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Dynamics of WIC Program Participation by Infants and Children, 2001 to 2003

Final Report

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Laura Castner
James Mabli
Julie Sykes

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USDA Food and Nutrition Service
Office of Research, Nutrition, and Analysis
Room 1028
3101 Park Center Drive
Alexandria, VA 22302

Project Officer:
Christine Kissmer

Submitted by:

Mathematica Policy Research, Inc.
600 Maryland Ave. S.W., Suite 550
Washington, DC 20024-2512
Telephone: (202) 484-9220
Facsimile: (202) 863-1763

Project Director:
Laura Castner

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EXECUTIVE SUMMARY

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) provides nutritious foods that promote the health of low-income pregnant women, new mothers, infants, and preschool children. Infants and children up to age five from low-income families and found to be at nutritional risk are eligible. Low-income women found to be at nutritional risk are also eligible for WIC throughout their pregnancy and for up to one year postpartum (limited to six months for mothers who are not breastfeeding). In some States, women, infants, and children in households that participate in other assistance programs are automatically income eligible. In 2008, an average of 8.7 million women, infants, and children participated in the program each month. Infants and children compose 75 percent of the WIC population.

WIC enrollment and departure by infants and children are largely affected by changes in eligibility related to age. However, other factors affect eligibility and participation as well, since many children drop out of the program before their eligibility period expires. In this study we focus on four events related to the dynamics of WIC participation by eligible infants and children: entry, exit, continuity of participation, and re-entry. We also examined trigger events that led to entry into the program and exit from it. We conduct the study in two stages. In the first stage, a descriptive analysis, we examine the dynamics of WIC participation for infants and children, from 2001 to 2003, including rates of entry among low-income infants and children; age of the infant or child at first entry; the percentage that continue to participate from one age to another; and age of the infant or child at exit. In the second stage, a multivariate analysis, we explore the factors associated with their entry into and exit from the program.

Periodic examination of these WIC participation dynamics leads to a better understanding of overall trends in the size of the WIC caseload and the factors that affect participation. In addition, this analysis may help WIC outreach programs in targeting those who tend to enroll late or not at all, and in understanding why some participants leave WIC when they remain eligible for the program.

METHODOLOGY

Our research and analysis was based on the Survey of Income and Program Participation (SIPP) for 2001 to 2003, a nationally representative longitudinal survey. The SIPP collects household economic and demographic information that is sufficient to determine income eligibility for WIC as well as identification of WIC participants, although it is not sufficient to determine nutritional risk or eligibility through participation in other programs. It consists of approximately 35,000 households that are interviewed every four months over a three-year period. Approximately 1,300 children in the sample were reported to have received WIC benefits.

For the descriptive analysis, we aligned children by their age. To overcome a primary weakness of the SIPP, namely, the “seam bias” where many respondents report changes in program participation as if they occurred at the seams between two four-month data collection (“reference”) periods rather than between two months within the reference periods, we identified

changes in participation across reference periods rather than across months. That is, we relied only on the participation recorded for the fourth month of the reference period. We then examined changes in participation from one reference period to the next.

We estimate separate multivariate models of WIC entry and exit for children. For entry, we estimate a logistic regression model of participation in period 1 as well as a discrete-time hazard model of entry in all subsequent periods. For exit, we estimate a discrete-time hazard model as well as a model that focuses on the decision to continue participating in WIC at each age threshold (for children turning one, two, three, and four years old).

ENTRY

To be eligible for WIC, the family must be income eligible (having income at or less than 185 percent of the federal poverty level or determined automatically income eligible based on participation in other programs such as Medicaid) and the individuals must be identified as at nutritional risk on the basis of a medical or nutritional assessment. WIC differentiates between infants, eligible from birth and certified through their first birthday, and children, certified for six-month periods from age one through their fifth birthday. Infants and children receive different food packages.

- ***Most child participants enter WIC as infants.*** Of the children who entered in 2001 to 2003, 71 percent entered as infants.[1]
- ***Over half of low-income children enter WIC by the child's fifth birthday.*** Using life tables to estimate the time until a low-income child participates, we find that approximately 59 percent of low-income children (with family income under 185 percent of poverty) enter by the time they turn five-years-old.
- ***A combined decrease in earnings and entry into other public assistance programs trigger entry into WIC for children.*** Various events may "trigger" a child's entry into the program. Infants in a family that experienced a decrease in earnings of at least 20 percent and entered into public assistance are six times more likely to enter WIC than infants living in families that do not experience a decrease in earnings and do not enter public assistance. Older children in similar family situations are five times more likely to enter WIC than children living in families that do not experience a decrease in income and do not have someone enter public assistance.
- ***Children in the Western Region are more likely to enter WIC than children in other Regions of the country, except the Midwest.***

[1] While WIC differentiates between infants (birth up to age 1) and children (from age 1 up to age 5), this report frequently groups infants and children into one group, identified as children.

EXIT

Children are required to exit the program when they reach age five. They may also become ineligible if the family income increases or they are no longer determined to be nutritionally at risk.

- ***Exit from WIC by children is not as closely tied to a particular age as entry is.*** We are somewhat more likely to see children exit around their first birthday, when making the transition from the infant WIC package to the child package, and around the fifth birthday when the child becomes ineligible.
- ***Enrollment in Medicaid decreases the likelihood of exit***. Children participating in Medicaid are less likely to exit the WIC program before they become ineligible due to age.

CONTINUITY OF PARTICIPATION

The SIPP, although longitudinal in nature, covers only a portion of a child's WIC eligibility. Thus, we cannot observe how many children participate for the entire five-year period, and instead observe continuity of participation across approximately two-year segments of the eligibility period.

- ***In any two-year period, about one-third of participating children participated continuously across the two years***. On average, younger children (age 2 and under) participated for about 20 of 28 months of eligibility.[2] Older children participated for about 16 of the 28 months they were eligible (age 3 to age 5).
- ***Most children participating at any given age are likely to continue participation at the next age.*** Eighty percent or more of infants and one- to three-year-olds continue to participate at the next age.
- ***Infants in poorer families are more likely to continue participation as a one-year-old than infants with higher family income.*** This is also true for infant children of nonworking mothers as compared to infant children of working mothers. For older children, continued WIC participation is more likely if the child is enrolled in Medicaid, but family income is not associated with continued participation.

RE-ENTRY

Re-entry among WIC participants is relatively uncommon. Less than 10 percent of children exit and re-enter WIC within a two-year period.

[2] The 28-month period covers seven 4-month periods: the wave of the child's birthday plus the six waves that follow through the birthday two years later.

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I. INTRODUCTION

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) is a relatively short-term intervention program that provides nutritious foods to promote the health of low-income pregnant women, new mothers, infants, and preschool children. In 2008, an average of 8.7 million women, infants, and children participated monthly in the program, reflecting a steady increase from 2000, when 7.2 million participated in an average month.

The dynamics of WIC participation, including program entry, continuity of participation, exit, and re-entry, are largely determined by changes in eligibility related to the status of the mother's pregnancy or the age of the child. However, other factors affect participation as well, since many mothers and children leave the program before their eligibility period expires or enter long after they become eligible.

This study examines WIC participation dynamics of infants and children from 2001 to 2003 using the Survey of Income and Program Participation (SIPP) and was conducted in two stages. In the first stage, we describe the characteristics of the WIC child participants, including ages, continuity of their spells based on age of entry, and differences in participation by characteristics of the mother and family. In the second stage, we conduct a multivariate analysis to identify factors that influence entry, continuity of receipt, and exit from the program. We focus in particular on the following research questions:

- ***Entry.*** What are the rates of entry into the program by children of various ages (at birth, during infancy, age one, two, three, or four)? What factors appear to influence their participation?
- ***Continuity of Participation.*** What participant and household characteristics distinguish those who rely on WIC for short periods from those who rely on WIC for longer periods?

- ***Exit.*** At what ages do infants and children exit the WIC program? What factors appear to influence their exits?
- ***Re-Entry:*** What are the rates of return among those who exit the WIC program?

Periodic examination of WIC participation dynamics leads to a better understanding of overall trends in the size of the WIC caseload and the factors that affect participation. In addition, this analysis may help WIC outreach programs in targeting those who tend to enroll late or not at all, and in understanding why some participants leave WIC when they remain eligible for the program.

The remainder of this chapter discusses eligibility of infants and children for WIC, the choice of datasets we used for the study, issues we faced in measuring eligibility and participation with the available data, and an overview of our approach. Chapter II presents additional details about the methodology and results of the descriptive analysis of participation dynamics for children, and Chapter III presents the findings of our multivariate analysis. Appendix A provides details on the modifications made to the underlying data from the SIPP, and Appendices B and C provide supporting information for Chapters II and III, respectively.[3] As part of this study, we also conducted an exploratory analysis of WIC participation dynamics for pregnant women and mothers. These results, which appear to be partially influenced by issues in the SIPP data, are presented in Appendix D.

A. ELIGIBILITY

Eligibility for the WIC program is based on three sets of criteria. First, individuals must be categorically eligible—that is, they must be either pregnant or postpartum women, infants, or

[3] This study of WIC program dynamics was preceded by a similar study of Food Stamp Program dynamics (Cody et al. 2007). The appendices of that report provide extensive detail on the issues related to using the SIPP data for analysis of participation in nutrition assistance programs. In the appendix of this report, we focus on the changes made only for the purpose of this analysis.

children up to age five. Second, individuals must be either income eligible (in most states, the WIC eligibility threshold is 185 percent of the federal poverty level) or adjunctively eligible (even with higher income) through their participation in other programs such as Medicaid. Third, individuals must be identified as being at nutritional risk on the basis of a medical or nutritional assessment by a "competent professional authority on the staff of the local agency," such as a physician, nutritionist, or nurse.[4]

Pregnant women are certified for the duration of their pregnancy and for as long as six weeks postpartum. Non-breastfeeding, postpartum women are certified until six months postpartum, and breastfeeding women are certified at six-month intervals up to the infant's first birthday. Infants are certified up to their first birthday in most states, and children are certified at six-month intervals up to the end of the month in which they reach their fifth birthday.

B. EXISTING RESEARCH ON WIC PARTICIPATION DYNAMICS

Little research has been conducted on WIC participation dynamics, and what has been done is limited to participation dynamics of children. Most of the work, focused on the early 1990s, was conducted by Burstein and Baker (1998) who used the 1991 and 1992 SIPP panels, and by Burstein et al. (2000) who used the 1992 and 1993 SIPP panels. They found that, out of a cross-section of WIC child participants at a given point in time, 71 to 75 percent entered the program as infants. Of all children who had ever received WIC benefits during the study period, about 70 percent entered as infants. Although it is difficult to study duration in WIC because SIPP data cover only a few years of the eligibility period, the researchers estimated that about 80 percent of infants continued to participate at least until they turned one year old, and just under 30 percent of those participating at a given point in time would receive benefits until they turned five. The

[4] WIC is not an entitlement program and the maximum number of clients served depends on funding.

largest exit triggers identified in both studies are the "aging out" phenomenon, which happens when a child reaches five years of age; a monthly increase in household earnings of $1,500 or more; and exit from other welfare programs. Re-entry was unlikely, with only two to three percent returning to the program within two years.

The characteristics of WIC participants—mothers and children—have been the focus of more research than participation dynamics. Kresge (2003) found that about half of WIC participants in 2002 were children age one to four, while infants represented slightly over one quarter and women made up the final quarter of all participants. Almost two-thirds of the participants whose income is reported in the administrative data were living at or below poverty. Based on the 1988 National Maternal and Infant Health Survey, Gordon and Nelson (1995) found that two-thirds of women participating in WIC had participated during a previous pregnancy. They also noted that participating mothers were less educated and more likely to be teenagers than both income-eligible nonparticipating mothers and higher-income nonparticipating mothers. Participating mothers were also less likely than nonparticipating mothers to be married or living with the baby's father.

Cole et al. (2001) noted a change in participant demographics that occurred when the WIC caseload doubled from 1988 to 1998. As a result of disproportionate growth of caseloads in the West, the percentage of Hispanic participants rose from 21 percent to 32 percent during this time. By 2002, Kresge noted that Hispanic participants represented the largest racial/ethnic group in the program. In examining income of participants, Cole et al. found that almost 75 percent of WIC participants lived in families with workers, and 15 percent received income from the Temporary Assistance for Needy Families (TANF) program. Trippe and Cunnyngham (2004), using the SIPP data, estimated that about one-third of households with individuals receiving WIC also participated in the Food Stamp Program (FSP).

C. METHODOLOGY

This study relies on data from the 2001 panel of the Survey of Income and Program Participation (SIPP), the only ongoing source of longitudinal data with a large enough sample and sufficient detail to permit a look at patterns of WIC participation by infants and children. With its data on income and household composition, the SIPP is particularly useful in assessing who is income-eligible for WIC. It is also the data source used in the Burstein and Baker (1998) and Burstein et al. (2000) studies of the early 1990s.

1. Advantages of SIPP Data

The SIPP data provide several advantages for this type of study:

- The overall sample is large (for example, the 2001 panel included more than 30,000 households), implying adequate sample sizes for analyses of low-income children.
- The interviews occur every four months.
- Each household is asked about WIC participation in the prior 4 months (that is, the "wave") and who participated in each month.
- The 2001 panel, which is the most current complete panel, is 36 months in length (9 waves), and thus can capture a substantial period of potential participation. If the household's respondent reports that the family started receiving WIC in the last 4 months, the survey uses a pre-coded list to ask for the reason.[5]

2. Limitations of SIPP Data

Although the SIPP is the best data set for this type of study, it does have several limitations. In particular, the SIPP underestimates the number of all WIC participants; does not identify pregnant or breastfeeding mothers or nutritional risk; does not cover the full period of eligibility

[5] If the household's respondent reports that the family stopped receiving WIC *within* the 4-month reference period, the survey also uses a precoded list to ask for the reason for exit. However, due to the SIPP seam effect (discussed below), most exits are reported as occurring between two reference periods rather than within a period, so the reasons for most exits were not captured in the survey. This has been corrected for the 2004 and subsequent SIPP instruments.

for children; and is subject to the seam effect, that is, changes in participation status are disproportionately reported between interview periods (on the "seam") rather than within interview periods.

Underreporting of WIC Participation. Earlier studies found that the SIPP substantially underreports WIC participation (Gordon et al. 1997) relative to participant counts from WIC administrative data. Trippe and Cunnyngham (2004) found the same result when they used the January 2001 wave of the 2001 SIPP panel and discovered that underreporting is worse for infants. For our analysis, this suggests that our estimated rates of entry into WIC among low-income mothers and children are too low**.** However, most of this analysis focuses on patterns of participation among those who report receipt. If the underreporting is consistent across ages and characteristics of mothers and children, then the impact on the estimates will be small**.**

Incomplete Coverage of Child's Eligibility Period. A span of 36 months does not cover the full period of eligibility for children. Following the example of Burstein et al., we examine transitions in participation from one year to another.

Seam Effect and Wave-Level Analysis. The SIPP seam effect leads to the bunching of changes in a person's status at the transitions between waves. To account for such bunching, we again followed the example of Burstein et al. and focused on continuity of particpation from one wave to the next. Treating the exact timing of participation changes as suspect, we use reported status in the last month of each wave and assume that changes may have occurred at any time during the wave.

Although most changes in reported WIC receipt occurred at the seams, on occasion we saw one-month spells or one-month gaps of participation within the wave. Because children are certified for at least six months at a time, we do not expect to see one-month spells, so we recoded the month of participation to a month of nonparticipation. Similarly, we believe it is

unlikely that a child would stop participating for a month and we recoded the month of nonparticipation to a month of participation.

As with Burstein and Baker (1998) and Burstein et al. (2000), we also recode one-wave gaps in participation. We do not, however, recode one-wave spells of participation because a one-wave spell could correctly reflect one six-month participation spell. For example, suppose a child who enters at age one is born in the first month of a wave (and thus turns one year old in the first month of their entry wave). Their six-month spell would last through the second month of the following wave, so we would observe them participating only in the wave in which they entered. That is, they would not continue to be observed as participating in the last month of the following wave, the month we choose to represent participation throughout the wave.

Using the assumption that the participation status of the last month of the wave applies to the entire wave indicates that few five-year-olds will be counted as participants. Approximately one-quarter of the children reach the age of five in the last month of the reference period and are thus eligible in that last month. However, other children, who turn five in the first three months in the wave and thus are ineligible in the last month, would not be counted as participants. Thus, we assume that any child participating in the wave immediately prior to their fifth birthday is also participating in the month in which they turn five. Without this assumption, we would have substantially underestimated the proportion of children who participate until they lose their categorical eligibility.

3. Differences from Previous Analyses

For most of this analysis we followed a methodology very similar to that of Burstein et al. However, in some cases, corrections that we were able to make to the data allowed us to take a different approach, as detailed below:

- ***Weighting***. Burstein et al. identified several problems with performing a weighted analysis from the 1992 and 1993 SIPP panels. First, infants who were born during the sample were given zero for a longitudinal weight because they were not original sample members, as were adopted children of original sample members. Second, children who no longer live with an adult original sample member are not followed by the survey. Due to these problems with the longitudinal weights, the researchers opted to report unweighted results.

- ***Participation of Newborns***. Burstein et al. noted that infants are underreported in the SIPP, with a larger-than-expected number first appearing well after their birth. Thus, the researchers opted to exclude data on infants under the age of 4 months, expecting that the participation of an infant age 4 to 11 months would be similar to that of an infant under age 4 months.

As described in Appendix A, we closely examined the SIPP records of infants who appear in the data well after their birth. We also identified many infants who appear before their birth. We determined that an appropriate correction to the data for infants who appear after their birth was to "backfill" the infant information to the wave of their birth (including WIC participation), and for infants who appear before their birth was to recode information recorded prior to their birth. At the same time, we developed longitudinal weights for these infants and for those who appear at birth but are not assigned a longitudinal weight because they were not original sample members. We are confident that our approach enhances the quality of the SIPP data and allows us to capture participation in the first months after birth and to use weighted data. While we present the results from Burstein et al. alongside our results for comparison purposes, we are cautious in drawing any conclusions from these comparisons.

D. OVERVIEW OF APPROACH

Our general methodological approach consists of two parts. First, we analyze the characteristics of participation spells observed in the 2001 to 2003 period of the SIPP. Second, we conduct a multivariate analysis of the factors that influence WIC participation dynamics. The

descriptive analysis builds on earlier studies of WIC dynamics for children, while the multivariate analysis identifies specific factors that influence participation in the program.

1. Descriptive Analysis

In the descriptive analysis, we discuss the entry and exit patterns of WIC participants, continuity of receipt, and present factors that may lead to exits from WIC. In particular, we discuss entry into WIC among low-income children and the timing of their entry by their age. We also examined the age at which children exit the program. Following that is a discussion of the continuity of receipt across the years of eligibility, as best we can observe it in the short SIPP panel. Next, we identify the differences in continuity of receipt by family characteristics. And finally, we discuss the prevalence of factors that may "trigger" exits, such as becoming too old to participate or an increase in family income that may make the child ineligible.

2. Analysis of Factors that Influence Participation Dynamics

While the descriptive analysis of WIC participation dynamics suggests single factors that may be influencing participation patterns, it cannot indicate the relationship between groups of characteristics and a particular pattern, nor can it allow us to control for the effects of demographic and state-level characteristics.

The multivariate analysis is divided into two parts: an analysis of determinants of entry and an analysis of determinants of exit. In each analysis, we examined the association between WIC entry or exit, respectively, and characteristics of the child and family; trigger event variables that measure changes in income, earnings, and receipt of public assistance benefits; and state-level characteristics and policy variables.

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II. DESCRIPTION OF WIC PARTICIPATION DYNAMICS OF CHILDREN

Participation in WIC can generally be characterized by a sequence of events: entry, participation, exit, and, if applicable, re-entry. Developing periodic estimates of the rates at which people enter and exit the program, the continuity of their participation, and identifying the events that precede their entry and exit helps policymakers improve their understanding of who participates in the program, why, and for how long. Such information can lead to policies that better target assistance to eligible and participating individuals.

Infants are eligible from birth to their first birthday. At their first birthday, they are recertified as "children" and are eligible through the month of their fifth birthday. In addition, the food package changes when an infant reaches his or her first birthday and is recertified as a child. Children (i.e., those older than one year) need to be recertified every six months to verify that their family's income remains under the threshold.

From the WIC administrative data, we know that in 2002, infants represented the largest share of all child participants, at about one-third, and for children age 1 and older, the share of participants decreases with age (see Table II.1). Ten years earlier, Burstein and Baker (1998) found from administrative data that 31 percent of the children age 4 months to 4 years (after excluding the infants age 0 to 3 months) were infants.

TABLE II.1

DISTRIBUTION OF WIC INFANT AND CHILD PARTICIPANTS ACCORDING TO ADMINISTRATIVE DATA, BY AGE

	Percentage of Participants	
Age of Participant (years)	2002	1992[a]
Infant	33	31
1	22	27
2	17	18
3	15	14
4	13	11

Source: 2002 WIC Program Characteristics Data (PC2002) and Burstein and Baker (1998).

Note: Children age 60 months included with 4-year-olds.

[a] Excludes infants age 0 to 3 months.

A. METHODOLOGY

To study the dynamics of WIC participation by infants and children, we realigned the SIPP data for each child in order to construct an analysis file that focused on the child's birth date. As in the earlier analysis by Burstein et al., we defined 16 four-month "periods" of potential WIC eligibility relative to the child's birth (see Table II.2). Because of the seam bias prevalent in the SIPP data, particularly for WIC, we used only participation data from the last month of each wave. As an example, consider an infant born in wave 2. This child will contribute to the analysis file for waves 2 through 9 in periods 1 through 8 and contain missing data for the later periods. As a second example, consider a child who turns age 3 in wave 1. This child will contribute data to the file for waves 1 through 7, corresponding to periods 10 to 16 and will contain missing data for earlier periods. The file contains all children who range in age from birth to age 5 at any point in the panel period.

TABLE II.2

STRUCTURE OF ANALYSIS FILE FOR CHILDREN

Period	Child's Age in Last Month of Period (months)	Child's Age (years)
1	0-3	Infant
2	4-7	Infant
3	8-11	Infant
4	12-15	Age 1
5	16-19	Age 1
6	20-23	Age 1
7	24-27	Age 2
8	28-31	Age 2
9	32-35	Age 2
10	36-39	Age 3
11	40-43	Age 3
12	44-47	Age 3
13	48-51	Age 4
14	52-55	Age 4
15	56-59	Age 4
16	60-63	Age 5

Note: No child will have data for more than 9 periods.

B. ENTRY AND EXIT

Time Until WIC Participation. To be eligible for WIC, the child's family must have income at or less than 185 percent of poverty or be adjunctively income-eligible and the child must be at nutritional risk. By developing a "life table" of WIC participation, we can estimate the time from birth to WIC participation. Since the three-year SIPP panel does not allow us to follow the children from birth to age five, the life table analysis assumes that the likelihood of entry at any age is independent of previous WIC participation. The entry rate in the life table measures the percentages of children who are not participating at the end of one age but do participate at

some point during the next age.[6] The cumulative entry rate is then calculated as the sum of the cumulative entry rate from the prior age and the product of the current entry rate and the previous survival rate. The survival rate is simply calculated as 100 minus the cumulative entry rate.

For 2001 to 2003, we estimate that 59 percent of infants and children whose family incomes are under 185 percent of poverty at some point during the panel period enter WIC before their fifth birthday (see Table II.3). Most of the participation spells start while the child is an infant.

TABLE II.3

LIFE TABLE FOR INFANTS AND CHILDREN WITH FAMILY INCOME LESS THAN 185 PERCENT OF POVERTY AT SOME POINT IN PANEL PERIOD

Age at WIC Entry	Entry Rate (Hazard)	Survival Rate	Cumulative Entry Rate (Percent)
Infant	48	52	48
1	6	49	52
2	6	46	55
3	6	43	57
4	3	41	59

Source: Enhanced 2001 SIPP data.

Sample Size: 1,288 total WIC entries.

Age of Entry During Panel Period. Although we cannot identify the age at which each WIC participant entered the program prior to the panel period, we can examine the age of entry of those who enter during the panel period. Figure II.1 presents the distribution of observed entries by age. A child is identified as entering at a given age if he/she was not previously

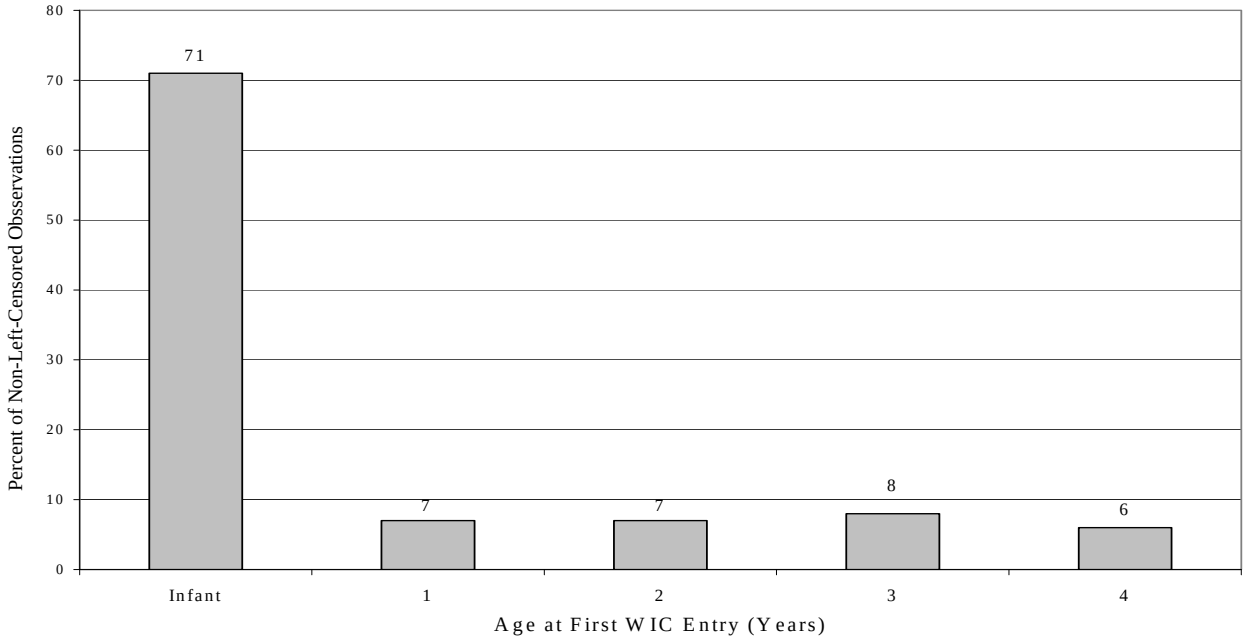
[6] In this table and throughout the analysis, we limit the estimates to infants and children that we observed over the months of interest. For example, the entry rate in the life table at each age includes children who are present in the sample at the end of one age and throughout the next age.

participating in the panel, not participating at the end of the previous age, and participating in at least one period of the given age.

Over 70 percent of entries are among infants. (Burstein et al. also found that at least 70 percent of entries were as infants). Since we cannot observe all entries that occur before the panel period, some of the entries for older children may, in fact, be re-entries. Thus, these estimates are slightly biased to show too many initial entries for the older children. However, re-entry is not prevalent among WIC participants (as shown below).

FIGURE II.1

AGE OF CHILD AT FIRST WIC ENTRY AMONG ENTRIES OBSERVED IN PANEL PERIOD



Source: Enhanced 2001 SIPP data.

Note: Limited to first spell observed to start in panel period.

Data differences (current estimates are weighted, include infants age zero to three months, and do not make adjustments for re-entries following spells that ended prior to the panel period) may account for difference between these and estimates in Burstein et al. (2000).

Sample Size: 1,266 infants and children.

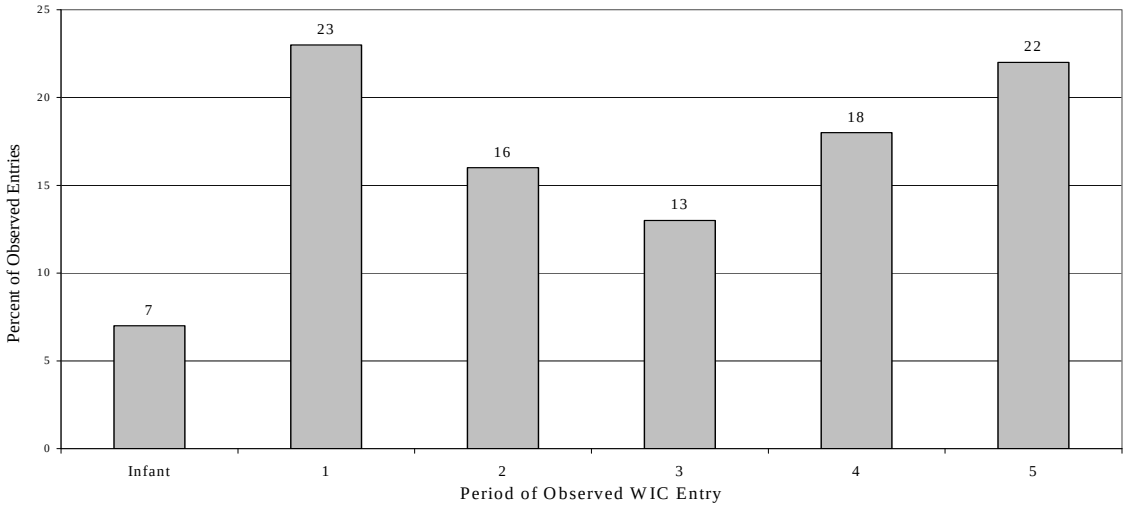
Age at Last Exit During Panel Period. Some infant WIC participants will exit the program before they would have become child participants, and some child participants at each age exit

before they reach their next birthday. Figure II.2 presents the distribution of exits by year of age. A child is identified as exiting if he/she does not re-enter later in the panel and was participating in the last period of the previous age but not participating in at least one period in the current age. Because we cannot observe the full first five years of a child's life in the SIPP panel, and we cannot observe any re-entries and exits after the panel ends, these results may be biased and show too many "last" exits at younger ages.

Figure II.2 shows that most exits observed in the panel period occur when the infant turns age 1 and when the child turns age 5. Although Burstein et al. found a higher percentage of infants exiting WIC, the distribution of exits was generally similar—most exits occurred at the youngest and oldest ages of eligibility. This is not surprising because the WIC food packages change when the infant is recertified as a child at age 1, and a child is no longer eligible after turning age 5.

FIGURE II.2

AGE OF CHILD AT LAST WIC EXIT AMONG EXITS OBSERVED IN PANEL PERIOD



Source: Enhanced 2001 SIPP data.

Note: Limited to last WIC spell observed in panel.
Data differences (current estimates are weighted, include infants age zero to three months, and do not make adjustments for re-entries following spells that ended prior to the panel period) may account for difference between these and estimates in Burstein et al. (2000).

Sample Size: 1,266 infants and children.

C. CONTINUITY OF PARTICIPATION AND RE-ENTRY

Knowing that most participants enter as infants, and exit most often when they reach age 5 and become ineligible, we next examined the continuity of participation by discussing transitions from one age to another and the continuity of receipt across two-year time periods.

Transitions from One Age to the Next. To measure the transition from one age to another, we found the percentage of children or infants participating in the last period of one age who then continue to participate in the first period of the next age. As described earlier, measuring WIC participation from the last month of the panel period means that we will not be able to observe participation at age 5 for three out of the four children that we observed during period 16 (the children are age 60 to 63 months in the last month of P16). Thus, we define a transition from age 4 to age 5 as participation during the last period of age 4 (that is, through period 15, which assumes that a child participating in the last months of age 4 will also participate in the month he/she turns 5).

As displayed in Table II.4 and consistent with Burstein et al., we found that at least 80 percent of participants continue to participate at the next age, except for the oldest children. Since infants are eligible for a full year, we see even fewer exits among WIC participants in the first three periods (Figure II.3).

TABLE II.4

WIC CHILD TRANSITION RATES BY YEAR OF AGE

Age	Percent Making Transition from Age to Age
Infant to Age 1	81
Age 1 to Age 2	85
Age 2 to Age 3	88
Age 3 to Age 4	85
Age 4 to Age 5	72[a]

Source: Enhanced 2001 SIPP data.

Note: This table displays the percentage of infants and children that participated in the last period of one age and continued to participate in the first period of the next age.

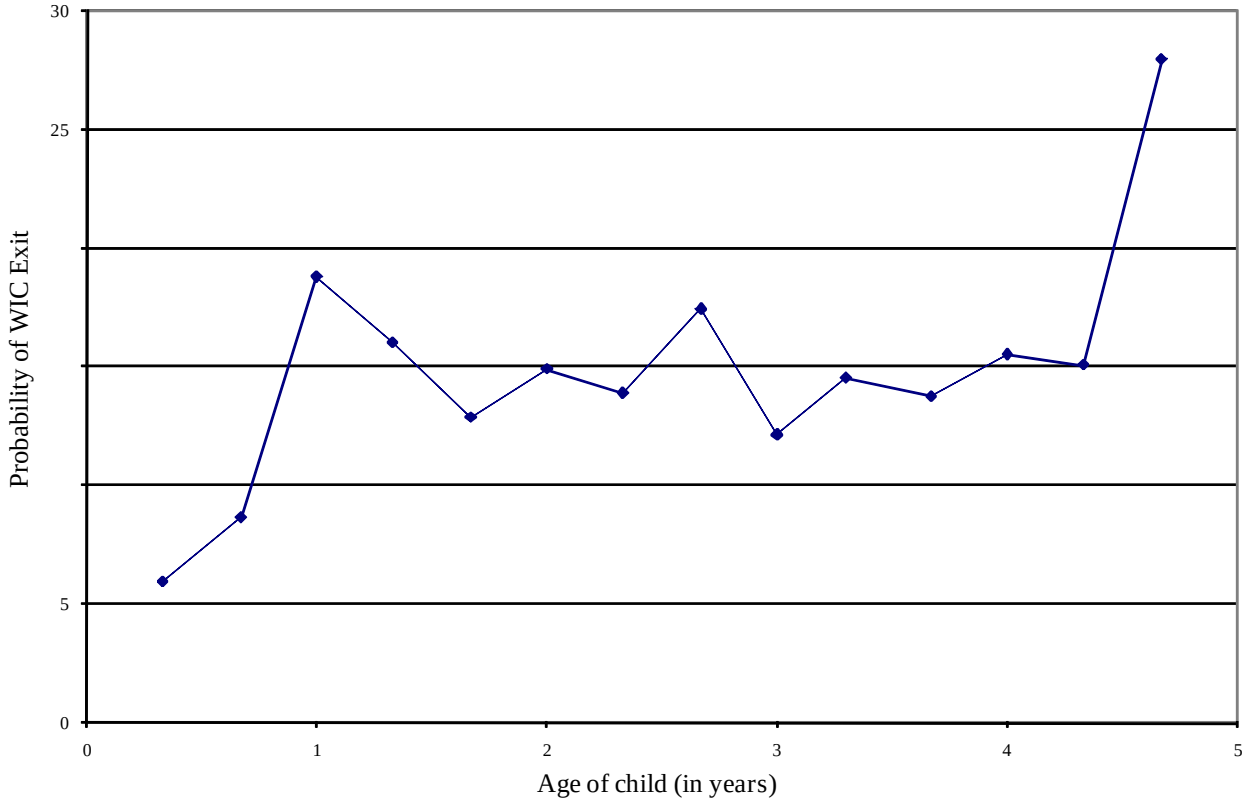
Sample size at transition ages: 387 to 714 infants and children.

[a] Measured as continuing to participate into last period before the child's fifth birthday because measuring participation in waves does not always allow us to observe participation for the fifth birthday.

We also examined transition rates from one age to the next by selected subgroups (Table II.5). This table differs slightly from earlier estimates of transition rates. Previously we examined transition rates by period—from the period at the *end* of one year to the period at the *beginning* of the next (Table II.4) or from one period to the next (Figure II.3). In Table II.5 we defined the transition as participation at any point during one age to the first period of the next age. This change enables us to include a slightly larger sample for the subgroup analysis.

FIGURE II.3

CHILD EXIT RATES BY PERIOD



Source: Enhanced 2001 SIPP data.

Sample size at transition ages: 585 to 714 infants and children.

We noticed that the yearly transition rates are slightly lower than the period-to-period transitions, but we still saw that the transition rate was higher for infants (to age one) than for the child transitions. This pattern generally holds across subgroups. In some cases, the transition rates from age 4 to 5 are higher than for the younger ages. This may be an artifact of our measurement, since we assume that participation at the end of the fourth year leads to participation through the fifth birthday.

TABLE II.5

PERCENTAGE OF CHILDREN MAKING TRANSITION FROM ONE AGE TO NEXT BY SELECTED SUBGROUPS

Subgroup (at the younger age)	Age 0 to 1	Age 1 to 2	Age 2 to 3	Age 3 to 4	Age 4 to 5
All Child Participants	74	68	69	69	66
Poverty Level					
<50 percent	81	71	72	71	63
50 to <100 percent	82	76	74	74	66
100 to <130 percent	82	75	73	73	76
130 to <185 percent	67	62	65	62	61
185 to <300 percent	68	58	63	64	70
300+ percent	58	61	61	64	35
Program Participation					
Medicaid	77	75	77	74	71
TANF	94	75	78	64	81
FSP	85	75	75	74	67
Any of the three programs	78	75	75	74	69
Mother's Employment Status[a]					
Part-time	71	69	69	59	70
Full-time	66	61	64	63	64
Not working for pay	79	71	72	74	66
Race/Ethnicity					
Black, non-Hispanic	78	68	67	68	65
White, non-Hispanic	67	64	67	64	68
Hispanic	80	71	72	75	63
Other	77	70	73	63	80
Mother's Marital Status[a]					
Never married	76	68	67	68	69
Currently married	71	68	70	68	64
Divorced	81	74	70	65	72
Separated	80	49	58	77	62
Widowed	59	75	93	83	100
Parity					
First child	76	65	67	70	64
Second child	68	67	68	66	66
Third or later child	77	72	72	69	68

Source: Enhanced 2001 SIPP data.

Notes: Transition from participation at age *a* to age *b* is defined as participation in any of the periods in age *a* to participation in the first period of age *b*. For example, 94 percent children receiving TANF and WIC sometime between the ages of 0 and 11 months continued to participate in at least the first period of age 1.

Sample Size: See Appendix B for the sample sizes for this table.

[a] If mother was not present, then the status of the father or guardian was considered.

Transition rates vary by income, participation in public assistance, and employment of the mother or guardian. Not surprisingly, the infants and children living in families with lower incomes (at the younger age) are more likely to make the transition from one age to the next than infants and children living in families with relatively higher incomes. Children in families with income more than 185 percent of poverty may be exiting because their income is too high to remain eligible (see discussion of exit triggers in Section D below). Infants and children who are connected to other public assistance programs, such as Medicaid, FSP, cash welfare through the TANF program, are more likely than the participant receiving only WIC to make the transition from one year to the next. However, children living with mothers who work (or fathers or guardians if the mother is not present), whether full- or part-time, are less likely to transition to the next year of participation than those whose mother does not work.

Transition rates also vary by other characteristics of participants, such as race, marital status of the child's mother, and parity (number of mother's other children). Hispanic children have the highest transition rates, while whites generally have the lowest, although this variation lessens among older children. Infants and children of divorced or never married mothers (or fathers or guardians if the mother is not present) generally have higher rates of transition than infants and children whose parents are married. Infants and children who are the third or later child in their family generally have higher transition rates than first- and second-born children; an exception is that first-born children also have high rates of transition from infancy to age one, but the difference does not persist for later transition periods.

Continuity of WIC Receipt. Although we cannot observe children for the full five years of eligibility, we can observe participation for shorter periods. To be consistent with Burstein et al., we examined the continuity and duration of WIC participation during two-year periods of eligibility (Table II.6).

Among the participants observed in the panel from birth through their second birthday, one-third participated for the entire seven periods, and the median number of periods of participation is five (approximately 20 of 28 months). The number of periods of participation is generally similar for older participants, though the median number of periods is slightly lower for the older children, at four periods (approximately 16 of 28 months).

We also examined the percentage of observed entries and exits within these two-year periods. We found that half (52 percent) of the youngest participants (by definition all children who participate in this period must also have entered in this period) enter and exit before their second birthday. While one-third participate for the entire period, another 15 percent enter after the period containing their birth and continue participating through their second birthday. For the later periods of participation, we see a large percentage (for example, 34 percent for children age one to three) who were participating at the beginning of the two-year period, exit within this timeframe, and do not re-enter.

Re-Entry. Table II.6 shows that a small percentage (10 percent or less) re-enter within the two-year periods. However, Burstein et al. found even fewer, estimating that two to three percent re-entered within these two-year periods.

TABLE II.6

CONTINUITY OF WIC RECEIPT

	Age Range (Periods of Observation)			
	Birth–Second Birthday (P1-P7)	First–Third Birthdays (P4 - P10)	Second–Fourth Birthdays (P7 - P13)	Third–Fifth Birthdays (P10 - P16)
Number of periods on WIC (percent of children in age range)				
1	6	15	17	14
2	10	9	11	13
3	14	11	9	12
4	9	10	11	12
5	13	14	9	14
6	14	8	12	36
7	34	33	31	na
Mean (periods)	5	5	4	4
Median (periods)	5	5	5	4
Percent of Children that:				
Received WIC continuously	34	33	31	36[a]
Entered and exited	52	18	24	24
Exited and re-entered	0[b]	9	4	2
Exited (and stayed off)	0[c]	34	24	28
Entered (and stayed on)[e]	15	6	17	11
Number of Spells (percent)				
One	93[e]	90	93	94
Two or more[d]	7	10	7	6

Source: Enhanced 2001 SIPP data.

Sample size: 288 to 321 infants and children.

[a] Our use of waves for the analysis means that we usually cannot observe participation at the child's fifth birthday, so we assumed that participation through the last period of the child's fourth year leads to participation and exit at the child's fifth birthday. Thus, we only measured six periods of participation.

[b] Infants who enter at birth are identified as WIC entrants, so if they also exit and re-enter in the panel they are captured in the row "Entered and exited."

[c] Infants who enter at birth then exit and stay off are counted in the row "Entered and exited."

[d] This differs from the "Exited and re-entered" category because it includes spells that were in progress at the beginning of the two-year period.

[e] Entered during the period and did not exit.

D. ENTRY AND EXIT TRIGGER EVENTS

Because eligibility for WIC is tied to the birth and age of the child, many entries and exits are tied to the child's age—that is, to changes in categorical eligibility. However, some children are seen to enter past their birth or first birthday and/or to exit well before their fifth birthday.

Thus, we examined events that precede the program entries to identify other factors that may be reasons for an entry or exit other than categorical eligibility—we sought to identify "trigger" events.

At entry, the SIPP asks the respondent to identify the reason for entry into the program.[7] Most respondents identified pregnancy as the reason for applying (Table II.7). Second to pregnancy was the identification of the loss of support income (income other than from the mother or mother's partner). Very few respondents indicated that they or their children were entering the program because they had just learned about it or just got around to applying.

TABLE II.7

REPORTED REASONS FOR APPLYING FOR WIC BENEFITS

	Children				
	Infants	Age 1	Age 2	Age 3	Age 4
Reason for Applying (percent)					
Pregnancy	63	58	54	52	47
Loss of job/wages/other income	8	8	13	12	9
Loss of other support income	17	19	13	18	24
Just learned about the program	2	3	3	5	6
Just got around to applying	1	2	1	2	4
Other (all reasons not listed above)	10	10	16	12	10

Source: Enhanced 2001 SIPP data.

Sample size: 1,439 entries.

SIPP respondents were allowed to report two reasons for entry, but we also observed the events that happened in the periods before entry in order to identify events that may not be

[7] If the household's respondent reports that the family stopped receiving WIC *within* the 4-month reference period, the survey uses a pre-coded list that asks for the reason of the exit. However, due to the SIPP seam effect, most exits are reported as occurring between two reference periods rather than within a period, so the reasons for most exits were not captured in the survey. This has been corrected for the 2004 SIPP instrument.

reported as associated with WIC entry. Table II.8 shows the percentage of children at each year whose entry is preceded by the trigger event in one of the two previous periods.

Obviously, a change in categorical eligibility—that is, an infant being born—triggers entry for infants but changes in income eligibility are also important triggers. About one-quarter to one-third of children, regardless of their period of entry, experienced a decrease in the number of people with earnings in the family in one of the two waves prior to their entry. The decrease in the number of earners appears not to have been a total loss of earned income, since the percentages of children experiencing a 100 percent decrease in income are not as high as those experiencing a decrease in the number of earners. Approximately 27 to 35 percent of children experienced a decrease in family earnings of 40 percent or more prior to entry.

Connection to WIC through another family member or to other public assistance programs is a common trigger that precedes WIC entry. We see that 30 to 41 percent of children's entries are preceded by another family member's WIC entry. Seventy percent of infant entries are preceded by an entry into TANF, the FSP, or Medicaid.[8]

Across subgroups, we might expect to see a much lower prevalence of triggers for children who exit at age five. Since the children become categorically ineligible, no other trigger event need exist for them to be forced to exit. However, the percentage of children experiencing trigger events prior to exiting WIC is not consistently lower for five-year-olds than for the other children.

[8] Trigger events for infants are based on the mother's status since we do not have information for the infant in the periods prior to birth.

TABLE II.8

PERCENTAGE OF CHILDREN EXPERIENCING TRIGGER EVENT
PRIOR TO ENTRY OR EXIT

	Children					
	Infants	Age 1	Age 2	Age 3	Age 4	Age 5[a]
Entry Triggers[b]						
Sample size of entries	849	130	163	173	124	n.a
Change in categorical eligibility	93	0	0	0	0	n.a
Number of earners in the family decreased	35	27	34	31	26	n.a
Family earnings decreased by 20% or more	47	46	53	49	42	n.a
Family earnings decreased by 40% or more	35	32	35	35	27	n.a
Family earnings decreased by 100%	17	11	15	17	12	n.a
Family other income decreased by 40% or more	32	23	26	26	30	n.a
Family other income decreased by 100%	19	10	12	11	17	n.a
Family earnings decreased by $1,000 or more	30	37	36	30	29	n.a
Family other income decreased by $500 or more	9	2	11	7	12	n.a
Other family member enters WIC	39	35	31	41	37	n.a
Enters TANF, FSP, Medicaid	70	42	41	42	42	n.a
Exit Triggers						
Sample size of exits	101	299	238	197	240	294
Change in categorical eligibility	0	0	0	0	0	100
Number of earners in the family increased	30	30	23	32	26	22
Family earnings increased by 20% or more	53	52	50	56	50	48
Family earnings increased by 40% or more	39	41	38	44	36	34
Family other income increased by 20% or more	27	37	39	37	34	38
Family other income increased by 40% or more	26	35	35	34	32	34
Family earnings increased by $1,000 or more	32	33	28	33	27	24
Family other income increased by $500 or more	7	8	9	9	10	11
Other family member leaves WIC	43	39	32	40	36	16
Exits TANF, FSP, Medicaid	24	35	33	34	38	24
Other adults join household with earnings	6	8	7	7	5	7

Source: Enhanced 2001 SIPP data.

[a] Children cannot enter at age 5. For exits, we assume a child transitions to participation at age 5 if he/she participates in the final period prior to turning 5.
[b] May include some re-entries.

Exits are preceded by increases in earnings at similar rates to entries being preceded by decreases in earnings. About one-third to less than one-half of exits are preceded by increases in earnings of 40 percent or more. About one-third are preceded by increases in other income of 40 percent or more.

Changes in participation in other public assistance programs by the child or other family members does not seem as tied to exit as to entry. About one-quarter to one-third of exits of children were preceded by the exit from another public assistance program (TANF, FSP, or Medicaid).

In summary, aside from changes in categorical eligibility, the most common entry trigger for infants is the entry into another public assistance program. For the older children, income losses and public assistance participation precede entry at similar rates. For exits, increases in family earnings stand out as being most prevalent.

E. SUMMARY OF FINDINGS

In examining the dynamics of WIC participation, we focused on four events: entry, exit, continuity of participation, and re-entry. We also discussed events leading to entry and exiting from the program.

1. Entry

In 2002, most children enter the WIC program as infants (71 percent of entries observed in the 2001 SIPP panel) and about one-third of a cross-section of WIC child participants from 2001 to 2003 were infants. Of the low-income children (income less than 185 percent of poverty), we estimate that slightly more than half of the children will enter WIC by the child's fifth birthday. The most common trigger events preceding entry are becoming categorically eligible through birth and a decrease in earnings. Connections to public assistance also appear to play a substantial role.

2. Exit

Exiting from WIC is not as tied to a particular age as entry is but we are more likely to see children exit around their first birthday when they would make the transition from the infant

WIC package to the child package, or around the fifth birthday, when the child becomes ineligible. Increases in family earnings also preceded about 40 to 50 percent of WIC exits by child participants.

3. Continuity of Participation

Due to the short panel period, we cannot observe child participants throughout their period of WIC eligibility. We focused instead on transitions from participation at one age to the next age, and we examined the continuity of receipt over two-year periods within the five-year eligibility window.

Most infant and child participants at any given age are likely to transition to participation at the next age (80 percent or more for infants and one- to three-year-olds; 72 percent for four-year-olds). Poorer children are more likely than relatively higher income children to make the transition to the next age as participants. Children with mothers who are not working make the transition more often than children with mothers who are working either full- or part-time. In addition, children who are either the first-born or third-or later born continue on WIC more often than children who were second-born.

In any two year period, about one-third of children participate continuously across the two years. On average, younger children participate for about 20 of 28 months within the two years. Older children participate for about 16 of the 28 months.[9]

4. Re-entry

Re-entry among WIC participants was relatively uncommon during the observation period. Less than 10 percent of children exit and re-enter WIC within a two-year period.

[9] The 28-month period covers seven 4-month periods: the wave of the child's birthday plus the six waves that follow through the birthday two years later.

III. A MULTIVARIATE ANALYSIS OF THE DETERMINANTS OF WIC ENTRY AND EXIT BY CHILDREN

The statistics presented in Chapter II describe the rates of entry into and exit from the WIC program by child participants. The multivariate analysis builds on the descriptive analysis by identifying the factors associated with WIC entry and exit while controlling for the effects of demographic and state-level characteristics. This relaxes the restrictive assumption in the descriptive analysis that the entry and exit transition rates are independent of characteristics of the nonparticipants (in the entry analysis) and participants (in the exit analysis). This analysis may help WIC outreach programs in targeting children who appear to be enrolled late or not at all, and to help understand why some children stop receiving WIC benefits when they are still eligible.

While recent studies have focused on the impact of the WIC program on participants' health outcomes, including the effect on breastfeeding rates (Oliveira et al. 2002; Rossi 1998), childhood obesity (Mei et al. 1998), and health insurance take-up rates (Bitler and Currie 2004), the factors that affect a mother's decision to participate or to enroll her child are largely unknown. Most of the existing WIC participation research has focused on the association between participation and characteristics of nonparticipants and participants taken at a point in time (Bitler, Currie, and Scholz 2003; Brien and Swann 2001). As demonstrated in numerous studies of FSP dynamics (Burstein 1993; Gleason et al. 1998; Cody et al. 2007), it is the changes in these characteristics over time that are most strongly associated with program entry and exit. The current analysis investigated whether this is also true for entry into and exit from the WIC program.

The trigger events explored in the analysis are changes in the most prevalent characteristics associated with WIC participation shown in the previous chapter, namely, family income or earnings with or without change in receipt of public assistance. The control variables are characteristics of mothers and children and of the State where the child participants receive WIC benefits. For example, the number of local WIC offices in each State is included as a measure of the ease of access to the program by eligible mothers and children. The variables used in the entry and exit models are:

- **Mother and Child Characteristics**
  - Child's gender, parity, age (by period)
  - Mother's race and ethnicity, age, highest grade completed, marital status, region of residence
  - Region of residence, location (urban or rural)
  - Family size and composition
  - Ratio of family income to poverty level, program participation (FSP, TANF, Medicaid)

- **Trigger Events for Entry and Exit**
  - Change in income or earnings
  - Change in receipt of public assistance (FSP, TANF, Medicaid)

- **State-Level Characteristics**
  - Maximum TANF benefit for family of size four
  - TANF participation rate
  - FSP participation rate
  - Number of local WIC agencies per State
  - Average cost of food packages for all WIC participants
  - Length of WIC benefit issuance period
  - State unemployment rate
  - State poverty rate

As will be shown, changes in income, earnings, and participation in other public assistance programs, such as the FSP and Medicaid, have the strongest associations for both WIC entry and exit by child participants.[10]

The multivariate analysis is divided into two parts. First, we analyzed the determinants of entry into the WIC program. Second, we analyzed the determinants of exits from the program versus continuing participation. In each analysis, we examined the association between WIC entry or exit and the characteristics of the child and family; trigger event variables that measure changes in income, earnings, and receipt of public assistance benefits; and State-level characteristics and policy variables.

A. METHODOLOGY

As in the descriptive analysis, the multivariate models are estimated using a sample of children that is defined using 16 four-month "periods" of potential WIC eligibility relative to the infant's birth. The WIC entry analysis consists of two multivariate models. The first model focuses on the decision to participate in the birth period and the second model uses a discrete-time hazard model to analyze WIC entry in all periods subsequent to the birth period. As described below, it is partitioned into two models because a discrete-time hazard model requires everyone in the sample to have at least one period of nonparticipation prior to entering the program and period 1 participants (that is, newborns) do not satisfy this criteria. Consequently, a separate model was constructed to analyze the characteristics associated with the decision to participate by families with infants age 0 to 3 months (Table II.2 shows four-month grouping of children into 16 periods).

[10] For brevity, we usually refer to all infants and children as "children."

Two multivariate exit models are also estimated. We used a discrete-time hazard model to analyze WIC exits. In addition, we estimated a model that focuses on the decision to continue participating in WIC at each age threshold (for children turning 1, 2, 3, and 4). Appendix C contains the results from this latter set of analyses.

1. First Period Entry Model

The characteristics associated with a child participating in WIC in the first period are determined by estimating a logistic regression model in which the dependent variable, Y, equals 1 if the child participates in the first period and equals 0 otherwise. The probability of participating is specified as $\Pr(Y=1)=\frac{1}{(1+\exp(-B'X))}$ where X is a set of covariates and B is a parameter vector that includes an intercept term. The model is estimated using maximum likelihood estimation. As is common when discussing the results of a logistic regression, we present odds ratios in place of coefficient estimates since their interpretation is simpler.[11]

The set of explanatory variables X includes continuous variables (such as the state unemployment rate), categorical variables (such as the number of children under 6 years old in the family), and indicator variables (such as gender, which are categorical variables restricted to the values of 0 and 1). Whether an explanatory variable is a continuous, a categorical, or an indicator variable affects the interpretation of the estimate of the variable's coefficient and, in turn, the estimate of the odds ratio of the coefficient.

For estimates of coefficients of indicator variables, the odds ratio reflects the likelihood that an event occurs for one group relative to the likelihood that it occurs for another group. In the first period WIC child entry model, for example, if the odds ratio associated with the Northeast

[11] The estimates, b, of the parameter vector B are converted to odds ratios by evaluating the exponential function at the value of the estimate, exp(b).

Region indicator is 1.75, then the odds of participating in WIC in the first period are 75 percent (=1.75-1.00) greater for children living in the Northeast than children living in the Western Region (the omitted category). Alternatively, one can say that children living in the Northeast Region are 1.75 times more likely to participate in WIC in period 1 relative to children living in the Western Region.

For continuous variables, such as the unemployment rate, the odds ratio represents the change in the likelihood of WIC entry given a one-unit change in the variable. For example, if the odds ratio associated with the coefficient on the state unemployment rate is 1.50, then each percentage point increase in the unemployment rate increases the odds of entry by 50 percent (=1.50-1.00).

2. Hazard Models of Entry and Exit

The discrete-time hazard model is a natural framework in which to analyze the determinants of WIC entry and exit. It has been used extensively to analyze the dynamics of the FSP and TANF (see, for example, Cody et al. 2007 and Gleason et al. 1998). Its attractiveness stems from the ease with which the model can be estimated and the results can be interpreted (it is typically estimated using logistic regression and the estimates are converted to odds ratios).

To be included in the sample used to estimate a discrete-time hazard model of entry for children, each child must contribute at least one period of nonparticipation to the sample. Since children who participate in WIC beginning at birth do not have a prior nonparticipation period, they cannot be included in the sample used to estimate the entry hazard model. Thus, the entry hazard model is estimated using a subsample that consists of children who did not participate in WIC in the first period (that is, as newborns). To be included in the sample used to estimate a discrete-time hazard model of exit, all participants must have at least one period of participation prior to exiting the WIC program.

We estimated the following discrete-time hazard models:

- WIC entry for children after the birth period using a subsample of children who do not participate in WIC in the birth period
- WIC exit using a subsample of children who receive WIC benefits

A hazard rate is defined as the probability that an individual leaves a particular state (nonparticipation in the entry analysis and participation in the exit analysis) in a particular period given that the individual has remained in that state up to that period. For example, the hazard rate in the children's entry model is the probability that a child leaves the state of nonparticipation and enters WIC, given that he or she did not participate in the program in the previous period.

More formally, the discrete-time hazard model consists of specifying the monthly hazard rate as $\lambda(t) = \frac{1}{(1+\exp(-B'X(t)))}$ where X(t) is a set of covariates (some of which may vary over time), and B is a parameter vector that includes an intercept term. The model is estimated using maximum likelihood estimation and the estimates of B are converted to odds ratios for ease of interpretation.

While the estimation of each discrete-time hazard model uses a logistic regression framework, the units of analysis differ from those used in the point-in-time models described in the previous section. For the entry models, the dependent variable equals 1 if the individual enters WIC in the next period and equals 0 otherwise. For the exit models, the dependent variable equals 1 if the individual exits WIC in the next period and equals 0 otherwise. However, the units of analysis are "person-periods" rather than persons—that is, each child will contribute an observation for each period at which they are at risk of a transition until the period that the exit or entry occurs. Thus, each individual in the sample can contribute one or more observations

(periods) to the sample depending on how long they remain off the program (in the entry analysis) or on the program (in the exit analysis). For example, a child who is in the sample at birth but does not participate in WIC until the fourth period will contribute three observations to the sample: two non-entry periods and one entry period. Children can also contribute observations from nonparticipation spells that do not end with entry (or observations from participation spells that do not end with exit), as the estimation procedure naturally allows for observations taken from right-censored spells.[12]

The set of explanatory variables used to estimate the hazard models is identical to the set used to estimate the first period participation models. The set consists of continuous, categorical, and indicator variables that can be classified as time-invariant or time-varying. *Time-invariant* explanatory variables are those whose values are selected at the start of the WIC participation or nonparticipation spell and remain fixed for the duration of the spell—for example, race and gender. *Time-varying* explanatory variables have values that are allowed to change during WIC participation and nonparticipation spells—for example, state unemployment rates, state poverty rates, and, where applicable, entry and exit triggers.[13]

The odds ratios have a similar interpretation in each hazard model as in the first period logistic regression models. In the entry models, the odds ratio is interpreted as the likelihood of entering WIC for one group relative to the likelihood of entering for another group (for coefficients of indicator variables); the change in the likelihood of entering for each incremental increase in the variable (for coefficients of categorical variables); and the change in the

[12] The estimation procedure also accommodates person-periods taken from left-censored spells since measures of the duration of nonparticipation or participation are not included in set of explanatory variables in the entry or exit models.

[13] The discrete-time nature of the model also facilitates the inclusion of time-varying explanatory variables.

likelihood of entering for each unit increase in the variable (for coefficients of continuous variables). The interpretations for the exit models are analogous to those for entry, except the coefficients measure changes in the likelihood of exit instead of entry.

3. Analyzing Trigger Events as Determinants of WIC Entry and Exit

The descriptive analysis showed that many individuals entering and exiting WIC experienced a trigger event prior to or shortly after their transition onto or off of the program. For example, 47 percent of children experience a decrease in family earnings by 20 percent or more prior to entering the WIC program (see Table II.8). We include these variables in the multivariate entry and exit analyses, but collapse the set of trigger event variables used in the descriptive analysis to a smaller, mutually exclusive, set of variables.[14]

The variables used in the entry (exit) analyses indicate whether:

- Family earnings or income decreased (increased) by 20 percent or more
- Someone in family entered (exited) the Food Stamp, TANF, or Medicaid programs
- Other family member(s) entered (exited) WIC

For the entry and exit hazard analyses, changes between the previous period and the current period are counted as possible triggers as well as changes between the current period and the next period. For example, if a child does not participate in periods 1 through 3, then enters in period 4, the trigger event variable associated with his or her last nonparticipation period (period 3) would measure changes in income or earnings between periods 2 and 3 and between periods 3 and 4. We include the change between the previous period and the current period (in this

[14] Collapsing the set of triggers was done to avoid limited variation in a trigger event variable given a particular value of the dependent variable (i.e., given that it takes a 1 or a 0). As Gleason et al. (1998) discuss, this limited variation can lead to a very large standard error on the parameter estimate for the variable's coefficient.

example, between periods 2 and 3) in the definition of the trigger event variable since there might be a lag of several months between the time the trigger event occurred and the start of WIC benefit receipt (for WIC entry analyses) or termination of WIC benefit receipt (for WIC exit analyses).[15]

For the first-period participation analyses, trigger event variables measure changes between period "0" and period 1 and between periods 1 and 2, where period "0" represents the four-month period prior to the start of period 1.

B. DETERMINANTS OF WIC ENTRY

In this section, we identify the factors associated with entry into the WIC program and interpret the results from the first-period entry analysis and the entry hazard analysis. Table III.1 contains the odds ratios and indicators of statistical significance for each model. In tables of results from the multivariate analyses in this chapter, statistical significance is estimated using the parameter estimate and not the odds ratio.[16] The results in Table III.1 are based on samples of children in families with income less than 185 percent of the poverty line at some point in the panel. Since WIC eligibility is also based on the nutritional status of applicants, this sample will include children who are ineligible for WIC benefits. As a result, the odds ratios (shown in Table III.1) of the effect of variables on child entries may be downwardly biased.

[15] This is similar to the trigger event variable definition in the descriptive analysis of Chapter II. Burstein and Baker (1998) also used lagged measures of trigger event variables in their descriptive analysis of WIC receipt using the 1992 and 1993 SIPP panels.

[16] Inference based on the odds ratio itself is rare, as its distribution is skewed for the sample sizes used in most studies, whereas the distribution for the parameter estimate (the log of the odds ratio) tends to follow a normal distribution for most smaller sample sizes (Hosmer and Lemeshow 2000).

TABLE III.1

WIC ENTRY MODEL: ODDS RATIOS OF ESTIMATED EFFECTS OF EXPLANATORY VARIABLES ON PROBABILITY OF CHILD ENTERING WIC (AMONG INDIVIDUALS IN FAMILIES WITH INCOME EVER BELOW 185% OF POVERTY)

Explanatory Variables	Child (period 1)	Child (all other periods)
Mother and Child Characteristics		
Child's Gender (female category is omitted)		
Male	0.91	1.10
Child's Parity (first child is omitted category)		
Second child	0.88	1.12
Third child or higher	1.72*	1.44**
Child's Age (by period) (periods 1,2,3 are omitted categories)		
Periods 4,5,6		0.53***
Periods 7,8,9		0.49***
Periods 10,11,12		0.43***
Periods 13,14,15		0.21***
Mother's Race and Ethnicity (Hispanic category is omitted)		
White, non-Hispanic	0.60**	0.44***
Black, non-Hispanic	0.85	0.57***
Other	0.45**	0.38***
Mother's Age (under 25-year-old category is omitted)		
25-35	0.69*	0.73**
36 and older	0.52**	0.54***
Mother's Highest Grade Completed		
High school graduate (or GED)	0.62**	0.88
Mother's Marital Status (never-married category is omitted)		
Married	1.05	0.68***
Divorced, Widowed, or Separated	2.06**	0.65**
Mother's Employment Status ("not working for pay" category is omitted)		
Employed full-time	1.37	0.89
Employed part-time	0.77	0.88
Region of Residence ("Western" category is omitted)		
Northeast	0.62	0.58**
Mid-Atlantic	1.21	0.66**
Midwest	1.20	0.77
Southeast	1.25	0.73*
Southwest	1.29	0.48**
Mountain Plains	1.41	0.41***
Family Size		
Number of adults	1.11	1.11**
Number of children less than age 6	0.89	0.87**
Number of children between ages 6 and 17	0.75***	0.92*
Ratio of Family Income to Poverty Level (less than 1.00 category is omitted)		
1.00 -< 1.30	1.33	0.94
1.30 -< 1.85	0.77	1.07
1.85 -< 3.00	1.17	0.78**
3.00 +	0.44**	0.47***
Household Location (rural is omitted)		
Urban	0.72*	0.80**

TABLE III.1 *(continued)*

Explanatory Variables	Child (period 1)	Child (All other periods)
Program Participation		
Food Stamp Program	1.73**	0.88
TANF	1.06	0.99
Medicaid	1.53**	1.60***
Trigger Events		
Trigger Events ("no decrease in income/earnings and no one enters PA" is omitted category)		
Decrease in income/earnings and someone enters PA	4.88***	4.36***
Decrease in income/earnings and no one enters PA	0.89	1.30**
No decrease in income/earnings and someone enters PA	4.69***	4.37***
State-Level Characteristics		
Policy Variables		
Maximum TANF benefit for a family of four	1.00	1.00
Per capita TANF participation	1.13	1.19**
Per capita FSP participation	1.06	1.02
Local WIC agencies per state	1.00	1.01**
Average cost of food packages for all WIC participants	1.02	0.95***
Length of WIC benefit issuance period	1.08	1.13
State Characteristics		
State unemployment rate	1.01	0.63***
State poverty rate	1.00	0.98
-2*Log Likelihood	1,109	5,695
Number of Spell Period Observations	1,127	18,580

Source: Enhanced 2001 SIPP data; Unemployment rates are obtained from the Bureau of Labor Statistics (http://www.bls.gov/lau/lausad.htm); Local WIC agencies per state, average cost estimates, and length of WIC benefit issuance period are taken from WIC Participant and Program Characteristics data 2000, 2002, and 2004; FSP participation data obtained from administrative records (http://www.fns.usda.gov/pd/snapmain.htm); TANF participation and benefit amounts obtained from administrative records (http://www.acf.hhs.gov/programs/ofa/data-reports/index.htm); State poverty rates estimated using Current Population Survey data.

Note: Samples include children with left-censored nonparticipation spells.

* Significantly different than zero at the 0.10 level, two-tailed test
** Significantly different than zero at the 0.05 level, two-tailed test
*** Significantly different than zero at the 0.01 level, two-tailed test

Mother and Child Characteristics. Several demographic characteristics of the child's mother are associated with entering WIC. The estimates for mother's race and ethnicity show that children with non-Hispanic mothers are less likely to enter WIC than children of Hispanic mothers. The odds of entering WIC after period 1 are reduced by 56 percent for children of white, non-Hispanic mothers compared to children of Hispanic mothers (see the "Child (all other periods)" column of Table III.1). For children of black, non-Hispanic mothers and children of non-white, non-black, non-Hispanic mothers, the reductions are 43 and 62 percent,

respectively.[17] This is an interesting result given the barriers to enrollment based on language and immigration status that Hispanic mothers may face. However, the WIC program makes a concerted effort to provide services in Spanish and to perform significant outreach activities, particularly with migrant and community health centers (USDA 2003; Bartlett et al. 2004). The findings related to race and ethnicity may reflect these recent efforts.

A child's age and a mother's age at the time of the infant's birth are also important determinants of entry. Older children and children of older mothers are less likely to enter WIC than younger children and children of younger mothers. The odds of a child entering after infancy get smaller as a child ages, from children in periods 4 to 6 being 47 percent less likely to enter than children in periods 1 to 3, to children in periods 13 to 15 being 79 percent less likely to enter than children in periods 1 to 3 (see "Child (all other periods)" column of Table III.1).

A mother's education and marital status are associated with WIC entry for children. Children of mothers with at least a high school diploma or GED are less likely to enter in period 1 than children of mothers with less education. Although we have controlled for income, having more education could be an indicator of income *potential*. For example, among two nonworking mothers with similar family incomes, the one with more education has a higher earnings potential, and may be more likely to return to work and thus less likely to have a child enter WIC.[18]

Children of married mothers are about one-third less likely to enter the program than children of mothers who have never been married. Although children with divorced, widowed, or

[17] Similar associations with child entry exist in period 1, though children of black, non-Hispanic mothers are equally as likely to enter as children of Hispanic mothers.

[18] Decreuse and Granier (2005) posit a theory of education and job mobility in which more education decreases the length of current unemployment and increases future income through job-to-job mobility.

separated mothers are almost twice as likely to participate in period 1 as children with mothers who have never married, they are about one-third less likely to enter in later periods.

Family Characteristics. Family income and participation in other public assistance programs should be associated with WIC entry because income is so closely related to eligibility and because program participation, controlling for income, may indicate integration of services or a mothers' savvy in obtaining benefits or services for their children.[19] While the results indicate that these associations do exist, other family characteristics are predominantly related to WIC entry after period 1 rather than in the first period.

In order to be income eligible for WIC, the family income of a child must be at or below 185 percent of poverty; however, in some states children with family incomes greater than this threshold can still be eligible if they participate, or have family members that participate, in the FSP, TANF, or Medicaid programs. Table III.1 indicates that children in families with income greater than three times the federal poverty level are about half as likely to participate in period 1, relative to children living in families below the poverty line. After period 1, children living in families with income greater than 185 percent of poverty are also less likely to enter compared to those in families with income below the poverty line.

The urban versus rural location of the family residence is a significant determinant of WIC entry for children, with the odds of a child entering WIC reduced for children living in urban locations relative to rural locations. In their study on participation in the FSP, TANF, and WIC programs in Illinois, Lee et al. (2000) also found that individuals in urban areas were less likely to participate.[20] They suggest that this may indicate that food assistance programs underserve

[19] Additionally, participating in a program other than WIC could indicate that a mother is affected less by the stigma associated with participation, making her or her child more likely to enter WIC.

[20] This is true in a specification of their regression model in which county-level poverty and unemployment rates are included.

children in urban areas; however, as we will discuss in our exit analysis, child WIC participants in urban areas also have a greater likelihood of leaving the WIC program once they enter. This suggests that rather than their children being underserved, mothers of child participants in urban areas may face greater burdens associated with having their children participate in the program, either through transportation or administrative costs or through social stigma. There also may be longer waiting times in clinics and fewer stores offering WIC foods in urban areas. Alternatively, there may be more options than WIC in urban areas.

The region in which the child's family lives is a significant determinant of entry for children after period 1. Relative to living in the Western Region, living in all other regions except the Midwest reduces the odds of entering WIC from 27 percent in the Southeast Region to 59 percent in the Mountain Plains Region. This is expected since the Western Region contained 25.5 percent of all infant and child WIC participants in the United States in 2002 (Bartlett et al. 2003).

Participation in public assistance programs such as the FSP and Medicaid program are associated with a child entering in period 1. Children in families that receive FSP benefits are 1.7 times more likely to enter in period 1 than those that do not receive benefits. This is also true for children who are enrolled in the Medicaid program, with the odds of entering WIC in the first period 53 percent higher for these children.[21] One important factor behind the associations between WIC entry and participation in the FSP or Medicaid program is the existence of adjunctive income eligibility rules stating that applicants who participate, or have family members who participate, in the FSP, TANF, or Medicaid programs automatically meet income eligibility criteria. In addition, participants in these programs are routinely referred to WIC if

[21] For entry in later periods, the odds are increased by 68 percent for Medicaid enrollees.

they seem eligible, and vice versa. In general, those receiving one type of public assistance are more likely to receive others, both because of links between programs and because they may be more motivated to seek help.

Trigger Events. Several of the trigger event variables included in the model are strongly associated with entry into WIC. Children living in families that experience at least a 20 percent decrease in earnings and that contain someone who enters public assistance, including the FSP, TANF, or Medicaid programs, are about 5 times more likely to enter the WIC program in period 1 (4.4 times more likely in later periods) than children living in families that do not experience a decrease in income or have someone enter public assistance. Similarly, children living in families that do not experience at least a 20 percent decrease in earnings, but contain someone that enters public assistance, are 4.7 times more likely to enter the WIC program in period 1 (4.4 times more likely in later periods) than children living in families that do not experience a decrease in income or have someone enter public assistance.[22] The odds of entering the program in later periods are also greater for children living in families in which no one enters public assistance, but that experience a decrease in earnings, relative to children in families that experience neither event.

It is notable that the magnitudes of these estimates are at least three times those of other coefficients. This highlights the importance of including measures of change in multivariate models of program dynamics. While the inclusion of trigger event variables in similar models has recently become more common in the analysis of FSP dynamics and health insurance transitions (for example, see Cody et al. 2007 and Czajka and Olsen 2000), multivariate analyses

[22] The estimates on which these odds ratios are based are each statistically significant at the 0.01 level.

of the determinants of WIC participation have consistently used variables measured at a single point in time.[23]

State Variables. State characteristics and policy variables have little to no association with children entering the WIC program. One exception is higher TANF participation rates in a child's State of residence, which are positively associated WIC entry.

C. DETERMINANTS OF WIC EXIT

In this section, we investigate the factors associated with exit from the WIC program. Unlike the entry analysis, there is one model for the determinants of exit for children. Table III.2 contains the odds ratios and indicators of statistical significance for each model. The results are based on a sample of children who at some point in the panel are WIC participants.

Mother and Child Characteristics. The age of the child is a significant determinant of a child's exit from the program, with children ages 1 to 3 being more likely to exit the program compared to children under 1. Four-year-old children are more than 5 times more likely to leave the program than children under 1; the magnitude of this estimate is undoubtedly attributable to the loss of categorical eligibility to receive benefits when the child turns 5.

[23] Variables measured at a point in time include both time-invariant and time-varying variables (specifically, time-varying variables that are not trigger event variables). Time-varying variables such as the unemployment rate still have a period-specific value recorded in a period (e.g., the unemployment rate in the reference month for period 1 is recorded in period 1 and the unemployment rate in the reference month for period 2 is recorded in period 2). This value may differ each period, but the change in the variable between two periods is not recorded in a given period (the change in the unemployment rate between periods 1 and 2 is not recorded in a given period, for example). It is this characteristic that separates variables measured at a point in time from those measured across time, such as trigger event variables.

TABLE III.2

WIC EXIT MODEL: ODDS RATIOS OF ESTIMATED EFFECTS OF EXPLANATORY VARIABLES ON PROBABILITY OF CHILD EXITING WIC

Explanatory Variables	Child (all periods)
Mother and Child Characteristics	
Child's Gender (female category is omitted)	
Male	0.97
Child's Parity (first child is omitted category)	
Second child	1.05
Third child or higher	0.82*
Child's Age (by period) (periods 1,2,3 are omitted categories)	
Periods 4,5,6	1.24**
Periods 7,8,9	1.30**
Periods 10,11,12	1.32**
Periods 13,14,15	5.41***
Mother's Race and Ethnicity (Hispanic category is omitted)	
White, non-Hispanic	1.24**
Black, non-Hispanic	1.06
Other	0.99
Mother's Age (under 25-year-old category is omitted)	
25-35	1.05
36 and older	0.94
Mother's Highest Grade Completed	
High school graduate (or GED)	1.02
Mother's Marital Status (never-married category is omitted)	
Married	1.08
Divorced, Widowed, or Separated	1.06
Mother's Employment Status ("not working for pay" category is omitted)	
Employed full-time	1.11
Employed part-time	1.23**
Family Characteristics	
Region of Residence ("Western" category is omitted)	
Northeast	1.11
Mid-Atlantic	0.74*
Midwest	1.34
Southeast	0.81
Southwest	0.67*
Mountain Plains	1.04
Family Size	
Number of adults	1.03
Number of children less than age 6	1.07
Number of children between ages 6 and 17	1.03
Ratio of Family Income to Poverty Level (less than 1.00 category is omitted)	
1.00 -< 1.30	1.06

Table III.2 (*continued*)

Explanatory Variables	Child (all periods)
1.30 -< 1.85	1.05
1.85 -< 3.00	0.93
Over 3.00	1.17
Household Location (rural is omitted)	
Urban	1.20**
Program Participation	
Food Stamp Program	1.00
TANF	0.98
Medicaid	0.72***
Trigger Events	
Trigger Events ("No increase in income/earnings and no one exits PA" is omitted category)	
Increase in income/earnings and someone exits PA	1.82***
Increase in income/earnings and no one exits PA	1.24**
No increase in income/earnings and someone exits PA	1.88***
State-Level Characteristics	
Policy Variables	
Maximum TANF benefit for a family of four	1.00***
Per capita TANF participation	1.04
Per capita FSP participation	0.98
Local WIC agencies per state	1.00*
Average cost of food packages for all WIC participants	1.00
Length of WIC benefit issuance period	0.84**
Policy Variables	
State unemployment rate	0.97
State poverty rate	1.01
-2*Log Likelihood	6,576
Number of Spell Period Observations	8,286

Source: Enhanced 2001 SIPP data; Unemployment rates are obtained from the Bureau of Labor Statistics (http://www.bls.gov/lau/lausad.htm); Local WIC agencies per state, average cost estimates, and length of WIC benefit issuance period are taken from WIC Participant and Program Characteristics data 2000, 2002, and 2004; FSP participation data obtained from administrative records (http://www.fns.usda.gov/pd/snapmain.htm); TANF participation and benefit amounts obtained from administrative records (http://www.acf.hhs.gov/programs/ofa/data-reports/index.htm); State poverty rates estimated using Current Population Survey data.

Note: Samples include children with left-censored nonparticipation spells.

* Significantly different than zero at the 0.10 level, two-tailed test
** Significantly different than zero at the 0.05 level, two-tailed test
*** Significantly different than zero at the 0.01 level, two-tailed test

Few characteristics of the child's mother, such as age, education, and marital status are associated with a child's exit from WIC. An exception is a mother's employment status. For children, the odds of exiting are greater for children of mothers who work part-time than for children of nonworking mothers.

Family Characteristics. The location of a child's household and whether he or she is enrolled in Medicaid are important factors in determining whether to leave the WIC program. For example, enrollment in Medicaid leads to a lower likelihood of exit. Children enrolled in Medicaid are more than 25 percent less likely to leave WIC than Medicaid nonparticipants. This may be due to Medicaid enrollees being adjunctively income-eligible when recertifying for WIC. In addition, Medicaid and WIC offices are more likely to be co-located. Household location also plays a role, as children living in urban areas are more likely to exit WIC than children living in rural areas.

Trigger Events. In the entry analyses, measures of change, such as a decrease in income, were found to be much stronger determinants of entry than variables measured at a point in time, such as the mother's marital status. The same results exist for WIC exit; however, the magnitudes of the associations between the trigger event variables and the likelihood of exiting WIC are significantly smaller than those between the trigger event variables and the likelihood of entering WIC.

Children living in families that experience at least a 20 percent increase in earnings and that contain someone that exits public assistance are 1.8 times more likely to exit WIC than children living in families that do not experience an increase in income or have someone exit public assistance. Similarly, children living in families who do not experience at least a 20 percent increase in earnings, but contain someone that exits public assistance are 1.9 times more likely to exit WIC than children living in families that do not experience an increase in income or have

someone exit public assistance.[24] For children living in families in which no one exits public assistance, but that experience an increase in earnings, the odds of exiting the program are also greater relative to odds for children in families that experience neither event.

State Characteristics. For children, there is limited association between the State-level policy and characteristic variables and exiting the WIC program.[25] In particular, the length of the time over which the WIC food package lasts is negatively related to the likelihood of a child exiting the WIC program. Most participants pick up their food packages in person at a local agency or delivery site every one, two, or three months. Our results show that a one-month increase in the length of WIC benefit issuance (i.e., from a one-month to two-month issuance or from a two-month to three-month issuance) is associated with a 16 percent decrease in the odds of exiting WIC. This suggests that increasing the supply of the WIC food package (i.e., allowing benefits to last a longer period of time) decreases the cost associated with visiting the WIC clinic to obtain program benefits, such as time costs, transportation fees, or child care expenses.

D. SUMMARY

The multivariate analyses reveal several relationships between WIC entry and exit and a set of demographic, economic, and policy variables. Common across the child entry and exit analyses is the association between trigger event variables and the decision to enter and exit WIC. These variables measure changes in income and earnings and receipt of public assistance benefits between periods. These associations are strongest for WIC entry, with children living in families that experience at least a 20 percent decrease in earnings and contain someone that

[24] The estimates on which these odds ratios are based are each statistically significant at the 0.01 level.

[25] State-level rates of unemployment and poverty, as well as FSP and TANF participation, do not affect the likelihood of a child exiting the WIC program. While the estimates of the coefficients of other policy variables, such as the number of local WIC agencies per state, are statistically significant, the magnitude of the estimate indicates that the odds essentially remain unchanged by a change in the policy variable.

enters public assistance being 4.9 times more likely to enter the WIC program in period 1 (4.7 times more likely for entering WIC in later periods) than children living in families that do not experience a decrease in income or have someone enter public assistance.

The demographic characteristics of the mother also affect the likelihood of entry and exit for children. Higher maternal age reduces the likelihood of entry for children, although children of older mothers (age 36 and older) are equally as likely to exit as those of younger mothers (under age 25).

Children of non-Hispanic mothers are less likely to enter than children of Hispanic mothers. This may reflect the WIC program's concerted effort to provide services in Spanish and to perform significant outreach activities, particularly with migrant and community health centers. For exits, however, only children of white, non-Hispanic mothers are more likely to exit WIC than children of Hispanic mothers. The likelihood of exiting is not significantly different for children of non-white, non-Hispanic mothers and children of Hispanic mothers.

Family characteristics, especially participation in the Medicaid program, are also important determinants of entry and exit. Children in families with income greater than 185 percent of poverty are less likely to enter the WIC program than children in families with income below the poverty line. For entry in period 1, this is true for children in families with income greater than 300 percent of poverty. However, family income is not always associated with a WIC exit.

Enrollment in Medicaid increases the likelihood of children entering WIC and decreases the likelihood of exit. Having a family member participate in the FSP is associated with greater odds of children entering the WIC program in period 1. They are no more likely to enter or exit the WIC program in later periods due to this association.

Including a set of policy variables—including State-level rates of unemployment, poverty, and FSP and TANF participation as well as the number of local WIC agencies—produced few

significant findings. One exception is the length of the issuance of the WIC benefit. The length of time for which the WIC benefit is issued is associated with exit for children. Increasing the length of issuance by one month is associated with a decrease in the odds of a child exiting WIC. This suggests that extending the length of the benefit issuance period decreases the cost (such as for time, transportation, or child care) associated with visiting the WIC clinic to obtain program benefits.

REFERENCES

Bartlett, Susan, Ramona Olvera, Ellen Bobronnikov, Nicole Gill, Anne Hazlett, Michele Laramie, Katherine Abe, Paul Howard, Don Laliberty, Joanna Golding, and Eileen Fahey. "WIC Participant and Program Characteristics 2002, WIC-03-PC." Alexandria, VA: U.S. Department of Agriculture, Food and Nutrition Service, 2003. Available at [www.fns.usda.gov/oane/menu/published/wic/files/pc2002tables.pdf]. Accessed August 25, 2007.

Bartlett, Susan, Ellen Bobronnikov, Nicole Pacheco. "WIC Participant and Program Characteristics 2004, WIC-04-PC." Alexandria, VA: U.S. Department of Agriculture, Food and Nutrition Service, 2006. Available at [www.fns.usda.gov/oane/MENU/Published/WIC/FILES/PC2004.pdf]. Accessed August 25, 2007.

Bitler, M., and Janet Currie. "Medicaid at Birth, WIC Take Up, and Children's Outcomes." IRP Discussion Paper Number 1286–04. Madison, WI: August 2004.

Bitler, M., J. Currie, and J.K. Scholz. "WIC Eligibility and Participation." *Journal of Human Resources*, vol. 38, 2003, pp. 1139-1179.

Brien, M., and C. Swann. "Prenatal WIC Participation and Infant Health: Selection and Maternal Fixed Effects." Unpublished manuscript, 2001.

Burstein, Nancy R. "Dynamics of the Food Stamp Program as Reported in the Survey of Income and Program Participation." Cambridge, MA: Abt Associates, Inc., January 1993.

Burstein, Nancy R. and Gus Baker. "The Dynamics of WIC Receipt by Children as Reported in the Survey of Income and Program Participation." Cambridge, MA: Abt Associates, Inc., April 1998.

Burstein, Nancy R., Mary Kay Fox, Jordon B. Hiller, Robert Kornfeld, Ken Lam, Cristofer Price, and David T. Rodda. "Profile of WIC Children." Cambridge, MA: Abt Associates, Inc., September 2000.

Cody, Scott, Laura Castner, James Mabli, and Julie Sykes. "Dynamics of Food Stamp Program Participation, 2001-2003." Washington, DC: Mathematica Policy Research, Inc., November 2007.

Cole, Nancy, David Hoaglin, and John Kirlin. "National Survey of WIC Participants." Report submitted to U.S. Department of Agriculture, Food and Nutrition Service. Cambridge, MA: Abt Associates, Inc., October 2001.

Cunnyngham, Karen, and Beth Brown. "Characteristics of Food Stamp Households: Fiscal Year 2003." Alexandria, VA: U.S. Department of Agriculture, Food and Nutrition Service, November 2004.

Czajka, John, and Cara Olsen. "The Effects of Trigger Events on Changes in Children's Health Insurance Coverage." Washington, DC: Mathematica Policy Research, Inc., April 2000.

Gleason, Philip, Peter Schochet, and Robert Moffitt. "The Dynamics of Food Stamp Program Participation in the Early 1990s." Washington, DC: Mathematica Policy Research, Inc., April 1998.

Gordon, Anne, and Lyle Nelson. "Characteristics and Outcomes of WIC Participants and Nonparticipants: Analysis of the 1988 National Maternal and Infant Health Survey." Princeton, NJ: Mathematica Policy Research, Inc., January 1995.

Hosmer, David W., and Stanley Lemeshow. *Applied Logistic Regression*. Second Edition. New York, NY: John Wiley & Sons, Inc., 2000.

Kresge, Julie. "WIC Participants and Program Characteristics, PC2002, Executive Summary." Alexandria, VA: U.S. Department of Agriculture, Food and Nutrition Service, September 2003.

Lee, B.J., L. Mackey-Bilaver, and R. George. "The Patterns of Food Stamp and WIC Participation and Their Effects on Health of Low-Income Children." *Children and Youth Services Review*, vol. 29, no. 4, April 2007, pp. 501-517.

Mei, Z., K.S. Scanlon, L.M. Grummer-Strawn, D.S. Freedman, R. Yip, and F.L. Trowbridge. "Increasing Prevalence of Overweight Among U.S. Low-income Preschool Children: The Centers for Disease Control and Prevention Pediatric Nutrition Surveillance, 1983 to 1995." *Pediatrics*, vol. 101, no. 1, January 1998.

Oliveira, Victor, Elizabeth Racine, Jennifer Olmsted, and Linda Ghelfi. "The WIC Program: Background, Trends, and Issues." Alexandria, VA: U.S. Department of Agriculture, Economic Research Service, September 2002.

Rossi, P.H. "Feeding the Poor: Assessing Federal Food Aid." Washington, DC: The American Enterprise Institute, 1998.

Ryan, Alan S., and Gilbert A. Martinez. "Breastfeeding and the Working Mother: A Profile." *Pediatrics*, vol. 83, no. 4, April 1989, pp. 524-531.

Trippe, Carole, and Karen Cunnyngham. "Multiple Benefit Receipt Among Persons Receiving Food Assistance and Other Government Assistance in January 2002." Washington, DC: Mathematica Policy Research, Inc., May 2004.

U.S. Department of Agriculture, Food and Nutrition Service. "The Special Supplemental Nutrition Program for Women, Infants, and Children: Serving Migrants in the WIC Program," Alexandria, VA: USDA 2003. Available at [www.fns.usda.gov/wic/ ServingMigrantsinWIC.pdf]. Accessed August 25, 2007.

APPENDIX A

WEIGHT CONSTRUCTION FOR THE SIPP WIC DYNAMICS FILE

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The analysis detailed in this report utilized a 2001 SIPP panel database that was enhanced by Mathematica Policy Research, Inc. (MPR) in several respects:

- Data were imputed to more than 6,000 sample members who were interviewed in the first and last waves of the survey but missed one or more nonconsecutive interviews; the imputations filled in all of the missing months of data for more than 170 variables.
- The Census Bureau's longitudinal panel weight was recalculated to incorporate these 6,000+ additional sample members.
- Adjustments were incorporated into the new panel weight to correct for the panel sample's under-representation of new mothers and over-representation of persons with health insurance coverage.
- Nearly 2,000 sample children who were born after the start of the panel were assigned longitudinal weights derived from their mothers, fathers, or guardians, and missing months following the births of many of these infants were backfilled from their first month in sample.

In this appendix, we focus on the weighting adjustments. Section A discusses the calculation of the new full-panel weight, including the adjustments to correct for the indicated biases in the longitudinal sample. Section B describes how weights were assigned to children born after the start of the panel and how we corrected what appears to have been an editing deficiency with respect to the initial appearance of newborn infants in sample households.

A. CALCULATION OF A NEW FULL-PANEL LONGITUDINAL WEIGHT

In order to assign full-panel longitudinal weights to sample persons to whom the Census Bureau did not assign such weights, we had to calculate a new full-panel longitudinal weight for all of the persons we included in the expanded longitudinal sample. This new weight, which we labeled MPRPNLWT, replaces the Census Bureau's weight, LGTPNWT3.[26]

[26] The 2001 panel includes three panel weights: LGTPNWT1, which represents the wave 1–4 longitudinal weight; LGTPNWT2, which represents the wave 1–7 longitudinal weight; and LGTPNWT3, which represents the wave 1–9 or full-panel longitudinal weight. We replaced LGTPNWT3.

MPRPNLWT was also assigned to children who were born to members of this expanded panel sample on or after January 2001 and were not "in sample" in January 2001. Because these children were not included in the January 2001 population controls, their full-panel weights could not be calculated using the procedures outlined below. As discussed in Section B, these children received their panel weights directly from their parents (generally their mothers) or non-parental guardians.

Persons who were assigned LGTPNWT3 and left the SIPP universe for any length of time between January 2001 and September 2003 retained their original values of LGTPNWT3. That is, MPRPNLWT was set equal to LGTPNWT3 and not altered. This is because we elected not to add any new panel members who left the universe.[27]

The creation of MPRPNLWT involved six steps:

1. Calculation of a preliminary weight, which was derived from the September 2003 cross-sectional weight and was adjusted to remove the effect of the Census Bureau's mover adjustment
2. Application of a noninterview adjustment to the preliminary weight
3. Preliminary calibration of the adjusted weights to match January 2001 population totals by age, sex, race, Hispanic origin, relationship to the household head, and rotation group
4. Calculation and application of an adjustment to the weights of women to correct an under-representation of mothers of infants
5. Final calibration of the adjusted weights
6. Assignment of weights to infants born after the start of the panel

[27] We are not confident that persons who left the SIPP universe are reliably identified on the public use file. Sample members who received a non-zero LGTPNWT3 despite leaving the sample clearly did leave the universe, or they would not have qualified to receive a non-zero LGTPNWT3. But if a sample member does not have a non-zero LGTPNWT3, we do not believe that we can differentiate between an attriter and someone who left the universe. Therefore, we did not assign MPRPNLWT to any additional sample members (other than newborns, as we will explain) who left the survey before the end of wave 9.

The first three and fifth steps are described in detail in the sections that follow. The fourth and last steps are described in Section B.

1. Calculation of Preliminary Weight

Our starting point in calculating a preliminary full-panel weight was the September 2003 cross-sectional weight. September 2003 is the common reference month for wave 9.

There are two main reasons why we chose to start with the wave 9 cross-sectional weight. First, and especially important, a wave 9 weight was present for all of the persons we added to the longitudinal sample.[28] Second, like the Census Bureau's full-panel weight, the wave 9 cross–sectional weight includes a nonresponse adjustment that reflects attrition through the end of the panel. This allowed us to build on the adjustment rather than attempt to replicate it. This is important because not all of the characteristics used in the Census Bureau's attrition adjustment are reported on the public use file.

The preliminary weight for the expanded panel sample was calculated from the September 2003 cross-sectional weight by removing the Census Bureau's "mover adjustment," which reduces the weights of longitudinal panel members who share households with adults who joined the sample after the first wave. These additional sample members receive cross-sectional weights and, when they meet the criteria, calendar year longitudinal weights, but they are not eligible for full-panel longitudinal weights because they were not in-sample in wave 1.

The preliminary panel weight, or PWGT, was calculated as:

PWGT = WPFINWGT(September 2003) / H_MA

[28] Recall that our criteria included having data for wave 9.

where the first term on the right hand side is the September 2003 cross-sectional weight, and H_MA is the household mover adjustment factor. H_MA was calculated at the household level and applies to every member of the expanded panel who resided at that address in September 2003. H_MA is defined as:

H_MA =
Number of Panel Adults / (Number of Panel Adults + Number of Nonpanel Adults)

Because our goal was to remove the Census Bureau's mover adjustment factor from the calendar month weight, we had to define it in the same way that the Census Bureau did. An adult is someone who was 15 or older in September 2003. Panel adults include all persons who were selected in wave 1, regardless of whether they were to be included in the expanded panel sample. Nonpanel adults are those who joined the sample *after* wave 1 but were in the SIPP universe during wave 1 (that is, they were eligible for selection into the 2001 panel in wave 1). Persons who joined the SIPP universe after wave 1—for example, by moving from abroad, leaving the military, or leaving an institution—have no impact on the selection probability of the household, so they do not enter into the calculation of the mover adjustment factor.

In principal, recalculation of the mover adjustment for the purpose of removing it from the wave 9 weight is straightforward. However, two things complicate the process. First, adults who joined the SIPP universe after wave 1 and, therefore, should be excluded from the calculation, are not explicitly identified as such on the public use file. Thus we cannot readily determine the number of nonpanel adults to use in applying the above formula. Second, for additional reasons that we do not understand, the mover adjustment applied by the Census Bureau does not always conform to the above rule. If our own calculation of the mover adjustment does not match the Census Bureau's, our derivation of PWGT will be incorrect.

Since our goal was to determine the amount of the mover adjustment in September 2003, we developed an algorithm that enabled us to back out the adjustment from the progression of cross-sectional weights leading up to September 2003. Essentially, this involved working back from wave 9 to determine, for each household, roughly how much a panel member's cross-sectional weight was changed in response to changes in the number of adult members of the household and then determining what whole number of nonpanel adults, when combined with the number of panel adults, would yield the closest approximation to the observed adjustment. We then used this number of nonpanel adults to calculate the final value of H_MA for that household.

While children were excluded from the *calculation* of H_MA, this factor still applied to any child eligible to receive an expanded panel weight. That is, the child's September 2003 weight was divided by H_MA in order to obtain the preliminary panel weight, PWGT.

2. Noninterview Adjustment

While the calibration that we describe in the next section mimics the Census Bureau's calibration of the 2001 SIPP panel longitudinal weights very closely, the noninterview adjustment that we applied in calculating MPRPNLWT departs from the Census Bureau's full-panel noninterview adjustment in a number of ways, explained below.

The panel noninterview adjustment, whether the Census Bureau's or our own, is designed to align the panel with the full SIPP cross-sectional sample with respect to the joint distribution of key characteristics observed at the start of the panel. The objective of this adjustment is to compensate for differential attrition that causes the panel to deviate from the population that it is supposed to represent. For each of a set of adjustment cells, defined by a combination of characteristics, the preliminary panel weights are inflated or deflated so that their sum equals the cross-sectional sample estimate of the population in that cell. The characteristics that are used to define the adjustment cells are ones that have been shown to be associated with the probability of

attrition over the life of a SIPP panel. For the 2001 SIPP panel the Census Bureau included the following characteristics in defining the noninterview adjustment cells for the full-panel weight:

- Person is white, non-Hispanic versus other (two categories)
- Person was self-employed or not (two)
- Person's family income relative to poverty (averaged over the four reference months) was less than or equal to 175 percent, 176 through 450 percent, or more than 450 percent (three)
- Person was in household with someone covered by a means-tested program (defined as SSI, TANF, WIC, Food Stamps, Medicaid, or other welfare) or person received unemployment compensation, or neither (three)
- Person was in household with someone receiving income from bond-type financial assets or not (two)
- Person's education level was less than 12 years, 12 to 15 years, or 16 or more years (three)
- Person was in labor force at least one month of wave versus not (two)
- Census division of household (nine)
- Number of imputations in household wave 1 data is none, one, or more than one (three)
- Stratum code of household is poverty versus nonpoverty (two)

A full cross-classification of these 10 variables implies 23,328 adjustment cells, but the Census Bureau reduced these to 149, using an algorithm that prioritized the variables, required a minimum number of 30 full-panel observations in each cell, and did not allow any adjustment factor to exceed 2 (U.S. Census Bureau 2001).

We opted for a simpler approach because: (1) we were starting with a preliminary weight that already included a wave 9 noninterview adjustment,[29] (2) we wanted to add health insurance

[29] The wave 9 noninterview adjustment would have matched the distribution of wave 9 households to the distribution of full wave 1 households with respect to the following wave 1 characteristics: (1) race and ethnicity of the household reference person (white, non-Hispanic versus not); (2) whether the reference person was a single female householder with children, a householder 65 and older, or other; (3) whether the household received public assistance or not; (4) household size; (5) whether the household had income from bond-type assets; (6) the reference

coverage to the adjustment, as there was evidence of differential attrition by insured status even after the Census Bureau's adjustment,[30] (3) we wanted to allow for a different set of adjustment cells by age group, (4) we could not identify poverty stratum with the public use file, and reconstructing the imputation indicator required far too many variables, and (5) we wanted to have more control over the final set of cells than was possible if we started with more than 23,000 cells.

We elected to retain five of the Census Bureau's 10 variables, add health insurance coverage as a sixth variable, and define separate adjustment cells for each of three age groups: (1) children under 15, (2) adults 15 through 64, and (3) adults 65 and older. Table A.1 identifies the six variables and their respective categories and indicates which variables were included in the adjustment cell matrix for each age group.

The full combination of these categories yields a matrix of 972 categories—still far too many to serve as adjustment cells. We pre-specified a smaller set of adjustment cells that were age-specific, and after viewing preliminary estimates we collapsed cells as necessary to achieve a minimum of 30 observations per cell and adjustment factors no larger than 2.

(continued)

person's education level; (7) whether the household own, rented, or lived in subsidized housing; (8) Census division; (9) whether the number of imputations in wave 1 was zero, one, or more than one; and (10) household income relative to a household poverty threshold. As with the panel noninterview adjustment, the implied number of cells greatly exceeds the final number of adjustment cells (109), so the full matrix would have been collapsed substantially, limiting the role of many of the 10 variables.

[30] When weighted by LGTPNWT3, the number of uninsured persons in January 2001 was fewer than the cross-sectional (full sample) estimate for that month.

TABLE A.1

VARIABLES USED IN THE NONINTERVIEW ADJUSTMENT, BY AGE

Variable	Age Group: Under 15	Age Group: 15 to 64	Age Group: 65 and Older
Race/ethnicity	X	X	X
White, non-Hispanic			
Other			
Income-to-poverty ratio	X	X	X
<= to 175 percent of poverty			
> 175 and <= to 450 percent of poverty			
> 450 percent of poverty			
Receipt of public assistance	X	X	X
Any of several assistance programs [a]			
Unemployment compensation only			
No assistance			
Labor force participation		X	
In the labor force			
Not in the labor force			
Educational attainment		X	X
No high school diploma			
Some college but no four-year degree			
Four-year degree or greater			
Health insurance	X	X	
Public coverage			
Private coverage only			
Uninsured			

[a] Programs include SSI, AFDC, WIC, Food Stamps, Medicaid, or other welfare.

We also added a second stage to the noninterview adjustment to compensate for the SIPP panel's progressive under-representation of women who gave birth or adopted children over the course of the panel. Unlike the initial noninterview adjustment and the calibration that followed, this adjustment had a longitudinal dimension. Because it merits a more extended discussion, including documentation of the SIPP's under-representation of births and infant adoptions, this adjustment is described in Section B, which also discusses the assignment of MPRPNLWT to infants born after the start of the panel.

3. Calibration

The purpose of calibration is to bring the weighted full-panel sample into agreement with independent population controls. We obtained the Census Bureau's specifications for calibrating its own full-panel weight, which utilized January 2001 population controls by age, sex, race, Spanish origin, and relationship to the household reference person. The relationship controls were based on a tabulation of the January 2001 Current Population Survey (CPS) whereas the other controls are from the Census Bureau's population estimates program, which provides population controls for all of the Census Bureau's household surveys. The population controls are divided by four and applied separately to each rotation group. Knowing this, we were able to back out the population controls and infer details about the calibration process that were not spelled out in the Census Bureau's specifications, such as how the cells were collapsed when sample frequencies were too low or the implied weighting adjustments were too large. We were also able to resolve some ambiguities in the specifications and identify places where the Census Bureau's implementation of calibration appeared to deviate from the specifications.

Because the full-panel sample is smaller than the January 2001 cross-sectional sample, calibrating the full-panel weights requires more collapsing across age groups—sometimes differentially by rotation group—than is needed for the cross-sectional weights. With the expanded panel sample, we were able to eliminate some of the collapsing when we calibrated MPRPNLWT.

Panel members who left the SIPP universe and, therefore, received an MPRPNLWT equal to their Census Bureau full-panel weight were excluded from calibration. Their weighted totals were subtracted from the controls that we used to calibrate the balance of the expanded panel sample.

The calibration algorithm was run twice. A preliminary calibration was applied immediately after the noninterview adjustment but prior to the adjustment to correct for the panel's progressive under-representation of new mothers. A final calibration was applied after the application of this latter adjustment.

B. ASSIGNMENT OF WEIGHTS TO CHILDREN

The Census Bureau does not assign full-panel longitudinal weights to persons who joined the sample after the start of the panel reference period. In addition to adults who moved into panel households, this encompasses infants born to or adopted by panel members over the course of the panel. While there is a clear rationale for limiting panel weights to sample members who were actually present at the start of the panel, there are analysts who would like to use the SIPP to follow children from birth or examine the impact of family dynamics on *all* children—not just those born before a certain date. In this context we note that by September 2003, weighted panel estimates from the 2001 panel excluded all children below two years and eight months of age.

To work around this limitation, users conventionally assign unweighted children the panel weights of their mothers—sometimes substituting the weights of the fathers or nonparental guardians if the mothers are not present.[31] Doing so, however, yields too few young children. Table A.2 documents the progressive decline in the estimated number of children less than three years of age when the children born to panel members after January 2001 are weighted in this manner. Accounting for most of this decline, the estimated number of infants falls steadily between January 2001 and January 2003 before turning upwards slightly over the next eight months of that year. By September 2003 the full-panel sample represents 19 percent fewer infants than it did in January 2001. The decline in the number of infants produces a lagged

[31] If the mother is present but has a weight of zero, then zero would be the appropriate weight for the child under this weighting scheme.

decline in the number of one-year-olds. Over this same period, children one year of age show a 17 percent decline.

TABLE A.2

ESTIMATES OF CHILDREN AT SELECTED AGES: SIPP FULL PANEL PLUS CHILDREN WHO JOINED THE SAMPLE BY BIRTH OR ADOPTION
(Thousands)

Age	January 2001	January 2002	January 2003	September 2003	Percentage Change
0	3,653	**3,487**	**2,810**	**2,951**	-19.2
1	4,074	3,738	**4,004**	**3,376**	-17.1
2	3,959	3,979	3,711	*3,889*	-1.8
3	3,717	3,917	3,956	3,700	-0.5
Under 3	11,686	*11,204*	*10,525*	*10,216*	-12.6
3 to 18	64,949	64,176	63,892	63,288	-2.6
3 to 9	27,765	27,350	27,031	26,633	-4.1
10 to 14	20,849	20,803	20,737	20,787	-0.3
15 to 18	16,335	16,023	16,124	15,868	-2.9
Total	76,635	*75,380*	*74,417*	*73,504*	-4.1

Source: Mathematica Policy Research tabulations of 2001 SIPP panel using the Census Bureau's full panel weight (LGTPNWT3).

Note: Children who joined the SIPP sample after January 2001 were not eligible for the Census Bureau's full panel weight. In this table, children born to or adopted by panel members were assigned the panel weights of their mothers, if present in the household. If a child's mother was not present, the child was assigned, in turn, the panel weight of the father, guardian, or household reference person, depending on who was present. Estimates in bold are based entirely on these supplemental weights. Estimates in italics are based on a mix of full panel and supplemental weight.

Oddly, this lagged effect is countered, in part, by an upsurge in the size of the last two birth cohorts between infancy and age one. The cohort of children who were infants in January 2002 grows by 0.6 million over the next 12 months, while the number of one-year-olds in September 2003 is nearly 0.6 million larger than the number of infants in January of that year. This contrasts sharply with the year-to-year change in the size of older cohorts. Every cohort declines slightly between ages one and two and between ages two and three. Furthermore, the growth between

infancy and age one for the two youngest cohorts is highly inconsistent with the pattern that we would expect to see in a panel sample that can grow only through birth and adoption.[32]

Altogether, the panel estimate of children under three years of age falls by nearly 1.5 million or 12.6 percent between January 2001 and September 2003. Over this same period the panel estimate of children aged three and older declines by just 2.6 percent, with only slight variation in this pattern across subsets of ages. While the number of young children in January 2001 does not tell us exactly how many children of the same age the panel ought to represent in any subsequent year, it provides a reasonably good proxy, given the relative stability of birth rates over this period. To confirm this point, later we provide estimates of the weighted number of infants that we would expect to observe in the panel by year, based on the application of age-specific birth rates to the women represented by the panel.

1. Under-Representation of New Mothers

If assigning newborn children the panel weights of their mothers produces a growing shortfall in the estimated number of infants (and older children as the infants age), it follows that there must be a growing under-representation of women giving birth after the start of the panel. While the panel weights correct for differential nonresponse by age, sex, race, Spanish origin, and selected other characteristics, these adjustments would not compensate for differentially higher attrition by new mothers relative to otherwise similar women. If new mothers are less likely to respond to the SIPP in the first place and more likely to attrite than other women with similar characteristics on the variables included in the Census Bureau's nonresponse adjustments, then new mothers will be under-represented in estimates produced from the full-panel data. Their under-representation will not affect the cross-sectional estimates of children at

[32] Reported adoptions would explain very little of the growth between infancy and age one in the number of children who were infants in January 2002 or 2003.

any point or the panel estimates of children who were alive at the start of the panel because the weights assigned to these children are controlled to independent population estimates by age. However, too few weighted mothers will affect the panel estimates of children who receive their mothers' weights.

The most direct way to correct the under-representation of young children is to apply population controls to the weights they receive from their mothers. We could have done so, but we chose instead to correct the problem at its source by adjusting the weights of women to compensate for the under-representation of new mothers. This had the advantage of correcting two problems—not just one. In order to develop a suitable correction, however, we first had to learn more about the under-representation of new mothers in the SIPP—a problem that, to our knowledge, has not been identified by other SIPP users. To do so, we had to determine how many mothers of infants we would expect to observe at any point in a population of women followed over time and then compare the SIPP panel estimates of mothers of infants to these expected numbers. This would tell us where and by how much the SIPP estimates fell short.

To estimate the number of mothers of infants that we would expect to observe in the SIPP at different points in time, we classified the panel sample women of childbearing age into five-year cohorts, based on their age in January 2001. Using the Census Bureau's full-panel longitudinal weight, LGTPNWT3, we estimated the number of women represented by the panel in January 2001, 2002 and 2003 as well as September 2003, the final reference month common to all four rotation groups (January 2001 being the first). By applying age-specific annual birth rates for 2000 through 2003 to these population estimates, we calculated the weighted number of births that we would have expected from each five-year cohort. We then used infant mortality rates by

age of mother to derive estimates of surviving infants by age of mother at each of the four points in time.[33]

The number of *mothers* of infants at any point in time is somewhat smaller than the number of infants. They would be identical except that: (1) some mothers have more than one infant due to multiple or closely-spaced births and (2) some mothers have died or moved away from their children, either temporarily or permanently.[34] By including adoptive mothers, we partially offset this second factor.[35] Nevertheless, some infants in the SIPP are observed without mothers or share the same mother with another infant.

We used SIPP data for January 2001 to estimate the number of mothers of infants that we would expect to observe in a household survey given the number of infants. Of the 3,870 thousand infants observed in the SIPP in January 2001 (based on the cross-sectional weight for that month), 144 thousand had no mother in the household, and 132 thousand shared a mother with an infant sibling, implying 3,493 thousand mothers of infants or 92.9 percent of the number of infants. We applied this proportion to our estimates of surviving infants by age of mother to derive estimates of the expected number of mothers of infants in each of the eight five-year age cohorts of women at each of the four points in time.

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[33] The infants observed in the panel at any point in time are, on average, six months old. Two-thirds of infant mortality is neonatal, occurring in the first month after birth, and infant death rates drop fairly steeply after that. In a population of infants observed in the SIPP, therefore, most of the infant deaths have already occurred. To derive the number of infants from an estimate of the number of births in the preceding 12 months, we applied annual infant mortality rates to the total births. While this overstates the number of infant deaths, the bias is sufficiently small for our purposes.

[34] In most household surveys, including the SIPP, a mother living apart from her infant child would not be identifiable as the mother of an infant.

[35] Native-born children who are given up for adoption shortly after birth will get counted in the SIPP as adopted infants. Foreign-born children who are adopted by U.S. families as infants will also be counted in the SIPP as adopted infants, although typically not as quickly after birth. Because foreign-born children are not counted in our estimates of expected infants and, therefore, do not contribute to our estimates of expected mothers of infants, they improve the SIPP's coverage of these populations inappropriately. Given the small number of reported adoptions generally, however, their overall contribution to the number of mothers of infants observed in the SIPP at any one time is very small.

Estimates of the expected number of mothers of infants by mother's age in January 2001 are presented for each of the four points in time in the top panel of Table A.3. The corresponding observed numbers are presented in the middle panel while differences between the observed and expected numbers are presented in the bottom panel. Between January 2001 and September 2003 our estimates of the expected number of mothers of infants represented by the SIPP panel decline slightly from 3,732 thousand to 3,536 thousand. Over this same period the observed numbers decline much more substantially, from 3,757 thousand to 2,698 thousand. In January 2003, when the gap is greatest, the observed number falls short of the expected number by 904 thousand. More than a third of this difference can be attributed to the ages 15 to 19. The next two age groups contribute a combined difference that is even greater, but the combined shortfall over the next four age groups is less than half the shortfall among women 15 to 19 alone.

We suggest that the patterns displayed in Table A.3 are due primarily to attrition among new mothers rather than women failing to report their children (but see below on delayed reporting). Childbirth itself may be an especially strong stimulus to attrition among young women, or it may be associated with other events that increase the probability of attrition—particularly among single mothers. Whatever may explain the findings in Table A.3, they indicate that in the final years of the 2001 SIPP panel the survey was severely under-representing a segment of the population that is of keen interest to policymakers and researchers.

TABLE A.3

COMPARISON OF EXPECTED AND OBSERVED MOTHERS OF INFANTS IN THE 2001 SIPP PANEL: SELECTED MONTHS, BY AGE IN JANUARY 2001)
(Thousands)

Age in January 2001	January 2001	January 2002	January 2003	September 2003
	Expected Mothers of Infants in the SIPP Panel			
Total	3,732	3,597	3,527	3,536
10 to 14	5	17	44	78
15 to 19	351	479	590	663
20 to 24	923	900	902	911
25 to 29	985	953	933	928
30 to 34	895	806	720	673
35 to 39	465	373	294	251
40 to 44	103	67	42	31
45 to 49	6	3	2	1
	Observed Mothers of Infants in the SIPP Panel			
Total	3,757	3,317	2,623	2,698
10 to 14	0	10	5	48
15 to 19	258	247	258	320
20 to 24	823	779	725	733
25 to 29	1,067	863	718	809
30 to 34	942	945	614	596
35 to 39	503	391	274	176
40 to 44	144	76	29	11
45 to 49	21	6	0	4
	Observed Minus Expected Mothers of Infants			
Total	25	-280	-904	-838
10 to 14	-5	-7	-39	-30
15 to 19	-93	-231	-332	-342
20 to 24	-100	-121	-177	-177
25 to 29	82	-90	-215	-119
30 to 34	47	140	-106	-77
35 to 39	38	18	-20	-75
40 to 44	41	8	-13	-21
45 to 49	15	2	-2	3

Source: Mathematica Policy Research tabulations of 2001 SIPP panel using the Census Bureau's full panel weight (LGTPNWT3).

2. Duration of Infancy

Even if attrition among new mothers were no higher than among the general population, and new mothers reported all of their births, both the number of infants and the number of mothers of infants would be under-estimated if new mothers delayed reporting their new children as household members. To give an extreme example, if mothers reported their new children only

after three months, then both the number of infants and the number of mothers of infants at any point in time would be understated by 25 percent—even though the total number of births reported over an interval would be correct. The shortfall would occur because the newborn infants would appear in the sample as infants for only nine instead of 12 months.

In work with an earlier SIPP panel, we discovered an inconsistency between the Census Bureau's conventions for determining when a newborn baby joins a SIPP household and when an infant's age is incremented to one. Only about half of the infants born in a given month are considered to be in sample in that month. We speculate that in order to be counted as in sample, a child must have been born (or joined the household) in the first half of the month.[36] The Census Bureau employs a different rule for incrementing ages, however. A sample member's age is incremented in the individual's month of birth, regardless of whether the individual was born in the first or second half of the month. What this means is that about half of all infants born into the SIPP sample are counted as infants (that is, with an age of 0) for only 11 months.[37] When newborns are assigned the panel weights of their mothers, this inconsistency between the in sample designation and the incrementing of ages reduces the number of infants in any given month by about one-half of 1/12, or about four percent.[38]

Children who do not get reported as household members until two or more months after their births also contribute to the shortfall in both the number of infants and the number of mothers of infants. Adoptions of children born overseas, as we have noted, do not present a

[36] Only the month and year of birth are reported on the public use file, so we cannot test this directly.

[37] For example, infants born in the second half of June will not be considered in sample until July. But all of these infants will be classified as a year old in June of the next year. These infants will have been in sample as infants for only 11 months before becoming one-year-olds.

[38] Again, cross-sectional estimates of the number of infants in a given month do not exhibit this shortfall because the cross-sectional weights are calibrated to independent population totals. All sample infants receive higher weights to offset the fact that half of them are in the sample as infants for only 11 months.

problem because their births do not contribute to the expected number of infants, but adoptions of children born in the United States do contribute to the shortfall when such children join SIPP households after their first month of life. Numerically, these U.S. adoptions are negligible, however. The bigger problem comes from infants who are simply not reported as new household members until two or more months after their births. In the 1996 SIPP panel, wherein we first examined this phenomenon closely, 9.1 percent of the infants who were assigned MPRPNLWT were listed as new household members two or more months after their reported births while 0.5 percent were listed as new household members one or more months *before* their reported births. The rest were evenly divided between those who were listed as new household members in their month of birth (45.1 percent) and those who were listed a month later (45.4 percent). In the 2001 panel, 36.4 percent of the infants who were assigned MPRPNLWT were first listed as household members two or months after their reported births. Only 25.2 percent were first listed as household members in their month of birth while 36.0 percent were listed a month later, and 2.4 percent were listed as household members one or more months before they were born.[39]

Because the classification of children as infants affects the identification of mothers of infants, we had to correct this problem before we adjusted the weights of mothers. The best correction for infants being reported one or more months after their births is to backfill the missing months, but this is complicated by the need to adjust family and household characteristics (such as family size, which in turn affects poverty thresholds). Given the complexity of these additional adjustments, we decided not to attempt to backfill missing months in either the 1996 panel or the earlier 2001-based food stamp dynamics file. Instead, for our earlier work, we modified when age incremented for children who were not considered in sample

[39] This last group was almost evenly divided among those appearing one, two, or three months before their births. This pattern suggests that these children were reported as present for the entire four-month reference period in which they were born, even though they were born in the second, third, or fourth month of the period.

until the month after their birth. Specifically, we delayed incrementing these children's ages until the anniversary of their designation as in sample. This resulted in their being classified as infants for a full 12 months. Thus a child born in June but not considered in sample until July would remain an infant until July the following year, would become a two-year-old in July of the next year, and so on. We did not alter the way that age incremented for infants who first appeared in sample prior to or more than one after their births.

In view of the importance of infants to the WIC dynamics analysis, we decided to address the missing months of infancy by backfilling the missing months from the birth month to the first month in sample and dispensing with the modification to the way that age incremented. We also removed the excess months for infants who appeared in sample prior to their birth month. We also adjusted family and household characteristics, as necessary, to incorporate (or remove) the additional members, and we recomputed poverty thresholds and income-to-poverty ratios.

3. Adjustment of Weights

The goal of the weighting adjustment was to increase the estimated number of women who were ever observed as new mothers. This would in turn produce an increase in the estimated number of newborn children.

While the shortfall in the SIPP estimates of mothers of infants grows over time, any compensating adjustment had to be implemented through a longitudinal weight that would remain fixed from the start of the panel. We decided that the weight adjustment for each sample woman would be based on the shortfall in the number of new mothers in her five-year birth cohort at the time she first appeared as the mother of an infant. This weight adjustment would then carry through to any subsequent appearances as a new mother. First-time mothers at later dates would receive adjustments that were calculated net of the adjusted weights of any other mothers whose weights had already been adjusted. In cohorts in which the shortfall in mothers of

infants grew with time, women who became mothers for the first time later in the panel would tend to receive larger adjustments than those who became mothers earlier in the panel. Women who were never observed as mothers of infants received a separate weight adjustment to offset the adjustments to the weights of new mothers, thus maintaining the weighted size of each five-year cohort. The adjustments were calculated at four points in time: each January from 2001 through 2003 plus September 2003.

Before calculating the adjustment factors, we backfilled the missing months of infancy, as described above, which affects not only the number of infants but the number of mothers of infants as well.[40] Had we not done so, we would have over-adjusted the number of mothers to correct a component of the shortage of infants that was due entirely to the infants. We also calibrated the sample so that the adjustments that we calculated would be consistent with the final number of women by age and household relationship code, which includes the presence of children in January 2001.

[40] When we extend a child's infancy by one month, we also extend the time that the child's mother is observed as the mother of an infant. This increases the number of mothers of infants at a given point in time.

The adjustment factors that we applied to the mothers of infants and to other women of childbearing ages are reported in Table A.4. The largest adjustments occur among women under 20, although the impact of the adjustments to women who were under 15 in January 2001 is negligible in comparison with the impact of the adjustments to women 15 to 19 because the number of mothers in the younger cohorts is much smaller. The adjustments to women who were 15 to 19 in January 2001 increase from 1.225 among those with infants in that month to 2.176 among women first observed with infants in January 2003. This growth in the adjustment factors reflects the growing under-representation of young mothers of infants over the duration of the 2001 panel. Women who were 15 to 19 in January 2001 but never observed as mothers of infants had their weights reduced by 7 percent to offset the upward adjustments to the weights of mothers of infants.

TABLE A.4

WEIGHT ADJUSTMENTS TO MOTHERS OF INFANTS, BY AGE IN JANUARY 2001

Age in January 2001 and Time Period Observed with Infant	Adjustment Factor
10 to 14	
Women with no infants over the time period	0.995
Women with infants beginning in January 2001	1.000
Women with infants beginning in January 2002	1.296
Women with infants beginning in January 2003	3.258
Women with infants beginning in September 2003	1.384
15 to 19	
Women with no infants over the time period	0.927
Women with infants beginning in January 2001	1.225
Women with infants beginning in January 2002	1.337
Women with infants beginning in January 2003	2.062
Women with infants beginning in September 2003	2.176
20 to 24	
Women with no infants over the time period	0.936
Women with infants beginning in January 2001	1.181
Women with infants beginning in January 2002	1.061
Women with infants beginning in January 2003	1.165
Women with infants beginning in September 2003	1.486

Table A.4 (*continued*)

Age in January 2001 and Time Period Observed with Infant	Adjustment Factor
25 to 29	
Women with no infants over the time period	0.980
Women with infants beginning in January 2001	0.927
Women with infants beginning in January 2002	0.973
Women with infants beginning in January 2003	1.192
Women with infants beginning in September 2003	1.251
30 to 34	
Women with no infants over the time period	1.023
Women with infants beginning in January 2001	0.966
Women with infants beginning in January 2002	0.757
Women with infants beginning in January 2003	1.053
Women with infants beginning in September 2003	1.299
35 to 39	
Women with no infants over the time period	1.003
Women with infants beginning in January 2001	0.916
Women with infants beginning in January 2002	0.861
Women with infants beginning in January 2003	0.989
Women with infants beginning in September 2003	2.045
40 to 44	
Women with no infants over the time period	1.001
Women with infants beginning in January 2001	0.820
Women with infants beginning in January 2002	0.894
Women with infants beginning in January 2003	1.201
Women with infants beginning in September 2003	4.000
45 to 49	
Women with no infants over the time period	1.001
Women with infants beginning in January 2001	0.500
Women with infants beginning in January 2002	0.727
Women with infants beginning in January 2003	1.000
Women with infants beginning in September 2003	1.000

Source: Mathematica Policy Research.
Note: Adjustments reported here have been rounded; the actual adjustment factors contained two additional decimal places.

The adjustments to women who were 20 to 24 in January 2001 range from 1.061 to 1.486 with a 6 percent downward adjustment to the weights of those who were never observed as mothers of infants. In the next age group the adjustments to new mothers of infants are downward (less than 1) in the first two time periods, indicating an excess number of mothers of infants, but they become positive for the two months of 2003. Downward adjustments for 2001

and 2002 recur in the older cohorts while the adjustments for 2003 become smaller except for two large values in September 2003 for women who were 35 to 39 or 40 to 44 in January 2001. These large adjustments indicate a substantial shortfall of new mothers in those cohorts in September 2003, but the weighted numbers of women affected by these adjustments are small.

4. Assignment of Weights to Infants

For any infant born after January 2001 (or born in January 2001 but not listed as a household member in that month), we assigned MPRPNLWT according to a scheme that gave priority to the mother's weight, as detailed below.

If the child's mother (biological or adoptive) was present at any point, we assigned the mother's MPRPNLWT to the child except when one parent (either the mother or the father) was an original member of the panel and the other parent joined the SIPP household after wave 1. If the father joined the household after wave 1, we assigned one-half the mother's weight. If the *mother* joined the household after wave 1, we assigned one-half the *father's* weight. This strategy of assigning half-weights in some cases was designed to increase the number of sample infants who received panel weights. It should not affect the weighted number of infants significantly. In all cases, weights were assigned without regard to whether they were positive versus zero. If the appropriate weight for a child was the mother's weight and the mother's weight happened to be zero, then the assignment of a zero weight to the child was appropriate as well.

If an infant's biological or adoptive mother was *never* present, we did the following. If the child's father (biological or adoptive) was present, we assigned MPRPNLWT (including values of zero) from the father. If neither parent was present, but someone in the household was identified as the child's guardian, we assigned MPRPNLWT from the guardian. If no one was

identified as the child's guardian, we assigned MPRPNLWT from the household reference person.[41] We followed this sequence regardless of the values of the weights.

Children who were adopted after January 2001 were eligible to receive panel weights, but only if they were also *born* after January 2001. Adopted children born in or before January 2001 were treated the same way as other persons who moved in with panel members after wave 1; they could not be assigned panel (longitudinal) weights, but their data contributed to the family and household characteristics of panel members in the months that they shared such membership. In addition, while present they received cross-sectional weights.

Out of 2,729 children who joined the SIPP panel as infants after January 2001 and were born no earlier than that month, 1,983 received positive MPR panel weights (Table A.5). Of this latter total, 1,790 (or 90.3 percent) received positive weights from their mothers, 115 (5.8 percent) received positive weights from their fathers, 76 (3.8 percent) received positive weights from nonparental guardians, and 2 (0.1 percent) received positive weights from household reference persons who were not identified as their guardians.

[41] A child could receive a weight from a stepparent only through either of these last two alternatives.

TABLE A.5

SOURCE OF WEIGHT FOR CHILDREN BORN AFTER THE START OF THE 2001 SIPP PANEL

Source of Weight	Child Assigned Weight Of Zero	Child Assigned Positive Weight	Total
Total Children	746	1,983	2,729
Panel Mother			
Mother's full weight	461	1,704	2,165
Half of mother's weight[a]	35	86	121
Panel Father			
Father's full weight[b]	19	20	39
Half of father's weight[a]	29	95	124
Nonpanel Mother[c]	159	0	159
Guardian[d]	40	76	116
Household Reference Person[d]	3	2	5

Source: Mathematica Policy Research tabulations of 2001 SIPP panel.

Note: A weight of zero is assigned if the source of the weight is not a panel member, or if the source is a panel member with a weight of zero. All persons interviewed in wave 1 are considered panel members.

[a] Spouse is present but not a panel member.
[b] Mother is never present.
[c] Father is not present or not a panel member.
[d] Neither father nor mother is ever present. Guardian is favored over the household reference person, regardless of panel membership.

5. Impact of Adjustments

To demonstrate the impact of our weight adjustments, we compare our final estimates of infants and mothers of infants (based on MPRPNLWT after calibration) with both the expected numbers and the Census Bureau's panel estimates (based on LGTPNWT3). We also compare our expanded panel estimates of participants in several means-tested programs with the Census Bureau's panel and cross-sectional estimates.

Comparisons of the alternative estimates of infants and mothers of infants are reported in Table A.6. The final estimates of mothers of infants lie within a percentage point of the expected numbers, ranging from 99.0 to 99.4 percent of the targets. The final calibration accounts for the

slight shortfall, but the shortfall would have been greater had we not calibrated the sample prior to calculating and applying the adjustment factors for mothers of infants. Furthermore, the improvement over the Census Bureau's full panel estimates is dramatic. For January and September 2003 the final MPR estimates are 25 and 23 percentage points better than the Census Bureau full-panel estimate.

TABLE A.6

EXPECTED VERSUS FINAL WEIGHTED NUMBERS OF INFANTS AND MOTHERS OF INFANTS: SELECTED MONTHS, JANUARY 2001 THROUGH SEPTEMBER 2003
(Thousands)

Description of Estimate	January 2001	January 2002	January 2003	September 2003
Expected Number of Mothers of Infants	3,732	3,597	3,527	3,536
Observed Number of Mothers of Infants	3,757	3,317	2,623	2,698
Final Number of Mothers of Infants (MPR)	3,698	3,575	3,494	3,500
Observed Number as Percent of Expected	100.7	92.2	74.4	76.3
Final Number as Percent of Expected	99.1	99.4	99.1	99.0
Expected Number of Infants	4,019	3,874	3,798	3,808
Observed Number of Infants	3,653	3,485	2,821	2,913
Final Number of Infants (MPR)	3,957	3,799	3,735	3,735
Observed Number as Percent of Expected	90.9	90.0	74.3	76.5
Final Number as Percent of Expected	98.5	98.1	98.3	98.1
Mothers as Percent of Infants				
Expected	92.9	92.9	92.9	92.9
Final Estimates	93.5	94.1	93.5	93.7

Source: Mathematica Policy Research tabulations of 2001 SIPP Panel.

Note: To obtain the observed number of infants, the Census Bureau panel weights of parents were assigned to infants born during the panel in the same manner that the MPR panel weight was assigned to these infants, following the algorithm illustrated in Table A.5. This differs slightly from the method used to assign weights to these infants in Table A.2.

The final estimates of infants lie within 2 percentage points of the expected number at every one of the four points in time, ranging from 98.1 percent in January 2002 and September 2003 to 98.5 percent in January 2001. The difference is 8 percentage points in January 2001, 5 percentage points in January 2002, and 18 percentage points in January and September 2003.

The final MPR estimate of infants is stronger than the MPR estimate of mothers of infants in January 2001, reaching 98.5 percent of the expected number, but it is not quite as strong at any subsequent point, ranging from 92.9 to 94.9 percent of the expected number. The additional shortfall for infants compared to mothers of infants appears to derive from our assumption that the number of mothers of infants is 92.9 percent of the total number of infants. We based our estimate of 92.9 percent on cross-sectional data for January 2001, but over time the attrition among infants may have been greater for those without mothers than for those with mothers. If the 92.9 percent figure is indeed too low, it will result in too few mothers of infants, which in turn will yield too few infants. Nevertheless, at 98 percent of the expected number, our final estimates of infants are exceedingly close to the where they should be and substantially better than the estimates obtained from the Census Bureau's full panel weight, which were only 75 percent of the expected numbers in January and September 2003.

Comparative estimates of program participants, based on the alternative panel weights and the cross-sectional weight for each of the four points in time, are reported in Table A.7. We note, first, that the total number of persons estimated by the MPR panel weight exceeds the number estimated by the Census Bureau panel weight after January 2001. The difference reaches one million by September 2003. This is due entirely to the adjustments that increase the number of infants born to or adopted by panel members.[42] The cross-sectional estimate of persons exceeds both panel estimates after January 2001, but this is because the cross-sectional weights are controlled to estimates of the total civilian noninstitutional population in each month, which includes people who entered the population after January 2001 and are not represented by the panel.

[42] The increased number of mothers of infants achieved by the weight adjustments does not increase the number of women. Recall that the increased number of mothers was offset by a reduction in the number of women who were not mothers of infants at each point in time.

TABLE A.7

ESTIMATES OF PROGRAM PARTICIPANTS REPRESENTED BY THE 2001 SIPP PANEL AT FOUR POINTS IN TIME BY ALTERNATIVE WEIGHT

Program and Weight	January 2001	January 2002	January 2003	September 2003
	Thousands of Persons			
Food Stamps				
MPRPNLWT	15,250	17,176	18,068	18,946
LGTPNWT3[a]	15,334	16,806	17,790	18,312
Cross-sectional weight	14,536	17,647	18,498	19,558
WIC				
MPRPNLWT	5,122	5,928	5,926	5,842
LGTPNWT3[a]	5,035	5,572	5,283	5,198
Cross-sectional weight	4,936	5,863	5,746	5,791
Medicaid				
MPRPNLWT	30,547	31,367	33,218	34,004
LGTPNWT3[a]	30,275	30,968	32,751	33,064
Cross-sectional weight	29,981	31,927	33,875	34,598
TANF				
MPRPNLWT	3,479	3,243	2,937	3,017
LGTPNWT3[a]	3,683	3,291	3,044	2,933
Cross-sectional weight	3,473	3,393	3,151	3,174
Total Persons				
MPRPNLWT	278,910	276,892	276,002	276,014
LGTPNWT3[a]	278,910	276,510	275,282	275,065
Cross-sectional weight	278,910	281,632	285,357	287,430
	Percent of Total Persons			
Food Stamps				
MPRPNLWT	5.47	6.20	6.55	6.86
LGTPNWT3[a]	5.50	6.08	6.46	6.66
Cross-sectional weight	5.21	6.27	6.48	6.80
WIC				
MPRPNLWT	1.84	2.14	2.15	2.12
LGTPNWT3[a]	1.81	2.02	1.92	1.89
Cross-sectional weight	1.77	2.08	2.01	2.01
Medicaid				
MPRPNLWT	10.95	11.33	12.04	12.32
LGTPNWT3[a]	10.85	11.20	11.90	12.02
Cross-sectional weight	10.75	11.34	11.87	12.04
TANF				
MPRPNLWT	1.25	1.17	1.06	1.09
LGTPNWT3[a]	1.32	1.19	1.11	1.07
Cross-sectional weight	1.25	1.20	1.10	1.10

Source: Mathematica Policy Research tabulations of 2001 SIPP Panel.

[a] Infants born during the panel were assigned panel weights in the same manner that the MPR panel weight was assigned.

The MPR panel estimates of FSP, WIC, and Medicaid participants exceed the cross-sectional estimates in January 2001, and they continue to do so (by a very slight margin) through the end of the panel for WIC but not for FSP or Medicaid. For these last two programs the larger population that the cross-sectional sample represents is the driving factor. The difference is 5 million persons in January 2002 and nearly 10 million in January 2003. The estimated proportion of the population participating in each of the three programs in 2003 is higher in the MPR-weighted panel sample than in the cross-sectional sample. Estimates of TANF participants and their proportion of the total population are narrowly higher in the cross-sectional sample than in the MPR-weighted panel sample.

Comparing the MPR and Census Bureau-weighted panel estimates, we find that the MPR panel estimates exceed the Census Bureau panel estimates of participants in the FSP, WIC, and Medicaid at every point after January 2001 (and for WIC and Medicaid even in January 2001). This is not true of TANF until September 2003, but the differences are less than 100,000 after January 2001. Since participants in all of these programs are underestimated by the SIPP and other surveys generally, we believe that the larger numbers derived with the MPR panel weights can be viewed as an improvement. At the least, they demonstrate that the expansion of the panel and the attendant assignment of new panel weights did not *adversely* affect the panel estimates of any of these programs. Where the MPR panel estimates of TANF participants fall short of the Census Bureau panel estimates in January 2001, they at least match the cross-sectional estimates in that month.

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APPENDIX B
SAMPLE SIZES FOR CHAPTER II TABLE

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TABLE B.1

SAMPLE SIZES FOR TABLE II.5

Subgroup (at the younger age)	Age 0 to 1	Age 1 to 2	Age 2 to 3	Age 3 to 4	Age 4 to 5
All Child Participants	790	680	609	552	445
Poverty Level					
<50 percent	190	152	118	127	103
50 to <100 percent	155	127	128	120	99
100 to <130 percent	87	107	99	75	71
130 to <185 percent	143	118	120	106	73
185 to <300 percent	148	131	113	89	82
300+ percent	67	45	31	35	17
Program Participation					
Medicaid	527	425	373	351	289
TANF	68	73	59	52	44
FSP	249	222	202	184	157
Any of the three programs	552	460	413	375	306
Mother's Employment Status[a]					
Part-time	147	128	112	98	69
Full-time	190	180	159	145	110
Not working for pay	453	372	338	309	266
Race/Ethnicity					
Black, non-Hispanic	171	139	129	119	100
White, non-Hispanic	353	288	259	233	178
Hispanic	223	214	187	172	146
Other	43	39	34	28	21
Mother's Marital Status[a]					
Never married	277	226	188	155	105
Currently married	423	375	343	316	273
Divorced	54	49	38	43	39
Separated	32	26	33	33	27
Widowed	4	4	7	5	1
Parity					
First child	270	253	221	210	188
Second child	239	204	193	158	120
Third or later child	281	223	195	184	137

Source: Enhanced 2001 SIPP data.

Note: Table II.5 shows the weighted percentage of these children who make the transition from participation at one age to participation at the next age. For example, in Table II.5, we see that 94 percent of infants who participate in WIC and TANF also participate in WIC in the period of their first birthday. From this table, we see that 68 infants in the sample were participating in WIC and TANF, so 94 percent (weighted) of the sample of 68 participated in the period containing their first birthday.

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APPENDIX C
ANALYSIS OF CONTINUED WIC PARTICIPATION BY INFANTS AND CHILDREN

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The estimations in this appendix are special cases of the multivariate exit model from Chapter III. They focus on the decision to continue WIC participation at each age threshold for children turning 1, 2, 3, and 4 years of age.

A. METHODOLOGY

A logistic regression is used to estimate each model, with the dependent variable equal to 1 if the child continues to participate in WIC after turning 1, 2, 3, or 4 years of age and equal to 0 if the child exits WIC. We restricted the set of explanatory variables to those used in Table II.5 to compare the results of the multivariate analysis with the results of the descriptive analysis in Chapter II. The odds ratios based on the estimates of the coefficients of these variables are interpreted, for discrete variables, as the likelihood of continued WIC participation following the age transition (or transition into the postpartum period) for one group relative to the likelihood of continued participation for another group, or, for continuous variables, as the change in likelihood of continuation per a one-unit change in the variable.

To be included in the sample, a child must have been observed in at least the last period of the first age group (for example, period 3 for infants) and the first period of the second age group (for example, period 4 for children age 1) and must have participated in one of the periods in the first age group. The dependent variable is then equal to 1 if the child participates in both the last period of the first age group and the first period of the second age group and is equal to 0 otherwise.

B. TRANSITION RATES FOR CHILDREN RECEIVING WIC BENEFITS AT VARIOUS AGE THRESHOLDS

The descriptive analysis in Chapter II showed that continued receipt of WIC for children from ages 0 to 1 and 1 to 2 is associated with the child's mother being divorced, separated, or never married; not working for pay; or being Hispanic (relative to being white and non-Hispanic)

(see Table II.5). It was also associated with the child's family having lower income or participating in the Food Stamp, TANF, or Medicaid programs. Our multivariate analyses of transition rates confirm most of these findings.

Table C.1 displays the results of the estimation of a logistic regression model in which the dependent variable equals 1 if the child receives WIC at age zero and continues to receive benefits after turning 1 year old and equals 0 otherwise.[43] The model is re-estimated for several other age transitions, including continued receipt from ages 1 to 2, 2 to 3, and 3 to 4. The set of explanatory variables in each estimation consists of the same set of variables found in the descriptive analysis tables (see Table II.5). This includes the ratio of family income to the federal poverty level; participation in the Food Stamp, TANF, or Medicaid programs; child parity; and mother's employment status, race and ethnicity, and marital status.

The odds ratios in Table C.1 confirm several other findings from the descriptive analysis. Children under 1 with family incomes greater than 1.30 times the Federal poverty level are less likely to continue to receive WIC upon turning 1 year old. For children turning 2, 3, or 4 years old, the lack of a significant association between family income and continued benefit receipt is most likely attributable to the composition of the sample (and the limited variation in income for this sample), as those children who remain on the program after the first year have lower family income than children in the first-year sample.

[43] The results in this table are based on samples in which all individuals had family income less than 185 percent of the poverty line at some point in the panel.

TABLE C.1

TRANSITION RATES FOR CHILDREN AT AGE THRESHOLDS: ODDS RATIOS OF ESTIMATED EFFECTS OF EXPLANATORY VARIABLES ON LIKELIHOOD OF CONTINUED RECEIPT OF WIC BENEFITS (AMONG INDIVIDUALS IN FAMILIES WITH INCOME EVER BELOW 185% OF POVERTY)

	Child Transitions			
Explanatory Variables	Age 0 to 1	Age 1 to 2	Age 2 to 3	Age 3 to 4
Ratio of family income to poverty level (less than 1.00 category is omitted):				
1.00 -< 1.30	1.44	1.22	0.93	1.10
1.30 -< 1.85	0.62 *	0.73	0.69	0.82
1.85 -< 3.00	0.71	0.73	0.64	0.84
3.00 +	0.42 **	1.01	0.84	0.75
Program Participation				
Food Stamp Program	1.38	1.13	1.04	1.26
TANF	3.63 **	0.90	1.38	0.51 *
Medicaid	1.42 *	2.20 ***	2.42 ***	1.99 **
Mother's Employment Status ("not working for pay" category is omitted):				
Employed full-time	0.63 **	0.74	1.09	0.60 **
Employed part-time	0.85	0.87	0.99	0.50 **
Mother's Race and Ethnicity (Hispanic category is omitted):				
White, non-Hispanic	0.66 *	0.80	0.76	0.57 **
Black, non-Hispanic	0.99	0.84	0.73	0.59 *
Other	1.44	1.05	0.92	0.43
Mother's Marital Status (never-married category is omitted):				
Married	1.15	1.25	1.54 *	0.96
Divorced, Widowed, or Separated	0.99	1.04	1.01	1.43
Parity (first child is omitted category)				
Second child	0.52 **	1.04	0.86	0.71
Third child or higher	0.68	1.40	1.10	0.849
-2*Log Likelihood	795	781	696	635
Number of Observations	760	660	595	537

Source: Enhanced 2001 SIPP panel

Note: Columns correspond to subsamples of individuals that are observed in at least the last period of the first age group and the first period of the second age group, and that participate in one of the periods in the first age group.

* Significantly different than zero at the 0.10 level, two-tailed test
** Significantly different than zero at the 0.05 level, two-tailed test
*** Significantly different than zero at the 0.01 level, two-tailed test

Even after controlling for income, the employment status of the mother is a significant determinant of the likelihood of continued WIC receipt for infants turning one year old. The odds of continuing to receive benefits are reduced by 30 percent for children whose mothers work full-time relative to children whose mothers do not work for pay. Since this estimate should be

interpreted as conditional on a level of family income, this suggests that there may be a change in the value of WIC associated with employment for mothers of infant WIC recipients. For example, children of mothers who work full time may attend a child care center where food is provided. Since most of these children will have stopped breastfeeding by their first birthday, the child care center's food provision may decrease the value of continued WIC receipt. Other opportunities for meals and snacks for older children include Head Start and family day care through Child and Adult Care Food Programs. Older preschoolers also have distinct opinions about what they want to eat and may reject foods in the WIC food package such as milk and low-sugar cereal. Finally, if WIC funds are limited, the first participants to be affected are usually 3- and 4-year-olds.

Other demographic characteristics of the child's mother, such as her race, ethnicity, and marital status play less of a role in determining whether a child continues to receive benefits across age thresholds. While children of white, non-Hispanic mothers turning 1 or 4 years of age are significantly less likely to continue receiving benefits than children of Hispanic mothers, children crossing other age thresholds show no association.

Child enrollment in Medicaid is positively and significantly associated with continued participation in WIC. Children enrolled in Medicaid are 1.4 to 2.4 times more likely to continue receiving WIC benefits across all age thresholds, with the greatest likelihood occurring for children who turn 3 years old. There is limited association between TANF participation and continued WIC participation and no association between FSP participation and continued WIC participation.

APPENDIX D
EXPLORATORY ANALYSIS OF THE DYNAMICS OF WIC PROGRAM PARTICIPATION BY MOTHERS

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In this appendix we describe our findings on the participation dynamics of WIC mothers and the extent to which problems with the data appear to affect some of these findings. Unlike the analysis of participation dynamics of WIC infants and children, this is the first SIPP analysis of dynamics of WIC participation by mothers. Like the current analysis of WIC infants and children, this analysis is also based on the 2001 SIPP Panel and uses a similar methodology for identifying entry and exit rates and measuring duration on WIC. However, because certain SIPP issues appear to have a greater affect on participation patterns by WIC mothers, in part because of their shorter time period of eligibility, the findings are being discussed in context of these data concerns. Where possible we discuss how some of the findings, particularly the participation by mothers in the postpartum period, appear inconsistent with administrative data and previous related research.

We first discuss the two most important problems with the SIPP data and how these affect the findings on participation dynamics of WIC mothers. We then proceed to discuss more details of the methodology and the findings.

A. SIPP DATA ISSUES

As with the analysis of the WIC participation dynamics of infants and children, the known issue of the seam bias, that is, reporting of changes in program participation between waves rather than within waves, led us to perform our analysis at the wave level. However, because of the potential for short certification periods for women (for example, a few months for a woman who enrolls late in her pregnancy and six months for a non-breastfeeding woman certified postpartum), examining participation dynamics in four-month intervals may be subject to substantial measurement error. To address this concern, we performed a more extensive analysis of both the reported participation patterns of women and the seam effect. *We determined that it is likely not the seam effect that is driving the lower-than-expected reported participation of*

mothers in the postpartum period, but rather a bias in the reporting of WIC participation in the postpartum period. Although participation by mothers is underreported throughout the eligibility period, it appears to be worse in the postpartum period.[44]

1. Underreporting of WIC Participation

As is common with government transfer programs, WIC participation is underreported in the SIPP. Table D.1 shows that the number of pregnant and postpartum women reporting WIC participation in the SIPP in April 2002 is less than half of the number of participants according to the WIC Participant and Program Characteristics (PC) data. In comparison, the number of infants and children reporting WIC participation in SIPP is over three quarters of the number accounted for in the program characteristics data. Although WIC participation by both pregnant and postpartum women is substantially underreported, it is worse for postpartum mothers (36 percent of the administrative total) than for pregnant mothers (47 percent).

TABLE D.1

WIC PARTICIPATION BY MOTHERS AND CHILDREN ACCORDING TO ADMINISTRATIVE AND SIPP DATA

Participants	April 2002 Administrative Data[a]	April 2002 SIPP Data	SIPP Participants as a Percentage of Administrative Data
Pregnant Women	878,619	414,072	47
Postpartum Women (including breastfeeding)	1,055,582	405,472	38
Infants and Children	6,082,714	4,781,567	79

Source: PC 2006 data for April 2002

[a] PC data counts all persons certified to receive WIC benefits including those who do not claim or use the food voucher/checks. FNS administrative data is based on only those participants who pick up their monthly benefit; about 90 percent of those certified. In April 2002, the administrative count for women (not available by pregnant or postpartum) was 1.8 million compared to 1.9 million in the characteristic data collected from States.

[44] SIPP does not provide information about pregnancy status for women. We infer pregnancy status based on the age of the child. Thus, the results only include women whose pregnancy results in an infant appearing in the SIPP household.

One possible explanation for this disparity is that some mothers report only their infant's WIC participation after the birth, and not their own. Pregnant women participating in WIC are eligible for benefits for six weeks after delivery. If certified again, the mother is eligible until the six month postpartum (or twelfth month if the mother is breastfeeding). To receive continuous WIC benefits for themselves, mothers must apply within six weeks after delivery. Although the process is not without burden, nutritional risk factors such as "breastfeeding mother/infant dyad" are easily established so that the mother can continue to receive benefits along with the child. Newborns are automatically eligible and WIC certification typically occurs soon after birth with the health information provided by the hospital. As a result we would expect the data to show continued participation by mothers and infants after delivery. We do not expect to see substantial numbers of mothers exiting the program until they are six months postpartum, at which time mothers that are not breastfeeding lose eligibility but continue to receive the infant benefit, in particular infant formula, until the infant's first birthday.

In Table D.2, we examine the participation of infants in the waves of and after their birth by the participation status of the mother.[45] We find that, among mothers who participated in the wave prior to the infant's birth but not in the wave of the birth, 68 percent of their infants are reported as participating in both the birth wave and the wave following the birth. That is, the mother appears to report that she no longer participated but reports that her newborn received WIC benefits. Among mothers who reported WIC participation through the infant's birth but not in the following wave, 78 percent reported that the newborn received WIC benefits in the birth wave—an overlap of mother and child participation of only one SIPP wave. Among mothers

[45] As with the infant and child WIC participants, we do not expect to see one-month participation spells or one-month gaps. Thus we overwrite one-month spells and fill one-month gaps before limiting our analysis to the wave level. We also fill one-wave gaps in participation.

who reported their WIC participation at least through the wave following the birth, 77 percent reported that the infant began participating in the birth wave an overlap in participation of mother and child of at least two waves. Because nutritional risk for further participation is so easy to establish, it is unlikely that 68 percent of mothers left the program but continued receiving WIC supplemental foods for their infants only. It is more likely that these mothers misreported their nonparticipation.

TABLE D.2

REPORTED WIC PARTICIPATION OF INFANTS BY WAVE OF MOTHER'S EXIT

	Number	Percentage
Mothers who report exit in the wave of the infant's birth	535,619	100
Infant participates in wave of its birth and following wave	362,685	68
Infant participates in wave of its birth but not following wave	38,248	7
Infant participates in wave after its birth but not wave of its birth	59,728	11
Infant does not participate in wave of its birth or wave after birth	74,958	14
Mothers who report exit in the wave after birth (participating in wave of its birth)	626,991	100
Infant participates in wave of its birth and following wave	488,165	78
Infant participates in wave of its birth but not following wave	39,298	6
Infant participates in wave after its birth but not wave of its birth	67,353	11
Infant does not participate in wave of its birth or wave after its birth	32,175	5
Mothers who report participation in wave of birth and wave after birth	746,657	100
Infant participates in wave of its birth and following wave	578,208	77
Infant participates in wave of its birth but not following wave	17,916	2
Infant participates in wave after its birth but not wave of its birth	80,147	11
Infant does not participate in wave of its birth or wave after its birth	70,387	9

Source: Enhanced 2001 SIPP data

Universe: Mothers with infants whose WIC participation is **not missing** either in the wave of the birth or in the wave following the birth.

As will be shown in Table D.11, the failure to report their own WIC participation when their children receive the infant package results in very low continuation rates by mothers from prenatal to postpartum. The exploratory analyses shows only 38 percent of mothers continuing participation from prenatal waves through the postpartum waves.

2. Seam Bias in Reporting of WIC Participation

In the 2001 panel, we found that 78 percent of reported WIC entries and 88 percent of reported WIC exits by mothers occurred at the seam between waves, instead of during months within the waves (see Table D.3). That is, mothers reported participation changes between the final month of one wave and the first month of the next wave. In the absence of a seam effect, we would expect the first month of a wave to account for about 25 percent of reported entries or exits. For a given seam month, it is not possible to determine which reported events are real and which actually occurred during a different month but were incorrectly reported on the seam.

TABLE D.3

REPORTING OF WIC ENTRIES AND EXITS IN THE 2001 PANEL

	Percentage of Events by Reference Month			
WIC Event	Month 1	Month 2	Month 3	Month 4
Entry (Mothers)	78	5	8	9
Entry (Infants and Children)	83	4	5	8
Exit (Mothers)	88	4	4	4
Exit (Infants and Children)	82	5	6	7

Source: 2001 SIPP Panel (prior to enhancements described in Appendix A)

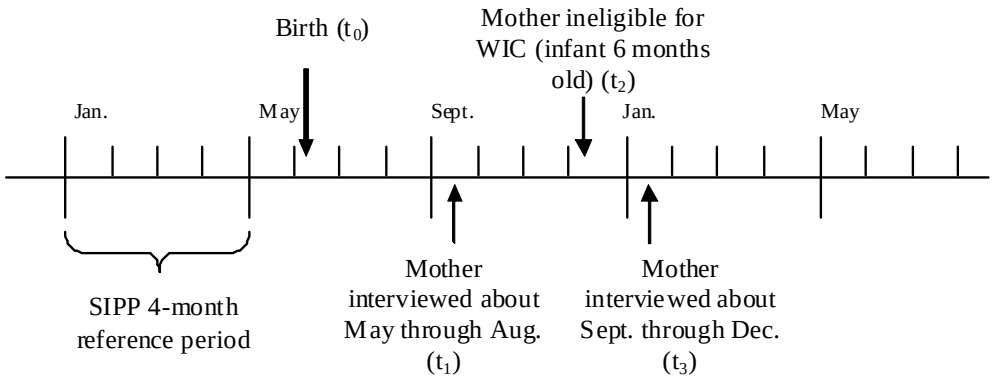
Note: An entry is the first month of participation following a month or more of nonparticipation (entries of newborns are excluded). An exit is defined as the first month of nonparticipation, following a month or more of participation.

To minimize the bias from the seam effect, we chose to conduct the WIC analysis at the wave level. Thus, we measured the dynamics in WIC participation in four-month increments. We used the reported participation in the last month of the wave as representative of the participation for the entire wave. Since survey interviews for a given wave are conducted in the month following the wave, the circumstances described by the respondent at the interview may be most representative of those in the last month of the wave. However, it is also possible that the respondent simply responded based on the status in the interview month.

The seam bias makes it particularly difficult to study participation by mothers in the postpartum period. Because nonbreastfeeding postpartum mothers are eligible for only six months after the birth of the infant, a mother who participates for the entire six months may be observed to participate only for the months near the birth, and not into the wave after the birth. For example, in Figure D.1, an infant is born in June (t_0), the second month of the wave. The participating mother will be certified to participate for six months (becoming ineligible in December, at t_2). In September (t_3), she is interviewed about her income and program participation in May through August. For this example, we assume she correctly reports that she is participating in WIC all of these months. However, in January when she is no longer participating and is interviewed about her income and program participation for September through December, the seam effect suggests that she will most likely report that she is participating for all of these months or none of them. Since she is not receiving WIC at the interview or in the last month of the reference period, she may report that she was not receiving WIC in any of the months in the wave. Or, since she was participating in over half of the months, she may report that she was participating all four months. If she reports that she is not participating in any of the four months of September to December, we will observe her exiting the program in September, that is, participating in August, but not in September. In this case, it will appear in the data as if she exited the program without advancing very far into the postpartum period of eligibility.

FIGURE D.1

EXAMPLE OF SIPP INTERVIEW TIMELINE FOR NONBREASTFEEDING MOTHER



To understand more about the seam bias in reporting of women's WIC participation, we conducted an analysis of the monthly reporting of participation by the birth month of the infant within the wave (that is, for mothers whose infants were born in the first month of the wave, the second month of the wave, etc.). We observed that many mothers report exiting WIC in the month preceding the birth, of the birth, or immediately after the birth—earlier than we would have expected to see an exit even with the known high level of reporting exits on the seam.

For this analysis of the seam bias and for the analysis of women's participation dynamics, we aligned the mothers' data by periods of eligibility. We assigned P3 to be the wave of the infant's birth, with P2 being the wave immediately preceding birth, and P1 the wave before that (see Table D.4, following the progression of the child's age vertically). We assign P4 to P6 as the three waves following the wave of the infant's birth.

TABLE D.4

ELIGIBILITY PERIODS FOR MOTHERS

	Reference Month of Infant's Birth within Wave			
	Month 1	Month 2	Month .3	Month .4
P1	-8	-9		
Early Pregnancy	-7	-8	-9	
5 to 8 months before the birth	-6	-7	-8	-9
	-5	-6	-7	-8
P2	-4	-5	-6	-7
Mid to Late Pregnancy	-3	-4	-5	-6
1 to 4 months before the birth	-2	-3	-4	-5
	-1	-2	-3	-4
P3	**birth**	**-1**	-2	-3
Wave of Infant's Birth	1	**birth**	-1	-2
Infant is 0 to 3 months old	2	1	**birth**	-1
	3	2	1	**birth**
P4	4	3	2	1
Postpartum	5	4	3	2
Infant is 4 to 7 months old	6	5	4	3
	7	6	5	4
P5	8	7	6	5
Postpartum	9	8	7	6
Infant is 8 to 11 months old	10	9	8	7
	11	10	9	8
P6	12	11	10	9
Infant reaches first birthday	13	12	11	10
Infant is 12 to 15 months old	14	13	12	11
	15	14	13	12

Note: Shading indicates the month in which a non-breastfeeding mom loses eligibility.

We then examined exit patterns by the month of the infant's birth. For each mother who reported participating in the fourth month of P2, we recorded the first month that she no longer reported participating in WIC. We call this her exit month. Table D.5 shows the percentage of mothers who exit in each of the months from P3 through P6. Note that mothers in the last row are those we did not observe to exit. That is, they reported participating past the end of their potential 12-month eligibility period for this infant. They may have continued to be eligible but only if they were pregnant with another child.

TABLE D.5

PERCENTAGE OF MOTHERS EXITING IN EACH MONTH AMONG THOSE WHO WERE PARTICIPATING IN LAST MONTH OF P2 (1 TO 4 MONTHS BEFORE THE BIRTH)

	Reference Month of Infant's Birth within Wave			
	Month 1	Month 2	Month 3	Month 4
P3	38	26	15	24
Wave of Infant's Birth	**7**	5	4	3
(Infant is 0 to 3 months old)	**1**	**11**	9	1
	0	**0**	**8**	9
P4	34	32	**35**	**47**
Postpartum	0	0	0	**0**
(Infant is 4 to 7 months old)	**0**	0	0	3
	2	**0**	0	0
P5	9	22	**20**	8
Postpartum	2	0	0	**0**
(Infant is 8 to 11 months old)	1	0	0	2
	1	0	0	0
P6	1	4	5	3
Infant reaches first birthday	0	0	0	0
(Infant is 12 to 15 months old)	0	0	0	0
	0	0	0	0
No observed exit	3	0	3	2

Notes: An exit is defined as the first month of nonparticipation, following a month or more of participation.
Shading indicates the birth month.
Bold values indicate the months in which we would expect to see exits (six weeks after birth, when the prenatal eligibility period ends, and at six months when the first postpartum eligibility period ends).

Sample sizes range from 62 to 80 mothers.

The first notable piece of information we pull from Table D.5 is that almost all exits that are *not* reported on the seam, that is, not in the first month of the period, are reported in the wave of the infant's birth. One possible explanation for this is that women are able to recall with more accuracy when they stopped participating when they are able to tie it to the month of the child's birth.

Table D.5 also shows that many mothers who participate in the prenatal period report exiting at or near the birth and do not appear to make the transition far into the postpartum period, if at

all. For example, for mothers whose infants were born in the last month of the period (see the last column of Table D.5), 24 percent report leaving (on the seam) in the first month of the birth period, 3 percent report exiting in the second month, 1 percent in the third, and 9 percent in the fourth. We would like to accept the three off seam values as being close to truth, so that *if they did not report on the seam, they may have reported their exit month accurately*. Thus, we find that 13 percent of mothers participating four months prior to the birth report exiting WIC in the months prior to the birth (see Table D.2 for the "age" of the infant at the end of P2). Then, from the 24 percent who report exiting on the seam, we can only infer that they exited WIC sometime before their interview for this wave, which occurs when the infant is one month old.[46] Therefore, 24 percent of mothers report exiting during or at the end of the prenatal eligibility period—at or before the infant is six weeks old. So we find that at least 37 percent of these mothers report exiting before the end of the prenatal eligibility period.

In continuing to examine the mothers whose infants were born in the last month of the wave (that is, mothers in the last column of Table D.5), we find that 47 percent report exiting on the seam in P4. Again, because the exit is on the seam, we cannot trust that the exit occurs in that first month, but simply infer that the exit happens in that wave, or possibly in the interview month. In this case, the interview takes place when the infant is five months old, within the postpartum eligibility period. Although we do not know exactly when in this wave the mother exits (anywhere from a few weeks to five months after birth), we do find that the mother reports exiting before her first postpartum eligibility period has ended. Combining this 47 percent with

[46] For further clarification, an exit in the first month of P3 indicates the mother reported participating in at least her last month of P2 but then not in the first month of P3. The interview regarding P2 occurs in the first month of P3, and the interview regarding P3 occurs in the first month of P4. Thus we accept that she is participating before the birth. However, when she is interviewed when the infant is one month old she reports that she did not participate in the first month of P2. Since it is on the seam, we do not know if she actually stopped participating in that first month or if she simply stopped participating sometime before her interview.

the 37 percent with exits in the prior period, we find that around 84 percent of mothers participating before the birth of their infant report exiting before the end of the first postpartum eligibility period, according to the data in the 2001 SIPP.[47]

For the remaining mothers, we cannot identify as precisely those mothers who exit before the end of the first postpartum period because the interview month is not within the prenatal eligibility period. However, regardless of the birth month, we observe a substantial decline in the number of women reporting participation at or near the birth. For mothers of infants born in the first month of the reference period, we see that 38 percent report exiting on the seam in the birth month and another 8 percent report exiting off the seam in the months following the birth. Of the 38 percent, we are unsure of their exact exit month, but it could be as late as the interview month, which occurred when the infant was four months old. Thus, we see that at a minimum, 46 percent of mothers report exiting WIC before the infant is four months old. In addition, a portion of the 34 percent who report exiting on the seam in P4 appear to exit before the end of the first postpartum eligibility period, though we cannot determine exactly when they exit. Similarly, for mothers of infants born in the second month of the wave (see Table D.5, Month 2 column), we find that 42 percent reported exiting before the end of the first postpartum eligibility period, and it is likely that a portion of the 32 percent who exit on the seam at the beginning of P4 exit before the end of the first postpartum eligibility period. For mothers of infants born in the third month of the wave (see Table D.5, Month 3 column), 36 percent report exiting at or before the end of the prenatal eligibility period, and it is likely that a portion of the 35 percent who exit on the seam between P3 and P4 exited before the end of the first postpartum eligibility period.

[47] It is possible that some of these mothers participated for some of the months of the postpartum eligibility period, but simply did not participate throughout the entire period. If we assume, though, that the 47 percent of exits should be distributed across the wave, we would still find that an additional 24 percent had exited when the infant was two months old or less, or approximately within the end of the prenatal eligibility period. This assumption would result in 61 percent exiting at or before the end of the prenatal period.

The results indicate that, in the SIPP data, even taking into account the seam bias, 35 to 46 percent or more of mothers appear to be exiting in the months before or shortly after the birth. And, up to another 32 to 47 percent (for a total of 67 to 93 percent) appear to be exiting before completing their first postpartum eligibility period. Of the mothers for whom we can best identify their participation through the first postpartum eligibility period, SIPP indicates that 84 percent exit by the end of this period.

3. Impact on Analysis Results

In the analysis of WIC participation dynamics presented in the sections below, we examine entry and exit by mothers, the continuity of participation, events triggering entry and exit, and determinants of WIC entry and exit. The bias resulting from the seam effect and the underreporting of WIC participation that appears worse for postpartum participants than prenatal participants affects both the estimates describing the participation of mothers and the factors associated with their exit. As highlighted in Table D.1, our analysis shows too few mothers participating postpartum in comparison to administrative data. *In addition, our estimates of the length of time a woman participates and the percentage of women who continue participation from the prenatal eligibility period to the postpartum period are likely underestimated.* In fact, as will be seen in Table D.10, our approach leads to an estimate that 38 percent of mothers who participated in the prenatal eligibility period participated through to the postpartum eligibility period. This estimate is inconsistent with Gordon and Nelson (1995) who found in the 1988 National Maternal and Infant Health Survey to study WIC participates that 77 percent of prenatal participants also participated postpartum. Our analysis of factors associated with WIC program exit may rest in part on women who were misidentified as having terminated their participation before or shortly after their infants were born. *Thus the characteristics of true exiters have been combined with those of women who simply failed to report their WIC participation.*

In the following sections we present our analysis of WIC participation dynamics in the 2001 SIPP panel. *We do not try to make any corrections or adjustments to the data to account for the seam bias or the differential underreporting of participation before and after childbirth.* As described in Appendix A we have made several adjustments to the SIPP to account for other problems, including an under-representation of new mothers.

B. DESCRIPTION OF PARTICIPATION DYNAMICS FOR MOTHERS

Since mothers are eligible for WIC for at most one year and nine months (21 months), we are able to observe all six periods of eligibility for many mothers, whereas we were unable to observe all 16 periods of eligibility for any child. Thus, some tables below only include mothers who are observed throughout the six periods. In other tables, however, we focused on the prenatal periods (P1-P3) or the postpartum periods (P3-P6) and only required that the mother be in the SIPP panel during those periods.

1. Entry and Exit

Time Until WIC Participation. Through life table analysis, we discussed earlier that 57 percent of infants and children with family income less than 185 percent of poverty participate in the program at some point in the panel. A life table analysis of mothers estimates that 34 percent of mothers in this income group, who were observed for all three prenatal periods, participate in WIC before the infant's birth (see Table D.6). Most of these entries occur in the period just before the birth, when the mother is one to four months prenatal. In Table D.7, we see that 16 percent of the mothers with family income less than 185 percent of poverty at some point in the panel enter in the postpartum period. Most of these entries are at or near the baby's birth; very few entries occur between the birth and age four to seven months, which is not surprising given that non-breastfeeding mothers lose eligibility six months after the birth. Across

all six periods of the mother's eligibility, we find that 46 percent of low-income mothers report participating in WIC by the child's first birthday (sample size: 609 mothers).

TABLE D.6

LIFE TABLE FOR PRENATAL MOTHERS WITH FAMILY INCOME LESS THAN 185 PERCENT OF POVERTY AT SOME POINT IN PANEL

Period	Entry Rate (Hazard)	Survival Rate	Cumulative Entry Rate (Percent)
P1 (5 to 8 months prenatal)	9	91	9
P2 (1 to 4 months prenatal)	17	76	24
P3 (birth period)	13	66	34

Source: Enhanced 2001 SIPP data

Note: Estimated among mothers observed for all three periods. The cumulative entry rate increases to 40 percent if we include mothers who are not observed for all three periods.

Sample size: 1,190 mothers

TABLE D.7

LIFE TABLE FOR POSTPARTUM MOTHERS WITH FAMILY INCOME UNDER 185 PERCENT OF POVERTY AT SOME POINT IN PANEL

Period	Entry Rate (Hazard)	Survival Rate	Cumulative Entry Rate (Percent)
P3 (birth period)	10	90	10
P4 (4 to 7 months postpartum)	4	87	13
P5 (8 to 11 months postpartum)	2	84	16
P6 (12 to 15 months postpartum)	1	84	16

Source: Enhanced 2001 SIPP data

Note: Estimated among mothers observed for all four periods. The cumulative entry rate is also 16 percent if we include mothers who are not observed for all three periods.

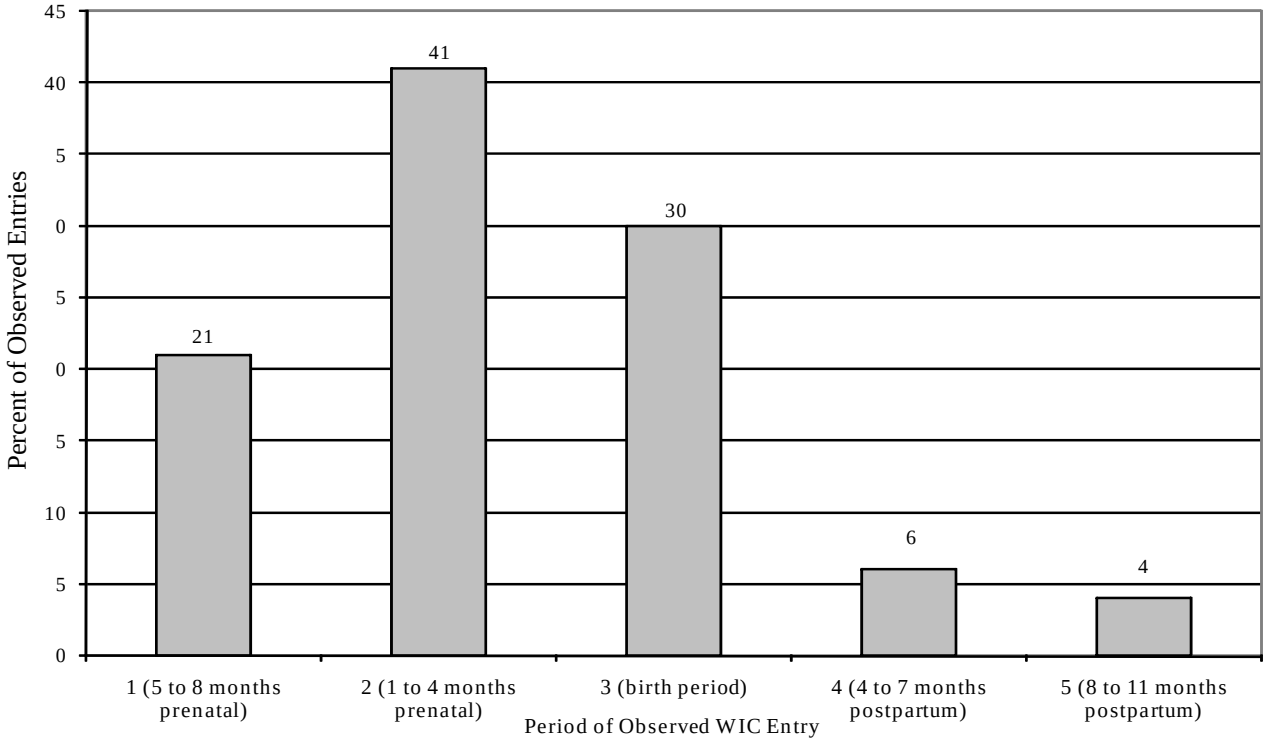
Sample size: 983 mothers

Months Pregnant/Postpartum at Mother's Entry. Among mothers who enter the WIC program and have data throughout their months of potential eligibility, most enter the program in

either the period before (41 percent) or period of (30 percent) the infant's birth (Figure D.2), representing 19 and 13 percent respectively of low-income mothers in these periods (Table D.8). As we noticed in the cumulative entry rate for mothers in the postpartum period, the fewest mothers report entering WIC in the postpartum periods, (a total of 10 percent) (Figure D.2).

FIGURE D.2

PERIOD OF ENTRY AMONG MOTHERS WHO REPORT ENTERING WIC



Source: Enhanced 2001 SIPP data

Note: Sums to greater than 100 because some mothers re-enter and each of their entries is counted.

Sample size: 274 mothers

TABLE D.8

PERCENTAGE OF MOTHERS WITH FAMILY INCOME LESS THAN 185 PERCENT OF POVERTY AT SOME POINT IN PANEL PERIOD ENTERING WIC, BY PERIOD

Period	Percent Who Report Entering
P1 (5 to 8 months prenatal)	10
P2 (1 to 4 months prenatal)	19
P3 (birth period)	13
P4 (4 to 7 months postpartum)	3
P5 (8 to 11 months postpartum)	2

Estimated among mothers observed through prenatal and postpartum periods.

The Source: Enhanced 2001 SIPP data

Notes: Percent of Mothers Entering column sums to greater than 100 because some mothers re-enter and each of their entries is counted. Re-entries are minimal, however.

Sample size: 274 mothers

Months Pregnant/Postpartum at Exit. Because we can observe many mothers throughout their eligibility period, we can directly see the length of time they participate in the program. Table D.9 presents the percentage of mothers who appear to exit at each period by their period of entry. Among mothers who enter five to eight months before the infant's birth, 51 percent appear to exit by the wave of the infant's birth and almost three-quarters appear to exit by the wave following the infant's birth. Similarly, of the mothers that enter WIC in the wave of the infant's birth, almost three-fourths will appear to exit within the next two waves. This is likely due to the six-month limit on eligibility for mothers who are not breastfeeding. Note that not all mothers exit in the sixth period of eligibility, since mothers who become pregnant before their infant turns one-year-old may continue to participate in the program.

TABLE D.9

PERIOD OF MOTHERS' REPORTED EXITS BY PERIOD OF ENTRY

Period of Entry	Period of Exit	Percent		
		Hazard or Exit Rate	Survival Rate	Cumulative Exit Rate
P1 (5 to 8 months prenatal)	2	9	91	9
	3	47	49	51
	4	44	27	73
	5	45	15	85
	6	79	3	97
P2 (1 to 4 months prenatal)	3	30	70	30
	4	47	37	63
	5	57	16	84
	6	79	3	97
P3 (birth period)	4	47	53	47
	5	51	26	74
	6	74	7	93

Source: Enhanced 2001 SIPP data

Note: Estimated among mothers observed for all prenatal and postpartum periods.

Sample size: 62 to 117 mothers; sample sizes are too small to report results for mothers who enter in periods 4 and 5.

2. Continuity of Participation and Re-entry

Knowing that most mothers enter during pregnancy and exit shortly after the birth, we next examine the duration patterns by discussing participation dynamics from one stage to another and the continuity of receipt across the eligibility period.

Continuation of WIC Participation Through Stages of Pregnancy. Continuation rates among participating mothers from the prenatal period to the postpartum period (that is, rates of mothers remaining on WIC after the birth) do not show the same patterns as the rates for children. While mothers with income from 50 to 100 percent of poverty and 100 to 130 percent of poverty appear to have the highest continuation rates, mothers in the lowest income group appear to have rates similar to the higher income groups. Mothers on public assistance also appear to have rates that are lower than all mothers, and those with part-time jobs or no job appear to have higher rates than mothers with full-time jobs.

Table D.10 presents continuation rates from prenatal to postpartum participation by characteristics of the mother. We see that Hispanic and non-Hispanic Black mothers appear to have the lowest rates, and those who were never married have the highest. Similar to continuation rates for children, mothers of first-born children and third- or later-born children appear to have higher continuation rates than those with one or two previous children.

Continuity of Receipt. Of participating mothers that we observed in the SIPP panel throughout the five periods, only 4 percent appear to have participated for the entire five periods (Table D.11). Of those observed for the prenatal period, 17 percent appear to have participated throughout, and 21 percent in the postpartum participated throughout. The mean number of periods of participation for the prenatal and postpartum periods is two.

Re-Entry. Re-entry among WIC mothers is rarely observed, with one percent or less re-entering following an exit during the SIPP panel. This is not surprising given the limited length of a mother's eligibility (21 months if she does not become pregnant before the infant's first birthday) and because we cannot infer which women are pregnant late in the panel and gave birth after the panel ends.

TABLE D.10

PROPORTION OF WIC MOTHERS IN PRENATAL PERIOD WHO CONTINUE TO PARTICIPATE IN POSTPARTUM PERIOD, BY SUBGROUP

Subgroup	Percent That Continues to Participate to Postpartum (as reported in SIPP)
ALL PRENATAL WIC MOTHERS	38
Poverty Level	
<50 percent	32
50 to <100 percent	40
100 to <130 percent	59
130 to <185 percent	34
185 to <300 percent	32
300+ percent	38
Program Participation	
Medicaid	35
TANF	32
FSP	31
Any of the three programs	36
Employment Status	
Part-time	42
Full-time	31
Not working for pay	39
Race/Ethnicity	
Black, non-Hispanic	33
White, non-Hispanic	42
Hispanic	33
Other	46
Marital Status	
Never married	42
Currently married	38
Divorced	22
Separated	15
Widowed	0
Parity	
First child	46
Second child	26
Third or later child	37

Source: Enhanced 2001 SIPP data

Note: Continuation from prenatal to postpartum participation is defined as participating in period before infant's birth (P2) and period after infant's birth (P4), measured across all mothers who are present in the panel in these periods. (If a mother is participating in P2 and P4, she must be coded as participating in P3, due to our convention of filling one-wave gaps in participation.)

Sample size: 322 mothers

TABLE D.11

CONTINUITY OF WIC RECEIPT AMONG PARTICIPATING MOTHERS (AS REPORTED IN SIPP)

	Periods of Observation		
	Prenatal through Birth Wave (P1 - P3)	Birth Wave through Postpartum (P3 - P5)	Prenatal through Postpartum (P1 - P5)
Number of Periods in WIC (Percent)			
P1	44	52	37
P2	39	27	35
P3	17	21	28
P4	0	0	13
P5	0	0	4
Mean (Periods)	2	2	2
Median (Periods)	2	1	2
Percent of Women that:			
Received WIC continuously	17	21	4
Entered and exited	23	33	76
Exited and re-entered	1	0	0
Exited (and stayed off)	1	41	4
Entered (and stayed on)	58	5	17

Source: Enhanced 2001 SIPP data

Note: We only measure participation through P5 because we cannot observe participation for approximately three-fourths of mothers in P6 (the children range from age 12 months to age 15 months in P6).

The high proportion of mothers entering and exiting and the low proportion remaining on across periods should be viewed with caution because of the SIPP issues discussed in this Appendix.

Sample size: 335 mothers

3. Entry and Exit Trigger Events for Mothers

Because eligibility for WIC is tied to the birth and age of the child, many entries and exits are tied to changes in pregnancy status or to the child's age—that is, to changes in categorical eligibility. However, we have seen that in the SIPP Panel mothers often appear to exit around the birth of the infant, before their six-month postpartum eligibility expires. Thus, we examined events that precede the program entries to identify other factors that may be reasons for an entry or exit other than categorical eligibility—we sought to identify "trigger" events.

At entry, the SIPP asks the respondent to identify the reason for entry into the program.[48] Most respondents identified pregnancy as the reason for applying (Table D.12). Second to pregnancy was the identification of the loss of support income (income other than wages). Very few respondents indicated that they or their children were entering the program because they had just learned about it or just got around to applying.

TABLE D.12

REPORTED REASONS FOR APPLYING FOR WIC BENEFITS

	Mothers	
	Pregnant	Postpartum
Reason for Applying (Percent)		
Pregnancy	66	61
Loss of job/wages/other income	6	13
Loss of other support income	15	14
Just learned about the program	1	3
Just got around to applying	1	1
Other (all reasons not listed above)	10	9

Source: Enhanced 2001 SIPP data

Sample size: 494 mothers' entries

SIPP respondents were allowed to report two reasons for entry, but we also observed the events that happened in the periods before entry in order to identify events that may not be associated with WIC entry. Table D.13 shows the percentage of mothers at each stage whose entry is preceded by the trigger event in one of the two previous periods.

Obviously, a change in categorical eligibility—that is, a woman becoming pregnant—triggers entry, but changes in income eligibility are also important triggers. Over one-third of

[48] If the household's respondent reports that the family stopped receiving WIC *within* the 4-month reference period, the survey uses a pre-coded list that asks for the reason of the exit. However, due to the SIPP seam effect, most exits are reported as occurring between two reference periods rather than within a period, so the reasons for most exits were not captured in the survey. This has been corrected for the 2004 SIPP instrument.

mothers, regardless of their period of entry, experienced a decrease in the number of people with earnings in the family in one of the two waves prior to their entry. However, the decrease in the number of earners appears not to have been a total loss of earned income, since the percentages of mothers experiencing a 100 percent decrease of income are not as high as those experiencing a decrease in the number of earners. Almost 40 percent of mothers and children experienced a decrease in family earnings of 40 percent or more prior to entry.

Connection to WIC through another family member or to other public assistance programs for the mother is a common trigger that precedes WIC entry. More than half of the entries for postpartum mothers are preceded by another family member entering WIC; most likely the entry is by their newborn infant, suggesting that a mother is connected to WIC through her infant's connection. More than half of prenatal entries by mothers are at the same time as an entry into TANF, FSP, or Medicaid.

For exits, changes in categorical eligibility, as measured by the child's first birthday, are not the primary reason that mothers leave, though they could have become categorically ineligible at six months if they were not breastfeeding.

Exits are preceded by decreases in earnings at similar rates to entries being preceded by increases in earnings. About one-third of exits for postpartum mothers are preceded by increases in earnings of 40 percent or more; about one-third are preceded by increases in other income of 40 percent or more.

Changes in participation in other public assistance programs by the mother or other family members does not seem as tied to exit as to entry. Less than a fifth of exits by mothers follow the WIC exit of another family member. The exit of a family member from WIC occurs more often for child participants, but this would often be the mother leaving, since she becomes ineligible before the child.

TABLE D.13

PERCENTAGE OF MOTHERS EXPERIENCING TRIGGER EVENT PRIOR TO ENTRY OR EXIT

	Mothers	
	Pregnant	Post-partum
Entry Triggers		
Sample size of entries	280	214
Change in categorical eligibility	66	1
Number of earners in the family decreased	34	40
Family earnings decreased by 20% or more	52	52
Family earnings decreased by 40% or more	38	39
Family earnings decreased by 100%	21	15
Family other income decreased by 40% or more	29	42
Family other income decreased by 100%	14	21
Family earnings decreased by $1,000 or more	32	33
Family other income decreased by $500 or more	9	12
Other family member enters WIC	12	58
Enters TANF, FSP, Medicaid	55	38
Exit Triggers		
Sample size of exits	20	537
Change in categorical eligibility[a]	0	16
Number of earners in the family increased	26	25
Family earnings increased by 20% or more	59	45
Family earnings increased by 40% or more	45	34
Family other income increased by 20% or more	8	35
Family other income increased by 40% or more	8	31
Family earnings increased by $1,000 or more	13	25
Family other income increased by $500 or more	0	9
Other family member leaves WIC	17	12
Exits TANF, FSP, Medicaid	43	36
Other adults join household with earnings	17	8

Source: Enhanced 2001 SIPP data

[a] We cannot identify mothers who became categorically ineligible at six months after the birth because they were not breastfeeding.

C. MULTIVARIATE ANALYSIS OF THE DETERMINANTS OF WIC ENTRY AND EXIT

As in the multivariate analysis of child entry and exit, the multivariate analysis for mothers is divided into two parts. First, we analyzed the determinants of entry into the WIC program. Second, we analyzed the determinants of exits from the program versus continuing participation. In each analysis, we examined the association between WIC entry or exit and characteristics of

the mother, child, and family; trigger event variables that measure changes in income, earnings, and receipt of public assistance benefits; and state-level characteristics and policy variables.

1. Methodology

The methodological approach for the set of models for WIC mothers is similar to that used for WIC children. The first WIC entry model focused on the decision to participate in the first period of the pregnancy and the second model used a discrete-time hazard model to analyze WIC entry in all subsequent periods. As described for children in Chapter III, the entry analysis for mothers is partitioned into two models for mothers since the discrete-time hazard model requires everyone in the sample to have at least one period of nonparticipation prior to entering the program. Since period 1 participating mothers do not satisfy this criteria, a separate model was constructed to analyze the characteristics associated with their participation decision.

Several multivariate exit models are also estimated. We used a discrete-time hazard model to analyze WIC exit. In addition, we estimated a model that focuses on the decision to continue participating at the transition from the prenatal to postpartum period.

As in the descriptive analysis, the mother's sample is defined using 6 four month "periods," with all mothers giving birth in period 3. The sample used in analyzing WIC entry for mothers after the first period of pregnancy uses a subsample of mothers who do not participate in WIC in the first period of pregnancy. For the WIC exit models, the sample consists of mothers who receive benefits during pregnancy or the postpartum period.

All models are estimated using logistic regression and a maximum likelihood estimator. The same set of explanatory variables that were included for WIC children in the analyses found in Chapter III and Appendix C are included in all models for WIC mothers. For details on the set of independent variables included in the regression, as well as the interpretation of coefficient estimates, the reader is referred to the methodological discussion for children in Chapter III.

2. Determinants of WIC Entry

In this section, we identify the factors associated with entry into the WIC program and interpret the results from the first-period entry analysis and the entry hazard analysis for mothers.

Table D.14 contains the odds ratios and indicators of statistical significance for each model. The results are based on samples in which all individuals had family income less than 185 percent of the poverty line at some point in the panel.

TABLE D.14

WIC ENTRY MODEL: ODDS RATIOS OF ESTIMATED EFFECTS OF EXPLANATORY VARIABLES ON PROBABILITY OF MOTHER ENTERING WIC (AMONG INDIVIDUALS IN FAMILIES WITH INCOME EVER BELOW 185% OF POVERTY)

Explanatory Variables	Mother (Period 1)	Mother (All Other Periods)
Mother and Child Characteristics		
Child's Gender (female category is omitted)		
Male	0.98	1.08
Child's Parity (first child is omitted category)		
Second child	0.88	0.87
Third child or higher	0.55	1.19
Before or After Infant's Birth (by period) (Periods 1,2 are omitted category)		
Period 3 (birth period)		0.30***
Period 4,5,6 (postpartum)		0.06***
Mother's Race and Ethnicity (Hispanic category is omitted)		
White, non-Hispanic	0.85	0.64**
Black, non-Hispanic	1.11	0.88
Other	0.86	0.77
Mother's Age (Under 25-year-old category is omitted)		
25-35	1.84*	0.56***
36 and older	0.58	0.41**
Mother's Highest Grade Completed		
High school graduate (or GED)	0.67	1.00
Mother's Marital Status (never-married category is omitted)		
Married	0.72	0.86
Divorced, Widowed, or Separated	0.64	1.30
Mother's Employment Status ("not working for pay" category is omitted)		
Employed full-time	1.29	0.73**
Employed part-time	1.08	1.12
Family Characteristics		
Region of Residence ("Western" category is omitted)		
Northeast	1.03	0.58
Mid-Atlantic	0.29*	0.87

Table D.14 (*continued*)

Explanatory Variables	Mother (Period 1)	Mother (All Other Periods)
Midwest	0.48	0.94
Southeast	1.46	1.00
Southwest	0.62	0.54
Mountain Plains	0.90	1.14
Family Size		
Number of adults	1.09	0.99
Number of children less than age 6	1.03	0.84*
Number of children between ages 6 and 17	1.02	1.06
Ratio of Family Income to Poverty Level (less than 1.00 category is omitted)		
1.00 to < 1.30	0.69	0.82
1.30 to < 1.85	1.06	1.01
1.85 to < 3.00	1.15	0.76
3.00 +	0.27**	0.37***
Household Location (rural is omitted)		
Urban	0.72	1.00
Program Participation		
Food Stamp Program	2.18**	1.53**
TANF	0.84	0.36**
Medicaid	0.67	1.08
Trigger Events		
Trigger Events ("No decrease in income/earnings and no one enters PA" is omitted category)		
Decrease in income/earnings and someone enters PA	5.44***	5.34***
Decrease in income/earnings and no one enters PA	0.56*	1.33*
No decrease in income/earnings and someone enters PA	5.37***	2.32***
Policy Variables		
Maximum TANF benefit for a family of four	1.00	1.00
TANF participation rate	1.47*	1.16
FSP participation rate	1.21**	0.98
Local WIC agencies per state	1.00	1.00*
Average cost of food packages for all WIC participants	0.95	0.99
Length of WIC benefit issuance period	1.29	1.18
State Characteristics		
State unemployment rate	0.74	0.81**
State poverty rate	0.88	1.01
-2*Log Likelihood	444	2,231
Number of Spell-Period Observations	788	6,440

Source: 2001 SIPP panel; Unemployment rates are obtained from the Bureau of Labor Statistics (http://www.bls.gov/lau/lausad.htm); Local WIC agencies per state, average cost estimates, and length of WIC benefit issuance period are taken from WIC Participant and Program Characteristics data 2000, 2002, and 2004; FSP participation rates obtained from FSPQC data; TANF participation rates obtained from administrative records (http://www.acf.hhs.gov/programs/ofa/data-reports/index.htm); TANF benefit amounts and state poverty rates estimated using Current Population Survey data.

Note: Sample includes mothers with left-censored nonparticipation spells.

* Significantly different than zero at the 0.10 level, two-tailed test
** Significantly different than zero at the 0.05 level, two-tailed test
*** Significantly different than zero at the 0.01 level, two-tailed test

Family characteristics, particularly family income and participation in other public assistance programs, should be associated with WIC entry because income is so closely related to eligibility and because program participation, controlling for income, may indicate integration of services or a mothers' savvy in obtaining benefits or services.[49] While the results indicate that these associations do exist, family characteristics are predominantly related to WIC entry after period 1 rather than in the first period.

In order to be income eligible for WIC, the family income must be at or below 185 percent of poverty; however, in some states mothers with family incomes greater than this threshold can still be eligible if they participate, or have family members that participate, in Food Stamp, TANF, or Medicaid programs. Table D.14 indicates that mothers in families with income greater than three times the federal poverty level are 73 percent less likely to participate in period 1, relative to mothers living in families below the poverty line. After period 1, mothers living in families with income greater than 1.85 times the poverty line are also less likely to enter compared to those in families with income below the poverty line.

As observed for children, participation in the FSP is also strongly associated with WIC entry for mothers; however, unlike the strong association between enrollment in Medicaid and WIC entry for children, mothers who receive Medicaid are equally as likely to enter WIC as mothers who do not receive Medicaid.

Trigger Events. Several of the trigger event variables included in the model are strongly associated with entry into WIC. Mothers living in families that experience at least a 20 percent **decrease** in earnings and that contain someone that **enters** public assistance, including the Food Stamp, TANF, or Medicaid programs, are about 5 times more likely to enter the WIC program

[49] Additionally, participating in a program other than WIC could indicate that a mother is affected less by the stigma associated with participation, making her more likely to enter WIC.

than mothers living in families that do not experience a decrease in income or have someone enter public assistance. Similarly, mothers living in families that do not experience at least a 20 percent decrease in earnings, but contain someone that enters public assistance, are 5 times more likely to enter the WIC program in period 1 (2 times more likely in later periods) than mothers living in families that do not experience a decrease in income or have someone enter public assistance.[50]

State Variables. Several State characteristics and policy variables are associated with a mother entering the WIC program at the beginning of her pregnancy, including higher FSP and TANF participation rates in a mother's State of residence. The estimates for the mother's analysis indicate that a higher State unemployment rate is associated with a lower likelihood of entry. Whether this is a counterintuitive result is not clear, as it is uncertain how many women work or search for jobs during the periods leading up to the birth of their child and during the postpartum period.

3. Determinants of WIC Exit

In this section, we investigate the factors associated with exit from the WIC program. Table D.15 contains the odds ratios and indicators of statistical significance for each model. The results are based a sample of mothers who at some point in the panel are WIC participants.

[50] The estimates on which these odds ratios are based are each statistically significant at the 0.01 level.

TABLE D.15

WIC EXIT MODEL: ODDS RATIOS OF ESTIMATED EFFECTS OF EXPLANATORY VARIABLES ON PROBABILITY OF MOTHER EXITING WIC

Explanatory Variables	Mother
Mother and Child Characteristics	
Child's Gender (female category is omitted)	
Male	1.45**
Child's Parity (first child is omitted category)	
Second child	1.41*
Third child or higher	1.18
Before or After Infant's Birth (by period) (Periods 1,2 are omitted category)	
Period 3 (birth period)	3.07***
Period 4,5,6 (postpartum)	5.89***
Mother's Race and Ethnicity (Hispanic category is omitted)	
White, non-Hispanic	0.84
Black, non-Hispanic	0.81
Other	0.65
Mother's Age (Under 25-year-old category is omitted)	
25-35	0.94
36 and older	0.48**
Mother's Highest Grade Completed	
High school graduate (or GED)	0.82
Mother's Marital Status (never-married category is omitted)	
Married	1.16
Divorced, Widowed, or Separated	2.15**
Mother's Employment Status ("not working for pay" category is omitted)	
Employed full-time	1.38
Employed part-time	1.12
Family Characteristics	
Region of Residence ("Western" category is omitted)	
Northeast	1.04
Mid-Atlantic	1.73
Midwest	0.92
Southeast	1.26
Southwest	0.85
Mountain Plains	0.96
Family Size	
Number of adults	1.27**
Number of children less than age 6	1.07

Table D.15 (continued)

Explanatory Variables	Mother
Number of children between ages 6 and 17	1.06
Ratio of Family Income to Poverty Level (less than 1.00 category is omitted)	
1.00 to < 1.30	0.65*
1.30 to < 1.85	0.79
1.85 to< 3.00	0.99
Over 3.00	0.82
Household Location (rural is omitted)	
Urban	1.13
Program Participation	
Food Stamp Program	1.38*
TANF	0.82
Medicaid	0.75*
Trigger Events	
Trigger Events ("No increase in income/earnings and no one exits PA" is omitted category)	
Increase in income/earnings and someone exits PA	1.63**
Increase in income/earnings and no one exits PA	1.47**
No increase in income/earnings and someone exits PA	1.82**
State-Level Characteristics	
Policy Variables	
Maximum TANF benefit for a family of four	1.00
TANF participation rate	1.08
FSP participation rate	0.93
Local WIC agencies per state	1.00
Average cost of food packages for all WIC participants	0.98
Length of WIC benefit issuance period	0.99
Policy Variables	
State unemployment rate	0.84*
State poverty rate	1.07
-2*Log Likelihood	1,500
Number of Spell-Period Observations	1,264

Source: Enhanced 2001 SIPP data; Unemployment rates are obtained from the Bureau of Labor Statistics (http://www.bls.gov/lau/lausad.htm); Local WIC agencies per state, average cost estimates, and length of WIC benefit issuance period are taken from WIC Participant and Program Characteristics data 2000, 2002, and 2004; FSP participation data obtained from administrative records (http://www.fns.usda.gov/pd/snapmain.htm); TANF participation and benefit amounts obtained from administrative records (http://www.acf.hhs.gov/programs/ofa/data-reports/index.htm); State poverty rates estimated using Current Population Survey data.

Note: Samples include mothers with left-censored nonparticipation spells.

*Significantly different than zero at the 0.10 level, two-tailed test
**Significantly different than zero at the 0.05 level, two-tailed test
***Significantly different than zero at the 0.01 level, two-tailed test

Mother and Family Characteristics. Similar to the findings for children, few demographic characteristics of the child's mother, such as age, education, and marital status are associated with a mother's exit from WIC. An exception is family size, with mothers living in families with more adults being more likely to exit WIC.

Mothers living in families that receive FSP benefits are more likely to exit WIC. Using their FSP benefits to purchase food that substitutes for purchases made using the WIC food package may be a way to alleviate the time or transaction costs associated with remaining on WIC such as those associated with visiting the local WIC agencies, picking up food, and recertifying. It is also possible that mothers receiving FSP benefits may underreport WIC participation more.

Enrollment in Medicaid, in contrast, leads to a lower likelihood of exit. Mothers enrolled in Medicaid are more than 25 percent less likely to leave WIC than Medicaid nonparticipants. This may be due to Medicaid enrollees being adjunctively income-eligible when recertifying for WIC. In addition, Medicaid and WIC offices are more likely to be co-located.

Trigger Events. As in the entry analyses, trigger events are also strongly associated with a mother's exit from the WIC program. The estimates of the associations are similar to those found in the children's exit analyses. Out of the three trigger event variables, mothers living in families that do not experience a 20 percent increase in income or earnings, but contain someone that exits public assistance, have the largest increase in the likelihood of exit relative to mothers living in families that neither experience an increase in income or earnings nor contain someone that exits public assistance.[51]

[51] The odds of exiting WIC are increased by 63 percent for mothers living in families that experience at least a 20 percent increase in earnings and that contain someone that exits public assistance relative to mothers living in families that do not experience an increase in income or contain someone that exits public assistance. For mothers living in families that do not experience at least a 20 percent increase in earnings, but contain someone that exits public assistance, there is an 82 percent increase in the odds of exiting WIC (relative to mothers living in families that do not experience an increase in income or contain someone that exits public assistance). The odds of exiting

State Characteristics. For mothers, the State-level policy and characteristic variables are not associated with exit from the WIC program.

D. Analysis of Continued WIC Participation

The estimations in this section are special cases of the multivariate exit model. Similar to the analyses for children in Appendix C that examined transition rates across age thresholds, this model focuses on the decision to continue participating in WIC at the transition from the prenatal to postpartum period for pregnant mothers.

A logistic regression is used to estimate each model. We restricted the set of explanatory variables to those used in Table D.10 to compare the results of the multivariate analysis with the results of the descriptive analysis above. To be included in the sample, a mother must have been observed in at least the last period of the prenatal stage and the first period of the postpartum stage and must have participated in WIC during one of the periods in the prenatal stage. The dependent variable is then equal to 1 if the mother participates in both the last period of the prenatal stage and the first period of the postpartum stage and is equal to 0 otherwise. Further details of the methodological approach can be found in Appendix C.

(continued)
the program are also greater for mothers living in families in which no one exits public assistance, but that experience an increase in earnings, relative to the odds for mothers in families that experience neither event.

TABLE D.16

CONTINUATION RATES FOR MOTHERS FROM PRENATAL TO POSTPARTUM: ODDS RATIOS OF ESTIMATED EFFECTS OF EXPLANATORY VARIABLES ON LIKELIHOOD OF CONTINUED RECEIPT OF WIC BENEFITS (AMONG INDIVIDUALS IN FAMILIES WITH INCOME EVER BELOW 185% OF POVERTY)

	WIC Mothers Continuous Participation
Explanatory Variables	Prenatal to Post-Partum
Ratio of family income to poverty level (less than 1.00 category is omitted):	
1.00 to< 1.30	2.27 **
1.30 to< 1.85	0.86
1.85 to< 3.00	0.69
3.00 +	0.86
Program Participation	
Food Stamp Program	0.60
TANF	0.80
Medicaid	0.49 **
Mother's Employment Status ("not working for pay" category is omitted):	
Employed full-time	0.70
Employed part-time	0.94
Mother's Race and Ethnicity (Hispanic category is omitted):	
White, non-Hispanic	1.83 *
Black, non-Hispanic	1.18
Other	3.06
Mother's Marital Status (never-married category is omitted):	
Married	0.63
Divorced, Widowed, or Separated	0.26 **
Parity (first child is omitted category)	
Second child	0.43 **
Third child or higher	0.89
-2*Log Likelihood	382
Number of Observations	316

Source: 2001 SIPP panel

Note: Columns correspond to subsamples of individuals that are observed in at least the last period of the first age group and the first period of the second age group, and that participate in one of the periods in the first age group.

* Significantly different than zero at the 0.10 level, two-tailed test
** Significantly different than zero at the 0.05 level, two-tailed test
*** Significantly different than zero at the 0.01 level, two-tailed test

The descriptive analysis showed that 38 percent of pregnant women that participate in WIC during the prenatal period continue to participate in the postpartum period. Continued receipt of WIC for these mothers into the postpartum period is associated with having lower income, never having been married, and having a first child.

The results from the multivariate analyses of these transition rates show that mothers with incomes between 1.00 and 1.30 times the federal poverty level are more than twice as likely to continue receiving WIC in the postpartum period than mothers with family income below the poverty line (Table D.16). Conditional on income, there is no association between a mother working in the prenatal period and her continued participation in the WIC program in the postpartum period.

Several demographic characteristics related to a mother's marital status, race and ethnicity, and her child's parity were found to be important determinants of continued participation in WIC. The odds of continuing to participate are reduced for divorced, widowed, or separated mothers (relative to mothers who have never been married), mothers who gave birth to their second child (relative to mothers who gave birth to their first child), and Hispanic mothers (relative to white, non-Hispanic mothers).

Participation in Medicaid is associated with a lower likelihood of continued receipt in the postpartum period for mothers participating in WIC in the prenatal period. While this differs from the finding of the mother's exit hazard model in which Medicaid participation was found to be associated with a lower likelihood of exit, *different samples were used to estimate each of these models.* The sample used to estimate the mother's exit hazard model includes women who participated in the prenatal or postpartum periods, whereas the sample used to estimate the transition from prenatal to postpartum consists only of those women who participated in the prenatal period. The exit hazard model also includes changes in Medicaid participation in the model among the set of trigger event variables.

D. FINAL CAUTION BEFORE INTERPETING ANALYSIS OF WIC PARTICIPATION DYNAMICS OF MOTHERS

Although the results of the exploratory analysis of participation dynamics of WIC mothers has produced some instructive information on the feasibility of such an analysis, the findings presented in this Appendix should be viewed with caution. The assessment of reported data by mothers in SIPP revealed an apparent bias in underreporting of WIC participation for themselves (although not necessarily for the children), with underreporting appearing worse in the postpartum period. This suggests strongly that participation exits around the wave that includes the birth of the WIC infant could be overstated, and rates of continuous participation across prenatal and postpartum eligibility periods could be understated. In addition to underreporting, evidence of considerable seam bias may have introduced measurement errors. Reliance on the last month of each wave for data observation may have missed participation information for mothers who received WIC benefits for short periods of eligibility.