Using Predisability Earnings as an Instrument
for Disability Determination Outcomes

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April 2004

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Summary

Researchers have consistently found that applications and awards for Social Security Disability Insurance (DI) benefits are affected by economic conditions, such as the unemployment rate, and by programmatic features, such as the weighted benefit formula. They have not agreed, however, on the size of these effects.

Fluctuations in the numbers of applications and awards are often thought to be the result of changes in incentives that are affected by program rules and by macroeconomic conditions (Rupp and Stapleton 1995). If this causality/effect result is true, a simple way to gauge the size of the incentive effect would be to measure the number of individuals who do not meet the eligibility standard relative to the total number of applicants.

The problem with using disability determination outcomes to explain labor force participation is that the decision to apply for benefits and the outcome of the decision are interrelated. On the one hand, the higher the allowance rate is, the more likely individuals are to apply. On the other hand, the rate of allowance will depend on characteristics of the applicants, such as their attachment to the labor force. Under these circumstances, standard techniques of estimation may produce a biased result. Failure to control for the correlation between labor force attachment and allowance status can lead to overestimating the extent to which beneficiaries would work in the absence of receiving DI benefits.

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This paper uses the predisability earnings of DI applicants as an instrument for disability determination outcomes because those earnings represent labor force attachment; and the earnings affect applications but applications do not affect the earnings.[1] To validate this choice of instrument, the paper first shows that the disability determination outcomes are correlated with predisability earnings. It then shows fluctuations in predisability earnings profiles, for those who applied for DI benefits during the period from 1977 through 1997, as evidence of the incentive effects generated by the interaction of program rules and macroeconomic conditions.

Sources of Data

This paper constructs a series of records for yearly DI application covered under Social Security from 1977 through 1997 using Social Security Administration (SSA) program data that are matched to multiple panels of the Survey of Income and Program Participation (SIPP). It analyzes the predisability earnings of applicants, by year of their applications, after controlling for their demographic characteristics. Using this approach, instead of a regression-based approach that compares and contrasts applicants with nonapplicants in terms of individuals' characteristics, program rules, and economic conditions, this study can avoid most common controversies in this area, from sample restrictions to identification assumptions.[2]

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[1] For profiling individual applicants' characteristics, predisability earnings appear to be the most suitable because they are available in Social Security earnings data and are determined years before the earliest application. Unlike earnings during the postapplication period, predisability earnings can be considered to be exogenous with respect to DI application incidence. Profiling applicants with respect to their (preapplication) health condition or occupation would be alternatives. However, such information is unavailable for DI applicants over time. Also, the nature of many occupations has changed in recent years.

[2] See Parsons (1980), Haveman and Wolfe (1984), Halpern and Hausman (1986), Gruber and Kubik (1997), Kreider (1999), and Benitez-Silva and others (2000). See Bound and Burkhauser (1999) and Haveman and Wolfe (2000) for additional information.

Samples used in this study are drawn from the 1984, 1992, 1993, and 1996 SIPP panels. Historical earnings and DI applications and determination results are obtained from SSA's Summary of Earnings Record (SER), Master Beneficiary Record (MBR), and "831" disability files.

The SIPP is a national survey conducted by the U.S. Census Bureau, designed as a continuous series of national panels since 1984, with sample sizes ranging from 14,000 to 36,700 interviewed households. The SIPP is a multistage, stratified sample of the U.S. civilian, noninstitutionalized population. Panel duration ranges from 2½ to 4 years; each panel consists of six to twelve 4-month waves, depending on the panel duration. Each SIPP wave consists of both a core file and a topical module file. The core file contains the demographic, labor force, program participation, and income data designed to measure the economic situations of the individuals in the sample; these data are repeated at each interviewing wave. The topical modules are designed to provide more detailed coverage of topics such as assets, health and disability, and employment history that are not covered in the core files.

The SER contains annual summaries of individuals' Social Security earnings from 1951 to the present and total amounts earned between 1937 and 1950. The SER extract used here also contains sex, race, date of birth, and annual quarters of coverage (QCs). The MBR includes the data needed to generate Social Security benefit checks under the Old-Age, Survivors, and Disability Insurance (OASDI) program. A record is established whenever an individual applies for old-age or disability benefits and the application is adjudicated. The record reflects the final decision on the initial claim, including any

denial at the initial, reconsideration, or hearing levels, and can be used to identify

whether the person was allowed, whether the person was paid, and, if so, the benefit

amount. However, it appears that records for some disability-denied applicants are

overwritten by newer, age-related retirement application and payment information (if

there is any).[3]

Hence this paper uses the SSA "831" disability file to identify DI applicants. An

831 record is established when the Disability Determination Services (DDS) renders an

initial medical determination or a reconsideration decision for an individual applying for

disability benefits covered under Social Security (Title II) and Supplemental Security

Income (Title XVI). Thus, an individual can have more than one 831 record (resulting

from multiple applications).[4] Since this paper analyzes earnings and labor force activities

during the period before filing for DI benefits, it uses the earliest observable application

date.

Characteristics of the Sample

This paper combined four SIPP panels with extracts of the SER, MBR, and "831"

disability files to construct the sample of yearly DI applicant pools for 1977 through

1997. The sample includes DI applicants who are aged 35 through 60 at their first

application. The sample excludes those under age 35 because their disability incidence

rates are low and they are unlikely to have sufficient past work activity for analysis here.

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[3] Consider an individual who applied for and was denied DI benefits in 1980 at age 50 and began to receive old-age benefits in 1995 at age 65. The MBR information represents this individual's old-age benefit status rather than his past disability denial.
[4] For further discussions on SSA administrative records, see SSA Program Data User's Manual (Panis and others 2000).

The sample also excludes those over 60 because they are nearing early retirement ages.

The resulting sample size is 7,368 DI applicants: 4,943 allowed and 2,425 denied.[5] The

SIPP provides the demographic characteristics (sex, race and ethnicity, and education) for

the sample.[6]

This paper reports the distribution of DI applicants by age at earliest time of

application for the sample in Table 1 and the distribution of applicants by filing year in

Table 2. The aggregated allowance rate of the sample is 67.1 percent.[7] The sample shows

that both the number of applicants and the percentage of allowed applicants increase as

age at first application increases. Results presented in Table 2 and Chart 1 are consistent

with historical trends: the number of applicants declined from 1979 through 1983, began

to increase in 1984, and increased rapidly from 1990 through 1993.[8]

Demographic characteristics of the whole sample and for applicants who were

allowed and denied are reported in Table 3. The mean age of the sample at first

application is 48.7, and 74.1 percent of the sample have 12 years of education or less

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[5] While DI applicants are identified by using the 831 disability file, eligibility outcomes are obtained from MBR benefit payment status. Thus, these eligibility outcomes can be considered to be final, including administrative law judge and Appeals Council decisions. The denied exclude technical denials. Any potential bias from dropping the technical denials from the sample would not weaken the findings from this study because they do not meet the technical requirements, such as having sufficient past work.

[6] Unfortunately, this study cannot use time-varying individual characteristics reported in the SIPP panels, because years of application for any individual can be scattered from 1977 through 1997; SIPP panels cover only 2½ to 4 years each.

[7] This sample allowance rate appears to be much higher than yearly allowance rates reported in the *Annual Statistical Report on the Social Security Disability Insurance Program, 2000,* Table 26. The report's yearly allowance rates were calculated including technical denials. The sample for this study excludes technical denials (approximately 12 percent of applicants). Moreover, the yearly allowance rates in the 2000 report are ratios of awards, regardless of year of application, to number of applications in the calendar year. The allowance rates in this study are ratios of final awards, regardless of year of award, to number of applicants in the calendar year. Thus the allowance rate of the sample used in this study is reasonably close to that of the population.

[8] See the *Annual Statistical Report on the Social Security Disability Insurance Program, 2000.* Note that the sample used in this study was drawn from 1984, 1992, 1993, and 1996 SIPP panels. Thus relatively fewer applicants were observed in the earlier study period. Of course, the most ideal data for the study would be the (entire) 831 disability file matched to the SER and MBR files. However, the construction of such a data set would be costly.

Table 1.
Distribution of Disability Insurance applicants, by age at the earliest time of application

Age at application	Number of applicants	Allowed		Denied	
		Number	Percent	Number	Percent
Total	7,368	4,943	67.09	2,425	32.91
35	228	112	49.12	116	50.88
36	228	124	54.39	104	45.61
37	261	152	58.24	109	41.76
38	240	135	56.25	105	43.75
39	225	131	58.22	94	41.78
40	225	147	65.33	78	34.67
41	250	154	61.60	96	38.40
42	240	154	64.17	86	35.83
43	258	150	58.14	108	41.86
44	261	157	60.15	104	39.85
45	264	168	63.64	96	36.36
46	268	179	66.79	89	33.21
47	259	178	68.73	81	31.27
48	264	160	60.61	104	39.39
49	261	185	70.88	76	29.12
50	292	189	64.73	103	35.27
51	260	186	71.54	74	28.46
52	321	233	72.59	88	27.41
53	265	204	76.98	61	23.02
54	306	207	67.65	99	32.35
55	334	255	76.35	79	23.65
56	360	273	75.83	87	24.17
57	341	260	76.25	81	23.75
58	374	280	74.87	94	25.13
59	389	277	71.21	112	28.79
60	394	293	74.37	101	25.63

SOURCE: Author's tabulations using the 1984, 1992, 1993, and 1996 Survey of Income and Program Participation matched with the Social Security Administration's Summary Earnings Record, Master Beneficiary Record, and "831" disability files.

Table 2.
Distribution of Disbility Insurance applicants, by filing year

Filing year	Number of applicants	Allowed		Denied	
		Number	Percent	Number	Percent
Total	7,368	4,943	67.09	2,425	32.91
1977	297	184	61.95	113	38.05
1978	266	165	62.03	101	37.97
1979	307	194	63.19	113	36.81
1980	285	170	59.65	115	40.35
1981	272	167	61.40	105	38.60
1982	229	143	62.45	86	37.55
1983	218	144	66.06	74	33.94
1984	232	151	65.09	81	34.91
1985	260	175	67.31	85	32.69
1986	237	179	75.53	58	24.47
1987	293	215	73.38	78	26.62
1988	280	208	74.29	72	25.71
1989	307	234	76.22	73	23.78
1990	370	273	73.78	97	26.22
1991	432	303	70.14	129	29.86
1992	442	309	69.91	133	30.09
1993	530	350	66.04	180	33.96
1994	540	367	67.96	173	32.04
1995	531	350	65.91	181	34.09
1996	553	358	64.74	195	35.26
1997	487	304	62.42	183	37.58

SOURCE: Author's tabulations using the 1984, 1992, 1993, and 1996 Survey of Income and Program Participation matched with the Social Security Administration's Summary Earnings Record, Master Beneficiary Record, and "831" disability files.
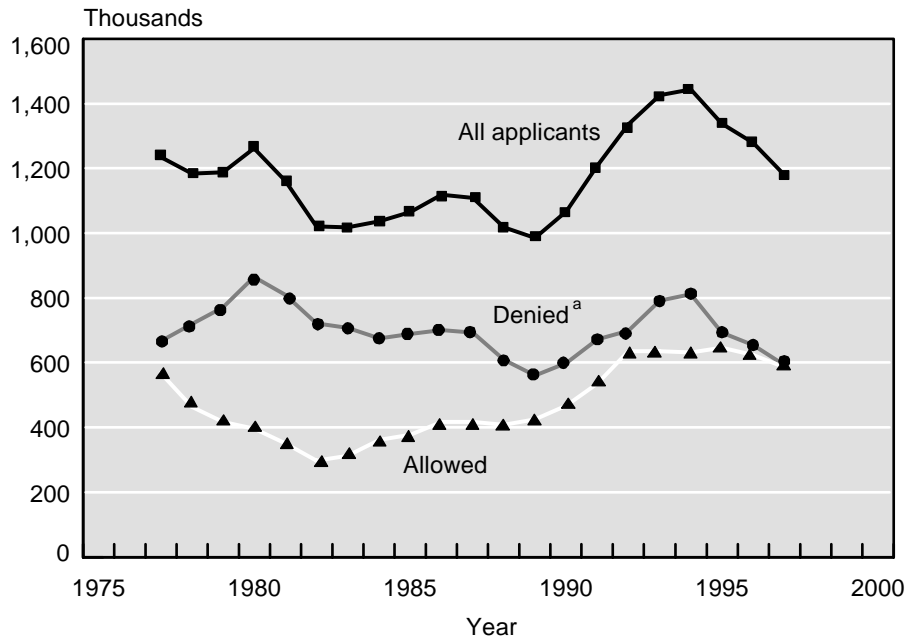
Chart 1.
Number of Disability Insurance applications and awards, 1977–1997

Thousands

All applicants

Denied[a]

Allowed

SOURCE: The *Annual Statistical Report on the Social Security Disability Insurance Program, 2000* (Social Security Administration; Office of Policy; Office of Research, Evaluation, and Statistics).

a. Technical denials are included.

Table 3.
Sample of demographic characteristics of Disability Insurance applicants

Characteristic	All		Allowed		Denied	
	Mean	Standard error	Mean	Standard error	Mean	Standard error
Male	0.5512	0.4974	0.5752	0.4944	0.5023	0.5001
Race and ethnicity						
White, European origin	0.3123	0.4635	0.3166	0.4652	0.3035	0.4599
White, other than European origin	0.3010	0.4587	0.3089	0.4621	0.2849	0.4515
Hispanic	0.0494	0.2167	0.0465	0.2107	0.0553	0.2285
Black	0.1930	0.3947	0.1792	0.3836	0.2210	0.4150
Age (at application x 10)	4.8705	0.7604	4.9466	0.7439	4.7155	0.7701
Education						
0–6 years	0.1235	0.3290	0.1250	0.3308	0.1204	0.3255
7–11 years	0.2694	0.4437	0.2739	0.4460	0.2602	0.4388
12 years or high school diploma	0.3485	0.4765	0.3461	0.4758	0.3534	0.4781
Some college but no degree	0.0733	0.2606	0.0692	0.2538	0.0816	0.2739
Number of observations	36,840 (7,368 x 5)		24,715 (4,943 x 5)		12,125 (2,425 x 5)	

SOURCE: Author's tabulations using the 1984, 1992, 1993, and 1996 Survey of Income and Program Participation matched with the Social Security Administration's Summary Earnings Record, Master Beneficiary Record, and "831" disability files.

(that is, high school graduate or less). Allowed applicants tend to be older and to have slightly more education than the denied. Differences in these characteristics between the two groups are much smaller than the standard errors of the characteristics, indicating that the predisability earnings differentials may not be attributable to differences in their demographic characteristics.

Descriptive Analyses

Generally, there are two difficulties in using the Social Security earnings data. First, the earnings of workers not covered by Social Security are recorded as zeros. So zeros can indicate that the worker either has no earnings or is not covered by Social Security.[9] Zero earnings in this study indicate that the worker has no earnings, because the sample consists of only DI applicants who are covered by Social Security. Zero earnings are recorded in years both before labor market entry (the first year of working) and after withdrawal from the labor market. The zero earnings after retirement also do not affect this analysis, because the sample includes only individuals who applied for DI from ages 35 through 60. This age restriction also eliminates most zero earnings occurring before the first year of working.[10] Additionally, this study treats earnings in years before the first nonzero earnings as "missing" rather than as zero. Any zero earnings between the first year with nonzero earnings and the year when the individual reaches age 62 are treated as zeros.

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[9] The Social Security program covers approximately 96 percent of the workforce. There are five major categories of noncovered workers: (1) civilian federal employee hired before January 1, 1984; (2) railroad workers; (3) employees of state and local governments who are covered by their own systems; (4) domestic and farm workers with earnings less than specific minimums; and (5) self-employed persons with low earnings (under $400 per year).

[10] By age 28, most individuals have entered the labor market.

The second difficulty in using the Social Security earnings data arises because recorded Social Security earnings are capped at the annual taxable maximum.[11] Fortunately, this censoring appears not to be a significant problem for the sample, as less than 5 percent of the sample reached the taxable maximum. Furthermore, any potential bias from ignoring the taxable maximum would not weaken the findings from this study, because the percentage of those who reached the maximum among the allowed exceeds that among the denied.[12]

Observed earnings around the time of DI applications are affected by the interaction of applicants' self-selection behavior and the substantial gainful activity (SGA) requirement.[13] Generally, these earnings are considered to be endogenous; thus, they contain no useful information. This study examines each individual's annual earnings in the 3 to 7 years before his or her earliest DI application. Table 4 reports summary statistics of annual earnings in the years from 7 years before through 7 years after the application year.[14] Because applications were filed from 1977 through 1997, this study deflated (or inflated) the annual earnings to 1990 values using national average annual wages.[15] Table 4 contrasts the earnings of the allowed and those of the

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[11] These maximums are adjusted in each year. See the *Annual Statistical Supplement* to the *Social Security Bulletin* for annual taxable maximum amounts.

[12] The moral hazard problem of inducing the substitution of nonworking for working may be more frequent among workers with low predisability earnings. The high replacement rate and the low opportunity costs of labor market withdrawal can influence those with low predisability earnings to apply for DI benefits and to be denied, assuming that other factors remain constant.

[13] Applicants are required to earn less than the SGA amount to be eligible for DI benefits. The SGA maximum for nonblind beneficiaries in 2002 was $780 per month.

[14] Although this paper focuses on earnings in the predisability period, it also reports earnings in the application and postapplication periods. Bound, Burkhauser, and Nichols (2002) report changes in monthly earnings and income from 36 months before through 36 months after the application month.

[15] See the *Annual Statistical Supplement, 2001,* to the *Social Security Bulletin,* p. 92, for the national average annual wages.

Table 4.
Earnings of Disability Insurance applicants during the pre- and postapplication periods

Year	Allowed				Denied			
	Number of observations	Mean	Standard deviation	Median	Number of observations	Mean	Standard deviation	Median
Before application								
-7	4,936	17,487	12,646	15,919	2,417	13,070	12,060	10,036
-6	4,942	17,414	12,743	15,718	2,417	12,964	12,174	9,871
-5	4,943	17,570	12,726	15,792	2,422	12,780	12,310	9,453
-4	4,943	17,436	13,015	15,467	2,423	12,502	12,351	9,527
-3	4,943	17,019	13,110	14,898	2,423	11,961	12,381	8,592
-2	4,943	16,248	13,282	13,887	2,425	11,253	12,359	7,434
-1	4,943	13,833	12,911	10,766	2,425	8,687	11,074	4,089
Application year								
0	4,943	5,974	9,004	2,108	2,425	4,168	7,241	501
After application								
1	4,943	1,718	5,429	0	2,425	4,906	8,570	205
2	4,639	1,588	5,624	0	2,241	5,829	9,556	134
3	4,025	1,642	5,790	0	1,955	6,281	9,894	520
4	3,469	1,747	6,087	0	1,684	6,475	10,218	375
5	2,938	1,890	6,335	0	1,449	6,675	10,229	397
6	2,477	1,891	6,331	0	1,232	6,714	10,402	73
7	2,070	2,017	6,669	0	1,051	6,991	11,113	0

SOURCE: Author's tabulations using the 1984, 1992, 1993, and 1996 Survey of Income and Program Participation matched with the Social Security Administration's Summary Earnings Record, Master Beneficiary Record, and "831" disability files.

NOTE: Earnings are in constant 1990 dollars adjusted by the average annual wage.

denied during the predisability period. Both mean and median earnings of the allowed are consistently higher, by approximately $5,000, than those of the denied over all the preapplication years. For example, in the 5 years before application, the median earnings for the allowed and the denied are $15,792 and $9,453, respectively. As expected, the earnings fall sharply around the year of application regardless of allowance status.

Because the earnings (not logged) distributions are highly skewed, this study reports percentage distributions of individuals in specific earnings ranges in Table 5: zero earnings; $1 to $3,000; $3,001 to $6,000; $6,001 to $12,000; $12,001 to $18,000; $18,001 to $24,000; and $24,001 or more. In the 5 years before the first application, 6.15 percent of the allowed have no labor earnings, and 21.38 percent earn $500 or less per month (the monthly maximum SGA amount in 1990). By contrast, 17.18 percent of the denied have no earnings, and 38.83 percent earn $500 or less per month (data not shown in table).[16] Similar differences between the allowed and the denied are observable in all years throughout the preapplication period.

Chart 2 shows the lower end of the earnings distribution: percentages of zero earners; workers with earnings below $3,000; below $6,000; below $12,000; and below $18,000. Significantly higher percentages of the denied are observed in all of these categories, indicating that the denied have lower predisability earnings than the allowed. It is neither surprising nor disturbing to find that the previous earnings of the allowed applicants were higher than those of the denied applicants. To the extent that individuals' applications for disability benefits depend on the generosity of the benefits that could

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[16] The denied are also insured for DI.

Table 5.
Percentage distribution of Disability Insurance applicants, by earnings range during the pre- and postapplication periods

Earnings range	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7
								Allowed							
$0	6.54	6.52	6.15	7.28	8.44	10.54	15.13	32.49	72.59	80.71	82.16	81.64	82.10	81.99	81.84
$1–$3,000	7.80	7.59	7.26	7.24	7.73	8.78	10.99	22.60	14.04	8.47	6.93	7.00	5.65	5.81	5.80
$3,001–$6,000	7.44	8.01	7.97	8.62	7.81	7.71	9.18	12.93	4.90	2.91	2.56	2.45	2.83	2.99	2.75
$6,001–$12,000	17.16	17.48	17.26	17.12	17.94	17.92	18.63	14.91	4.23	3.60	3.38	3.60	3.51	3.23	3.57
$12,001–$18,000	16.33	16.51	17.94	16.47	16.16	15.74	14.32	7.30	1.88	1.51	2.16	2.16	2.55	2.46	2.08
$18,001–$24,000	14.75	14.91	13.66	14.24	13.96	13.13	11.11	4.53	0.75	1.19	1.04	1.21	1.23	1.45	1.50
$24,001 or more	29.98	28.98	29.76	29.03	27.96	26.18	20.64	5.24	1.62	1.62	1.76	1.93	2.14	2.06	2.46
								Denied							
$0	14.11	16.09	17.18	18.16	20.97	24.67	30.98	42.90	47.73	48.82	46.55	47.51	47.96	49.19	50.24
$1–$3,000	12.41	10.76	11.35	12.67	12.96	11.76	14.81	22.90	16.34	11.56	11.30	9.98	8.97	9.66	9.13
$3,001–$6,000	10.34	10.59	10.40	9.45	9.20	9.28	10.35	11.01	9.32	8.57	8.49	8.67	7.38	6.98	6.09
$6,001–$12,000	18.70	18.29	18.04	17.99	16.80	16.87	15.51	11.88	11.92	12.85	13.40	12.95	13.46	10.55	10.56
$12,001–$18,000	14.52	14.73	13.50	13.04	12.92	12.17	10.40	5.45	6.97	7.85	8.70	9.09	9.59	9.33	10.18
$18,001–$24,000	9.27	9.60	10.20	10.44	9.41	9.36	7.22	2.97	2.76	3.75	4.55	4.87	5.31	6.90	4.66
$24,001 or more	20.65	19.94	19.32	18.24	17.75	15.88	10.73	2.89	4.95	6.60	7.01	6.95	7.32	7.39	9.13

SOURCE: Author's tabulations using the 1984, 1992, 1993, and 1996 Survey of Income and Program Participation matched with the Social Security Administration's Summary Earnings Record, Master Beneficiary Record, and "831" disability files.

NOTES: Numbers indicate percentages of individuals in the specific range of earnings for the given year relative to application. Earnings are in constant 1990 dollars adjusted by the average annual wage.

Chart 2.
Distribution of allowed and denied Disability Insurance applicants at the lower end of the earnings distribution, by earnings level at years before and after application
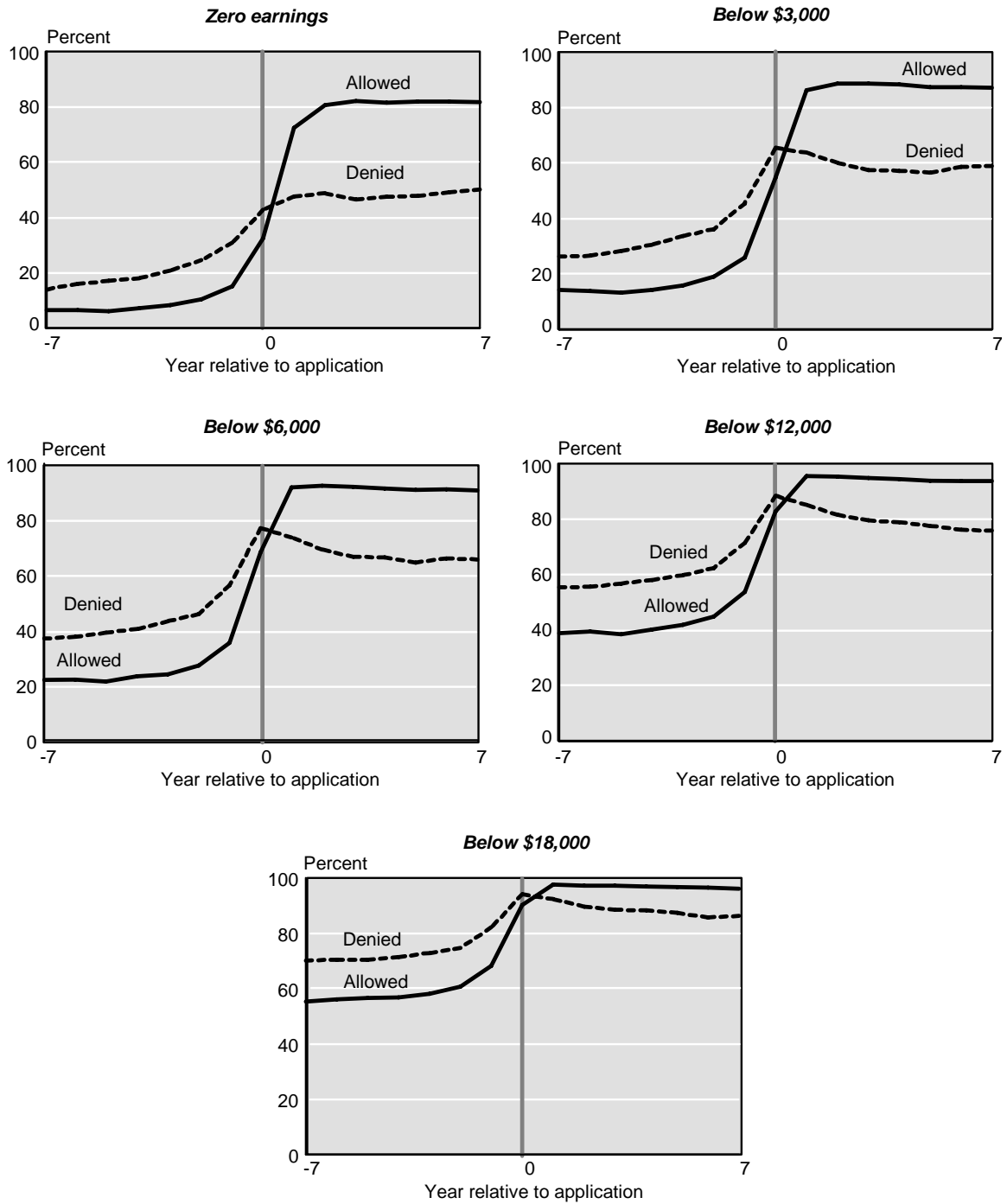
Zero earnings

Below $3,000

Below $6,000

Below $12,000

Below $18,000

SOURCE: Author's tabulations using the 1984, 1992, 1993, and 1996 Survey of Income and Program Participation matched with the Social Security Administration's Summary Earnings Record, Master Beneficiary Record, and "831" disability files.

be available to them, the progressivity of the benefit formula will cause low-wage earners to be more likely than high earners to apply for benefits. Because successful applicants must earn less than the SGA threshold, the opportunity cost of applying is higher for high earners than for low earners with similar health conditions. The statistically significant differentials in predisability earnings between the allowed and the denied confirm that the denied are more likely to apply because of economic incentives. Thus, differentials in predisability earnings do not stem from decisions on eligibility but reflect other individual characteristics that affect the application decision.

Yearly quarters of coverage (QCs) earned can be used as an alternative measure of labor force attachment to compare the allowed with the denied (Bound 1989).[17] Table 6 reports both mean and median QCs for the allowed and the denied. The mean and median total QCs (during the 10-year period before application) for the allowed are 34.8 and 39.0, respectively. The denied tend to have earned fewer QCs than the allowed—the mean and median of the denied are 29.8 and 33.0, respectively. The table also reports both means and medians of years in which at least one QC and all four QCs were earned. Although these differences in QCs earned are not as dramatic as are the earnings levels, differences are still apparent.[18]

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[17] Since 1978, QCs no longer indicate actual quarters during which people worked. Four QCs are awarded based on the total amount of earnings for the year; these earnings can be earned entirely in one quarter.
[18] There are limitations in using QCs to contrast the labor force attachment of the denied with the allowed. For example, workers need to earn $520 to get one QC in 1990 and $2,080 to get all four QCs. Hence, one cannot differentiate those who earn $2,080 in 1990 from those who earn much more in terms of QCs. And the SGA maximum (for the nonblind) in 1990 was $500 per month.

Table 6.
Quarters of coverage earned by Disability Insurance applicants in the 10-year period before their first application

Coverage status	Allowed			Denied		
	Mean	Standard deviation	Median	Mean	Standard deviation	Median
Total quarters of coverage	34.8	7.3	39.0	29.8	11.2	33.0
Years earning at least one quarter of coverage	9.2	1.7	10.0	7.9	2.7	9.0
Years earning four quarters of coverage	8.3	2.2	9.0	6.9	3.1	8.0

SOURCE: Author's tabulations using the 1984, 1992, 1993, and 1996 Survey of Income and Program Participation matched with the Social Security Administration's Summary Earnings Record, Master Beneficiary Record, and "831" disability files.

Regression Analyses

The following regression analyses quantify both the predisability earnings differential between the allowed and the denied and the average predisability earnings of individuals in the applicant pool by their application years, after controlling for their demographic characteristics. The dependent variable is predisability earnings (7 to 3 years before application) in 1990 constant values (in thousands of dollars).[19] These analyses use both ordinary least squares (OLS) and Tobit on the pooled data.[20] These regressions control for demographic variables such as age at application, education, and race/ethnicity and time relative to the application year.[21] Regression analyses here are designed to show how much of the variation in predisability earnings can be explained by the ex-post disability determination outcomes and by the calendar year in which applications were filed.

As seen in Chart 1, applications and awards for DI benefits underwent three distinct phases: both applicants and awards decreased from 1979 through 1983; they began to increase in 1984; and they increased rapidly from 1990 through 1993. These phases coincided with administrative tightening of enrollment in 1980 through 1983 and the recession in 1991 and 1992. Hence, the regression analyses here can establish a linkage between these application growth patterns and the predisability earnings profiles

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[19] Since each applicant has 5 years of earnings, total observations for the regression analyses are 36,840 (7,368 x 5).

[20] As seen in Table 5, 6.2 percent to 8.4 percent of the allowed and 14.1 percent to 21.0 percent of the denied have zero earnings during the predisability period (7 to 3 years before application).

[21] This study includes four time dummies: 7 years through 4 years before the application year. The omitted year is the 3rd year before the application year.

of yearly applicant pools, particularly when it is focused on the decrease in applications and awards in 1980 through 1983 and the fast growth in 1990 through 1993.[22]

Table 7 presents both OLS and Tobit regression results that quantify the differential of the predisability earnings between the allowed and the denied. Coefficients of age and education variables, including the second-order term of age, are statistically significant in both OLS and Tobit regressions. Men tend to earn more than women. Estimates of the time dummies show that the earnings differentials decrease in the years close to application. Perhaps the most interesting finding in these regression results is the coefficient of the dummy variable representing benefit eligibility (allowed). The OLS estimate indicates that the allowed earn $3,717 more than the denied during the 7 to 3 years before the first DI application. The Tobit estimate shows that the allowed earn $4,518 more than the denied.[23]

The statistically significant predisability earnings differential between the allowed and the denied confirms the validity of using the predisability earnings as an instrument for disability determination outcomes in detecting the effect of induced applicants on fluctuations in applications. More specifically, the severity of disability, measured by disability determination outcomes, is positively correlated with predisability earnings among DI applicants. This result implies that conclusions drawn from postdenial labor force activity, without considering individuals' labor force activity before application,

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[22] Disabilities stemming from service in the Gulf War also had a small effect on applications during the period under study.
[23] Bound, Burkhauser, and Nichols (2002) also found that on average the preapplication employment and earnings of the denied were lower than those of the allowed. Their preapplication period covers only up to 3 years before application.

Table 7.

Regression estimates on predisability earnings of Disability Insurance applicants, by demographic variables

Variable	Ordinary least squares		Tobit	
	Estimate	Standard error	Estimate	Standard error
Constant	-7.2380	2.8037	-8.1223	3.0951
Time dummy				
Earnings in previous 7 years	0.6712	0.1959	0.9262	0.2162
Earnings in previous 6 years	0.5913	0.1958	0.8048	0.2162
Earnings in previous 5 years	0.6392	0.1958	0.8424	0.2162
Earnings in previous 4 years	0.4580	0.1958	0.5829	0.2163
Male	6.5584	0.1256	6.9083	0.1386
Age (at application)	5.8237	1.1837	5.5137	1.3065
Age squared	-0.3716	0.1230	-0.3345	0.1358
Race and ethnicity				
White, European origin	1.3589	0.1990	1.3167	0.2193
White, other than European origin	1.2305	0.2021	1.2050	0.2228
Hispanic	-0.0509	0.3257	-0.1373	0.3597
Black	-0.6722	0.2169	-0.7058	0.2393
Education				
0–6 years	-6.3594	0.2310	-6.6380	0.2551
7–11 years	-5.9209	0.1891	-6.1495	0.2087
12 years or high school diploma	-2.9523	0.1789	-2.9448	0.1971
Some college but no degree	-1.4107	0.2757	-1.2135	0.3032
Allowed	3.7174	0.1337	4.5180	0.1483
Sigma	. . .	. . .	12.9664	0.0517
R-squared		0.1457		
Log of likelihood		-1,354,461.78		
Number of observations		36,840 (7,368 x 5)		

SOURCE: Author's tabulations using the 1984, 1992, 1993, and 1996 Survey of Income and Program Participation matched with the Social Security Administration's Summary Earnings Record, Master Beneficiary Record, and "831" disability files.

NOTES: The dependent variable is 1990 constant earnings in thousands of dollars. The omitted race group is "Asian and Pacific Islanders." The omitted education group is "College degree or more."

. . . = not applicable.

may misrepresent the counterfactual labor force activity of beneficiaries in the absence of the program.

In studying the labor supply disincentive effect of the DI program, for example, Bound (1989) considered the denied as a control group for beneficiaries. In doing so, he assumed that (1) the denied are healthier than the allowed, and (2) characteristics of the denied, besides health, which are different from those of the allowed, will not lead the denied to low labor force performance. Based on these assumptions, the labor force activity of the denied can be interpreted as an upper-bound estimate for the labor force activity of the allowed in the absence of the program. Bound concluded that only 40 percent to 50 percent of DI beneficiaries would be working in the absence of the program, since fewer than 50 percent of the denied return to work after being denied.

Bound's estimate will overstate the effect of the disability program on labor force participation, however, if the rejected applicants earn systematically less or are less attached to the labor force than are the allowed applicants. The result presented here suggested that, indeed, rejected applicants have lower average earnings than do allowed applicants during the preapplication period. Adjusting for this differential between the allowed and the denied, the labor supply reduction caused by the DI program appears to be at least 10 percent smaller than Bound's estimate, because work-participation rates for the denied are at least 10 percent lower than for the allowed throughout the preapplication period.

Although the above result shows a significant earnings differential between the allowed and the denied, the differential may arise as a result of the time aggregation. To assess whether the earnings differential occurs consistently over the study period, the

regression in Table 8 replaces the benefit eligibility dummy with 21 dummies that are obtained from the interaction of application calendar year and benefit eligibility. Thus, coefficients of these interacted dummies (application year and being allowed) capture earnings differentials by year of application. The relative-time dummies and other demographic variables also are included in the analysis, and, as expected, their coefficients remain similar to the estimates reported in Table 7. Coefficient estimates of the interacted dummies are all positive and statistically significant at the 1 percent level.[24] Coefficients of these dummies show interesting and meaningful fluctuations. While estimates of the dummies of 1980 through 1983 are the largest, estimates of the dummies of 1990 through 1994 are the smallest. These results indicate that the predisability earnings differentials are inversely correlated with the growth of DI applications.[25]

Last, to investigate how the average predisability earnings of the yearly applicant pool changes in both the fast-growing and the administrative-tightening periods, application-year dummies (1977–1996) were included as explanatory variables. Thus, coefficients of these dummies represent the relative earnings level of yearly applicant pools.[26] Results presented in Table 9 indicate that predisability earnings are the highest among applicants in the 1981–1983 period and that they are the lowest among applicants during the 1990–1994 period.[27]

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[24] A simple likelihood ratio test rejects the null hypothesis that the estimates for those year dummies are equal to each other; the likelihood statistic is 104.8 with 19 restrictions.

[25] During the 1980–1983 period, numbers of applications were the lowest and the denial rates were also the highest (see Table 2). The latter period (1990–1994) was a period of fast growth in the number of applications (see Table 2 and Chart 1).

[26] Since the omitted year is 1997, coefficients represent average earnings levels relative to the earnings of 1997 applicants.

[27] Note that the dependent variable is earnings in thousands of 1990 constant dollars adjusted by national average-wage levels.

Table 8.

Regression estimates on predisability earnings of Disability Insurance applicants, by demographic variables, application year, and benefit eligibility

Variable	Ordinary least squares		Tobit	
	Estimate	Standard error	Estimate	Standard error
Constant	-7.5738	2.8045	-8.4414	3.0953
Time dummy				
Earnings in previous 7 years	0.6712	0.1956	0.9252	0.2158
Earnings in previous 6 years	0.5912	0.1956	0.8046	0.2158
Earnings in previous 5 years	0.6392	0.1955	0.8423	0.2158
Earnings in previous 4 years	0.4580	0.1955	0.5826	0.2159
Male	6.5208	0.1256	6.8696	0.1386
Age (at application)	6.0119	1.1842	5.6960	1.3067
Age squared	-0.3926	0.1231	-0.3550	0.1358
Race and ethnicity				
White, European origin	1.2889	0.1994	1.2443	0.2197
White, other than European origin	1.1961	0.2022	1.1690	0.2229
Hispanic	-0.0218	0.3256	-0.1063	0.3595
Black	-0.7334	0.2171	-0.7706	0.2395
Education (in years)				
0–6	-6.3691	0.2319	-6.6451	0.2560
7–11	-5.9932	0.1903	-6.2168	0.2099
12 or high school diploma	-2.9330	0.1791	-2.9204	0.1972
Some college but no degree	-1.3764	0.2758	-1.1819	0.3032
Application year and allowed dummy				
1977	3.4138	0.4074	4.2245	0.4480
1978	3.5582	0.4291	4.3653	0.4717
1979	3.2735	0.3974	4.1030	0.4367
1980	4.4212	0.4224	5.4049	0.4632
1981	5.9940	0.4258	6.9119	0.4673
1982	5.3611	0.4584	6.2625	0.5030
1983	4.4660	0.4570	5.2357	0.5024
1984	4.0011	0.4460	4.5841	0.4917
1985	4.6544	0.4164	5.4409	0.4576
1986	4.0896	0.4115	4.8077	0.4527
1987	4.5957	0.3786	5.3955	0.4161
1988	4.3348	0.3850	5.0162	0.4238
1989	4.0128	0.3644	4.6164	0.4015
1990	2.4800	0.3398	3.1441	0.3744
1991	3.3905	0.3242	4.2394	0.3562
1992	2.9931	0.3214	3.6940	0.3539
1993	3.3477	0.3040	4.1546	0.3343
1994	2.3511	0.2985	3.2107	0.3282
1995	4.1294	0.3045	5.0273	0.3345
1996	3.3943	0.3016	4.2202	0.3316
1997	3.5874	0.3249	4.4793	0.3567
Sigma	. . .	. . .	12.9457	0.0516
R-squared		0.1485		
Log of likelihood		-135,409.38		
Number of observations		36,840 (7,368 x 5)		

SOURCE: Author's tabulations using the 1984, 1992, 1993, and 1996 Survey of Income and Program Participation matched with the Social Security Administration's Summary Earnings Record, Master Beneficiary Record, and "831" disability files.

NOTES: The dependent variable is 1990 constant earnings in thousands of dollars. The omitted race group is "Asian and Pacific Islanders." The omitted education group is "College degree or more."

. . . = not applicable.

Table 9.

Regression estimates of predisability earnings of Disability Insurance applicants, by demographic variables and application year

Variable	Ordinary least squares		Tobit	
	Estimate	Standard error	Estimate	Standard error
Constant	-10.4329	2.8393	-11.5964	3.1355
Time dummy	0.6719	0.1974	0.9163	0.2179
Earnings in previous 7 years				
Earnings in previous 6 years	0.5933	0.1973	0.8007	0.2179
Earnings in previous 5 years	0.6395	0.1973	0.8402	0.2179
Earnings in previous 4 years	0.4580	0.1973	0.5796	0.2180
Male	6.7491	0.1264	7.1392	0.1396
Age (at application)	7.6272	1.1944	7.6241	1.3187
Age squared	-0.5296	0.1242	-0.5165	0.1371
Race and ethnicity				
White, European origin	1.2209	0.2012	1.1677	0.2218
White, other than European origin	1.1624	0.2039	1.1314	0.2249
Hispanic	-0.2438	0.3286	-0.3747	0.3630
Black	-0.9257	0.2188	-0.9932	0.2414
Education				
0–6 years	-6.4095	0.2341	-6.6780	0.2586
7–11 years	-6.0599	0.1925	-6.2651	0.2124
12 years or high school diploma	-3.0202	0.1807	-3.0206	0.1991
Some college but no degree	-1.4541	0.2783	-1.2863	0.3062
Application year dummy				
1977	-0.3920	0.3965	-0.6551	0.4381
1978	0.0767	0.4105	-0.1163	0.4532
1979	0.5385	0.3926	0.4201	0.4331
1980	1.2420	0.4016	1.1570	0.4429
1981	2.6077	0.4074	2.5578	0.4491
1982	2.3791	0.4306	2.3889	0.4743
1983	2.7846	0.4382	2.8243	0.4824
1984	1.7441	0.4281	1.5380	0.4726
1985	1.6417	0.4126	1.5575	0.4548
1986	1.3388	0.4249	1.1647	0.4689
1987	2.3587	0.3968	2.3415	0.4371
1988	1.3110	0.4027	1.0605	0.4446
1989	1.8924	0.3908	1.7807	0.4308
1990	0.0184	0.3706	-0.1780	0.4090
1991	0.0544	0.3545	-0.0733	0.3909
1992	0.3477	0.3526	0.2562	0.3887
1993	0.5326	0.3370	0.4030	0.3716
1994	-0.3451	0.3350	-0.4144	0.3692
1995	1.0826	0.3365	1.1479	0.3705
1996	0.3763	0.3332	0.3503	0.3671
Sigma	. . .	. . .	13.0754	0.0521
R-squared		0.1330		
Log of likelihood		-135817.4100		
Number of observations		36,840 (7,368 x 5)		

SOURCE: Author's tabulations using the 1984, 1992, 1993, and 1996 Survey of Income and Program Participation matched with the Social Security Administration's Summary Earnings Record, Master Beneficiary Record, and "831" disability files.

NOTES: The dependent variable is 1990 constant earnings in $1,000. The omitted race group is "Asian and Pacific Islanders." The omitted education group is "College degree or more."

. . . = not applicable.

References

Autor, David H., and Mark G. Duggan. 2003. "The Rise in the Disability Rolls and the Decline in Unemployment." *Quarterly Journal of Economics* 118(1): 157–205.

Benitez-Silva, H.; M. Buchinsky; H-M Chan; J. Rust; and S. Sheidvasser. 2000. *How Large is the Bias in Self-Reported Disability?* NBER Working Paper No. 7526, Cambridge, Mass.: National Bureau of Economic Research.

Bound, J. 1989. "The Health and Earnings of Rejected Disability Insurance Applicants." *American Economic Review* 79(3): 482–503.

Bound, J., and R.V. Burkhauser. 1999. "Economic Analysis of Transfer Programs Targeted on People with Disabilities." In *Handbook of Labor Economics,* vol. 3C, edited by O.C. Ashenfelter and D. Card. Amsterdam: Elsevier Science Press, pp. 3417–3518.

Bound, J.; R.V. Burkhauser; and A. Nichols. 2002. "Tracking the Household Income of SSDI and SSI Applicants." In *Research in Labor Economics,* vol. 22, edited by S.W. Polachek. Amsterdam: Elsevier Science Press, pp. 113–159.

Gruber, J., and J. Kubik. 1997. "Disability Rejection Rates and the Labor Supply of Older Workers." *Journal of Public Economics* (64): 1–23.

Halpern, J., and J. A. Hausman. 1986. "Choice Under Uncertainty: A Model of Applications for the Social Security Disability Insurance Program." *Journal of Public Economics* (31): 1314–1361.

Haveman, R., and B. Wolfe. 1984. "Disability Transfers and Early Retirement: A causal Relationship?" *Journal of Public Economics* (24): 47–66.

_____. 2000. "The Economics of Disability and Disability Policy." In *Handbook of Health Economics,* vol. 1, edited by A.J. Culyer and J.P. Newhouse. Amsterdam: Elsevier Science Press, pp. 995–1050.

Kreider, B. 1999. "Social Security Disability Insurance: Applications, Awards, and Lifetime Income Flows." *Journal of Labor Economics* 17(4): 784–827.

Panis, Constantijn; Roald Euller; Cynthia Grant; Melissa Bradly; Christine E. Peterson; Randall Hirscher; and Paul Stinberg. 2000. *SSA Program Data User's Manual.* Baltimore, Md.: Social Security Administration.

Parsons, D.O. 1980. "The Decline in Male Labor Force Participation." *Journal of Political Economy* 88(1): 117–133.

Rupp, K., and D. Stapleton. 1995. "Determinants of the Growth in the SSA's Disability Programs—An Overview." *Social Security Bulletin* 58(4): 43–70.

Social Security Administration. 2000. *Annual Statistical Report on the Social Security Disability Insurance Program, 2000*. Washington, D.C.: Office of Policy; Office of Research, Evaluation, and Statistics.

_____. 2001. *Annual Statistical Supplement, 2001,* to the *Social Security Bulletin.* Washington, D.C.: Office of Policy; Office of Research Evaluation, and Statistics.