, up from 0.37.

c. *Calendar:* In the main results, the months follow the calendar, from the 1st day to the last day of the month. Though if an end-of-month paycheck is delayed by a few days (or a beginning-of-month paycheck hits early), it can look like there's more volatility than households actually feel. Similarly, steady weekly earnings can translate into choppy monthly earnings: When workers are paid weekly, some longer months will include 5 paychecks, and thus will have 25 percent more income than months with just 4 paychecks. But from the households' perspective things are steady week by week.

   Although the most granular data available are daily records of income cash flows, we aggregate income to the monthly level. To determine the time unit, we consider frequencies of regular income. Employment income accounts for nearly all regular income that arrives one or more times within the month. The month then is the lowest common multiple of income intervals in nearly all households. Although income change from week-to-week is important for many analyses, especially when explaining the timing of non-income events, we are careful to not overstate the general level of volatility that households feel during the year. As an example, a job that pays weekly would be considered much less volatile than a job that pays every two weeks, even if they shared the same month-to-month level of volatility.

   Still, the daily granularity of the USFD data is essential in checking the robustness of its higher-aggregate volatility results, which we show here. As we discuss below, volatility

from month-to-month varies notably with small changes in the timing and amounts of individual income flows.

Many jobs pay at the start, end or middle of the calendar month. We test whether income a few days early or late have an impact on volatility when income is measured by the calendar month. We redefine the month to start on the 8th (and run through the 7th of the following calendar month) to avoid small changes of up to six or seven days in payments that are distributed near the 1st or the 15th of the month. [12] This change alone lowers the average CV, however slightly, to 0.37, down from 0.39.

The second concern about time units that we address here is income that arrives every week or every two weeks (that is, income that is not based on calendar months). In the months when a job pays three paychecks, though it usually only pays two, or a job pays five paychecks, though it usually only pays four, we reallocate half of the largest income flow to the subsequent month. This reduces the average volatility in the sample slightly to 0.38, down from 0.39.

d. *Trend:* When income is steadily rising or steadily falling over a time frame, measures of volatility can give the impression that there are ups and downs. This is because households spend substantial time below their mean for the period and then substantial time above their mean (or the opposite). The problem is biggest when measuring volatility from year to year, and it matters less when viewing volatility within a year.

   We see significant trends over time in monthly income (within households) during the year. However the trends do not inflate volatility. Monthly income around these trend-lines is as unsteady as the volatility that we measure around the household's flat average. The standard deviation of percent differences from the trend-line (which is comparable in magnitude to the CV) is 0.38, which is close to the average CV of 0.39.

e. *Brooklyn:* If data collection improved gradually during the year, we would expect the sample to exhibit a positive average trend in income over time. We test for a trend in a panel regression of income on time with household fixed effects. The data show a significant, positive average trend of 1 percent increase in income per month, or a 12 percent increase on average for the year.

   We attempt to explain the positive trend by comparing trends across subsamples. Taking into account geography, field researcher, the field researcher's grade of households, income level, and immigration background, the only significant difference in trend is across geography, where New York City is the only region to stand out from the rest. With closer examination we see that the three research sites in New York City (which

[12] In the USFD households, nearly all of the paycheck schedules that were based on the calendar month fell near the 1st or the 15th of the month.

account for 32 percent of the USFD households) are the only sites with a positive trend in monthly income over time. By design of the USFD sampling, the main similarity across the sites in New York City is geography, which suggests that geography drives the trend.

We consider three explanations of the geographic difference: First, New York City was the only site to weather a natural disaster during the study. The Hurricane/Post-Tropical Cyclone Sandy hit the city in late October. This affected New York City fieldwork and the local economy, starting in the first half of the main data collection period of the USFD. We are unable to find data that indicate whether local economic recovery drove an upward trend in sampled household's income in New York City. However any adverse effects on measurement appear to be limited, at most, to one site: Only the site in Brooklyn shows a significant, site-wide drop in recorded income during this time.

Second, we consider whether the trend is real. Sample households may have increased their income on average in New York City, though this appears to be very unlikely since the average trend in each site is quite steep – with average increases in income ranging from 24 percent to 48 percent over the year, depending on the site.

Third, we consider that measurement error may have decreased over time in New York City at a much slower rate than we see elsewhere in the country.

Without concluding the reason for the trend, we test whether sample definitions that exclude New York City show average CV of income close to the CV in the full sample. After excluding sites in New York City, the average CV of income is 0.34 percent, down from 0.39 percent. Still the volatility is relatively high. While part of the difference may reflect measurement error, just as much may be due to selection. Although the New York City sample accounts for 32 percent of USFD households, it accounts for 52 percent of the households below the poverty line. We note that with or without the New York City sample, we find greater volatility below the poverty line than above.

The trend of income over time is most severe in the Brooklyn sample, even controlling for differences in the months when Hurricane Sandy was the most disruptive. Excluding the Brooklyn site, the average CV of income across the full sample falls just slightly to 0.37 , down from 0.39.

f. *Including outliers*:After including the top five percent of the distribution, the average CV of income is 0.46 and the median is lower, at 0.36. Among the high-grade subsample of households the distribution remains right-skewed, with an average CV of income of 0.40 and a median of 0.32. In the discussion of the data we describe the extreme cases of volatility that fill in the top five percent of the income CV distribution.

g. *Combined robustness checks:* While robustness checks yield similar results when they are taken individually, the combined effect the changes in sample definitions on the average CV of income is greater. We combine robustness indicators by calculating the CV with month intervals running from on the 8th of the month, dispersing the week-based paychecks across months, excluding low-grade households, and excluding Brooklyn households, followed by excluding the top 5 percent of households in the remaining CV of income distribution. We find that the average CV falls from 0.39 percent to 0.32 percent (a fall of about a fifth).

   The difference does not appear to be driven by income. Income levels are similar in the new sub-sample, where the average household is 166 percent of the poverty level, up (by about a sixteenth) from 156 percent on average in the larger sample.

Robustness of Volatility across Income Levels

Table 5 also shows the impacts of volatility as households get better off:

a. *Data quality:* High-grade households show a similar difference between poor households and those above the poverty line. And again, volatility above the poverty line doesn't appear to follow a clear trend.

   Tax refunds: Tax refunds are mostly progressive in USFD households, where the lower-income households tended to receive the largest returns (as a percent of their income). When including tax refunds in the volatility calculations, volatility falls monotonically as income notches upward.

b. *Calendar*: The effect on volatility from paychecks that fall near the 1st of the month does not change the results substantially, nor does volatility caused by week-based income schedules.

c. *Brooklyn*: Income volatility in Brooklyn is the highest in the sample, while it also has the largest portion of households below the poverty line. The sharp positive monthly trend in income in this site may indicate significant measurement error, which could drive an overstated negative trend for CV in income in the full sample. Excluding Brooklyn, the average CV of income is generally lower across income levels, though the inequality of the CV across the poverty line remains clear.

d. *Combined robustness checks*: Following all robustness indicators to the sample that appears the most reliable, the inequality across the poverty line remains, while the trend above the poverty line again is unclear. As discussed above, these results are run with month intervals running from on the 8th of the month, dispersing the week-based

paychecks across months, excluding low-grade households, and excluding Brooklyn, followed by excluding the top 5 percent of the CV of income distribution.

7. Conclusion

Economic insecurity is a growing public policy concern, even as attention turns to inequality and mobility. Most financial data on insecurity tracks changes from year to year. Here, we analyze data designed to capture ups and downs within the year. The US Financial Diaries data aim to follow every dollar that a small sample of low-income and moderate-income households earn, spend, borrow, save, and share.

The data show considerable volatility within the year, both in income and spending. This volatility drives insecurities. For poor households, self-reported perceptions suggest that roughly a quarter of income is difficult to predict. Better-off households have an easier time predicting income, but nonetheless we find that approximately 9-15% of income is reported as being hard to predict.

In counting extreme swings of income and spending (spikes and dips of 25 percent of average income or more), we find that the poor households experience 3.6 income spikes and 3.4 dips per year. Non-poor household experience less volatility: 2 to 2.6 spikes per year and 2 to 2.5 dips per year. While better-off households are relatively more stable, they remain exposed to substantial swings.

The same pattern holds when we turn to coefficients of variation of income within the year: the poorest face the greatest volatility, but better-off families nonetheless experience substantial swings during the year. When more than one adult household member is working, total household labor earnings volatility tends to fall, but households are still exposed to considerable volatility.

These results suggest that within-year variation deserves much greater attention. The US Financial Diaries data are not representative of the United States population, but the data reflect important elements of the US population – big city, small city, small town, and rural; immigrant and US-born; white and black; poor, low-income, and moderate-income. A series of robustness checks shows that while particular numbers change depending on the sample, the general patterns do not.

Better-off households are able to smooth the swings to a degree. The spending of poorer households is much more likely to track the ups and downs of income. The findings point to a need for policies that help households better manage liquidity in the short-term. Rather than primarily focusing efforts on encouraging long-term savings, for example, the evidence suggests that tools to manage the short-term can also lead to major improvements in welfare.

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Table 1

Average Household Income (as Percent of SPM), by Predictability Level					
	Very Easy	Easy	Not Easy	Difficult	Very Difficult
Average Income (as Percent of SPM)	165%	140%	144%	106%	96%
Number of Households	81	56	43	17	9

Note: Household income is normalized by the Supplemental Poverty Measure (SPM).

Table 2

Unpredictable Portion of Income				
	Poor (< 100% SPM)	Near Poor (100%-150% SPM)	Moderate (150%-200% SPM)	Middle Income (> 200% SPM)
Households on Average	26.15%	14.65%	8.55%	9.01%
Households at the Median	17.10%	8.85%	5.30%	3.42%
Number of Households	54	48	57	44

Note: Household income is normalized by the Supplemental Poverty Measure (SPM). "< 100% SPM" indicates poverty.

Table 3

Volatility (CV) of Monthly Household Income				
	Poor (< 100% SPM)	Near Poor (100%-150% SPM)	Moderate (150%-200% SPM)	Middle Income (> 200% SPM)
Households on Average	55%	35%	32%	33%
Households at the Median	54%	33%	29%	29%
Number of Households	63	54	60	53

Note: Household income is normalized by the Supplemental Poverty Measure (SPM). "< 100% SPM" indicates poverty.

Table 4

Volatility (CV) of Monthly Household Income for Comparison with Labor Earnings and Non-Labor Income				
	Poor (< 100% SPM)	Near Poor (100%-150% SPM)	Moderate (150%-200% SPM)	Middle Income (> 200% SPM)
Households on Average	54%	34%	32%	32%
Households at the Median	49%	32%	28%	30%
Number of Households	43	44	48	35
Volatility (CV) of Monthly Household Labor Earnings				
	Poor (< 100% SPM)	Near Poor (100%-150% SPM)	Moderate (150%-200% SPM)	Middle Income (> 200% SPM)
Households on Average	72%	40%	38%	32%
Households at the Median	69%	34%	36%	28%
Number of Households	43	44	48	35
Volatility (CV) of Monthly Non-Labor Household Income				
	Poor (< 100% SPM)	Near Poor (100%-150% SPM)	Moderate (150%-200% SPM)	Middle Income (> 200% SPM)
Households on Average	117%	97%	104%	108%
Households at the Median	79%	68%	72%	91%
Number of Households	43	44	48	35

Note: Household income is normalized by the Supplemental Poverty Measure (SPM). "< 100% SPM" indicates poverty. Table excludes households above the 95th percentile in CV of total income, labor earnings, or non-labor income.

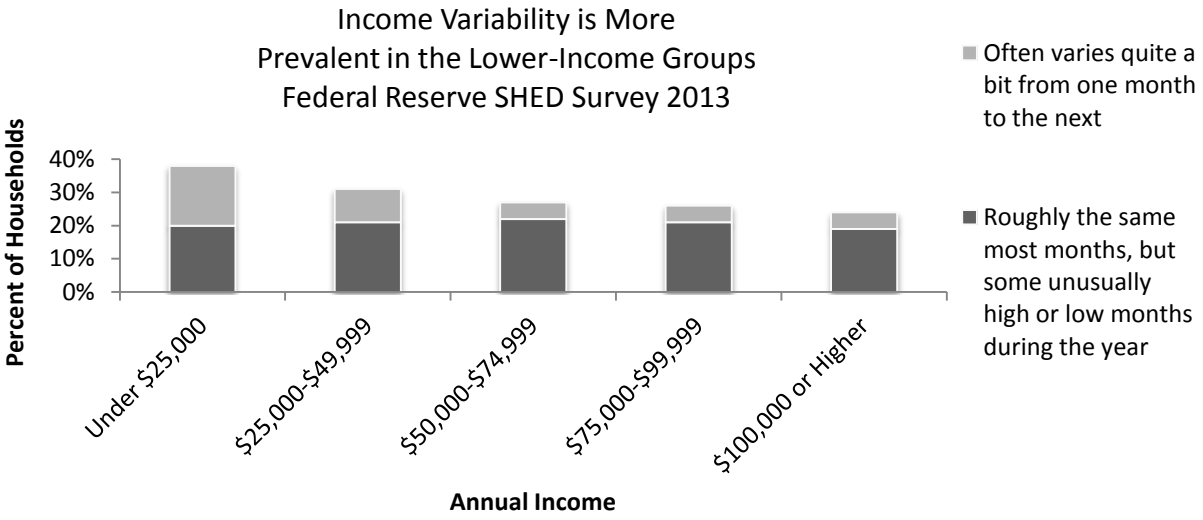
Table 5

Coefficient of Variation (CV) of Monthly Household Income

Definition of Sample or Income	Summary Statistics	Income as Percent of Supplementary Poverty Threshold				
		All	< 100%	100%-150%	150%-200%	> 200%
Households Below 95th Percentile of CV	*Average*	0.39	0.55	0.35	0.32	0.33
	Median	0.34	0.54	0.33	0.29	0.29
	Sample Size	231	64	53	59	53
All Households	*Average*	0.46	0.66	0.40	0.36	0.38
	Median	0.36	0.56	0.33	0.30	0.30
	Sample Size	244	68	56	64	56
High-Grade Households	*Average*	0.36	0.48	0.32	0.35	0.31
	Median	0.32	0.44	0.31	0.30	0.29
	Sample Size	124	28	29	37	29
Including Tax Refunds in Income	*Average*	0.51	0.62	0.53	0.47	0.42
	Median	0.45	0.66	0.46	0.42	0.39
	Sample Size	226	60	54	59	52
Excluding Brooklyn Households	*Average*	0.37	0.51	0.32	0.31	0.33
	Median	0.32	0.47	0.30	0.29	0.29
	Sample Size	209	50	49	56	52
Month Starting on the 8th	*Average*	0.37	0.52	0.31	0.31	0.31
	Median	0.32	0.48	0.26	0.29	0.25
	Sample Size	231	65	53	59	53
Spreading Week-Based Income	*Average*	0.38	0.55	0.32	0.30	0.31
	Median	0.32	0.54	0.30	0.28	0.28
	Sample Size	231	64	53	59	53
Combined Robustness Checks	*Average*	0.32	0.41	0.27	0.31	0.27
	Median	0.28	0.36	0.24	0.28	0.23
	Sample Size	113	23	27	33	28

Note: Household income is normalized by the Supplemental Poverty Measure (SPM). "< 100% SPM" indicates poverty. The "combined robustness checks" row excludes tax refunds from income, starts months on the 8th, spreads week-based income, and narrows the sample to high-grade households, excluding households in Brooklyn (site eight), and excludes households above the top five percentile of CV in the remaining sample.

Figure 1



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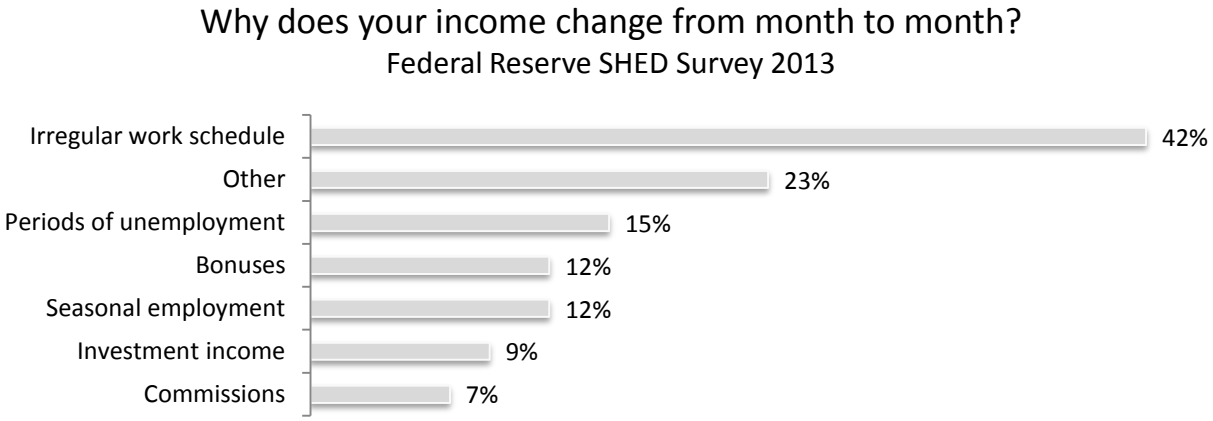

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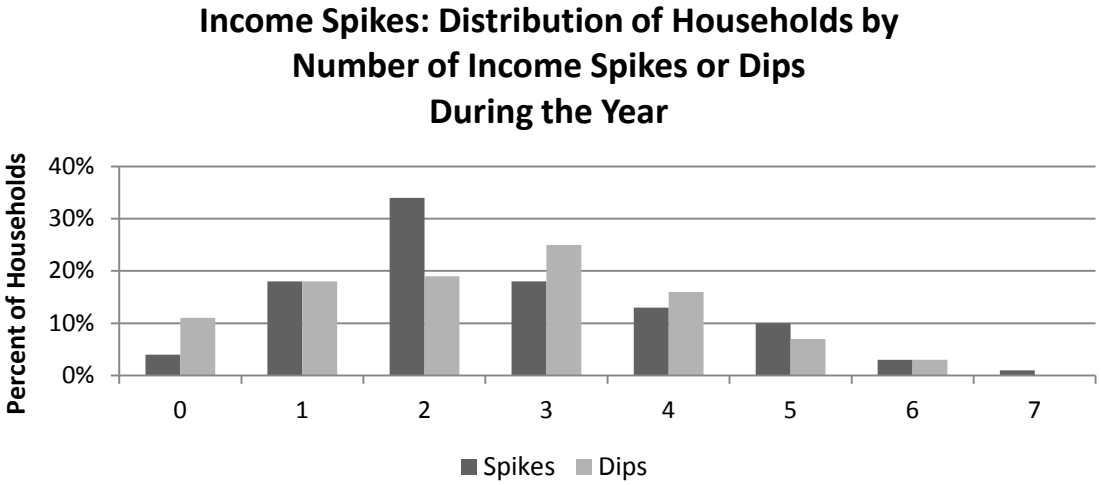

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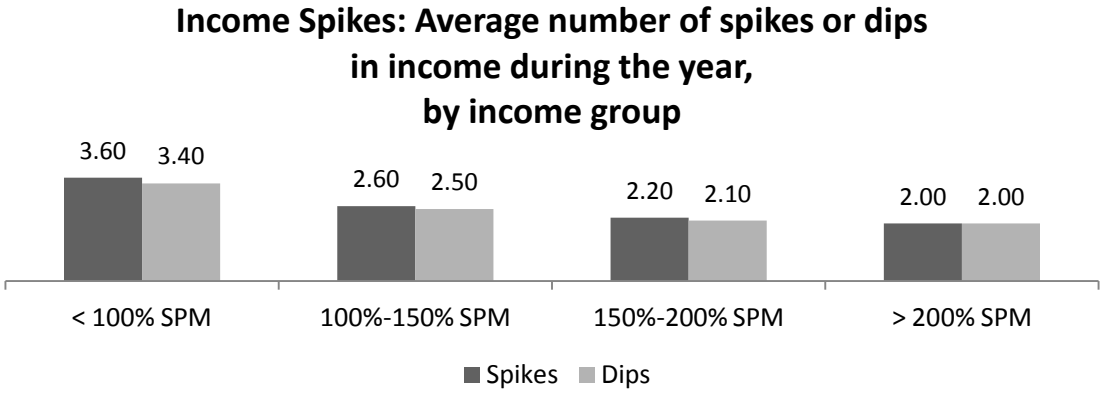

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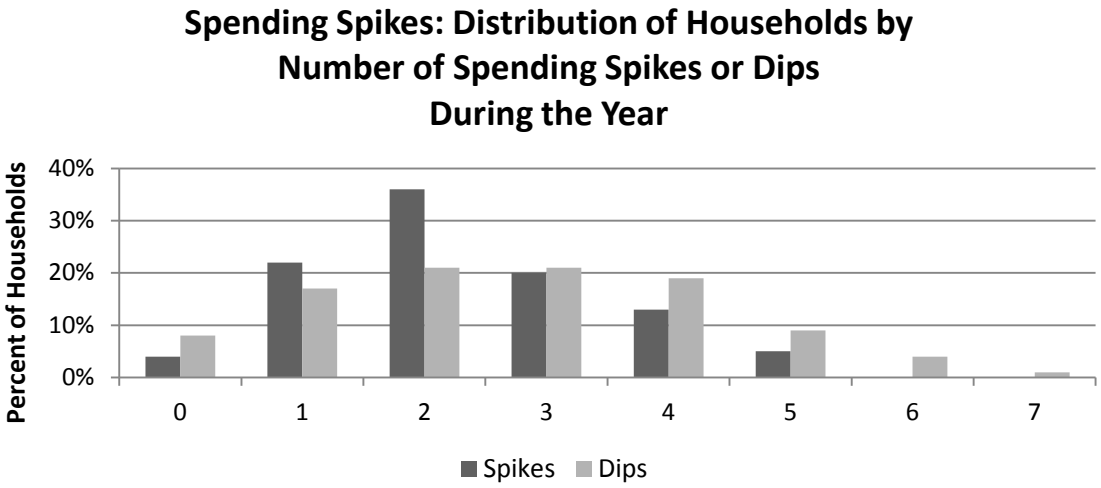

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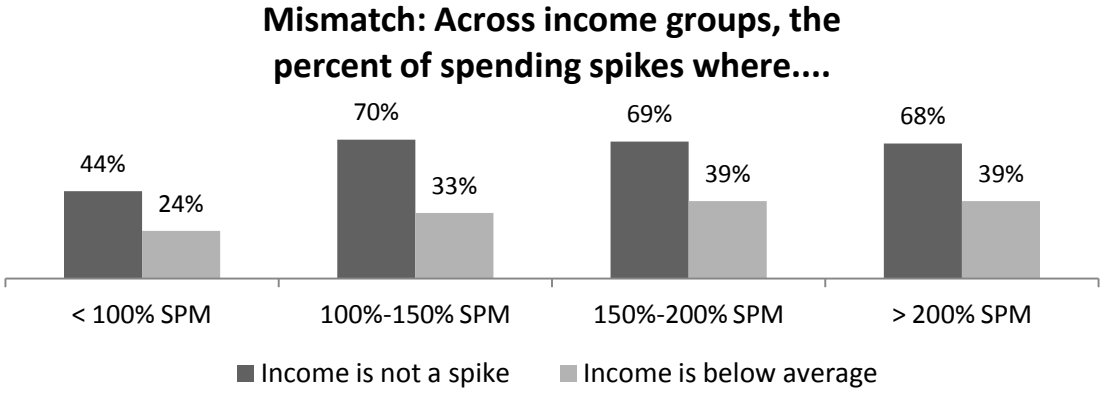

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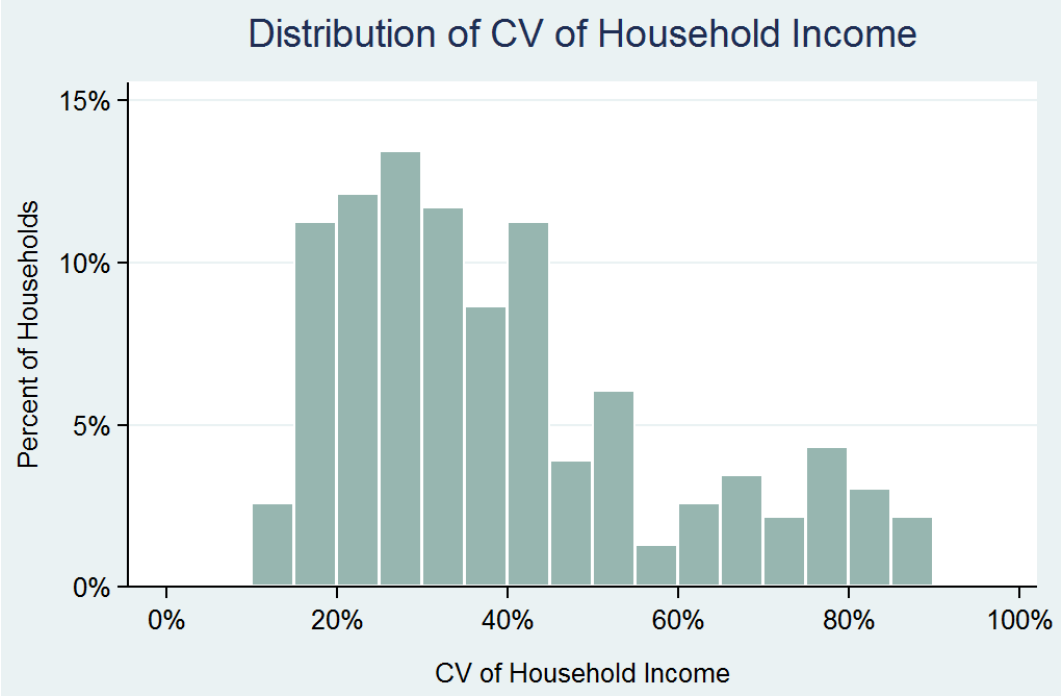

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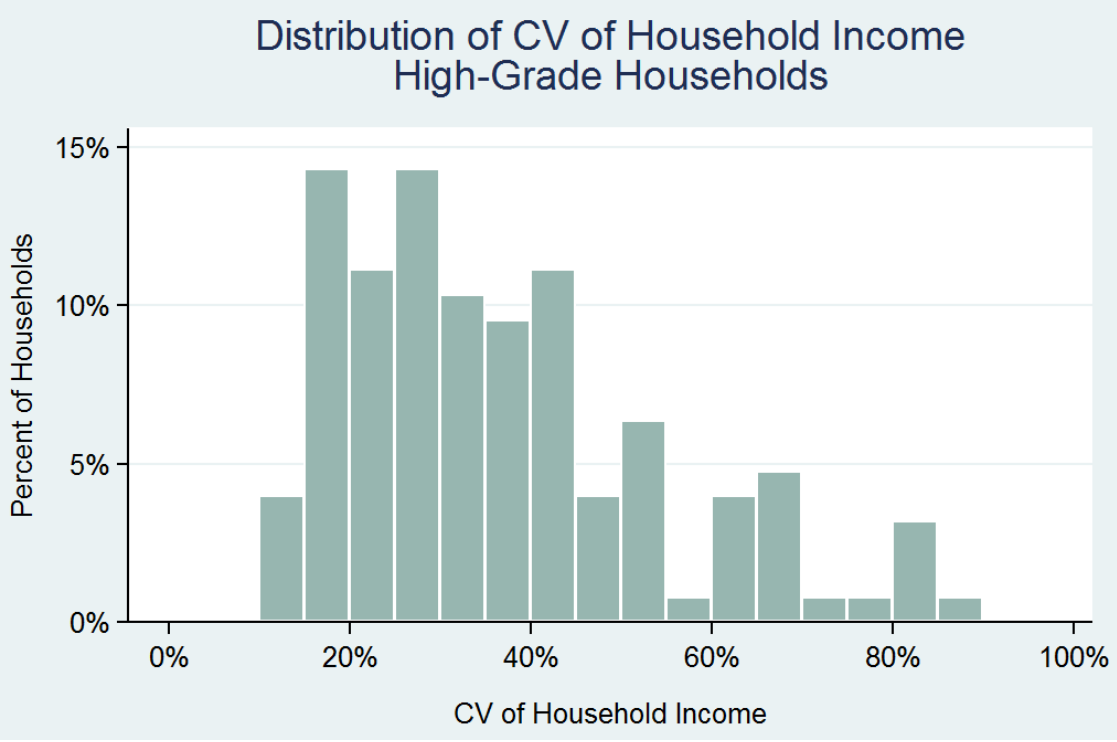

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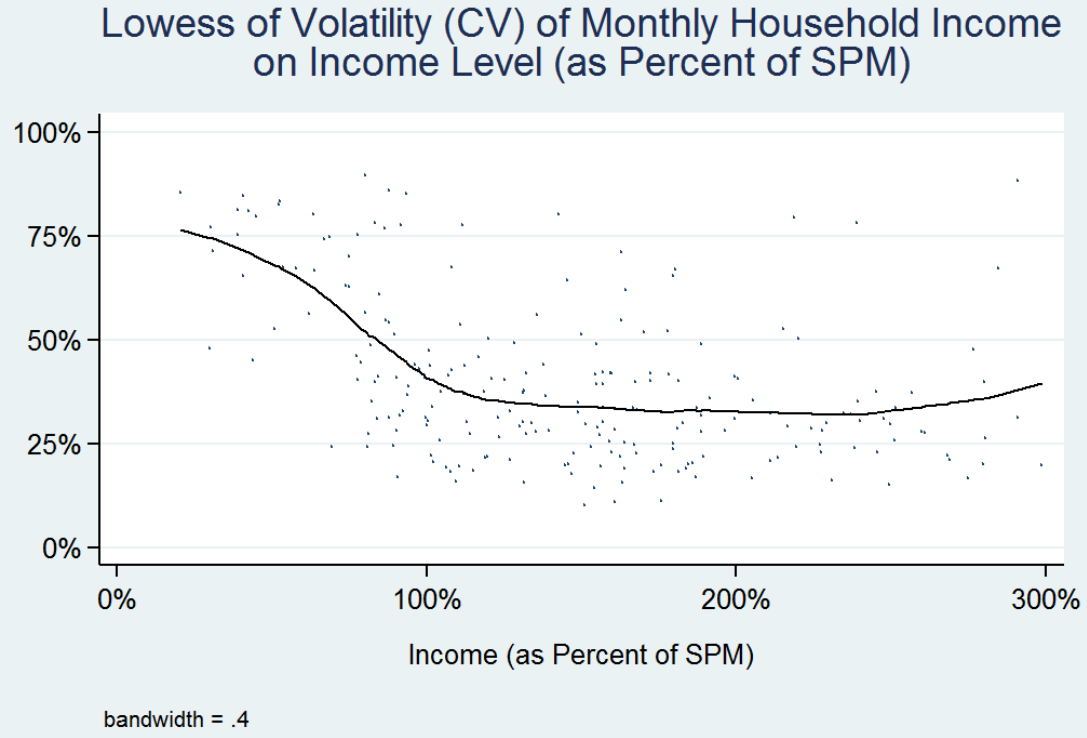
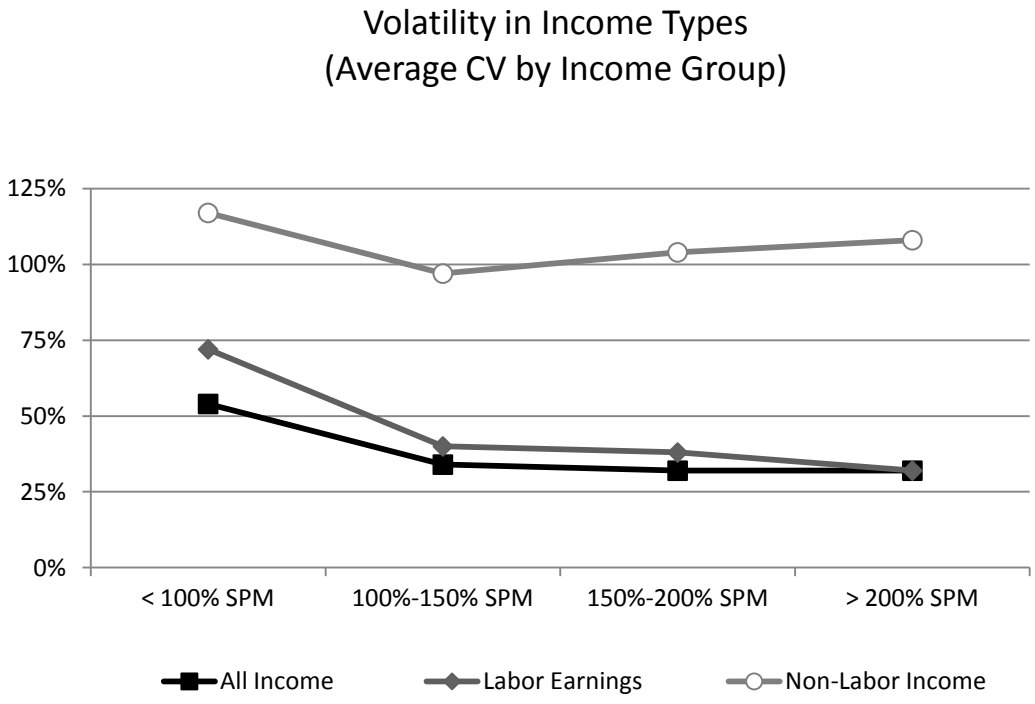
Figure 10