How Postsecondary Education Improves Adult Outcomes for Supplemental Security Income Children with Severe Hearing Impairments

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Summary

The rapid growth in the number of children participating in the Supplemental Security Income (SSI) program before the age of 18 has led policymakers to consider new methods of assisting children with disabilities in their transition from school to work. Postsecondary education represents one path that SSI children may take to acquire the skills necessary to enter employment and reduce dependency on the SSI disability program as adults. Yet little is known about SSI children's experience with postsecondary education, let alone their ability to increase their labor market earnings and reduce their time on SSI as adults in the long term. This lack of information on long-term outcomes is due in part to a lack of longitudinal data.

This article uses a unique longitudinal data set to conduct a case study of SSI children who applied for postsecondary education at the National Technical Institute for the Deaf (NTID) within the Rochester Institute of Technology. The data set was created by merging NTID administrative data on the characteristics and experiences of its applicants to Social Security Administration (SSA) longitudinal data on earnings and program participation. We used this data file to estimate the likelihood that an SSI child will graduate from NTID relative to other hearing-impaired NTID applicants, and we estimated the influence of graduation from NTID on participation in the SSI adult program and later success in the labor market.

The results of our analysis show that the percentage of NTID applicants who were SSI children increased over time, from a low of 10 percent in 1982 to more than 41 percent in 2000. However, the differences in the probability of graduation from NTID between deaf SSI children and deaf applicants who were not SSI children did not change accordingly. The probability of graduation for SSI children who applied to NTID was 13.5 percentage points lower than for those who were not SSI children. The estimated disparity indicates that targeting college retention programs toward SSI children may be an effective way to improve overall graduation rates.

Our results also show that SSI children who graduated from NTID spent less time in the SSI adult program and had higher earnings than SSI children who did not gradu-

ate. Compared with SSI children who were accepted to NTID but chose not to attend, SSI children who graduated from NTID left the SSI program 19 months earlier, were less likely to reenter the program, and at age 30 had increased their earnings by an estimated 49 percent. Our findings demonstrate that SSI children need not be relegated to a lifetime of SSI participation as adults, despite the poor overall labor market experience of this population since the creation of the SSI program in 1974.

Introduction

The Supplemental Security Income (SSI) program is the largest federal means-tested cash assistance program in the United States. It is administered by the Social Security Administration (SSA) and provides assistance to children with disabilities, working-age adults with disabilities, and the aged, as long as they meet the income and resource requirements necessary for eligibility.[1] In 2005, approximately 1 million children under the age of 18 received disability payments through the SSI program. The number of children receiving SSI has tripled over the past 15 years, far outpacing the growth of working-age adults and the aged receiving it (Social Security Administration 2006). Many of these children are likely to participate in the SSI disability program for a majority of their lifetime (Rupp and Scott 1995) because they are unlikely to reach the income or resource levels, either through work or through other means, to make a long-term exit from the SSI program. The rapid growth in the number of children receiving disability payments and the evidence that suggests that many of them will depend on these benefits for most of their lives has prompted policymakers to consider new methods to assist children in the transition from school to work. SSA program administrators have referred to these efforts as "managing against the risk of disability."[2]

Postsecondary education represents one path that SSI children (that is, those who enter the SSI program before age 18) may take to acquire the skills necessary to enter employment and reduce dependency on the adult SSI disability program. Yet little is known about SSI children's experience with postsecondary education, let alone its ability to increase their labor market earnings and reduce their time on SSI as adults in the long term. This lack of information on the long-term outcomes is due in part to the absence of longitudinal data on them.[3]

The findings reported here are from a unique longitudinal data set we created. The data set consists of administrative records from the Rochester Institute of Technology's National Technical Institute for the Deaf (NTID) linked to data from SSA's Supplemental Security Record, the Master Earnings File, and the Numident file. We use these data to conduct a case study of the subsequent educational and labor market success of SSI children as well as their SSI program participation as adults, relative to other deaf children who apply for postsecondary education.

The case study followed persons with severe hearing impairments who applied to NTID, one of two federally supported postsecondary schools that serve the population with severe hearing impairments. The postsecondary education programs offered at NTID include vocational degree programs that provide specific training for particular occupations. They also include professional degree programs that may lead to an associate of science, bachelor of arts, or master of arts degree. Almost all NTID applicants have hearing impairments that meet the medical criteria used to determine eligibility for the Social Security disability programs, and so they also are eligible to receive SSI adult benefits if they meet the income and resource tests.

We found that SSI children who graduated from NTID spent less time in the SSI adult program and had higher earnings than SSI children who did not graduate. However, we also found that SSI children who applied to NTID had a greater risk of not graduating than their fellow deaf students who did not participate in the SSI program as children. Our findings suggest that greater effort may be necessary to prepare SSI children for postsecondary education and that the currently SSA-funded youth transition demonstration projects may contribute to our understanding of how such efforts can improve adult outcomes for SSI children with disabilities.

Literature Review

There is a significant body of research on the transition from secondary school to postsecondary education and employment for youth with disabilities. (See Wittenburg and Maag [2002] for a review of this literature.) We contribute to this literature by examining a subgroup of SSI recipients—SSI children. We describe their experiences during the transition to postsecondary education and quantify their economic outcomes as young adults. Our study is unique in that the longitudinal data on Social Security participation and earnings allowed us to examine outcomes over a relatively long period after the completion of postsec-

ondary education. Here we summarize research related to this study and describe its contribution to the larger body of research.

Postsecondary Education for Youth with Disabilities

As of 2003, participation in postsecondary education among youth with disabilities was estimated to be about half of the participation rate for the general population of youth (Wagner and others 2005). This research, which used the National Longitudinal Transition Survey (NLTS) and the National Longitudinal Transition Survey 2 (NLTS-2), also showed increased participation in postsecondary education for youth with disabilities from 1987 to 2001 and that this increase was greater than the increase for the general population (Wagner and others 2005). This finding indicates that the gap between the two groups has declined over time and that the transition from secondary education to postsecondary education is becoming more prevalent among youth with disabilities.

Data on postsecondary education completion rates show that youth with disabilities are less likely to complete postsecondary education than other youth. Horn and Berktold (1999) used the Beginning Postsecondary Students Longitudinal Study (BPS: 90/94) to support this finding; the BPS: 90/94 was a survey of undergraduates who enrolled in postsecondary education for the first time in the 1989–1990 period and were interviewed for the last time in 1994. Their results show that, at the time of the last interview, 53 percent of students with disabilities had completed postsecondary education or were still enrolled, compared with 64 percent of those without disabilities. Horn and Berktold state that this difference may have been partly due to differences in attributes that correlate with lower completion rates. For example, persons with disabilities were more likely to have General Educational Development (GED) degrees rather than standard high school diplomas, and persons with GED degrees are less likely to complete postsecondary education.

Research on the benefits of postsecondary education is limited to outcomes immediately following completion of postsecondary education. Horn and Berktold (1999) used the BPS: 90/94 to show that the gap between postsecondary education graduates with and without disabilities is small in terms of postgraduation employment, participation in graduate school, and participation in employment related to their postsecondary degree. They concluded that postsecondary education graduates with disabilities fare relatively well when compared with those without disabilities. This finding is in stark contrast to the experience of the general population with disabilities, which does not fare nearly as well with respect to both employment and earnings compared with the general population. However, the postsecondary education outcomes considered by Horn and Berktold focused only on the year immediately following graduation; the study did not examine employment and earnings in subsequent years. Thus, these studies may have missed differences that arise in terms of earnings growth and long-term employment prospects.

The only study that examines long-term employment outcomes among persons with disabilities was performed by Walter, Clarcq, and Thompson (2002), who used data from a 1998 version of the NTID/SSA matched data to examine employment outcomes for all NTID applicants. Their analysis suggests that a postsecondary education from NTID yields significant economic gains for persons with severe hearing impairments. However, their analysis was based on a single cross section of data and hence did not follow the individuals over time; nor did it examine whether there are differences in these outcomes between those who are former SSI children and those who are not.

SSI Children

Research on SSI children shows that they are likely to spend a significant portion of their adult life collecting SSI benefits and that they are less likely to enroll in postsecondary education compared with the general population.

Rupp and Scott (1995) provide evidence of the length of stay in the program for SSI children. The authors used sample cohorts of persons awarded SSI as children from 1974 through 1982 and examined a 10-year follow-up period using administrative records from 1974 through 1992. They found that the mean length of the first spell of SSI participation was 11.3 years for SSI children. By the time SSI children turn 65, it is estimated that more than half of them will have spent over 25 years in the program; the mean length of stay for all children was 26.7 years.[4]

The postsecondary education enrollment rates for former SSI children aged 19–23 are described in Loprest and Wittenburg (2005). To examine the transition process, they used data from the National Survey of SSI Children and Families (NSCF), an SSA-funded nationally representative survey of current and former SSI children, fielded from August 2001 through July 2002.[5] Part of their study examined the

educational attainment of a posttransition cohort of people who were aged 19–23 in 2000 and had received SSI payments as children in 1996. At the time of the interview, they found that an estimated 42.3 percent had graduated from secondary school but were not in postsecondary school, while 6.3 percent had graduated from secondary school and made the transition to postsecondary school.[6] The 6.3 percent of SSI children who enrolled in postsecondary education provides some context for our study. Although the rate was not zero, it was small compared with the estimate of 35 percent enrollment rate for youth in the general population who were aged 18–24.[7] The NSCF estimate of 42 percent of SSI children who completed secondary education but did not enroll in postsecondary education may point to additional SSI children who could benefit from postsecondary education.

How the Current Study Contributes to the Literature

Our study builds on existing research by focusing on SSI children and examining postsecondary education completion rates, as well as on how postsecondary education can influence length of stay in the adult SSI program and long-term employment outcomes. No other study has examined either postsecondary education completion rates for SSI children or long-term outcomes, such as dependency on the adult SSI disability program or adult employment associated with postsecondary education for this population. The few studies that have considered long-term outcomes for youth with disabilities who participate in postsecondary education have not taken full advantage of the longitudinal data. Our analysis used a longitudinal database and used techniques that take advantage of the longitudinal nature of our data to characterize outcomes for SSI children.

Data

A data file based on administrative data from NTID and SSA was used for the analyses. The data file was created under a Memorandum of Agreement (MOA) whereby NTID paid SSA to create the merged data file for the purpose of conducting research on outcomes for NTID applicants. The two organizations worked together with researchers at Cornell University to design a merged NTID/SSA event history data file that could be used to track NTID applicants' outcomes for Social Security program participation, employment, and labor earnings. SSA staff constructed the file, which is securely stored at SSA; only SSA employees are allowed to perform analysis on the individual records.[8]

The NTID data contain information on all persons who have applied to the school since it opened in 1968. The data allow NTID applicants to be disaggregated into four groups:

1. those who were not accepted,
2. those who were accepted but chose not to attend,
3. those who attended but withdrew before earning a degree, and
4. those who graduated.

Individual information is available on the age, sex, and race of all applicants. Additional data are collected for those who attended NTID, including information on the age at which the hearing impairment began, the severity of the person's hearing impairment, and family background.

Social Security Administration data come from the Supplemental Security Record, the Master Earnings File, and the Numident file.[9] The Supplemental Security Record contains the complete history of SSI program participation since the program began in 1974. The file is used to identify childhood participation in the SSI program and to construct an event history file of SSI program participation in adulthood. The Master Earnings File contains information on annual earnings that are subject to Federal Insurance Contribution Act (FICA) taxes from 1981 through 2003.[10] It is used to estimate labor earnings for the age/earnings profiles. The Numident file contains information on deaths that occurred before 2004.

The resulting NTID/SSA merged data file has several features that make it superior to all other data sets that describe postsecondary education experiences of and outcomes for persons with disabilities. First, it is the only data set able to track long-term outcomes for youth with disabilities, such as adult SSI participation, employment, and earnings. Second, the NTID data include three different groups of applicants who did not graduate from NTID—those who were not accepted, those who were accepted but chose not to attend, and those who attended but withdrew before earning a degree. By comparing NTID graduates with these applicant groups, we were able to reduce the influence of selection bias associated with comparing them with all other persons who had disabilities. Third, our data were administrative, so we were able to match almost all NTID applicants to their administrative records. In this way, we avoided the usual problems

with survey data that rely on self-reporting and have low response rates, which can affect validity.

We focused on applicants born from 1965 through 1979 who were alive at the time we extracted their SSA administrative records.[11] We restricted our sample to persons born after 1964 because a significant amount of data in the NTID database is missing for earlier cohorts and because by doing so we avoided complications associated with SSI rule changes that occurred in the early 1980s.[12] We restricted our sample to persons born before 1980 to ensure that we would observe graduation from NTID.

A total of 5,638 applicants met our criteria for the analyses. We refer to this group as NTID applicants. In some of our analyses, we used the subset of 1,366 applicants who were SSI children. Finally, we drew a sample of 9,388 SSI children from SSA administrative data who met our selection criteria for the analyses. The latter group was used to show how program participation and earnings outcomes differ between SSI children in the four NTID applicant groups and all SSI children.

Table 1 describes the variables used in our analysis, organizing them by NTID applicant group, participation in the SSI program as a child, demographic characteristics, age at onset of hearing impairment, severity of impairment, and family background characteristics. The descriptive statistics in Table 2 show how the composition of characteristics differed across the four NTID groups.[13] For example, there are differences in the percentage of each NTID applicant group who were SSI children—16 percent of graduates were SSI children compared with 29 percent of those who withdrew; 24 percent of those who were accepted but chose not to attend; and 32 percent of applicants who were not accepted. The lower percentage of NTID graduates who were SSI children suggests that the former SSI children who applied to NTID had a relatively lower chance of graduating than other NTID applicants. However, there also are sizable differences

Table 1.
Definition of variables

Variable	Definition
Applicant group	
Graduated	Value equals 1 if person graduated from NTID; 0 otherwise.
Withdrew	Value equals 1 if person withdrew from NTID; 0 otherwise.
Accepted, did not attend	Value equals 1 if person was accepted but did not attend NTID; 0 otherwise.
Not accepted	Value equals 1 if person was not accepted into NTID; 0 otherwise.
Received SSI as a child	
SSI child	Value equals 1 if person received SSI payments before age 18; 0 otherwise.
Not SSI child	Value equals 1 if person did not receive SSI payments before age 18; 0 otherwise.
Sex and race	
Female	Value equals 1 if sex is female; 0 otherwise.
Nonwhite	Value equals 1 if race is nonwhite; 0 otherwise.
Age at onset of hearing loss	
Age	Value equals age at deaf onset; 99 or "." if missing.
Birth	Value equals 1 if age at hearing loss is birth; 0 otherwise.
Ages 0–5	Value equals 1 if age at hearing loss is 0–5; 0 otherwise.
Ages 6 or older	Value equals 1 if age at hearing loss is 6 or older; 0 otherwise.
Missing	Value equals 1 if age at hearing loss is missing; 0 otherwise.
Severity of hearing loss	
Mild	Value equals 1 if lowest PTA hearing score is between 0 and 60; 0 otherwise.
Severe	Value equals 1 if lowest PTA hearing score is between 61 and 90; 0 otherwise.
Severe spline	Is a continuous value that is the difference between the PTA score and the score of 60, which is the definition of a severe hearing impairment. It is equal to 0 for those with a PTA score above 89 and below 60.
Profound	Value equals 1 if lowest PTA hearing score is greater than 90; 0 otherwise.
Profound spline	Is a continuous value that is the difference between the PTA score and the score of 90, which is the definition of a profound hearing impairment. It is equal to 0 for those with a PTA score below 90.

(Continued)

Table 1.
Continued

Variable	Definition
Father's education	
Elementary	Value equals 1 if father's education is elementary school; 0 otherwise.
Secondary	Value equals 1 if father's education is secondary school; 0 otherwise.
College	
2 years	Value equals 1 if father's education is 2 years of college; 0 otherwise.
4 years	Value equals 1 if father's education is 4 years of college; 0 otherwise.
5 or more years	Value equals 1 if father's education is postgraduate; 0 otherwise.
Missing	Value equals 1 if father's education is missing; 0 otherwise.
Mother's education	
Elementary	Value equals 1 if mother's education is elementary school; 0 otherwise.
Secondary	Value equals 1 if mother's education is secondary school; 0 otherwise.
College	
2 years	Value equals 1 if mother's education is 2 years of college; 0 otherwise.
4 years	Value equals 1 if mother's education is 4 years of college; 0 otherwise.
5 or more years	Value equals 1 if mother's education is 5 or more years of college; 0 otherwise.
Missing	Value equals 1 if mother's education is missing; 0 otherwise.
Deaf parents	
Neither	Value equals 1 if neither parent is deaf; 0 otherwise.
One	Value equals 1 if one parent is deaf; 0 otherwise.
Two	Value equals 1 if two parents are deaf; 0 otherwise.
Missing	Value equals 1 if parents' hearing status is missing; 0 otherwise.
Birth year	Set of indicators equal to 1 for each birth year from 1965 to 1979; 0 otherwise.

SOURCES: Data file of administrative records from the National Technical Institute for the Deaf linked to data from the Social Security Administration's Supplemental Security Record, Master Earnings File, and Numident file.

NOTE: NTID = National Technical Institute for the Deaf; SSI = Supplemental Security Income; PTA = pure tone average hearing level.

across the four groups in terms of other individual characteristics, and these differences may also explain differences in graduation probabilities. Below, we describe how we accounted for these differences in our analyses.

Methods

Our analyses focused on describing the following three outcomes for SSI children:

1. The probability that an SSI child who applied to NTID would graduate, compared with NTID applicants who did not participate in the SSI program in childhood;
2. Dependency on the SSI adult program for SSI children who graduated from NTID, compared with each of the three groups of SSI children who applied but did not graduate; and
3. Levels and growth of earnings for SSI children who graduated from NTID, compared with each of the three groups of SSI children who applied but did not graduate.

Different methods were required to describe each of the outcomes. Here, we provide an overview of the methods used. The technical details can be found in Appendix A.

Educational Outcomes

The differences in the probability of graduation between SSI children and those who were not SSI children (outcome 1) were used to assess whether the differences between the two groups are large enough for policymakers to consider special programs that specifically target SSI children who apply for postsecondary education. If there are no differences in the probability of graduation between the two groups, then postsecondary education programs specifically targeting SSI children may have a smaller potential for affecting educational success. This information is important to policymakers interested in identifying which programs have the potential to help SSI children make the transition to adult life. We do not attribute the differences to the presence of the SSI program; that is, we do not conclude that if the SSI program did not

Table 2.
Descriptive statistics for NTID applicants, by outcome of application (in percent unless otherwise specified)

	Total		Not accepted		Accepted, did not attend		Withdrew		Graduated	
Variable	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Individual characteristics										
Former SSI child	24.23	0.57	31.94	1.84	23.72	1.39	28.68	0.94	15.84	0.87
Female	44.75	0.66	49.61	1.97	53.51	1.63	38.90	1.02	45.93	1.19
Nonwhite	24.49	0.57	44.03	1.96	30.96	1.51	21.41	0.86	17.89	0.92
Age at onset of hearing loss										
Mean age at onset (years)	--	--	--	--	--	--	10.80	0.64	9.65	0.69
Birth	--	--	--	--	--	--	75.15	0.90	76.52	1.01
Ages 1–5	--	--	--	--	--	--	10.23	0.63	10.77	0.74
Ages 6 or older	--	--	--	--	--	--	1.00	0.21	0.68	0.20
Missing	--	--	--	--	--	--	13.62	0.72	12.02	0.78
Severity of hearing loss										
Mean hearing loss	--	--	--	--	--	--	93.13	0.45	94.87	0.46
Missing	--	--	--	--	--	--	2.22	0.31	1.60	0.30
Mild	--	--	--	--	--	--	4.22	0.42	2.68	0.39
Severe	--	--	--	--	--	--	27.89	0.94	25.81	1.04
Severe spline (mean)	--	--	--	--	--	--	5.60	0.20	5.26	0.23
Profound	--	--	--	--	--	--	65.67	0.99	69.91	1.10
Profound spline (mean)	--	--	--	--	--	--	9.52	0.21	9.87	0.23
Father's education										
Elementary	--	--	--	--	--	--	11.88	0.68	8.60	0.67
Secondary	--	--	--	--	--	--	32.94	0.98	30.71	1.10
College										
2 years	--	--	--	--	--	--	17.15	0.79	15.67	0.87
4 years	--	--	--	--	--	--	17.93	0.80	22.22	0.99
5 or more years	--	--	--	--	--	--	9.27	0.61	14.07	0.83
Missing	--	--	--	--	--	--	10.84	0.65	8.72	0.67
Mother's education										
Elementary	--	--	--	--	--	--	10.36	0.64	8.15	0.65
Secondary	--	--	--	--	--	--	39.51	1.02	35.84	1.14
College										
2 years	--	--	--	--	--	--	22.32	0.87	21.20	0.98
4 years	--	--	--	--	--	--	16.45	0.77	20.97	0.97
5 or more years	--	--	--	--	--	--	5.09	0.46	7.29	0.62
Missing	--	--	--	--	--	--	6.27	0.51	6.55	0.59
Deaf parents										
Neither	--	--	--	--	--	--	88.90	0.66	93.68	0.58
One	--	--	--	--	--	--	1.65	0.27	1.20	0.26
Two	--	--	--	--	--	--	8.18	0.57	4.90	0.52
Missing	--	--	--	--	--	--	1.26	0.23	0.23	0.11
Mean birth year	1970.9	0.1	1969.4	0.2	1970.1	0.1	1971.8	0.1	1970.6	0.1
Number of observations	5,638		645		940		2,298		1,755	

SOURCES: Social Security Administration (SSA) calculations using the data file of administrative records from the National Technical Institute for the Deaf linked to data from SSA's Supplemental Security Record, Master Earnings File, and Numident file.

NOTE: NTID = National Technical Institute for the Deaf; SE = standard error; SSI = Supplemental Security Income; -- = not available.

exist there would be no difference in graduation rates. SSI eligibility is based on family income and resource tests, and in the absence of the SSI program these children might have experienced similar differences in the probability of graduation because their families had lower income and resources compared with NTID applicants who were not SSI children.

The method we used to estimate differences in the probability of graduation among all applicants is referred to as a sequential response model. This type of model disaggregates the probability of graduation into a sequence of three events and may be used to show how differences in the probability of graduation are related to the probability that each of the following events will occur:

- an NTID applicant will meet the school's admission criteria,
- an accepted applicant will choose to attend NTID, and
- for those who attend NTID, whether they will graduate.

Some of those who attend NTID will withdraw from the school before completing the requirements for graduation.

We used multivariate logit models to estimate how participation in the SSI program as a child is related to the probability that each of these events will occur; therefore, our model is referred to as a sequential logit.[14] The motivation for using the sequential logit is based on the descriptive statistics in Table 2, which show substantial differences in sex and race for those who are admitted to NTID, those who choose to attend, and attendees who graduate from NTID. Therefore, differences between SSI children and those who are not SSI children could be driven by differences in sex or race.[15] The sequential logit model allows us to estimate how the probability that a particular event will occur and differs for those who participate in the SSI program as children, compared with those who do not, after accounting for differences in sex, race, and birth year across the two groups. It also allows us to examine differences in graduation that may be related to sex or race.

The estimates from the sequential logit may be used to show how individual characteristics have different effects on the overall probability of graduation at each event within the sequence of events leading to graduation.[16] This information is important because it can show policymakers how each of the three events—NTID admission among those who apply, NTID attendance among those accepted, and NTID graduation among those who attend—is related to differences in the probability of graduation for particular types of applicants. For example, if lower graduation rates among SSI children occur because they decide not to attend NTID, efforts to improve graduation rates might consist of providing better information on how SSI children can get financial assistance. However, other efforts would be called for—such as improvements to college retention programs—if lower graduation rates occur because SSI children are withdrawing from NTID before earning a degree.

Program Dependency and Earnings Outcomes

SSI children who graduate from NTID (outcome 1) may experience reduced dependency on the adult program (outcome 2) and increased earnings (outcome 3). Our strategy for identifying the potential impact of NTID graduation was to compare these outcomes for SSI children who graduate from NTID with the outcomes for the following groups of applicants:

- SSI children who were accepted to NTID but chose not to attend, and
- SSI children who withdrew before earning a degree.

To attribute the entire difference in these outcomes to graduation from NTID, we need to assume that the NTID graduates would have experienced the same outcomes as the comparison groups if they had not graduated from NTID. We refer to our estimates as "potential impacts" because we are not able to verify that this assumption is valid.

We used two other comparison groups to provide further context to our estimates of these outcomes:

- SSI children who applied to NTID but who did not meet the admission standard. Our hypothesis is that this comparison group spent more time in the SSI program as adults and earned less than those who were accepted to NTID because they did not meet the NTID admission standard.
- former SSI children who qualified on the basis of a primary diagnosis of deafness and were similar in age to the NTID sample.

These comparison groups place our results in the context of the SSI program. We hypothesize that the full population of deaf SSI children spent the most time in the SSI program and had the lowest earnings.

We measured adult dependency on the SSI program using survival analysis, which provides estimates of

the timing of exit from and reentry into the SSI program after reaching age 19. Survival analysis entails following individuals from one particular event (for example, entering the adult SSI program) to another (for example, exiting the adult SSI program), and comparing the amount of time between events across groups. We estimated the potential effect of NTID graduation by comparing SSI children who graduated from NTID with each of our comparison groups using the following measures:

- the estimated probability of remaining in the program for each year over a 10-year period,
- the probability of leaving the program at the end of the 10-year period, and
- the estimated median number of months spent in the adult SSI program.

Dependency on the SSI Program as an Adult. For this analysis, we confined our sample to NTID applicants who were SSI children receiving SSI adult benefits at age 19.[17] The event history file contains the month that the person turns 19 and either the month that the person exits the adult SSI program or the last month available in our data. Months are a natural time unit for the measurement of SSI participation because an SSI recipient's payment status is determined on a monthly basis. For presentation purposes, we grouped months into yearly intervals. Some people in our data set were still participating in the SSI program as of the last time period we recorded; that is, we never observed a transition from the SSI program for some persons. These cases are referred to as censored cases, and we accounted for them by using standard statistical techniques (described in Appendix B).

We used a similar approach to examine the timing of reentry into the adult program after a first exit. In this case, the first event was the month that a person first exited the adult SSI program, and the second event was the month that a person first reentered the SSI program. Like the analysis of first exit from the adult SSI program, we grouped months into yearly intervals for presentation and used standard techniques to account for censored cases in the analysis. Because of data limitations, we focused on the probability of reentry into the program within 5 years of first exit as another measure of SSI dependency.

Earnings. To describe the third outcome, earnings, we used age/earnings profiles to examine differences in earnings from ages 18–30 across the four groups of NTID applicants. For each person in the data set, earnings were observed for each age up to 2002, the final year that annual earnings are available in our data. A data set that contains an observation for each person at each age was created, and the dollar values were adjusted to 2004 dollars using the consumer price index for all urban consumers (CPI-U). We used three key statistics to describe the age/earnings profiles:

- the percentage of persons with at least $1 of earnings at a particular age,
- the mean earnings for those with at least $1of earnings at a particular age, and
- the mean earnings for all persons at a particular age.

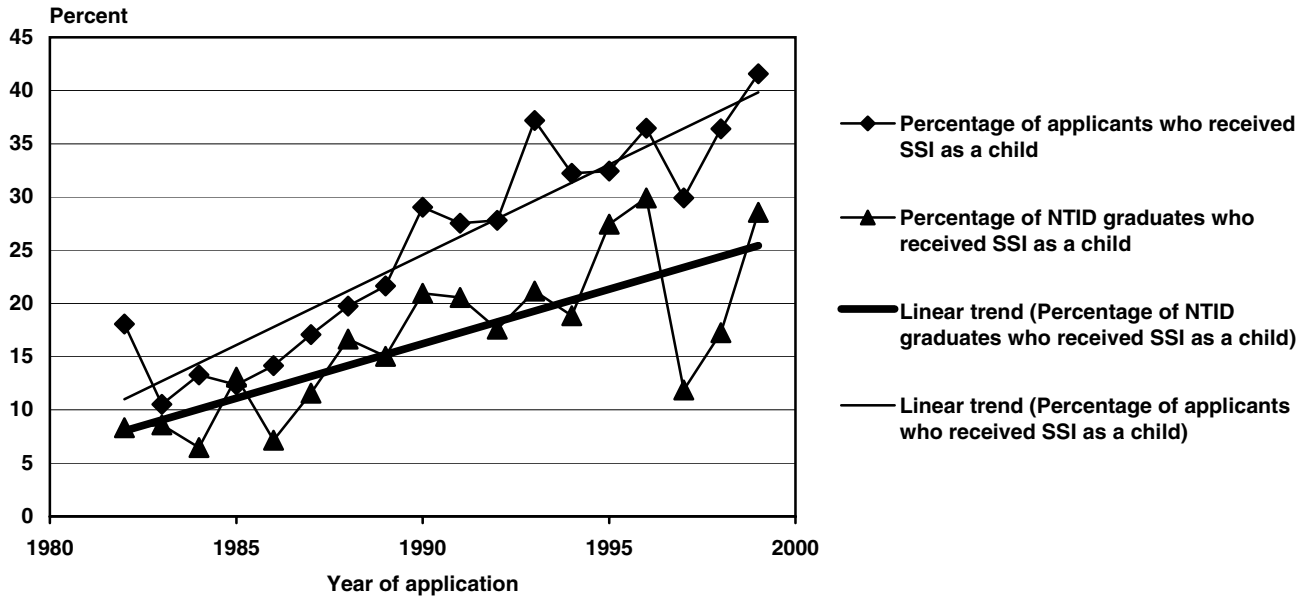
Appendix B contains data for each of the three statistics. Separate profiles were estimated for each of the four NTID applicant groups using mean earnings for all persons. Mean earnings for each age were plotted in an age/earnings graph, and a third-order polynomial trend line was fit to the means to illustrate the pattern for the various groups. The analysis allowed us to examine differences in both the level and growth in earnings from ages 18–30 and to describe the potential effects of an NTID education on earnings during this period.

Results

From 1982 to 2000, the percentage of both NTID applicants and graduates who were SSI children steadily increased. These two trends are illustrated in Chart 1, which organizes NTID applicants and graduates by the year they first applied, so that there is a common basis of comparison. The chart shows that the percentage of all NTID applicants who were SSI children increased from 10 percent in 1983 to 43 percent in 1999. It also shows that the fraction of NTID graduates who were SSI children increased from 8 percent of those who applied in 1982 to 28 percent in 1999. These results indicate that SSI children with hearing impairments accounted for a significant share of applicants and graduates during this period and that they were willing and able to participate in postsecondary education.

The position of the trend lines in Chart 1 also shows that, for each application year, the fraction of eventual graduates who were SSI children was smaller than the fraction of all applicants who were SSI children. For the 1999 application-year cohort, 42 percent of applicants were SSI children, compared with only 28 percent of eventual graduates. Overall, the percentage of those who graduated and were classified as SSI children was lower than the percentage who graduated

Chart 1.
Time series of the percentage of NTID applicants and graduates who were SSI children, by year of application



SOURCES: Social Security Administration (SSA) calculations using the data file of administrative records from the National Technical Institute for the Deaf linked to data from SSA's Supplemental Security Record, Master Earnings File, and Numident file.

NOTE: NTID = National Technical Institute for the Deaf; SSI = Supplemental Security Income.

and were not in the SSI program in childhood. Hence, SSI children who applied were less likely to graduate, compared with other applicants. The chart shows that this finding existed for almost every application year from 1982 to 1999.

Finally, the slopes of the two trend lines are different.[18] This difference indicates that even though both trends increased, the fraction of NTID applicants who were SSI children increased at a faster rate. As a result, the likelihood that an SSI child who applies to NTID will eventually graduate has decreased over time. More SSI children are applying to NTID, but the rate of graduation among these applicants has declined slightly over time. The estimates below more precisely measure the exact relationship between participation in SSI as a child and educational success as an adult.

Probability of Graduation

The results of our multivariate logit model show some substantial and statistically significant differences in the characteristics of applicants who were not admitted to NTID, were admitted and chose to attend NTID, and attended and completed degree requirements. Table 3 shows the differences in the probability for each of these events between SSI children and those who were not SSI children. Compared with non-SSI children, the probability that SSI children who applied to NTID would be admitted was 4.8 percentage points lower, the probability that SSI children who were admitted would attend NTID was not statistically different, and the probability that SSI children who attended NTID would graduate was 16 percentage points lower. The difference in the graduation rate among those who attend NTID is large; after adjusting for differences in sex and race, we estimate that 47 percent of NTID attendees who were not SSI children graduated compared with only 31 percent of those who were SSI children. The difference suggests that college preparation and retention programs that target SSI children may have the potential to substantially improve their graduation rates.

The results for females and nonwhite applicants are remarkably different from those described for SSI children. Females who applied were less likely to be admitted, and those who were admitted were less likely to attend. However, the probability of graduation for females who attended NTID was 8.1 percentage points higher than that of their male counterparts. Compared with whites, nonwhites were less likely to meet the admission criteria, and those who met the

Table 3.
Sequential logit model results of relationship between SSI participation as a child and graduation from NTID: Estimated impact on the probability that each event will occur (in percentage points)

Variable	Difference in probability of being admitted to NTID among applicants	Difference in probability of attending NTID among those admitted	Difference in probability of graduation among those who attend NTID
Former SSI child	-4.81 ***	-0.76	-16.07 ***
	[1.09]	[1.34]	[1.81]
Female	-1.93 ***	-7.27 ***	8.11 ***
	[0.83]	[1.11]	[1.55]
Nonwhite	-12.42 ***	-11.28 ***	-0.69
	[1.19]	[1.50]	[1.98]
Birth year indicators	Yes	Yes	Yes
Predicted probability (percent)	88.6	81.2	42.7
Number of observations	5,638	4,993	4,053

SOURCES: Social Security Administration (SSA) calculations using the data file of administrative records from the National Technical Institute for the Deaf linked to data from SSA's Supplemental Security Record, Master Earnings File, and Numident file.

NOTES: The sequential model is based on a sequential logit specification as described in Appendix A. Logit coefficients, odds ratios, and marginal effects for the entire model are in Table A-2.

Standard errors are in brackets.

SSI = Supplemental Security Income; NTID = National Technical Institute for the Deaf.

* significant at .10 level; ** significant at .05 level; *** significant at .01 level.

Table 4.
Sequential logit model results of relationship between SSI participation as a child and graduation from NTID: Decomposition of each event's impact on the overall probability of graduation among applicants (in percentage points)

Variable	Difference in probability of graduation among all NTID applicants	Difference in probability of graduation due to NTID admission decision	Difference in probability of graduation due to decision to attend NTID	Difference in probability of graduation due to decision to complete an NTID degree
Former SSI child	-13.5	-1.7	-0.3	-11.5
Female	2.4	-0.7	-2.7	5.8
Nonwhite	-9.1	-4.3	-4.3	-0.5

SOURCES: Social Security Administration (SSA) calculations using the data file of administrative records from the National Technical Institute for the Deaf linked to data from SSA's Supplemental Security Record, Master Earnings File, and Numident file.

NOTES: The sequential model is based on a sequential logit specification as described in Appendix A. Logit coefficients, odds ratios, and marginal effects for the entire model are in Table A-2.

SSI = Supplemental Security Income; NTID = National Technical Institute for the Deaf.

criteria were less likely to choose to attend NTID. However, the differences in graduation rates between whites and nonwhites who attended NTID were not statistically different.

We also looked at the relationship between individual characteristics and the overall probability of graduation among NTID applicants at each stage of the process.[19] As shown in Table 4, the probability of graduation for all SSI children who applied to NTID was 13.5 percentage points lower than that for NTID applicants who were not SSI children. The lower probability was spread over the three separate events that lead to graduation for applicants—with 1.7 percentage points attributed to the admittance step, 0.3 percentage points attributed to the attendance step, and 11.5 percentage points attributed to the graduation step. Thus, the final step was responsible for most of the disparity in the overall graduation rates for SSI children who applied to NTID compared with the rate for those who were not SSI children.

Given the importance of the graduation step, we estimated a multivariate logit model of the probability of graduation for those who attended NTID that includes the additional characteristics available for those attendees. The results are in Table 5 and are comparable with those shown in Table 3. The inclusion of the additional characteristics slightly reduces the estimated difference in the probability of graduation between former SSI children and those who had not been in the SSI program as children. However, the difference is still large and statistically significant. The probability that former SSI children who attended NTID would graduate was 13.5 percentage points lower than for those who were not SSI children. To put this result in perspective, the probability of graduation for those who were not SSI children was 46 percent, compared with an estimated 32.5 percent for former SSI children. Thus, even after controlling for sex, race, severity of hearing impairment, family background characteristics, and birth cohort, former SSI children

Table 5.
Logit model results of the probability of graduation for NTID attendees

Variable	Coefficient	Effect on probability of graduation (percentage points)
Individual characteristic		
Former SSI child	-0.5887 ***	-13.5
	[0.0873]	[1.92]
Female	0.3653 ***	8.5
	[0.0668]	[1.54]
Nonwhite	-0.0158	-0.4
	[0.0873]	[2.01]
Age at onset of hearing loss		
Birth	-0.0049	-0.1
	[0.1086]	[2.52]
Ages 1–5 (reference)	. . .	. . .
Ages 6 or older	-0.4722	-10.7
	[0.3797]	[8.16]
Missing	-0.2385	-5.5
	[0.1503]	[3.4]
Severity of hearing loss		
Mild	0.1989	-4.5
	[0.2492]	[5.5]
Severe (reference)	. . .	. . .
Severe spline	0.0034	0.1
	[0.0077]	[0.18]
Profound	0.2314	5.4
	[0.1866]	[4.28]
Profound spline	-0.0009	0
	[0.0050]	[0.12]
Missing	0.5797 *	13.4
	[0.3399]	[7.84]

(Continued)

Table 5.
Continued

Father's education			
Primary	-0.0707		-1.6
	[0.1470]		[3.3]
Secondary	0.0831		1.9
	[0.1038]		[2.4]
College			
2 years (reference)	. . .		. . .
4 years	0.2016	*	4.8
	[0.1113]		[2.65]
5 or more years	0.2923	**	7.0
	[0.1345]		[3.21]
Missing	-0.3107		-6.9
	[0.1977]		[4.29]
Mother's education			
Primary	0.0741		1.7
	[0.1467]		[3.35]
Secondary	-0.0117		-0.3
	[0.0930]		[2.14]
College			
2 years (reference)	. . .		. . .
4 years	0.2	*	4.7
	[0.1072]		[2.53]
5 or more years	0.3513	**	8.3
	[0.1591]		[3.75]
Missing	0.6418	***	14.8
	[0.2372]		[5.42]
Deaf parents			
Neither (reference)	. . .		. . .
One	-0.1507		-3.5
	[0.2871]		[6.59]
Two	-0.3507	**	-8.0
	[0.1409]		[3.12]
Missing	-1.9819	***	-34.0
	[0.5822]		[5.49]
Constant	0.4382	*	. . .
	[0.2350]		. . .

SOURCES: Social Security Administration (SSA) calculations using the data file of administrative records from the National Technical Institute for the Deaf linked to data from SSA's Supplemental Security Record, Master Earnings File, and Numident file.

NOTES: Birth cohort dummy variables are included. Number of observations was 4,053. Standard errors are in brackets.

NTID = National Technical Institute for the Deaf; SSI = Supplemental Security Income; . . . = not applicable.

* significant at .10 level; ** significant at .05 level; *** significant at .01 level.

were significantly less likely to graduate than their non-SSI counterparts.

In summary, the result of a lower probability of graduation for SSI children was partly due to the admission standard (that is, SSI children were less likely to be accepted to NTID), but most of it was due to the lower probability of graduation for SSI children who attended NTID. Devoting efforts to improving retention rates among SSI children who attend NTID appears to be necessary to reduce the differences in graduation rates.

Relationship Between NTID Graduation and Participation in the Adult SSI Program

Almost all of the SSI children who applied to NTID participated in the SSI program when they turned 19. After age 19, the patterns of exiting the program differed substantially between NTID graduates and each

of the comparison groups: SSI children who graduated were more likely to have left the program within 10 years following age 19 and were less likely to reenter the program.

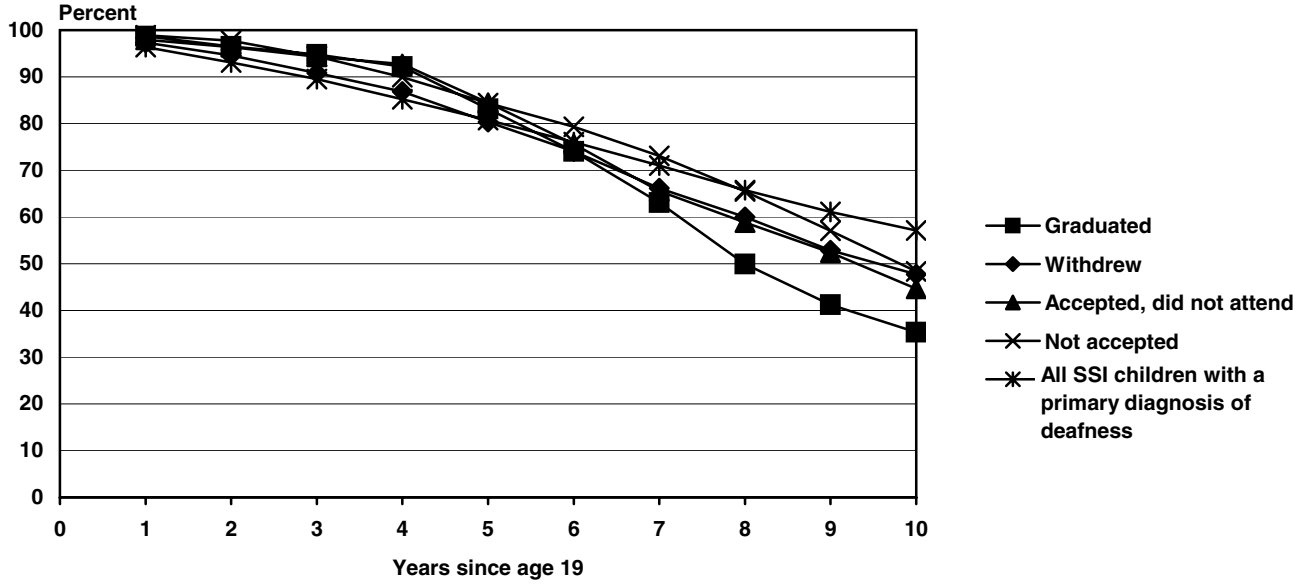
Using the survival probability for each year following age 19 as a measure, we examined the changes in the probability of remaining on the SSI program for SSI children who graduated from NTID compared with each of our comparison groups. Chart 2 shows that SSI children who graduated were more likely to remain in the program during the first 4 years following their 19th birthday—the years that many of them were attending NTID—and that after the 4th year there was a relatively sharp decline in the probability of remaining in the SSI program. By the 10th year, there was only a 34 percent chance that they would remain in the SSI program, which was significantly lower than the probability for each of the other comparison groups.

The potential impact of NTID graduation on the likelihood that SSI children will leave the program within 10 years following their 19th birthday and the median amount of time they spend in the program are shown in Table 6. We estimated that there was a 64.7 percent chance that SSI children who graduated from NTID would leave the program within 10 years, which was larger than and statistically different from the estimates of 52.2 percent for those who withdrew from NTID, 55.3 percent for those who did not attend, 51.6 percent for those who were not accepted, and 42.9 percent for the group of all SSI children with a primary diagnosis of deafness.

We also found that NTID graduation may increase the probability of SSI children leaving the program within 10 years following their 19th birthday. That probability increased by 12.5 percentage points compared with SSI children who withdrew from NTID and by 9.4 percentage points compared with SSI children who were accepted but chose not to attend. SSI children who graduated from NTID fared even better when compared with each of the other two groups; the probability of leaving the program within 10 years was 13.1 percentage points higher for SSI children who were not admitted and 21.8 percentage points higher for the group of all SSI deaf children.

The potential impact measured as the difference in the median time spent in the SSI program before leaving is also shown in Table 6. For the group of NTID graduates, the median expected time spent in the SSI program before leaving it was 95 months—substan-

Chart 2.
Probability that SSI children will remain in the adult SSI program for 1–10 years after age 19, by NTID status



SOURCES: Social Security Administration (SSA) calculations using the data file of administrative records from the National Technical Institute for the Deaf linked to data from SSA's Supplemental Security Record, Master Earnings File, and Numident file.

NOTE: SSI = Supplemental Security Income; NTID = National Technical Institute for the Deaf.

Table 6.
Estimates of first exit from SSI program for children receiving SSI at age 19, by NTID status

NTID status	Probability of leaving SSI program within 10 years		Median number of months to first exit from SSI	
	Estimate (percent)	Potential impact of NTID graduation (percentage points)	Estimate (percent)	Potential impact of NTID graduation (percentage points)
Graduated	64.7	. . .	95	. . .
	[3.29]		[1.44]	
Withdrew	52.2	12.5 ***	116	-21 ***
	[2.28]		[3.34]	
Accepted, did not attend	55.3	9.4 *	114	-19 ***
	[3.71]		[2.58]	
Not accepted	51.6	13.1 **	118	-23 ***
	[3.84]		[2.61]	
All SSI children awarded benefits on the basis of a hearing impairment [a]	42.9	21.8	145	-50
	[0.57]		[2.38]	

SOURCES: Social Security Administration (SSA) calculations using the data file of administrative records from the National Technical Institute for the Deaf linked to data from SSA's Supplemental Security Record, Master Earnings File, and Numident file.

NOTES: Standard errors are in brackets.

SSI = Supplemental Security Income; NTID = National Technical Institute for the Deaf; . . . = not applicable.

a. The group of all SSI children awarded benefits on the basis of a hearing impairment is not mutually exclusive from the group of NTID graduates, and we do not calculate statistical tests for this group.

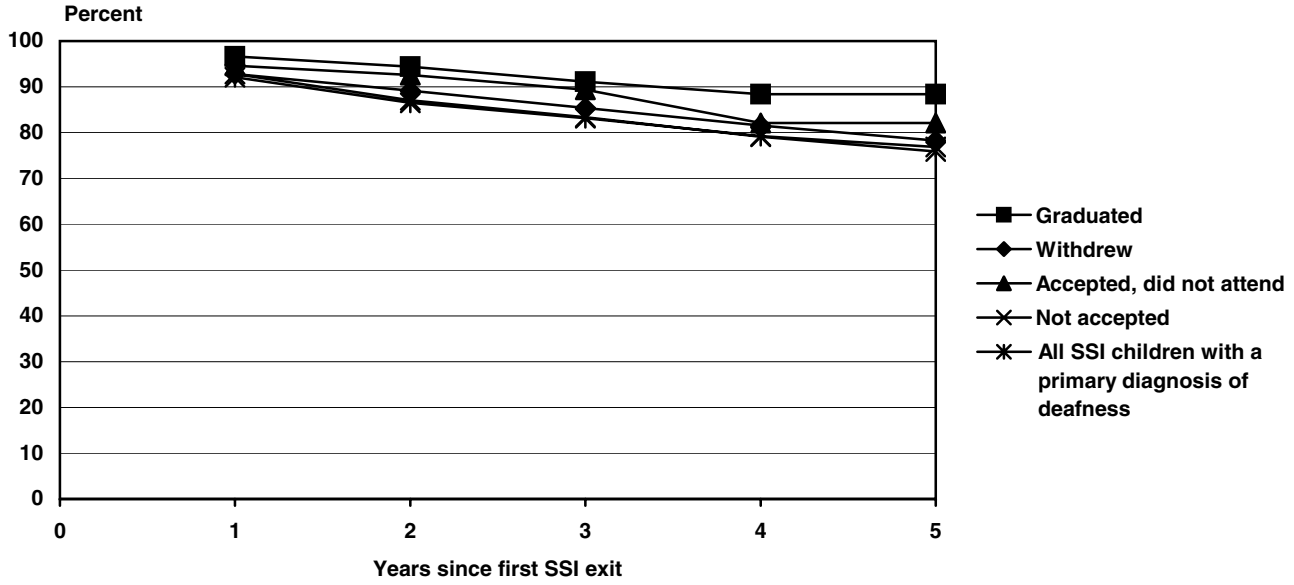
* significant at .10 level; ** significant at .05 level; *** significant at .01 level.

tially less than the 116 months estimated for those who withdrew from NTID, 114 months for those who chose not to attend, 118 months for those who were not accepted, and 145 months for the group of all deaf SSI children. The potential impact for SSI children who graduated was a 21-month reduction in median months spent in the program before leaving when compared with those who withdrew from NTID and a 19-month reduction when compared with those who were accepted but chose not to attend. Again, SSI children who graduated fared even better when compared with the other two groups; the median time before leaving was 23 months less than for those who were not admitted and 50 months less than for the group of all SSI deaf children.

An examination of the first SSI episode does not fully measure the relationship between NTID graduation and dependency on the SSI program. If NTID graduates were less likely to reenter the program after their first exit, then our estimate may have understated the role of an NTID degree on reductions in dependency on the SSI program. Chart 3 shows that the probability that the person would remain off the program, or survive without the program, was higher for NTID graduates across the 5 years after first exit. The sample sizes declined dramatically after the 5th year (as shown in Table A-5), and our estimates for later years have larger standard errors.

Table 7 shows the probability that an SSI child would reenter the SSI program within 5 and within 10 years following first exit from the program after reaching age 19, using the survival probability as a measure.[20] The probability of reentry within 5 years after leaving the program was only 11.6 percent for SSI children who graduated from NTID, which was smaller than the 21.7 percent estimate for those who withdrew, the 17.9 percent estimate for those who were accepted but chose not to attend, the 24.1 percent for those who were not accepted, and the 23.2 percent for the group of all deaf SSI children. The potential impact of NTID graduation for SSI children was a drop of 10.1 percentage points in the probability of reentering the SSI program when compared with those who withdrew and a drop of 6.3 percentage points when compared with

Chart 3.
Probability that SSI children will remain off the adult SSI program after first exit, by NTID status



SOURCES: Social Security Administration (SSA) calculations using the data file of administrative records from the National Technical Institute for the Deaf linked to data from SSA's Supplemental Security Record, Master Earnings File, and Numident file.

NOTE: SSI = Supplemental Security Income; NTID = National Technical Institute for the Deaf.

Table 7.
Probability that SSI children will reenter the SSI program within 5 or 10 years following first exit from the program after reaching age 19, by NTID status

	Within 5 years		Within 10 years	
NTID status	Estimate (percent)	Potential impact of NTID graduation (percentage points)	Estimate (percent)	Potential impact of NTID graduation (percentage points)
Graduated	11.6 [2.84]	. . .	14.4 [3.38]	. . .
Withdrew	21.7 [2.86]	-10.1 **	27.2 [3.67]	-12.8 ***
Accepted, did not attend	17.9 [3.99]	-6.3	33.1 [6.28]	-18.7 ***
Not accepted	24.1 [4.82]	-12.5 **	26.1 [5.08]	-11.7 *
All SSI children awarded benefits on the basis of a hearing impairment [a]	23.2 [0.88]	-11.6	32.2 [1.44]	-17.8

SOURCES: Social Security Administration (SSA) calculations using the data file of administrative records from the National Technical Institute for the Deaf linked to data from SSA's Supplemental Security Record, Master Earnings File, and Numident file.

NOTES: Standard errors are in brackets.

SSI = Supplemental Security Income; NTID = National Technical Institute for the Deaf; . . . = not applicable.

a. The group of all SSI children awarded benefits based on a hearing impairment is not mutually exclusive from the group of NTID graduates, and we do not calculate statistical tests for this group.

* significant at .10 level; ** significant at .05 level; *** significant at .01 level.

those who chose not to attend NTID (although the latter result is not statistically significant). The estimates for the other two groups show that the group of all deaf SSI children also fared better. The probability of reentering the program within 10 years shows that the potential impact of NTID graduation is also substantial and statistically significant.

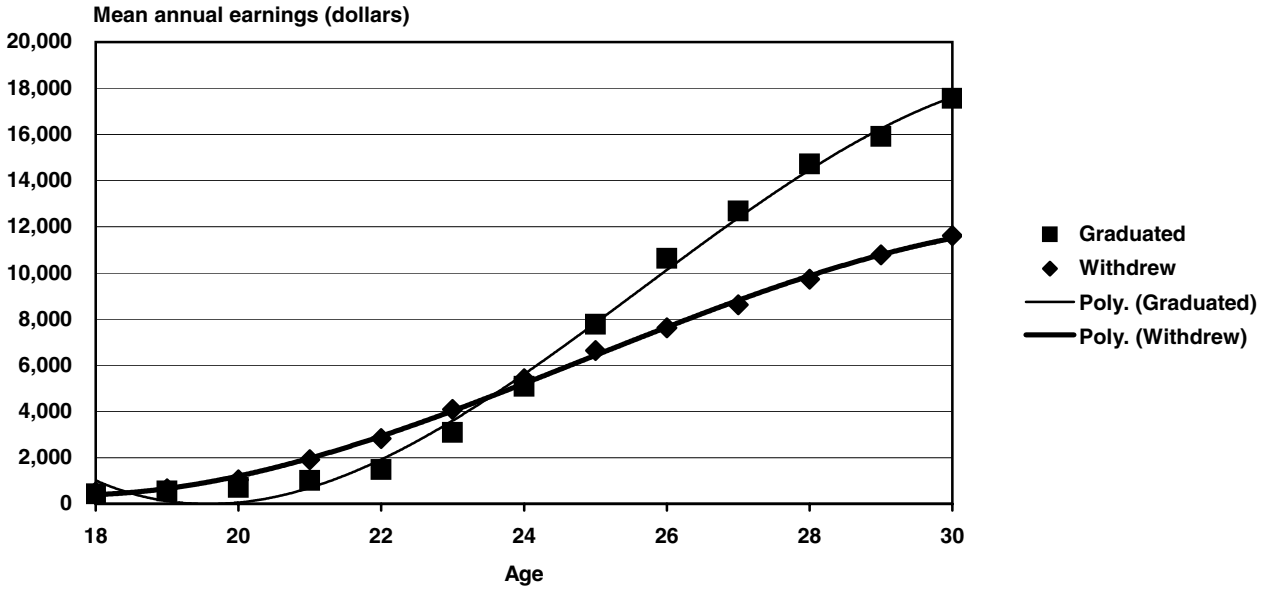
Age/Earnings Profiles

To determine the potential impact of NTID graduation on the labor earnings of SSI children during the early portion of their adult life, we compared the age/earnings profile for SSI children who graduated from NTID with the profile for SSI children who withdrew from NTID (Chart 4).[21] The results show that SSI children who graduated had a mean annual earnings level of less than $1,000 between the ages of 18 and 21, ages at which most graduates were attending NTID. The trend line shows that their mean annual earnings grew from about $1,000 at age 21 to $17,500 by age 30. SSI children who withdrew from NTID experienced very little earnings growth, and by age 30 the mean annual earnings level for the group was a little less than $11,600 per year. By age 30, the gap between the two groups was almost $6,000, with SSI children who graduated earning 51 percent more than those who withdrew.

The potential earnings impact for SSI children who graduated from NTID compared with SSI children who were accepted to NTID but did not attend is shown in Chart 5. The earnings of SSI children who graduated exceeded the earnings of those who chose not to attend at every age after reaching age 24. The earnings of those who did not attend NTID grew to slightly more than $12,100 by the time they were age 30. By age 30, SSI children who graduated from NTID were earning about $5,400 (or 44 percent) more than SSI children who were accepted to NTID but chose not to attend.

Comparisons between SSI children who graduated from NTID and those who were not admitted are shown in Chart 6. SSI children who were not accepted to NTID had modest growth in mean annual earnings from age 18 to age 30, with a mean level of earnings of about $8,800 at age 30. This level was well below the level for SSI children who graduated. At age 30, the earnings gap was about $8,700; SSI children who graduated from NTID earned about 99 percent more than those who were not accepted.

Chart 4.
Age/earnings profiles for SSI children who graduated from NTID compared with those who withdrew

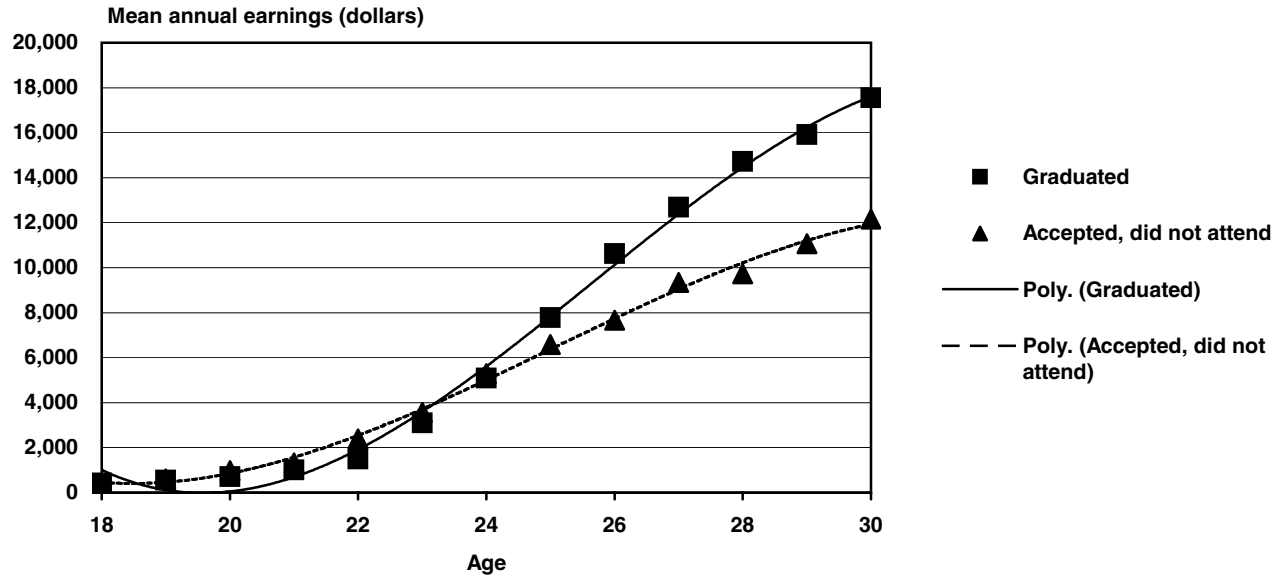


SOURCES: Social Security Administration (SSA) calculations using the data fle of administrative records from the National Technical Institute for the Deaf linked to data from SSA's Supplemental Security Record, Master Earnings File, and Numident file.

NOTES: Data include zero earners.

SSI = Supplemental Security Income; NTID = National Technical Institute for the Deaf; Poly. = polynomial trend line.

Chart 5.
Age/earnings profiles for SSI children who graduated from NTID compared with those who were accepted but chose not to attend

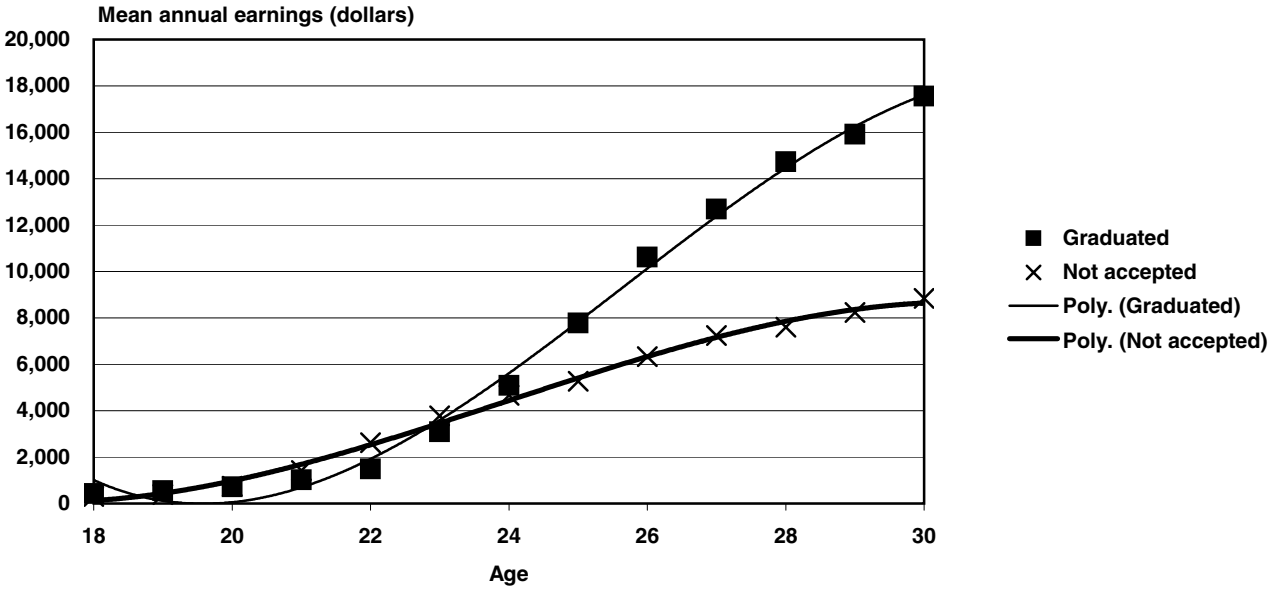


SOURCES: Social Security Administration (SSA) calculations using the data file of administrative records from the National Technical Institute for the Deaf linked to data from SSA's Supplemental Security Record, Master Earnings File, and Numident file.

NOTES: Data include zero earners.

SSI = Supplemental Security Income; NTID = National Technical Institute for the Deaf; Poly. = polynomial trend line.

Chart 6.
Age/earnings profiles for SSI children who graduated from NTID compared with those who were not accepted

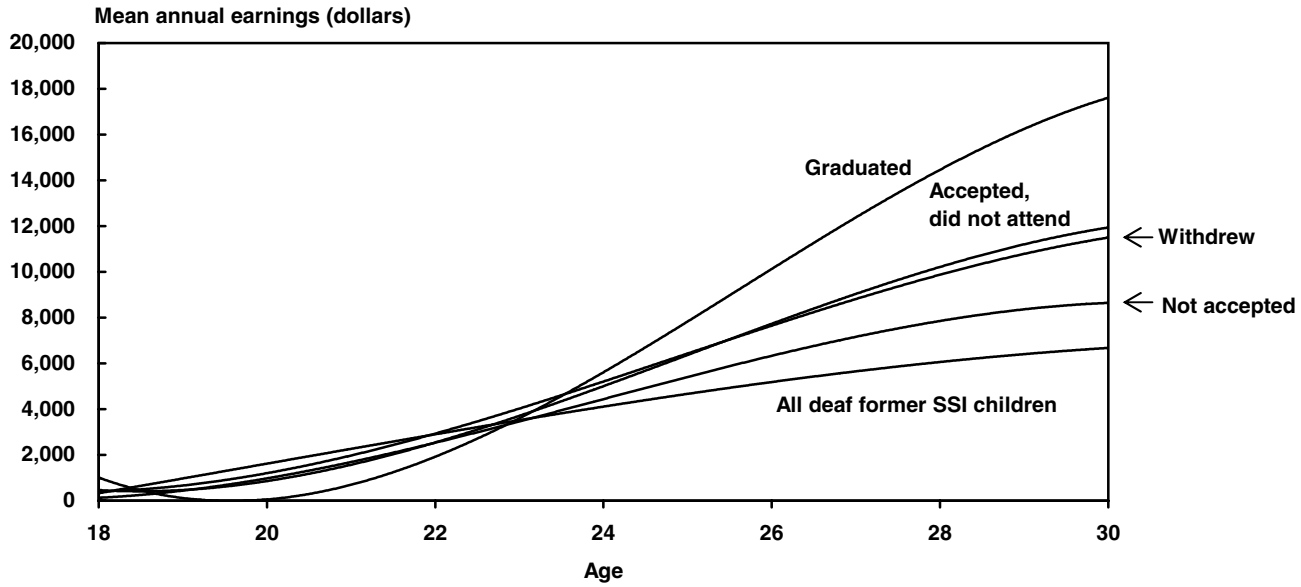


SOURCES: Social Security Administration (SSA) calculations using the data file of administrative records from the National Technical Institute for the Deaf linked to data from SSA's Supplemental Security Record, Master Earnings File, and Numident file.

NOTES: Data include zero earners.

SSI = Supplemental Security Income; NTID = National Technical Institute for the Deaf; Poly. = polynomial trend line.

Chart 7.
Age/earnings profiles for SSI children using polynomial trend lines, by NTID status



SOURCES: Social Security Administration (SSA) calculations using the data file of administrative records from the National Technical Institute for the Deaf linked to data from SSA's Supplemental Security Record, Master Earnings File, and Numident file.

NOTES: Data include zero earners.

SSI = Supplemental Security Income; NTID = National Technical Institute for the Deaf.

In Chart 7, the age/earnings profiles of the four groups of NTID applicants are compared with the broader population of SSI children with a primary diagnosis of deafness. Mean earnings among the group of former SSI children were lower than for all other groups from ages 25–30, and by age 30 their annual earnings were about $6,800, which was well below the earnings of each of the NTID applicant groups.

Discussion of the Findings and Future Research

Our analysis focused on the relative success of former SSI children who applied to NTID. We found that the percentage of NTID applicants who were SSI children increased over time, from a low of 10 percent in 1982 to more than 41 percent in 2000. However, the differences in the probability of graduation from NTID between deaf SSI children and deaf NTID applicants who were not SSI children did not change accordingly. The probability of graduation for SSI children who applied to NTID was 13.5 percentage points lower than for those who were not SSI children. Finally, using our most credible comparison group—SSI children who were accepted to NTID but chose not to attend—we found that SSI children who graduated from NTID left the SSI program early in their adult life (19 months earlier), were less likely to reenter the SSI program, and at age 30 had increased their earnings by an estimated 49 percent. Our findings demonstrate that SSI children need not be relegated to a lifetime of SSI participation as adults, despite the poor overall experience of this population since the creation of the SSI program in 1974. Postsecondary education can increase their earnings and reduce their dependency on SSI as adults.

These key findings—the lower postsecondary graduation rates among deaf SSI children and the potential for successful adult outcomes for deaf SSI children who graduate—suggest that there is a need to carefully examine the current support services for SSI children and identify improvements or new support services that will increase postsecondary graduation rates for SSI children. The Social Security Administration's youth transition demonstration projects are beginning to address these issues, but to date they have not focused on specific support for postsecondary educational achievement.

Our analysis is a case study of deaf persons who apply to NTID, and there are limitations to generalizing our results to the broader population of SSI chil-

dren with disabilities. Children who qualify for the SSI program on the basis of other types of disabilities may face different barriers to postsecondary education and to successful labor market outcomes. NTID is unique in that it is tailored to the needs of the deaf population. SSI children with other types of disabilities generally must rely on postsecondary educational institutions that are not specifically designed to meet their special needs. These children may face different challenges—such as an environment with physical barriers, an inaccessible commuting environment, or social isolation—that may reduce the likelihood of application to and graduation from postsecondary institutions.

To assess the potential for programs that promote postsecondary education to reach SSI children with different impairments, we used 2001–2002 data from the Office of Special Education Programs (OSEP) on high school graduation rates for all children with disabilities, by impairment type.[22] According to OSEP data, 51 percent of children with disabilities graduated from high school. That percentage is similar to the estimate of 48 percent for SSI children reported by Loprest and Wittenburg (2005), which we used as an upper bound of SSI children who may benefit in the short run from such programs.[23] The OSEP data showed substantial differences in high school graduation rates by impairment type: graduation rates were above average for children with visual impairments (71 percent), hearing impairments (67 percent), specific learning disabilities (57 percent), and orthopedic impairments (56 percent); graduation rates were below average for children with mental retardation (39 percent) and children with severe emotional disturbances (32 percent). These data suggest that programs that promote postsecondary education may be more accessible to SSI children with certain types of impairments than with others.

One area for further research is to examine specific barriers in completing postsecondary education for SSI children with different types of impairments and to estimate the impact that such barriers may have on program participation and labor market outcomes.[24] Another area for future research is to extend our analysis by using data from the National Survey of Children and Families (NSCF) linked to Social Security administrative records for the broader population of SSI children who undertake postsecondary education. That study would be limited initially to a short postgraduation follow-up period and a smaller sample size, but over time the data may provide further evidence of the long-term effects of postsecondary education.

Our analysis has two other limitations that could be addressed in future research. First, our analysis does not examine entry and exits from the Social Security Disability Insurance (DI) program.[25] Our analysis of the age earnings/profiles, as well as preliminary analysis of cross-sectional data on DI participation among NTID applicants, suggests that postsecondary education may have the added effect of reducing dependency on the DI program. We are currently constructing an event history file of DI participation, and future research will examine how postsecondary education is related to participation in this program.

Finally, our analysis is based on nonexperimental data, so it is possible that those who graduated from NTID may have experienced better adult outcomes, in part, because of unobserved attributes such as higher levels of motivation or ability. At the same time, our findings show that positive outcomes are possible and suggest that a more rigorous evaluation, such as a randomized experiment, may be worthwhile. In the future, it would be useful to consider a project that includes a rigorous test of interventions promoting postsecondary education and examines the effect of such interventions on postsecondary education outcomes, SSI program participation, and long-term earnings.

Appendix A: Estimating the Probability of Graduation for SSI Children

The purpose of this section is to provide further details on the estimates and the statistical methodology used to estimate the probability of graduation. Table A-1 shows the time-series estimates used to create Chart 1. Table A-2 shows additional estimates used for the sequential logit model. Table A-3 shows additional logit model estimates of the probability of graduation. In the remainder of this section we provide further details on the statistical methodology used to estimate the probability of graduation.

A sequential logit model was used on the entire set of NTID applicants to estimate the relationship between participation in the SSI program as a child and graduation from NTID.[26] The sequential logit model disaggregates the graduation process into a sequence of three events. The first event is the NTID decision on the application—that is, whether or not an NTID applicant meets the admission criteria. The probability that this event will occur for an individual is not observed; instead we observe the discrete outcome of whether the applicant meets the criteria for admittance to NTID or not. The second event is the

Table A-1.
Time series data on the composition of NTID applicants and graduates

Year of first contact with NTID	Percentage of applicants who received SSI as a child	Percentage of NTID graduates who received SSI as a child
1982	18.07	8.33
1983	10.53	8.60
1984	13.29	6.45
1985	12.35	13.08
1986	14.15	7.14
1987	17.07	11.56
1988	19.76	16.67
1989	21.65	15.04
1990	29.05	20.95
1991	27.53	20.56
1992	27.81	17.58
1993	37.20	21.18
1994	32.22	18.85
1995	32.42	27.45
1996	36.47	29.90
1997	29.90	11.86
1998	36.41	17.24
1999	41.57	28.57
2000	43.59	0

SOURCES: Social Security Administration (SSA) calculations using the data file of administrative records from the National Technical Institute for the Deaf linked to data from SSA's Supplemental Security Record, Master Earnings File, and Numident file.

NOTE: NTID = National Technical Institute for the Deaf; SSI = Supplemental Security Income.

admitted applicant's decision to attend. The probability that an applicant will choose to attend NTID is not observed; instead we observe the discrete outcome of the decision to attend or not. For those who attend NTID, the final event is graduation. The probability of graduation is not observed; rather those who choose to attend either graduate from NTID or withdraw without earning a degree. An applicant's probability of graduation is the result of outcomes at each of these steps, as shown in Equation A-1.

Equation A-1

$$P(Graduate \mid Applied = 1, X) = P(Admitted = 1 \mid Applied = 1, X) \cdot P(Attend = 1 \mid Applied = 1, Admitted = 1, X) \cdot P(Graduate = 1 \mid Applied = 1, Admitted = 1, Attended = 1, X)$$

In Equation A-1, X represents a vector of individual characteristics that includes an indicator variable for whether the person received SSI as a child, an indicator variable for nonwhite race, an indicator variable for female sex, and a set of indicator variables for year of birth. We estimate the conditional probability that each event will occur for the particular population of interest using logit models.[27]

To quantify how individual characteristics are associated with the likelihood of graduation at each point in the sequential process, we use the decomposition of the sequential logit proposed by Heckman and Smith (2004), shown in Equation A-2.

Equation A-2

$$\frac{\partial P(Graduate \mid Applied = 1, X)}{\partial X} = \frac{\partial P(Admitted = 1 \mid Applied = 1, X)}{\partial X} \cdot P(Attend = 1 \mid Applied = 1, Admitted = 1, X) \cdot P(Graduate = 1 \mid Applied = 1, Admitted = 1, Attended = 1, X) + P(Admitted = 1 \mid Applied = 1, X) \cdot \frac{P(Attend = 1 \mid Applied = 1, Admitted = 1, X)}{\partial X} \cdot P(Graduate = 1 \mid Applied = 1, Admitted = 1, Attended = 1, X) + \partial P(Admitted = 1 \mid Applied = 1, X) \cdot P(Attend = 1 \mid Applied = 1, Admitted = 1, X) \cdot \frac{P(Graduate = 1 \mid Applied = 1, Admitted = 1, Attended = 1, X)}{\partial X}$$

This decomposition results from the application of the chain rule to Equation A-1. The first term on the right-hand side of Equation A-2 describes the relationship between the admittance step and the overall probability of graduation; the second term shows the relationship between the attendance step and the overall likelihood of graduation; and the third term shows the relationship between the graduation step and the overall likelihood of graduation.

The NTID/SSA matched data contain additional health and family background information for the two groups—those who graduate or withdraw—who choose to attend NTID. The additional information allows us to examine whether the inclusion of additional characteristics affects our estimate of the relationship between the receipt of SSI as a child and the conditional probability of graduation from NTID for those who choose to attend.

The estimates of the logit parameters do not provide a direct measure of the relationship between individual characteristics and the probability that each event in the graduation process will occur. We use the logit parameters to estimate how individual characteristics are related to the difference in the probability that each event within the sequential graduation process will

Table A-2.
Additional sequential logit results of the relationship between SSI participation as a child and the graduation process

	Accepted			Attended			Graduated		
Variable	Coefficient	Odds ratio	Marginal effects	Coefficient	Odds ratio	Marginal effects	Coefficient	Odds ratio	Marginal effects
Former SSI child	-0.4645 ***	0.6285 ***	-0.0481 ***	-0.0514	0.9499	-0.0076	-0.6972 ***	0.4980 ***	-0.1607 ***
	[0.0980]	[0.0616]	[0.0109]	[0.0906]	[0.0861]	[0.0134]	[0.0831]	[0.0414]	[0.0181]
Female	-0.2006 **	0.8182 **	-0.0193 **	-0.4902 ***	0.6125 ***	-0.0727 ***	0.3431 ***	1.4092 ***	0.0811 ***
	[0.0864]	[0.0707]	[0.0083]	[0.0744]	[0.0455]	[0.0111]	[0.0659]	[0.0928]	[0.0155]
Nonwhite	-1.0840 ***	0.3382 ***	-0.1242 ***	-0.6931 ***	0.5000 ***	-0.1128 ***	-0.0295	0.9709	-0.0069
	[0.0904]	[0.0306]	[0.0119]	[0.0848]	[0.0424]	[0.0150]	[0.0845]	[0.0821]	[0.0198]
Birth year									
1966	0.2658	1.3044	0.0357 *	0.0817	1.0852	0.0143	0.1516	1.1638	0.0371
	[0.1692]	[0.2207]	[0.0212]	[0.1613]	[0.1750]	[0.0277]	[0.1551]	[0.1805]	[0.0379]
1967	0.3797 **	1.4618 **	0.0494 **	0.1140	1.1208	0.0199	0.0859	1.0897	0.0211
	[0.1728]	[0.2526]	[0.0202]	[0.1605]	[0.1798]	[0.0273]	[0.1541]	[0.1680]	[0.0378]
1968	0.5901 ***	1.8042 ***	0.0728 ***	0.1110	1.1174	0.0194	0.0136	1.0137	0.0033
	[0.1802]	[0.3251]	[0.0187]	[0.1600]	[0.1788]	[0.0273]	[0.1541]	[0.1562]	[0.0378]
1969	0.6125 ***	1.8451 ***	0.0749 ***	0.5264 ***	1.6928 ***	0.0822 ***	-0.0369	0.9638	-0.0090
	[0.1759]	[0.3246]	[0.0180]	[0.1674]	[0.2834]	[0.0228]	[0.1466]	[0.1413]	[0.0359]
1970	0.6329 ***	1.8831 ***	0.0774 ***	0.1960	1.2166	0.0336	0.0398	1.0406	0.0097
	[0.1837]	[0.3460]	[0.0186]	[0.1637]	[0.1991]	[0.0268]	[0.1549]	[0.1612]	[0.0379]
1971	0.7691 ***	2.1579 ***	0.0915 ***	0.0930	1.0974	0.0164	-0.0197	0.9805	-0.0048
	[0.1897]	[0.4094]	[0.0178]	[0.1628]	[0.1786]	[0.0281]	[0.1582]	[0.1551]	[0.0386]
1972	0.7460 ***	2.1085 ***	0.0869 ***	0.3340 *	1.3965 *	0.0551 **	-0.1330	0.8754	-0.0324
	[0.2115]	[0.4460]	[0.0194]	[0.1827]	[0.2551]	[0.0277]	[0.1664]	[0.1457]	[0.0404]
1973	0.9294 ***	2.5330 ***	0.1065 ***	0.5124 ***	1.6693 ***	0.0814 ***	-0.2702	0.7632	-0.0649 *
	[0.2073]	[0.5251]	[0.0176]	[0.1840]	[0.3071]	[0.0255]	[0.1652]	[0.1261]	[0.0391]
1974	0.9625 ***	2.6182 ***	0.1088 ***	0.0967	1.1016	0.0171	-0.3212 *	0.7253 *	-0.0771 *
	[0.2125]	[0.5563]	[0.0175]	[0.1719]	[0.1894]	[0.0298]	[0.1715]	[0.1244]	[0.0403]
1975	1.5466 ***	4.6953 ***	0.1445 ***	0.7759 ***	2.1725 ***	0.1141 ***	-0.1904	0.8266	-0.0461
	[0.2822]	[1.3251]	[0.0144]	[0.2117]	[0.4599]	[0.0246]	[0.1736]	[0.1435]	[0.0416]
1976	1.9192 ***	6.8156 ***	0.1632 ***	1.2038 ***	3.3328 ***	0.1573 ***	-0.1261	0.8815	-0.0305
	[0.3176]	[2.1648]	[0.0122]	[0.2381]	[0.7934]	[0.0206]	[0.1728]	[0.1523]	[0.0416]
1977	1.9381 ***	6.9458 ***	0.1605 ***	2.0937 ***	8.1147 ***	0.2081 ***	-0.3876 **	0.6787 **	-0.0926 **
	[0.3281]	[2.2788]	[0.0120]	[0.3266]	[2.6505]	[0.0135]	[0.1684]	[0.1143]	[0.0391]
1978	1.7251 ***	5.6129 ***	0.1539 ***	1.4081 ***	4.0881 ***	0.1726 ***	-0.5450 ***	0.5799 ***	-0.1281 ***
	[0.2972]	[1.6681]	[0.0133]	[0.2522]	[1.0309]	[0.0186]	[0.1746]	[0.1012]	[0.0390]
1979	1.3335 ***	3.7942 ***	0.1355 ***	0.5186 ***	1.6798 ***	0.0830 ***	-0.9355 ***	0.3924 ***	-0.2095 ***
	[0.2544]	[0.9653]	[0.0159]	[0.1973]	[0.3314]	[0.0274]	[0.1938]	[0.0760]	[0.0377]
Constant	1.9054 ***	. . .	. . .	1.5078 ***	. . .	. . .	-0.1200	. . .	. . .
	[0.1141]	. . .	. . .	[0.1103]	. . .	. . .	[0.1043]	. . .	. . .
Observations	5,638	5,638	5,638	4,993	4,993	4,993	4,053	4,053	4,053

SOURCES: Social Security Administration (SSA) calculations using the data file of administrative records from the National Technical Institute for the Deaf linked to data from SSA's Supplemental Security Record, Master Earnings File, and Numident file.

NOTES: Standard errors in brackets.

SSI = Supplemental Security Income; . . . = not applicable.

* significant at .10 level; ** significant at .05 level; *** significant at .01 level.

Table A-3.
Additional logit model estimates of the probability of graduation

Variable	Model with only SSI child variable			Model with variables available for all applicants			Model with full set of variables for attendees		
	Coefficient	Odds ratio	Marginal effects (percentage points)	Coefficient	Odds ratio	Marginal effects (percentage points)	Coefficient	Odds ratio	Marginal effects (percentage points)
Individual characteristics									
Former SSI child	0.7590 ***	2.1362 ***	17.7 ***	0.7639 ***	2.1467 ***	17.7 ***	0.5887 ***	1.8017 ***	13.5 ***
	[0.0800]	[0.1709]	[1.74]	[0.0814]	[0.1748]	[1.76]	[0.0873]	[0.1574]	[1.92]
Female	. . .	. . .	. . .	-0.3224 ***	0.7244 ***	-7.7 ***	-0.3653 ***	0.6940 ***	-8.5 ***
	. . .	. . .	. . .	[0.0652]	[0.0472]	[1.56]	[0.0668]	[0.0463]	[1.54]
Nonwhite	. . .	. . .	. . .	0.0971	1.1019	2.3	0.0158	1.0159	0.4
	. . .	. . .	. . .	[0.0828]	[0.0913]	[1.96]	[0.0873]	[0.0887]	[2.01]
Age at onset of hearing loss									
Birth	. . .	. . .	. . .	. . .	. . .	. . .	0.0049	1.0049	0.1
	. . .	. . .	. . .	. . .	. . .	. . .	[0.1086]	[0.1091]	[2.52]
Ages 6 or older	. . .	. . .	. . .	. . .	. . .	. . .	0.4722	1.6036	10.7
	. . .	. . .	. . .	. . .	. . .	. . .	[0.3797]	[0.6089]	[8.16]
Missing	. . .	. . .	. . .	. . .	. . .	. . .	0.2385	1.2693	5.5
	. . .	. . .	. . .	. . .	. . .	. . .	[0.1503]	[0.1908]	[3.4]
Severity of hearing loss									
Mild	. . .	. . .	. . .	. . .	. . .	. . .	0.1989	1.2201	4.5
	. . .	. . .	. . .	. . .	. . .	. . .	[0.2492]	[0.3040]	[5.5]
Spline severe	. . .	. . .	. . .	. . .	. . .	. . .	-0.0034	0.9966	-0.1
	. . .	. . .	. . .	. . .	. . .	. . .	[0.0077]	[0.0077]	[0.18]
Profound	. . .	. . .	. . .	. . .	. . .	. . .	-0.2314	0.7934	-5.4
	. . .	. . .	. . .	. . .	. . .	. . .	[0.1866]	[0.1480]	[4.28]
Profound spline	. . .	. . .	. . .	. . .	. . .	. . .	0.0009	1.0009	0.0
	. . .	. . .	. . .	. . .	. . .	. . .	[0.0050]	[0.0050]	[0.12]
Missing	. . .	. . .	. . .	. . .	. . .	. . .	-0.5797 *	0.5600 *	-13.4 *
	. . .	. . .	. . .	. . .	. . .	. . .	[0.3399]	[0.1904]	[7.84]
Father's education									
Primary	. . .	. . .	. . .	. . .	. . .	. . .	0.0707	1.0733	1.6
	. . .	. . .	. . .	. . .	. . .	. . .	[0.1470]	[0.1578]	[3.3]
Secondary	. . .	. . .	. . .	. . .	. . .	. . .	-0.0831	0.9203	-1.9
	. . .	. . .	. . .	. . .	. . .	. . .	[0.1038]	[0.0955]	[2.4]
College									
4 years	. . .	. . .	. . .	. . .	. . .	. . .	-0.2016 *	0.8174 *	-4.8 *
	. . .	. . .	. . .	. . .	. . .	. . .	[0.1113]	[0.0910]	[2.65]
5 years or more	. . .	. . .	. . .	. . .	. . .	. . .	-0.2923 **	0.7466 **	-7.0 **
	. . .	. . .	. . .	. . .	. . .	. . .	[0.1345]	[0.1004]	[3.21]
Missing	. . .	. . .	. . .	. . .	. . .	. . .	0.3107	1.3643	6.9
	. . .	. . .	. . .	. . .	. . .	. . .	[0.1977]	[0.2698]	[4.29]

(Continued)

Table A-3.
Continued

Variable	Model with only SSI child variable			Model with variables available for all applicants			Model with full set of variables for attendees		
	Coefficient	Odds ratio	Marginal effects (percentage points)	Coefficient	Odds ratio	Marginal effects (percentage points)	Coefficient	Odds ratio	Marginal effects (percentage points)
Mother's education									
Primary	. . .	. . .	. . .	. . .	. . .	. . .	-0.0741	0.9286	-1.7
	. . .	. . .	. . .	. . .	. . .	. . .	[0.1467]	[0.1362]	[3.35]
Secondary	. . .	. . .	. . .	. . .	. . .	. . .	0.0117	1.0117	0.3
	. . .	. . .	. . .	. . .	. . .	. . .	[0.0930]	[0.0941]	[2.14]
College									
4 years	. . .	. . .	. . .	. . .	. . .	. . .	-0.2000 *	0.8187 *	-4.7 *
	. . .	. . .	. . .	. . .	. . .	. . .	[0.1072]	[0.0878]	[2.53]
5 years or more	. . .	. . .	. . .	. . .	. . .	. . .	-0.3513 **	0.7038 **	-8.3 **
	. . .	. . .	. . .	. . .	. . .	. . .	[0.1591]	[0.1119]	[3.75]
Missing	. . .	. . .	. . .	. . .	. . .	. . .	-0.6418 ***	0.5263 ***	-14.8 ***
	. . .	. . .	. . .	. . .	. . .	. . .	[0.2372]	[0.1249]	[5.42]
Deaf parents									
One	. . .	. . .	. . .	. . .	. . .	. . .	0.1507	1.1626	3.5
	. . .	. . .	. . .	. . .	. . .	. . .	[0.2871]	[0.3337]	[6.59]
Two	. . .	. . .	. . .	. . .	. . .	. . .	0.3507 **	1.4201 **	8.0 **
	. . .	. . .	. . .	. . .	. . .	. . .	[0.1409]	[0.2002]	[3.12]
Missing	. . .	. . .	. . .	. . .	. . .	. . .	1.9819 ***	7.2564 ***	34.0 ***
	. . .	. . .	. . .	. . .	. . .	. . .	[0.5822]	[4.2250]	[5.49]
Inclusion of birth cohort dummy variables		No			No			Yes	
Constant	0.1041 ***	. . .	. . .	0.2206 ***	. . .	. . .	0.4382 *	. . .	. . .
	[0.0359]	. . .	. . .	[0.0468]	. . .	. . .	[0.2350]	. . .	. . .
Observations	4,053	4,053	4,053	4,053	4,053	4,053	4,053	4,053	4,053

SOURCES: Social Security Administration (SSA) calculations using the data file of administrative records from the National Technical Institute for the Deaf linked to data from SSA's Supplemental Security Record, Master Earnings File, and Numident file.

NOTES: Standard errors in brackets.

SSI = Supplemental Security Income; . . . = not applicable.

* significant at .10 level; ** significant at .05 level; *** significant at .01 level.

occur, based on the mean of individual-level changes in the probability.[28] For the sequential logit model, we also present the results of the decomposition that shows how individual-level characteristics contribute to the likelihood of graduation at each step in the process. The estimated logit parameters and odds ratios are reported in Tables A-2 and A-3.

Appendix B: Technical Description of Survival Analysis

The purpose of this section is to provide additional details on the estimates and methodology for the analysis of time spent in the SSI program, along with additional details on the estimates of age/earnings profiles. Table B-1 shows the estimates of the time to first exit from the SSI program that are used for Chart 2. Table B-2 shows the estimates of the time to reentry into the SSI program that are used for Chart 3. Table B-3 shows the data used to construct the age/earnings profiles that are used for Charts 4 through 7. In the remainder of this section we provide further details on survival analysis, which is the technique used to construct the estimates of the time spent in the SSI program.

The probability that an exit from the SSI program will occur within 1-year intervals beginning at age 19 may be described using a hazard function or a survival function. Both measures use the probability of failure, f_t, in time interval t. The probability of failure is defined as the percentage of persons in the SSI program at the beginning of the time interval who are observed leaving the SSI program within the 12-month interval. The probability of failure is shown in Equation B-1.

Equation B-1

$$f_t = \frac{d_t}{(N_t - \frac{m_t}{2})}$$

In Equation B-1, d_t is the number of people who leave the program in year t, N_t is the total number of persons observed at the beginning of the year, and m_t is the number of censored observations within year t. Censored cases are those for which we do not have data on participation in the program within the time interval and so do not know whether the participants left the program.

The hazard at time t, λ_t, is the probability that a person will exit the SSI program within a 1-year interval, given that the person has not left the program at the beginning of the interval (shown in Equation B-2).

Equation B-2

$$\lambda_j = \frac{f_j}{(1 - \frac{f_j}{2}) \cdot (t_{j+1} - t_j)}$$

Where $t_{j+1} - t_j$ is the length of the interval in months—which is 12 in our case. The denominator is the standard adjustment for censored cases in the interval.[29]

The probability that a person remains on the SSI program until period j, referred to as survival (S_j), is the probability that a person has not left the SSI program within a particular interval (shown in Equation B-3).

Equation B-3

$$S_j = \prod_{k=1}^{j} (1 - f_k)$$

Equation B-3 is simply the probability that failure will not occur in each time interval from 1 to j.

Equations B-1 through B-3 are modified to describe the hazard and the survival estimates for reentry into the SSI program within 1-year intervals, beginning at the point when applicants leave the SSI program. In this case, the hazard rate in Equation B-1 represents the probability that an applicant will reenter the program within a 1-year interval, given that he or she has not reentered the program before the interval. The survival rate in Equation B-3 represents the probability that an applicant has not reentered the SSI program within a particular interval.

Table B-1.
Lifetable estimates of time to first exit from SSI for adults who received SSI as a child, by NTID status

Years following age 19	Graduated			Withdrew			Accepted, did not attend			Not accepted			All former SSI children with a primary diagnosis of deafness		
	Number eligible	Hazard (multiplied by 100)	Survival (percent)	Number eligible	Hazard (multiplied by 100)	Survival (percent)	Number eligible	Hazard (multiplied by 100)	Survival (percent)	Number eligible	Hazard (multiplied by 100)	Survival (percent)	Number eligible	Hazard (multiplied by 100)	Survival (percent)
1	231	0.11	98.70	555	0.23	97.30	193	0.17	97.93	179	0.09	98.88	9,388	0.31	96.34
2	228	0.18	96.54	540	0.23	94.59	189	0.13	96.37	177	0.09	97.77	9,037	0.29	93.07
3	223	0.15	94.81	525	0.34	90.81	186	0.18	94.30	175	0.29	94.41	8,723	0.32	89.53
4	219	0.23	92.21	501	0.37	86.85	182	0.14	92.75	169	0.40	89.94	8,378	0.41	85.18
5	213	0.86	83.12	482	0.65	80.36	179	0.78	84.46	161	0.53	84.36	7,958	0.45	80.75
6	192	0.96	74.03	446	0.68	74.05	163	0.92	75.65	151	0.51	79.33	7,533	0.50	76.01
7	171	1.33	63.08	411	0.94	66.17	146	1.19	65.53	142	0.68	73.10	6,967	0.57	71.02
8	142	1.94	49.92	336	0.82	59.98	119	0.90	58.81	127	0.91	65.49	5,645	0.64	65.75
9	107	1.59	41.23	275	1.05	52.89	103	0.95	52.43	110	1.15	57.04	4,461	0.62	61.07
10	82	1.29	35.31	219	0.85	47.77	89	1.33	44.69	93	1.37	48.36	3,451	0.56	57.09
Cumulative probability of exit within 10 years (percent)		64.7			52.2			55.3			51.6			42.9	
		[3.29]			2.28			3.71			3.84			0.57	
Median months to SSI exit [a]		95			116			114			118			145	
		[1.44]			[3.34]			[2.58]			[2.61]			[2.38]	

SOURCES: Social Security Administration (SSA) calculations using the data file of administrative records from the National Technical Institute for the Deaf linked to data from SSA's Supplemental Security Record, Master Earnings File, and Numident file.

NOTES: Standard errors are in brackets.

SSI = Supplemental Security Income; NTID = National Technical Institute for the Deaf.

a. Rounded to the nearest month.

Table B-2.
Lifetable estimates of time to SSI reentry for adults who received SSI as a child, by NTID status

Years following first exit	Graduated			Withdrew			Accepted, did not attend			Not accepted			All former SSI children with a primary diagnosis of deafness		
	Number eligible	Hazard (multiplied by 100)	Survival (percent)	Number eligible	Hazard (multiplied by 100)	Survival (percent)	Number eligible	Hazard (multiplied by 100)	Survival (percent)	Number eligible	Hazard (multiplied by 100)	Survival (percent)	Number eligible	Hazard (multiplied by 100)	Survival (percent)
1	157	0.29	96.63	295	0.62	92.82	115	0.46	94.59	104	0.62	92.82	3,315	0.69	92.07
2	135	0.20	94.39	242	0.34	89.15	101	0.18	92.62	84	0.53	87.09	2,619	0.52	86.53
3	120	0.29	91.12	205	0.36	85.39	89	0.30	89.35	73	0.36	83.36	2,122	0.33	83.17
4	107	0.25	88.41	166	0.39	81.52	78	0.70	82.11	64	0.43	79.12	1,764	0.40	79.28
5	92	0	88.41	136	0.34	78.26	64	0	82.11	51	0.35	75.86	1,371	0.26	76.84
6	79	0	88.41	109	0.17	76.68	51	0.35	78.72	44	0.22	73.91	994	0.22	74.88
7	71	0.27	85.58	87	0.21	74.74	44	0.42	74.84	33	0	73.91	710	0.22	72.96
8	52	0	85.58	69	0	74.74	35	0.56	70.01	23	0	73.91	520	0.17	71.51
9	45	0	85.58	54	0	74.74	25	0.38	66.90	17	0	73.91	376	0.10	70.64
10	36	0	85.58	44	0.22	72.82	19	0	66.90	15	0	73.91	280	0.34	67.80
Cumulative probability of reentry within—[a]															
5 years		11.60			21.70			17.90			24.10			23.16	
		[2.84]			[2.86]			[3.99]			[4.82]			[0.88]	
10 years		14.40			27.20			33.10			26.10			32.2	
		[3.38]			[3.67]			[6.28]			[5.08]			[1.44]	

SOURCES: Social Security Administration (SSA) calculations using the data file of administrative records from the National Technical Institute for the Deaf linked to data from SSA's Supplemental Security Record, Master Earnings File, and Numident file.

NOTES: Standard errors are in brackets.

SSI = Supplemental Security Income; NTID = National Technical Institute for the Deaf.

a. Median months to reentry not estimated.

Table B-3.
Data used in age/earnings profiles for NTID applicants who received SSI as a child, by age and NTID status

	Graduated			Withdrew			Accepted, did not attend			Not accepted			Graduated but not a former SSI child			All former SSI children with a primary diagnosis of deafness		
		Mean (dollars)			Mean (dollars)			Mean (dollars)			Mean (dollars)			Mean (dollars)			Mean (dollars)	
Age	Percentage with earnings	Earners	Earners and non-earners	Percentage with earnings	Earners	Earners and non-earners	Percentage with earnings	Earners	Earners and non-earners	Percentage with earnings	Earners	Earners and non-earners	Percentage with earnings	Earners	Earners and non-earners	Percentage with earnings	Earners	Earners and non-earners
18	46.4	934	434	53.0	963	510	48.4	845	409	40.8	753	307	57.4	1,076	618	42.5	1,113	473
19	45.0	1,219	548	47.6	1,357	646	49.3	1,244	614	46.6	831	387	55.2	1,254	692	47.3	1,804	854
20	50.0	1,425	712	51.0	2,042	1,041	51.6	1,894	977	50.5	1,462	738	57.8	1,576	910	50.8	2,889	1,468
21	55.8	1,820	1,015	57.5	3,334	1,917	54.3	2,429	1,318	60.2	2,370	1,427	62.3	1,932	1,203	54.1	4,165	2,255
22	57.2	2,603	1,489	64.8	4,372	2,833	62.3	3,823	2,383	65.0	4,039	2,627	64.0	2,774	1,775	55.8	5,277	2,946
23	69.4	4,460	3,096	66.2	6,188	4,094	65.0	5,481	3,564	73.8	5,117	3,776	69.3	4,820	3,341	55.1	6,461	3,562
24	68.7	7,410	5,091	70.4	7,698	5,420	66.8	7,925	5,295	73.3	6,352	4,656	74.0	7,724	5,716	54.9	7,627	4,191
25	76.7	10,140	7,774	70.7	9,404	6,646	72.2	9,115	6,586	71.6	7,362	5,269	79.9	10,593	8,460	54.9	8,650	4,745
26	84.6	12,560	10,624	72.3	10,544	7,618	74.9	10,237	7,665	72.9	8,697	6,337	83.8	13,131	11,003	55.2	9,439	5,209
27	86.6	14,655	12,689	73.1	11,788	8,615	74.9	12,490	9,351	72.7	9,963	7,241	86.5	15,619	13,507	55.0	10,203	5,614
28	86.6	17,003	14,725	73.8	13,177	9,727	78.9	12,328	9,729	68.7	11,054	7,596	88.6	17,570	15,572	55.2	10,797	5,956
29	85.2	18,681	15,914	75.1	14,371	10,788	79.1	13,992	11,063	69.2	11,895	8,230	89.8	20,073	18,019	54.8	11,445	6,268
30	84.5	20,776	17,560	76.2	15,232	11,610	81.1	14,996	12,159	73.2	12,071	8,842	90.4	21,748	19,668	55.7	12,246	6,822
31	81.8	20,689	16,915	73.2	16,538	12,107	79.4	17,636	14,001	74.6	12,351	9,218	90.1	23,408	21,090	56.2	12,525	7,037
32	84.8	22,626	19,187	75.7	16,882	12,787	78.1	18,011	14,061	66.1	14,480	9,577	88.7	25,418	22,556	55.2	13,168	7,268
33	80.8	25,358	20,491	75.5	17,071	12,892	82.0	19,529	16,014	70.4	14,707	10,350	87.6	26,818	23,505	53.5	14,065	7,530
34	80.5	28,815	23,202	66.4	18,498	12,290	77.1	21,175	16,335	64.8	16,038	10,398	86.2	27,971	24,112	53.1	14,949	7,943
35	84.7	31,000	26,271	66.7	19,552	13,035	86.0	20,629	17,741	59.2	16,878	9,984	85.4	28,187	24,078	51.9	15,586	8,086

SOURCES: Social Security Administration (SSA) calculations using the data file of administrative records from the National Technical Institute for the Deaf linked to data from SSA's Supplemental Security Record, Master Earnings File, and Numident file.

NOTE: NTID = National Technical Institute for the Deaf; SSI = Supplemental Security Income.

Notes

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[1] See Daly and Burkhauser (2003) for an overview of the SSI program.

[2] The term "managing against the risk of disability" in the context of the children and youth remaining in the SSI disability program has been used by the former Deputy Commissioner for Disability and Income Support Programs at SSA (Gerry 2002).

[3] Wittenburg and Maag (2002) identify the lack of data as a limitation to research on the relationship between children's participation in the SSI program and adult outcomes. The National Council on Disability (2003) also identifies limitations in the data available to examine postsecondary education for youth with disabilities.

[4] Rupp and Scott (1995) do not disaggregate the length of stay in the program by the time spent on SSI as a child and the time spent in the program as an adult. Rather, for children, they estimate the total time spent in the program. Thus, one cannot use their estimates to identify the portion of time spent in the program as a child and the portion of time spent in the program as an adult.

[5] See Davies and Rupp (2006) for further information on the NSCF data.

[6] Of the remaining SSI children, 38.5 percent had dropped out of secondary school and 12.9 percent were still enrolled.

[7] Estimates of enrollment rates vary across sources and subgroups. The 35 percent estimate is based on all persons aged 18–24. The rate is estimated from the Current Population Survey (CPS), as reported in Hurst and Hudson (2005). Estimates from other surveys range from 32 percent to almost 40 percent.

[8] The data merge is possible under the authority of the Privacy Act of 1974 as amended by U.S.C. Section 552a (b) (5), which states, "disclosures may be made with advance adequate written assurance that the record will be used solely as a statistical and reporting record, and transferred in a form that is not individually identifiable."

[9] The NTID/SSA merged data file contains information on a total of 13,863 persons who applied to NTID. Of these, 1,597 were not accepted to NTID, 2,068 were accepted but chose not to attend, 5,128 withdrew before completing a degree, and 5,070 graduated from NTID.

[10] Although FICA earnings cover most workers, some persons may work in jobs not covered by FICA. Thus, our estimates must be interpreted as employment and earnings within the covered sector.

[11] There were 66 deaths among the 5,704 sample members in our case study. The sample size is too small to treat these cases as separate outcomes in our analysis. We estimated the models with and without these cases. Although there was a slight difference in magnitude, it did not have a large impact on the results.

[12] In particular, Public Law 96–265 (enacted in 1980) changed the rules regarding parental deeming. Children aged 18 or older were no longer subject to parental deeming for the purposes of program eligibility.

[13] Note that Table 2 does not cover the SSA administrative sample of all former SSI children who had a primary diagnosis of deafness and who were born from 1964 through 1980. The reason is that NTID does not have data on those who do not apply for admission.

[14] The technical details of the sequential logit model are given in Appendix A. It is important to emphasize that this is a reduced form model that describes the NTID graduation process, and not a formal structural model. Nonetheless, the descriptive results can be very informative to policymakers, as shown in Heckman and Smith (2004) and Ruiz-Quintanilla and others (2006).

[15] To illustrate this point, the descriptive statistics show that former SSI children are less likely to graduate. They also show that nonwhites are less likely to graduate. Because SSI children tend to be nonwhite, it is possible that SSI children are less likely to graduate because they tend to be nonwhite, not because they participated in the program as children. Researchers have found lower college graduation rates among minority students and have attributed the findings to the low percentages of minority students on college campuses, which may lead to social isolation, lower social attachment, and, therefore, lower graduation rates (Scott and others 2006). At the same time, it is possible that nonwhites are less likely to graduate because they tend to participate in the SSI program as children. Research by Rupp and others (2006) show that 52.8 percent of all SSI children are nonwhite. The descriptive statistics cannot differentiate between these two alternative explanations. The multivariate models described below provide a measure of the influence of participation in the SSI program as a child, holding race and other characteristics constant.

[16] See Appendix A for details.

[17] We used age 19 because many SSI children have a short period of time around their 18th birthday when they are out of the program. As of their 19th birthday, 1,158 of the 1,366 SSI children were in the program. We also estimated the models for those who we observed collecting SSI adult benefits, beginning in the month they turned 18. The sample sizes were smaller for this analysis, but the results were similar to those described in this article. They are available on request from the corresponding author, Robert.Weathers@ssa.gov.

[18] We tested for the difference in slopes by estimating a regression that allowed for a separate intercept for each series but restricted the slopes to be equal (restricted model) and estimated a regression that allowed separate intercepts and slopes for each trend line (unrestricted model). We computed an F statistic as follows:

$$F(J, n-K) = \frac{(R_u^2 - R_r^2)/J}{(1-R_u^2)/(n-K)}$$

Where J is the number of restrictions, which is equal to 1 in our case, n is the number of observations (which is equal to 36) and K is the number of independent variables in the unrestricted model (which is equal to four separate constants and slopes). The

R-squared for the restricted model is 0.776487 and the *R*-squared for the unrestricted model is 0.810819. Thus, $F(1,32) = 5.807 > 4.17$, which is the 95th percentile of the corresponding *F*, and we can reject the hypothesis that the two slopes are the same.

[19] The decomposition is based on estimates from Table 3. For example, the first term in decomposition shows the contribution of the admitted step to the overall probability of graduation. The first term in Equation A-2 in Appendix A shows that this can be estimated by multiplying the change in the probability of being admitted for SSI children by the conditional probability of attending and by the conditional probability of graduating given attendance. Using the values shown in Table 3, the first term of the decomposition is .0482 * 0.812 * .427 = -.017. We use the term "unconditional probability" to differentiate the probability of graduation among all applicants from the probability of graduation conditional on an applicant being admitted to and choosing to attend NTID.

[20] We are unable to produce credible estimates of the median time to reentry because most of our sample does not reenter the SSI program.

[21] In the comparisons that follow, we focused on former SSI children who graduated from NTID and compared them with SSI children who were in each of the three groups that did not graduate from NTID. As we showed earlier, SSI children are less likely to graduate from NTID compared with those who had not been on SSI as children. SSI children also had age/earnings profiles that were slightly lower than NTID graduates who were not SSI children. The results are available on request from the corresponding author, Robert.Weathers@ssa.gov.

[22] See Table 1-22 from Office of Special Education and Rehabilitative Services, Office of Special Education Programs (2005).

[23] Loprest and Wittenburg (2005) do not disaggregate graduation rates by impairment type, which is why we use the OSEP data on graduation rates for all SSI children, by impairment type.

[24] See Cornell University http://www.ilr.cornell.edu/edi/p-ccfid.cfm for a study that assesses the state of Web accessibility in the community college network for students with disabilities. The study focuses on examining problems that prospective students with disabilities may have with the online admissions application process, applying for financial aid via the Web, as well as finding important programmatic information on college Websites.

[25] The DI program covered under Social Security is a social insurance program funded through payroll tax contributions to the Social Security trust funds, whereas the SSI program is a means-tested cash assistance program funded from general revenues. There are several important differences in these two programs that make separate analysis more practical than attempting to model the two together. We plan to conduct future research on the relationship between postsecondary education and dependency on the DI program.

[26] See Madalla (1983) for more information on the sequential logit and Ruiz-Quintanilla and others (2006) for a recent application of the sequential logit to participation in SSA demonstration projects.

[27] The logit for the first step was estimated by using the sample of all applicants to NTID. The logit for the second step used the subset of applicants who were admitted to NTID. The logit for the third step used the subset of applicants who were admitted and chose to attend NTID.

[28] We used the Stata program written by Bartus (2004) to estimate the changes in the probability related to a change in each characteristic in our sequential logit model.

[29] See Allison (1995, 46) for more details on the adjustment for censored observations.

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