V. THE RELATIONSHIP BETWEEN PARTICIPATION STATUS AND INCOME

Exhibits IV.5 and IV.6 suggest that household income and earnings in months other than the current month are important determinants of FSP participation. In this chapter, we further examine the relationship between participation in a single month and income over a longer period. What we would like to do is observe the relationship between participation and the income concept that is relevant for the household's participation decision, which we refer to as expected long-term income. We cannot observe expected long-term income directly, because it is a value that exists only in the minds of households' decision makers. Nonetheless, we might be able to make inferences about the nature of the relationship between expected long-term income and participation, through the use of various proxy measures and other techniques.

To further motivate the analysis, we first describe the relationship between participation rates and observed current month income. We then consider the same relationship for what might be a better proxy for expected long-term income – annual income. After this, we present findings from a series of econometric models aimed at revealing more about the relationship between participation rates and expected long-term income.

A. Participation Status versus Current Income

We begin by examining the relationship between participation status in the current month and current month income. Although we expect to see a negative relationship between participation and current income, as discussed in Chapter III, that relationship might not be as strong as one might expect because current income as measured in SIPP might not reflect the concept of income that is relevant for the household's participation decision.

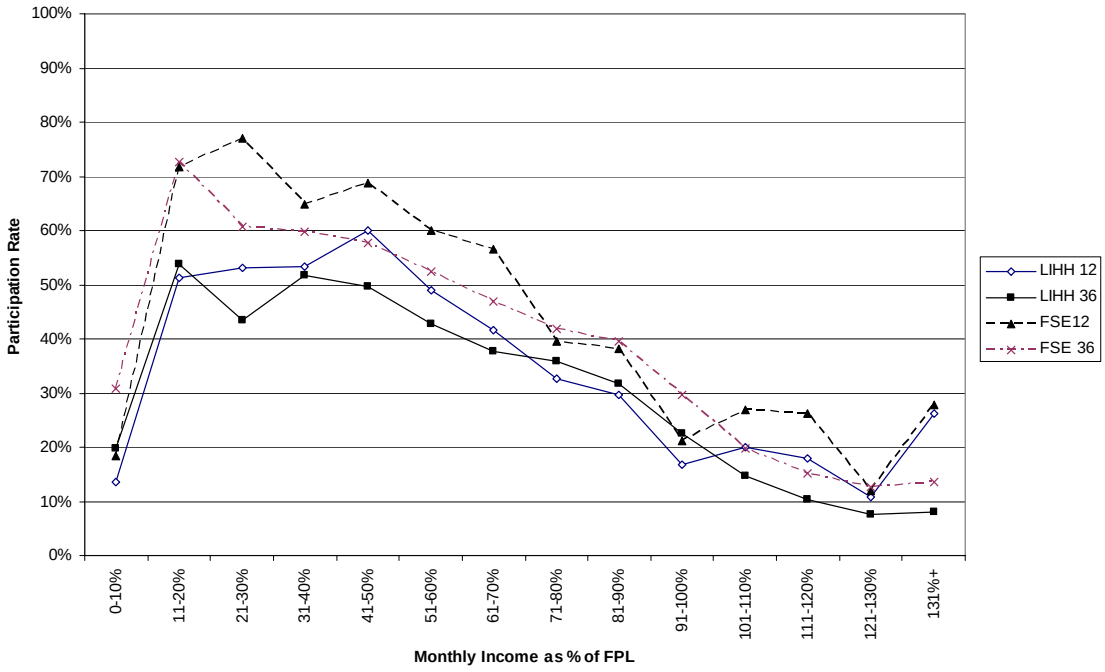
In ***Exhibit V.1***, we plot the relationship between participation rates and household income for each of our four samples. To construct these plots, we first divided each sample into current income subgroups: 0 – 10% FPL, 11 – 20% FPL, 21 – 30% FPL, etc. We then computed the participation rate for each subgroup and plotted it against the mid-point of the subgroup's income range.

We do, in fact, find a negative relationship between reported current month income and participation rates over most of the income range. Surprisingly, however, in each sample, the relationship between participation rates and income has, roughly, an inverted-U shape. That is, participation rates in the lowest income subgroups are actually *lower* than in somewhat higher income subgroups. For instance, in the LIHH-12 sample, the participation rate in the 0-10% FPL subgroup is only 14 percent, then increases with income to a maximum of 60 percent for the 41 – 50% FPL subgroup, before declining.[24]

[24] Other studies have found zero income households have substantially lower participation rates than those with low, but positive income (see Cunnyngham 2002). Wemmerus and Porter (1996) examined the group of zero-income households on the 1990 SIPP longitudinal file and found that many were financially viable, but a clear event or condition (e.g., a job loss, household dissolution, enrollment in school or loss of cash benefits) precipitated the zero-income period.

Participation rates are uniformly higher in the samples that include only those who meet the program's eligibility requirements than in the larger sample of low-income households, but are still well below 100 percent in each income subgroup, and the relationship for this sample also has the inverted-U shape. For FSE-12, the participation rate for the lowest income subgroup is only 18 percent, and rises to a maximum of 77 percent for those in the 21 – 30% FPL subgroup, before declining.

Exhibit V.1: Current Month Participation versus Current Month Income



NOTE: LIHH-12 and -36 samples have gross income less than 130% FPL in month 12 and month 36, respectively; FSE-12 and -36 samples meet the FSP eligibility criteria in the respective month.

This finding is not simply due to a few outliers in a small sample or some other artifact of the data or methodology. Cunnyngham (2002) reports a similar result in her estimates of individual participation rates by household income category based on FSP administrative data (for the numerator) and the CPS (for the denominator). She finds that the participation rate for individuals in eligible households with no reported income was only 28 percent in 1997.[25]

This raises the question of why there are so many non-participants in very poor households – including very poor households that appear to meet all program eligibility criteria. We posit four explanations:

- Many of these households really are very poor, and need food stamps, but are not receiving them – perhaps because the same conditions that limit their income (e.g., low literacy,

[25] Cunnyngham (2002), Table 5.

psychiatric disorders, cognitive disorders, or communication disorders) also limit their ability to participate in FSP as the program is currently implemented.

- Many households with very low incomes have actual incomes that are higher than those reported; i.e., many have negative reporting errors.[26] These could be systematic omissions of perhaps informal, or even illegal, income, or more random errors in reporting and recording. If the errors are systematic, they are also likely to exist in longer-term measures of income, such as annual income, so use of longer-term income measures might not eliminate the upward sloping portion of the inverted-U. If the errors are predominantly random, however, use of longer-term income measures should reduce or eliminate the upward sloping portion of the inverted-U.

- Many of these households really have low current income, but their expected long-term incomes are considerably higher. If this is the explanation, we might observe characteristics for these households that are indicative of higher expected long-term incomes. In the LIHH samples, this would include high assets. In all samples, this could include households including adults who are between jobs. If we control for such characteristics, the upward sloping portion of the inverted-U shape might be eliminated. Comparison of participation-income relationships for the LIHH and FSE samples suggests that this is an important part of the explanation for the inverted U. In the latter samples, we have eliminated households with substantial assets, which presumably are reflective of higher long-term incomes. In these samples the inverted-U appears only between the two lowest income categories. Nonetheless, it remains.

- These households might fail to report FSP participation more frequently than households with higher incomes (see Bollinger and David, 1997, 2001).

These possible explanations have very different policy implications. If the first explanation is right, there would appear to be a need for policies to address the low participation rates of these very low-income, non-participant households. If the finding is only due to the other three explanations, then it could be that the program is successfully meeting the food needs of all very low-income households that really have such needs. Most likely, the inverted-U shape is explained by some combination of these possible reasons.

In the remainder of this chapter, we employ various methods to better describe the relationship between participation and the inherently unobserved concept of expected long-term income, primarily to assess the extent to which the large gap between actual participation and 100 percent participation that we see for very low income households remains when we replace the monthly income measure by expected long-term income. We do find evidence that the gap is considerably smaller when we replace monthly income with expected long-term income, but it also appears that the remaining gap is substantial. The analysis leaves open three possibilities: 1) income is systematically underreported in SIPP for substantial numbers of very low income,

[26] Of course, reported current income in households with higher current incomes might also deviate from actual current income, either randomly or systematically. What is different about the households with the lowest incomes is that any large deviations must be negative; households with large positive deviations cannot have low *reported* income.

non-participant households, and the techniques we use cannot adjust for that; 2) under-reporting of FSP participation is especially substantial in households with very low expected long-term income; and 3) some households with very low expected long-term incomes are not participating in FSP despite substantial need. In the next chapter, we take a closer look at the observed characteristics of non-participant households in the lowest income subgroups, to assess the extent to which they have significant unmet need for food stamps, assuming that they have accurately reported income and participation.

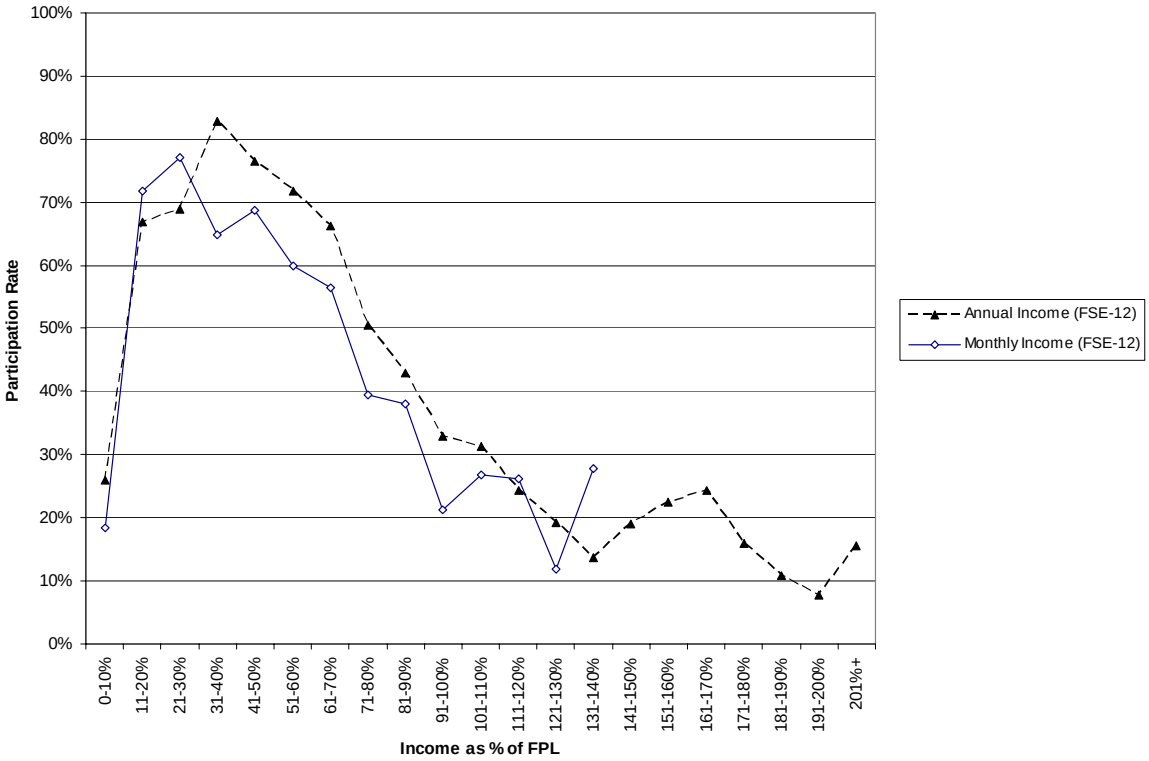
B. Participation Status Versus Annual Income

The simplest way to assess whether the relationship between participation and expected long-term income is closer to the relationship represented by Exhibit III.1 than the observed relationship between participation and current month income is to use a longer-term income measure than reported current month income. Presumably income measured over a moderately longer period will be a better proxy for expected long-term income than current income.

To illustrate, we examine the relationship between participation rates and household subgroups defined by annual income (i.e., income over the 12-month period beginning six months before the current month and ending five months after it) and compare it to the relationship using current income (see ***Exhibit V.2***).[27] Annual income is frequently used in the research literature using survey data, so it is important to investigate the participation rate as a function of low annual income. For this analysis, we focus on the FSE-12 sample only. For most subgroups with incomes below 130% FPL, participation rates are higher when we use annual income than when we use current income. However, the upward sloping section of the inverted-U is just as substantial as when we use monthly income. The participation rate for the lowest income group defined by annual income is only not substantially higher than the rate for the lowest group defined by monthly income (26 versus 18 percent).

[27] This figure was constructed in exactly the same way as Exhibit V.1, except for the use of the annual income measure.

Exhibit V.2: Participation Rate versus Annual and Monthly Income (FSE-12 Sample)



NOTE: FSE-12 and -36 samples meet the FSP eligibility criteria in the respective month.

One other feature of the relationship using annual data is that the participation rate is above zero for households with annual incomes as high as 200% FPL. Similar findings emerge from analyses of the other three samples (not shown).

Although this analysis does suggest that the gap between 100 percent participation and actual participation is smaller when expected long-term income, rather than current income, is used, it still appears to be very large, especially for the lowest income groups. The maximum participation rate observed is 83 percent for households with incomes between 31% FPL and 40% FPL. While annual income appears to be a better proxy for expected long-term income than current income, it might still be very imperfect. One possible reason is systematic misreporting of income over much or all of the year. A second possible reason is that the relevant time period is different than a year – most likely longer. A third possible reason is that annual income implicitly weights monthly income in each of the 12 months equal, but perhaps the weights should be different. Finally, and most importantly, no variable we could construct from survey responses can exactly represent the relevant concept of expected long-term income for each household; for any measure we construct, there will always be idiosyncratic differences between the measure for a household and what the household's decision makers consider to be the household's expected long-term income.

C. Participation Status versus Annual Income after Controlling for Other Variables

The relationships between participation rates and both current month and annual incomes presented in the two previous sections are not adjusted for other observed differences between households across the income subgroups. That is, as we move from the lowest income subgroups to the highest income subgroups, other characteristics of the households change along with their incomes. The observed relationship between participation and the relevant income measure is the relationship allowing these other characteristics to change. Changes in these characteristics might help explain the inverted-U shape of the participation-income relationships, and controlling for these characteristics might change the shapes of these relationships in substantial ways.

One of the most important characteristics to consider is ABAWD status, as we expect much lower participation rates for ABAWD households, and some such households might have very low temporary incomes and very high expected long-term incomes.

We used logit analysis to control for other characteristics and to produce participation rate/income relationships that are adjusted for these characteristics. For the results presented in this section, the log odds ratios are specified to be a fifth order polynomial in annual income[28] and linear in selected characteristics (***Exhibit V.3***). The fifth-order polynomial specification was chosen after we determined that fifth-order polynomials could be used to closely approximate the shapes of the unadjusted participation rate/income relationships.

[28] That is, we included income, income^2, income^3, income^4, and income^5 as explanatory variables.

Exhibit V.3: Logistic Regressions for the Probability of Participation, Food Stamp Eligible Samples

Explanatory Variable	FSE-12 Coefficient		FSE-12 Marginal Effect	FSE-36 Coefficient		FSE-36 Marginal Effect
Annual Household Income (% FPL)						
1st Power	5.427	***	n.a.	1.648		n.a.
2nd Power	-12.555	***	n.a.	-5.595	***	n.a.
3rd Power	7.668	***	n.a.	3.112	***	n.a.
4th Power	-1.716	***	n.a.	-0.602	**	n.a.
5th Power	0.115	***	n.a.	0.034	**	n.a.
Sex of Head (base = Female)						
				-0.354		-0.073
Male	-0.417	***	-0.094			
Race of Head (base = White)						
Black	0.112		0.026	0.109		0.023
Native American	-0.036		-0.008	0.523		0.119
Asian	0.635		0.155	0.684		0.159
Ethnicity (base = non-Hispanic)						
				-0.204		-0.042
Hispanic	-0.077		-0.017			
Age of Head (base = 18 - 25)						
26-35	-0.224		-0.051	-0.115		-0.024
36-45	0.011		0.003	-0.012		-0.002
45+	-0.177		-0.040	-0.269		-0.055
Household Members (base = one child, no elderly or disabled members)						
At least one disabled member	0.917	***	0.219	0.936	***	0.213
At least one elderly member	0.021		0.004	0.250		0.054
Two or three children	0.485	***	0.113	0.428	***	0.092
Four or more children	0.609	***	0.147	0.789	***	0.182
ABAWDs	-1.198	***	-0.230	-0.800	***	0.147
Age of Youngest Child (base = under age 2)						
2 to 4	0.442	**	0.105	0.647	***	0.147
5 and over	0.604	***	0.145	0.397	**	0.088
Marital Status of Head (base = never married)						
Married	-0.583	***	-0.130	-0.387		-0.079
Divorced	0.522	***	0.123	0.216	*	0.046
Widowed	0.172		0.040	0.202		0.044
Education of Head (base = less than high school)						
High school graduate/GED	-0.176		-0.040	0.085		0.018
Trade/vocational school	-0.051		-0.012	0.244		0.054
Some college	-0.400		-0.088	-0.398	**	-0.079
College graduate or higher	-0.283		-0.063	-0.819	***	-0.147
Intercept	**0.246**			0.351		

NOTES: * Significant at 0.10 level; ** Significant at 0.05 level; *** Significant at 0.001 level
LIHH-12 and -36 samples have gross income less than 130% FPL in month 12 and month 36, respectively; FSE-12 and -36 samples meet the FSP eligibility criteria in the respective month.

We found that many of the characteristics were significant predictors of participation in all samples, whether we used annual income or current month income, but others were not. As discussed in Chapter III, the significance of individual characteristics could be either because the characteristic has some direct effect on participation, or because the characteristic captures part of the effect of expected long-term income (even after controlling for annual income).

The "marginal effect" for each characteristic reported in Exhibit V.3 represents the estimated effect of a change in a characteristic from the base (omitted) category to the category indicated on the probability of participation, holding other characteristics and the annual income variables constant at their means.

We consistently found that ABAWD households were much less likely to participate than others. Holding annual income and other characteristics constant at their means, we estimate that the probability of an ABAWD household's participation in month 12 was 23 percentage points lower than that of a non-ABAWD household with one child and no disabled or elderly adults. As will be seen below, this understates the difference between participation rates of ABAWD and non-ABAWD households holding annual income constant because mean values of other characteristics for these two types of households are quite different.

We also found the following significant differences (values in parentheses are estimated percentage point differences in participation rates for the FSE-12 and FSE-36 samples, respectively, holding annual income and other characteristics constant at the mean):

- Male-headed households are less likely to participate than female-headed households (9.4 and 7.3);
- Households with at least one disabled member were much more likely to participate (21.9 and 21.3) than households without a disabled member;
- Households in which the youngest child is at least two years old are more likely to participate than households with the youngest child under two (10.5 and 14.7 for households with the youngest child aged 2 to 4, and 14.5 and 8.8 for households with the youngest child aged 5 or older);
- Households in which the head is married are much less likely to participate than households in which the head has never been married (-13.0 and –7.9), while households in which the head is divorced are much more likely to participate (12.3 and 4.6) than never-married heads; and
- There is a negative relationship between level of education completed by the household head and participation, although estimates for individual categories of education at the level of high school graduation or above are not always significantly different from estimates for those with less than a high school education, holding other things constant. Households headed by a person with a college degree are least likely to participate,

holding other things constant (-6.3 and –14.7 compared to those in which the head has less than a high school education).

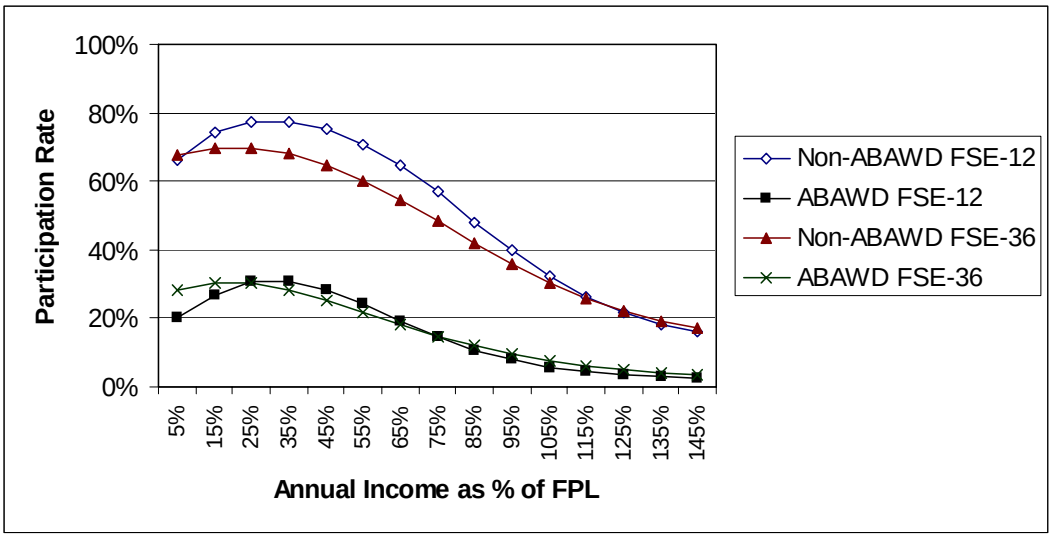
- We did not consistently find significant differences in participation by age, race or ethnicity after controlling for annual income and other characteristics.

We suspect that the findings with respect to disability, education, marital status, and sex are related to differences in expected long-term income that are not captured in annual income. This is perhaps most apparent for disability status. It also seems especially likely for marital status and education as, holding other things constant, we would expect to find households with married, well-educated heads to participate at a rate that is at least as high as households with never married and less educated heads if their long-term income prospects were truly the same; they are more likely to contain two adults, instead of one, and a well educated head is presumably more capable of accessing the program than the less educated head. Instead we find the opposite relationship, after holding annual income and other characteristics constant (i.e., households with a well-educated, married head are less likely to participate than those headed by a less-educated, never married head).

The relationships between participation rates and annual income implied by these estimates are shown in ***Exhibit V.4***, separately for ABAWD and non-ABAWD households. Each plot shows the fitted value for the participation rate at each annual income level indicated, holding all characteristics constant at the means for the relevant group (ABAWD or non-ABAWD). For both the FSE-12 and FSE-36 samples, we used the means from the FSE-12 samples so that differences in the plots for the two samples would not reflect differences in the means. As noted in Chapter III, however, the only substantial difference between the means for the two samples is that the heads of households in the FSE-36 sample are, on average, approximately 24 months older than those in the FSE-12 sample.

These plots show that the relationships between participation rates and annual income for both ABAWD and non-ABAWD households, after holding other characteristics constant (within each group) are very similar in the two sample periods for the FSE samples. They also show that the difference between participation rates for ABAWD and non-ABAWD households, holding annual income constant, but not holding the means of characteristics constant, are much larger than differences when the means of characteristics are held constant for income levels below approximately 100% FPL. The difference is greatest for households with annual income at approximately 35% FPL – 46 percentage points in the FSE-12 sample and 40 percentage points in the FSE-36 sample.

Exhibit V.4: Participation Rate versus Annual Income by ABAWD Status (FSE-12 means for characteristics)



NOTE: FSE-12 and -36 samples meet the FSP eligibility criteria in the respective month.

For both types of households, participation rates peak at approximately 35% FPL, but this simply reflects the fact that the logit specification implicitly constrains the income coefficients to be the same for the two types of households. Of greater interest is the finding that, after controlling for other characteristics, the inverted-U shape remains.[29] That is, at least some of the low participation rates of the very low-income households are accounted for by their observed characteristics. As indicated above, that might be because the characteristics partially reflect differences in expected long-term income after controlling for annual income.

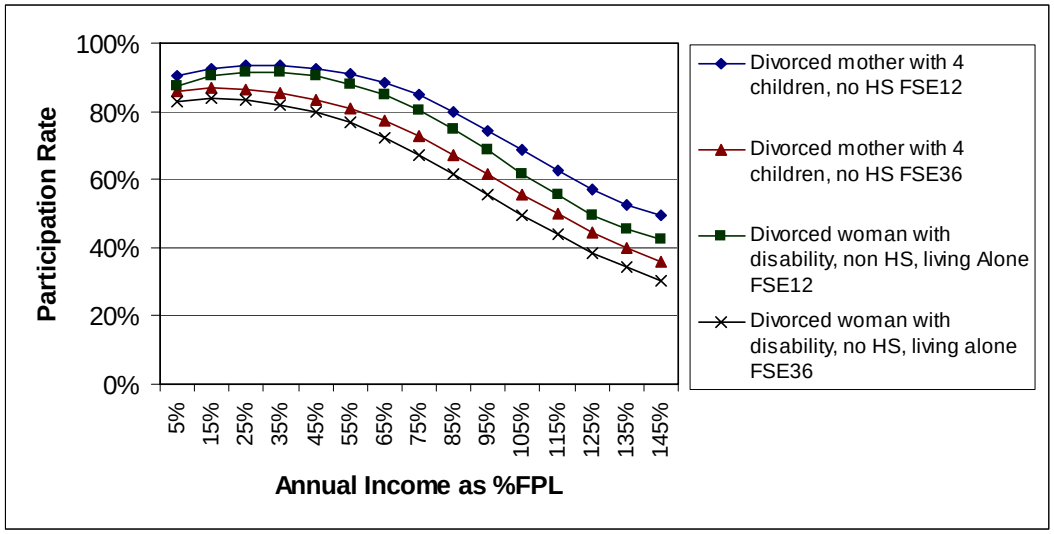
As in the earlier analysis, substantial shares of very low-income households do not participate, even among non-ABAWD households. The highest estimated participation rate for the latter, at annual income of 35% FPL, is 78 percent in the FSE-12 sample and 68 percent in the FSE-36 sample.

We can also use the model to look at participation rates of more specific groups. For instance, based on the model, estimated participation rates for households with four children over age five, headed by a divorced woman who had not completed high school, are in the 88 – 95 percent range if household income is below 65% FPL, in both samples (***Exhibit V.5***). Similarly, estimated participation rates for households headed by a divorced woman with a disability, who has not completed high school and who is living alone are in the 77 – 87 percent range if household income is below 65% FPL. Most would consider these two types of households to be

[29] The lines for the FSE-12 date in this figure differ from those in Figure V.1 in three respects. First, we smoothed the lines by use of the fifth-order polynomial in the logit model. Second, we controlled for other characteristics, including ABAWD status, through their inclusion as independent variables in the logit model. Third, we show separate lines for ABAWD and non-ABAWD groups. We obtained very similar lines when we did not include characteristics other than ABAWD status in the model. When we do not control for ABAWD status, either, the smoothed lines are very similar to those reported in Exhibit V.1.

extremely disadvantaged, with poor long-term income prospects. While the estimates indicate that the vast majority of such households do participate, the share not participating appears to be substantial.

Exhibit V.5: Participation Rate versus Annual Income by ABAWD Status for Selected Groups (1997 means for characteristics)



NOTE: FSE-12 and -36 samples meet the FSP eligibility criteria in the respective month.

In summary, when we consider the effects of various household characteristics on participation, we continue to find evidence that substantial numbers of very low income households do not participate, even when their characteristics suggest that their current income is indicative of their expected long-term income. It appears that, after controlling for household characteristics and annual income, many very low income households either: a) did not report all of their annual income; b) had higher expected long-term income than their annual income and other characteristics indicate; c) did not take advantage of the FSP for some other reason, and/or d) participated in FSP but failed to report it.

D. Current, Past and Future Income as Predictors of Current Participation

In using annual income as a proxy for expected long-term income, we implicitly made arbitrary choices about weighting income in each month; that is, we placed a weight of one twelfth on income in each of the 12 months from the sixth month before the current month to the fifth month after, and a zero on income in every other past and future month. To explore whether use of alternative weights, determined by the data rather than arbitrary decisions, would perhaps better reflect expected long-term income, and better predict participation, we estimated logit specifications in which we included the fifth-order polynomial in current income and

separate variables for mean monthly income in half-year intervals before and after the current month.[30] We included the same characteristics variables as in other specifications.
We estimated different variants of this model for months 12 and 36 because the number of prior and future months observed differs for the two samples. We can include reported income for the two prior half-years and for the following six half-years when using the 12-month samples, and vice versa when using the 36-month samples. Initial estimates for the 12-month samples showed that coefficients on income more than three half-years after the current month were never significant, so in the estimates we report for the 12-month samples we have dropped incomes in half-years four through six after month 12. Initial estimates for the 36-month samples showed that income in the sixth half-year before month 36 had a significant coefficient in several samples, so we retained all of the variables for all of the half-years available for that sample. In each model we included the fifth-order polynomial in current income as well, so that we could assess the extent to which inclusion of variables for income in earlier and later periods affects the shape of the relationship between current income and participation.

With one exception, the coefficients of all the half-year income variables are negative, and the one that is positive is very close to zero (see ***Exhibit V.6***). In the 12-month sample, the largest coefficient is for the previous half-year, and the second largest is for the second previous half-year, and both are significant. The coefficient for the first half-year after the current month is also negative, large and significant, while the coefficient for the second half-year later is negative, but not as large and only significant at the 0.10 level.

In the 36-month sample, the coefficients for the first half-year before and the first half-year after the current month are both significant, but are much smaller than for the 12-month sample. The coefficients for the second, third and fourth half-years before the current month are all negative and decline in value moving away from the current month, but none are significant at even the 0.10 level. The coefficient for the sixth half-year before the current month is also negative, is larger than the coefficients in all other months, and is quite significant. When we estimated this model using only five half-years before the current month (not reported), we found that the coefficient for the fifth half-year earlier was negative, large and statistically significant.

This evidence suggests that: a) past income is a stronger predictor of participation than future income; b) the predictive power of past or future income deteriorates as one moves away in either direction from the current period; and c) earnings in the more distant past (three or more years earlier) might have substantial predictive power.

[30] Because the current month is included as a separate variable, we define the first half-year interval after the current month as the five months after the current month. Also, we only observe five months of the second half-year before the 12th month and the sixth half-year before the 36th month, so means for those two half-year periods are based on just the five observed months. All other half-year means are based on a full six months.

Exhibit V.6: Logit Results with Leads and Lags of Mean Monthly Income for Half-year Periods, Food Stamp Eligible Samples

Explanatory Variable	FSE-12 Leads & Lags? No		FSE-12 Leads & Lags? Yes		FSE-36 Leads & Lags? No		FSE-36 Leads & Lags? Yes	
Current Month Household Income (% of FPL)								
1st Power	5.4684	***	5.8894	***	3.8408	***	3.9332	***
2nd Power	-11.6192	***	-10.3592	***	-9.8387	***	-9.0567	***
3rd Power	6.8710	***	6.2022	***	5.9488	***	5.6237	***
4th Power	-1.5443	**	-1.3981	***	-1.3378	***	-1.2843	***
5th Power	0.1168	***	0.1051	***	0.0989	***	0.0957	***
Mean Monthly Income in Prior Half-year Periods								
6th half-year earlier[b]	-		-		-		-0.3757	***
5th half-year earlier	-		-		-		0.0497	
4th half-year earlier	-		-		-		-0.0997	
3rd half-year earlier	-		-		-		-0.1271	
2nd half-year earlier[b]	-		-0.3703	**	-		-0.1805	
1st half-year earlier	-		-1.0003	***	-		-0.3115	**
Mean Monthly Income in Later Half-year Periods								
1st half-year later[a]	-		-0.2652	**	-		-0.1195	*
2nd half-year later	-		-0.3153	*	-		-0.0647	
3rd half-year later	-		0.0544		-		-	
Sex of head (base = Female)								
Male	-0.4771	***	-0.3601	***	-0.4485	***	-0.3944	***
Race of head (base = White)								
Black	0.1832		0.0987		0.1307		0.0680	
Native American	-0.0336		0.0728		0.4065		0.4750	
Asian	0.4966		0.5473		0.6719	*	0.8051	*
Ethnicity (base = non-Hispanic)								
Hispanic	0.0802		0.0302		-0.1830	*	-0.2918	**
Age of head (base = 18 - 25)								
26-35	-0.1223		-0.1529		-0.0242		-0.0577	
36-45	0.0209		0.0559		0.0415		0.0279	
45+	-0.0855		-0.1457		-0.1604		-0.2218	
Household members (base = one child, no elderly or disabled members)								
At least one disabled member	0.9896	***	0.8459	***	1.0327	***	0.9001	***
At least one elderly member	-0.0606		0.1327		0.2294		0.4522	***
Two or three children	0.5452	***	0.4865	***	0.5131	***	0.4245	***
Four or more children	0.7766	***	0.6028	***	0.9241	***	0.7571	***
Able-bodied adults only	-1.0209	***	-1.0348	***	-0.8253	***	-0.7242	***
Age of youngest child (base = under age 2)								
2 to 4	0.4969	**	0.4424	**	0.6330	***	0.6954	***
5 and over	0.7047	***	0.5999	***	0.3834	**	0.3936	**
Marital status of head (base = never married)								
Married	-0.7069	***	-0.5257	***	-0.5324	***	-0.3342	*
Divorced	0.5061	***	0.5566	***	0.1372		0.2229	*
Widowed	0.1188		0.2436		0.2174		0.3446	*

Exhibit V.6: Logit Results with Leads and Lags of Mean Monthly Income by Half-year Periods, Food Stamp Eligible Samples (continued)

Explanatory Variable	FSE-12 Leads & Lags? No		FSE-12 Leads & Lags? Yes		FSE-36 Leads & Lags? No		FSE-36 Leads & Lags? Yes	
Education of head (base = less than high school)								
High school graduate/GED	-0.2992		-0.1910		0.0427		0.1164	
Trade/vocational school	-0.2082		-0.0059		0.1747		0.2687	
Some college	-0.5810		-0.4294		-0.4852	***	-0.3609	*
College graduate or higher	-0.5277	**	-0.2185		-0.9575	***	-0.7540	**
Intercept	-0.313		0.593		-0.119		0.622	

NOTES: * Significant at 0.10 level; ** Significant at 0.05 level; *** Significant at 0.001 level.

FSE-12 and -36 samples meet the FSP eligibility criteria in the respective month.

a/ Based on the first five months after the current month only.

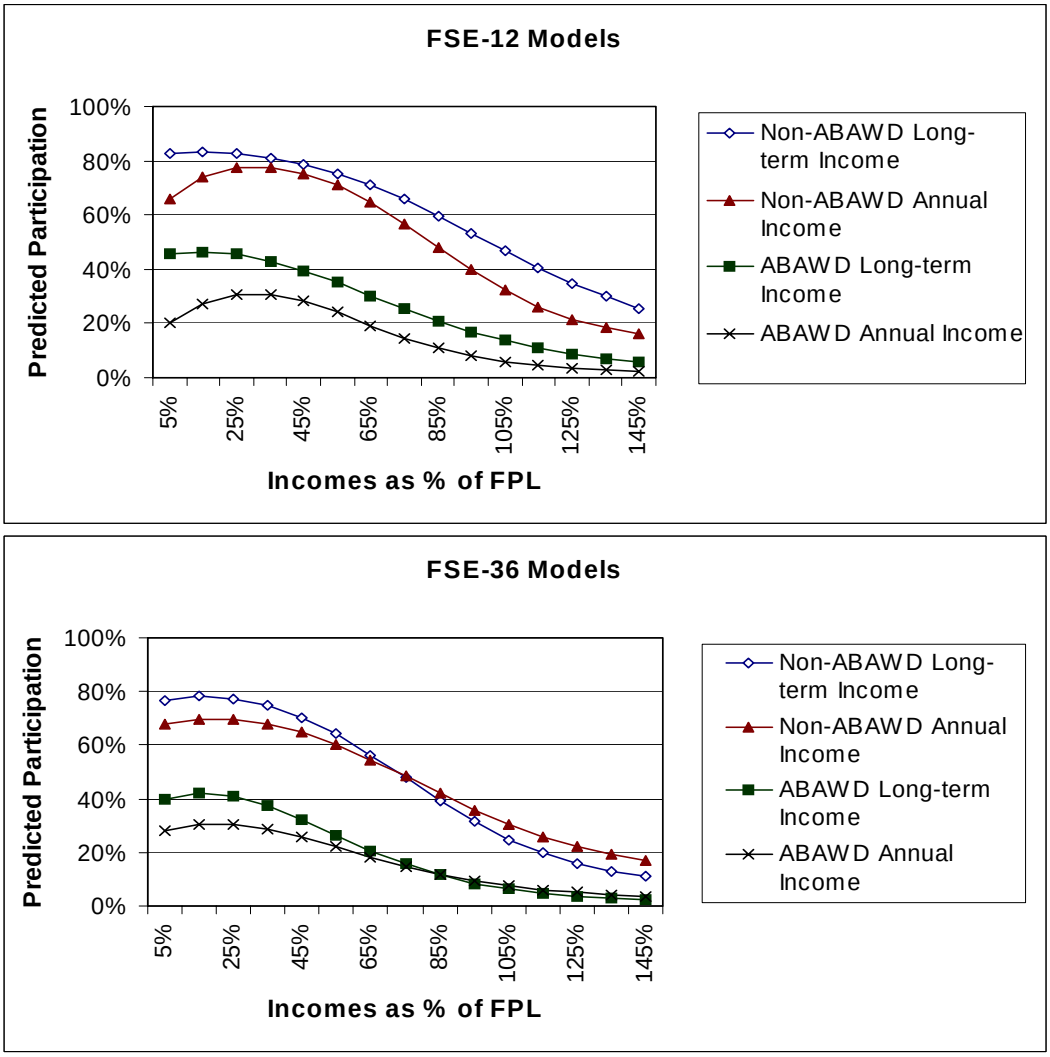
b/ The mean for the second half-year before the current month in the month 12 sample and the sixth half-year before the current month in the month 36 sample are based on the last five months of the half-year only -- the first five months of the survey period.

To illustrate the implications of this specification for the relationship between participation and expected long-term income, we consider how the participation rate varies across households with constant income over the relevant period. More specifically, we substitute the same income value into the equation for each income variable, and trace how the predicted participation rate changes with the value substituted, holding the characteristic variables constant at the means for non-ABAWD households, then repeat the exercise for ABAWD households. We would expect households with constant income over long periods to have expected long-term incomes that are very close to current incomes, so the resulting relationship might be fairly close to the relationship between participation and expected long-term income.

We compare the relationships based on long-term constant incomes to the relationships based on annual income from Exhibit V.4 by ABAWD status (***Exhibit V.7***). The top half of the panel is based on the long-term model for FSE-12 and the bottom half is based on the long-term model for FSE-36. As the two models are different, the long-term constant income lines in the two panels are not comparable to each other.

Both long-term income models produce estimated participation rates that are above the corresponding rates for the annual income models in the lower income range (below 75% FPL), but a surprising finding is that the model for the FSE-12 sample also produces higher estimated participation rates at 75% FPL and above. The model for the FSE-36 sample produces lower participation rates above 75% FPL. We would expect the long-term income models to produce lower participation rates than the annual income model in the highest income range (e.g., above 100% of poverty), because the long-term model implies that income has been at that relatively high level for a longer period than the annual model does. The main difference between the models for the two periods is the inclusion of income six half-years earlier in the FSE-36 model, with a large and significant coefficient, and the exclusion of that term from the FSE-12 model. Thus, it might be that income from that far in the past adds important information to our knowledge of expected long-term income.

Exhibit V.7: Participation Rate versus Annual and Long-term Constant Income[31]



NOTE: FSE-12 and -36 samples meet the FSP eligibility criteria in the respective month.

For both long-term income models, the positively sloped section of the inverted-U is substantially less pronounced than in the corresponding annual income model. This suggests that high income from periods further away from the current month than six months does help explain why some very low-income households do not participate, but there remains substantial room for competing explanations – namely systematic under reporting of income, relatively high underreporting of FSP participation, and/or the difficulties such very low income households might face in participating in the program.

[31] The long-term constant income relationship for FSE-12 is based on an assumption of constant income from two half-years before the current month through three half-years after the current month. The long-term constant income relationship for FSE-36 is based on an assumption of constant income from six half-years before the current month through two half-years after the current month. For both samples, values for other characteristics in the non-ABAWD and ABAWD relationships are fixed at FSE-12 means for non-ABAWDs or ABAWDs, respectively.

E. Instrumental Variables Estimates for the Expected Long-term Income Model

One classic approach to estimation of expected long-term income models in the consumption function literature is to use past or future income as an instrumental variable (IV) for current income. In this approach, income in any period is viewed as an imperfect measure of expected long-term income (the variable we would like to include in the regression), including a transitory measurement error. When income is observed for multiple periods, each period's income can be viewed as a separate measure of the household's expected long-term income. Income in the current period is included as an explanatory variable in the regression, but income values for other periods are used as IVs. This approach should work well if deviations of observed income around expected long-term income are independent from month to month after controlling for other explanatory variables.

In this section, we present results from an initial effort to apply this method to FSP participation. To apply it in a straightforward fashion, we first switch from the logit model to the "linear probability model;" that is we specify that the probability of participation is a linear function of the explanatory variables, rather than specify that the log odds of participation is a linear function of the same variables. Although the linear probability model has the undesirable property of not confining probability predictions to the zero-one interval, it is more amenable to application of IV estimators than non-linear models such as logit and probit.[32]

We specify a polynomial in current income, and also include the characteristics variables. Initially we tried a fifth-order polynomial, reflecting our experience with the logit models, but found that a third-order polynomial fit the data essentially as well. We treat all orders of current income as endogenous. For IVs, we use mean monthly income in months four through six and seven through nine before the current month and months four through six and seven through nine after the current month, each raised to the same powers as are represented in the polynomial.[33] Thus, for the third-order estimates reported, we used a total of 12 instruments. We interpret IV estimates of the coefficients on the current income variables as the coefficients for the unobserved expected long-term income variable. We do not use income in the three months before or after the current month as instruments because the four-month interview cycle makes it likely that current-month deviations from expected long-term income are likely to be reflected in income for at least some of these months, violating the independence assumption.

We present estimated participation rate/income relationships for the FSE-12 and FSE-36 samples in ***Exhibit V.8.*** Characteristics for all relationships depicted are fixed at the means for non-ABAWD observations from the FSE-12 sample. The "OLS" lines are based on ordinary least squares estimates of exactly the same linear probability model. These lines are quite similar to

---

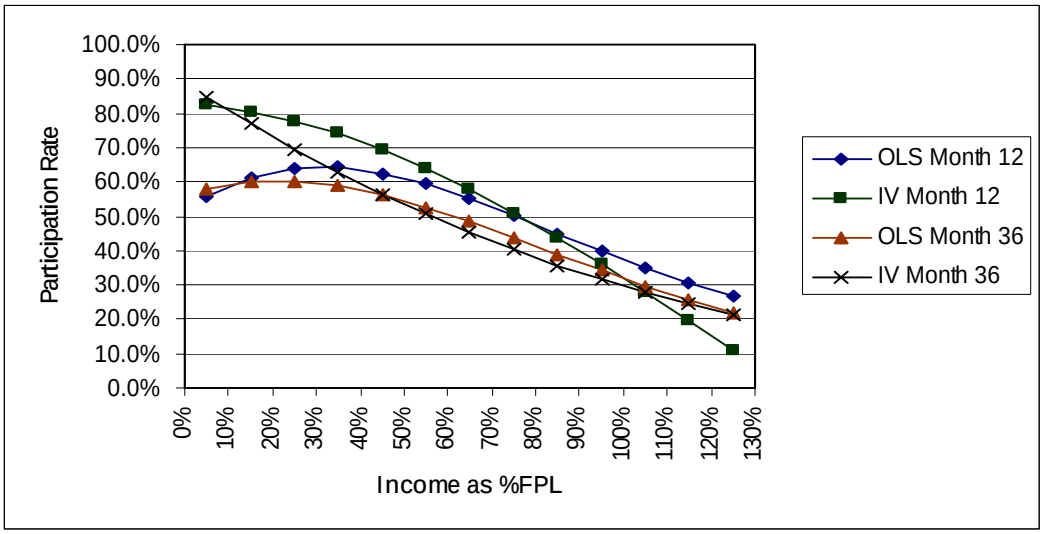
[32] Another well-known problem with the linear probability model is that the model's disturbance is necessarily heteroskedastic. In the presence of heteroskedasticity, the usual OLS and IV formulas for standard errors are biased downward. We have addressed this issue by using robust standard errors (White, 1980).

[33] Technically, the other explanatory variables in the model are also used as IVs, but they essentially serve as IVs for themselves.

the lines derived from the logit models using current month income as the only income variable (not shown).

For both samples, the IV line declines monotonically, and the highest estimated participation rate is for the lowest income level. This is consistent with what we would expect if the lines truly reflected the relationship between participation and expected long-term income. The shape of the IV line for the FSE-12 sample and its location relative to the OLS line for that sample is also consistent with expectations; at the lowest income level, the IV line is well above the OLS line (82 percent participation versus 56 percent), then declines at an increasingly rapid rate as income increases, eventually crossing the OLS line at about 75% FPL, and falling to just 11 percent at 125% of poverty. The shape of the IV line for FSE-36, however, is not fully consistent with expectations. The estimated participation rate declines linearly with income, and the line drops below the OLS line at about 35% FPL, remains below the OLS line until about 105% FPL, then is again above the OLS line.[34]

Exhibit V.8: OLS and IV Estimates of the Relationship Between the Participation Rate and Current Income*



* Household characteristics held constant at the means for non-ABAWD households in the FSE-12 sample.

F. Under-Reporting of Participation

As indicated above, one reason for the gap between participation reported in SIPP and 100 percent participation is under-reporting of participation. It is likely that under-reporting affects both the height and slope of the relationship between expected long-term income and reported participation. As discussed in Chapter II, Bollinger and David (2001) were able to use 1984 SIPP

[34] We estimated the same models using just six instruments, based on mean income in months four to six before and after the current month. Results were quite similar, but participation rates for the lowest income groups were somewhat lower in both samples. This suggests that the instruments based on months that are further away convey important information about permanent income.

data matched to administrative records in several states to show that the negative relationships between participation and their measures of household earnings potential and assets were stronger after correcting for under-reporting than in the absence of a correction. They also found that actual participation of households based on matched administrative records in three states from the first two waves of the 1984 SIPP was 13.8 percent higher than reported (see their Table 4).

Unfortunately, we do not have FSP administrative records, so we can only speculate about the possible effect of under-reporting on the estimated relationship. It is clear that under-reporting is substantial in the SIPP, as estimates derived from SIPP are always lower than those based on administrative data. We do not know the extent of under-reporting for the households in our sample, because estimates based on administrative data for a comparable set of households are not available.

Cunnyngham (2002) reports a participation rate of 57.5 percent for all eligible households in September 1997, based on administrative quality control records (numerator) and the Current Population Survey (CPS). This is 26 percent higher than our estimate of 45.5 percent in the FSE-12 sample. For September 1999 she reports an estimate of 53.0 percent, 38 percent higher than our estimate of 38.5 percent for our FSE-36 sample. Her households include households in which all adults are elderly, which historically have had lower participation rates than others, so a rate for a set of households that is comparable to ours might be even higher than her overall estimate. However, the denominator for her estimate is based on the Current Population Survey (CPS), and she reports evidence that the participation rate would be lower if the denominator were based on the SIPP.[35] The fact that some of her estimates for subgroups are in excess of 100 percent also suggests that her estimates are too high. Also, our use of a sample for which we had 48 complete months of data should reduce the extent of under-reporting based on the Bollinger and David (2001) finding that those who fail to report participation are also more likely than others to attrite from the sample.

This information suggests to us that actual participation for households in our FSE samples is on the order of 10 to 20 percent higher than our estimates indicate. To illustrate how this might affect our results, consider the IV estimate of the relationships between participation and expected long-term income in the FSE-12 sample (Exhibit V.8). If participation is higher by 10 to 20 percent at every income level, then our estimate of the participation rate for households with income at five percent of FPL would increase from 81 percent to 90 - 98 percent, and our estimate at 125 percent of FPL would increase from 11 percent to 12 - 14 percent. While these figures are hypothetical, they do indicate that under-reporting could explain a substantial share of the gap between 100 percent participation and observed participation for low-income households. They also suggest that the estimated relationship between participation and expected long-term income might be substantially stronger than we report.

[35] For 1996, Cunnyngham reports an estimate for the individual participation rate (rather than the household rate) based on a SIPP denominator and an estimate based on a CPS denominator (Figure C.1). The SIPP-based estimate is about six percentage points lower.