The Income Volatility See-Saw
Implications for School Lunch

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Abstract

Income volatility challenges the effectiveness of the safety net that USDA food assistance programs provide low-income families. This study examines income volatility among households with children and the implications of volatility for eligibility in the National School Lunch Program (NSLP). The results show that income volatility was higher for successively lower income groups and that the major determinants of changes in NSLP eligibility were changes in total household hours worked and the share of working adults. Income volatility in two-thirds of lower income households caused one or more changes in their monthly NSLP eligibility during the year. An estimated 27 percent of households that were income eligible for subsidized lunches at the beginning of the school year were no longer income eligible for the same level of subsidy by December due to monthly income changes.

Keywords: National School Lunch Program, income volatility, program access, and program integrity

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Summary

USDA food assistance programs aim to provide a safety net for low-income families in times of need. Income volatility challenges the functioning of that safety net. Low-income families are often on a see-saw of income changes that make it difficult for program administrators to accurately target benefits and to define sensible eligibility periods. Which families are low-income and for how long are important issues for program policy, and income volatility directly affects those policy decisions. Also, flexible food assistance that smoothes household food consumption over the ups and downs of labor force participation is important in providing assistance to the working poor.

What Is the Issue?

Understanding the implications of income volatility for food assistance program eligibility is particularly important if the programs are to effectively serve the needy. Questions that must be answered include how often does program eligibility for low-income families change within a year? How does income volatility compare across income groups? What are the labor force participation and household changes most associated with short-term income changes? We answer these questions using nationally representative household survey data.

We also looked at how income volatility affected eligibility for free and reduced-price lunches in the National School Lunch Program (NSLP). USDA had been concerned about "overcertification"—where local school food authorities erroneously certify that children are eligible to receive free or reduced-price lunches. New rules in the Child Nutrition and WIC Reauthorization Act of 2004 redefined eligibility so that income volatility has become less relevant as a source of the erroneous certification. However, understanding the past role of income volatility in the NSLP is important because income volatility can affect policy changes for other food assistance programs that aim to support working families in times of need.

What Did the Project Find?

Our study found that the lower a household's income, the more likely it is to face volatile swings in monthly income. Such income volatility meant that, before the recent rule changes, the children in these households moved back and forth across the eligibility threshold for the NSLP. Changes in total household hours worked and in the share of adults working were the primary causes of the changes in monthly income.

Income Volatility Dynamics

We measured monthly income changes across the threshold that marks income eligibility for a reduced-price school lunch. That threshold is found by first comparing income to the poverty line that applies to the household's size. When income is at or below 185 "percent of poverty," a student is eligible for a reduced-price lunch. We found that, for households with income below 185 percent of poverty in at least 1 month of the year, two-thirds (65 percent) had income above that threshold in at least 1 other month in the same year. Households with average monthly income between

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130 and 240 percent of poverty were particularly affected by volatility, crossing the eligibility line five times per year on average.

The most important factors associated with exit from or entry into program eligibility (an increase or decrease in income relative to 185 percent of poverty) were similar. In both cases, changes in total household hours worked and in the share of adults working were the most likely to lead to exit or entry. The results point to the importance of the labor market participation of all household members as a source of short-term income volatility.

Households were grouped into six income-to-poverty categories. Income volatility was found to be successively higher for each lower income-to-poverty group. The monthly income variation for households below 75 percent of annual poverty was double that of households above 300 percent of annual poverty.

Effects of Income Volatility on NSLP Error Rates

Month-to-month income changes could feasibly explain a large portion of estimated overcertification rates. In the 3 school years examined, an average of 27 percent of households that were income eligible for either a free or reduced-price lunch in August were no longer income eligible for the same lunch benefit by December of each year. This estimate accounts for much, or all, of previous overcertification estimates, which range from 12 percent to 33 percent. But, because we do not also estimate the extent of the other sources of error, this estimate must be qualified. Other studies have found that misreporting and administrative error also contribute to overcertification. Furthermore, this estimate does not take into account participation behavior of eligible households.

How Was the Project Conducted?

We used 1996 panel data from the Survey of Income and Program Participation on households with children and several other methodological approaches to understand income volatility and how it affects eligibility dynamics. We used three complete school years from the panel: 1996-97, 1997-98, and 1998-99. We compared coefficients of variation of monthly income across income groups. We examined changes in income eligibility for NSLP within the school year for different subpopulations.

We used a hazard model to estimate the causes of income changes in eligibility. Our analysis was conducted twice to analyze separately the factors that could lead to decreases or increases in income across the threshold of 185 percent of poverty. A rich set of events that might trigger an increase or decrease in income-to-poverty status was tested while also controlling for unchanging demographic and labor market participation characteristics.

Under the old NSLP rules, by December, a sample of families was asked to provide documentation of their current income to verify their continued eligibility. In the survey data, we traced monthly income changes from the beginning of the school year to December. This exercise provides an estimate of the effect of income volatility on overcertification errors. We also examined the effects of using annual income as a hypothetical eligibility criterion versus the criterion of 1 month of income.

Introduction

Federal food assistance programs are means tested: A household is eligible to receive program benefits if household income falls below a certain threshold and, in some programs, household income affects the amount of program benefits. Income volatility—month-to-month changes in a household's income—creates policy challenges for targeting and administration. Because income fluctuates, a household that is poor today may become ineligible in subsequent months due to an increase in income. Program integrity is reduced when a household continues to receive program benefits after it has lost eligibility.

Program integrity is enhanced by selecting a reporting policy or mechanism by which to identify households that are eligible or no longer eligible. One such policy is to require households to submit detailed income information to the program at regular intervals. This policy provides the opportunity for program staff to more accurately assess eligibility, but it creates greater administrative burden in terms of staff time and resources. And, it can be a burden on households themselves if the detail required is hard to compile or if the households are required to report income frequently. Such a burden can be a disincentive to participate even for eligible households. Thus, the phenomenon of income volatility creates fundamental policy tradeoffs between access and integrity.

In this study, we examine the dynamic effects of monthly income volatility to better understand how it affects low-income populations. We also examine the implications of income volatility for household eligibility and program integrity in the National School Lunch Program (NSLP). The analysis contributes to our understanding of the potential impacts of volatility on other U.S. Department of Agriculture (USDA) food assistance programs and on the changing economic conditions of low-income households.

Because of the importance of income volatility and the lack of empirical analysis on the topic, we explore the issue in some depth. The analysis starts by addressing these questions:

- *Is income volatility relatively larger or smaller for lower income households than for higher income households?* In this section, we compare the distributions of income volatility across six income groups using the coefficient of variation, a scale-independent measure of volatility.

- *How often during a typical school year do households experience monthly income changes that cross the income-to-poverty ratio threshold of 185 percent?* We examine the income distribution of households with children and the frequency of income changes over this threshold, which is used in the NSLP and other food assistance programs.

- *What types of changes in household circumstances explain transitions above and below the 185 percent threshold for different types of households?* We examine descriptive statistics and estimates from hazard models to understand which short-term trigger events for which household types are most likely to explain eligibility changes.

Second, we examine the implications of income volatility for targeting efficiency in the NSLP. As this report shows, an understanding of the interaction between income volatility and eligibility policy sheds light on recent concerns about NSLP integrity. A series of studies in the late 1990s raised concerns about the accuracy of the NSLP application and eligibility certification procedures. Estimates of "overcertification" rates—the share of students receiving benefits for which they were not entitled—ranged from 12 percent to 33 percent. Undersecretary Bost, the USDA official who administers the domestic food assistance programs, stated at a Senate committee hearing that "we have a problem with the accuracy of certification in the National School Lunch Program. While we do not know the exact scope of the problem, we do know that we have a problem and that the problem appears to be getting worse."[1]

The U.S. Congress recently amended the National School Lunch Act through the Child Nutrition and WIC Reauthorization Act of 2004. One of the most important changes to eligibility was to extend the eligibility period from 1 month to the school year. Before that, the rules stipulated that households report income changes in excess of $50 per month and household composition changes to school authorities. If these reported changes led to a change in a household's eligibility, school authorities were supposed to increase, reduce, or terminate benefits accordingly. Households seldom reported such changes, and the administrative burden would have been significant if they had.

This study estimates how income volatility contributed to overcertification as defined under the pre-2004 act regulations. Understanding the concerns about overcertification requires a brief description of the program eligibility certification process. The NSLP contains three categories of meals—full-price, reduced-price, and free—which correspond to the three different prices charged to students for a lunch. A student's income eligibility for a particular meal category is based on the household's income relative to poverty—which in turn depends on income and the number of people in the household.[2] If a student's household income relative to poverty is equal to or below 130 percent, the student is eligible for a free lunch. If a student's household income relative to poverty is between 131 percent and 185 percent, the student is eligible for a reduced-price lunch.

By law, the school food authorities (SFAs) must verify the eligibility status of a small sample of students who were certified as eligible at the time of application, which is usually in August or September. Once a household is selected and contacted by the SFA, it must produce proof of income. Under the old rules, this "verification" procedure had to be conducted before mid-December. If their current income did not match the eligibility criteria for which the children had qualified at the start of the school year, the benefits were changed, as applicable.

Three factors have been identified as possible sources of overcertification. First, the household could provide inaccurate information—knowingly or unknowingly—about its income or household size. Second, the school staff could incorrectly assess the household's eligibility. And third, changes in monthly household income (or size) could affect the household's eligibility status—under the old rules. This source of error can be examined with existing national data, unlike the two other sources of error which require special data collection efforts.

[1]Statement of Eric M. Bost, Undersecretary, Food, Nutrition, and Consumer Services before the Senate Committee on Agriculture, Nutrition, and Forestry, April 3, 2003.

[2]The poverty guidelines used for Federal means-tested programs are established annually by the U.S. Department of Health and Human Services; they differ slightly from the Census Bureau poverty thresholds. In 2004, the Federal poverty guideline for a household of four was $18,850 of annual income.

The extent to which each potential source of error actually contributed to total overcertification is unknown. Several recent investigations have looked into the roles of other sources of error. This report focuses on the income volatility explanation and addresses these two questions:

- *How many households that were eligible in August were still eligible in subsequent months?* We trace how changes in income by month affect eligibility changes of initially eligible households. This process allows us to estimate the likely effects of income volatility on verification results in December as well as by the end of the school year.

- *Is one month of income a good predictor of eligibility in the coming year?* We estimate how the use of one month of income to determine eligibility (in August) compares with the use of 1 year of income, which better matches the eligibility period under the new law. This process allows us to understand the importance of another eligibility policy, the ability of households to apply throughout the year.

We use the 1996 panel of the Survey of Income and Program Participation (SIPP) for the analysis. SIPP is a nationally representative longitudinal panel that allows us to track changing household income over time for the same set of households. SIPP contains monthly income data, which allow us to measure income dynamics over a shorter timeframe than most datasets permit. For the problem of overcertification in the NSLP, annual data lack the needed detail for identifying which eligible households at the start of the school year subsequently exit eligibility later in the year.

The report reviews the major findings from studies on income volatility as well as recent studies on overcertification. Previous economic research that relates to income volatility includes studies on poverty dynamics and on Food Stamp Program participation dynamics. The report also discusses a data transformation that was done to correct for "seam bias," an issue in longitudinal surveys that could confound our measure of monthly income volatility.

The analysis suggests overall that households eligible for free or reduced-price NSLP meals experience substantial income fluctuations, largely from labor market events, and that those fluctuations may explain a large amount of overcertification error. The report does not estimate the size of other types of error that could also be important, such as errors made by households or administrators. But the evidence on income volatility alone contributes an important piece to the puzzle of what caused high overcertification error rates in the past. The example of how income volatility has affected NSLP eligibility also illustrates how income volatility can affect eligibility in all USDA food assistance programs.

Data and Eligibility Criteria

SIPP: Description and Issue of Seam Bias

We use the 1996 panel of the Survey of Income and Program Participation (SIPP). SIPP was designed to measure government program participation and income from a full list of possible sources, including labor force participation, public assistance, business income, and assets. SIPP is a series of panel surveys that cover 2½-4 years, collecting detailed information for each household member for each month during the course of the panel.

Besides the benefits of the longitudinal design mentioned in the introduction, SIPP also has the advantage of supplying monthly rather than annual income, which provides the opportunity to analyze income dynamics over a shorter time frame than has been common. The 1996 panel is a 4-year panel that started in December 1995 and ended in February 2000. It had an initial sample size of 40,188 households. Households from areas of high poverty concentration were oversampled in order to provide sufficient data for evaluating program effects. The 1996 panel differed from earlier panels in that it followed households over a longer period, it started with a larger sample size, and no other SIPP panels were fielded at the same time. The 1996 panel was the first to use Computer-Assisted Interviewing (CAI) techniques that generally improve the accuracy of data collection.

SIPP is structured in "waves," which are the number of times each household is interviewed; the 1996 panel encompassed 12 waves. Within each wave, the household reports on the previous 4 months of activity, which are referred to as "reference months 1 through 4," with the interview taking place effectively in the fifth month. Data for the month in which the interview is conducted is collected in the subsequent wave, making the first month of each wave the month in which respondents report on the previous 4 months.

SIPP has two important disadvantages: attrition and seam bias. The first problem, attrition, is a problem inherent to all longitudinal surveys. Over the course of the survey, some participants will choose to drop out, changing the composition of the sample. The Census Bureau provides household weights for each month in order to match the initial sample design. We use those weights in our analysis.

The other problem is seam bias, which occurs in surveys that ask for information from differentiated periods in the past. As described, the SIPP interviewer contacts the interviewees every 4 months (every "wave") and asks them to report information for each month over the past 4 months, the "reference period." If the interviewee does not remember exactly the different circumstances of each month, he or she is likely to use some kind of inference strategy to fill in the details. A respondent may blur differences in the past for many reasons, ranging from having a poor memory to deliberately attempting to speed up the interview. Whatever the cause, the effects are evident in the data: When data are plotted across months, differences in the values of the data tend to be greater between months in different reference periods than between months in the same reference period.

Earnings and total income data are susceptible to seam bias error (U.S. Department of Commerce, U.S. Census Bureau, 1998). However, no research

is known that examines the extent of seam bias for earnings or income data.[3] Most studies of poverty dynamics using SIPP have not attempted to address the problem, while many others have addressed it by combining the reference period months into one period, thus aggregating monthly data into data covering 4 months. This technique is unavailable for this report because month-to-month changes in income are central to the analysis. We want to understand the differences that occur in very short time intervals in order to understand NSLP eligibility changes between September and December.

In the 1996 SIPP panel, we find seam bias in the income data. Table 1 shows the median percentage change in income in absolute terms by reference month, where the first month of the reference period is the month following the seam (Month 1). If there were no seam bias, there would be no noticeable differences in the percentage income changes across months. However, in the 1996 SIPP panel, the magnitude of the percentage income change in Month 1 was much greater than the income changes in the other months: In Month 1 for each of the 3 school years examined, the percentage income change was 17-19 percent; for the other three reference months, the percentage income change was 2-6 percent.

Seam bias creates a type of artificial volatility in some months but not others. Reported income may jump from one month to the next due to some combination of an actual income change—which we want to identify as much as possible—or to misreporting at the seam. Thus, using the raw, unadjusted data on reported income would result in overestimating the true extent of volatility. In order to differentiate between true but unobserved income volatility and volatility from misreporting, we need to smooth the data in some way. We perform two kinds of adjustments to the data that depend on different assumptions about the cognitive causes of the seam problem.[4]

Based on two fundamental explanations for seam bias error, memory failure and inference strategy, we test two ways of adjusting the data to smooth the differences across the seams.[5] In our first adjustment, we assume that the income change that was misreported at the seam would have been evenly distributed over the first 3 months in the interview period if accurately reported and that the most recent month was accurately recalled. This inference strategy is a common one used by interviewees and is referred to as a "constant wave response" (Rips et al., 2003). In the second adjustment, we assume a decreasing distribution around the seam with a small amount spilling back into the last month of the previous period and the rest being distributed in decreasing order from the first month of the current reference period through the next 2 months. The cognitive basis for this adjustment is pure memory failure. It assumes that the respondent knows the general period of the change and that the change was likely to have occurred close to the date reported but truly occurred slightly before or sometime afterward.

Table 1

Median of the absolute percentage income change by reference month reveal seam bias in unadjusted data

	Reference month			
School year	1	2	3	4
	Percent			
1996-97	19	3	4	6
1997-98	18	3	4	5
1998-99	17	2	3	4

Source: U.S. Department of Commerce, U.S. Census Bureau, 1996 panel of the Survey of Income and Program Participation.

[3]Research on the extent of seam bias has focused on how it affects estimates of program participation transition data (Doyle, Martin, and Moore, 2000; see U.S. Census Bureau, 1998, "SIPP Quality Profile" for a review).

[4]We also tested other ways of adjusting and organizing the data that are not discussed here, such as using only the most recent month of data (the fourth reference month) and using 3-month intervals that skip the seam instead of 4-month intervals. Both methods provided similar evidence of income volatility as we show later.

[5]See Kalton and Miller (1991), Marquis and Moore (1990), Rips et al. (2003) for analysis of the cognitive roots of seam bias.

Table 2

Median of the absolute percentage income change by reference month reveal seam bias in adjusted data 1 but no seam bias in adjusted data 2

	Reference month			
School year	1	2	3	4
	Adjusted data 1, percent (even distribution)			
1996-97	13	3	4	12
1997-98	12	3	4	11
1998-99	11	2	3	10
	Adjusted data 2, percent (decreasing distribution)			
1996-97	7	9	9	9
1997-98	7	9	8	8
1998-99	7	9	8	8

Source: U.S. Department of Commerce, U.S. Census Bureau, 1996 panel of the Survey of Income and Program Participation.

The effect of the two data adjustments on the measurement of data changes at the seams is shown in table 2. The first adjustment does not fully remove the apparent seam bias as measured by absolute percentage income differences at the seams. The second adjustment, which was one of a decreasing function around the seam, does remove the apparent seam bias; the absolute percentage income change across periods is fairly equal at the seam and within the reference period. This suggests that the second is the better of the two adjustments as an alternative to the unadjusted data. In the following analysis, we report results from the unadjusted data and the adjusted data using the second adjustment.

Eligibility and Sampling Criteria

In this study, "eligibility" is determined strictly by NSLP income limits even though households are also eligible directly as a result of participating in Temporary Assistance for Needy Families (TANF), the Food Stamp Program, or the Food Distribution Program on Indian Reservations (FDPIR). We use a pure income definition of eligibility in order to directly relate eligibility to income volatility. The restriction has little effect: In the SIPP data, only 1 percent of the households that would have been eligible by program participation were ineligible by income.

We sometimes combine eligibility for either a free lunch or a reduced-price lunch into one "eligible" category. One reason for combining is that it simplifies the discussion. Another is that the savings to USDA of catching errors related to changes in free to reduced-price status are much smaller than the savings related to finding errors related to eligibility for either benefit. In 2004-05, the amount reimbursed to schools by USDA was $1.84 for a reduced-price lunch and $2.24 for a free lunch; both are much larger than the $0.21 reimbursement for a paid lunch.

We use the same household definition as that defined in the SIPP. When someone moves from one of the original households interviewed, the person who moved and his or her household members are classified as a new household. Also, when someone new moves into the original household, he or she is considered part of the original household. This definition ends up being a rather strict test for total household eligibility because it counts all household members' incomes toward the total, whereas, in practice, all household members may not share income as assumed.

Income Volatility Analysis

Recent studies of poverty dynamics highlight the importance of income volatility. In a recent Census report using the 1996 SIPP panel, John Iceland (2003) found that the average monthly poverty rates for each year in the panel were higher than the corresponding annual poverty rates (1996-99). Other studies found that annual poverty rates are lower than the average share of people in poverty during at least 1 month of the year (Coder et al., 1987; Ruggles and Williams, 1986; Doyle and Trippe, 1991).

Huff Stevens (1999) found that half of all individuals exiting poverty reentered poverty within 4 years. She used annual data from the Panel Study of Income Dynamics for years 1967-88, allowing her to focus on changes across several years (but not across months). She concluded that the amount of time spent in poverty has been underestimated by previous work that counted only single spells of poverty. She cited the following conclusion from a review of poverty studies, all of which focused on single spells: "…most low-income people, including most blacks, will be poor for less than two years" (Gottschalk et al., 1994). But the chances of them falling back into poverty are high, according to Huff Stevens. She writes, "[M]ore than half of all blacks and around one third of whites falling into poverty will spend five or more of the next ten years in poverty." Monthly fluctuations, as opposed to the annual fluctuations which Huff Stevens looked at, should show even greater effects of cycling in and out of poverty.

Analyses of the dynamics of participation in USDA's Food Stamp Program (FSP) have highlighted the importance of multiple spells of participation. To be eligible for food stamps, an individual must have a monthly income of 130 percent of the poverty level or below. Burstein (1993) used SIPP data from the late 1980s and found that 38 percent of people who exited the program reentered within a year. The median spell length was 6 months. Gleason et al. (1998) similarly found high FSP reentry levels in the early 1990s using SIPP. They write: "More than half of those who stop receiving food stamps reenter the program within two years… Among all individuals who exit food stamps, one-fourth starts receiving food stamps again within four months and 42 percent within one year." A literature review by Gleason et al. (1998) has more examples of frequent exit from and entry into the FSP.

Income Volatility by Income Group

Research on month-to-month variation of household income is scarce, so this section begins by examining the magnitude of monthly income volatility. We use the coefficient of variation (CV), which is the standard deviation divided by the mean, as the main statistic to compare volatility across income groups because it measures relative volatility. One can expect that the standard deviation of a household's monthly income increases in size with income, but the CV does not necessarily do so. Scaling the standard deviation by its mean produces a statistic of dispersion that is more easily compared across income groups. Each household was assigned to one of the six income groups according to the household's average monthly income status relative to the monthly poverty line, averaged over the number of months the household was in the survey.[6] The groupings were roughly defined in light of the 55-percentage-point difference between the NSLP eligibility cutoffs at

[6]We include all households that were in the survey for 12 months or more in order to maximize observations (11,135). The median number of months in the survey for those in the survey 12 months or more was 31 months, and 39 percent of the households were in for the maximum 36 months. The results are similar, if not more pronounced, when using the smaller sample sizes of households in the survey for 24 months or more (7,195 households) or in the survey for 36 months (4,333 households).

130 percent and 185 percent of poverty for free and reduced-price lunches. The groups are defined as 0-75 percent, 76-130 percent, 131-185 percent, 186-240 percent, 241-300 percent, and 301 percent and over.

Each household in the sample can be thought of as having a mean long-term income, measured for the given household as the average of its monthly income, where the average is taken across all months that a household participated in the survey (for households participating 12 months or longer). For the income group in the range of 0-75 percent of poverty, long-term income was $699 per month on average across households in the group. For the highest income group in the range of 300 percent of poverty and over, long-term income was $6,907 per month, averaged across households in the group. For the sample as a whole, long-term income averaged $4,428 per month.

In any given month, a household's current (monthly) income is typically different from its long-term income due to income fluctuations around the household's mean income. The household's standard deviation of monthly income is a measure of how dispersed its current income is from its long-term income in a typical month. The standard deviations were $342 for the lowest income group and $1,974 for the highest income group (on average across households within each respective group). On average across all households in the sample, the standard deviation was $1,303. The CV expresses the standard deviation of income relative to the size of the household's long-term income. For example, one of the households in the sample had a long-term income of $3,956 and a standard deviation of $866, making its CV equal to 0.22, or 22 percent dispersion relative to the mean ($866/$3,956). This 22 percent figure can be compared with the CV of either a lower or higher income household.

Figure 1 shows the CVs in monthly income across six income groups (adjusted for seam bias).[7] The line that crosses through the middle of each box represents the median of the CV distribution for the particular income group. The bottom endpoint of the box represents the points below which 25
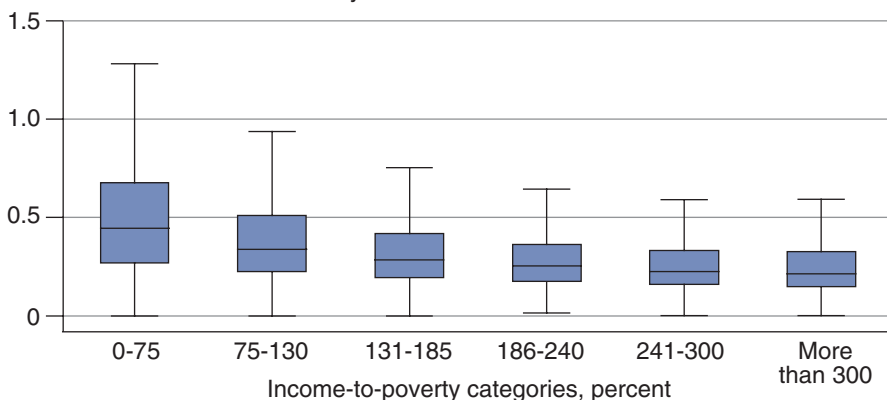
[7]The same diagram using unadjusted data shows qualitatively the same result of lower CVs at higher income-to-poverty levels. But the unadjusted data show higher CVs for all groups than do the adjusted data, as expected.

Figure 1
Distribution of income volatility over 12 months by average share of poverty status
Monthly income variation is higher among lower income groups

Coefficient of variation of monthly income

Income-to-poverty categories, percent

Note: Number of observations = 11,135.
Source: U.S. Department of Commerce, U.S. Census Bureau, 1996 panel of the Survey of Income and Program Participation.

percent of households have that level of variation, and the top endpoint of the box represents the points below which 75 percent have that level of variation.
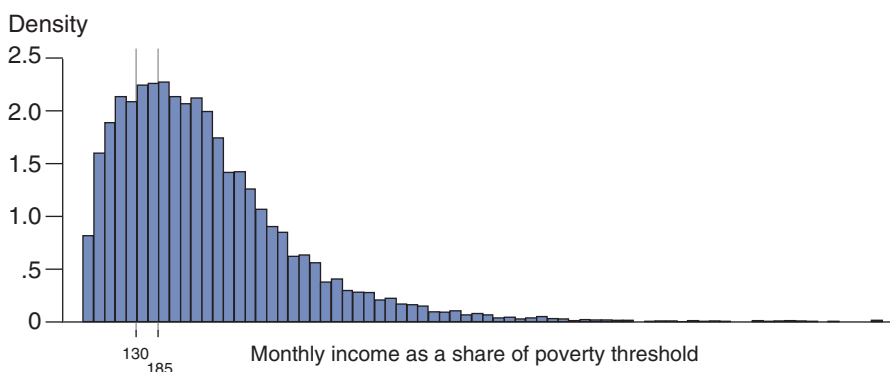
The diagram shows a continuous decline, from the poorest group to the richest, in the medians of the groups' CV distributions. This decline means that a typical lower income household (at the median of the group's distribution) has higher percentage variation in income than a typical higher income household. In addition, decreases across income groups can be seen at the 25th and 75th percentiles, as well as at the upper limits of the CV distributions. So, a lower income household with high volatility for its group has greater volatility than a household with high volatility in any of the successively higher income groups. And even a lower income household with low volatility has greater volatility than households with low volatility in the successively higher income groups. In conclusion, the entire CV distribution for an income group shifts downward as income increases (see app. table 1).[8]

A significance test was performed to examine whether the measured differences in mean CVs across groups are statistically significant. The mean CV in each income-to-poverty status group was compared with the mean CV of all the other groups combined. In each case, a group's CV was significantly different at the 0.001 level from the combined mean of all other groups. An additional test was performed, and each mean CV was significantly different at the 0.001 level from the mean CV in the following and preceding income-to-poverty groups. Thus, the declines in CVs across income groups in figure 1 are unlikely to be due to chance. Lower income groups exhibit greater volatility, in percentage terms, in their monthly household income than do higher income households.

What are the implications for NSLP eligibility of income volatility being higher at lower income levels? To answer that, we need to have some understanding of how many families would be likely to change eligibility status as a result of income volatility. How many families are close to the income eligibility limits for subsidized meals? If family incomes are unlikely to fall close to the limits, then income volatility would be less likely to change the eligibility status of many households. Figure 2 shows a histogram of the

[8]Appendix table 1 provides the numerical values for the diagrams as well as a few other statistics that describe the CV distributions for both adjusted and unadjusted data. The means of the CV distributions range from 0.31 for the highest income group to 0.61 for the lowest income group. Because the seam bias-adjusted data were derived by smoothing reported income, it is not surprising that the mean CVs of each income group are lower than in the unadjusted data: Mean CVs range from 0.27 to 0.53 across income groups. Thus, whether examining adjusted or unadjusted data, the CV of the lowest income group is double the CV of the highest income group.

Figure 2
Distribution of income to poverty, June 1996
Households are concentrated around 185 percent of poverty

Note: Number of observations = 10,456.
Source: U.S. Department of Commerce, U.S. Census Bureau, 1996 panel of the Survey of Income and Program Participation.

distribution of monthly income-to-poverty ratios in July 1996, the month that would have been typically used to determine eligibility (in August) for the 1996-97 school year. For each household, the monthly income-to-poverty ratio is calculated by dividing the seam-adjusted income to the monthly poverty line. The graph is labeled with "130" and "185" to denote 130 percent and 185 percent of poverty, and each bar has a width of about 0.27 percent. In July 1996, the mode of the distribution was at 185 percent of poverty—more families were clustered around 185 percent of poverty than around any other income-to-poverty ratio. Thus, the distribution suggests that a relatively large number of households might experience eligibility changes in the event of an income change.
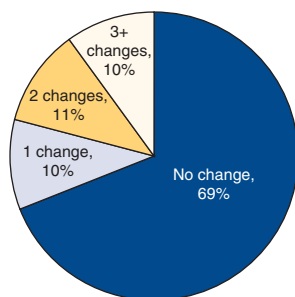
Eligibility Status Changes

How would income volatility have affected eligibility status over the course of time under the old rules for NSLP? In this section, we calculate the numbers of changes in monthly eligibility status within 1 year and, separately, within 3 years. The frequency of changes in eligibility provides a measure of the implications of income volatility for administrative burden when SFAs had to reexamine a household's eligibility status for every $50 change in income. Even though the rule was not generally enforced, it is an indicator of how the year-long eligibility rule reduces the SFAs' statutory responsibility and the amount of work that would have been required to fully enforce the previous law.

For the analysis in this section, households eligible for either the free or reduced-price categories are combined. We, therefore, examine the frequency of income changes around the 185 percent income-to-poverty threshold. Our definition of a change in status is one of either exiting or entering eligibility; we do not distinguish between the directions of change in order to get a simple directionless measure. The reasons for change in one direction or the other may be different—and they have been shown to be (for example, see the next chapter "Income Volatility Trigger Events" and McKernan and Ratcliffe, 2002)—but the frequency of eligibility change itself gives a distilled picture of the effects of volatility. We start the year in July because the monthly income for July is the first that may be used to determine eligibility if the household applies in August.

Figure 3 depicts the distribution of eligibility status changes across households with children during the 12-month period from July 1996 to June 1997. Of those, more than two-thirds (69 percent) never changed status. Of the households that changed status, it was just as common to change one time (10 percent of households) as it was to change two (11 percent) or three times or more (10 percent).

Figure 3
Number of changes in NSLP eligibility status among all households, 1996-97
Eligibility status changed in one-third of all housholds within a year

Note: Number of observations = 8,753.
Source: U.S. Department of Commerce, U.S. Census Bureau, 1996 panel of the Survey of Income and Program Participation.

To translate the numbers of status change into an upper bound estimate of the administrative burden associated with the former law, we first must assume that all of the income changes are reported by households. Then, because many households change status more than once, we should count each change as a separate incident that would have required action on the part of the SFA. On this basis, the 11 percent of households that required two status changes are equivalent to 22 percent of households that required one change. The 10 percent of households that required three or more changes constitutes over 30 percent of households that needed to be changed once. Altogether, the changes in status of roughly 30 percent of all households with children imply a potential administrative burden on the SFAs that is roughly equivalent to more than 60 percent of the households each changing status once. Although the assumption of most households faithfully reporting income changes is unrealistic, the SFAs were responsible for any errors that existed. These numbers measure the maximum extent to which the SFAs would have had to take action to fulfill their statutory responsibility.
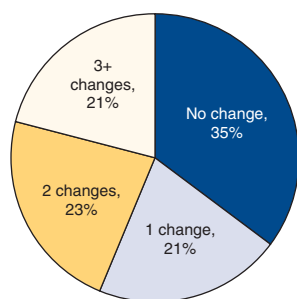
Figure 4 shows the status changes of the households that had at least 1 month of eligibility. This condition omits households that were never below 185 percent in any month of the period, narrowing the sample to a low-income population. Among them, a little more than one-third had no change in status (in contrast to the 69 percent who never changed status in figure 3). Almost one-half (44 percent) had two status changes or more, while one-fifth (21 percent) had three or more status changes.

Appendix table 2 shows the data used for figures 3 and 4. It also shows that the patterns in the figures were not unique to 1996-97; it was almost the same in the following years (1997-98 and 1998-99).

One could expect that frequent changes in eligibility status would be even more pronounced when looking at the households over 3 school years. This outcome is a simple result of the time extension: Households have more time in which changes may occur. Over the 3 years from July 1996 to June 1999, 50 percent of all households with school-aged children had no change in status in contrast to 69 percent in 1996-97, while 14 of the households with 1 or more months of eligibility had no change in status in contrast to 35 percent in 1996-97 (app. table 2).

We also examine the number of eligibility changes within each of the income groups to examine the CV differences. As expected, most changes in eligibility status occur in the income groups closest to the eligibility limit. In the first income group, where average income was 0-75 percent of the

Figure 4
Number of changes in NSLP eligibility status among households that were eligible at least once, 1996-97
Eligibility status changed in two-thirds of NSLP housholds within a year

Note: Number of observations = 4,376.
Source: U.S. Department of Commerce, U.S. Census Bureau, 1996 panel of the Survey of Income and Program Participation.

poverty line, the average number of changes in status was 0.2. For the next income group, between 76 percent and 130 percent of poverty, the average number of status changes was 1.2. The two groups closest to the eligibility cutoff of 185 percent of poverty had the most changes. For the 131-185 percent group, the average number of status changes was 4.9, and for the 186-240 percent group, it was 5.0. The next two higher categories (241-300 percent and 301 percent and up) had an average number of changes of 2.2 and 0.6. Households close to the eligibility income cutoff point of 185 percent of poverty had more eligibility changes per year, but the average number of five changes per year for the income groups above and below the line reveals how important income volatility can be.

These results are consistent with the findings previously discussed of high rates of reentry into the FSP after exiting (Burstein; Gleason et al., 1998) and high rates of reentry into poverty after exit (Huff Stevens, 1999). Those studies are not fully comparable because we do not account for the program participation decision and we are analyzing a slightly larger low-income population. Despite these differences, our results, like those cited, point to the importance of income volatility in understanding low-income population issues.

Income Volatility Trigger Events

While the previous section examined the magnitude of income volatility and its connection to overcertification, this section investigates the sources of monthly income changes. For any one household, NSLP eligibility changes when the household's income relative to poverty crosses the 185 percent threshold.

Many household characteristics or experiences could be factors that lead to exit from or entry into eligibility. Household members could obtain more or less employment in the form of extra jobs or fewer jobs or through changes in the amount of time spent on the same job. Employed workers could get a raise or a cut in pay. The composition of the household could change: Children could join or leave the household; people could marry or separate; and extended family members or unrelated individuals could join or leave the household. Many of these events could occur in the same month, and they could have opposite effects on the household's total income. A household member could lose one job but receive a raise in another job. One household member could lose a job while another chooses to work longer hours, perhaps in response to the other's job loss.

These simultaneous events could trigger an increase or a decrease in household income, depending on the relative magnitudes of the wage and hours changes. The statistical tool used here to analyze these diverse sources of income volatility is a hazard model. The model statistically associates the types of household conditions and behaviors with the timing of an income change.

This section investigates which factors are associated with entry into and exit from NSLP eligibility. Entry is analyzed separately from exit because the role played by any one determinant could differ between the types of transitions. The analysis also considers how the roles played by eligibility determinants could vary depending on the length of the time horizon. A factor that may be relevant over a short-term time horizon of 1-4 months may become less important if the horizon is extended to 48 months, and vice versa.

We approach the analysis in two steps. First, we estimate the odds of different trigger events associated with households entering and exiting NSLP eligibility. Second, we assess the degree to which those odds differ over different lengths of time. The first step is a common approach that many researchers have used in analyses of poverty dynamics (Bane and Ellwood, 1986; Ruggles and Williams, 1987; McKernan and Ratcliffe, 2002; among others). The second step is similar to one used in a study of poverty dynamics by McKernan and Ratcliffe (2002) using the Panel Survey of Income Dynamics. They compared the effects of trigger events on poverty spells of 4 years or more (longer term poverty) and poverty spells of 3 years or less (shorter term).

We extend the analysis of McKernan and Ratcliffe by comparing trigger effects in a series of different short-term periods of 4, 8, 12, and 48 months, the maximum length of time that occurs in our data. We use a traditional hazard model to estimate the effects of a large set of household characteristics and

trigger events on monthly entry into and exit from NSLP eligibility. We estimate these effects over the different time lengths as a way of changing the focus from one of looking at the effects from a very short-term to longer term perspective.

Some analysts looking at program participation dynamics have formed mutually exclusive categories when presenting descriptive statistics of trigger events. For example, they categorize changes into whether someone loses a job *or* whether someone left the household. But that would not work well in our case because we can measure many different simultaneous combinations. In a given household, we can see if a household member lost a job, if someone left the household, and if both events occurred in the same month. In fact, we could track many simultaneous trigger events. Rather than try to decompose all changes into mutually exclusive events, we present the frequency of different trigger events and the probability of exit or entry if the event occurs.[9]

The Multivariate Discrete-Time Hazard Model

For the multivariate analysis, we estimate hazard models to assess the relative importance of different triggers as well as different household characteristics associated with entries and exits from eligibility spells. We use a discrete-time hazard model, which can be estimated well with the traditional logit specification (Allison, 1984; Jenkins, 1995). A hazard model estimates the probability of an event happening at a certain point in time given that it has not occurred before that point in time. The probability can depend on many explanatory variables, which in our context includes the characteristics and trigger events occurring over time to households.

A discrete formulation of the probability is used to account for our data, which is in discrete monthly periods; the alternative continuous formulation assumes that events are measured in continuous time. While monthly data represents finer detail than annual data, it is still a relatively large block of time over which many changes are summed. Most studies of poverty and program participation dynamics use the discrete-time logit hazard model (Huff Stevens, 1999; McKernan and Ratcliffe, 2002; and many others), which is written as:

$$P(t) = \frac{1}{1 + e^{-Z(t)}} \qquad (1)$$

where

$$z(t) = c(t) + X\beta \qquad (2)$$

The model of eligibility or ineligibility, $z(t)$, is a function of $c(t)$, the baseline hazard function (or the hazard function in the absence of other explanatory factors). $X\beta$ represents the matrix of explanatory factors and their respective parameters. The hazard model in (1) is estimated by the method of maximum likelihood, and we report on the odds ratios that are computed from the estimated coefficients. In a logit regression, the dependent variable is transformed into the natural log of the odds of the event occurring. The odds ratios are computed from the estimated coefficients by using the exponential function (raising the natural log e to the b_1 power).

[9]In their analysis of poverty dynamics, McKernan and Ratcliffe also say that it is hard to try to define mutually exclusive categories because there are so many. But in the program participation literature, for example, Gleason et al. (1988) defined trigger events for FSP participation entry and exit as falling into three mutually exclusive groups of (1) income changes, (2) household composition changes, and (3) the combination of both events happening simultaneously.

An odds ratio compares the odds of a certain event occurring over two groups. In a regression, the odds ratio for each independent variable compares the odds of the event occurring when there is a one-unit change in the independent variable with the odds when there is no change. If the ratio is equal to one, the event is equally likely to occur in both groups with or without the change in the independent variable.

The trigger events and static characteristics that we use in the analysis include variables that describe household composition, labor force participation, State unemployment rates, public assistance receipt, the race or ethnicity of the household head, education, job experience, disability status, and other characteristics. The full list, shown in tables 3 and 4, includes both time-invariant characteristics, such as race, and time-varying ones, such as the number of years of job experience held by different members. The trigger events are depicted by dummy variables, which equal one when a characteristic has changed.

We use five different household wages and their changes as trigger dummy variables: wages for primary and secondary jobs of the household reference person (the person who owns or rents the home) and the spouse each and a summed pay rate for all other adults in the house in all of their jobs. Wages are measured in one of two ways. The first is a wage reported as the "regular hourly pay rate," which is separately provided for the primary and secondary jobs. The second, which is used only if the first is not available, is the sum of monthly gross earnings from the job divided by the product of the "usual hours worked per week at this job" and the "number of weeks with a job in the month."

For most trigger variables, we allow the effects of a change in a given characteristic to be captured by the trigger dummy variables over 1 month. For example, we calculate as one of the trigger variables a change in the number of jobs worked by the household reference person. If this individual experienced a change in the number of jobs worked in the current month, the trigger dummy for the number of jobs worked is one for the current month. It is common in the literature to allow for delayed effects, such as in the case where a job change takes a few months to induce an income change. But we wanted to test the effects of short-term events as much as possible.

We made an exception for changes in marital status, public assistance receipt, disability status, presence or not of a subfamily in the household, and changes in the number of children. We thought that the effects of these institutional and family-related variables, especially those that occur very infrequently, would be too hard to capture in 1 month. For marital status changes, the dummy variable for a change was equal to one if the change occurred 1 or 2 months prior to the current observation or if it occurred 1 month ahead. For the other types of changes for which we made an exception, the dummy variable was equal to one if the event occurred in the last 1 or 2 months.

Table 3
Summary statistics for NSLP eligibility exit model variables

Variables	Mean	Standard deviation	Minimum	Maximum
Characteristics (weighted):				
Dependent variable: end of eligibility spell	0.163	0.369	0	1
Log of time	1.416	1.018	0	4
State unemployment rate	4.881	1.294	2	10
Number of working adults per household member	.278	.173	0	1
Number of school-age children	1.758	.940	1	9
Number of jobs held by household reference person	.725	.615	0	4
Number of jobs held by spouse of reference person	.371	.564	0	5
Number of jobs held by other adults	.317	.675	0	8
Tenure of household reference person	.618	17.265	-1	480
Tenure of spouse or partner	.840	12.012	0	372
Tenure of other adults	.264	6.549	0	576
Education of reference person	2.677	1.052	1	5
Education of spouse	1.634	1.537	0	6
Black/non-Hispanic reference person	.198	.399	0	1
Hispanic reference person	.174	.379	0	1
Native American reference person	.026	.158	0	1
Asian reference person	.030	.171	0	1
Disabled reference person	.123	.328	0	1
Disabled spouse or partner	.062	.242	0	1
Disabled other adults	.062	.272	0	4
Subfamily shares household	.098	.298	0	1
Household receives public assistance	.171	.377	0	1
Single female-headed household	.344	.475	0	1
Single male-headed household	.077	.267	0	1
Group home household	.002	.044	0	1
Triggers:				
Public assistance gained	.019	.136	0	1
Reference person leaves disability	.027	.162	0	1
Female household head marries	.003	.057	0	1
Child leaves household	.013	.114	0	1
Subfamily joins household	.006	.079	0	1
Household's total hours worked increase	.273	.446	0	1
Reference person gains one job or more	.019	.136	0	1
Spouse/partner gains one job or more	.012	.108	0	1
Other adults gain one job or more	.020	.140	0	1
Reference person's wage from primary job increases	.100	.300	0	1
Reference person's wage from secondary job increases	.023	.150	0	1
Spouse's/partner's wage from primary job increases	.082	.274	0	1
Spouse/partner's wage from secondary job increases	.011	.103	0	1
Other adults' wages increase	.066	.249	0	1
Share of working adults in household increases	.046	.210	0	1
Number of observations	65,084	NA	NA	NA

NA = Not applicable.
Source: U.S. Department of Commerce, U.S. Census Bureau, 1996 panel of the Survey of Income and Program Participation.

Table 4
Summary statistics for NSLP eligibility entry model variables

Variables	Mean	Standard deviation	Minimum	Maximum
Characteristics (weighted):				
Dependent variable: end of ineligibility spell	0.111	0.314	0	1
Log of time	1.703	1.071	0	3.9
State unemployment rate	4.739	1.285	2.3	9.8
Number of working adults per household member	.414	.161	0	.9
Number of school-age children	1.750	.881	1	9
Number of jobs held by household reference person	.869	.591	0	5
Number of jobs held by spouse of reference person	.577	.627	0	6
Number of jobs held by other adults	.589	.956	0	9
Tenure of household reference person	.660	17.729	-1	480
Tenure of spouse or partner	.919	12.429	0	372
Tenure of other adults	.212	5.372	0	492
Education of reference person	2.993	1.008	1	5
Education of spouse	2.196	1.553	0	5
Black/non-Hispanic reference person	.126	.332	0	1
Hispanic reference person	.120	.325	0	1
Native American reference person	.014	.118	0	1
Asian reference person	.032	.177	0	1
Disabled reference person	.077	.267	0	1
Disabled spouse or partner	.051	.221	0	1
Disabled other adults	.055	.251	0	4
Subfamily shares household	.085	.279	0	1
Household receives public assistance	.053	.225	0	1
Single female-headed household	.225	.417	0	1
Single male-headed household	.075	.263	0	1
Group home household	.002	.046	0	1
Triggers:				
Public assistance lost	.010	.098	0	1
Reference person becomes disabled	.021	.143	0	1
Married female becomes single household head	.003	.054	0	1
Child added to household	.018	.132	0	1
Subfamily leaves household	.003	.057	0	1
Household's total hours worked decrease	.334	.472	0	1
Reference person loses one job or more	.014	.119	0	1
Spouse/partner loses one job or more	.012	.107	0	1
Other adults lose one job or more	.023	.149	0	1
Reference person's wage from primary job decreases	.148	.355	0	1
Reference person's wage from secondary job decreases	.029	.167	0	1
Spouse's/partner's wage from primary job decreases	.098	.298	0	1
Spouse's/partner's wage from secondary job decreases	.019	.137	0	1
Other adults' wages decrease	.074	.262	0	1
Share of working adults in household decreases	.031	.174	0	1
Number of observations	82,419	NA	NA	NA

NA = Not applicable.

Source: U.S. Department of Commerce, U.S. Census Bureau, 1996 panel of the Survey of Income and Program Participation.

The data used for the analysis is from all years and months in the 1996 panel, starting in December 1995 and ending in February 2000. Before any data are excluded, the sample has 436,479 household-month observations and 20,016 unique households. The households are in the sample for up to 48 months. Slightly more than one-half are in the sample for 3 years, and 40 percent are in the sample for 4 years.

When a data set does not contain an entire spell, it is called a "censored spell," meaning that either the end or the beginning of the spell fell outside the period surveyed. Most analysts exclude "left-censored" spells, the spells cut off at the beginning, but they keep "right-censored" spells, spells cut off at the end, because of the nature of hazard analysis.

In hazard analysis, the method estimates the factors that contribute to the length of a given spell, given that the spell has lasted to that point. If a spell does not end in the data, the fact that it did not end within the period examined is useful information. But for this type of analysis, it is crucial to know when the spell started, which is why most analysts exclude left-censored spells. One study by Iceland (1997) found that excluding left-censored observations leads to some bias in estimating the lengths of spells (of poverty) because the left-censored spells are more likely to include households in the middle of long spells. Because our focus is on understanding the determinants of short-term spells rather than in estimating the median spell length per se, we chose to exclude the left-censored spell observations. This exclusion reduces the sample size considerably and means we examine only households that underwent at least one change in eligibility.[10]

The full sample is divided into two parts: households that are in spells of ineligibility—the "entry" sample—and households that are in spells of eligibility—the "exit" sample. Before excluding left-censored observations, the entry sample has 287,674 household-month observations and 58,313 continuous spells of NSLP ineligibility. The full exit sample is much smaller at 148,805 household-month observations and 46,358 continuous spells of NSLP eligibility. The exit sample is smaller because fewer households have incomes below 130 percent of the poverty line than above it. Once we exclude the left-censored spells of eligibility in the exit sample, we reduce the sample to 65,084 household-month observations and 13,774 spells. And once we exclude the left-censored spells of ineligibility from the entry sample, we have 82,419 household-month observations and 13,253 spells.

Descriptive Statistics

The summary statistics for all variables are shown in tables 3 and 4. Table 5 shows the frequency of trigger events that occur in the separate exit and entry samples, the frequency of entries and exits that occur when a given trigger event has taken place, and the frequency of the corresponding trigger events if an entry or exit occurs.

The tables show that most of the trigger events did not occur very often, except for changes in time worked by the household. This outcome is not surprising given that we think these events are important determinants of income change, but some of the triggers occur so infrequently that it may be hard to fully capture their effects when they do occur. For example, a change in family structure from a single female-headed household to a married household

[10]Analysis was also conducted with the left-censored variables included. The main substantive difference in the results is that more variables were significant, and those that were significant without the left-censored observations were more significant with them.

Table 5
Frequency of trigger events in the NSLP eligibility exit and entry samples

Trigger events for exit	frequency	occurs	frequency	Trigger events for entry	frequency	occurs	frequency
Trigger events for exit	Event frequency rate (1)	Exit rate if event occurs (2)	Event frequency rate if exit occurs (3)	Trigger events for entry	Event frequency rate (4)	Entry rate if event occurs (5)	Event frequency rate if entry occurs (6)
		Percent				*Percent*	
Job gains:				Job losses:			
Household reference person gains a job	1.9	22.0[1]	2.6[1]	Household reference person loses a job	1.4	13.8[2]	1.8[2]
Spouse gains a job	1.2	24.0[1]	1.7[1]	Spouse loses a job	1.2	12.9	1.4
Other adult gains a job	1.8	23.2[1]	1.6[1]	Other adult loses a job	2.2	10.1	2.0
Total household hours worked increase	27.3	21.0[1]	35.2[1]	Total household hours worked decrease	33.4	13.0[1]	40.3[1]
Total household weeks worked increase	28.5	20.3[1]	35.6[1]	Total household weeks worked decrease	33.4	13.1[1]	40.7[1]
Wage or salary gains:				Wage or salary losses:			
Household reference person's pay increases for job 1	10.2	18.1[1]	11.4[1]	Household reference person's pay decreases for job 1	15.0	10.1	14.2
Household reference persons' pay increases for job 2	2.3	20.9[1]	3.0[1]	Household reference persons' pay decreases for job 2	2.9	11.4	3.1
Spouse's/partner's pay increases for job 1	8.3	22.5[1]	11.5[1]	Spouse's/partner's pay decreases for job 1	10.2	8.9[1]	8.4[3]
Spouse's/partner's pay increases for job 2	1.1	25.0[1]	1.6[1]	Spouse's/partner's pay decreases for job 2	1.9	11.9	2.1
Other household adults' pay increases	6.0	22.0[1]	8.1[1]	Other household adults' pay decreases	7.0	10.5	6.9
Public assistance gains:				Public assistance losses:			
Household gains assistance	1.7	10.0[3]	1.1[3]	Household loses assistance	0.9	16.8[1]	1.3[1]
Disability changes:				Disability changes:			
Household member leaves disability	2.5	16.0	2.5	Household member becomes disabled	2.0	12.5	2.4
Household composition changes:				Household composition changes:			
Child leaves household	1.2	16.6	1.3	Child joins household	1.7	14.0[1]	2.2[1]
Subfamily joins household	.4	19.3	.5	Subfamily leaves household	.3	10.6	.3
Female household head marries or partners	.3	21.8	.4	Married female becomes female household head	.3	29.3[1]	.8[1]
Share of working adults increases	4.49	23.8[1]	6.5[1]	Share of working adults decreases	3.0	15.1[1]	4.3[1]
Number of observations	65,084	NA	NA	Number of observations	82,419	NA	NA

NA = Not applicable.

[1]Significant at the 0.001 level. (The test is whether the occurrence of exit or entry is significantly different when the trigger event occurs compared with when the trigger event does not occur.)

[2]Significant at the 0.005 level. (The test is the same as above.)

[3]Significant at the 0.001 level in the opposite direction expected. (The test is the same as above.)

Source: U.S. Department of Commerce, U.S. Census Bureau, 1996 panel of the Survey of Income and Program Participation.

occurs in less than 1 percent of the months in both the exit and entry samples. Other studies have found this trigger to be among the most important events leading into and out of poverty. We note that the information provided in table 5 is limited because it captures only the effect of one event at a time and that a fuller picture will be provided by the multivariate analysis.

The most frequent trigger events in the exit and entry samples were changes in hours worked, weeks worked, wages of all members, and the share of working adults in households. Total household hours and weeks worked in the month changed more frequently than did the other triggers. In the exit sample, total hours worked increased in 27 percent of all household-months. In the entry sample, total hours worked decreased in 33 percent of all household-months.[11] Changes in the reference person's primary wages were also relatively frequent in both samples: The reference person's wages increased in 10 percent of the household-months observed in the exit sample and decreased in 15 percent of the household-months in the entry sample. Changes in the primary wages of the reference person's spouse or partner were frequent in both samples. Primary wages of the spouse increased at a rate of 8 percent in the exit sample and decreased at a rate of 10 percent in the entry sample. Changes in the wages of all other working adults were relatively frequent in both samples, with wage increases in the exit sample at a rate of 6 percent and decreases in the entry sample at a rate of 7 percent.

In the exit sample, most of the trigger events that we thought could lead to exit were indeed statistically more likely to result in exit than not. Additional jobs, more total hours and weeks of work, increases in wages, and increases in the share of working adults were all more likely to lead to exit from NSLP eligibility than if they did not occur. A single mother marrying, however, did not lead to a significantly greater probability of exit. A change in female marital status in the other direction, where the household changed from having a married reference person to having a single female reference person, did lead significantly to entry into eligibility. Of all entry trigger events, this event triggered the highest entry rate, 29 percent, suggesting that marriage is not necessarily a route out of NSLP eligibility. Other triggers that were significantly likely to lead to entry into eligibility include changes in total hours and weeks worked, changes in a spouse's or partner's wages, the loss of public assistance (TANF or FSP), the addition of a child to the household, and a decrease in the share of working adults in the household.

When we compare the rate of exit and entry with a particular trigger, the exit triggers are generally more likely to be associated with exit than the entry triggers are associated with entry (table 5, columns 2 and 5). The job-related exit triggers—changes in the number of jobs a household member has, the total household hours worked, wages, etc.—are associated with exit almost one-quarter of the time for most of these variables. The more family-related variables are not significantly linked to exit. In the entry sample, the job-related entry triggers are important, but they are not much larger than the two family-related variables, the addition of a child to the household and becoming a female-headed household. All of the triggers with a significant association with entry are smaller in size than those in the exit sample; they are closer to 13 percent, and the highest is the trigger of becoming a female-headed household at 29 percent. The other relatively large and significant trigger associated with entry is the loss of public assistance (17 percent).

[11]The changes in all of these variables include all changes; no threshold of change was defined for a change to be counted. But the changes at the median are not trivial. For example, the median change in the total household hours worked in 1 month was 60 hours in both directions.

These results suggest that family and institutional changes are more important in determining entry into poverty (roughly defined) and that economic variables are relatively more important for exiting poverty.

In table 5, columns 3 and 6, we show the frequency rate of trigger events with exit or entry, depending on the sample. In both samples, we see that changes in hours worked and weeks worked were the most likely triggers. In the exit sample, wage changes for the reference person, spouse, and other adults were the next most likely triggers, but they were not significant in the entry sample. The next largest frequency rate was for working adults, which was significant in both samples. These results underline the conclusion that job-related variables are the main drivers of change in eligibility status. They are, by far, more likely to have occurred if a household changes eligibility status, either exiting or entering.

As previously noted above, many changes can occur simultaneously, so the way to understand the relative importance of different trigger events is by using a multivariate framework. We now turn to the results of the discrete-time hazard models of NSLP eligibility entry and exit.

Results From the Hazard Models of NSLP Eligibility Entry and Exit

In the models of eligibility entry and exit, we include as determinants a measure of time in logarithmic form to capture the baseline changes over time, the State unemployment rate, static characteristics of households measured in levels, and dummy variables to measure specific trigger events. We have opted for a very inclusive set of independent variables, and there is some correlation among them, though we avoid it as much as possible by excluding the most correlated among them that represent similar phenomena.

As an obvious example, we use increases in total household hours worked, but we do not use weeks worked. We also use number of jobs held by different members of the household: the reference person, their spouse or partner, and other adults (as a composite). We include changes in jobs held by different members. The number of jobs held is a lumpier measure of employment than hours worked, and it is used here chiefly to identify job changes by household member type rather than to identify impacts of employment per se, which is what the change in total-hours-worked variable captures. The change-in-hours trigger provides an aggregate view of household work changes, and the number of jobs held by household member provides a more detailed view of the relative importance of jobs held by different members. Because employment changes can occur in so many ways in a household, we want to include as many aspects as possible. As other authors in the literature have also noted, the results should not be interpreted as definitive causal effects because some of the independent variables may be considered endogenous.

We show the results from two models of NSLP eligibility exit and from two similar models of NSLP entry in tables 6-9. The first of each set of two models shows the results of the model using all periods in the 1996 SIPP panel where the maximum period a household may be in the survey sample was 48 months. Left-censored spells are excluded from all of the analysis. The second table for each model shows the results of the model using 4 months.

We tested each model using 12- and 8-month intervals, but the longest and shortest periods of 48 and 4 months display the important results. We discuss the results from all four models in the following discussion. By running the same model on the different periods, we tested whether and how determinants differ depending on the scope of time examined.

Exit Results

In the whole sample, many of the hypothesized effects were significant (table 6). The measure of changes over time was highly significant and indicates that the likelihood of exit decreased over time, essentially with longer spells of eligibility. This finding is common in the poverty literature. Among the other significant determinants, the share of working adults in the household had a positive effect on the odds of exit, and it had the largest effect relative to the other factors. The odds ratio of 2.2 can be interpreted to mean that moving from no working adults to all working adults would more than double the odds of exit. The sizes of the estimated odds ratios for the other variables ranged from 0.61 to 1.37, though each of the units of observation must be considered in deriving an impact. We discuss only the general direction of impacts here.

More school-aged children per household led to lower odds of exit; and more jobs for the reference person, spouse/partner, or other adults led to higher odds of exit, with additional jobs for other adults having a slightly larger effect than the other two. The working tenure of the reference person and the spouse had significant, but almost negligible, effects on exit. A higher education level of the reference person and the spouse led to greater odds of exit. Households with a Black/non-Hispanic, Hispanic, or Asian reference person had lower odds of exit compared with households with a White reference person. Anyone in the household receiving public assistance decreased the odds of exit. The result for single female-headed households was negligible but not significant, not surprisingly given its weak effect in the descriptive analysis.

We find three trigger events to be significant determinants of exit in the 48-month sample: increases in total household hours worked, increases in the spouse's primary job wage, and increases in the share of working adults in the household. The odds ratios are directly comparable because they are all dummy variables. The highest was the increase in total household hours worked (1.37), the second highest was the increase in the share of working adults in the household (1.23), and the third was the increase in the spouse's primary wage (1.14).

What happens when we use samples of different time lengths? We compare the general results to a restricted sample of less than or equal to 12 months (not shown). The characteristics that have a positive and significant effect include the share of working adults in the household, the number of jobs held by each member, the tenure of the reference person and spouse, and the education level of the reference person and spouse. The characteristics that have a negative and significant effect include the log of time; the number of children; the reference person being Black non-Hispanic, Hispanic, or Asian; the reference person being disabled; and the household receiving public assistance. All of these characteristics show the same effects as those in the unrestricted 48-month sample. The trigger events that are significant are the same as those in the 48-month exit sample, and they are very similar estimates.

Table 6

Logit estimates of the determinants of NSLP eligibility exit, periods 1-48

Variables	Odds ratio	Standard error	z	P>z
Characteristics:				
Log of time	**0.66**	0.01	-33.00	0
State unemployment rate	.99	.01	-1.25	.212
Number of working adults per household member	**2.20**	.18	9.42	0
Number of school-age children	**.92**	.01	-6.24	0
Number of jobs held by household reference person	**1.20**	.03	8.24	0
Number of jobs held by spouse of reference person	**1.23**	.03	8.14	0
Number of jobs held by other adults	**1.27**	.02	12.31	0
Tenure of household reference person	**1.00**	.00	3.76	0
Tenure of spouse or partner	**1.00**	.00	2.88	.004
Tenure of other adults	1.00	.00	.25	.801
Education of reference person	**1.09**	.01	6.26	0
Education of spouse	**1.06**	.01	4.20	0
Black/non-Hispanic reference person	**.82**	.03	-5.90	0
Hispanic reference person	**.81**	.03	-5.72	0
Native American reference person	.86	.07	-1.79	.073
Asian reference person	**.73**	.05	-4.35	0
Disabled reference person	.92	.04	-2.08	.038
Disabled spouse or partner	.91	.05	-1.83	.067
Disabled other adults	1.00	.05	.02	.987
Subfamily shares household	1.07	.05	1.48	.138
Household receives public assistance	**.61**	.03	-11.04	0
Single female-headed household	1.00	.05	.01	.995
Single male-headed household	1.13	.06	2.35	.019
Group home household	1.18	.37	.52	.605
Triggers:				
Public assistance gained	.98	.11	-.18	.859
Reference person leaves disability	1.00	.07	-.02	.983
Female household head marries	1.44	.29	1.83	.068
Child leaves household	.82	.09	-1.81	.071
Subfamily joins household	.93	.14	-.50	.619
Household's total hours worked increase	**1.37**	.04	12.08	0
Reference person gains one job or more	1.12	.10	1.28	.202
Spouse/partner gains one job or more	1.03	.11	.28	.777
Other adults gain one job or more	1.00	.09	-.03	.974
Reference person's wage from primary job increases	1.04	.04	.88	.377
Reference person's wage from secondary job increases	.91	.07	-1.19	.236
Spouse's/partner's wage from primary job increases	**1.14**	.05	3.18	.001
Spouse's/partner's wage from secondary job increases	.92	.10	-.78	.438
Other adults' wages increase	1.12	.06	2.09	.037
Share of working adults in household increases	**1.23**	.07	3.91	0
Number of observations	65,084	NA	NA	NA

Numbers in red bold = Significant at the 0.001 level. Numbers in black bold = Significant at the 0.010 level. NA = Not applicable.

Source: U.S. Department of Commerce, U.S. Census Bureau, 1996 panel of the Survey of Income and Program Participation.

Examining the results from the regressions for shorter periods of 8 months (not shown) and 4 months (table 7) reveals that the results are almost the same as those for the two longer periods. In the shortest period of 4 months, the trigger event of a change in the share of working household members was not significant, but that was the only major difference. The trigger event of the marriage of a female household head was not significant in any of the regressions. This outcome is likely due to this trigger occurring infrequently in the data, but it again suggests that marriage is not necessarily a route out of poverty for single females with children.

The events found to trigger exit from very short-term spells of NSLP eligibility are increases in total household hours worked in a month and in the wages of the spouse or partner. This outcome is understandable given that these are the work-related variables that can change easily, but it is somewhat surprising that changes in the reference person's wages are not significant. It suggests that a second major income source, in addition to that of the reference person (assuming they work), is a critical component to exiting eligibility.

Entry Results

The results from the hazard models of entry into NSLP eligibility are fairly consistent with the results from the exit model, but more trigger events are significant in the entry model. In the model covering the 48-month period, the one significant household characteristic that was positively associated with entry was the race of the reference person being other than White or Asian (table 8). The significant factors that were negatively associated with entry were the log of time, the share of working adults in the household, the number of jobs held by the reference person and other adults, the education level of the reference person and spouse, and the household being single male-headed. All of these effects were significant in sensible directions.

Many more trigger events were significant in the entry model than in the exit model (eight versus three). The trigger events that significantly and positively affected the odds of entry into eligibility were a change from a married household to single female-headed household; a reduction in total household hours worked; a reduction in the wages of the reference person, the spouse, and other adults; and a reduction in the share of working adults in the household. A negative, significant trigger was the departure of a subfamily, suggesting that subfamilies represented more of a financial burden than a support. The other negative, significant trigger was an increase in the number of jobs held by other adults in the household, again showing the importance of multiple income sources. The trigger with the largest odds ratio was the change from a married household to one headed by a single female (3.09), which was much higher than in any other in the model. The next highest two ratios were the reduction in total household hours worked (1.54) and the decrease in the share of working adults in the household (1.48).

How do the results differ over shorter periods? The model results had very few differences across the different periods: 12 months, 8 months, and 4 months (table 9). The two trigger events in the 48-month sample that were negative and significant—the departure of a subfamily and the loss of jobs by other adults—were no longer significant in the shorter term models. The change was small in the ranking of trigger event effects over time. As the sample period got shorter, the odds ratio for the change from a single female-headed

Table 7

Logit estimates of the determinants of NSLP eligibility exit, periods 1-4

Variables	Odds ratio	Standard error	z	P>z
Characteristics:				
Log of time	**0.70**	0.02	-12.91	0
State unemployment rate	.99	.01	-.92	.359
Number of working adults per household member	**2.18**	.22	7.85	0
Number of school-age children	**.93**	.02	-4.09	0
Number of jobs held by household reference person	**1.22**	.03	7.65	0
Number of jobs held by spouse of reference person	**1.22**	.04	6.74	0
Number of jobs held by other adults	**1.24**	.03	9.88	0
Tenure of household reference person	**1.00**	.00	3.72	0
Tenure of spouse or partner	**1.00**	.00	2.87	.004
Tenure of other adults	1.00	.00	.45	.655
Education of reference person	**1.09**	.02	5.53	0
Education of spouse	**1.05**	.02	2.82	.005
Black/non-Hispanic reference person	**.80**	.03	-5.16	0
Hispanic reference person	**.79**	.04	-5.11	0
Native American reference person	.85	.09	-1.52	.127
Asian reference person	**.67**	.06	-4.38	0
Disabled reference person	**.86**	.04	-2.93	.003
Disabled spouse or partner	.89	.06	-1.85	.065
Disabled other adults	1.00	.06	-.08	.935
Subfamily shares household	1.11	.06	1.86	.063
Household receives public assistance	**.59**	.04	-8.60	0
Single female-headed household	.93	.05	-1.34	.179
Single male-headed household	1.09	.07	1.37	.170
Group home household	1.32	.51	.73	.467
Triggers:				
Public assistance gained	.96	.14	-.29	.775
Reference person leaves disability	.99	.09	-.11	.910
Female household head marries	1.59	.42	1.77	.077
Child leaves household	.82	.10	-1.55	.121
Subfamily joins household	.95	.16	-.29	.772
Household's total hours worked increase	**1.34**	.04	9.15	0
Reference person gains one job or more	1.01	.12	.11	.912
Spouse/partner gains one job or more	1.03	.14	.23	.819
Other adults gain one job or more	.92	.10	-.78	.437
Reference person's wage from primary job increases	1.03	.05	.69	.492
Reference person's wage from secondary job increases	.93	.09	-.80	.426
Spouse's/partner's wage from primary job increases	**1.16**	.06	2.87	.004
Spouse's/partner's wage from secondary job increases	.98	.12	-.15	.878
Other adults' wages increase	1.06	.07	.97	.334
Share of working adults in household increases	1.16	.08	2.09	.036
Number of observations	34,814	NA	NA	NA

Numbers in red bold = Significant at the 0.001 level. Numbers in black bold = Significant at the 0.010 level. NA = Not applicable.

Source: U.S. Department of Commerce, U.S. Census Bureau, 1996 panel of the Survey of Income and Program Participation.

Table 8
Logit estimates of the determinants of NSLP eligibility entry, periods 1-48

Variables	Odds ratio	Standard error	z	P>z
Characteristics:				
Log of time	**0.45**	0.01	-58.43	0
State unemployment rate	.98	.01	-1.69	.092
Number of working adults per household member	**.27**	.03	-12.91	0
Number of school-age children	1.01	.02	.62	.536
Number of jobs held by household reference person	**.91**	.02	-4.10	0
Number of jobs held by spouse of reference person	.94	.03	-2.16	.031
Number of jobs held by other adults	**.79**	.01	-12.84	0
Tenure of household reference person	1.00	.00	.81	.420
Tenure of spouse or partner	1.00	.00	1.86	.062
Tenure of other adults	1.00	.00	.61	.544
Education of reference person	**.87**	.01	-10.65	0
Education of spouse	**.89**	.01	-8.21	0
Black/non-Hispanic reference person	**1.18**	.04	4.50	0
Hispanic reference person	**1.18**	.05	4.16	0
Native American reference person	**1.33**	.12	3.21	.001
Asian reference person	.95	.07	-.68	.494
Disabled reference person	1.00	.05	.00	.999
Disabled spouse or partner	.94	.06	-1.01	.313
Disabled other adults	.89	.05	-2.27	.023
Subfamily shares household	.98	.05	-.47	.640
Household receives public assistance	1.12	.06	2.15	.031
Single female-headed household	.95	.05	-1.12	.262
Single male-headed household	**.85**	.05	-2.64	.008
Group home household	.79	.24	-.78	.438
Triggers:				
Public assistance lost	1.05	.11	.42	.672
Reference person becomes disabled	1.03	.09	.31	.759
Married female becomes single household head	**3.09**	.58	6.00	0
Child joins household	1.09	.09	.97	.333
Subfamily leaves household	**.55**	.12	-2.64	.008
Household's total hours worked decrease	**1.54**	.04	16.58	0
Reference person loses one job or more	.92	.10	-.77	.441
Spouse/partner loses one job or more	.78	.10	-1.99	.047
Other adults lose one job or more	**.74**	.07	-2.99	.003
Reference person's wage from primary job decreases	**1.21**	.04	5.16	0
Reference person's wage from secondary job decreases	1.11	.09	1.30	.195
Spouse's/partner's wage from primary job decreases	1.11	.05	2.19	.029
Spouse's/partner's wage from secondary job decreases	**1.45**	.14	3.84	0
Other adults' wages decrease	**1.27**	.07	4.23	0
Share of working adults in household decreases	**1.48**	.11	5.48	0
Number of observations	82,419	NA	NA	NA

Numbers in red bold = Significant at the 0.001 level. Numbers in black bold = Significant at the 0.010 level. NA = Not applicable.
Source: U.S. Department of Commerce, U.S. Census Bureau, 1996 panel of the Survey of Income and Program Participation.

Table 9

Logit estimates of the determinants of NSLP eligibility entry, periods 1-4

Variables	Odds ratio	Standard error	z	P>z
Characteristics:				
Log of time	**0.33**	0.01	-35.65	0
State unemployment rate	1.00	.01	-.03	.979
Number of working adults per household member	**.36**	.04	-8.47	0
Number of school-age children	**1.06**	.02	3.07	.002
Number of jobs held by household reference person	**.93**	.03	-2.74	.006
Number of jobs held by spouse of reference person	.93	.03	-2.34	.020
Number of jobs held by other adults	**.78**	.02	-10.42	0
Tenure of household reference person	1.00	.00	.24	.807
Tenure of spouse or partner	1.00	.00	1.62	.104
Tenure of other adults	1.00	.00	.49	.621
Education of reference person	**.88**	.01	-7.99	0
Education of spouse	**.87**	.02	-7.47	0
Black/non-Hispanic reference person	**1.23**	.05	4.59	0
Hispanic reference person	1.11	.05	2.24	.025
Native American reference person	1.29	.14	2.40	.016
Asian reference person	1.04	.09	.43	.667
Disabled reference person	1.07	.06	1.23	.217
Disabled spouse or partner	.93	.07	-1.08	.279
Disabled other adults	.88	.06	-1.98	.048
Subfamily shares household	.95	.06	-.89	.374
Household receives public assistance	1.13	.07	2.02	.043
Single female-headed household	.93	.06	-1.23	.217
Single male-headed household	**.79**	.06	-3.20	.001
Group home household	.76	.31	-.67	.503
Triggers:				
Public assistance lost	1.07	.12	.55	.582
Reference person becomes disabled	.93	.10	-.64	.522
Married female becomes single household head	**2.47**	.64	3.47	.001
Child joins household	.98	.10	-.22	.827
Subfamily leaves household	.52	.14	-2.47	.014
Household's total hours worked decrease	**1.74**	.06	17.41	0
Reference person loses one job or more	.84	.12	-1.20	.232
Spouse/partner loses one job or more	.79	.13	-1.49	.136
Other adults lose one job or more	.72	.10	-2.47	.013
Reference person's wage from primary job decreases	**1.16**	.06	3.02	.003
Reference person's wage from secondary job decreases	1.10	.11	.94	.349
Spouse's/partner's wage from primary job decreases	1.06	.07	.86	.391
Spouse's/partner's wage from secondary job decreases	**1.41**	.18	2.74	.006
Other adults' wages decrease	**1.30**	.10	3.58	0
Share of working adults in household decreases	1.08	.12	.75	.452
Number of observations	34,405	NA	NA	NA

Numbers in red bold = Significant at the 0.001 level. Numbers in black bold = Significant at the 0.010 level. NA = Not applicable.

Source: U.S. Department of Commerce, U.S. Census Bureau, 1996 panel of the Survey of Income and Program Participation.

household to a married household decreased. The odds ratio for the change in total household hours worked increased. The odds ratios for the other three trigger events changed slightly, but not as markedly in one direction or the other.

Overall, according to results from the exit and entry models, the most important short-term catalyst is a change in total household hours worked. Changes in hours worked is consistently significant in all of the models, increasing in value in the entry model as the period gets shorter and being the larger of only two triggers that are significant in the shortest exit model. The other trigger event significant in both models is a change in the share of working household members (as well as the static share). The robust significance of these two events in both models points to the relative importance of changes in total labor market participation at the household level as opposed to changes in labor market participation by a particular household member or changes in household composition in determining household income volatility. The one exception is the household composition change of moving from married to single status for mothers, which was an important determinant of entering eligibility, more so when looking at the question over a longer period.

In the entry models, the change from being a married household to being a single female-headed household had a much larger odds ratio than the change in hours, making it arguably more important even though its value declines in each shorter period model. But it had no parallel effect in the exit model. Could it be that changing marital status has an asymmetric effect on economic well-being? Getting married does not appear to help single mothers exit NSLP eligibility, but becoming single appears to contribute to entry. One explanation for this asymmetry could be that marriage does not necessarily imply that both married partners work in the labor force. One member may choose to stay home to care for the children, which may cause the household to remain in a low-income status. Another explanation could be that the pools of women in the two categories are different enough that we should not necessarily expect the same results. The women who have been single also may be less educated and poorer than those who have been married. They also may have fewer potential marriage partners who could sufficiently raise their standard of living. As just noted, the infrequency of both of these events in the data makes it difficult to accurately estimate their effects, but it is interesting that one estimate would be stronger than the other.

In the entry models, decreases in the wages of all household members also were important triggers. The effects declined somewhat in shorter periods but not by much. In the exit models, only the spouse's wage increases were significant. These results point to the greater importance of wages overall and somewhat to "who" gets the pay increase. The exit results suggest that, for the household to exit eligibility, the wage of the second earner and changes to it are critical. This outcome is consistent with the explanation about the asymmetric results for marital status changes for women; whether the spouse works or not in a married family may make or break the family's eligibility status. We do not see the mirror effects in the exit models, but in general, wage changes matter in both models.

NSLP Eligibility and Income Volatility

In this section, we examine the effects of income volatility on eligibility under the pre-2004 rules for eligibility in the NSLP. We describe the basic features of the program, review the literature on the overcertification issue, and present the analysis, using SIPP, of income volatility effects on eligibility.

NSLP Administrative Procedures

We briefly describe NSLP administration, procedures for application, certification, verification, and recent changes made in the Child Nutrition and WIC Reauthorization Act of 2004.

Administration

The program is administered at the Federal level by USDA's Food and Nutrition Service (FNS) and at the local level by School Food Authorities (SFAs), which roughly cover school district areas. FNS is responsible for coordinating policy at the Federal level, providing technical assistance, and managing the work of the State agencies. USDA provides cash subsidies, as well as agricultural commodities. The State agencies are operated by either State departments of education or agriculture. In some cases, the program is administered locally by FNS regional offices. The State agencies operate the program through agreements with local SFAs and are responsible for managing fiscal elements of the program, monitoring SFA performance, and providing SFAs with technical assistance. SFAs administer NSLP at the local level. They process applications, certify students as eligible, verify eligibility, and maintain program data.

The program rules and regulations that are not stipulated by Congress in the National School Lunch Program Act (NSLA) are determined by USDA. For good stewardship of public funds, USDA strives to balance its goals of ensuring access to intended beneficiaries and maintaining program integrity. Access is compromised if the application requirements deter eligible students from participation, and integrity is compromised if students obtain benefits for which they are not eligible. With limited budget resources, USDA needs to meet these goals with reasonable and efficient administration.

Application and Certification

All children in participating schools can purchase an NSLP lunch at full price, and some qualify for reduced-price or free lunches. A student is certified as eligible for a free meal if his or her household income is at or below 130 percent of the Federal poverty guideline. The student is eligible for a reduced-price meal if household income is between 130 percent and 185 percent of the poverty guideline. If a student's household receives assistance from FSP, TANF, or FDPIR, the student is "categorically eligible" for free lunch benefits. Alternatively, a student may be certified for a free meal through "direct certification," by which the SFAs work with their State's FSP, TANF, and FDPIR agencies to directly identify beneficiaries of these programs. Homeless, migrant, and runaway students are also categorically eligible. They may be directly certified for free meal eligibility once an appropriate local authority has identified them as meeting the relevant criteria.

Households are not required to provide documentation of their income with their applications, though an adult must sign a statement affirming that the information provided is correct. This self-reporting feature of the NSLP application has advantages and disadvantages. One advantage is that it lowers the burden on households of preparing an application. Another advantage is that it reduces the administrative burden to the SFAs of collecting and reviewing documentation that accompany an application. Self-reporting has the disadvantage of allowing for inaccuracies on the application, whether deliberate or unintentional.

Verification

In an early effort to detect and discourage reporting errors, Congress passed a law in 1981 requiring SFAs to verify the NSLP eligibility status of a sample of their beneficiaries. SFAs were required to reevaluate the eligibility status of a small sample of their approved applicants by December 15 each year. Sampled households were asked to provide documentation for the income they originally reported. Under the new law, SFAs must verify eligibility by November 15, and they can accept proof of income at any time between when the application was submitted and when the verification is conducted.

The new law combines methods formerly used for verification in a way that increases the administrative duties of the SFA but that should make verifications more effective. Previously, SFAs were able to choose between two verification methods: random sample or focused sample. Using the random sample, SFAs verified 3 percent of all approved applications or 3,000 applications, whichever was less. Those applications were selected at random from all approved applications on file. Using the focused sample, they verified fewer applications but focused on more error-prone ones. Specifically, they verified 1 percent (or up to 1,000 applications) selected from applications in which income was within $100 of the eligibility limit. In addition they verified 500 applications (or 0.5 percent if smaller) of those who received food stamps, TANF, or FDPIR.

Under the new law, the methods are combined: The SFA must verify the incomes of 3,000 applications (or 3 percent if smaller) from those with income within $100 of the eligibility limit. If there are not enough of these families to meet the sample size requirement, the SFA can add households randomly selected from all approved applications. These changes increase the administrative burden for SFAs because either they have to conduct more verification reviews if they were using the focused sample or they have to institute procedures for identifying the error-prone households if they were using the random sample. An SFA can qualify to continue following the prior rules if it receives responses from 80 percent or more of the households selected for verification or if a large SFA increases its response rate by more than 10 percent (see Neuberger, 2004, for more detail).

The households sampled in the verification process are asked to provide documentation of their total household income to the SFA. Based on the documentation provided, SFAs reassess the household's eligibility and may increase, reduce, or eliminate benefits. Benefits are also eliminated for families that do not provide documentation. Under the new rules, the SFA must conduct one

followup attempt if they do not receive a reply to their first request for information in the verification process. Families that lose benefits may reapply if they provide the documentation or if they become eligible at a later date.

Studies on NSLP Overcertification Errors

Studies of NSLP error rates and potential sources of error have played an important role in the issue of overcertification rates. A few influential studies in the late 1990s were the first to suggest that there was a problem. In the early 2000s, more in-depth studies focused on the problem. An "error" as typically defined and measured in most of these studies refers to "overcertification" error, or the misclassification of students who receive benefits for which they were not eligible. This misclassification includes children who may have been certified for a free lunch but were found to be eligible for reduced-price lunches. It does not include children who should have been certified for free or reduced-price meals but were mistakenly denied certification.

FNS has sponsored several studies on NSLP program integrity. One of the earlier studies covered the 1986-87 school year and estimated that 15 percent of certified households were ineligible (St. Pierre et al., 1990).[12] The report compiled and summarized findings from a nationally representative sample of SFA verifications. In 1997, USDA's Office of Inspector General audited Illinois schools for 1994-95 and 1995-96 and found that 19 percent of students had their benefits reduced or terminated at the time of verification (USDA, OIG, 1997). This percentage included households that had not responded to the verification request.

Another FNS study used Current Population Survey (CPS) data to compare NSLP eligibility and participation during 1993-97 (USDA, FNS, 1999). The study estimated the number of NSLP-eligible households from CPS survey data and compared the estimate with administrative data on the number of households actually certified for free or reduced-price meals. FNS found that more households were certified for benefits than the CPS data showed to be eligible. It also found that the number of NSLP-certified households rose over the period while the estimates of eligible households fell. This divergence was greater for free lunch beneficiaries than for reduced-price beneficiaries. The number of households certified for free lunches went from 99 percent of households estimated to be eligible for free lunches in 1993 to 127 percent in 1999. For free and reduced-price lunch benefits combined, the differences went from 82 percent to 102 percent. CPS, however, collects only annual income data, whereas the NSLP uses monthly income, and the CPS covers a calendar year rather than a school year.

Neuberger and Greenstein (2003) used more detailed data and found different results than the 1999 FNS study did. They used SIPP monthly income data rather than annual income data to estimate program eligibility and compared certification and eligibility data from the same periods. They reported that, for the 1998 school year, using August or September 1998 income, 2.7 million more children were eligible for free meals than were eligible using annual income data for the following year. Only 2 percent more families received free lunches than were estimated to be eligible. For combined reduced-price and free lunches, however, 15 percent fewer families were certified compared with those estimated to be eligible.[13]

[12]The 15 percent error is the sum of errors from December results and the error rate inferred from a May audit of families that did not respond to the request for verification in December. One-third of those who did not reply in December were found to be ineligible in May. That ineligible percentage rate was added to the rate from December.

[13]Unlike this study, Neuberger and Greenstein present analysis that compares participation in the NSLP along with eligibility. We focus on eligibility dynamics only.

Short-term income volatility was predicted to be an important determinant of NSLP eligibility dynamics in a 1992 study of household NSLP eligibility by Robert St. Pierre and Michael Puma. Their study was addressed to policymaker concerns from the early 1980s that misreporting in applications was a significant problem (akin to the recent concern). They found that misreporting was lower than expected, estimated to be about 4.8 percent per year and that the incidence of misreporting was smaller than changes resulting from income and household composition changes, estimated to be about 3 percent per month over the year.

Over the last 3 years, FNS has sponsored a series of new studies by Mathematica Policy Research, Inc. (MPR), on certification errors. One MPR study assessed the verification results from a sample of 21 large metropolitan SFAs by collecting data from households and comparing that data with the verification results (Burghardt et al., 2004a). They found that just over one-half of households that had not responded to the December verification were eligible for the level of benefits they had received or for a higher level of benefits. They also found that 26 percent of households that had been certified for free meals but that did not respond to the verification request were eligible for reduced-price meals.

More than three-fourths of the households that were re-approved for benefits (after having been dropped for nonresponse) were re-approved for the same level of benefits they had received before or for a higher level of benefits. One-third of the households whose status was verified as unchanged were no longer eligible for the benefits received by the time of their interview in February or March 2003. Burghardt et al. estimate that as much as 30-40 percent of the differences between household eligibility status from the time of verification to the time of their survey data could be explained by changes in household income or household composition.

Another recent MPR study used nationally representative school administrative data along with SIPP data to analyze the impacts of direct certification (Gleason et al., 2003). They estimated the rate of ineligibility among certified students resulting from the two main certification processes, direct certification and the regular application process. They found that, for the average school district, the share of ineligible students in December was 12-20 percent. The lower rate was based on the assumption that families that did not respond to the verification request were eligible, and the higher rate was based on the assumption that they were not. Because the error rates were significantly higher in large districts, Gleason et al. also estimated error rates for all certified students. They found that the error rate for all certified students was 12-33 percent. Bear in mind that an error rate at either end of this range is implausible. The study of the verification process in large SFAs showed that half of the households that do not respond to the verification request are eligible. The actual error rate likely lies somewhere near the middle of this range (around 23 percent).

Two studies by MPR also evaluated FNS-sponsored pilot projects that used upfront documentation of income and additional household verifications to address the issue of certification accuracy. Burghardt et al. (2004b) found that neither piloted method significantly affected overall certification accuracy but that both methods deterred eligible families and effectively raised application

barriers to eligible families. Their overall estimate of certification error was 18 percent, meaning that 18 percent of the students who were certified as eligible for free meals were not eligible for free meals, although about two-thirds of those were eligible for reduced-price meals. Hulsey et al. (2004) found that the two piloted methods significantly increased administrative error rates.[14]

Income Changes Likely To Be Detected at Verification

Next, we examine the possible effects of volatility on verification findings. The purpose is to identify the extent to which income volatility can account for the magnitude of verification error rates identified in previous studies under the regulations in effect at that time.

Under the provisions in effect before the new law, how many of the households eligible in August were still eligible for the same benefits in subsequent months? We look separately at 3 school years, 1996-97, 1997-98, and 1998-99, to see if the pattern was typical or not. In this section, we look at eligibility for free and reduced-price lunch, both together and separately. We combine them for reasons previously discussed, and we separate them in order to understand how much of the changes in status that resulted from verification were due to changes across these categories. We report the results using both the unadjusted data and seam-bias-adjusted data.

As just stated, these results do not take into account possible household choices about whether to apply for the program or not given their income situation, so the results represent solely the effect of income volatility if all income-eligible (at the time of application) households participate. Additionally, the analysis does not identify households that were NSLP-certified at that time and we assume that all eligible households at the start of the year were correctly certified. Thus, the analysis examines the extent to which income volatility for eligible households alone can account for overcertification.

The first question we address is: How many households eligible in August for either a reduced-price or free lunch were ineligible for either by the next month, September, due to an increase in income relative to poverty that raised the household above 185 percent? How many of them were ineligible in the following months of the school year? Households can become eligible again in this counting framework—that is, households that become ineligible in 1 month are not excluded from the sample. Given the number of changes in eligibility we saw earlier, some households are known to be cycling in and out of eligibility status over the course of a year (tables 10, 11, and 12).[15]

Each of tables 10, 11, and 12 shows estimates from a different school year of the share of initially eligible households that are ineligible in each subsequent month of the school year. The tables report both the estimates and their respective 95-percent confidence intervals. December is highlighted to identify what share of initially eligible households were ineligible as of the final month of verification.

The unadjusted data for the 1996-97 school year show that 15.6 percent of the initially eligible households were ineligible as of September and that 21.2 percent of them were ineligible as of December (table 10). The September data for 1997-98 and 1998-99 were 13.9 percent and 8.7 percent, and the

[14]Other studies explored the role of administrative errors (USDA, FNS, 2002; Strasberg, 2004). In FNS's 2002 study of the eligibility determination process, an average of 6 percent of certifications for benefits were inaccurate and an average of 8 percent of verification decisions were inaccurate.

[15]In other words, these are not life tables of the percentage of households with children who become ineligible by a certain month and are treated as no longer at risk for re-entry or re-exit in following months. Instead, these tables are a tally of ineligibility in any month, inclusive of those who may have re-exited and re-entered. This analysis is designed to estimate what percentage of households with children can be expected to be ineligible if a verification sample of these households were conducted in various months.

December data for 1997-98 and 1998-99 were 19.2 percent and 17.9 percent (tables 11 and 12). These estimates, however, are subject to artificial inflation from the possibility of seam bias.

When we use adjusted income data, we see that, as expected, the share of households that became ineligible is lower month-by-month than in the unadjusted data.[16] The data for September for the 3 consecutive school years were 13.7 percent, 11.8 percent, and 7.2 percent, plus or minus 1 or 2

[16]The data reverses in the 1996-97 school year for some months after April in that the share from the adjusted data exceeds the share from the unadjusted data. We are not entirely sure why these adjustments would yield higher estimates in some cases. The differences, however, are not large enough such that the 95-percent confidence intervals of each estimate do not also contain the other estimates.

Table 10

Share of households that were eligible for NSLP in August but ineligible after August, 1996-97 school year

Month	No adjustment		Seam-adjusted data	
	Ineligible households	95-percent confidence interval	Ineligible households	95-percent confidence interval
	Percent			
September	15.6	14.4-16.9	13.7	12.5-14.9
October	14.4	13.2-15.6	12.9	11.8-14.1
November	19.0	17.7-20.3	17.6	16.3-18.9
December	***21.1***	***19.7-22.4***	***19.5***	***18.2-20.9***
January	20.7	19.4-22.1	20.3	18.9-21.6
February	22.8	21.4-24.3	22.1	20.7-23.5
March	23.2	21.8-24.7	23.0	21.6-24.4
April	21.9	20.5-23.3	22.2	20.8-23.6
May	22.4	21.0-23.8	23.1	21.7-24.6
June	26.3	24.8-27.7	25.9	24.4-27.4
July	22.7	21.3-24.2	23.3	21.8-24.7

   Note: December figures are highlighted because December is when certification errors are likely to be caught.
   Source: U.S. Department of Commerce, U.S. Census Bureau, 1996 panel of the Survey of Income and Program Participation.

Table 11

Share of households that were eligible for NSLP in August but ineligible after August, 1997-98 school year

Month	No adjustment		Seam-adjusted data	
	Ineligible households	95-percent confidence interval	Ineligible households	95-percent confidence interval
	Percent			
September	13.9	12.3-15.4	11.8	10.4-13.3
October	14.3	12.7-15.9	13.1	11.6-14.7
November	22.2	20.3-24.1	21.1	19.3-23.0
December	***19.2***	***17.4-21.0***	***18.4***	***16.7-20.2***
January	20.9	19.1-22.8	19.8	18.0-21.6
February	24.5	22.6-26.5	23.8	21.8-25.7
March	21.9	20.0-23.8	21.6	19.7-23.4
April	22.2	20.3-24.1	22.0	20.2-23.9
May	23.9	21.9-25.8	23.5	21.6-25.4
June	25.7	23.8-27.7	25.3	23.4-27.3
July	23.2	21.3-25.1	23.2	21.3-25.1

   Note: December figures are highlighted because December is when certification errors are likely to be caught.
   Source: U.S. Department of Commerce, U.S. Census Bureau, 1996 panel of the Survey of Income and Program Participation.

percentage points when including the possible range of values in the 95-percent confidence intervals. The data for December for the 3 school years were 19.5 percent, 18.4 percent, and 16.8 percent, plus or minus 1 or 2 percentage points when including the possible range of values in the 95-percent confidence intervals.

What about the error related to households eligible for free lunches becoming eligible for only reduced-price lunches by December? This change in eligibility is considered an overcertification error because it entails an unwarranted payment of benefits. Results from the adjusted income series show that, in the 1996-97 school year, 9.4 percent of households that were eligible for free lunches in August were eligible for only reduced-price lunches by December (table 13). In the next 2 years, the share was 8.2 and 7.9 percent.

Combining the two types of errors that would lead to a benefit reduction or termination in December verifications under the old law, we estimate overcertification error for the 3 school years at 28.9, 26.6, and 24.7 percent, or an average of 27 percent. These estimates are notable when compared with the estimates of errors found in December verifications discussed in the literature review. Our estimate of ineligibility due to an income volatility of 27 percent constitutes 82 percent of the high-end estimate of total error of 33 percent among students as estimated by Gleason et al. (2003) (which is considered unrealistic because it assumes all nonrespondents are ineligible). Our estimate would more than explain the lower estimate of total error of 12 percent by Gleason et al., as well as estimates from other studies of 15-19 percent. Given that we do not estimate the effects of participation or certification that income volatility might also affect, this estimate may be upwardly biased. We conclude that income volatility by itself can possibly account for a large amount of overcertification error rates found in previous studies, though the precise amount is unknown.

Table 12
Share of households that were eligible for NSLP in August but ineligible after August, 1998-99 school year

Month	No adjustment		Seam-adjusted data	
	Ineligible households	95-percent confidence interval	Ineligible households	95-percent confidence interval
	Percent			
September	8.7	7.7-9.7	7.2	6.3-8.1
October	13.1	11.9-14.3	11.1	10.0-12.2
November	18.6	17.2-20.0	17.0	15.7-18.3
December	*17.9*	*16.5-19.2*	*16.8*	*15.5-18.1*
January	19.1	17.7-20.4	19.0	17.7-20.4
February	20.3	18.9-21.7	20.0	18.6-21.4
March	19.5	18.1-20.9	18.8	17.4-20.2
April	20.9	19.4-22.3	20.6	19.2-22.0
May	24.3	22.8-25.8	23.8	22.3-25.3
June	22.7	21.2-24.1	22.5	20.1-24.0
July	23.8	22.3-25.3	23.6	22.1-25.1

Note: December figures are highlighted because December is when certification errors are likely to be caught.

Source: U.S. Department of Commerce, U.S. Census Bureau, 1996 panel of the Survey of Income and Program Participation.

Tables 10-13 reveal an interesting temporal pattern in the changes over time of the share of households that are ineligible.[17] The share typically increased with each passing month, but the rate of increase diminished over time. Although the share of households ineligible for any benefit grew from zero in August to about 18 percent by December, after 4 more months, the share of ineligible households increased to only around 23 percent by the end of the school year. Similarly, households that went from free-lunch eligible to reduced-price eligible hit a maximum of 1-2 percentage points higher than the December figures in the subsequent spring and summer months. This pattern can be understood by remembering that only part of the population is significantly changing eligibility status over the course of a year, and they are the ones likely to be still changing (compared with their status in August) at the end of the year. The bulk of the changes that occur earlier include the households that experience one change in status, especially those close to the eligibility limit, some of which may have steady State incomes just above the limit.

Table 14 shows how changes in a household's month-to-month eligibility status differ by its original eligibility status—reduced-price or free lunch—using the adjusted data. Most of the households that became ineligible in the months immediately after August had been eligible for the reduced-price lunch. For example, in the 1996-97 school year, 80.3 percent of households that were ineligible in September were households that had been in the reduced-price-meal category in August. In the other years, 79.3 and 70.0 percent of households that were ineligible in September had been eligible for the reduced-price lunch the month before. The preponderance of reduced-price households among the households that crossed the 185 percent income threshold is logical because these households were closest to the threshold. The share of reduced-price-eligible households among subsequent ineligible households declined continuously with each month. By December, the share was about three-fifths. By July, the share was about half.

[17]This pattern is not affected by seasonal factors.

Table 13

Share of households that changed eligibility status for free and reduced-price lunches after August, 1996-97, 1997-98, and 1998-99 school years[1]

Month	1996-97, eligibility after August from:		1997-98, eligibility after August from:		1998-99, eligibility after August from:	
	Free to reduced-price lunches	Reduced-price to free lunches	Free to reduced-price lunches	Reduced-price to free lunches	Free to reduced-price lunches	Reduced-price to free lunches
	Percent					
September	7.2	3.6	6.9	4.4	4.5	7.1
October	6.8	6.1	6.0	5.6	7.1	8.1
November	8.9	6.2	9.1	5.3	8.2	6.7
December	***9.4***	***7.6***	***8.2***	***7.1***	***7.9***	***9.3***
January	9.2	8.2	8.3	7.1	9.2	9.4
February	10.9	8.4	9.4	6.5	10.1	8.5
March	10.3	8.0	7.7	8.4	9.3	9.9
April	10.1	8.2	8.7	8.4	10.5	9.2
May	10.1	7.9	9.2	7.1	11.0	8.2
June	11.3	7.0	9.6	7.0	9.9	9.0
July	10.8	7.3	9.1	8.0	10.6	8.9

Note: December figures are highlighted because December is when certification errors are likely to be caught.

[1]Based on seam-adjusted data.

Source: U.S. Department of Commerce, U.S. Census Bureau, 1996 panel of the Survey of Income and Program Participation.

Another type of error occurs when the household is not provided extra benefits to which they are entitled after an income change. Instead of measuring the share of households going from free-lunch to reduced-price eligibility, we measure the share of households going from reduced-price to free-lunch eligibility. In practice, these households may have applied for the increased benefits, in which case, they have not been underpaid at all. However, for illustration, table 13 also shows the possible extent of underpayment of free lunch benefits to those receiving reduced-price lunches. This type of error appears to be slightly smaller than the free to reduced-price direction of error in general. For example, 3.6 percent of households eligible for reduced-price lunches in August became eligible for free lunches in September compared with 7.2 percent of households moving from free-lunch eligibility to reduced-price eligibility. However, in several months, the differences were reversed. In 1998-99, 7.1 percent of households moved from free-lunch to reduced-price eligibility compared with 4.5 percent of households moving from free-lunch to reduced-price eligibility.

Income dynamics can also bring households that are ineligible in August into eligibility during the school year. Because December serves as a useful benchmark, table 15 again highlights the December data. The adjusted data show that, in 1996-97, 5.2 percent of households that were ineligible in August for either benefit were eligible for free lunches in December and 3.2 percent were eligible for reduced-price lunches. The share rose slightly over the school years for households becoming eligible for free lunches as of December: 5.9 percent in 1997-98 and 6.5 percent in 1998-99. The share declined slightly for households becoming eligible for reduced-price lunches: 2.9 percent in 1997-98 and 2.7 percent in 1998-99. Many households that were not certified at the start of the school year experienced income or household composition changes that changed their eligibility

Table 14

Share of households that were eligible for free or reduce-price lunches in August but ineligible for either after August, 1996-97, 1997-98, and 1998-99 school years[1]

Month	1996-97, ineligible after August for either, had been eligible for:		1997-98, ineligible after August for either, had been eligible for:		1998-99, ineligible after August for either, had been eligible for:	
	Reduced-price lunches	Free lunches	Reduced-price lunches	Free lunches	Reduced-price lunches	Free lunches
			Percent			
September	80.3	19.7	79.3	20.7	70.0	30.0
October	66.0	34.0	63.7	36.3	60.8	39.2
November	65.9	34.1	64.9	35.1	58.5	41.5
December	*61.7*	*38.3*	*59.6*	*40.4*	*57.2*	*42.8*
January	58.0	42.0	60.1	39.9	57.0	43.0
February	58.4	41.6	60.5	39.5	54.6	45.4
March	56.9	43.1	57.2	42.8	53.5	46.5
April	55.8	44.2	55.7	44.3	54.5	45.5
May	55.4	44.6	55.0	45.0	54.5	45.5
June	56.1	43.9	54.5	45.5	51.8	48.2
July	52.4	47.6	54.0	46.0	52.7	47.3

Note: December figures are highlighted because December is when certification errors are likely to be caught.
[1]Based on seam-adjusted data.
Source: U.S. Department of Commerce, U.S. Census Bureau, 1996 panel of the Survey of Income and Program Participation.

status within a few months (table 15). The largest change in the share of eligible households occurred in the first month, mirroring the changes from eligible to ineligible status just analyzed.

Annual Versus Monthly Eligibility Determination

SFAs use monthly income most often to determine household eligibility at the time of application. This was the case under the old rules and still is under the new rules. Households apply for program benefits based on 1 month of income under the tacit assumption that monthly income is a good predictor of annual income. Is 1 month of income a good predictor of annual income? One would imagine that its power as a predictor would decline the more variable it was over the year. To explore the power of 1 month of income as a predictor in the context of NSLP eligibility, we compare estimates of eligibility by using August income alone and estimates of eligibility based on annual income reported in the following months of the school year (using adjusted data). We do not think that August has any particular seasonal properties; any single month's income would provide similar results. We look at the share of households that qualify for various categories: (1) the two categories of eligible or ineligible for any benefits, and (2) the three categories of free, reduced-price, and ineligible.

Table 16 allows us to view the complete overlap of the two categories of eligibility determined by month and by year. Looking at the first section of the table that shows the cross-tabulations for August 1996 and the school year 1996-97, we see that the share of households eligible from the annual calculation is 33.8 percent. In contrast, the share of households eligible from the August (monthly) calculation is 29.9 percent, about 4 percentage points lower. Similarly, for the other 2 years, the August calculation is lower by about 3 percentage points in 1997-98 and by almost 5 percentage points in 1998-99.

Table 15

Share of households that were ineligible for free or reduce-price lunches in August but eligible for one or the other after August, 1996-97, 1997-98, and 1998-99 school years[1]

Month	1996-97, eligible after August for:		1997-98, eligible after August for:		1998-99, eligible after August for:	
	Free lunches	Reduced-price lunches	Free lunches	Reduced-price lunches	Free lunches	Reduced-price lunches
	Percent					
September	2.6	1.0	3.5	1.0	5.0	0.8
October	4.0	2.1	4.5	1.6	5.2	1.3
November	4.3	2.3	3.8	1.8	4.3	1.7
December	***5.2***	***3.2***	***5.9***	***2.9***	***6.5***	***2.7***
January	5.8	3.8	5.9	3.4	5.7	3.4
February	5.7	3.7	5.2	3.8	6.2	3.9
March	5.3	4.7	6.4	4.7	7.5	4.2
April	6.3	4.9	6.5	4.7	7.2	3.9
May	6.2	5.0	5.8	4.5	5.9	3.9
June	5.3	5.1	5.8	4.5	6.7	4.7
July	6.0	5.2	6.2	4.9	6.7	4.7

Note: December figures are highlighted because December is when certification errors are likely to be caught.
[1]Based on seam-adjusted data.
Source: U.S. Department of Commerce, U.S. Census Bureau, 1996 panel of the Survey of Income and Program Participation.

In 1996-97, of the households that were annually eligible, the monthly determination of eligibility counted 68.9 percent of them as eligible, whereas for the annually *in*eligible, the monthly determination was closer—it counted 90.1 percent of them as ineligible. Households with high incomes in August tended to have high incomes throughout the school year. Italicized numbers in table 16 show the results of analyzing the monthly cross-tabulations. In 1996, 78 percent of households that were eligible in August were also annually eligible; 85 percent of households that were ineligible in August were also annually ineligible. The single-month determination appears to be better at capturing annually ineligible than annually eligible households. The same pattern was repeated in the other 2 years.

How does the August determination compare with the annual determination of eligibility when we look at the three categories of ineligible, reduced-price-eligible, and free-eligible? As in the two-category case, the

Table 16
Monthly (August) versus annual eligibility determinations: Overlap between the two determinations of eligibility, 1996-97, 1997-98, and 1998-99 school years

Month and year	Monthly eligibility	Annual eligibility, 1996-97		
		Ineligible	Eligible	Total
		Percent		
August 1996	Ineligible	*85.0*	*15.0*	*100.0*
		90.1	31.1	70.1
	Eligible	*22.0*	*78.0*	*100.0*
		9.9	68.9	29.9
	Total	*66.2*	*33.8*	*100.0*
		100.0	100.0	100.0
		Annual, 1997-98		
		Ineligible	Eligible	Total
		Percent		
August 1997	Ineligible	*86.6*	*13.4*	*100.0*
		90.5	29.4	70.7
	Eligible	*21.9*	*78.1*	*100.0*
		9.5	70.6	29.3
	Total	*67.6*	*32.4*	*100.0*
		100.0	100.0	100.0
		Annual, 1998-99		
		Ineligible	Eligible	Total
		Percent		
August 1998	Ineligible	*86.2*	*13.8*	*100.0*
		92.4	32.3	73.5
	Eligible	*19.6*	*80.4*	*100.0*
		7.6	67.7	26.5
	Total	*68.6*	*31.4*	*100.0*
		100.0	100.0	100.0

Italicized numbers highlight row frequencies, and unitalicized numbers highlight column frequencies.
Note: Annual income uses data from months July to June of each respective school year.
Source: U.S. Department of Commerce, U.S. Census Bureau, 1996 panel of the Survey of Income and Program Participation.

monthly determination classifies a higher share of the whole population as ineligible than as eligible for the free and reduced-price categories (see app. table 3).

This analysis shows that income from a single month tends to overestimate annual income for households with children. Perhaps this overestimation is attributable to the higher relative volatility of low-income households: Households with greater volatility (even if only relative) may be more likely to cross the threshold of eligibility and be "caught" on the ineligible side when 1 month's income is used to determine eligibility. To the extent that households are not aware of their ability to apply for NSLP benefits throughout the year, using monthly income to determine eligibility could lead to a lower certification rate than that which would come from using annual income, which more accurately matches the certification period of a year. This outcome suggests that it is important for schools to emphasize to families that they can apply for benefits at any time of the school year.

Conclusions

In this study, we found that income volatility among households with children could cause frequent shifts in food assistance program eligibility. We used the 1996 panel of the Survey of Income and Program Participation. We started by testing the notion that lower income households have more volatile incomes than higher income households do. For a measure of volatility, we used the coefficient of variation rather than the standard deviation of a household's monthly income in order to provide a scale-independent measure of variation. We found that relative income volatility decreased as income increased. That is, monthly incomes of higher income households showed smaller changes relative to their means than those of lower income households. The relative income volatility of households with incomes below 75 percent of poverty was double the magnitude found for households with incomes above 300 percent of poverty.

Monthly incomes of families with children were clustered around 130-185 percent of the poverty line; the most frequently reported category of the household income distribution was between the two thresholds for NSLP free and reduced-price lunch eligibility. Thus, small changes in monthly income for these large groups of households could produce a high frequency of overall changes in monthly eligibility status. To examine changes in monthly eligibility status, the analysis combined the free and reduced-price lunch categories and examined how many times households crossed the 185-percent threshold in a year. Most households did not experience a change in their eligibility status during the school year. Only one-third (31 percent) of households had one or more transitions from eligibility to ineligibility or vice versa. However, that result is driven by including higher income households for which the chances are relatively small of dropping below the 185-percent threshold. Among those lower income households with income below 185 percent of poverty in at least 1 month, two-thirds (65 percent) had one or more transitions, and one-fifth (21 percent) had three or more transitions.

Not surprisingly, we also found that households closest to the eligibility income cutoff point of 185 percent of poverty experienced more eligibility changes per year. Households with children whose average monthly income (across the survey) fell between 130 percent and 240 percent of poverty crossed the eligible line five times per year on average. Altogether, this analysis of eligibility transitions shows that schools would be changing the eligibility status of numerous households throughout the school year if households faithfully reported income changes and schools reexamined the eligibility status of these households.

In order to estimate the main sources of eligibility changes, we conducted bivariate and multivariate analysis of income change events (or "triggers") that might lead to eligibility change. For the multivariate analysis, we estimated a hazard model of entry into NSLP eligibility and another hazard model of exit from NSLP eligibility. In the models, we included static characteristics of households and triggers of economic and household changes. We estimated entry and exit models using periods of different lengths in order to understand which triggers may be more important for shorter

periods versus longer periods. However, we did not find large differences in the kinds of triggers that were statistically significant between the shorter and longer period models.

In both the exit and entry models, the most important triggers were changes in the total household hours worked in a month and changes in the share of working adults in the household. We obtained the standard results with respect to the static household-level determinants that one would expect in a model of poverty dynamics. For example, higher education levels led to higher chances of exit from eligibility, and households with Black, Hispanic, or Asian reference people were less likely to exit compared with those with White reference people. Corresponding results were obtained for the entry model.

In the entry model, the event that had the highest odds of triggering entry into eligibility was for a woman to become divorced, separated, or widowed. But the opposite event of a female head of household getting married did not lead to exit from eligibility—an asymmetry of effects that could be explained in at least two ways. A married woman may choose not to work outside the home and instead focus on child care or other unpaid domestic work, thus not adding earned income to household income. Or the women in these two groups possibly are not demographically similar enough for us to expect a symmetric effect of marital status change; the marriage "markets" and other economic circumstances may be quite different among women who go from being single to being married and vice versa. Pay cuts for all household members were important triggers for entering eligibility, but only increases in spouses' wages were important for exiting eligibility. An explanation for this result could be that, when the pay rates of spouses increase, the extra earnings to the household provide a critical route out of low-income status.

We then turned to the question of the impact of income volatility on NSLP certification errors. For the 3 school years that are in the 1996 SIPP panel, we traced over the next 12 months the income changes of households that would be eligible in August, based on income criteria alone (under the old rules), to count the share of households that were ineligible for benefits received in any given month. We counted changes to eligibility for any benefit as well as changes from free-lunch eligible to reduced-price eligible, which is the standard type of error that has raised concern. We found that up to one-fifth of households that were eligible in August became ineligible right away in September: 21 percent in 1996-97, 19 percent in 1997-98, and 12 percent in 1998-99. In all 3 years, the share of August eligibles that were ineligible increased through December: 29, 27, and 25 percent in each school year in turn. These shares constitute this study's estimates of households that were ineligible by December due to changes in income alone. We also found that the majority (57-60 percent) of those that were ineligible in December were households that had been eligible for reduced-price lunch.

In the literature on certification errors, estimates of overcertification differ widely. The estimated range of 12-33 percent error found by Gleason et al. (2003) provides a benchmark of two estimates at the extremes. Earlier studies found verification error rates in the range of 15-19 percent. Our

estimate of overcertification in December due to income volatility alone of 27 percent is higher than most estimated overcertification error rates. (See table 17 for a summary list of estimates from other studies.) However, an important qualifier to these results is that we had to assume that there was no interaction between income volatility and household or school administration behavior. These results assume all households participate if eligible and that all certifications are made correctly. Thus, the results may be overstated to the extent that there are, in reality, important interactions that we have not considered. We conclude that income volatility has the potential to explain a large portion of NSLP overcertification error but that the exact amount is unknown.

Next, we looked at the question of how well monthly income predicts eligibility if eligibility were determined by annual income. We found that a certification process that uses a single month's income produces systematically fewer eligible households than a certification process that uses annual income. The differences in matching were largest for reduced-price-eligible households. A monthly determination of reduced-price eligibility was less likely to match an annual determination of reduced-price eligibility than it was to match free-lunch eligibility. A monthly determination was more likely to correctly match ineligible households than to match reduced-price- or free-lunch-eligible households. Overall, a single month's determination is more likely to err in the direction of ineligibility. Up to 5 percent of the annually eligible population was found to be ineligible when we used income from August.

The important insight from this exercise is that program accessibility is supported by the rule that families can apply for benefits throughout the school year. The importance of this policy is also suggested by the evidence on the frequency of eligibility changes that low-income families experience within a year. The policy is important to gaining full program accessibility.

Table 17
Comparison of overcertification estimates in the literature

Year	Authors	Data	Estimates of overcertification rates
			Percent
1990	St. Pierre et al.	National school data	15
1997	USDA, Office of Inspector General	Illinois school data	19
1999	USDA, FNS	CPS	27[1]
2003	Neuberger and Greenstein	SIPP	2[1]
2004a	Burghardt et al.	21 large metro schools	17[2]
2003	Gleason et al.	National school data	12-33[3]
2004b	Burghardt et al.	FNS Pilot Data	181

[1]Measuring eligibility for free lunch only.
[2]This is of the total students verified, including the 50 percent who did not respond to verification.
[3]The low estimate assumes nonrespondents were eligible, and the high estimate assumes they were ineligible. (These error rates are based on the average student not the average school district because the error rates were found to be significantly higher in large districts.)

The Child Nutrition and WIC Reauthorization Act of 2004 extended NSLP eligibility through the school year. One implication of the new law is that the administrative responsibility and potential burden for schools to adjust eligibility status every month has been eliminated. Another direct implication is that income volatility will no longer affect NSLP eligibility. However, it remains an important issue to other USDA food assistance programs. The evidence here shows that income volatility is relatively more important for low-income households, and it is strongly linked to monthly changes in the characteristics of a household's labor force participation. To the extent that the USDA food assistance programs are to serve the needy, the volatility associated with low-income working households will become an increasing challenge to program administration.

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Appendix table 1
Coefficient of variation (CV) of income data: Distribution over 1 year by average monthly income-to-poverty status

	Unadjusted data					
Income-to-poverty status	<0.75	0.75-1.30	1.30-1.85	1.85-2.40	2.40-3.00	>3.00
Observations (number)	792	1,290	1,402	1,452	1,387	4,807
75th percentile	0.77	0.57	0.47	0.41	0.37	0.37
50th percentile (median)	.52	.39	.32	.28	.25	.24
25th percentile	.32	.26	.22	.20	.18	.17
Mean	.61	.44	.38	.33	.31	.31
Standard deviation	.45	.28	.26	.19	.24	.23
Interquartile range	.45	.31	.25	.21	.19	.20
	Adjusted data					
	<0.75	0.75-1.30	1.30-1.85	1.85-2.40	2.40-3.00	>3.00
Observations (number)	792	1,290	1,402	1,452	1,387	4,807
75th percentile	0.68	0.51	0.42	0.36	0.33	0.33
50th percentile (median)	.45	.34	.28	.25	.23	.21
25th percentile	.27	.22	.19	.17	.16	.15
Mean	.53	.39	.34	.29	.28	.27
Standard deviation	.40	.25	.23	.17	.22	.20
Interquartile range	.41	.29	.23	.19	.17	.18

Note: The average CV in each income-to-poverty status group is significantly different from the average CV of all the other groups combined, and each average CV is significantly different from the average CV in the following and preceding income to poverty groups. The differences are all significant at the 0.0001 level.

Source: U.S. Department of Commerce, U.S. Census Bureau, 1996 panel of the Survey of Income and Program Participation.

Appendix table 2
Changes in eligibility status by household over 1 year and 3 years

	A	B	C	D	E	F
	Over 1 year, 1996-97,		Over 1 year, 1997-98,		Over 3 years, 1996-99,	
Changes	Including never-eligible households	Only once-eligible households	Only once-eligible households	Only once-eligible households	Including never-eligible households	Only once-eligible households
	Percent					
0 changes	69	35	34	35	50	14
1 change	10	21	21	22	5	8
2 changes	11	23	23	22	14	23
3+ changes	10	21	22	21	32	54
	Number					
Observations	8,753	4,376	3,798	3,583	4,333	2,571

Source: U.S. Department of Commerce, U.S. Census Bureau, 1996 panel of the Survey of Income and Program Participation.

Appendix table 3

Monthly (August) versus annual eligibility determinations:
Overlap between three determinations of eligibility,
1996-97, 1997-98, and 1998-99 school years

| Month and year | Monthly eligibility | Annual eligibility, 1996-97 | | | |
		Ineligible	Reduced-price eligible	Free-eligible	Total
		Percent			
August 1996	Ineligible	*85.0*	*5.8*	*9.2*	*100.0*
		90.1	34.7	29.3	70.1
	Reduced-price	*39.5*	*40.4*	*20.1*	*100.0*
	eligible	6.5	37.8	9.8	10.9
	Free-eligible	*12.0*	*16.8*	*71.2*	*100.0*
		3.4	27.5	60.9	19.0
	Total	*66.2*	*11.6*	*22.2*	*100.0*
		100.0	100.0	100.0	100.0

| | | Annual eligibility, 1997-98 | | | |
		Ineligible	Reduced-price eligible	Free-eligible	Total
		Percent			
August 1997	Ineligible	*86.6*	*5.6*	*7.9*	*100.0*
		90.5	32.6	27.5	70.7
	Reduced-price	*36.1*	*47.3*	*16.6*	*100.0*
	eligible	6.0	43.8	9.2	11.2
	Free-eligible	*13.2*	*15.7*	*71.1*	*100.0*
		3.5	23.7	63.4	18.1
	Total	*67.6*	*12.1*	*20.3*	*100.0*
		100.0	100.0	100.0	100.0

| | | Annual eligibility, 1998-99 | | | |
		Ineligible	Reduced-price eligible	Free-eligible	Total
		Percent			
August 1998	Ineligible	*86.2*	*6.4*	*7.4*	*100.0*
		92.4	40.4	27.5	73.5
	Reduced-price	*31.3*	*45.7*	*23.0*	*100.0*
	eligible	4.4	37.6	11.2	9.6
	Free-eligible	*12.9*	*15.3*	*71.8*	*100.0*
		3.2	22.0	61.3	16.8
	Total	*68.6*	*11.7*	*19.7*	*100.0*
		100.0	100.0	100.0	100.0

Italicized numbers highlight row frequencies, and unitalicized numbers highlight column frequencies.

Source: U.S. Department of Commerce, U.S. Census Bureau, 1996 panel of the Survey of Income and Program Participation.