Understanding the Dynamic Effects of the SSP Applicant Experiment

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ABSTRACT

In the SSP Applicant Experiment, a random sample of new welfare entrants was informed that if they remained on welfare for a year they would become eligible to receive a generous earnings subsidy. Those who satisfied the waiting period, then left welfare and began working full time within the following year, were entitled to receive payments for up to 36 months whenever they were off welfare and working full time. A simple optimizing model suggests that the program rules created an unusual sequence of incentives: (1) an incentive to prolong the initial spell on welfare to achieve potential eligibility; (2) an incentive to establish subsidy entitlement by finding full time work and leaving welfare in the period from 12 to 24 months after initial entry; and (3) an incentive to choose work over welfare during the three years that subsidies were available. Consistent with these implications, comparisons between the experimental treatment group and a randomly assigned control group show that the program increased welfare participation in the first year after initial entry and lowered it over the following 5 years. We develop an econometric model of welfare participation and program eligibility status that allows us to identify the behavioral effects associated with the program rules. We find important responses to all three incentives. In addition, we find that the impact of the program persisted after subsidy payments ended, though the effect decayed over time.

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Introduction

During the 1990s the Canadian government funded a large scale social experiment to evaluate the feasibility of an earnings subsidy for welfare leavers. The program, known as the Self Sufficiency Project or SSP, was targeted to single parents who had been on public assistance for at least a year.[1] A major concern with SSP (and similar reforms) is that the availability of the subsidy might encourage people to prolong their stay on Income Assistance, raising the ultimate costs of the program. As part of the overall SSP evaluation, a separate experiment was conducted in which a randomized group of welfare applicants was informed that they could receive the subsidy if they remained on welfare for a year. The goals of the Applicant Experiment were to test whether the offer of eligibility would lead to an increase in the duration of welfare spells, and to evaluate the long run consequences of making SSP a permanent feature of the Income Assistance system.[2]

In addition to the one year "waiting period" requirement, the program had a second important time limit. Individuals who satisfied the initial waiting period requirement then had to find a full time job, leave welfare, and begin receiving the subsidy within a year (i.e. during the second year after entering welfare). Those who also achieved this were then entitled to receive subsidy payments in any month they were working full time and off welfare over the next three years. Those who did not lost all future eligibility, and returned to the regular Income Assistance system.

Data for the treatment and control groups of the Applicant Experiment were collected for seven years after random assignment, providing information on the short-term and longer-run impacts of the program on welfare participation and labor market outcomes. Simple comparisons between the groups

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[1]See Michalopoulos et al. (2000).

[2]See Ford et al. (2003) for a description of the Applicant experiment and summary of its main impacts. The importance of considering the potential effect of program benefits on the size of the program caseload has been emphasized in studies of the negative income tax (e.g., Ashenfelter, 1983) and in theoretical analyses of welfare participation (Moffitt, 1996). The existing literature on "entry effects" is summarized in Card and Robins (2004).

show that the offer of SSP raised welfare participation by 2-3 percentage points by the end of the waiting period (Card and Robins, 2004). In subsequent months, however, the welfare participation rate of the program group fell below that of the control group, with a peak impact of about -11 percentage points in the period from 24-30 months after initial entry. This impressive gap faded over time, however. By 48 months after initial entry the impact on welfare participation had fallen to 5 percentage points, and by 84 months the welfare participation rates of the treatment and control groups were nearly equal. The time profile of impacts in the post-waiting period of the SSP Applicant experiment is similar to the profile of impacts in the SSP Recipient experiment, which offered subsidy payments with no waiting period to long-term Income Assistance (IA) participants. Nevertheless the relative size of the effects in the Applicant experiment was larger, since that the behavioral impact was driven by the responses of the roughly one-half of the experimental population that satisfied the waiting period requirement (Ford et al., 2003).

The main objective of this paper is to identify the dynamic impacts associated with the incentives of the various SSP program rules. In particular, we focus on the incentives associated with the rules around the initial 12 month waiting period, the next 12 month window to establish entitlement, and the subsequent 3 year entitlement period. Although the time patterns of the experimental impacts of SSP highlight the importance of the changing incentives over these periods, they do not provide a way of disentangling the various effects on the time profile of the observed impacts.[3] As well as being important for understanding the contributions of the various impacts of the SSP subsidy, more broadly our analysis emphasizes the need to carefully understand and consider the incentives of, and behavioral responses to, alternative program rules when considering policy changes.

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[3]For example, simple comparisons between the treatment and control groups of the Applicant Experiment cannot distinguish these separate incentive effects, since the later effects only apply to a subset of the treatment group. As noted by Ham and Lalonde (1996), even with a randomly assigned intervention the estimation of dynamic impacts requires a full specification of the process generating individual welfare histories.

Our modeling focuses primarily on the impact of SSP on IA participation. To understand the expected pattern of impacts in section II we develop a simple theoretical model of the behavioral effects of the SSP Applicant Experiment on the choice between welfare and work. Extending the dynamic search model developed in Card and Hyslop (2005) for the SSP Recipient Experiment, we show that Applicant Experiment created three incentives: (1) an "eligibility" incentive for everyone in the program group to remain on welfare for a year to become eligible for the subsidy; (2) an "establishment" incentive for members of the treatment group who satisfied the waiting period requirement to find a job and leave welfare within the next 12 months; and (3) an "entitlement" incentive for those who established SSP eligibility to work full time and remain off welfare in the three year period during which subsidy payments were available.

We then present a relatively simple econometric model that incorporates the behavioral reactions to these three incentives. The model has three components: a selection model for determining who survives the waiting period and becomes eligible to receive the SSP offer; a hazard model for determining when and if people who satisfied the waiting period begin receiving SSP payments; and a dynamic panel data model for welfare participation, with separate treatment effects representing the impacts of the establishment and entitlement incentives. This model allows us to distinguish the impacts of the various SSP incentives and estimate the impact of the earnings subsidy on welfare entry and exit rates among those who achieved eligibility.

Our empirical results show that the time profile of the experimental impacts observed in the Applicant study is attributable to a combination of the eligibility incentive (which increased welfare participation during the waiting period), the establishment incentive (which led to a rapid rate of welfare-leaving among members of the program group who satisfied the waiting period requirement), and the longer-term entitlement incentives of the program. We also find evidence that the impact of the subsidy persisted after SSP payments ended, although the effect appears to have decayed substantially by the end

of the follow-up period (2-3 years after all payments ended). Since our analysis of wage outcomes suggests that the program had little permanent effect on wages, we conclude that the persistence of the impacts on welfare participation and employment arose through other channels.

A limitation of our modeling approach is the narrow focus on welfare participation, rather than on a broader set of outcomes, such as welfare and employment status. Over most of the sample period the time profiles of experimental impacts on welfare participation and full time employment are mirror images. Thus we believe that our basic findings can be translated directly into implications for employment. An interesting exception is the effect of the waiting period requirement. Although the waiting period seems to have increased welfare participation in the first year after initial entry into IA, there is no evidence of a corresponding effect on lower employment. Moreover, the fraction of the program group who were on IA and working full time near the close of the eligibility window is about 3 percentage points larger than the fraction of the control group. Taken together, these findings suggest that some people in the program group began working while remaining on IA in anticipation of the subsidy's availability. Such behavior suggests that monitoring systems would have to be improved if SSP subsidies were made a permanent feature of the IA system.

I. The SSP Applicants Demonstration - Description and Overview of Impacts

a. Income Assistance Programs and the SSP Experiment

The income support system for low income families in Canada during the early 1990s, known as Income Assistance (IA), reduced benefits dollar-for-dollar for any earnings beyond a modest set-aside amount.[4] The implicit 100 percent tax rate on earnings and the availability of other benefits for IA recipients (e.g., dental services) reduced the incentives for IA recipients to ever leave the system. Rising

[4]The IA program is operated at the provincial level, but all the provincial programs share several important features, including a dollar-for-dollar benefit reduction rate. See Human Resources and Development Canada (1993) for a

welfare caseloads in the 1980s led to concerns that the system was promoting long-term dependency, in part because of the limited financial incentives for work. In this context the Self Sufficiency Project (SSP) was conceived as a test of a generous time-limited earnings subsidy. The SSP demonstration was designed to evaluate the effects of an earnings subsidy available to long-term IA recipients, and consisted of two main experimental studies: the SSP "Recipient" study (SSP-R), conducted on a sample of long-term welfare recipients;[5] and the SSP "Applicant" study (SSP-A), conducted on a sample of new welfare applicants. The Recipient study was designed to examine both the short- and long-run impacts of the subsidy on the existing stock on long-term welfare recipients; whereas the Applicant study was designed to examine the impacts of the subsidy offer on a new cohort of welfare applicants, with particular focus on possible "entry effects" caused by individuals delaying their exit from IA in order to become eligible for the SSP offer.

As a background to the SSP-Applicant study, it is useful to first briefly summarize the Recipient study. SSP-R was conducted in the provinces of British Columbia and New Brunswick, and involved randomizing a group of single parent IA recipients who had been on welfare for at least a year into either a program group, who were offered the SSP subsidy, or a control group, who remained in the regular welfare system. At least three features of the SSP subsidy offer distinguish it from other work-based subsidy programs. First, payments were restricted to individuals who were off IA and working full time. Second, individuals had to take up the subsidy offer by finding full-time work and leaving IA within a year of joining the program, otherwise they lost all future entitlement. Third, the SSP subsidy was time-limited: those who established eligibility were entitled to receive the subsidy any time over the next three years that they were working full time and off IA.

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detailed inventory and description of income support programs in Canada in the early 1990s.

[5]In addition, there was a smaller demonstration conducted on a subset of the Recipient sample, the SSP "Plus" study, that included both financial incentives and program services. See Lin et al (1998) for a comprehensive description of the SSP Recipients program and results from the first 18 months of the experiment, Michalopoulos et al (2000) for

The Applicant study offered the same package of subsidy benefits as SSP-R to a group of *new welfare entrants* in British Columbia, who were informed that if they remained on IA for the next year (and so become "long term" recipients), they would become eligible for the SSP offer. The primary goal of SSP-A was to determine whether the potential availability of SSP benefits would lead to a significant change in IA leaving behavior by new welfare entrants (see Berlin et al, 1998). A secondary goal was to offer a longer-term perspective on the costs and benefits of SSP, since if it were made a permanent feature of the Canadian welfare system, eventually all the recipients of SSP would be single parents who had entered IA and met the one-year waiting period.

Table 1 summarizes the main features of the Applicant study, including the eligibility criteria for the experimental sample and details of the subsidy formula. Sample members were selected from a pool of single parents aged at least 19 who had recently started a "new" spell of IA. Specifically, they could not have received IA payments in the previous 6 months.[6] After random assignment, members of the program group received a "treatment" consisting of a letter and brochure explaining the SSP program. They were also mailed a reminder letter 7 months after random assignment. Those who satisfied the waiting period requirement by remaining on welfare for a year were then informed of their eligibility and invited to attend a group session to explain the mechanics of the supplement program.[7]

The SSP subsidy formula is equivalent to a negative income tax with a 50 percent tax rate, a "guarantee level" somewhat above average welfare benefits (but independent of family size) and a full-

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a summary of results in the first 36 months, and Michalopoulos et al (2002) for the final report on the experiment.

[6]No further limitations were placed on the sample. Thus, the experimental sample is in principle representative of the population of IA applicants in British Columbia. Roughly 90 percent of people who were contacted to participate in the experiment signed an informed consent decree and completed the baseline survey, and were then randomly assigned (Lin et. al, 1998, p.8).

[7]As explained below, the actual eligibility rule was that people had to receive IA in 12 of the 13 months since their initial entry into IA. This rule allowed for 1 month gaps caused by such features as the receipt of child support payments, which could be large enough to offset IA payments for a month.

time hours requirement.[8] The formula was designed to significantly enhance the financial incentives for work. For example, in 1996 a single parent with one child in British Columbia was entitled to a basic Income Assistance grant of around $1,000 per month. If she were to leave IA and work 35 hours per week at a minimum wage job ($7 per hour), she would earn $1,061 before tax, providing almost no financial incentive to leave welfare. If she was also entitled to SSP, however, she would receive an additional $1,037 in supplement payments (equal to half the difference between her earnings and the benchmark level of $3,135), significantly enhancing the payoff to work. Since subsidy payments were taxable, and also affected daycare costs under the provincial cost formula, the payoff net of taxes and transfers was only about two-thirds as big as the pre-tax payoff, but still relatively large (see Lin et al, 1998, Table G.1).

There were several changes in the background environment in which the SSP-Applicant study operated during the period of the demonstration. First, there was a general improvement in the economic conditions in Vancouver between 1994 and 2000: the unemployment rate dropped from around 9% to 6%, and the minimum wage increased from $6 per hour to $7.60 per hour. Second, and potentially more importantly for the impact of SSP, in 1996 there were significant changes to welfare policy in British Columbia. A key change was the introduction of a $103 per child monthly benefit for all low income families (i.e. irrespective of income assistance status) that was matched by an equal reduction in IA benefits. Other changes included a reduction in the generosity of the earnings disregard for welfare recipients; and changes to the IA application process and eligibility criteria, including a 6-month disqualification from IA benefits for any person who quit a job without "just cause". All of these changes tended to reduce the relative generosity of IA, and could confound the interpretation of the Applicant experiment, since some of the changing impact of SSP could be driven by changes in the background

[8] In a conventional negative income tax with constant tax rate t and guaranteed (or minimum) income G, an individual with earnings y receives a subsidy of G-ty. This is equivalent to an earnings supplement equal to t times the difference between actual earnings and the "break-even" level B = G/t .

income support system (rather than the dynamic incentives of SSP) . The quit disqualification also potentially affected the dynamic incentives associated with taking a job, and thus could affect the behavior of the SSP program and control groups differentially.

Although the SSP payment formula is relatively straightforward, the other eligibility requirements, including the waiting period and the time limit on starting subsidy payments, are more complex. Before turning to a more detailed analysis of these incentives, we summarize some of the key experimental findings from the SSP-Applicant study.

b. The SSP-Applicant Sample Characteristics

Data for the Applicant experiment evaluation were derived from three sources. Information on IA participation and payments was obtained from provincial administrative records. SSP participation and supplement payment data were collected from SSP administrative records. Finally, demographic and labor market outcome data were obtained from surveys conducted at regular intervals, beginning with a baseline survey just prior to random assignment, and four follow-up surveys at 12, 30, 48, and 72 months post-assignment. The experimental sample consisted of 3,315 individuals, 1,667 in the control group and 1,648 in the program group. Of these, we have excluded 32 observations whose records show either no IA receipt in the six months before or after the date of random assignment, or an unusual gap between the date of entry into IA and the date of random assignment.[9] This leaves us with an analysis sample of 3,283 observations: 1,651 in the control group, and 1,632 in the program group.

Table 2 provides an overview of the characteristics of our analysis sample, with comparisons to the overall population of lone parents in Vancouver in the 1996 Canadian Census. Column 1 shows the

[9]We exclude 5 observations who had no IA receipt within 6 months of random assignment (3 controls and 2 programs); 1 control group observation whose first month of IA receipt was 5 months prior to random assignment; 23 observations who began receiving IA 4 months prior to random assignment (12 controls and 11 programs); and 3 program group observations whose records show that they first received IA in the month after random assignment.

mean characteristics of the Census sample, while columns 2 and 3 show the mean characteristics of the SSP control and program groups respectively. Columns 4 – 7 compare the characteristics of specific SSP subgroups, according to whether or not they satisfied the waiting period rule for potential SSP eligibility. Finally, the last two columns in the table (8 and 9) describe the subgroups of the SSP-eligible program group, classified by whether they did or did not successfully initiate subsidy payments within the allotted time frame.

As expected given random assignment, the baseline characteristics of the program and control groups in columns 2 and 3 are statistically indistinguishable. The SSP-A sample is 90 percent female, with an average age of 32.5 years and an average of 1.5 children. About a quarter of sample members had never been married, 30 percent were foreign-born, and one-third grew up in single parent families. There are some notable differences between SSP-A sample and all lone parents in the Vancouver area. Applicants are more likely to be female and foreign born, more likely to have pre-school children, and less likely to be working or to hold a University degree. In general these differences are expected, since welfare applicants presumably over-represent the population with lower earnings potential. There are also some interesting contrasts between the SSP-A sample and the sample in the SSP-Recipient study (see Table 2 in Card and Hyslop, 2005). People in the Applicant experiment had more previous work experience, were more likely to be working at random assignment, were more likely to have been ever married, and had much lower previous welfare use. These and other differences confirm that new welfare applicants differ substantially from the existing stock of long term recipients, and underscore the importance of understanding how SSP affected new welfare applicants.[10]

Most of the SSP-A sample (70 percent) were randomly assigned in the month after their IA reference spell began, but 7 percent were assigned in the same month their spell started, 20 percent were

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[10] SSP-A was only conducted in one of the two sites used in SSP-R. However, this does not explain much of the difference in characteristics of the sample members in the two experiments.

assigned 2 months after the start of the spell, and 3 percent were assigned after 3 months. This means there is some variation between "months since random assignment" and "months since initial entry into welfare". Since SSP eligibility rules relate to timing from the start of an individual's spell, in this paper we normalize all dates to be relative to the start of the reference spell.[11]

The next four columns of Table 2 describe the characteristics of the ineligible and eligible subsets of the control and program groups – i.e. the subsets that did-not and did satisfy the waiting period requirement. (Of course members of the control group were not actually eligible.) Overall, 57 percent of the program group satisfied the waiting period requirement to become eligible compared to 54 percent of the control group, implying a 3 percentage point (or 3/46=6.5 percent) delayed exit response to the offer of SSP. Looking within the program group, those who became eligible were younger, less educated and less likely to be working at the baseline than those who did not. It is also interesting to compare the eligible program group to people in the control group who satisfied the eligibility criteria even though they could not receive the subsidy: The eligible group is comprised of this "windfall" group and a smaller group of "delayed exiters" who changed their behavior to become eligible (approximately 3/57 of the group). Perhaps because the windfall group is so large, however, there are few notable differences between the eligible program group and the potentially eligible control group.

The SSP program group can be further classified into three mutually exclusive subgroups: the subgroup who left IA and were "not eligible" for payments (shown in column 6, and consisting of 701 individuals, or 43% of the sample); the "eligible, non-entitled" subgroup who satisfied the initial waiting period but didn't establish entitlement during the next 12 months for the subsidy (shown in column 8, consisting of 544 individuals, or 33% of the sample); and the "eligible, entitled" subgroup who did

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[11]The Data Appendix discusses this and other data issues. In particular, we adopt the convention that month 0 corresponds to the first month of IA receipt in the reference spell. The delay between entry into IA and random assignment varied complicates the interpretation of the program group's behavior, since people could have been on IA for 0, 1, 2, or 3 months before finding out about their program status. This issue is discussed in Card and Robins (2004), but we ignore it here.

establish entitlement by finding fulltime work and leaving IA in the next 12 months (shown in column 9, consisting of 387 individuals, or 24% of the sample). Comparisons across the 3 subgroups suggest that ineligible group has the most favorable labor market characteristics at the baseline interview (e.g., the highest level of previous work experience, the highest likelihood of a college degree, and the lowest fraction with a child under 6), whereas the eligible non-entitled subgroup had the worst labor market characteristics, with the eligible entitled group somewhere in between. This ranking is consistent with the "two-sided selection" of the eligible entitled group. The most "job ready" people presumably left before achieving eligibility, whereas the least "job ready" of the eligible subgroup could not move to full-time employment quickly enough to become entitled to SSP.

c. Experimental Impacts on Welfare

The experimental impact of the SSP program on IA participation is described in Figure 1a, which shows the average IA participation rates of the control and program groups, together with the estimated program impact (calculated as the difference between the program and control group), in each month from the start of the IA reference spell (month 0) until the end of the time window in which data are available for all sample members (month 84). The delayed-exit effect of the SSP offer is illustrated by the positive program impact on IA participation in months 3-13: this impact rises to 3 percentage points near the end of the waiting period. After month 13 the IA participation rate of the program group drops relatively quickly, leading to a negative program impact that peaks in absolute value at –11 percentage points in month 27. This negative impact persists but declines steadily in size to only –3 percentage points in month 60, at which point all SSP payments have ended. The impact continues to decline gradually and is negligible by month 84.

Figures 1b and 1c plot the welfare exit and entry rates of the control and program groups over this

same period.[12] Because of the selective nature of the risk sets for exit and entry, the differences between the rates of the two groups are not strictly experimental impacts. However, the patterns of differences between the program and control groups are consistent with the impacts on IA participation. Specifically, the program group's exit rate was up to 1 percentage point lower than the control group's over the initial eligibility period, then averaged about 2 points higher in the following 12-18 months, about 1 point higher from month 18 to month 72, and finally turned negative (about –0.5 points) in the final 12 months or so of the period. The higher exit rate of the program group over the interval from 60-72 months is suggestive of a persistent program impact beyond the end of SSP payments. The IA entry rates in Figure 1c show broadly patterns. The program group's welfare entry rate was 1-2 percentage points higher than the control group's over the initial eligibility period, then averaged about 0.5 points lower in the next year or so. The gap in entry rates was on average slightly negative over the period from month 24 to month 60, and then was essentially zero over the final 24 months of the experimental sample period.

We next examine the behavior of the "entitled" program subgroup around the events corresponding to the beginning and the end of the SSP entitlement period. Figure 2a shows the IA participation rate, full time employment rate, and the fraction receiving SSP payments during the event window from 12 months before the first month of SSP receipt to 12 months after. The fraction receiving supplement payments drops from 1 to around 0.7 by month 6 and is then steady over the following 6 months. The full time employment rate rises steeply from about 0.2 4 months prior to receiving any supplement to about 0.7 in the month prior, and then settles around this level. IA participation falls gradually during the 12 months prior to initial supplement receipt, reaching about 0.8 just before the start of SSP payments. It then falls steeply over the next 3 months, reaching a low of about 0.1. This reflects the SSP program rules, which required supplement receivers to leave welfare, coupled with lags in the IA

[12] The exit and entry rates are simply calculated as the fractions of exits from IA, and entries to IA, respectively in each month. These rates are then smoothed to reduce the level of noise by calculating the simple 3-month centered moving average rate for each.

payment process (which issues checks based on retrospective eligibility). After the initial dip, the fraction on IA rises slightly over the subsequent 6-12 months. These patterns suggest that employment anticipates SSP subsidy receipt by1-2 months, while exit from IA tends to lag receipt of the subsidy by 1-2 months, as was the case for the Recipient study (shown in Card and Hyslop, 2005).

In Figure 2b we conduct a similar event study around the data of expiration of SSP entitlement. During the last year of entitlement the average full time employment rate falls from 0.7 to near 0.6 in the 33rd month (after the first SSP payment). Surprisingly, however, there is no drop-off at month 36. In contrast, the fraction receiving SSP payments, which moves in parallel to the full time employment rate over months 24-33, shows the expected drop to zero in month 37. IA participation also rises slightly over the period from month 26 to 32, but shows no change at month 36. Nor is there any evidence of a rise in welfare entry rates (though the series is relatively noisy). These results contrast with the results of a similar event study for the Recipient experiment (Card and Hyslop, 2005), which shows a sharp drop in full time employment and a corresponding spike in IA entry at precisely the end of SSP entitlement. The lack of a change in IA behavior at the end of entitlement in the Applicant experiment is consistent with the smooth trend in the program impact in Figure 1a between months 48 and 60, and suggests that responses to the program did not immediately stop when payments ended.

d. Experimental Impacts on Labor Market Outcomes

We use the labor market data collected in surveys at 12, 30, 48 and 72 months after random assignment to measure the impacts of SSP on employment and monthly earnings of the program participants, and also to construct the mean hourly wages of the two groups in each month. Unfortunately, response rates to the surveys were incomplete (only 70% of the initial sample responded to the 72 month survey). Moreover, labor market data are only available for 74 months after initial entry into welfare for most people in the sample. The shorter sample window makes it particularly difficult to

assess the long run impacts of SSP on labor market outcomes.

Figure 3a compares the full-time employment rate of the program group with that of the control group over months 0-74. Note that the rate for both groups starts out at just over 10 percent and that the control group's rate rises steadily over time. In light of the results in Figure 1a showing the program group's IA participation rate is higher than the control group's over the first 12 months corresponding to the SSP eligibility period, it is surprising that the full-time employment rate of the program group is actually slightly above that of the control group during this period. The combination of a higher IA participation rate and a similar full time employment rate suggests that some program group members may have been accepting full time work but remaining on IA in order to retain SSP eligibility. Simple calculations shown in Table 3 support this suspicion. For example, during the eligibility period following IA entry, 9.3 percent of the program group was on IA and working full time on average, versus 7.8 percent of the control group, and this accounts for most of the impact on IA. Furthermore, almost all of this appears to be due to differences between the "eligible" subgroups (consisting of those who satisfy the initial waiting period): e.g. 9.2 percent of the "eligible" program group was on IA and working full-time in any month versus only 6.5 percent of the eligible control group, while the fractions of the program and control ineligible groups are about the same (9.3 percent). A question that naturally arises is whether the higher rate of coincident IA-participation and full-time work is associated with either lower earnings and/or lower IA payments? The evidence in Table 3 is inconclusive on this issue, although the results may be confounded by the selective nature of the comparison groups, and there is comparatively large sampling variation associated with the small samples.

Following the end of the eligibility period in month 12, the program group's full time employment rate rises steeply during the next year or so, resulting in a peak impact of 11 percentage points in month 26. The control group's employment rate then rises less quickly than the control group's, and the impact falls gradually to 5.5 percent by the end of the entitlement period (month 60), and 2.5

percent in month 74. Thus, apart from the anomalous behavior during the waiting period, the impacts of SSP on full time employment and welfare participation are roughly mirror images.

Figure 3b compares the average hourly wage rates of the employed subgroups of the control and program groups.[13] This figure shows that program group members who were working in the waiting period (months 1-12) and during the SSP establishment window (months 13-24) earned slightly higher average wages than control group members. The average wage difference in months 1-20 is 30-70 cents per hour, or about 3-6 percent. Average wages for the two groups converge by month 24, and track pretty closely after that. This pattern of mean wages is quite different than the pattern observed in SSP-R. In that experiment, the average wages of the program group were typically below the wages of the control group, with a gap that was larger in months with a bigger gap in employment between the two groups. In contrast, the difference in mean wages in Figure 3b is essentially uncorrelated with the gap in full time employment in Figure 3a, or with the difference in overall employment rates.

In Card and Hyslop (2005), we showed that under certain assumptions it is possible to estimate the "average marginal wage" for the extra hours generated by the SSP program. Specifically, under the assumptions that SSP had no effect on wages for people who would have worked in the absence of the program, and that SSP had only positive effects on hours, the ratio of the program impacts on earnings and hours gives an estimate of the average marginal wage. We used this procedure to estimate the average marginal wages for the SSP-induced hours in each month of SSP-A. Consistent with the patterns in Figure 3b, the average marginal wage is slightly above the average wage of control group workers in the early months of the experiment, but tracks the mean wages of the control group very closely in the later months. Again, this is different from the results of a similar analysis in the SSP Recipient experiment (Card and Hyslop, 2005, Figure 5) which shows average marginal wages very close to the minimum

[13] For reference, average hourly earnings in our 1996 Census sample of lone parents in Vancouver were about $21 per hour.

wage. We infer that the Recipient experiment induced people with relatively low wage opportunities to leave welfare, whereas the offer of SSP in the Applicant experiment affected people with average wage or even above-average wage opportunities.

Figure 3c compares the average monthly earnings of the control and program groups. In months 1-12 average earnings are quite similar for the two groups. Given that the employment rates of the two groups are roughly equal and the program group has somewhat higher hourly wages, this suggests program group members have lower hours of work on average. The program group's earnings rise steeply relative to the control group over the following 12-18 months, with a peak difference of $220 per month in month 26, equivalent to 40 percent gain in monthly earnings for the program group relative to the controls. The earnings difference then declines over months 26-48, and finally stabilizes at about $100 per month over the remainder of the sample period.

An interesting and somewhat puzzling feature of the SSP Applicant experiment is the apparent persistence in the program's impact on earnings. Although the impact on IA participation is much smaller in month 74 than in month 42, (and likewise for full-time employment), the impact of earnings is remarkably stable in the last 30 months of the sample period. We are unsure of the reasons for this gap. In any case, the persistence in earnings is quite different from the pattern in the SSP Recipient experiment, which showed minimal impacts on employment or earnings within a year of the end of supplement payments.

II. A Simple Model for the Behavioral Impacts of the SSP-Applicants Experiment

The set of program rules in the SSP-Applicant experiment have strong implications for understanding the incentives and interpreting the experimental impacts of the program. First, the initial 12 month waiting period requirement to become eligible to receive the SSP offer creates an eligibility incentive for individuals to delay their exit from IA. Second, those who become eligible to receive the

SSP offer then face an incentive to establish entitlement for the subsidy within the next 12 months or lose their future entitlement. Third, having established entitlement, there is an entitlement incentive to work full time and stay off IA during the following 3 years. Although the time patterns of the experimental impacts of SSP shown in the previous section highlights the importance of these three distinct incentives, they do not provide a way of disentangling the various effects on the time profile of the observed impacts. The main objective of this and the next section is to develop a theoretical and empirical framework to decompose the time varying observed impacts into contributions attributable to each of these incentives.

We begin by outlining a simple theoretical model of work and welfare participation in the presence of the subsidy program to help clarify the various incentive effects of the SSP-Applicant experiment. This model extends the simple search model developed in Card and Hyslop (2005) for the SSP-Recipient experiment to incorporate behavior over the initial 12-month period from the start of a new welfare spell to the close of the waiting period for SSP eligibility. Thus we provide a relatively brief description of the Recipient model and extensions for the Applicant study here. Although this model forms the basis for our interpretation of the impacts of the SSP-A study, there are several important caveats that we discuss before turning to econometric specification and results in the next section.

The model is a standard discrete time search model (e.g., Mortensen, 1977, 1986) in which a risk neutral single parent has two mutually exclusive options, welfare participation or full time employment, and individuals maximize expected future income using a monthly discount rate of r. Welfare pays a monthly benefit $b and yields a flow payoff of b. Full time employment at a monthly wage of $w yields a flow payoff of w-c, where c reflects the disutility of work relative to welfare (including child care costs, work expenses, the value of foregone leisure, and potential stigma effects). The model assumes constant rates of job arrival (for workers and nonworkers) and job destruction (of new and existing jobs),[14] and that

[14]A key simplifying assumption is that wage opportunities do not depend on previous work effort. Based on the fact that the average marginal wage for hours of work attributed to SSP does not rise relative to the mean wage of the control group, we believe this assumption is reasonable.

wage offers are drawn from a stationary distribution.

In the absence of a wage subsidy program optimal behavior in this model is characterized by a stationary value function U(w) that gives the discounted expected value associated with a job paying wage w, and a value V^0 of welfare participation. Individuals employed at a wage w accept any offer paying more than w, while those on welfare follow a reservation wage strategy and accept any job paying more than R, defined by $U(R)=V^0$. Under the assumptions of the model it is readily shown that the reservation wage is R=b+c (see Card and Hyslop, 2005, for details).

If an SSP subsidy is made available, an eligible individual currently on welfare has to evaluate three separate value functions: $V_i(t)$, the value of not working in month t, conditional on not yet having established entitlement; $U_e(w,d)$, the value of a job paying a wage w conditional on SSP-entitlement with d months of elapsed entitlement; and $V_e(d)$, the value of not working conditional on entitlement with d months of elapsed entitlement. The rules of SSP provide a link between these functions and the value functions in the absence of the program. In particular, $V_i(t)=V^0$ for $t\geq 13$, and $U_e(w,d) = U(w)$ and $V_e(d) = V^0$ for all $d>36$, because of the time-limited (12 month) establishment and (36 month) entitlement periods respectively. A revealed preference argument establishes that $U_e(w,d) \geq U(w)$ for all w and any $d\leq 36$, since the subsidy paid to a worker earning a wage w is strictly positive. From this it follows that $V_i(t)$ is decreasing in t since less time is available to establish entitlement, and that $U_e(w,d)$ and $V_e(d)$ are both decreasing in months of elapsed entitlement since the entitlement period is finite.

As in the absence of a subsidy, people who are SSP-entitled and working accept any job offer that pays more than their current wage, while those who are on welfare with d months of elapsed entitlement follow a reservation wage strategy and accept any job paying more than $R_e(d)$, defined by $V_e(d) = U_e(R_e(d),d)$. Since people can quit jobs that are no longer acceptable once their SSP entitlement ends, the optimal reservation wage for an SSP-entitled nonworker equates the net income from a reservation-wage job to the flow value of welfare, b+c. Since b and c are fixed, R_e is independent of d and is defined by the

equality $R_e+s(R_e) = b+c$, where s(w) is the subsidy for working at a wage rate w.[15]

Furthermore, SSP-eligible individuals who are still on welfare in month t and not yet established SSP entitlement have a reservation wage R(t) satisfying the condition $V_i(t) = U_e(R(t),1)$. It follows from this, and the fact that $V_i(t)$ is decreasing in t, that the reservation wage R(t) is decreasing in t: i.e. eligible individuals with fewer months to establish entitlement will accept lower wage jobs. Moreover, the reservation wage in the first month of eligibility, R(1), is strictly less than the reservation wage once entitled, since a full-time job for someone who is not yet entitled provides the same flow benefits as for someone who is entitled, and also guarantees future eligibility: i.e. $R_e > R(13) \geq R(14) .... \geq R(24)$.

Extending this search model to the Applicant case requires modeling dynamic behavior over the pre-eligibility waiting period that covers the first 12 months of a welfare spell. During this period, a potentially eligible individual has to evaluate the following two value functions: $V_i^P(t)$, the value of welfare in month t conditional on not having left welfare and being potentially SSP-eligible; and $U_i^P(w,t)$, the value of taking a job paying wage w in month t and also losing eligibility, conditional on being potentially eligible before taking the job. First, note that $V_i^P(12) = V_e(0) \geq V^0$, since SSP-eligibility is achieved after 12-months, and so the value of not working in month 12 is the value of not working conditional on eligibility with 0 months of elapsed eligibility. Similarly, $V_i^P(t) \geq V^0$ for t=1, ..., 12, since there is a positive option value to being on welfare and potentially SSP-eligible relative to being on welfare without SSP-eligibility. Second, note that $U_i^P(w,t) = U(w)$ for t=1, ..., 12, since if someone takes a job before achieving SSP-eligibility they lose their eligibility. Thus, the value of working is the same as in the absence of SSP. The reservation wage for an individual still on welfare after t months, $R^P(t)$, satisfies the condition: $V_i^P(t) = U_i^P(R^P(t),t) = U(R^P(t)) \geq V^0$. This implies that $R^P(t) \geq R$, since the reservation wage for someone who remains potentially SSP-eligible is greater than in the absence of SSP.

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[15]Since $s(w)\geq 0$, the reservation wage for those with SSP-entitlement is below the reservation wage R in the absence of the program. Indeed since $R=b+c$, we have that $R_e+s(R_e) = R$. Note that R_e could be below the minimum wage, however SSP rules required participants to earn at least the minimum wage.

Furthermore, the reservation wage rises during this pre-eligibility period because the present discounted value of the option value associated with achieving SSP-eligibility increases as the eligibility date approaches – i.e. $R^P(t+1) \geq R^P(t) \geq R$, for t=1, ..., 11.

The effects of SSP on the welfare/work decision can be summarized by the difference between the reservation wage profiles of a representative welfare recipient in the presence or absence of SSP. Figures 4a-c show the reservation wage R=b+c in the absence of SSP, together with the sequence of reservation wages for a recent welfare entrant who is offered potential SSP eligibility, under three scenarios. Figure 4a shows the sequence for someone who leaves welfare during the 12 month waiting period and therefore loses SSP eligibility. Figure 4b describes the sequence for someone who stays on welfare for the full 12 month waiting period and becomes eligible for the SSP offer, but fails to establish entitlement. Finally, Figure 4c shows the sequence for someone who becomes eligible for SSP and successfully establishes entitlement for the subsidy in month t_e.

During the 12 month waiting period the reservation wage of someone who is potentially eligible for SSP is above R and increasing. From month 12 to month 24 (the entitlement window), the reservation wage for someone who is SSP-eligible is below R and declining. For those who establish entitlement, the reservation wage immediately jumps up (at month t_e) and then remains constant over the entitlement period. In all cases the reservation wage reverts to R=b+c, either after potential eligibility is lost (for those who leave welfare in the pre-eligibility period), or at the end of the entitlement window (in month 24) for those who become SSP eligible but fail to establish entitlement, or in month t_e+36 for those who do successfully initiate supplement payments between month 12 and 24.

The path of the optimal reservation wage illustrates the three different incentive regimes experienced by members of the SSP-A treatment group. First, during the 12 month waiting period members of the treatment group have a high and increasing reservation wage relative to members of the control group, leading to a slower exit rate from welfare. Although the SSP rules allowed individuals to

be off-welfare for a single month during the first year and still maintain eligibility, loss of eligibility is essentially determined by the first exit from welfare during this period. This has implications for modeling the pre-eligibility waiting period, which we discuss in the next section in the context of our econometric modeling. Second, for program group members who become eligible, there is a low and declining reservation wage up to the establishment of entitlement in month t_e, or 24 months after the start of the reference spell for those who don't establish entitlement, leading to a faster rate of transition from welfare to work than would be expected in the absence of SSP. Finally, those who establish entitlement then adopt a higher reservation wage, but still lower than in the absence of SSP, implying that they are more likely to leave welfare and re-enter work than otherwise similar members of the control group. The jump in the reservation wage at t_e implies that some people who accepted low-paying jobs to gain eligibility would be expected to quit and return to welfare almost immediately. Once SSP eligibility or entitlement ends, the reservation wage returns to its level in the absence of the program and the behavioral effects of SSP disappear. Again, as a result of the jump in the reservation wage at the close of entitlement, people holding jobs paying less than the reservation wage in the absence of SSP would be expected to quit and re-enter welfare.

The model is a clearly oversimplified description of the potential effects of SSP, and does not capture several important facets of the environment in which it operated and participant behavior. First, as discussed in Card and Hyslop (2005), the model assumes that the cost of work is constant over time and unaffected by previous work experience. A model with habit persistence might imply that individuals who work more when SSP is available eventually lower their reservation wages, leading to a persistent effect on employment and IA. In our empirical model (described below) we incorporate a post-entitlement treatment effect that we interpret as a habit persistence effect (given the lack of any effect of SSP on wage opportunities).

The model also assumes that people either receive welfare or work full time when, in fact, some

people work full time without leaving welfare (see Table 3), and others leave welfare *without* entering full time work. In our empirical model, we distinguish between leaving welfare and becoming SSP-entitled to allow for this. Closely related to this point, the model assumes that individuals either accept or turndown job offers as they arrive, and that they have no ability to "inventory" an offer until sometime in the future. This may be particularly important during the initial eligibility period if, e.g., members of the program group are able to find and accept a job but negotiate to delay their start date until after the waiting period has ended so as to stay on IA and not lose their eligibility to receive the SSP offer. Although there are several possible implications of this for modeling purposes, one particular hypothesis that we consider is that such inventorying behavior during the eligibility period should be associated with a high SSP establishment rate as people accept jobs shortly after the eligibility period ends. To the extent that people could actually take a full time job and remain on welfare the issue of inventorying of job offers is moot. From the point of view of modeling SSP entitlement and IA behavior, however, whether delayed exiters actually took a full time job or only held on to the offer of a job is not important, since in either case we expect to observe a rapid transition to entitlement and an associated move off welfare as soon as the eligibility waiting period is over.

Finally, the model predictions are susceptible to the welfare policy changes that occurred in British Columbia over the period. As discussed earlier, these changes tended to reduce the level of generosity associated with welfare in general. Also, the 6 month disqualification period for IA applicants who quit a job without just cause, introduced in 1996, would likely affect the predictions of the model that some program groups members may quit their job and return to IA after the ends of the both the establishment period (at 24 months) for those who just establish entitlement, and/or the entitlement period when the subsidy expires.

It is worth emphasizing that in this stylized model SSP causes higher employment and lower IA participation in the post-waiting period by inducing people to accept lower wage jobs than they would in

the absence of the program. This prediction may seem inconsistent with the results in Figure 3b, which imply that the extra jobs attributable to SSP paid roughly "average" wages. There is not necessarily an inconsistency, however, since it is possible that the single parents induced to work in the Applicant experiment were those with relatively high wage opportunities *and* relatively high reservation wages in the absence of SSP.

III. An Econometric Framework for Estimating the Impacts of SSP on Welfare

a. Overview

In this section we turn to the specification of an econometric model for estimating the impacts of SSP on welfare participation. Our model starts with a logistic probability model for monthly welfare participation in the absence of SSP, with second order state dependence and a relatively simple specification of unobserved heterogeneity. Although other approaches are feasible (such as a two-state hazard model framework), the data from the SSP experiment are recorded on a monthly basis, so a discrete panel data approach is not particularly restrictive.[16] Moreover, as we show in the next section, this class of models provides a relatively successful description of the observed behavior of the experimental groups.

Building on the insights developed in the previous section, we extend this model to the program group by incorporating three sequential incentives: an incentive to remain on IA in the qualification period; an incentive to find a job and leave IA in the immediate post-eligibility period (for those who satisfied the waiting period requirement); and an incentive to stay off welfare during the three year period of SSP entitlement (for those who satisfied the waiting period and found a full time job within the next year). In recognition of the pattern of experimental impacts observed in Figure 1, we also estimate

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[16] Efron (1988) shows that in a conventional hazard model setting in which the data are recorded in discrete time, a simple logistic model for the failure event has many attractive features. We are unaware of a similar analysis for the "two state" case.

models that include a post-entitlement effect for those who received SSP payments.

As noted in our discussion of the theoretical model, one possible reaction to the offer of SSP eligibility is to accumulate an inventory of deferred job offers during the waiting period and then take the best one that is still available immediately after achieving eligibility. We incorporate this possibility by assuming that some fraction of program group who delayed their exit from welfare to achieve SSP eligibility began receiving supplement payments very soon after the end of the waiting period. To simplify the associated empirical model, we do not explicitly model welfare participation in the first 12 months after initial entry into the IA system.[17] Instead, we collapse the first 12 months into a single period, summarized by whether or not the individual was still potentially eligible for SSP at the end of the period. We combine this with a model of IA participation in months 13-84 and a model for the process of initiating SSP payments among members of the eligible program group.

b. SSP Eligibility, SSP Entitlement, and Welfare Dynamics

Formally, we summarize the welfare outcomes and SSP status of the program and control groups with three sets of variables: a dummy variable S_i indicating whether individual i was still potentially eligible for SSP at the end of the 12 month waiting period; a sequence of dummy variables ($E_{i13}, E_{i14}, \ldots, E_{iT'}$) indicating whether or not the individual was entitled to SSP payments as of the start of month t (with T' denoting the last month of potential entitlement); and a sequence of dummy variables ($y_{i13}, y_{i14}, \ldots y_{i84}$) indicating IA participation in each month from 13 to 84 months after initial entry into IA. Building on the model developed in Card and Hyslop (2005), we assume that differences across the experimental population are summarized by a one-dimensional (or possibly multi-dimensional) random

[17] Card and Robins (2004) present a series of models examining the behavior of the program and control groups of the Applicant experiment in the first year after random assignment.

effect α_i.[18] Since treatment status is randomly assigned, we assume that the distribution of random effects is the same for the program group (indicated by P_i=1) and the control group (indicated by P_i=0).

For a given value of the random effect, we assume that eligibility status is determined independently of subsequent SSP receipt or IA participation, that entitlement status of the eligible program group is determined independently of current or lagged IA participation; and that IA participation depends on lagged participation and current and lagged entitlement status. Specifically, we assume that the joint probability of eligibility status, entitlement, and IA participation, conditional on program group status, is given by a model of the form:

$$P(S_i;\ E_{i13,}E_{i14,}\ldots E_{iT};\ y_{i13,}y_{i14,}\ldots y_{i84} \mid P_i)$$

$$= \int_{\alpha}\left\{P(S_i \mid P_i,\alpha_i).\prod_t P(y_{it},E_{it} \mid y_{it-1},\ldots,E_{it-1},\ldots,S_i,P_i,\alpha_i)\right\} f(\alpha_i)d\alpha_i$$

$$= \int_{\alpha}\left\{P(S_i \mid P_i,\alpha_i).\prod_t P(E_{it} \mid E_{it-1},\ldots,S_i,\alpha_i).P(y_{it} \mid y_{it-1},y_{it-2},E_{it},\ldots,S_i,P_i,\alpha_i)\right\} f(\alpha_i)d\alpha_i$$

where $f(\alpha_i)$ represents the probability distribution of the random effect. We adopt the convention that a higher value of α_i is associated with a higher probability of IA participation. In particular, we assume that α_i represents a person-specific intercept in the model for $P(y_{it} \mid y_{it-1}, y_{it-2}, E_{it}, E_{it-1},\ldots, P_i, \alpha_i)$. We make two alternative assumptions on the distribution of random effects: that $f(\alpha_i)$ is a normal density, with mean 0 and standard deviation σ; or that $f(\alpha_i)$ is a discrete distribution with a relatively small number of points of support (Laird, 1978; Lindsay, 1983a, 1983b; Card and Sullivan, 1988).

Modeling SSP Eligibility

For an individual to be potentially eligible for SSP, the rules required that they receive IA for at least 12 of the 13 months from the start of their reference spell. Thus, we would expect eligibility status

[18] Thus, we ignore any observable components of heterogeneity, such as age, gender, or education.

to be highly correlated with the intercept in the welfare participation model. In our normal heterogeneity models we assume that the probability of eligibility is given by:

(1a) $P(S_i=1 \mid P_i, \alpha_i) = logit [\ \delta_0 + \delta_1 \alpha_i + \delta_2 P_i + \delta_3 P_i \alpha_i\ ],$

where logit[x]=exp[x]/(1+exp[x]) represents the logistic distribution function. For members of the control group this probability depends on the index $\delta_0 + \delta_1 \alpha_i$. We expect $\delta_1>0$, reflecting the correlation of eligibility status with the latent propensity to remain on IA. The index for the program group includes an intercept shift δ_2 and an interaction $\delta_3 \alpha_i$. Since members of the program group had an incentive to delay their exit from IA, we expect $\delta_2>0$. The sign of δ_3 depends on whether high or low propensity welfare users respond more or less to the SSP delayed-exit incentive. In our discrete heterogeneity models, we consider a generalization of (1a) that allows different probabilities of eligibility in the treatment and control groups for each value of the random effect:

(1b) $P(S_i=1 \mid P_i, \alpha_i) = logit [\ \delta_1(\alpha_i) + \delta_2(\alpha_i) P_i\ ],$

where $\delta_1(\alpha_i)$ and $\delta_2(\alpha_i)$ take on separate values for each value of α_i.[19]

Modeling SSP Entitlement

For members of the program group who attained SSP eligibility, the second part of our model describes the sequence of dummies indicating when (and if) they successfully initiated SSP payments. Conceptually, the eligible program group can be divided into two subgroups: those who would have been eligible even if they were assigned to the control group (which we refer to as the "windfall-eligible" subgroup); and those who delayed their IA exit behavior in order to gain SSP eligibility (the "delayed exiters").[20] Although we cannot identify which subgroup a given individual belongs to, we posit separate behavior for each subgroup, and assume that the observed behavior of the eligible program group

[19] Note that this is equivalent to assuming that heterogeneity is summarized by a three dimensional vector with discrete points of support.

[20] The eligibility rates of the control and program groups are 54.1% and 57.0%, respectively. Hence the delayers represent about 5.1% (= 100*(57.0-54.1)/57.0) of the eligible subgroup.

represents an (appropriately weighted) average of the two subgroups.

For people in the windfall-eligible subgroup we follow Card and Hyslop (2005) and assume that the sequence of establishment dummies follows a simple hazard process:

$$(2a)\quad h_t(\alpha_i) = P(E_{it}=1 \mid E_{it-1}, E_{it-2}, \ldots; \alpha_i) = \Phi[\, d_{E0} + d_{E1}(t-13) - k\,\alpha_i\,] , \qquad E_{it-1}=0 \text{ and } 13 \le t \le T'$$

$$= 1, \quad E_{it-1}=1$$

$$= 0, \quad E_{it-1}=0 \text{ and } t>T',$$

where Φ is the standard normal distribution function. This model implies that the hazard of initiating SSP payments depends on a linear trend and on the heterogeneity component α_i through the factor loading k. In our models with discrete heterogeneity we also consider a generalization of equation (2a) that includes a separate intercept for each value of the random effect. The SSP rules stated that after achieving eligibility people in the program group had one year to find a fulltime job and initiate supplement payments, implying that T'=24. In the available data files, however, we only know the date of each person's first SSP check. We assume that the date of the first check is two months after the date of actual entitlement. Even under this assumption, there are many people with late entitlement dates. To allow for administrative delays and other sources of slippage we set T'=26, implying a 14 month entitlement window (see the Data Appendix for further discussion). We censor the establishment date at month 26 for all cases where it seems to have occurred later.

With respect to the delayed exiters, we assume that a fraction θ had obtained an earlier job offer which they were able to start within a few weeks of satisfying the waiting period requirement. An examination of the distribution of entitlement dates shows only a small fraction of people became entitled at month 13 (3.6% of those who ever became entitled), but reveals a sharp "spike" in entitlements at month 14 (11.6% of those who ever became entitled). Since there was no such spike in the entitlement distribution in the SSP Recipient experiment, we believe this is plausibly attributable to the delayed exiters. After some experimentation, we settled on the assumption that a fraction λ_{14} of delayed exiters

with an inventoried job became entitled at month 14, and the remainder became entitled in month 15.[21]

The observed entitlement hazard of the eligible program group in month t depends on the fraction of delayed exiters in the population at risk to initiate SSP. For a given value of the random effect, the fraction of the eligible program group who are delayed exiters at the beginning of month 13 is

(2b) $\pi_{13}(\alpha_i) = [\, P(S_i=1 \mid P_i=1, \alpha_i) - P(S_i=1 \mid P_i=0, \alpha_i)] \,/\, P(S_i=1 \mid P_i=1, \alpha_i)$.

Given our assumption that none of the delayed exiters establish entitlement in the first possible month, the overall hazard of entitlement in month 13 (conditional on α_i) is therefore

$(1- \pi_{13}(\alpha_i)) \times h_{13}(\alpha_i)$.

At the beginning of month 14, the fraction of delayed exiters among those who have not yet established SSP entitlement is

(2c) $\pi_{14}(\alpha_i) = \pi_{13}(\alpha_i) / [\, (1-\pi_{13}(\alpha_i))\,(1-h_{13}(\alpha_i)) + \pi_{13}(\alpha_i)\,]$,

reflecting the attrition of the windfall-eligible subgroup. The overall hazard of entitlement in month 14 is therefore

(2d) $(1-\pi_{14}(\alpha_i)) \times h_{14}(\alpha_i) + \pi_{14}(\alpha_i) \times \theta \times \lambda_{14}$.

Following a similar argument, the fraction of delayed exiters among those still at risk to become entitled in month 15 is

(2e) $\pi_{15}(\alpha_i) = \pi_{14}(\alpha_i)\,(1-\theta\lambda_{14}) \,/\, [\, (1-\pi_{14}(\alpha_i))\,(1-h_{14}(\alpha_i)) + \pi_{14}(\alpha_i)(1-\theta\lambda_{14})\,]$,

and the overall hazard of entitlement in month 15 is

(2f) $(1- \pi_{15}(\alpha_i)) \times h_{15}(\alpha_i) + \pi_{15}(\alpha_i) \times \theta$.

Finally, under the assumption that all of the delayed exiters with an inventoried job offer become entitled in either month 14 or month 15, the overall hazard of entitlement in months 16 and later is just the hazard for the windfall-eligible group, $h_t(\alpha_i)$. The combination of equations (2a)-(2f) provides a complete probability statement for $P(E_{i13}, E_{it14}, \ldots E_{i26} \mid P_i, S_i, \alpha_i)$.

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[21] We experimented with some models that allowed the delayed exiters to establish eligibility in months 13, 14, or 15.

Modeling the IA Participation Dynamics

The final component of our model is a specification for IA participation behavior over the period beginning in month 13. We consider models of the form:

(3) $P(y_{it-1} \mid y_{it-1}, y_{it-1}, \ldots, E_{it}, E_{it-1}, \ldots, S_i, P_i, \alpha_i)$

$= logit\ \{\alpha_i + d_y(t) + \gamma_1 y_{it-1} + \gamma_2 y_{it-2} + \gamma_3 y_{it-1}y_{it-2} + P_i \tau(t,S_i,E_{it},t^e_i,y_{it-1},\alpha_i)\}, \quad t=13, \ldots, T=84,$

where $d_y(t) = d_{y0} + d_{y1}(t\text{-}12) + d_{y2}(t\text{-}12)^2 + d_{y3}(t\text{-}12)^3$ is a cubic trend in the number of months since the close of the eligibility window, $\tau(t,S_i,E_{it},t^e_i,y_{it-1},\alpha_i)$ represents the treatment effect of SSP on applicants' IA participation in month t, and $t^e_i = \min_t \{E_{it}=1\}$ represents the month in which individual i established SSP entitlement. Note that for the control group model (3) is just a logistic model with second-order state dependence and a random effect. For the program group, we assume that there are three distinct treatment effects SSP. The first effect, which we call the "establishment effect", reflects the requirement that people had to find a full time job and leave IA in order to become entitled to subsidy payments. Thus, we expect to observe a large negative impact on IA participation in the period immediately surrounding t^e_i (the first month of entitlement). The second effect, which we call the "entitlement effect", reflects the fact that people who were entitled to the SSP subsidy had a stronger incentive to remain off welfare than similar members of the control group. This incentive remained in effect up to the end of SSP entitlement (t^e_i+35). The third effect, which we call the "post-entitlement effect", reflects any long term impact of subsidy receipt, and affects behavior after month t^e_i+36.

Specifically, we assume that the treatment effects of SSP on the program group are given by:

(4) $$\begin{aligned}\tau(t,S_i,E_{it},t^e_i,y_{it-1},\alpha_i) = S_i \times E_{it} \times \{\ & 1(t^e_i \le t \le t^e_i+2)\ [\tau_{01}(\alpha_i)y_{it-1} + \tau_{00}(\alpha_i)(1-y_{it-1})] \\ & + 1(t^e_i+3 \le t \le t^e_i+35)\ [\tau_{11}(\alpha_i)y_{it-1} + \tau_{10}(\alpha_i)(1-y_{it-1})] \\ & + 1(t^e_i+36 \le t)\ [\tau_{21}(\alpha_i)y_{it-1} + \tau_{20}(\alpha_i)(1-y_{it-1})]\ \},\end{aligned}$$

where $\tau_{01}(\alpha_i)$ and $\tau_{00}(\alpha_i)$ represent the establishment effects of SSP entitlement for people who were on or off IA in the preceding month, respectively, $\tau_{11}(\alpha_i)$ and $\tau_{10}(\alpha_i)$ represent the corresponding entitlement

effects, and $\tau_{21}(\alpha_i)$ and $\tau_{20}(\alpha_i)$ represent the post-entitlement effects. Note that the treatment effects are confined to members of the program group who are actually entitled to SSP as of month t, and that the establishment effects occur in a narrow 3-month window from t^e_i to t^e_i+2. We adopt a simple "one-factor" model for the variation in treatment effects with the value of the random effect:

$$\tau_{uv}(\alpha_i) = \omega_{uv} + \eta_{uv}\,\alpha_i \qquad \text{for } u=0,1,2 \text{ and } v=0,1.$$

In addition, to allow for the possibility that the post-eligibility effects fade over time (as appears to be the case in Figure 1a), we consider a specification in which these effects decay exponentially with the number of months since the end of SSP entitlement.

A final issue in modeling IA dynamics from month 13 onward is the specification of the initial conditions (y_{i11},y_{i12}) for this process. To deal with this issue we use the empirical distribution of (y_{i11},y_{i12}) conditional on S_i from the combined SSP-A sample. This is an over-simplification because it ignores any variation in the likelihood of a specific initial condition with respect to the value of the random effect. Among the subset who are classified as eligible for SSP, however, 95% have the initial condition $(y_{i11},y_{i12})=(1,1)$, so the potential for variability with the unobserved heterogeneity component is limited. The distribution of initial conditions is more variable for those who are classified as ineligible, though even here 75% have $(y_{i11},y_{i12})=(0,0)$. Thus, we believe this simple approach should provide a reasonable approximation to the process generating the initial conditions.

IV. Estimation Results

a. Models for the Control Group Only

The first three columns of Table 4 report parameter estimates for three alternative specifications of the model, restricted to the control group only. Column 1 reports a specification with normally distributed heterogeneity, column 2 reports a model with discrete heterogeneity (assuming four mass points), and column 3 presents a model with discrete heterogeneity and a generalized model of selection

into eligibility. For the normal heterogeneity model we report the estimated standard deviation of the random effect in the 4th row of the table. For the models with discrete heterogeneity, we report the locations of the mass points and their probabilities at the bottom of the table. Note that all three models (and the combined models in columns 4-6) also include a cubic time trend.

The estimated state dependence parameters from all three specifications are very similar, with large positive coefficients for the first and second lags of IA participation and a negative interaction effect. The parameters of the eligibility model in columns 1 and 2 are also very similar, and show a high correlation between the random effect and the probability of eligibility. This makes sense, given that eligibility status is roughly the same as not having left welfare by month 12. The specification in column 3 replaces the "one factor" assumption of the baseline eligibility model (equation 1a) with a set of mass-point-specific constants. This addition improves the likelihood significantly, but has little impact on the state dependence parameters. Although not reported in the table, the estimated constants are very highly correlated with the mass points in the IA participation model (correlation = 0.9 across 4 mass points) suggesting that a "1-factor" model like (1a) is reasonable.

In order to evaluate the predictive power of the alternative models, we simulated each model (using 40 draws on the random effect for each observation) and derived the predicted fractions of the control group in 20 mutually exclusive "cells" defined by the total number of months on IA during months 13-84, and the number of transitions between IA states.[22] We then construct an informal summary statistic based on the sum of the squared differences between the actual and predicted

[22]Overall there are 2^{72} possible welfare histories over the interval from month 13 to 84. In order to ensure reasonable cell sizes, we classify the number of months on IA into 8 intervals (0, 1-6, 12-23, 13-24, 25-36, 37-54, 55-71, and 72), and classify the numbers of transitions into 4 categories: 0 (implying either always on or always off IA), 1 (i.e. a single transition over the period), "2+ even" (implying an individual's final, month-84, state is the same as their initial, month-13, state), and "3+ odd" (implying their final state differs from their initial state). Table 5 shows the actual distribution of the control and program groups across these cells, and the predictions from the model in column (6) of Table 4.

frequencies in each cell.[23] Based on this measure, the mass point models provide a slightly better fit than the normal heterogeneity model, and the model with generalized selection provides the best fit (GOF=137.8). The qualitative and quantitative differences between the models are small, however. We also fit a model with 5 mass points. This model has only a slightly higher likelihood than the model in column 3, and yields very similar predictions for the IA histories of the control group.

b. Models for the Program and Control Groups

Columns 3-6 of Table 4 present a set of increasingly complex specifications for the joint behavior of the control and program groups in the SSP Applicant experiment. The first model, in column 4, extends the simple normal heterogeneity model of column 1 to include the SSP-entitlement process and treatment effects for members of the program group. The model in column 5 similarly extends the mass point model in column 2. In both cases we adopt a very simple specification for the post-entitlement effects of the SSP program, and assume that these effects are proportional to the effects during the entitlement period, with separate proportionality factors for the effects on IA entry and exit. Based on a series of initial estimates, we also adopt the simplifying assumption that <u>all</u> of the "delayed exiters" in the eligible program group become entitled in months 14 or 15 (i.e., we assume that the parameter θ=1 in equations (2c)-(2f)).[24]

Interestingly, the estimates for the shared parameters in the pooled and controls-only models are very similar, providing some support for the underlying assumptions of our modeling framework. In particular, the state dependence parameters are nearly identical, as are the estimates of the standard

[23]The idea of comparing the actual and predicted frequencies from multinomial models is formalized in Moore (1977) and has been used by Card and Sullivan (1988), Chay and Hyslop (2001), and Card and Hyslop (2005). We construct the standard Pearson statistic, $\Sigma_j (O_j - E_j)^2/E_j$, where O_j and E_j are the observed and predicted frequencies in cell j.

[24] The parameters of the entitlement hazards for the two subgroups are essentially identified by functional form. As discussed later, if we try to estimate θ the estimate is typically very close to 1 but imprecise.

deviation of the random effect (for the normal heterogeneity models 1 and 5), and the locations and probabilities of the mass points (for the discrete heterogeneity models 2 and 6). Although not reported in the table, the estimates of the cubic trend parameters are also very similar in the pooled and "controls-only" models. The goodness-of-fit statistics for the control group are also quite similar for the pooled and controls-only models.

The model in column 6 of Table 4 generalizes the specification in column 5 in three ways. First, like the specification in column 3, it includes a generalized eligibility model, with unrestricted parameters for the eligibility rate at each mass point for either the program or control groups. Second, it includes a generalized specification for the hazard of establishing SSP, with separate intercepts for each mass point. Third, it includes an extra parameter measuring the potential decay of the post-entitlement treatment effects. In particular, the treatment effects on the probability of IA participation s months after the end of SSP entitlement are:

$$\tau_{21}(s; \alpha_i) = \rho_1 \exp[-Rs]\, \tau_{11}(\alpha_i), \text{ and}$$

$$\tau_{20}(s; \alpha_i) = \rho_0 \exp[-Rs]\, \tau_{10}(\alpha_i) .$$

where $\tau_{11}(\alpha_i)$ and $\tau_{10}(\alpha_i)$ represent the treatment effects during the entitlement period, ρ_1 and ρ_0 represent the fractions of these treatment effects that persist immediately after the end of entitlement, and R is a parameter representing the decay rate of the post-eligibility effects.

The generalized model has a significantly higher likelihood than the more restrictive mass point model in column 5, and also leads to a slightly better goodness of fit statistic for the control group (though not the program group). The estimated treatment effects from this specification are similar to the estimates from either of the simpler models, and show a strong negative impact of the entitlement process on IA participation, a somewhat smaller negative impact on participation rates during the entitlement period, and a sizeable degree of post-entitlement persistence. The two models with no decay in the post-entitlement effects suggest that about 50% of the effect on IA exits and 70% of the effect on IA entry

persisted after the end of SSP payments. The more general model in column 6 suggests that a larger fraction of the entitlement effects persisted intially, but that the effects decayed relatively rapidly, at a rate of 2.9 percent per month (or about 30 percent per year).

The estimated establishment and entitlement period treatment effects for the models in Table 4 are similar to the estimates we obtained for a similar specification of the welfare participation behavior in the SSP Recipient Study (Card and Hyslop, 2005, Table 6). In particular, in both experiments we find that the establishment treatment effects are larger (more negative) for people with higher values of the random effect. An explanation for this pattern is that everyone who started receiving SSP payments had to leave welfare: thus, those with a higher underlying probability of welfare participation experienced a bigger proportional treatment effect. An important difference between the experiments, however, is the degree of persistence of the treatment effects in the post-eligibility period. In the Recipient experiment, a model with no persistence in the treatment effects provides a remarkably good description of the experimental impacts (Card and Hyslop, 2005). In the Applicant experiment, however, there is much stronger evidence of a lasting impact.

We have fit a number of additional models to probe the robustness of the results from our main specifications. One alternative extended the model in column 6 to include 5 mass points. As we found in our model for the control group alone, the addition of an extra mass point leads to only a marginal improvement in the likelihood of the model, and very little change in the predicted behavior of either program group. Another model extended the specification in column 4 by including a free parameter for θ, the fraction of delayed exiters who ultimately became entitled to SSP. In this specification the estimate of θ is 0.96, and the likelihood is essentially the same as for the restricted model. We also experimented with an alternative parameterization for $f(\alpha_i)$, in which we assumed a mixture of normal heterogeneity and a mass of "pure leavers" – individuals who leave welfare too soon to establish eligibility and never return. This model does not fit as well as our most general discrete distribution model (column 6), but leads to

similar estimates for the treatment effects, and roughly similar predictions for the IA histories of the program groups.

c. Assessing Goodness of Fit

To provide more insight into the ability of the models in Table 4 to explain the behavior of the program and control groups, Table 5 shows the predicted and actual distributions of the control and program groups across the 20 cells used in our summary goodness of fit statistics, using the predictions from the model in column 6. Inspection of the table shows that one place where the model does a relatively poor job is in predicting the fraction of the sample that is off IA in every month. For example, in the control group this cell has 396 observations (24% of the control population) but the predicted number is only 328 (20% of the control population). Likewise in the program group this cell has 360 observations (22% of the program group) but the model only predicts 318 people in the cell (19% of the sample). Interestingly, however, these prediction errors only contribute modestly to the overall goodness of fit statistics. The biggest contributors are the two cells with 1 transition and 25-36 or 37-54 months on IA. In the control group, the model predicts a total of 55 people in these cells (3.3%) versus an actual count of 110 (6.7%). Since the goodness of fit statistic sums the squared deviation between the predicted and actual counts, divided by the predicted count, these two cells contribute 42% of the total value of the fit statistic. Likewise, in the program group, the model only predicts 35 people in these cells (2.1% of the sample) relative to an actual count of 89 (5.4%), implying that these two cells contribute 58% of the total value of the fit statistic for the program group. Taking the sensitivity of the fit statistics to small cells into consideration, we conclude that the model in column 6 of Table 4 provides reasonable predictions for the IA histories of the two groups, albeit not accurate enough to pass conventional chi-squared tests.

Another way to assess the predictive power of the model is to compare the predicted and actual

time profiles of welfare participation. Figure 5 shows the predicted and actual IA profiles for the treatment and control groups. The predictions for the control group are quite accurate, with a root mean squared prediction error of 0.004. The predictions for the program group are a little less so (root mean squared prediction error=0.009) though the correlation between the predicted and actual fraction on IA is over 0.998. Close inspection of the figure suggests that the model over-predicts the welfare participation rate of the program group in months 24-32, and under-predicts the rate in later months of the sample period.

Further insights are provided in Figures 6a, 6b, and 6c, which compare the actual and predicted IA participation rates for various subgroups of the control and program groups. Figure 6a compares the model's fits to the actual IA profiles of the eligible and ineligible subsets of the control group. Considering the simplicity of the model, it does remarkably well in predicting the divergent paths of the two groups. Figure 6b compares the actual and predicted participation patterns for the eligible and ineligible subsets of the program group. The model does quite well for the eligible subgroup, but has some difficulty predicting the IA profile of the ineligible subgroup. In particular, the model over-predicts IA participation of the ineligible programs in months 18-34 and under-predicts their IA participation in months 54 onward. According to the model, the time profile of IA participation for the ineligible program group should roughly parallel the profile of the ineligible controls, since they only differ in terms of the relative distribution of random effects. In fact, however, as we discuss further below, there is a distinct difference in the time profiles of IA participation for the two groups which is not explained by our model.

Finally, Figure 6c compares the actual and predicted profiles for subsets of the eligible program group who did or did not manage to establish SSP entitlement. The predictions for the two groups are unbiased on average, but there are clearly intervals where the model over-predicts the IA participation of one group and over-predicts the rate for the other, and vice versa. A notable difficulty for the model is in

predicting the "dip" in IA participation in months 24-36 for the group who received SSP. In our analysis of the Recipient experiment we encountered a similar problem, perhaps due to the imprecision in our measure of the timing of the transition period during which eligible program group members first became entitled to SSP.

Another way to evaluate the model is to compare the predicted and actual gaps in IA participation between the treatment and control groups. This exercise is presented in Figure 7a. Consistent with the patterns in Figure 6c, the model under-predicts the SSP impacts on IA participation in months 18-36. It also systematically over-predicts the magnitude of the gap between the program and control groups after month 36. At first glance this may seem to be evidence that the model is over-estimating the post-entitlement effects of SSP. Further investigation, however, suggests that the problem is related to the difficulty of under-predicting the IA participation of the ineligible programs, noted in Figure 6b. One piece of evidence in favor of this interpretation is Figure 7b, which shows the predicted and actual gaps in IA participation between the eligible program group and the subset of the control group who satisfied the eligibility criterion.[25] The model does a relatively good job of explaining the gaps in IA participation between the eligible program group and the eligible control group, especially after month 36. The "flip side" of this comparison is presented in Figure 7c, where we present the predicted and actual gaps in IA participation between the ineligible program group and the ineligible control group. The profile of actual differences displays an unusual pattern, falling in the first 24 months of the experiment, rising between months 24 and 36, and then fluctuating around a mean of about 2% after month 36. In contrast, the predicted difference is quite stable and very close to 0. Since the ineligible groups comprise about one-half of the experimental population, the 2 percentage point prediction error for the gap between the ineligible program and control groups can account for the roughly 1-percentage point prediction error for

[25]An issue with this comparison is that the eligible program group is bigger, since it includes the delayed exiters. These are only about 5 percent of the total eligible programs, however, so their influence is small

the overall gap between the treatment and control groups in the later months of the sample.

As a further check on this interpretation, we re-estimated the model in column 6 of Table 4, imposing the assumption that all the behavioral effects of SSP ended when subsidy payments ended. The resulting model has a significantly lower likelihood (chi-square statistic = 24.0 with 3 degrees of freedom) and does a much worse job of tracking the differences between the program and control group, and between the eligible subsets of the two program groups. Based on these findings, and the results in Figures 7b and 7c, we conclude that the systematic pattern of prediction errors for the overall treatment effect of SSP is driven by the relatively flatter trend in IA participation for the ineligible program group than the ineligible control group – a divergence that is not explainable by our simple model of eligibility determination, and may in fact be due to random chance.

The other models presented in Table 4 lead to broadly similar predictions as those shown in Figures 5, 6a-6c, and 7a-7c, although the model in column 6 has the best forecasting performance (in terms of root mean squared prediction errors). In particular, comparisons between the specifications in columns 4 and 5 suggest that there is not much difference in the predictive performance of models that use a discrete distribution of random effects or a normal distribution. The superior performance of the model in column 6 seems to be attributable to the generalized selection and establishment models, and to the introduction of the decay parameter for the post-entitlement effects.

d. Understanding SSP's Effects

By simulating the models in Table 4 under various counterfactual assumptions it is possible to gain some additional insights into the behavioral responses of the program group to the incentives created in the Applicant experiment. This exercise is particularly useful for illustrating the separate impacts of the establishment effect and the entitlement effect of the SSP, and showing the effect of the delayed

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on either the actual or predicted outcomes.

exiters on the profile of SSP impacts.

Figure 8 conducts this exercise using the model in column 6 of Table 4. We first simulate the IA participation rates of the control group. Then we simulate the rates for the program group, beginning by assuming that the only treatment effects are the establishment effects (associated with the requirement that people leave IA to establish an entitlement to SSP payments). The resulting profile of treatment effects peaks at about -5 percentage points in month 26, then dissipates relatively quickly. Next, we simulate the rates for the program group, including both the establishment effects and the entitlement period effects. The predicted treatment effects under this scenario peak at about -8.5 percentage points in month 26, remain relatively large until about month 54 (when people began to exhaust their three year entitlements to subsidy payments), then fade relatively quickly. The third simulation adds the post-eligibility treatment effects, and generates the profile that was shown in Figure 7a. A comparison of these three profiles suggests that the pattern of observed impacts in the SSP Applicant experiment can be explained by a combination of the establishment effects, the entitlement period effects generated by the availability of the subsidy, and the post-entitlement effects, which seem to have persisted for at least two years after people were no longer receiving SSP payments.

The final simulation in Figure 8 is designed to show the impact of the delayed exiters in the program group. We conduct this simulation by "switching off" the eligibility of people in the program group who would not have been eligible if they were in the control group. The presence of this group, which (in the simulation) represents about 2 percent of the overall program group, explains the positive impact of SSP on IA participation in month 12. In the counterfactual simulation with no delayed exit response, virtually all of these people are off IA in month 12, and the implied experimental impact is 0. Our model assumes all of the delayed exiters took up the subsidy, so in later months their presence adds to the net impact of the program. On average, however, we estimate that the program impact would only have been about 0.20 percentage points smaller in months 18-54 in the absence of this group.

V. Conclusions

In this paper we develop and estimate an econometric model of the behavioral effects of the SSP Applicant Experiment. We use a simple search-theoretic model to show that Applicant experiment created three incentives: (1) an eligibility incentive for new welfare entrants to remain on welfare for a year to become eligible for the subsidy; (2) an establishment incentive for people who satisfied the waiting period requirement to find a job and leave welfare within the next 12 months; and (3) an entitlement incentive for those who established SSP eligibility to work full time and remain off welfare over the 36 months that subsidy payments were available. Conventional comparisons between the treatment and control groups of the experiment cannot separately distinguish these effects. Thus, we extend the econometric model developed in Card and Hyslop (2005) for analyzing the SSP Recipient experiment to incorporate the waiting period requirement in the Applicant study.

Our empirical results show that the time profile of the experimental impacts in the SSP Applicant study can be explained by a combination of the eligibility incentive (which increased welfare participation during the waiting period), the establishment incentive (which led to a rapid rate of welfare-leaving among members of the program group who satisfied the waiting period requirement), and the longer-term entitlement incentives of the program. In particular, the model results imply that most of the early impact of SSP after the waiting period was due to the "establishment" incentive, with about two-thirds of the peak impact attributable to this incentive. Our results help reconcile the relatively large peak impact observed in the SSP Applicant experiment compared to other welfare reform programs with universal eligibility, and offers a simple interpretation for the decline from the 11 percentage point peak effect 27 months after initial entry into IA to about 6 percent by months 40-48. We also find evidence that the impact of the subsidy persisted after SSP payments ended. Our results suggest that 60-90 percent of the entitlement incentive effects persisted in the immediate post-entitlement period, though the effect

faded relatively quickly, with a decay rate of about 3 percent per month.

Finally, our model results imply that nearly all of the people in the treatment group who delayed their initial exit from IA in response to the incentives of the program left IA within 2-3 months of the end of the waiting period, and became entitled for the SSP subsidy. As suggested by our benchmark theoretical model, these delayed exiters were apparently responding to the incentives created by the SSP time limits, leading to an increase in the costs of the program. Nevertheless, simulations from our models suggest that the presence of the delayed exiters has a very small effect on the magnitude of the SSP impacts in later months.

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Data Appendix

This appendix explains various aspects of the data used in this study concerning timing conventions, and variables used and created.

a. Timing conventions

Unless otherwise explicitly stated, all dates in the analysis are relative to the start month of the IA reference spell. As shown in table 2, these start months range from 3 months prior to the month of random assignment until the month of random assignment.

b. Determining Eligibility-status and date Eligibility was Achieved

We have used the binary variable "Eligible" in the original SSP-Applicants data extract as the indicator of eligibility status. We edited one observation in the program group with Eligible=0, but with a specified eligibility date ("Eligdate") and received SSP payments, to be Eligible=1. Although a date of eligibility ("Eligdate") is provided for observations with Eligible=1, preliminary analysis suggested that simply assuming eligibility occurs 12 months after the first month of the reference spell, as in the program rules, appears to be more internally consistent with the data. For this reason, we have adopted this assumption to date the eligibility for those individuals who achieve eligibility status.

c. SSP Entitlement-status, the month Entitlement was Established, and the Transition Period

The entitlement status for the program group individuals who have Eligible=1 is determined by whether or not they ever received supplementary payments. The original dataset contains a variable "tkupdate" that specifies the start of the entitlement period. However, from preliminary analysis of the patterns of supplementary payment receipt around this variable date, we prefer instead to estimate the establishment month directly from the patterns of supplementary payments. In particular, we took the first month supplementary payments were received less 2 months (to reflect processing lags and delays between first working fulltime, filing pay stubs and receiving the supplement payments) as our initial estimated establishment month. This resulted in a range for the estimated establishment months of 12-28 (months relative to the start of the reference spell). We then allowed a 14 month establishment window rather than 12 as specified in the SSP rules for processing delays and/or administrative flexibility in the application of the rules, and censored this date at month 25 (this affects 12 out of 387 entitled individuals: 10 with month=26, and 1 each with month=27 and 28). Recognizing a delay occurs between establishing entitlement and leaving IA, we add 1 month to these dates for our analysis of welfare dynamics, giving the range of establishment months from 13 to 26. Finally, as in Card and Hyslop (2005), we assume a 3 month transition period beginning in the month entitlement is established, during which an entitled individual is obliged to leave IA.

Table 1: Key Features of the SSP Applicants Demonstration

A. Program Eligibility

· Eligibility limited to single parents, aged 19 and over, who are new applicants for Income Assistance (IA) – not on IA in 6 months prior to current application.

· Sample members drawn from IA registers in British Columbia, with random assignment between February 1994 and March 1995.

· 1,667 single parents assigned to the program group; 1,648 assigned to the control group.

B. Program Features

· Eligibility for subsidy payments required program group members to remain on IA for 1 year (12 out of 13 months following start of IA reference spell).

· Of those who become eligible, payments are only available to members who successfully initiate their first supplement payment within one year of becoming eligible (13-24 months after start of IA reference spell). Subsidy payments are available for 36 months from time of first payment.

· Subsidy payments available to program group members who work at least 30 hours per week (over a four-week or monthly accounting period), and earn at least the minimum wage.

· Once established, program group members can return to IA at any time. Subsidy is re-established when an eligible person begins working full time again. Recipients are ineligible for IA while receiving subsidy payments.

· Subsidy equals one-half of the difference between actual earnings and an earnings benchmark, set at $3,083 per month in British Columbia in 1993, and adjusted for inflation in subsequent years.

· Subsidy payments are unaffected by unearned income or the earnings of a spouse / partner, and are treated as regular income for income tax purposes.

· Employers are not informed of SSP status. Program group members apply for subsidy payments by mailing copies of payroll forms.

Table 2: Characteristics of SSP Applicants Experimental Samples

	1996 Census Vancouver Lone Parents	Control Group	Program Group	Control Group, by Eligibility Status		Program Group, by SSP: Eligibility Status		Program Group, by SSP: Establishment	
				Ineligible	Eligible	Ineligible	Eligible	No takeup	Takeup
Fraction Female	0.850	0.915	0.896	0.897	0.931	0.879	0.910	0.910	0.910
Average Age	39.5	32.4	32.7	33.1	31.8	33.3	32.2	32.4	32.0
Fraction Under 25	0.052	0.146	0.157	0.115	0.172	0.138	0.172	0.182	0.158
Fraction Never Married	0.219	0.245	0.227	0.222	0.264	0.217	0.234	0.230	0.240
Average No. Children < 6	0.430	0.61	0.62	0.56	0.65	0.53	0.68	0.71	0.64
Average No. Children 6-15	1.24[(a)]	0.81	0.77	0.80	0.82	0.76	0.78	0.76	0.81
Average No. Children 16-18	---	0.13	0.13	0.15	0.12	0.15	0.11	0.11	0.12
Fraction Foreign Born	0.358	0.309	0.299	0.235	0.372	0.246	0.339	0.369	0.295
Fraction Grew Up with 2 Parents	---	0.647	0.655	0.661	0.636	0.680	0.636	0.626	0.650
Fraction High School Graduate	0.629	0.622	0.630	0.677	0.575	0.666	0.603	0.543	0.683
Fraction College Graduate	0.245	0.130	0.138	0.157	0.106	0.162	0.119	0.109	0.134
Start of IA reference-spell relative to Random assignment:									
3 months prior	---	0.026	0.022	0.033	0.020	0.023	0.022	0.026	0.016
2 months prior	---	0.213	0.187	0.202	0.222	0.170	0.200	0.206	0.191
1 month prior	---	0.692	0.721	0.701	0.685	0.742	0.706	0.700	0.713
month of RA	---	0.069	0.070	0.065	0.073	0.066	0.073	0.068	0.080
No. Months on IA Prior 3 Years	---	3.5	3.8	3.7	3.4	3.9	3.8	3.7	3.8
Fraction Working at Baseline	0.612[(b)]	0.253	0.257	0.372	0.152	0.348	0.188	0.140	0.256
Average Years Work Experience	---	9.6	10.0	10.9	8.5	11.2	9.1	8.5	9.8
Fraction SSP Eligible	---	0.541	0.570	0	1	0	1	1	1
Fraction Take-up SSP	---	---	0.237	---	---	0	0.416	0	1
Number of Observations	1,543	1,651	1,632	758	893	701	931	544	387

Note: 1996 Census sample includes all lone parents aged 19-55 living in Vancouver. SSP samples exclude observations who were not on IA in the 6 months before or after random assignment, and whose IA reference spell started either 4 months before, or 1 month after, random assignment.

[(a)] Average number of children aged 6+.

[(b)] Working at Census date.

Table 3: Summary Statistics on Subsamples of those Working Full-time and On-IA

	Control Group			Program Group		
	Percent of Sample	Average Monthly Earnings	Average IA Receipt	Percent of Sample	Average Monthly Earnings	Average IA Receipt
			A: Full Samples			
Pre-Initial Spell Months [-12,-1]	0.9	1,506	662	1.0	1,361	687
Eligibility Period Months [0,12]	7.8	1,157	771	9.3	1,215	755
Establishment Period Months [13,24]	5.3	1,326	759	6.6	1,325	823
Entitlement Period Months [25,60]	2.9	1,259	647	2.6	1,451	712
Post-Entitlement Period Months [61,72]	2.0	1,346	667	2.6	1,460	724
			B: SSP-Ineligible			
Pre-Initial Spell Months [-12,-1]	1.4	1,494	658	1.4	1,432	722
Eligibility Period Months [0,12]	9.4	1,330	751	9.3	1,425	735
Establishment Period Months [13,24]	3.1	1,547	766	3.6	1,572	721
Entitlement Period Months [25,60]	1.9	1,422	652	1.8	1,493	657
Post-Entitlement Period Months [61,72]	1.2	1,436	711	1.6	1,672	609
			C: SSP-Eligible			
Pre-Initial Spell Months [-12,-1]	0.5	1,531	673	0.7	1,254	634
Eligibility Period Months [0,12]	6.5	949	795	9.2	1,060	770
Establishment Period Months [13,24]	7.1	1,247	756	8.7	1,252	853
Entitlement Period Months [25,60]	3.8	1,190	645	3.1	1,434	734
Post-Entitlement Period Months [61,72]	2.7	1,312	650	3.3	1,385	765

Table 4: Parameter Estimates for Models of IA Participation, SSP Eligibility, and SSP Entitlement

	Models for the Control Group Only:			Models for the Control and Program Groups:		
	(1)	(2)	(3)	(4)	(5)	(6)
IA Participation Model:						
Coefficient of y(t-1)	5.44 (0.07)	5.43 (0.07)	5.46 (0.07)	5.46 (0.05)	5.47 (0.05)	5.44 (0.07)
Coefficient of y(t-2)	2.16 (0.06)	2.17 (0.06)	2.19 (0.07)	2.17 (0.04)	2.19 (0.04)	5.44 (0.07)
Coefficient of y(t-1)×y(t-2)	-1.76 (0.09)	-1.75 (0.09)	-1.80 (0.09)	-1.70 (0.06)	-1.73 (0.06)	5.44 (0.07)
Std. dev. of random effect	1.42 (0.04)	mass points	mass points	1.37 (0.03)	mass points	mass points
Eligibility Model:						
Constant	0.24 (0.07)	0.08 (0.11)	mass-pt specific	0.28 (0.05)	-0.02 (0.10)	mass-pt specific
Coefficient of random effect	0.93 (0.07)	0.90 (0.07)	--	0.95 (0.06)	0.95 (0.05)	--
Program group dummy	--	--	--	0.08 (0.03)	0.09 (0.03)	--
Program group×random effect	--	--	--	-0.04 (0.04)	0.00 --	--
Establishment Model:						
Parameter for Delayed Exiters:						
Hazard in month 14	--	--	--	0.73 (0.15)	0.77 (0.14)	0.78 (0.11)
Parameters for Windfall Eligibles:						
Constant	--	--	--	-1.97 (0.06)	-1.97 (0.06)	-1.96 (0.09)
Trend	--	--	--	0.23 (0.07)	0.23 (0.07)	0.26 (0.07)
Coefficient on random effect	--	--	--	0.02 (0.03)	0.01 (0.03)	mass-pt specific

Note: table continues. See notes at end of table.

Table 4: Parameter Estimates for Models of IA Participation, SSP Eligibility, and SSP Entitlement, Continued

	Models for the Control Group Only:			Models for the Control and Program Groups:		
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment Effects of IA:						
Establishment Period:						
Exit	--	--	--	-2.50 (0.17)	-2.35 (0.22)	-2.22 (0.21)
Exit × random effect	--	--	--	-0.82 (0.14)	-0.77 (0.15)	-0.82 (0.15)
Entry	--	--	--	-1.62 (0.41)	-1.75 (0.49)	-1.65 (0.44)
Entry × random effect	--	--	--	-0.28 (0.28)	-0.41 (0.28)	-0.21 (0.28)
Entitlement Period:						
Exit	--	--	--	-0.91 (0.17)	-0.84 (0.21)	-0.75 (0.18)
Exit × random effect	--	--	--	-0.42 (0.10)	-0.41 (0.10)	-0.42 (0.10)
Entry	--	--	--	-1.06 (0.15)	-1.13 (0.16)	-0.95 (0.18)
Entry × random effect	--	--	--	0.00 (0.10)	-0.03 (0.09)	-0.03 (0.12)
Post-Entitlement Effects:						
Exit	--	--	--	0.52 (0.07)	0.53 (0.06)	0.61 (0.13)
Entry	--	--	--	0.73 (0.10)	0.73 (0.09)	0.93 (0.21)
Decay rate (% per month)	--	--	--	--	--	2.88 (1.50)
Number of Parameters	10	15	17	26	30	38
Log-likelihood	-34510.7	-36389.1	-36383.5	-35696.4	-35698.0	-35685.1
Goodness of Fit:						
Control group	154.1	142.1	137.5	152.7	140.0	131.3
Program group				177.3	175.2	183.2
Mass Point Locations:						
Point 1	--	0.00 --	0.00 --	--	0.00 --	0.00 --
Point 2	--	-1.66 (0.13)	-1.55 (0.14)	--	-1.58 (0.12)	-1.59 (0.12)
Point 3	--	1.20 (0.08)	1.20 (0.08)	--	1.22 (0.07)	1.27 (0.06)
Point 4	--	2.84 (0.16)	2.90 (0.16)	--	2.77 (0.12)	2.84 (0.12)
Mass Point Probabilities						
Point 1	--	0.35	0.35	--	0.34	0.36
Point 2	--	0.27	0.27	--	0.24	0.24
Point 3	--	0.28	0.28	--	0.31	0.30
Point 4	--	0.10	0.10	--	0.11	0.10

Notes: Standard errors in parentheses to right of coefficient estimates. See text for description of models.

Table 5: Summary of IA Participation Patterns of Control and Program Groups – Actual and Predicted

Months on IA in 13-84	Summary of Actual Patterns: Number of Transitions					Summary of Predicted Patterns: Number of Transitions				
	0	1	2+ Even	3+ Odd	Total	0	1	2+ Even	3+ Odd	Total
Control Group										
0	396	0	0	0	396	328	0	0	0	318
1-6	0	104	90	28	222	0	116	125	35	275
7-12	0	69	31	43	143	0	58	48	62	168
13-24	0	84	47	127	258	0	64	57	126	247
25-36	0	58	30	91	179	0	30	43	96	168
37-54	0	52	44	96	192	0	25	66	115	206
55-71	0	33	106	44	183	0	23	24	52	198
72	78	0	0	0	78	61	0	0	0	61
Total	474	400	348	429	1651	328	315	462	485	1651
Program Group										
0	360	0	0	0	360	318	0	0	0	318
1-6	0	175	86	31	292	0	167	123	48	338
7-12	0	105	48	58	211	0	86	49	84	220
13-24	0	85	49	111	245	0	56	60	138	254
25-36	0	34	41	87	162	0	20	42	82	144
37-54	0	53	42	67	162	0	15	62	83	160
55-71	0	23	92	28	143	0	16	100	38	154
72	57	0	0	0	57	45	0	0	0	45
Total	417	475	358	382	1632	363	360	436	473	1632

Note: The predicted summaries of IA Participation patterns are based on 40 simulations using the model for both the Control and Program presented in column 6 of Table 3.

Figure 1a: Income Assistance Participation Rates – Control and Program Groups

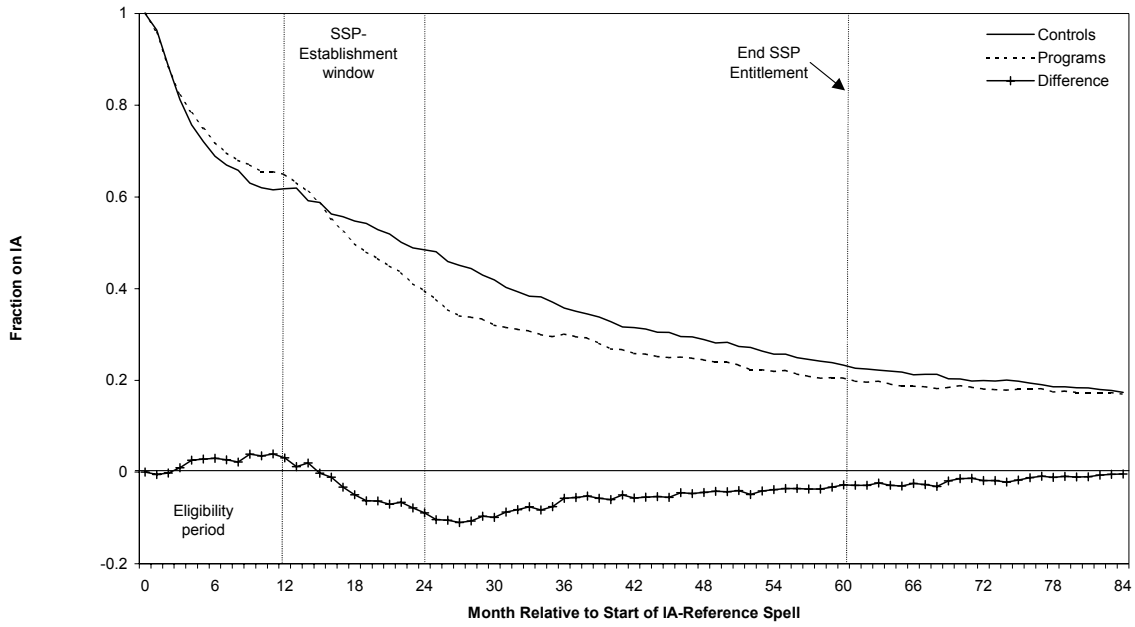

Figure 1b: Smoothed Exit Rates from Income Assistance – Control and Program Groups

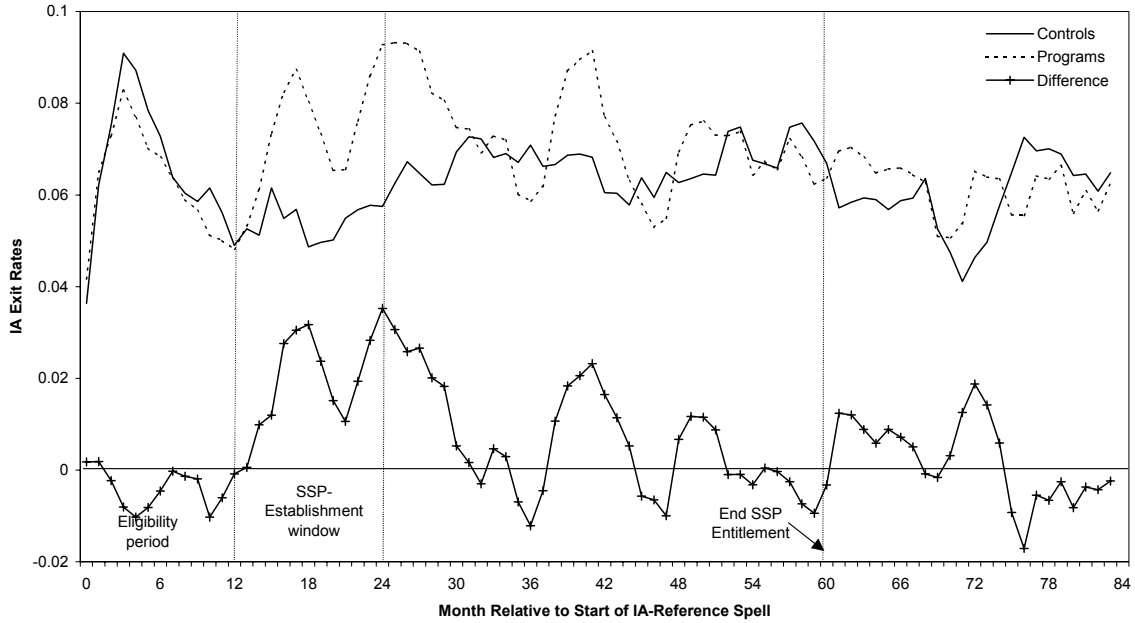

Figure 1c: Smoothed Entry Rates to Income Assistance – Control and Program Groups

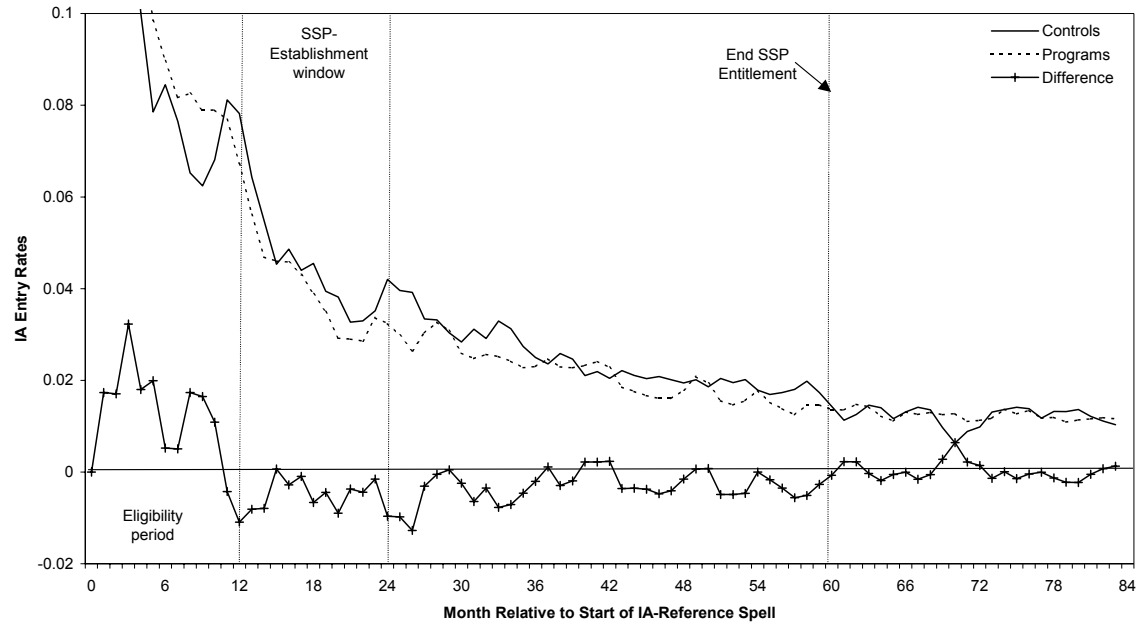

Figure 2a: Outcomes Around Start of SSP Receipt

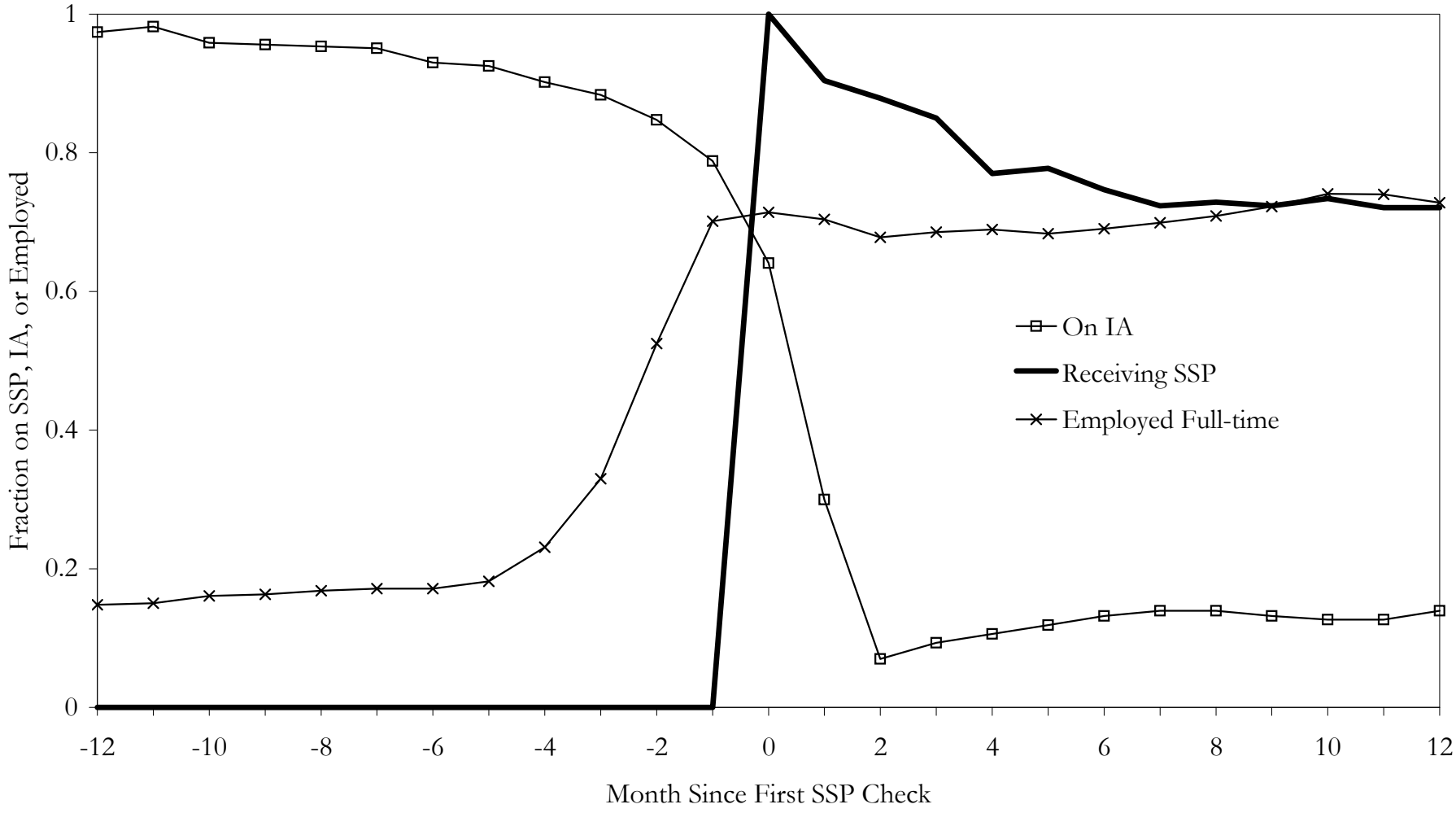

Figure 2b: Outcomes Around Expiry of SSP Entitlement

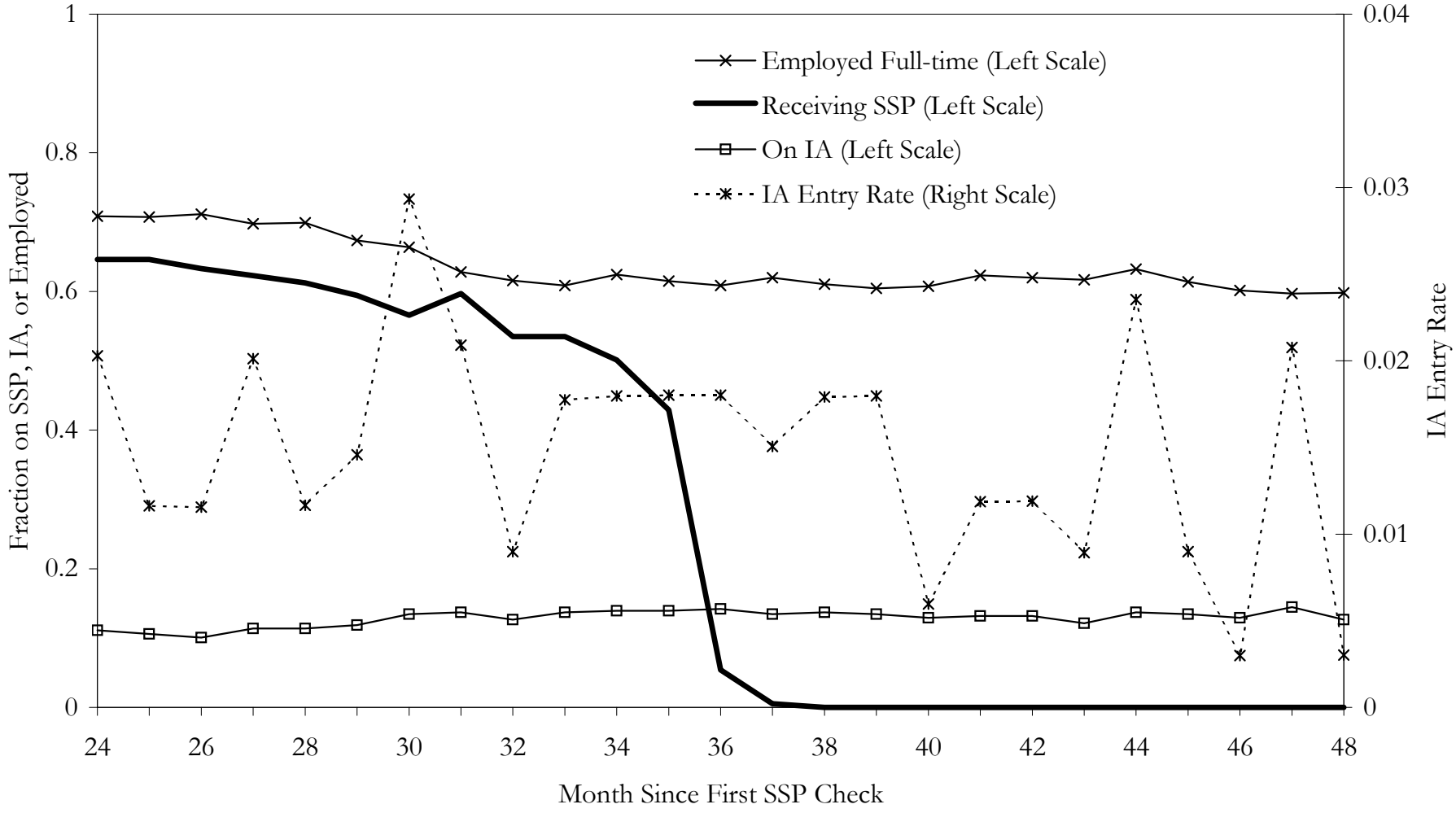

Figure 3a: Fulltime Employment Rates – Control and Program Groups

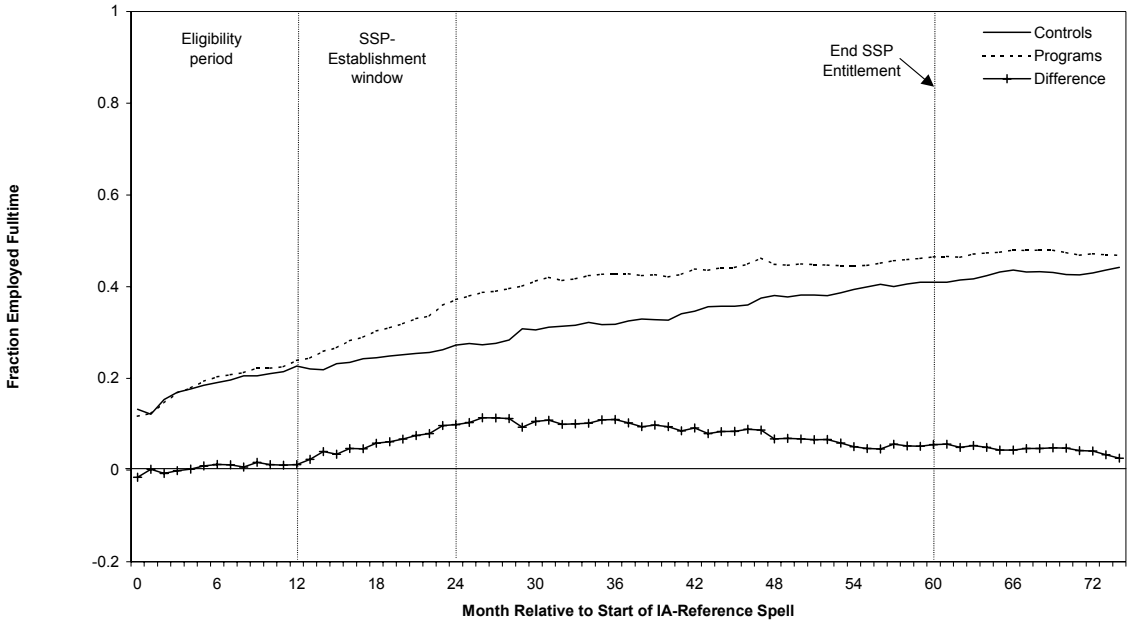

Figure 3b: Wage Rates – Control and Program Groups

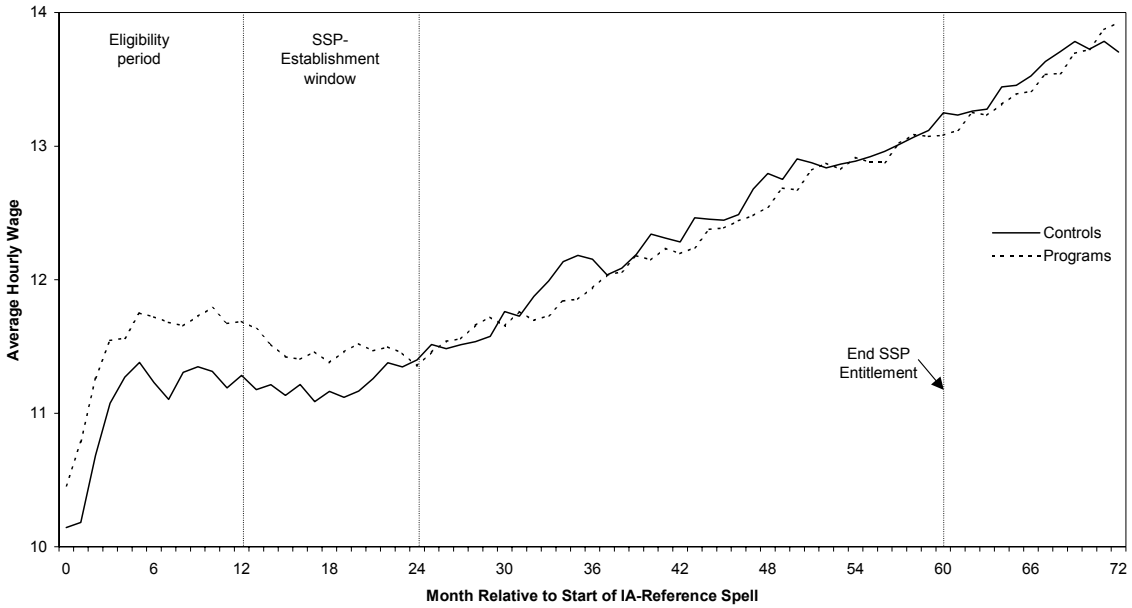

Figure 3c: Monthly Earnings – Control and Program Groups

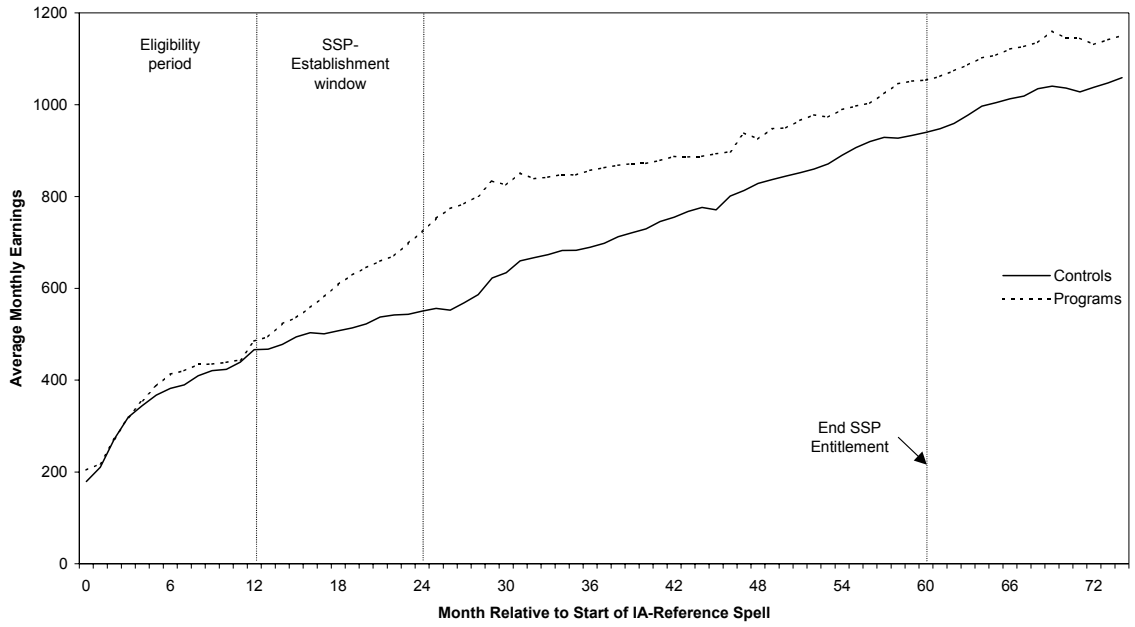

Figure 4a: Reservation Wage of Ineligible Program Group Member

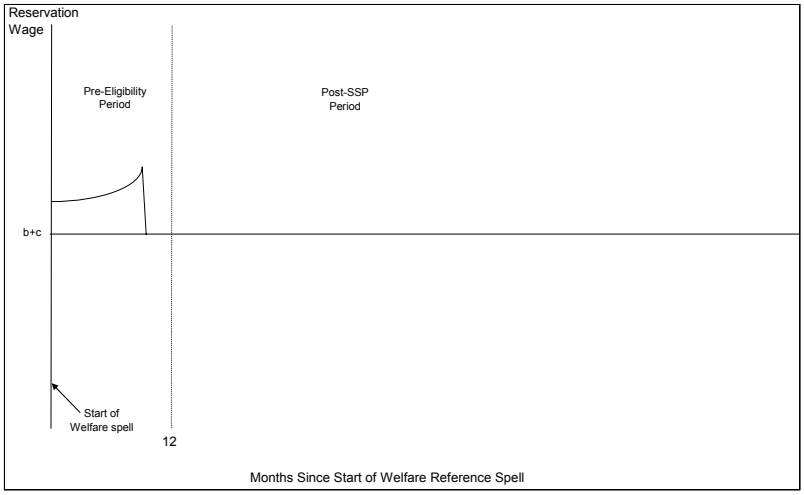

Figure 4b: Reservation Wage of Eligible but Not-Entitled Program Group Member

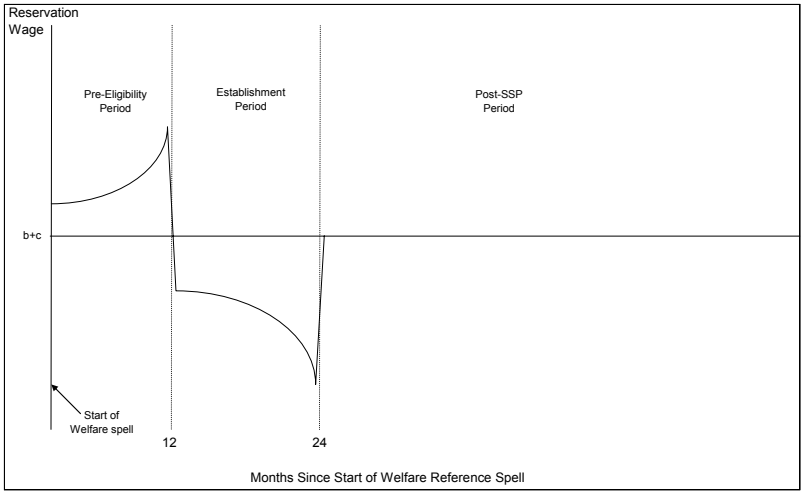

Figure 4c: Reservation Wage of Eligible and Entitled Program Group Member

Figure 5: Actual and Predicted IA Participation Rates of Control and Program Groups

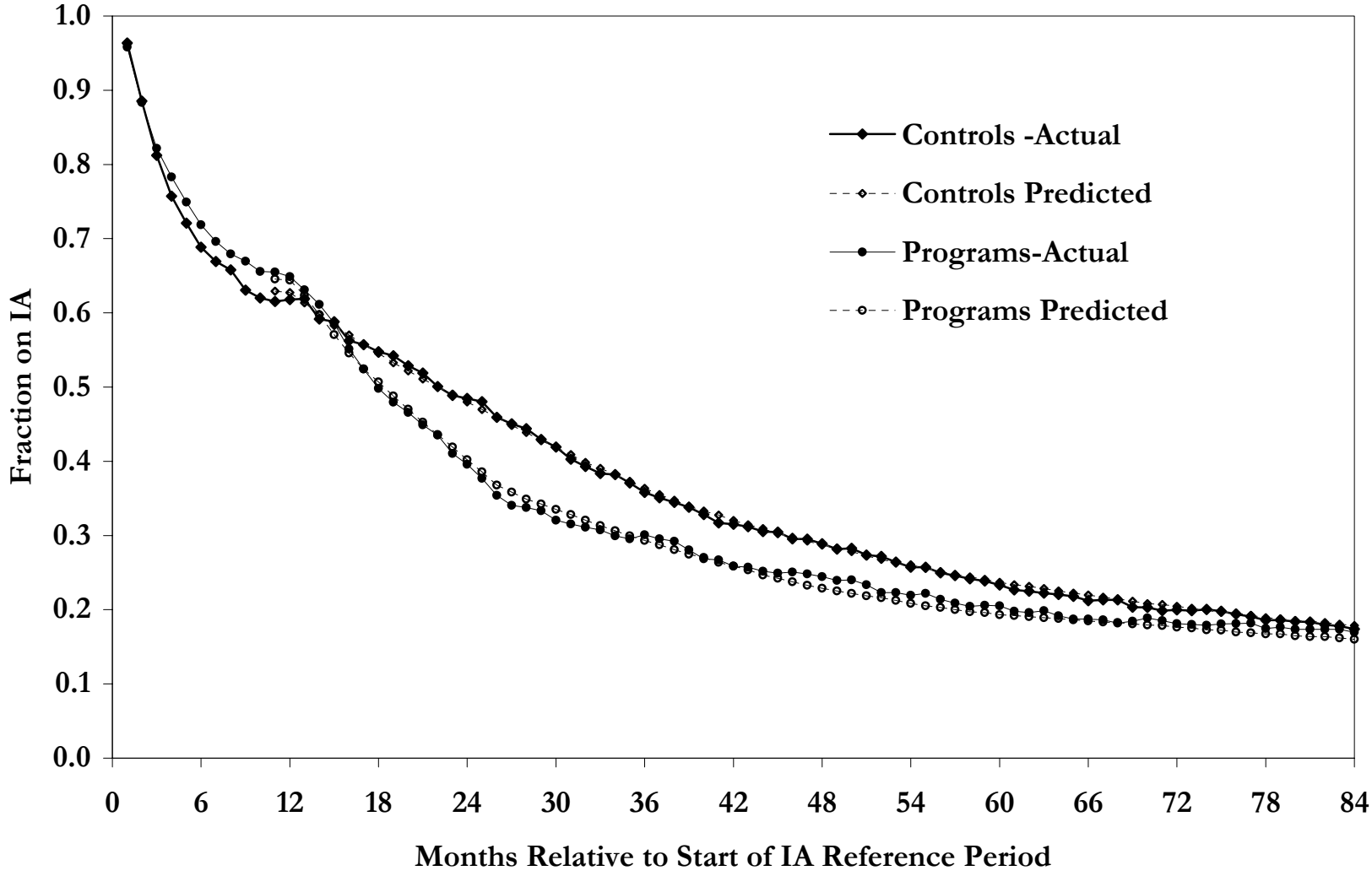

Figure 6a: Actual and Predicted IA Rates for Eligible and Ineligible Control Subgroups

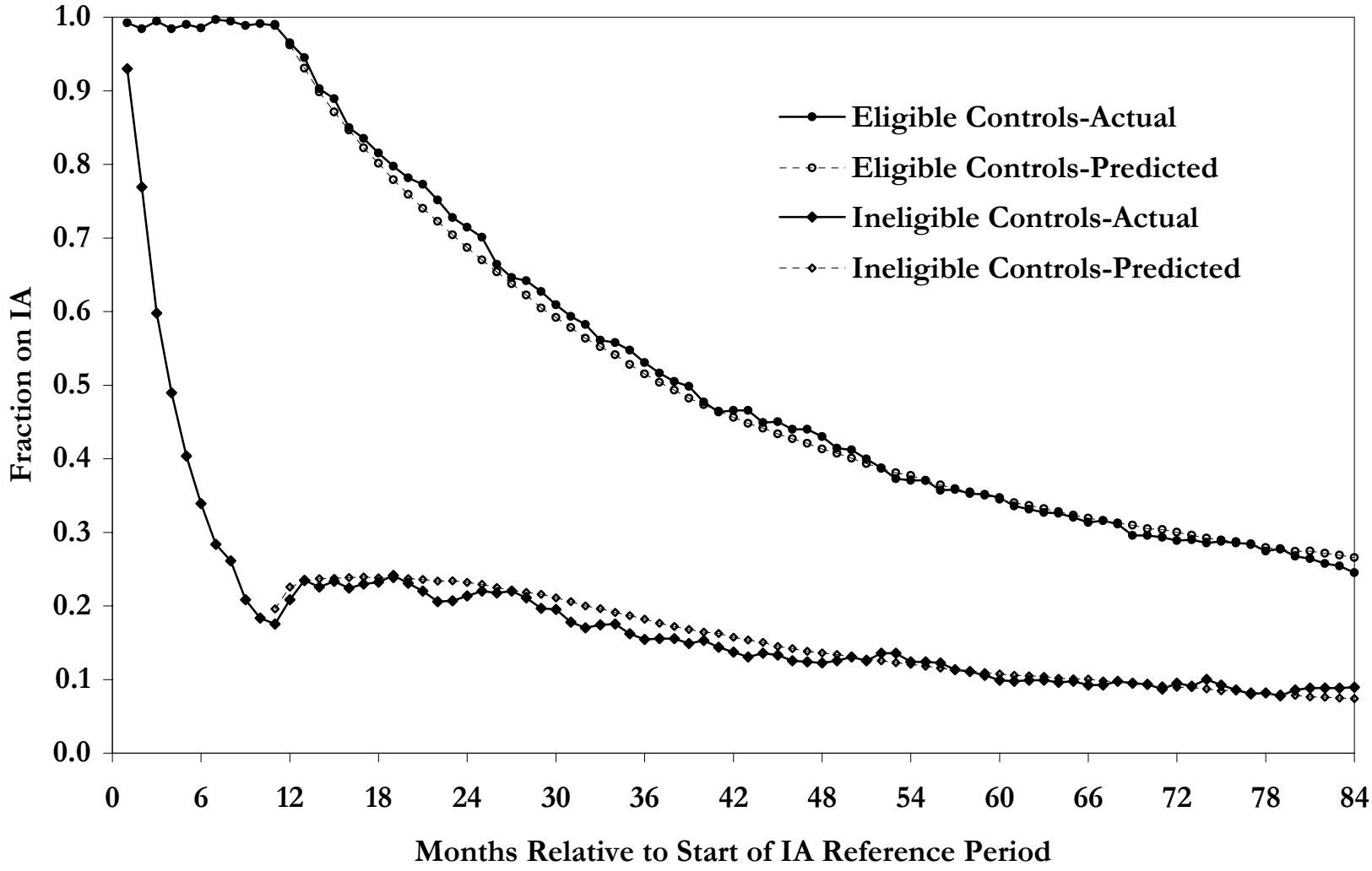

Figure 6b: Actual and Predicted IA Rates for Eligible and Ineligible Program Subgroups

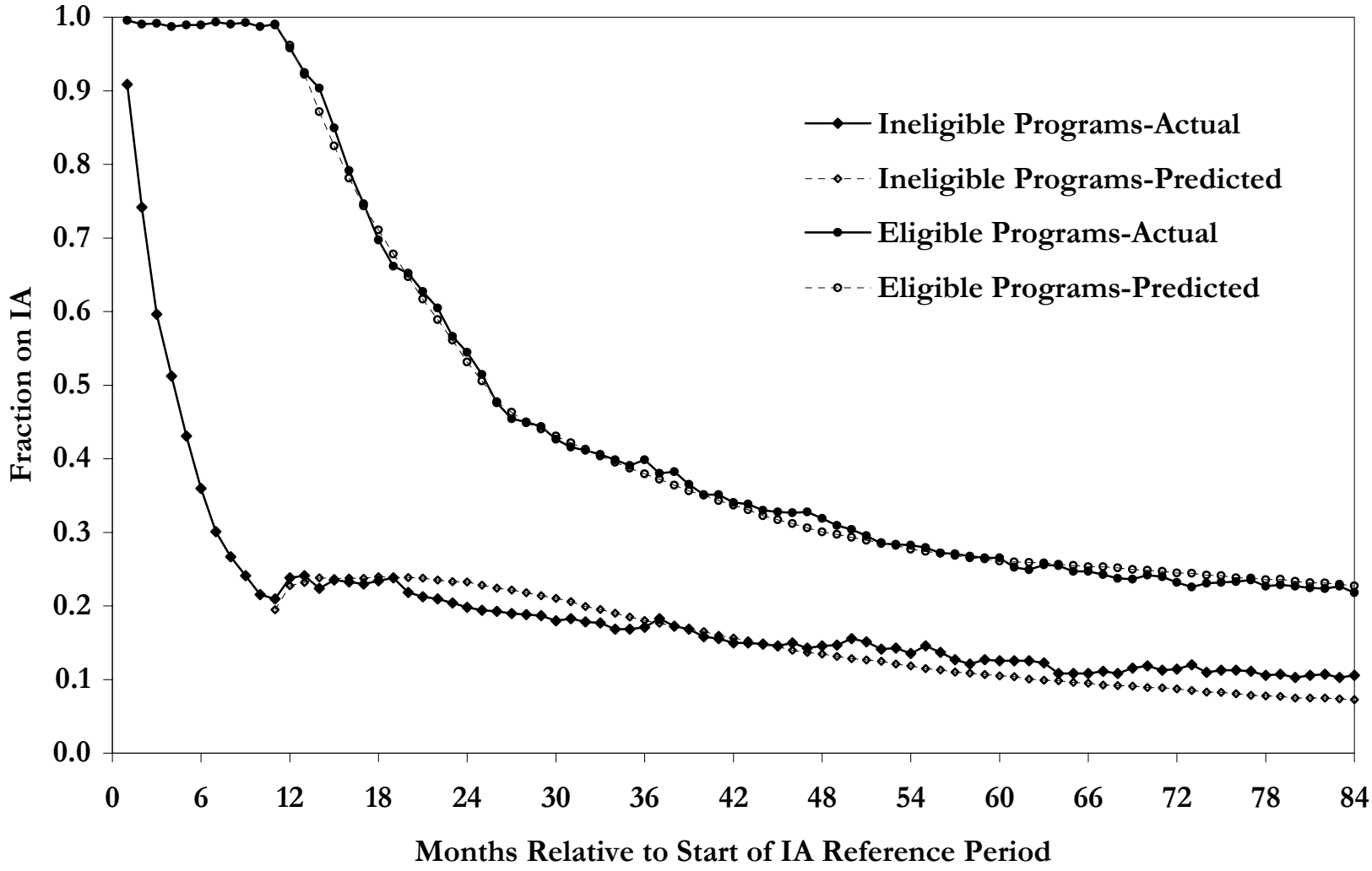

Figure 6c: Actual and Predicted IA Rates for Eligible Program Subgroups

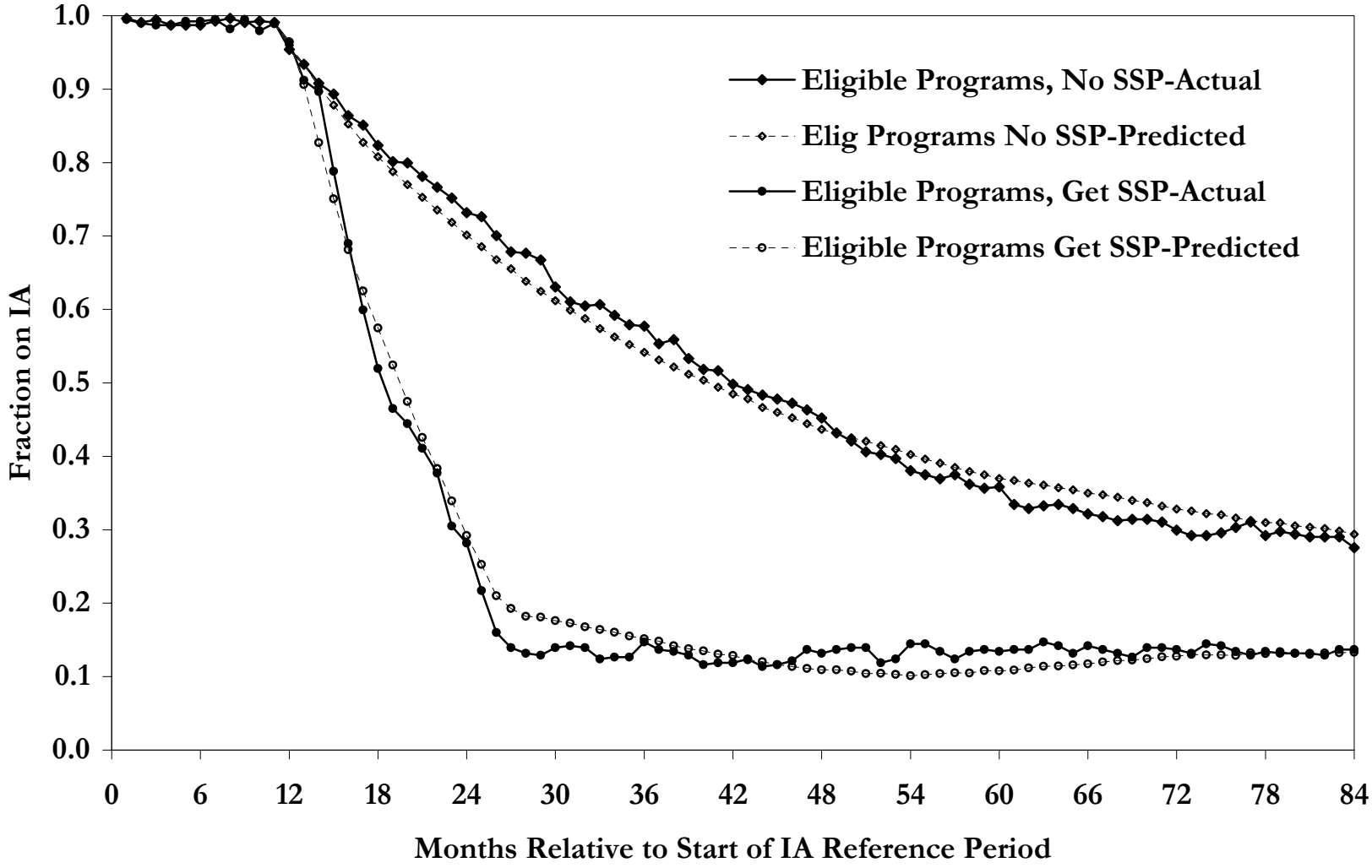

Figure 7a: Actual and Predicted Treatment Effects on IA Participation

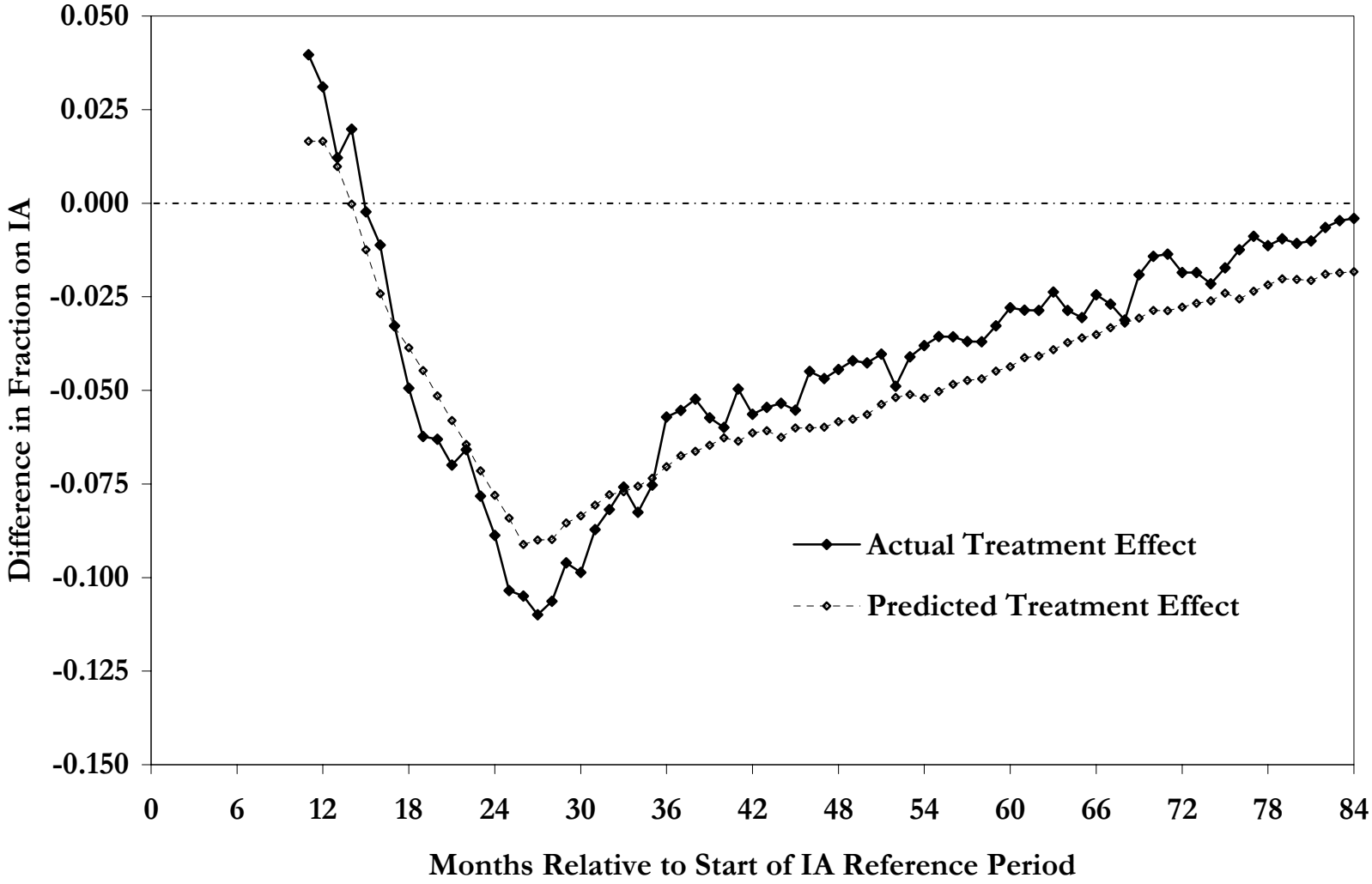

Figure 7b: Differences in IA Participation, Eligible Treatments Versus Eligible Controls

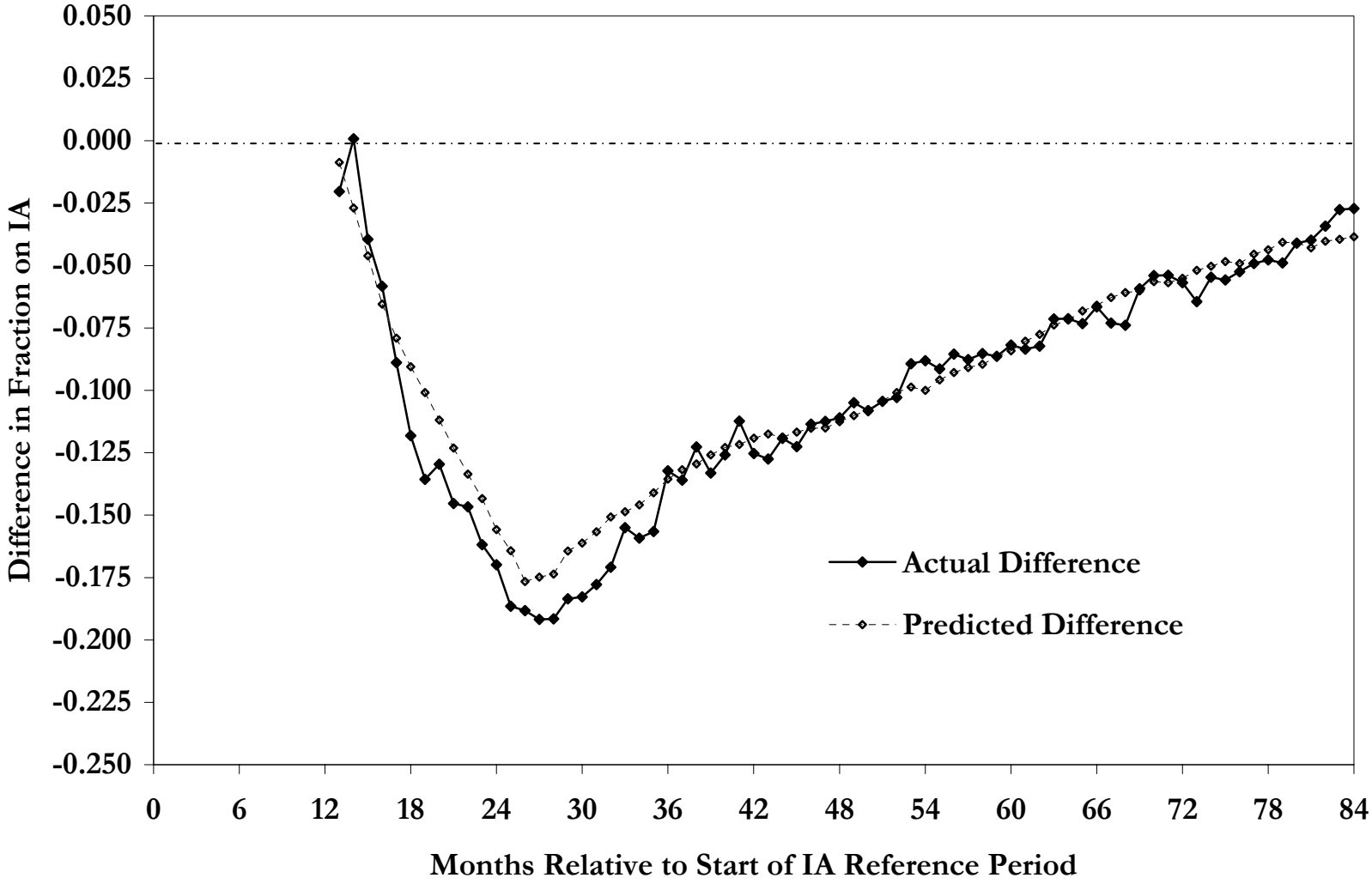

Figure 7c: Differences in IA Participation, Ineligible Treatments Versus Ineligible Controls

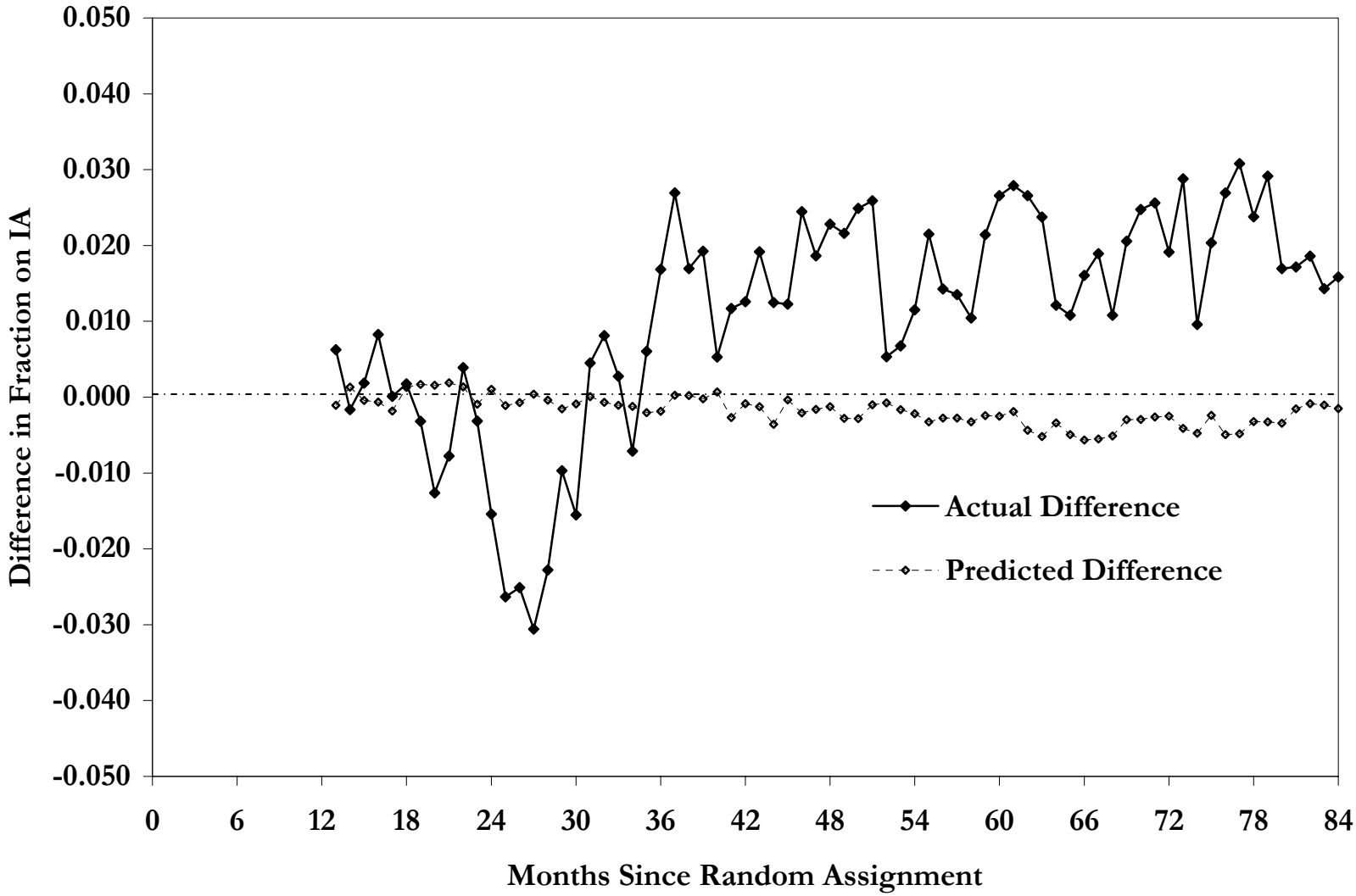

Figure 8: Decomposition of Predicted Treatment Effects on IA Participation