Trends in Employment and Earnings of Allowed and Rejected Applicants to the Social Security Disability Insurance Program[†]

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Since the early 1980s, changes in the economic environment and in the process for determining eligibility for the Social Security Disability Insurance (DI) program have had significant effects on the program. First, the economic situation and labor force opportunities for lower-skilled people continued to decline, leading to lower rates of participation in the labor force for less-educated men. Second, changes in the eligibility process made it easier to obtain DI benefits based on conditions difficult to clearly identify on medical terms alone, such as back pain or depression.[1]

Those two factors have likely contributed to a substantial increase in the number of individuals receiving DI, as well as a significant change in the characteristics of applicants and new beneficiaries over the same period. Both applicants and new beneficiaries have become younger, longer-lived, more likely to apply because of nonterminal conditions such as back pain or mental health, and more likely to be female.[2] As a result, recent work projects a rapid increase in program costs as greater numbers of beneficiaries stay on the program for more years (e.g., David H. Autor and Duggan 2006).

The concurrent developments in the economy and eligibility rules have also fueled the concern that the generosity of DI increasingly induces low-income workers to apply for and sometimes receive benefits, and that some of those beneficiaries would be able to work in the absence of the program. Indeed, a growing body of research suggests that some workers in difficult economic conditions exit the labor force to

[†] To view additional materials, visit the article page at
http://www.aeaweb.org/articles.php?doi=10.1257/aer.101.7.3308.

[1] The Social Security Disability Benefits Reform Act of 1984 revised the standards for determining mental impairments, placed more weight on the treating physician's opinion, and required greater emphasis on the combined effects of multiple impairments in the absence of a single severe impairment. The act also required proof of medical improvement prior to the termination of benefits and put in place new standards to evaluate pain. See Tim A. Zayatz (1999).

[2] See John Bound and Richard V. Burkhauser (1999), Teran Martin and Paul S. Davies (2004), and Mark G. Duggan and Scott A. Imberman (2006). Men under age 45 received about 22 percent of awards in 1975 but 38 percent by the early 1990s (Social Security Administration 2008).

apply for and often receive DI benefits (e.g., Kalman Rupp and David Stapleton 1995; Dan Black, Kermit Daniel, and Seth Sanders 2002).[3] That pattern has intensified since the mid-1980s (Stapleton et al. 1998; Autor and Duggan 2003). Because such economically motivated applicants on average should have less severe disabilities, some of them might have worked in the absence of DI.

In contrast, a long-standing result by Bound (1989) suggests that at least among older male beneficiaries, few are likely to work in the absence of DI. To obtain an estimate of the potential labor force attachment of new DI beneficiaries in the absence of DI, Bound suggested using employment of rejected DI applicants as a counterfactual. Bound's argument was that rejected applicants are more similar to new beneficiaries than the typical worker, but they are also likely to be in better health; thus, their labor force attachment constitutes an upper bound for the employment behavior of new beneficiaries. Using data covering the mid-to-late 1970s, he found that the employment rate of older male rejected DI applicants was quite low. That finding has been replicated for the early 1990s and extended by work exploiting different features of the DI system to obtain more precise counterfactuals (e.g., Bound, Richard V. Burkhauser, and Austin Nichols 2003; Susan Chen and Wilbert van der Klaauw 2008; Nicole Maestas and Na Yin 2008).

In this paper, we provide new evidence on the employment and earnings of allowed and rejected DI applicants before and after the year of application. Our findings are based on a large, high-quality longitudinal database rarely used for disability research. Our data contain administrative information on DI application and receipt from 1981 to 1999, as well as earnings before and after application spanning the period from 1978 to 2006. We use those data to extend Bound's analysis of older allowed and rejected applicants to the analysis of younger applicants, who constitute an increasing share of applicants and have higher potential lifetime employment. Our data also allow us to provide robust counterfactual employment measures by different impairment, industry, and earnings groups. In addition, we provide new information on the dynamics of earnings before and after application for workers admitted at different stages of the application process. We use those findings to try to reconcile some of the seemingly contrasting findings in the literature and to obtain a more detailed and nuanced picture of how the presence of DI may affect labor force participation.[4]

We first replicate Bound's result for male applicants age 45–64 and show that his main conclusion is stable over time and robust to many alternative specifications.[5] We then extend Bound's analysis to male applicants age 30–44. Those younger applicants constituted a small fraction in Bound's sample, but they grew to almost 40 percent of new DI beneficiaries in the early 1990s and accounted for about 30

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[3] This more recent work builds on an earlier literature suggesting that the presence of DI may be responsible for declines in labor force participation of older men (e.g., Donald O. Parsons 1980).

[4] We show our findings are robust to controlling for detailed employment and earnings histories and for employment trends within industry, earnings, or impairment groups. As discussed below, our results are confirmed by the recent work of Eric French and Song (2010), who use an instrumental variable strategy to obtain counterfactual work behavior for allowed applicants.

[5] Prior analyses replicating Bound (1989) mainly focused on the early 1990s without analyzing yearly developments up to the late 1990s; did not examine employment of rejected applicants by age, impairment, industry, or earnings groups; and did not control for prior average earnings, industry, or employment trends prevailing for nonapplicants as we do here.

percent of new beneficiaries and more than half of rejected applicants in 2007. For young rejected applicants we find significant postapplication employment. Similarly, we show that employment of rejected applicants who applied based on mental health or musculoskeletal conditions is nonnegligible. The difference in employment potential of older and younger DI beneficiaries is even larger if we account for the longer expected duration of benefit receipt. Since the share of younger beneficiaries and beneficiaries with low-mortality impairments has increased, these findings suggest that the overall employment potential of DI beneficiaries is likely to have increased since the late 1970s. Our findings also suggest that for the sizable fraction of young beneficiaries, the results from a counterfactual analysis in the spirit of Bound do not conflict with the literature, indicating a potentially important degree of moral hazard.

We also find that first-time applicants who were allowed during later stages of the application process have a much higher propensity to work than first-time applicants allowed during the earlier stages. Beneficiaries who are allowed at later stages or after subsequent application (labeled "hearings level allowed" in this paper) suffer from impairments and economic circumstances that do not clearly identify them as unable to engage in gainful employment. They are, thus, the group most likely to be able to work among new beneficiaries and provide support for the view that economic conditions may have induced a nonnegligible fraction of DI applicants who are potentially able to work, especially among younger workers. This finding does not challenge the result that a substantial fraction of older DI recipients may not be able to engage in substantial work.

Several other new and robust findings relate to the interaction of labor market conditions and application to DI. First, average preapplication earnings of applicants have been declining over time relative to nonapplicants, especially for rejected applicants, who traditionally have had lower earnings than DI beneficiaries. Second, rejected applicants experience preapplication dips in employment and earnings over a number of years; on the other hand, declines in earnings and employment for allowed applicants are concentrated in the year prior to application. Third, even for young rejected applicants who return to the labor force, earnings losses are permanent and substantial when compared to similar nonapplicants.

Our findings are robust to composition changes and detailed controls for observable characteristics, and they hold within industry, earnings, and impairment groups. Our results are consistent with two hypotheses that are difficult to distinguish. The first is the notion that DI increasingly has attracted economically less successful workers, and at least some fraction of those applicants has been screened out during the application process. Second, some rejected applicants are likely to be truly disabled, and our findings are partly driven by worsening economic conditions for less healthy workers. The findings also suggest that the application to DI itself might be costly in terms of depressed earnings for rejected applicants returning to the labor force.

Section I briefly describes our data and trends in the DI system. Section II replicates Bound's (1989) analysis for older and younger male DI applicants. It also highlights differences among impairment groups and discusses the potential magnitude of the counterfactual employment rates we find. Section III presents additional results on pre- and postapplication earnings of DI applicants and discusses changes

over time. Section IV offers new evidence on characteristics of DI beneficiaries whose first application was rejected at the early stages of the process. Section V briefly discusses the trends we find in light of a stylized economic model of DI application.

I. Social Security Data and Trends in Federal Disability Insurance

To study the economic outcomes of applicants to the Social Security DI program, we merged several administrative data sources. The first is a 1 percent sample of all initial applications to DI from 1981 through 1999, including concurrent applicants who apply to both DI and the Supplemental Security Income (SSI) program. The file contains information on the applicant (such as age, gender, education, and impairment) as well as information on the decision at the Disability Determination Services (DDS) level that includes the initial stage and the reconsideration phase.[6] Many applications, however, are decided in the later hearings stages of the decision process. To discern whether applicants actually received DI benefits, we merged data on first-time applicants at the DDS level to information on final benefit receipt from the Social Security Administration's (SSA) Master Beneficiary Record (MBR).[7] Doing so allows us to identify applicants who were awarded benefits at the DDS level, those whose claims were finally rejected, and those who were rejected at the DDS level but eventually received benefits. Because the application status of the first two applicant groups is relatively unambiguous, we will limit our main analysis to DDS-level allowed and finally rejected applicants.[8] We will return to the intermediate group below. To measure employment and earnings of DI applicants, we merged our sample with uncapped annual earnings recorded on workers' W-2s contained in SSA's Master Earnings File (MEF).[9] That information provides longitudinal earnings from 1978 to 2006, both before and after DI application. Based on that information, we consider a worker employed if he has any positive earnings in a given calendar year.

Trends in the basic characteristics of our sample have been documented in detail elsewhere (e.g., Duggan and Imberman 2006; Social Security Administration 2008), so we will be brief. Our sample consists of all first-time DI applicants who

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[6] The 831 file contains information on all new and repeat DI applications but has no information on decisions made at the hearings levels or on technical denials (usually for insufficient work history). We look at primary applicants only.

[7] We merged the 831 file with the MBR, the Master Earnings File, and the Numident at SSA using Social Security numbers, gender, and age. For a more detailed description, see von Wachter, Song, and Manchester (2008).

[8] An applicant is "rejected" if he does not receive benefits within ten years of his first application. Bound's (1989) definition is similar. The final allowance rates in our Table 1 for a given cohort of applicants are larger than the final allowance rates based on applications and allowances in a given year typically published by SSA. Our allowance rates exclude technical denials, target a slightly older population of applicants because we omit those under age 30, and apply only to first-time applicants. See online Appendix B for further detail. The final allowance rates in Table 1 are similar in magnitude to those of Hugo Benitez-Silva et al. (1999) for a cohort of applicants from the Health and Retirement Survey.

[9] Our approach likely understates employment as it omits self-employment and other non-W-2 sources of labor income (Wojciech Kopczuk, Emmanuel Saez, and Song 2009). Timing of allowances also affects the employment statistics of allowed versus rejected applicants. The administrative data for DI applicants in 1998 show that two years after initial application, 11 percent of applications had been allowed and 11 percent were still in process. Four (ten) years after application, 55 percent (56 percent) had received allowances and just 3 percent (0.2 percent) were still in process.

Panel A. Number of allowed and rejected applicants to DI, men age 30–64
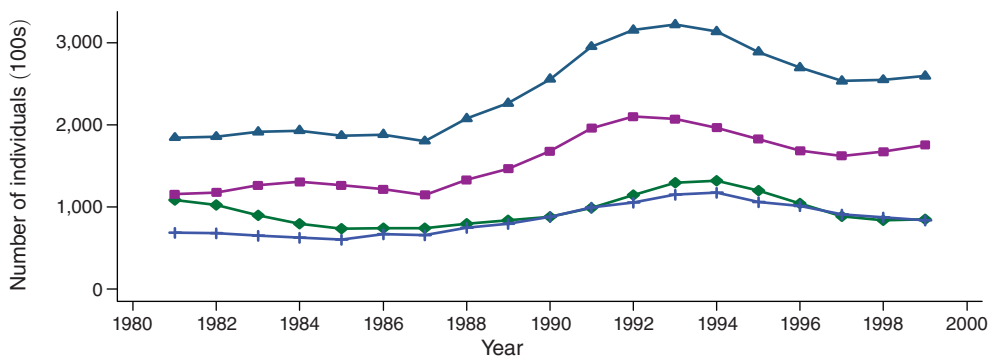
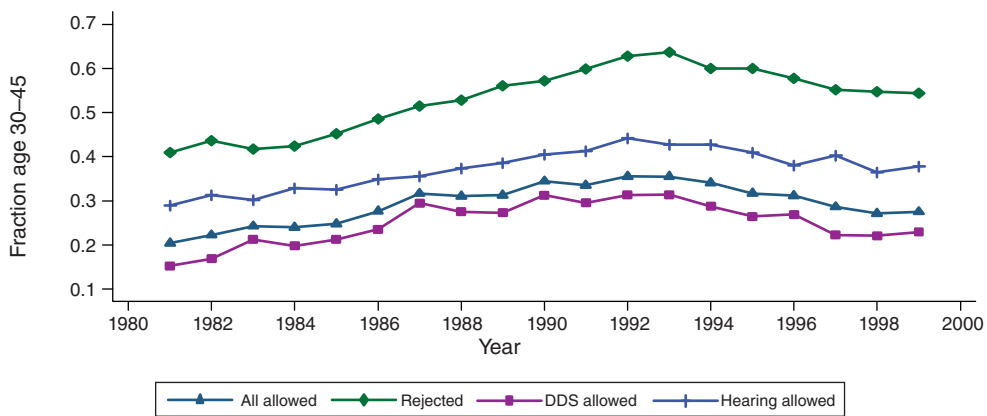Panel B. Fraction allowed and rejected DI applicants in age range 30–44, men age 30–64

FIGURE 1. NUMBER AND FRACTION OF ALLOWED AND REJECTED DI APPLICANTS

Note: Labels refer to rejected applicants, DDS level allowed beneficiaries, and hearings level allowed beneficiaries (see text).

Source: 1 percent files of Social Security administrative data (see text).

filed an application between 1981 and 1999. "New beneficiaries" refers to DI applicants in our sample who became newly enrolled in the DI program. The number of male new beneficiaries (labeled "allowed" applicants) between the ages of 30 and 64 has grown substantially since 1981 (see Figure 1, panel A).[10] In addition, an important fraction of initial applicants, between 20 percent and 40 percent depending on the age of applicants, do not receive DI benefits (labeled "rejected"). The figure also shows that although a majority of new beneficiaries was awarded benefits during the adjudication phases at the DDS level ("DDS allowed"), a sizable fraction of new beneficiaries received allowances during the later stages or following subsequent application ("hearings allowed"). Panel B displays the fraction of individuals age 30–44 among those groups. The pattern demonstrates that although older men

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[10]Our focus on applicants age 30–64 ensures that the majority of our sample is disability insured and allows measuring preapplication average earnings on a consistent basis. Including younger ages would strengthen the points we make.

remain the main target group for DI, the age of new beneficiaries has fallen over time. Among male beneficiaries, the share age 30–44 grew about 75 percent from 1982 to 1992 and has stayed relatively high. Particularly relevant for our purposes, a nonnegligible and increasing share of rejected applicants tends to be younger; whereas men age 30–44 constituted about 45 percent of rejected applicants in 1982, that share rose to 60 percent in 1992 and has remained above 50 percent since then. In contrast, men age 30–44 constituted 25 percent of all first-time applicants in 1982 and 36 percent in 1997.

Another trend that has received attention is the continuing increase in the number of applicants to DI with impairments associated with low mortality, in particular musculoskeletal conditions and mental health. That increase is only partially a consequence of the changing age structure and holds within age groups as well (e.g., Duggan and Imberman 2006; Social Security Administration 2008). We will return to that trend in Table 2 below. Last, partially due to increasing DI coverage driven by rising labor force participation, the number of women among applicants and new beneficiaries has increased rapidly as well. For reasons of space, and because men were the main subject of an important part of the prior literature, we focus on men here. Our longer working paper shows that both allowed and rejected female applicants have rates of employment similar to those of men before and after DI application, but lower levels of annual earnings (von Wachter, Song, and Manchester 2008).

II. Replicating Bound's Results for Older and Younger Male Applicants

A. *Male Applicants Age 45–64*

Merging different administrative datasets allows us to replicate as closely as possible the main table of Bound's (1989) analysis (his Table 2; see our Table 1). To be comparable with Bound, we initially examine male applicants age 45 to 64 in 1982. The first columns of panel A in Table 1 show our employment measure for workers applying to DI in 1982, as well as for a 0.2 percent random sample of nonapplicant males in the same age range.[11] Two years after application, only 40 percent of rejected applicants have any positive earnings. Because we do not have information on hours worked, we also show the fraction of workers with earnings above a minimal threshold (defined as one quarter of full-time earnings at the 2000 minimum wage).[12] Similar to Bound's findings, only 32 percent of rejected applicants have earnings beyond the minimal threshold, compared to 70 percent of nonapplicants.[13] In addition, median earnings of rejected applicants are an order of magnitude lower than those of nonapplicants. As discussed below, the lower earnings are in part due

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[11] Nonapplicants are drawn from the MEF. For more details on this sample see the online Appendix A.

[12] We chose not to use the substantial gainful activity (SGA) level of earnings as a threshold for several reasons. We do not know monthly earnings, whether a beneficiary is participating in the trial work period, or whether an individual is blind and thus subject to a higher SGA level. Also, we follow all individuals who receive DI benefits at some point, even though a small percentage of them will leave the program due to improved health or high, prolonged earnings.

[13] Differences in data make an exact comparison difficult. As discussed in detail in the online Appendix A, however, our magnitudes are fairly comparable to those reported in Bound. In results not shown, we found that the patterns in Table 1 and Figure 3 hold if we exclude workers above age 54; thus, we confirm Bound's earlier conclusion that the patterns are not simply driven by retirement behavior.

TABLE 1—EMPLOYMENT, EARNINGS, AND OTHER CHARACTERISTICS OF NONAPPLICANTS, REJECTED, AND ALLOWED DISABILITY INSURANCE APPLICANTS (*Men*)

Application year	1982				1997			
Application status	Non-applicants	Rejected applicants	DDS level allowed beneficiaries	Hearings level allowed beneficiaries	Non-applicants	Rejected applicants	DDS level allowed beneficiaries	Hearings level allowed beneficiaries
Panel A. Men age 45–64 at beginning of application year								
Labor supply and earnings 2 years after application								
Percent positive covered earnings	73.3	*40.4*	9.6	25.4	82.2	*52.6*	17.9	24.5
Percent earnings above minimum amount[a]	70.2	*31.6*	6.3	18.4	78.5	*42.7*	10.4	17.5
Average annual earnings ($1,000)	34,759	*6,672*	1,254	3,785	46,699	*7,639*	1,415	2,475
Median positive annual earnings ($1,000)	37,000	*10,000*	4,500	8,000	35,000	*10,000*	3,000	5,000
Demographics								
Median age at application	52	*55*	56	52	50	*54*	50	52
Percent nonwhite	11.1	*20.6*	14.3	17.8	18.4	*21.1*	23.2	23.3
Median years of schooling	—	**—**	—	—	—	*17*	19	14
Percent dead after application								
Percent deceased 2 years after application	4.5	*7.6*	34.8	4.4	2.6	*3.4*	23.1	3.0
Percent deceased 4 years after application	6.1	*11.9*	42.9	9.7	3.6	*6.7*	31.0	4.6
Observations	151,945	*582*	961	472	204,205	*386*	1,245	526
Panel B. Men age 30–44 at beginning of application year								
Labor supply and earnings 2 years after application								
Percent positive covered earnings	82.9	*59.8*	25.0	41.4	87.7	*69.6*	26.1	36.9
Percent earnings above minimum amount[a]	79.5	*50.7*	13.8	25.6	84.6	*57.4*	12.9	24.5
Average annual earnings ($1,000)	36,725	*10,393*	2,702	5,541	40,666	*8,440*	2,988	3,640
Median positive annual earnings ($1,000)	37,000	*10,000*	2,000	5,000	32,000	*8,000*	2,000	5,000
Demographics								
Median age at application	33	*34*	35	36	26	*38*	29	28
Percent nonwhite	17.9	*28.4*	24.5	20.0	12.0	*12.0*	12.0	12.0
Median years of schooling	—	**—**	—	—	—	*18*	20	13
Percent dead after application								
Percent deceased 2 years after application	1.3	*3.6*	23.5	4.2	0.9	*2.3*	18.3	2.0
Percent deceased 4 years after application	1.7	*4.9*	28.6	7.0	1.2	*4.6*	21.6	4.8
Observations	189,920	*450*	196	215	286,955	*474*	356	355

Notes: Earnings are in 2000 dollars adjusted by the CPI. Applications refer to initial application for benefits from Social Security Disability Insurance (DI). "Rejected applicants" are those applicants who are rejected at the DDS stages of the screening process and do not receive benefits within ten years of initial application. "DDS level allowed beneficiaries" are those applicants who are awarded benefits during the DDS stages of the screening process. "Hearings level allowed beneficiaries" are those applicants who are rejected at the DDS stages of the screening process but receive benefits within ten years of application.

[a] The minimum earnings threshold used corresponds to earnings during three months of full-time employment at the minimum wage in 2000.

Source: 1 percent files of Social Security administrative data (see text).

to significant earnings differences prior to application, but the earnings loss for rejected applicants remains high.

Limited information on the demographic characteristics of our sample of rejected applicants shows a median age of 55 years (again see Table 1), with higher probabilities of being nonwhite and less educated (available in the 831 files starting in 1987). We also report mortality, derived by merging individuals' date of death from the Numident file maintained by the Social Security Administration. Mortality is a biased measure of health, in part because the 1980s reforms targeted nonfatal conditions. But it does provide evidence on the growing duration of beneficiaries on the program and the differences between applicants and the overall population.

The evidence shows that the death rate of rejected applicants two years after initial application to DI is about 50 percent higher than the rate for nonapplicants. Higher mortality is not surprising because rejected applicants are more likely to be drawn from a population with low earnings and low education, and are less likely to be white. As in Bound, however, the table also shows that rejected applicants enjoy longer lives than new beneficiaries, among whom a large fraction dies within four years of application.

Different types of impairments among applicants and new beneficiaries are associated with differences in the potential for employment and earnings, as seen in the work behavior of rejected applicants. We categorized information on the primary impairment code—available from the DI application on a consistent basis starting in the mid-1980s—to be as comparable as possible to the self-reported health conditions reported in Bound.[14] Among older new beneficiaries, the fraction with primary impairments of the musculoskeletal system (e.g., back problems) was 26 percent in 1987 but 32 percent in 1997. The fraction of older new beneficiaries with mental disorders as the primary impairment was 8 percent in 1987 but 12 percent in 1997. At the same time, impairments of the circulatory system (e.g., cardiovascular diseases) declined.

To assess the employment of older men in different time periods, panel A of Figure 2 shows the fraction of years worked in the five years following application, by year of application from 1981 to 1999, for different groups. Whereas postapplication employment of older rejected applicants and beneficiaries allowed at the DDS level stayed roughly flat until the early 1990s, it gradually has increased about 10 percentage points since then. That increase is also shown in panel A of Table 1, which replicates the basic Bound results for applicants in 1997.

We abstract from fluctuations in single years and show the evolution of average labor force attachment for workers who applied during two time periods, 1982–1987 and 1992–1997, in Figure 3.[15] Panels A and B focus on older men. The upward shift in employment after application for rejected applicants is apparent in panel A, but it is also clear that employment is higher prior to application as well. Hence, the higher rate of employment for rejected applicants may be partially due to aggregate trends in labor force participation of older workers, which we control for explicitly in Section III. It may also be partly driven by changes in the underlying health of rejected applicants; for example, increases in acceptance rates over the time period we study could imply that rejected applicants have become healthier over time. Thus, while in general the patterns indicate broad stability in pre/postemployment and earnings for older men, as further discussed in Section III, care has to be taken in making comparisons over time.

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[14] See our online Appendix D for additional detail on impairment conditions over time. Bound allows multiple impairments per person, but we record only the main impairment on the DI application. In the administrative data, the impairment is documented by medical examination and thus on more solid grounds. On the other hand, due to administrative requirements it may not fully correspond to actual health status.

[15] Again, we postpone the discussion of the more ambiguous hearings-level beneficiaries to Section IV. The age restriction in the figures still refers to the baseline year (1982 and 1992) so that we can impose similar criteria for nonapplicants in a matching and regression analysis (von Wachter, Song, and Manchester 2008). Our approach implies the actual age at application lies above the stated age ranges. Replicating the figures with age at application gives similar results.

Panel A. Fraction of years employed in the five years postapplication
Nonapplicants, allowed, and rejected applicants, men age 45–64
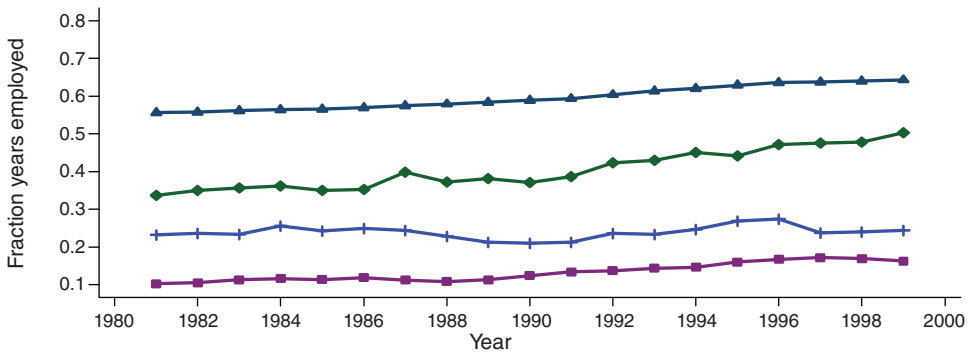
Panel B. Fraction of years employed in the five years postapplication
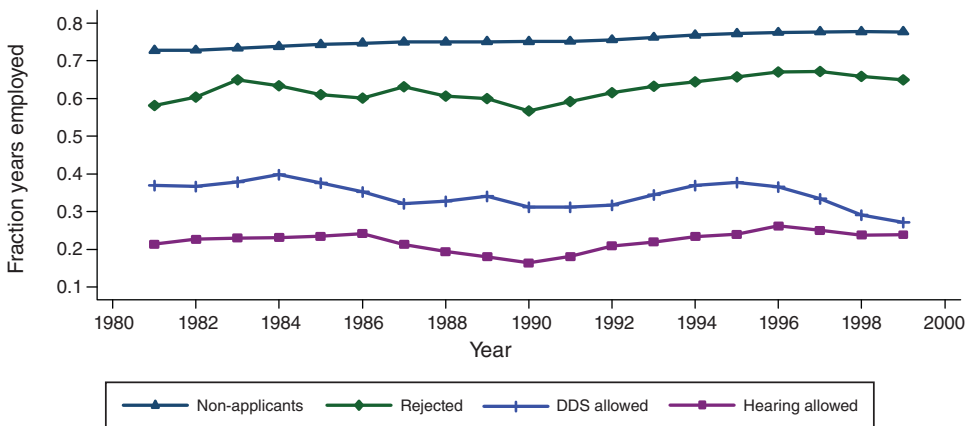Nonapplicants, allowed, and rejected applicants, men age 30–44

FIGURE 2. FRACTION OF YEARS EMPLOYED IN THE FIVE YEARS POSTAPPLICATION

Note: Labels refer to rejected applicants, DDS level allowed beneficiaries, and hearings level allowed beneficiaries (see text).

Source: 1 percent files of Social Security administrative data (see text).

In sum, the picture that emerges for older men applying to DI in the 1980s and 1990s is quite similar to that found by Bound (1989) for the late 1970s. Rejected applicants have limited attachment to the labor force and low earnings. They are more likely to be nonwhite, younger, and less skilled than new beneficiaries. They have lower mortality rates than the majority of new beneficiaries, but higher rates than the overall population. Thus, were employment and earnings of rejected applicants to be taken as an upper bound for the potential behavior of new beneficiaries in the absence of DI, their predicted labor force attachment would be weak.

B. *Male Applicants Age 30–44*

Younger men now comprise a higher fraction of DI applicants and new beneficiaries than in the 1970s. To analyze what impact that trend might have on our

Panel A. Annual fraction employed of allowed and rejected applicants, age 45–64

Panel B. Positive annual earnings ($1,000) of allowed and rejected applicants, age 45–64

Panel C. Annual fraction employed of allowed and rejected applicants, age 30–44

Panel D. Positive annual earnings ($1,000) of allowed and rejected applicants, age 30–44

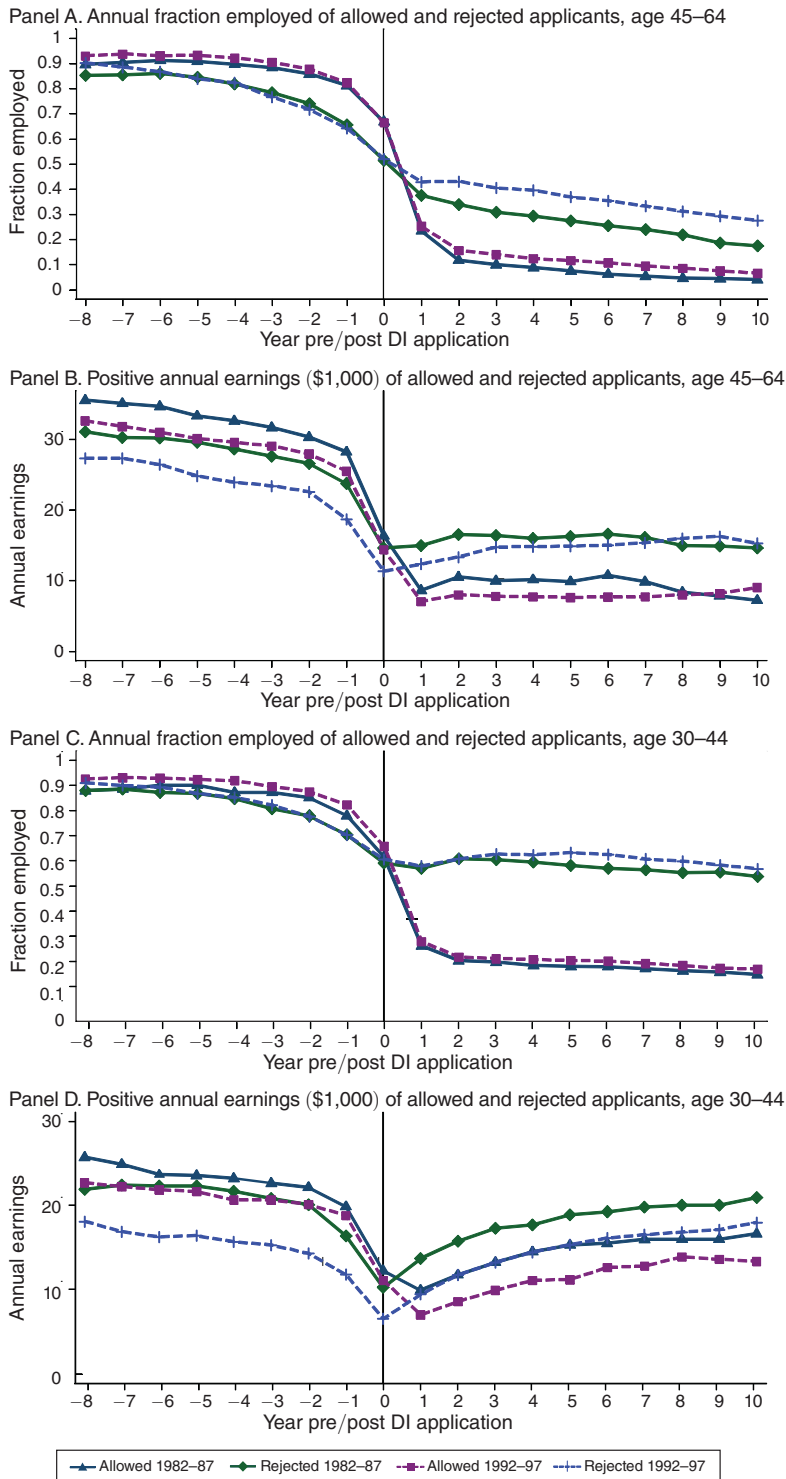Allowed 1982–87 ——▲——   Rejected 1982–87 ——◆——   Allowed 1992–97 ——■——   Rejected 1992–97 ——+——

FIGURE 3. AVERAGE ANNUAL EMPLOYMENT AND EARNINGS FOR ALLOWED AND REJECTED MALE DI APPLICANTS
BEFORE AND AFTER APPLICATION FOR DISABILITY INSURANCE

Note: Allowed refers to DDS level allowed beneficiaries; rejected refers to finally rejected applicants (see text).
Source: 1 percent files of Social Security administrative data (see text).

assessment of the potential employment of DI beneficiaries, the lower panel of Table 1 replicates Bound's analysis for men age 30–44 who applied to DI in 1982 and 1997; the lower panels of Figures 2 and 3 show the dynamic pattern of employment and earnings. The numbers in the table and figures imply the following: (i) the employment rate of rejected applicants after application is 50–60 percent, down from 70–80 percent prior to application; (ii) compared to preapplication earnings, average earnings after application and rejection decline; however, they remain considerably higher than those of older rejected applicants; (iii) the patterns are broadly stable over time, with the exception of an upward trend in employment in the 1990s and a drop in average earnings of rejected applicants in the mid-1980s discussed in Section III.

Overall, we reach a different conclusion for young rejected DI applicants than we had for older men; the labor force attachment of young rejected applicants remains substantial following application despite significant losses in earnings. Given that the age of applicants has declined, that result will be important when assessing trends in the potential work behavior of new beneficiaries. The apparent stability in the pattern we find, despite large changes in the number of young applicants and in the DI system, is striking. Absent underlying offsetting trends not apparent in our data, it suggests that the average employment levels we present may be a reasonable indicator of the future behavior of younger applicants.

Employment rates of younger rejected applicants should be higher than those of older workers for several reasons. Younger rejected applicants may be healthier than their older counterparts, and they may face stronger incentives to return to the labor force. For example, they have fewer options to replace lost income than older workers, an important fraction of whom can draw on pension benefits (Bound, Burkhauser, and Nichols 2003). Younger rejected applicants also benefit from reentry to the labor force over a longer period of time. They are likely to face smaller losses in occupation, industry, or firm-specific human capital, and also benefit more from reinvesting in specific human capital (Kerwin Kofi Charles 2003).

Our core findings are robust to several important sensitivity checks that go beyond the existing literature. For brevity, we summarize only our main results here and leave further discussion to Section III, an online Appendix, and our longer working paper (von Wachter, Song, and Manchester 2008). First, the employment and earnings patterns after application are robust to matching on, or to including regression controls for, average earnings and industry prior to application, age, and, where available, impairment code. Thus, our findings are not affected by differences or changes over time in observable characteristics of allowed and rejected applicants. That conclusion also holds if we compare allowed and rejected applicants with similar prior career histories—those who had the same employer in the four years prior to application.

Second, our results are robust to the inclusion of a control group of nonapplicants with similar average earnings, age, and industry affiliation. Thus, our analysis of employment of rejected applicants, its contrast with allowed applicants, and its comparison over time is not driven by employment trends in specific industry or earnings groups. Overall, the results imply that our findings for older and younger male applicants hold within relatively narrow groups of workers and are not mainly

TABLE 2—EMPLOYMENT AND EARNINGS BY IMPAIRMENT STATUS OF REJECTED AND
ALLOWED MALE DISABILITY INSURANCE APPLICANTS

Primary health condition at application		Musculo-skeletal system	Circulatory system	Mental disorders/ nervous system	Respiratory system	Neoplasms	Infectious diseases	Injuries
Panel A. Men age 45–64 at beginning of application year								
Percent positive covered earnings 4 years prior to application	All new beneficiaries	91.7	91.4	90.8	90.7	90.6	93.3	90.6
	Rejected applicants	81.9	81.7	81.8	78.2	82.8	85.0	81.3
Percent positive covered earnings 2 years after application	All new beneficiaries	19.4	18.5	21.5	14.7	8.5	16.8	20.3
	Rejected applicants	43.9	41.4	44.1	30.2	37.2	41.5	51.7
Percent earnings above minimum amount 2 years after application[a]	All new beneficiaries	11.7	11.8	13.2	7.7	5.2	10.6	12.8
	Rejected applicants	34.0	34.5	33.7	21.1	30.9	30.9	41.3
Average annual earnings 2 years after application ($1,000)	All new beneficiaries	1,657	2,097	2,199	1,222	1,156	1,596	2,377
	Rejected applicants	6,283	6,526	6,257	3,554	6,715	5,385	8,314
Median positive annual earnings 2 years after application ($1,000)	All new beneficiaries	3,752	4,308	4,167	2,743	3,446	3,812	4,409
	Rejected applicants	8,475	10,005	7,521	7,881	9,868	9,351	10,003
Observations	All new beneficiaries	11,142	11,030	7,327	3,228	6,820	597	2,179
	Rejected applicants	2,847	2,042	1,432	450	408	100	754
Panel B. Men age 30–44 at beginning of application year								
Percent positive covered earnings 4 years prior to application	All new beneficiaries	91.3	90.9	89.4	87.7	90.9	92.0	90.5
	Rejected applicants	87.2	86.5	83.8	84.6	84.5	82.3	86.9
Percent positive covered earnings 2 years after application	All new beneficiaries	25.5	24.8	27.6	20.7	13.3	18.6	28.2
	Rejected applicants	59.0	53.0	59.4	48.9	63.5	49.8	65.2
Percent earnings above minimum amount 2 years after application[a]	All new beneficiaries	17.5	15.7	15.8	12.7	9.5	11.5	20.0
	Rejected applicants	47.4	45.3	44.4	36.9	56.3	40.1	54.1
Average annual earnings 2 years after application ($1,000)	All new beneficiaries	2,832	2,642	2,471	1,756	2,506	1,675	3,288
	Rejected applicants	8,725	8,351	7,077	5,012	15,655	5,796	9,761
Median positive annual earnings 2 years after application ($1,000)	All new beneficiaries	5,339	3,853	3,104	4,963	6,845	3,936	6,132
	Rejected applicants	10,036	11,441	7,009	6,739	15,944	7,571	9,313
Observations	All new beneficiaries	6,786	3,149	8,484	644	2,561	2,323	2,246
	Rejected applicants	6,119	1,184	3,913	402	219	334	2,396

Notes: Mean over application years 1987–1999. Earnings are in 2000 dollars adjusted by the CPI. Applications refer to initial application for benefits from Social Security Disability Insurance (DI). "Rejected applicants" are those applicants who are rejected at the DDS stages of the screening process and do not receive benefits within ten years of initial application. "All new beneficiaries" in this table refer to all applicants who are eventually awarded benefits (either in the DDS stages or at the hearings level).

[a] The minimum earnings threshold used corresponds to earnings during three months of full-time employment at the minimum wage in 2000.

Source: 1 percent files of Social Security administrative data (see text).

driven by changes in group composition or group-specific trends. Of course, as further discussed in Section III, we cannot fully exclude a role for differences and trends in unobservable characteristics.

C. *Employment by Impairment Group*

In addition to the decline in the average age of DI applicants and beneficiaries since the 1970s, an important trend likely to affect potential employment of new beneficiaries is the increasing importance of nonfatal impairments such as musculoskeletal or mental health conditions. As described above, the share of those impairments has been rising *within* our two broad age groups as well. Examining the average employment rate of allowed and rejected DI applicants before and after application by impairment type for 1987 and 1997 suggests some heterogeneity

in employment after application by impairment class (see Table 2).[16] Among both older and younger rejected and allowed DI applicants, those with musculoskeletal conditions, mental health conditions, and injuries are most likely to work. Thus, changes in the distribution of impairment types suggest that potential employment will change as well. We also see that young applicants work more independent of impairment, suggesting that the apparent age differences in impairments are unlikely to explain differential work behavior among older and younger applicants.

Similarly, examining work behavior of applicants by industry of employment and level of preapplication earnings suggests that group-specific trends matter somewhat, but differences in composition are unlikely to explain our main findings (see online Appendix D). First, declines in the fraction of applicants coming from manufacturing sectors are likely to have reduced employment rates of both allowed and rejected applicants. Second, changes in the fraction of high-earning applicants have led to increases in employment after application for older workers and to declines for younger workers. Finally, we also examined postapplication mortality rates and, not surprisingly, found those groups of workers with the lowest ten-year mortality rates have the highest employment rate, whether rejected or allowed.

D. *Employment Potential*

Our findings suggest that the observed increase in the share of younger beneficiaries may have led to a rise in the employment potential of DI recipients. Given, however, that younger beneficiaries on average remain on the DI program much longer than older beneficiaries, the annual employment rate understates the potential impact of a rising share of younger beneficiaries. To better gauge the impact of changes in the age structure on the overall potential effect of the DI program on employment, we can use our counterfactual employment rates to obtain a rough approximation of the employment potential of the stock of DI beneficiaries. Administrative data give us information on the stock of individuals on the DI rolls in 2000 by age. We used statistics on the expected number of years on the program from the Social Security Administration based on actual experience during 1996–2000 to determine the number of years each individual is likely to remain in the program given their age and number of years already on the rolls (Zayatz 2005, Table 24). We then applied our employment rates and earnings for both older and younger rejected applicants to get an upper bound on the number of years of work and value of lifetime earnings that might be expected.

We find that the upper bound of potential years of work above our minimum earnings level, based on the employment rates of rejected applicants, is about 8 years for each male beneficiary on the rolls in 2000 who applied between ages 30 and 44.[17] For a male beneficiary who applied between ages 45 and 64, the upper bound

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[16] Information on impairments of both denied and allowed disability applicants from the 831 file is not reliable until 1986. Therefore, the table is based on application years beginning with 1987, although the trends displayed began at least in the early 1980s (Social Security Administration 2008). We average employment and mortality over different application years for space reasons, but no group-specific time trends appear beyond those described for the full sample.

[17] The average predicted number of years on the program is about 15 years for younger and 4 years for older male applicants (see online Appendix Table G1).

is less than 2 years. The upper bound on the potential loss in earnings is also larger for young beneficiaries than for older ones. The present discounted value (PDV) of potential earnings for a male beneficiary who applied between ages 30 and 44, on average, is about $61,000. For a male beneficiary who applied between ages 45 and 64, the corresponding potential earnings are less than $14,000. By way of comparison, the PDV of DI benefits for a male beneficiary who applied at younger ages is $181,000 ($253,000 including Medicare benefits) but just $60,000 ($83,000 including Medicare benefits) for a beneficiary who applied at older ages. (See our online Appendix G for further details.)

Given the large stock of beneficiaries, the maximum total foregone amount of potential earnings is substantial—on average, about a third of the total outstanding liabilities of DI in terms of benefits (a fifth if projected Medicare payments are included). If the age structure had remained at the level of 1980, maximum potential foregone earnings would have been 15 percent lower. At the same time, total outstanding liabilities would have been 10 percent lower. Such numbers suggest that the impact of a decline in the age of new beneficiaries on employment rates alone is likely to understate the potential maximum effect of the DI program on employment. These back-of-the-envelope calculations based on approximate non-experimental upper bounds, although robust to an extensive sensitivity analysis and confirmed by quasi-experimental estimates (French and Song 2011), should be treated as indicative.[18] They suggest, however, that the maximum potential effect of DI on employment is substantial for younger applicants and may, therefore, have risen significantly over time.

III. Additional Evidence on Earnings of Applicants and Beneficiaries

The previous sections have argued that continuing changes in the age and impairment composition of DI applicants and new beneficiaries can have important implications for our assessment of potential employment outcomes of DI recipients. In this section, we summarize two additional results. First, we examine the robustness of our comparison to controlling for observable preapplication characteristics using a matching analysis. Second, our data reveal interesting patterns *within* groups of applicants over time that may have implications for our assessment of potential employment outcomes of DI recipients.

Differences and changes in characteristics of rejected and allowed DI applicants may make it difficult to interpret the predicted employment rates and compare them over time or across groups. When the bounds for potential employment implied by rejected applicants are wide, as is the case of young workers, comparisons of

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[18] In our online Appendix F, we construct counterfactual annual employment rates based on employment patterns of rejected applicants that account for differences in observable characteristics among allowed and rejected applicants; we also assess the impact of changes in characteristics over time. French and Song (2011) look at DI, SSI, and concurrent cases that go to administrative law judges to exploit random assignment to "high" allowance judges. Despite the differences in approach and sample, their results come to similar conclusions regarding work and earnings of allowed and rejected applicants.

predicted employment rates across groups or over time should be made with particular care.[19]

An ideal approach to obtain a tight estimate of potential employment that is comparable over time or across groups would be to obtain, for each time period, a counterfactual based on workers with identical observable and unobservable characteristics. While that is not feasible in a nonexperimental study, the large samples in our data allow us to go beyond existing studies by comparing employment before and after application within detailed age, gender, earnings, impairment, and industry groups.[20]

The robustness of the changes in employment and earnings before and after application to controlling for differences in core characteristics is quite striking and leads us to believe that counterfactual employment rates based on rejected applicants are informative. In Figure 4 we show estimates obtained by nearest neighbor matching of the impact of application on employment and earnings before and after the actual application date.[21] Consistent with this finding, despite some expected heterogeneity in earnings losses, the differences in work behavior between older and younger rejected applicants also hold within industry, earnings, or impairment classes.[22]

Several additional pieces of evidence are consistent with the notion that an increasing fraction of applicants for DI may be motivated to apply due to economic conditions. First, with the exception of some flattening during the DI retrenchment in the early 1980s, average earnings of new DI beneficiaries declined relative to nonapplicants until the early to mid-1990s. As seen in Figure 5, average earnings of male rejected DI applicants in the five years prior to application have declined relative to new beneficiaries and nonapplicants for both age groups. Second, Figure 3 confirms that especially older rejected applicants experience declines in employment rates and earnings prior to application, a pattern that is roughly stable over time. Such a dip is not present for allowed beneficiaries. Third, among rejected applicants with positive earnings, earnings reductions relative to the preapplication level are considerable, irrespective of age groups (again, see Figure 3). The rebound apparent for younger applicants is driven by the common age-earnings profile.

We should caution that interpreting changes over time in this context may be more difficult than interpreting cross-sectional differences because of changes in application and allowance rates. After recovery from the DI retrenchment in the early 1980s, acceptance rates have remained stable for younger men since the mid-1980s and have risen moderately for older men. Application rates rose and fell in the early to mid-1990s. If, on average, the screening process eliminates the

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[19] That caveat is especially true when the implied bounds are nested, as in the case of younger and older DI applicants. We are thankful to the editor for emphasizing this point. Further discussion of the interpretation of our predicted employment rates as bounds can be found in the online Appendix E.

[20] An additional piece of evidence suggesting that health differences between allowed and rejected applicants are no larger for young than for old individuals is that gaps in mortality rates are of a similar order of magnitude (Appendix Table D). Figure 6 of our longer working paper (von Wachter, Song, and Manchester 2008) shows that differences in mortality rates have been roughly stable for young workers and slightly declining for older workers.

[21] The propensity score is calculated using information on age, average earnings prior to application, and industry prior to application. See the online Appendix H for further details. We obtain very similar results when we implement this comparison in a regression framework with flexible group-specific year effects (online Appendix I and von Wachter, Song, and Manchester 2008).

[22] Again see von Wachter, Song, and Manchester (2008, figs. 7–10).

healthiest applicants, increasing application and acceptance rates may imply that rejected applicants in the late 1990s might have higher earnings potential than rejected applicants in the early 1980s.[23] An extension of our matching analysis addresses this point: for each baseline year we reweighted both allowed and rejected applicants to match the distribution of characteristics of the control group of nonapplicants. In so far as characteristics of nonapplicants have evolved smoothly over time, this approach controls for the influence of trends in observable characteristics and produces very similar findings to those in Figure 4. These findings are replicated when we directly reweight data in all year-groups to match characteristics of nonapplicants in the early 1980s. By these measures, and by our analysis of trends within earnings, industry, or impairment groups, our findings regarding the employment of rejected applicants are robust to decomposition changes over time.

Clearly, we are aware that differences and trends in unobservable characteristics may affect our results. Such differences or trends, however, had to be consistent with the stable and robust patterns we find. For example, increases in employment rates of disabled individuals due to improvements in medical and technological advances might be offset by an increase in DI applications from discouraged workers with low employment rates, leaving employment rates of rejected applicants unchanged, even within narrow groups. We cannot exclude the presence of such offsetting trends in our data but do not find any strong indication of such patterns.

Finally, it is well known that the employment of rejected applicants provides a valid upper bound on employment of new beneficiaries only if the application process itself does not affect employment and earnings. That condition requires that the low employment rate and low earnings of rejected applicants are due to bad health or due to generally poor labor market prospects, but *not* due to factors associated with the application to DI itself. Estimates from the literature on job displacement suggest that earnings losses on the order of magnitude that we find for younger applicants could result to a large extent from the effect of job separation alone (e.g., Louis Jacobson, Robert LaLonde, and Daniel Sullivan 1993; von Wachter, Song, and Manchester 2009; Kenneth A. Couch and Dana W. Placzek 2010). Less healthy workers are likely to be particularly affected by adverse employment shocks (e.g., Bound and Burkhauser 1999). If that is the case, then the counterfactual employment measures are likely to *understate* what would happen had workers never applied for DI.[24] They may still, however, represent valid bounds for the

[23] See online Appendix C for a more detailed discussion. As alluded to there and in the introduction, this is not necessarily the case. If increases in application rates are driven by less healthy individuals, acceptance rates increase without a corresponding increase in the health of rejected applicants.

[24] The question of whether the application process to DI itself affects the employment potential of workers has been debated (e.g., see the exchange in Bound 1991 and Parsons 1991). In particular, calculations presented in Bound (1991) suggest that time lost due to application to DI in the late 1970s was small. Benitez-Silva et al. (1999) show time spent out of the labor force was larger in the 1990s, especially for applicants appealing the initial decision. Nevertheless, it is more likely that losses in firm-specific skills or rents drive earnings losses at job separation, not time out of employment. The fact that we see losses with respect to long-term preapplication earnings for younger rejected applicants who have substantial labor force attachment before and after application casts additional light on that question. Estimates from the literature on displaced workers suggests that separating from the job alone, independent of time spent out of the labor force, is likely to reduce workers' long-run earnings by 20 percent to 40 percent, depending on workers' age.

Panel A. Difference in fraction of employed relative to nonapplicants, age 45–64

Panel B. Difference in positive annual earnings ($1,000) relative to nonapplicants, age 45–64

Panel C. Difference in fraction of employed relative to nonapplicants, age 30–44

Panel D. Difference in positive annual earnings ($1,000) relative to nonapplicants, age 30–44

— ▲ — Allowed 1982–87   — ◆ — Rejected 1982–87   - - ■ - - Allowed 1992–97   - - + - - Rejected 1992–97
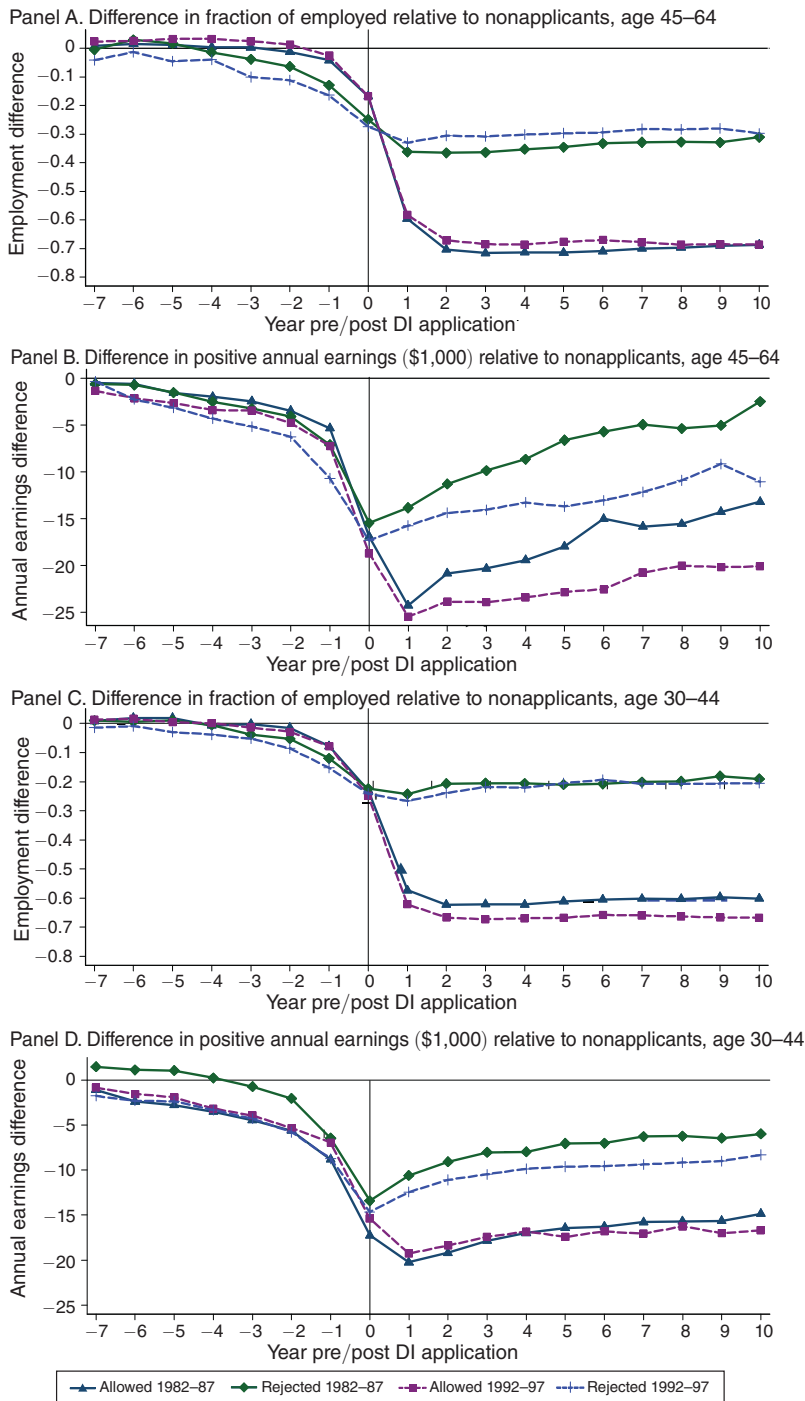
FIGURE 4. DIFFERENCE IN EMPLOYMENT AND EARNINGS BETWEEN ALLOWED OR REJECTED AND NONAPPLICANTS
BEFORE AND AFTER DI APPLICATION (*Men, full specification*)

Notes: Allowed refers to DDS level allowed beneficiaries; rejected refers to finally rejected applicants (see text). Results are based on nearest neighbor matching, where the propensity score is based on age, baseline average annual earnings, and industry class (see text).

Source: 1 percent files of Social Security administrative data (see text).

counterfactual of whether a worker currently receiving benefits would work were his benefits terminated.[25]

## IV. Additional Evidence on Employment of Beneficiaries

The foregoing sections have reconfirmed existing results and provided new and robust findings on the potential employment status and the economic background of new beneficiaries. In addition, our administrative data enable us to go beyond Bound's original approach and provide direct evidence on employment behavior of new beneficiaries. To do so, we analyzed labor force attachment of individuals whose application is rejected at the DDS level of the disability review process, but who are awarded benefits during the hearings phase or following subsequent application. Compared to applicants allowed at the DDS level, hearings-level applicants have medical conditions that are much less likely to correspond exactly or be equivalent to medical conditions in SSA's listing of impairments. In addition, during the initial screening they are more likely determined to be able to find employment equivalent to their predisability employment. As noted at the outset, hearings-level beneficiaries constitute a high fraction of all new beneficiaries, especially among younger men.

Hearings-level beneficiaries clearly exhibit characteristics making them more likely to be able to engage in gainful activity. They are younger (Figure 1, panel B) than applicants allowed at the DDS level, they are more likely to be affected by musculoskeletal and mental health conditions, and they have considerably lower mortality rates than applicants allowed at the DDS level (Table 1). They also exhibit higher employment and earnings prior to application than ultimately rejected applicants (Table 1). Hearings-level beneficiaries also bear some sign of being economically motivated applicants, since their preapplication earnings are lower than those allowed at the DDS level and have been declining over time (Figure 5). They do not, however, exhibit preapplication employment declines the way finally rejected applicants do.

The postapplication employment rate for hearings-level beneficiaries is high relative to beneficiaries allowed at the DDS level (see Table 1 and Figure 3). The average five-year employment rate has fluctuated around 25 percent for older applicants (compared to about 10 percent for DDS-level allowed applicants), and 35–40 percent for younger applicants (compared to about 20–25 percent for DDS-level allowed applicants). Among all allowed applicants, that group clearly stands out as having the highest potential labor force attachment. Median earnings for those who work is nonnegligible and, for older workers, near the maximum earnings limits allowed by the DI rules. Earnings levels are about 50 percent of what rejected applicants earn, but double that of DDS-level allowed applicants. These results further suggest

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[25] For similar reasons, Bound's methodology also understates the effect of DI on employment if rejected applicants stay out of the labor force while appealing the initial decision or reapplying (e.g., Parsons 1991). Based on administrative data for individuals who applied for DI and SSI in 1998, we find that two years after initial application, 51 percent of applications had been allowed and 11 percent were still in process. Four years after the applications were filed, 55 percent had received allowances and just 3 percent were still in process (see online Appendix B for further discussion).

Panel A. Average annual earnings preapplication of nonapplicants, allowed,
and rejected applicants, men age 45–64
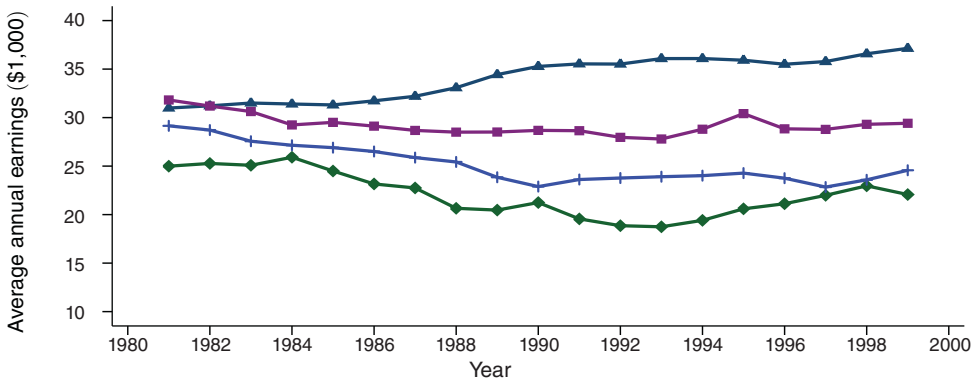
Panel B. Average annual earnings preapplication of nonapplicants, allowed,
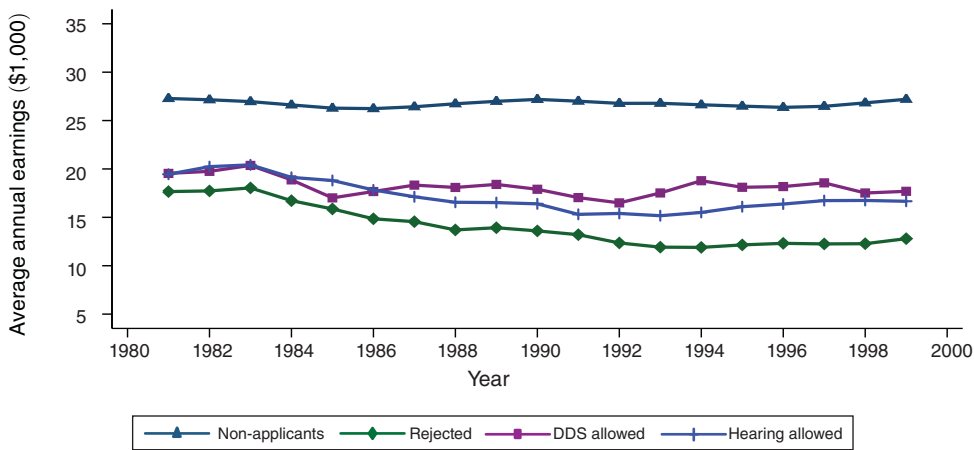and rejected applicants, men age 30–44

FIGURE 5. AVERAGE ANNUAL EARNINGS OF DI APPLICANTS

Notes: Labels refer to rejected applicants, DDS level allowed beneficiaries, and hearings level allowed beneficiaries (see text). Earnings in 2000 prices adjusted by CPI.

Source: 1 percent files of Social Security administrative data (see text).

that large groups of individuals among DI recipients have considerable potential employment, even among older applicants.[26]

V. Discussion

The patterns we presented have potentially important implications for the modeling of application to DI in the context of the labor market. To see this, it is helpful

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[26] Several factors explain the high fraction of years with positive earnings among the hearings-level beneficiaries. Given the ten-year time span between first application and DI allowance, some beneficiaries may have worked after rejection and before reapplying. While receiving benefits, they may work with earnings below the SGA level, participate in the trial work period or extended period of eligibility, or work above SGA levels.

to consider our findings in light of a stylized model of job search in the spirit of Autor and Duggan (2003). In the basic model, workers follow the Bellman principle to decide whether to apply to DI in any given period based on the present discounted value of utility from health and income. To better explain the phenomenon just described, it is useful to add three additional features to the model. First, to better analyze the characteristics of allowed and rejected applicants, we let the probability of receiving benefits be a function of health. Second, to have some rejected applicants return to the labor force, we introduce a source of nonstationarity into the model such as learning about the application process, changes in technology that facilitate work, mean reversion in health, or a budget constraint. Third, to make the application decision more realistic, we assume workers face a known wage reduction upon reentry into the labor market after unsuccessful DI application.

A basic comparative static exercise then yields the following findings. First, rejected applicants have lower average preapplication earnings and better health than allowed applicants, who in turn have lower average earnings than nonapplicants. Second, liberalization in screening reduces average earnings and raises health of both allowed and rejected applicants. Third, a mean-preserving spread of the earnings distribution lowers average earnings of both allowed and rejected applicants. Yet a decline in economic conditions of all workers, such as a strong recession, at given screening stringency would raise the earnings and health of allowed applicants. Fourth, a key implication is that rejected applicants return to work only if their optimization problem changes in a significant way; perhaps health improves, technology advances facilitate work, they cannot finance continuing the application process, or they learn that their true allowance probability is lower.

The levels of preapplication earnings of applicants we described in Figure 5 are consistent with the basic implications of the model. The trends shown in the same figure are also consistent with liberalization in screening and an increase in inequality occurring in the early to mid-1980s. The fact that a nonnegligible fraction of rejected applicants returns to work despite large earnings losses is indicative of potentially important changes in individuals' assessment or their actual ability to carry on the application process. Overall, the results suggest that individuals decide to apply for DI given their health and economic opportunities in an environment of nonstationarity and uncertainty about the outcome of the application process. Useful extensions would derive predictions for the characteristics of applicants who appeal the DDS-level rejection and for the specific circumstances that lead rejected applicants to return to the labor force.

VI. Conclusion

We provide evidence that younger rejected male DI applicants exhibit substantial labor force attachment. Similarly, applicants with low-mortality impairments such as back pain and mental health problems exhibit substantial labor force attachment. We show that continuing increases in the share of younger beneficiaries or beneficiaries with low-mortality impairments will further raise the potential employment of workers receiving DI benefits. Since younger new DI beneficiaries are on average

on the DI program longer than older new beneficiaries, the higher potential employment rates we find imply significant potential losses in lifetime employment and earnings. These losses are substantial compared to the higher lifetime value of DI benefits for younger new beneficiaries.

We also provide new results on the level and dynamics of earnings of different applicant groups before and after application. Mean preapplication earnings have fallen, rejected applicants experience preapplication declines in earnings, and beneficiaries whose first application was rejected at the DDS level but who ultimately received benefits exhibit substantial employment. Our results confirm that an increasing number of individuals may have applied for DI because of worsening economic conditions. Such economic inducement is consistent with our finding of substantial employment among beneficiaries whose application was rejected at the DDS level.

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.

Autor, David H., and Mark G. Duggan. 2006. "The Growth in the Social Security Disability Rolls: A Fiscal Crisis Unfolding." *Journal of Economic Perspectives*, 20(3): 71–96.

Benitez-Silva, Hugo, Moshe Buchinsky, Hiu Man Chan, John Rust, and Sofia Sheidvasser. 1999. "An Empirical Analysis of the Social Security Disability Application, Appeal, and Award Process." *Labour Economics*, 6(2): 147–78.

Black, Dan, Kermit Daniel, and Seth Sanders. 2002. "The Impact of Economic Conditions on Participation in Disability Programs: Evidence from the Coal Boom and Bust." *American Economic Review*, 92(1): 27–50.

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

Bound, John. 1991. "The Health and Earnings of Rejected Disability Insurance Applicants: Reply." *American Economic Review*, 81(5): 1427–34.

Bound, John, and Richard V. Burkhauser. 1999. "Economic Analysis of Transfer Programs Targeted on People with Disabilities." In *Handbook of Labor Economics*. Vol. 3c. ed. O. Ashenfelter and D. Card, 3417–3528. Amsterdam: Elsevier Science, North-Holland.

Bound, John, Richard V. Burkhauser, and Austin Nichols. 2003. "Tracking the Household Income of SSDI and SSI Applicants." In *Worker Well-Being and Public Policy*, ed. S. W. Polachek, 113–58. Research in Labor Economics, vol. 22. Amsterdam: Elsevier Science.

Charles, Kerwin Kofi. 2003. "The Longitudinal Structure of Earnings Losses among Work-Limited Disabled Workers." *Journal of Human Resources*, 38(3): 618–46.

Chen, Susan, and Wilbert van der Klaauw. 2008. "The Work Disincentive Effects of the Disability Insurance Program in the 1990s." *Journal of Econometrics*, 142(2): 757–84.

Couch, Kenneth A., and Dana W. Placzek. 2010. "Earnings Losses of Displaced Workers Revisited." *American Economic Review*, 100(1): 572–89.

Duggan, Mark G. and Scott A. Imberman. 2006. "Why Are the Disability Rolls Skyrocketing?" In *Health in Older Ages: The Causes and Consequences of Declining Disability among the Elderly*, ed. David Cutler and David Wise, 337–790. Chicago: University of Chicago Press.

French, Eric, and Jae Song. 2011. "The Effect of Disability Insurance Receipt on Labor Supply." Federal Reserve Bank of Chicago Working Paper WP-09-05.

Jacobson, Louis S., Robert J. LaLonde, and Daniel G. Sullivan. 1993. "Earnings Losses of Displaced Workers." *American Economic Review*, 83(4): 685–709.

Kopczuk, Wojciech, Emmanuel Saez, and Jae Song. 2010. "Earnings Inequality and Mobility in the United States: Evidence from Social Security Data since 1937." *Quarterly Journal of Economics*, 125(1): 91–128.

Maestas, Nicole, and Na Yin. 2008. "Labor Supply Effects of the Interaction between the Social Security Disability and Retirement Programs at Full Retirement Age." http://www.mrrc.isr.umich.edu/publications/papers/pdf/wp194.pdf (accessed October 1, 2011).

Martin, Teran, and Paul S. Davies. 2003. "Changes in the Demographic and Economic Characteristics of SSI and DI Beneficiaries between 1984 and 1999." *Social Security Bulletin*, 65(2): 1–13.

Parsons, Donald O. 1980. "The Decline in Male Labor Force Participation." *Journal of Political Economy*, 88(1): 117–34.

Parsons, Donald O. 1991. "The Health and Earnings of Rejected Disability Insurance Applicants: Comment." *American Economic Review*, 81(5): 1419–26.

Rupp, Kalman, and David Stapleton, ed. 1998. *Growth in Disability Benefits: Explanations and Policy Implications*. Kalamazoo, MI: W. E. Upjohn Institute for Employment Research.

Social Security Administration. 2008. "Annual Statistical Report on the Social Security Disability Insurance Program, 2007." SSA Publication 13-11826.

Stapleton, David et al. 1998. "Empirical Analyses of DI and SSI Application and Award Growth." In *Growth in Disability Benefits: Explanations and Policy Implications*, ed. K. Rupp and D. C. Stapleton, 31–92. Kalamazoo, MI: W. E. Upjohn Institute for Employment Research.

von Wachter, Till, Jae Song, and Joyce Manchester. 2008. "The Employment Effects of Social Security Disability Insurance in the Past 25 Years: A Study of Rejected Applicants Using Administrative Data." Columbia University, Department of Economics Discussion Paper DP0809-05. http://www.econ.columbia.edu/RePEc/pdf/DP0809-05.pdf (accessed October 1, 2011).

von Wachter, Till, Jae Song, and Joyce Manchester. 2009. "Long-Term Earnings Losses due to Job Displacement During the 1982 Recession: An Analysis Using Longitudinal Administrative Data from 1974 to 2004." Unpublished.

von Wachter, Till, Jae Song, and Joyce Manchester. 2011. "Trends in Employment and Earnings of Allowed and Rejected Applicants to the Social Security Disability Insurance Program: Dataset." *American Economic Review*. http://www.aeaweb.org/articles.php?doi=10.1257/aer.101.7.3308.

Zayatz, Tim A. 1999. "Social Security Disability Insurance Program Worker Experience," Actuarial Study #114, Social Security Administration, June 1999. http://www.socialsecurity.gov/OACT/NOTES/s1990s.html (accessed October 1, 2011).

Zayatz, Tim A. 2005. "Social Security Disability Insurance Program Worker Experience," Actuarial Study #118, Social Security Administration, June 2005. http://www.socialsecurity.gov/OACT/NOTES/s2000s.html (accessed October 1, 2011).