Web Appendix

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Web Appendix A: Summary of Various Data Issues, Definitions, and Comparisons

DI Application Process. During the application process for DI benefits, applications first go to the Disability Determination Services (DDS) at the state level for the initial review and "reconsideration" of initial denials. A denied applicant may then appeal at the hearings level where decisions are made by administrative law judges, Appeals Councils, and Federal Courts. See Lahiri, Vaughan, and Wixon (1995).

Definition of "Rejected" Applicant. An applicant is defined as "rejected" in our paper if he does not receive benefits within ten years of his first application. Bound's (1989) definition is similar; new beneficiaries are receiving DI benefits, and rejected applicants have applied at some point but currently are not receiving benefits (see his footnote 12). Because workers in his data applied for DI four years prior to the survey, on average, the majority of rejected applicants are likely to be final rejections.

For beneficiaries who were rejected at the DDS level, we do not know if they appealed at the hearings stage or if they reapplied. Some of them might have returned to work prior to reapplication and were awarded benefits during the DDS phase of a subsequent application process. If they appeal, we do not know the stage at which a decision was made.

Direct Evidence on Characteristics of Rejected DI Applicants. Benitez-Silva, Buchinsky, and Rust (2004) suggest that a non-negligible fraction of rejected DI applicants are disabled. Bound and Burkhauser (1999) suggest that disabled applicants are particularly affected by adverse labor market trends.

Definition of Non-Applicant Sample. Non-applicants are drawn at random within each age and gender group from the Master Earnings File. Applicants and non-applicants must be disability insured, and all workers must have positive earnings at least once during 1978 to 1981. That restriction has no bearing on our results and mainly affects the employment level of non-applicants. Our choice of years avoids using 1978-1980 too heavily because the Master Earnings File has a high fraction of imputed values in those years (see Kopczuk, Saez, and Song 2009).

Comparison of Employment and Earnings to Findings of Bound (1980). In Bound's *1978* Survey of Disability and Work, 69% of the population reported being employed at the survey date, whereas 87% reported having worked at some point in 1977; among rejected applicants, the fractions were 29% and 40%, respectively. Because labor force participation rates for older men were falling during the period, the fraction with positive earnings in 1984 is expected to be lower than 87% but perhaps

not as low as 73%. The absence of self-employment earnings in our data likely explains the understatement of both older men's participation and employment of rejected applicants, but is unlikely to affect our overall conclusions.

In 2000 dollars, median 1977 earnings for the population in Bound's Table 2 would be $39,000 (using CPI inflation), similar to what we find for non-applicants. Bound's scaled-up earnings number is $14,840 for rejected applicants, higher than what we find. Those differences could well be part of a secular decline in average earnings we find for rejected applicants and may arise from changes in the DI system during that period (von Wachter, Song, and Manchester 2008). The difference does not affect the overall similarity of our findings for older men with the results in Bound.

Trial Work Period. Monthly earnings by a DI beneficiary above a certain amount trigger the start of a "trial work period," during which benefits are paid, that covers up to nine months (not necessarily consecutive) in a rolling 60-month period. In 2006, a month in which earnings exceeded $620 was considered a month of services for an individual's trial work period. A 3-month grace period follows in which benefits are paid even if monthly earnings exceed the SGA level. During the next 33 consecutive months, DI benefits are paid only in months with earnings less than SGA. In 2006, the monthly SGA amount for statutorily blind individuals was $1450; it was $860 for others.

Web Appendix B: Why are Award Rates in the Paper Higher than Published Award Rates?

We investigated whether the high final acceptance rates in our data are a property of the particular data set we are using.

We have concluded that a) our data can replicate raw figures from published SSA data, giving us confidence in the quality of its information; b) the high within-cohort acceptance rates we show are likely to be a real phenomenon, and not a particular feature of our data or sample; c) explaining the discrepancy with respect to annual allowance rates frequently published by SSA is beyond the scope of our paper.

To restate the issue, the *final* acceptance rates of a cohort of first-time applicants to DI implied by our Table 1 are 64% and 74% for men age 30-64 in 1982 and 1997, respectively. For 1997, the cross-sectional acceptance rate at all adjudication levels is significantly lower in official SSA publications, around 55% in 1999 (e.g., *Annual Statistical Report on the Social Security Disability Insurance Program*, 2007, Table 59).

To make sure that our data can replicate basic comparable information from published statistics, we have compared the acceptance rate at the DDS level for an unrestricted sample of workers from the 831 file (on which our sample is based) with data from SSA. The advantage of using DDS-level adjudications for this purpose is that they are directly measured in the 831 file, while we have to infer final disability receipt using entries in the Master Beneficiary Record.

The comparison is shown in the Appendix Table B attached to this Web Appendix. Column 1 shows the annual acceptance rate at the DDS level based on SSA numbers (obtained from SSA internal data obtained directly from the DDS offices; the allowance rates are somewhat higher but similar to those published in the Annual Statistical Report, say Table 60).

Column 2 of the table shows DDS level allowance rates from the 831 file without any restrictions. The rates are quite similar. One difference is that the 831 file does not contain information on technical denials, while those technical denials are typically included in allowance rates in SSA publications. Doing so leads allowance rates on the raw 831 file to be higher on average (e.g., if the rate of technical denials was stable at 10% of initial applicants, as it was in the late 1990s, the difference is about 11%).

The remainder of the table shows the DDS-level allowance rates for the samples we end up using in our paper; those samples are older and impose some additional restrictions. For example, we only look at primary applicants (i.e., we exclude individuals filing as dependents) and we only consider first-time applicants. The age-restriction in particular tends to raise the acceptance rate (compare columns 3 and 4). Columns 5 to 7 show the evolution of allowance rates at the DDS level for our cohort-samples; here, over time aging plays an important role since the age-restriction applies at the start of the relevant year (e.g., as of January 1st of 1982 for applications starting in 1982).

The second part of the table then shows final allowance rates based on the 831 file. Final allowance rates are on average 25 points higher than initial allowances. As mentioned above, they are also higher than final allowance rates in published SSA data.

However, the final allowance rates we find are consistent with reported data on acceptance rates at different levels of the adjudication process. For example, see the acceptance rates displayed in the Appendix Figure B published in the 2003 *Green Book* (http://waysandmeans.house.gov/media/pdf/greenbook2003/Section1.pdf). If one walks through the probabilities as if one were to follow a single cohort, the final allowance rate is 61%. The

allowance rate at the DDS level is 41%. The biggest jump occurs at the ALJ level. Those allowance rates are lower but consistent with the acceptance rates shown in our appendix table.

Since the numbers underlying the *Green Book* chart are not from a single cohort, we can also compare our cohort-level final allowance rates with those published by Benitez-Silva, Buchinsky, Chan, Rust, and Sheidvasser (*Labour Economics,* 1999). They use the Health and Retirement Study to follow cohorts of older individuals who applied to DI in the early 1990s. The final allowance rate they calculate is 73%, whereas the DDS-level allowance rate they obtain is 46%. Again, while smaller than our final numbers (which are on the order of 80% for applicants age 45-64), they are in the same ballpark; the remaining difference may well be explained by our focus on first-time applicants and the exclusion of technical denials.

Thus, we are inclined to believe that the high final acceptance rates we find for first-time applicants whom we follow through their entire application process are a real phenomenon and not due to a feature of our data. Our numbers are of a different nature than the annual statistics published by SSA, which are based on all decisions in a given year. It would be important to get to the bottom of the discrepancy. However, we believe that doing so is beyond the scope of our current analysis. In particular, our data (the 831 file) do not contain enough information to replicate the numbers SSA publishes in the Annual Statistical Report or to examine at which stages in the adjudication process applicants were awarded benefits or stopped appealing a rejection.

Web Appendix C: Changes in Allowance and Application Rates by Age and Selection

Even though we find the employment behavior of allowed and rejected DI applicants is stable over time even after controlling for trends in observable characteristics, our findings might be affected by changes in unobservable characteristics. In particular, if the allowance rate or the application rate changes substantially, this might imply change in the underlying health of rejected applicants. For example, if the healthiest applicants tend to get rejected, a steep increase in the allowance rate over time would imply an improvement of the average health of rejected applicants.

After discussing the trends in allowance and application rates in what follows, we come to the conclusion that our findings are unlikely to be strongly affected by changes in unobservable characteristics related to fluctuations in application and allowance rates. First, over most of the period we study, the allowance rate was stable for young men and experienced modest increases for older men. Second, the changes in the allowance rate and the application rate occurring in the period we study were non-monotonic, such that underlying changes should be either averaged out by our

grouping of application cohorts or be apparent by our comparison of multiple cohort-groups. The fact that employment rates are very stable over time suggests that any trends in underlying health affecting our results had to be non-monotonic and occur in unison with offsetting forces.

Appendix Table C1 shows the evolution of annual allowance rates for older and younger men in our sample (Appendix Table C2 shows the results for women). Although in our discussion we focus on total allowance rates, the table also shows allowance rates by stage of adjudication.[1] The table shows the following key findings:

(1) All ages experience an increase in allowance rates from 1981 to 1984 as allowance rates recovered from the substantial drop during the DI retrenchment in the early 1980s.

(2) Starting in 1984, the allowance rate of younger DI applicants fluctuates around a stable level.

(3) Starting in 1984, the allowance rate of older DI applicants increases by about five points in the late 1980s, after which it fluctuates around a stable level.

(4) The patterns are quite similar for female applicants.[2]

These patterns may have implications for the underlying health of rejected applicants. For example, if the disability screening process successfully eliminates the healthiest applicants, then a higher allowance would imply an increase in the underlying health of rejected applicants. This would imply that we had to be careful in comparing employment rates *within* the group of rejected or allowed applicants over time; that care had to be taken in interpreting the *difference* in employment rates between allowed and rejected applicants over time.

By this reasoning, the numbers in Appendix Table C suggest that we may not have to be too concerned about changes in selection due to changes in the allowance rate for younger workers. Such a change would apply very early in our sample period, but all our results are robust for a contrast from the late 1990s to, say, the mid 1980s.

There is more reason for concern for older applicants. However, the following arguments suggest the effect of changes in allowance rates on underlying health may not be very strong:

[1] The allowance rates for all ages differ slightly from the corresponding figures in Appendix Table B (column 9), since to be consistent with the sample we use in the text, we impose a minimal attachment to the labor force (of one year worked out of the four year prior to application). This was not imposed in Appendix Table B, whose purpose was to reconcile the pattern in our data with those in official SSA publications.

[2] The increase for older female applicants is somewhat larger and more protracted, possibly related to continuing increases in coverage by DI for older applicants.

- The fluctuations in the 1990s around a stable level are almost as prominent as the increase in the late 1980s; yet, neither of these fluctuations is reflected in changes in employment rates. Thus, either they are successfully averaged out by our grouping, or offset by exactly counteracting fluctuations.
- None of the various fluctuations in allowance rates have corresponding changes in mortality rates (see our longer working paper).
- Allowance rates have fluctuated independently of the business cycle, especially throughout the 1980s, suggesting there are no offsetting patterns from changes in labor market conditions during that period.
- For modest increases of the allowance rate such as in the mid- to late-1980s, it is unlikely that the average health of rejected applicants improves strongly due to presence of errors of both the 1st and 2nd type in the screening process.

Overall, these considerations lead us to believe that while increases in allowance rates likely led some changes in the underlying health of rejected applicants, these patterns were unlikely to have been very strong over the majority of our sample period.

Another source of improvements in the health of rejected applicants may have come from increases in the application rate. Figure 1 implies a hump-shaped rise in application rates for both older and younger workers, with a pronounced increase and ensuing decline in the early to mid 1990s.[3] How this increase affects the health of rejected applicants depends on its source.

Scenario 1: The application rate of less healthy workers increases. This leads to an increase in the allowance rate, whereas the health of rejected applicants stays constant.

Scenario 2: The application rate of more healthy workers increases. This per se leads to a decline in allowance rates and an increase in average health of rejected applicants. If at the same time allowance rates increase (for example because the screening process has become more favorable), this should further increase the health of rejected applicants.

Thus, the concurrent rise in application and allowance rates does not necessarily imply a rise in the underlying health of rejected applicants. However, rapid increases in application rates are a reason for concern.

In our case, the fact that the rise in application rates is non-monotonic is useful. The strong rise and ensuing decline in application rates should be partially averaged out by our cohort-groups;

[3] As discussed in the text, the increase began earlier and was more pronounced for younger workers, leading to rapid increase in the fraction of younger applicants that peaked in the mid-1990s and then declined again somewhat.

and if still present, should not affect all our cohort-groups equally. The fact that our findings are stable over time thus speaks against a strong impact of either changes in application or allowance rates on the underlying health of rejected applicants.

If there were strong changes in underlying health that affected the comparability of our findings over time, they had to be non-monotonic and occur in conjunction with other exactly offsetting trends affecting the employment rate of individuals of differential health status. While this is certainly possible, we do not find any evidence of such a pattern in our data.

Web Appendix D: Mortality Rates of DI Applicants by Impairment Code and Industry

In addition to the decline in the average age of DI applicants and beneficiaries since the 1970s, another important trend that is likely to affect potential employment of new beneficiaries is the increasing importance of non-terminal impairments such as musculoskeletal or mental health conditions. The share of these impairments has been rising within our two broad age groups (see the first four columns of Appendix Table D). 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 the middle columns of Appendix Table D).[4] Both among older and younger rejected and allowed DI applicants, those with musculoskeletal conditions, mental health conditions, and injuries are most likely to work. Thus, the observed time-trends in impairment types suggest that potential employment will rise. We can also see that young applicants work more independent of impairment, suggesting that the apparent age differences in impairments is unlikely to explain differential work behavior among older and younger applicants. Despite the observed heterogeneity among impairment classes, our main results are not driven by any particular group.

Examining applicants by industry of employment, level of earnings, and post-application mortality rates leads to three further results (again see Appendix Table D). First, declines in the fraction of applicants coming from manufacturing sectors are likely to have reduced employment rates of allowed and rejected applicants. Second, changing fractions of high-earning applicants has led to increases in employment after application for older workers and to declines for younger

[4] Unfortunately, information on impairments of both denied and allowed disability applicants from the 831 file only begins to be reliable in 1986. Therefore, the table shows application years 1987 and 1997, though 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. We do not find apparent group-specific trends in addition to the trends in employment and mortality described in Subsections A and B for the full sample.

workers. Finally, differences in group-specific mortality rates, shown in the last two columns of Appendix Table D, are as expected. Overall, those groups of workers with the lowest 10-year mortality rates have the highest employment rate, whether rejected or allowed.

Web Appendix E: Discussion of Bounds for Potential Employment of DI Beneficiaries

To help clarify the implications of using the employment rate of rejected DI applicants as an upper bound for the potential work behavior of DI beneficiaries, it is useful to introduce some notation. Let the *potential* employment rate of beneficiaries be

$$e_{jt}^{D} = \Pr\{E_{jt} \mid \textit{SSDI beneficiary}\} = \lambda \Pr\{E_{jt} \mid \textit{SSDI beneficiary, healthy}\} + (1-\lambda)\Pr\{E_{jt} \mid \textit{SSDI beneficiary, unhealthy}\}$$

where λ is the fraction of 'healthy' DI beneficiaries; j denotes age group, t denotes time period, and E_{jt} is an employment indicator. Without loss of generality, assume that there are healthy and unhealthy DI beneficiaries, and that healthy beneficiaries can work, whereas unhealthy DI beneficiaries cannot.[5] Thus, the potential employment of beneficiaries can be rewritten as

$$e_{jt}^{D} = \lambda \Pr\{E_{jt} \mid \textit{SSDI beneficiary, healthy}\}$$

Similarly, let δ be the fraction of rejected applicants who are healthy and thus able to work. Let the employment rate of unhealthy rejected applicants be zero. Then the *actual* employment rate of rejected applicants would be

$$e_{jt}^{R} = \delta \Pr\{E_{jt} \mid \textit{rejected applicant, healthy}\}.$$

One way to state the idea of Bound (1989) is to say that

$$e_{jt}^{D} \le e_{jt}^{R}, \quad \text{such that} \quad e_{jt}^{D} \in [0, e_{jt}^{R}];$$

In essence, Bound argued that this inequality is likely to hold for two reasons. First, if the screening process has some validity, then it is reasonable to assume that beneficiaries are on average less healthy than rejected applicants, i.e., $\lambda \le \delta$. In addition, it is reasonable to assume that $\Pr\{E_{jt} \mid \textit{SSDI beneficiaries, healthy}\} \le \Pr\{E_{jt} \mid \textit{rejected applicant, healthy}\}$, since beneficiaries may have lost touch with the labor force or have lost more of their skills. If at least one of these

[5] Extending the analysis to multiple groups with differential health status and employment rates would not contribute additional insights to the discussion.

comparisons holds as a (weak) inequality, the average *potential* employment rate of DI beneficiaries should be lower than that of rejected applicants.

For old beneficiaries, the employment rate of rejected applicants is relatively small; thus, the range of values indicated by e_{jt}^{R} is tight; at one extreme, if $e_{jt}^{R} = 0$, the bound yields one value. However, at the other extreme, if $e_{jt}^{R} = 1$, the bound is essentially uninformative. For example, because young beneficiaries have relatively high employment rates, the range $\left[0, e_{jt}^{R}\right]$ is relatively wide.

It is important to realize this property and limitation of Bound's approach. Nevertheless, we believe that Bound's original exercise is informative even with non-zero employment of rejected applicants. To see why, consider the case in which we were able to isolate groups of rejected applicants and new beneficiaries who are equally healthy (e.g., suppose $\lambda = \delta$). It is reasonable to assume that the employment *potential* of these beneficiaries is approximated reasonably well by the employment choices of their rejected counterparts; in other words,

$$\Pr\{E_{jt} \mid \textit{SSDI beneficiaries, healthy}\} \approx \Pr\{E_{jt} \mid \textit{rejected applicant, healthy}\}.$$

At a minimum, one would expect remaining differences to be relatively small; in any case, any remaining differences are likely to be attributable to the DI system itself; thus, one may want to include these in an assessment of the effect of DI receipt on employment rates.

We have neither complete information on the health status of rejected and denied applicants nor random assignment into DI, and thus cannot construct a perfect 'match' of DI recipients and rejected applicants. However, we claim that our comparisons are still informative.

A first approach to resolving the problem of comparing apples and oranges is to obtain direct information on the health and earnings status of rejected applicants and DI beneficiaries; this is essentially the approach taken by Bound to support his conclusions. Such analysis, also summarized in Section IV of the paper, suggests that there are indeed some differences in the average earnings prior to application and the mortality patterns of rejected applicants and beneficiaries.[6] However, as in Bound, our findings suggest that the difference between allowed and rejected applicants is much smaller than differences relative to non-applicants. What is particularly

[6] There have been changes in average earnings prior to application over time (see Figure 5); mortality differences among allowed and rejected are roughly comparable across age groups, decline slightly over time among younger applicants, and decline more noticeably for older applicants (see Table 2).

relevant for our analysis is that the absolute differences in prior average earnings and mortality rates are no larger among younger than among older applicants (see Figure 3 and Table 2).

To address the concern of remaining discrepancies in characteristics among allowed and rejected applicants and differences therein over time and across groups, we have complemented Bound's original analysis with a regression analysis that matches allowed and rejected applicants based on observable characteristics. Our large samples allow us to compare rejected applicants and beneficiaries holding constant detailed observable characteristics, such as earnings history and industry of employment prior to application or impairment codes. Moreover, we can replicate our comparison within industry, impairment, or earnings classes. This analysis is summarized in Section IV and in Web Appendices H and I.

The main finding of this analysis is that the comparison of employment rates of rejected applicants and beneficiaries is robust to added control variables; this suggests that observable differences in characteristics may not play a very large role in explaining our results. However, as we make clear in the paper, we are aware that there may be remaining differences in unobserved characteristics.

At a given point in time within a cross-section, if rejected applicants are healthier than new beneficiaries, this implies that even the more detailed comparisons may overstate the employment potential of new beneficiaries. Over time there may be differences and trends in unobservable characteristics. Since the differences in employment we find are stable over time, such trends would have to offset each other. For example, such a pattern would arise if increases in employment rates of disabled individuals due to improvements in medical and adaptive technologies might be offset by an increase in DI applications from discouraged workers with low employment rates.

Web Appendix F: The Effect of Composition Changes on Potential Employment Rates

Sections III A, B, and C demonstrated considerable heterogeneity in post-application employment among rejected DI applicants. In this section, we assess the impact of changes in the distribution of applicant characteristics on the *overall* predicted employment of DI beneficiaries. For each age and impairment group, we follow Bound's approach, taking the employment of rejected applicants as the upper bound of the employment of new beneficiaries. We obtain aggregate predicted employment ($\hat{e}_t^{DI}$) by reweighting group-specific employment rates (e_{gt}^{R}) of rejected applicants by the shares among allowed applicants (s_{gt}^{DI}). Since the distribution of age and impairment codes differs among rejected and allowed applicants, our approach yields a more

accurate upper bound in employment than the aggregate employment rate of rejected applicants. To then assess the role of changes in, say, the age-impairment distribution among allowed applicants, we can compare $\hat{e}_t^{DI}$ with a measure constructed holding population shares constant ($\tilde{e}_t^{DI}$). We thus obtain the following two measures of predicted employment

$$\hat{e}_t^{DI} = \sum_{g=1}^{G} e_{gt}^{R} s_{gt}^{DI} \quad and \quad \tilde{e}_t^{DI} = \sum_{g=1}^{G} e_{gt}^{R} s_{g0}^{DI},$$

where G is the number of groups we choose.

We examine the result of the decomposition exercise for average employment rates among all male applicants ages 30-64 (see Appendix Figure F). Here, the groups (g) we consider are five age groups. The top line represents the actual employment rate of rejected applicants, trending upward in large part because of the changes within age groups shown in Figure 2 and an increasing fraction of younger workers among rejected applicants. The second line shows $\hat{e}_t^{DI}$, the potential employment of allowed applicants predicted by the employment rates of rejected applicants, weighted by the age shares among the allowed. That line is lower, since allowed applicants are typically older, and older rejected applicants work less. The third line represents $\tilde{e}_t^{DI}$, which holds age-shares constant at 1981 levels. The difference between $\hat{e}_t^{DI}$ and $\tilde{e}_t^{DI}$ reflects the contribution of changes in age-shares to the overall evolution of predicted employment. The gap between the two lower lines widens until the early 1990s to about 5 percentage points, reflecting the rise in the share of young applicants. Thus, ignoring that trend, one would have missed the majority of the observed increase in potential employment indicated by $\hat{e}_t^{DI}$.[7]

Next we replicate the exercise for age, impairment, and earnings groups, but now separately for the broad age-groups we have worked with so far (see Appendix Table F). We present the measures for every five application years from 1982 to 1997. The first row again shows the employment rate of rejected applicants shown in Table 1. Rows (2) to (9) show predicted employment for allowed applicants for different groups, as well as predicted employment at constant shares. Differing age and impairment distributions (rows 2 and 4) among rejected and

[7] Our lack of reliable data on impairments prior to 1986 makes a further decomposition into age-impairment groups prior to 1987 difficult. In Table 3 of the paper, we show the effect of changes in impairment shares starting from 1987. Table 3 shows the effect by broad age-groups. Since holding impairment shares constant has the opposite effect for young and old applicants, for the full sample the effect of holding impairment shares constant is negligible. Given important legislative changes that occurred in the mid-1980s, we suspect a different outcome if we were able to compare the early to mid-1980s.

allowed tend to lower predicted employment, whereas different distribution of earnings tends to raise it (row 6), although the results differ somewhat by age-class. On net, reweighting employment by age, impairment, and earnings shares of new beneficiaries tends to lower predicted employment somewhat for older workers (row 9 vs. row 1), and more strongly for younger workers. Holding age, impairment, and earnings shares constant tends to lower predicted employment for older workers only slightly (say, row 9 vs. row 8), whereas the effect is larger among younger workers, especially from the mid-1980s to the early 1990s.

Overall, although changes in age structure and impairment shares tend to lead to higher predicted employment, declines in mean earnings tend to offset that pattern. The main effect from changes in the characteristics of DI applicants we find derives from changes in the overall age-structure among all male applicants shown in Figure 4. Future increases in the share of younger beneficiaries or of low-mortality impairments will likely further increase predicted employment. However, our results also suggest that it is important to analyze those trends in conjunction with the evolution with other characteristics, such as beneficiaries' changing economic backgrounds.

Web Appendix G: Approximating Maximal Potential Life-Time Program Effects

Since younger workers are likely to spend a longer time on the DI program than older workers, the effect of DI on the employment rate is only a partial measure of the potential employment effect of the program. Instead, to obtain a full picture of the potential program effects on employment and earnings, it is helpful to assess the potential reduction in employment and earnings due to entry into DI over applicants' remaining life-time. Such estimates of the potential program effect on employment complement measures of the direct costs of the program in terms of the present discounted value of life-time benefit payments and Medicare benefits.

Here, we briefly describe approximate measures of the potential maximum effect of DI on employment years and present discounted value of earnings lost. We obtain such measures by age group, and then use information on changes in the age-distribution of DI beneficiaries to assess the impact of a reduction in age of new beneficiaries on direct program costs and indirect program costs through lost employment. Since changes in the age-distribution have a bigger effect on new beneficiaries than on the stock of existing beneficiaries, we present separate estimates for the total stock of beneficiaries in 2000 and for the group of new beneficiaries in 1997 (to be consistent with Table 1 in the paper). We also show separate numbers by gender.

To project the potential years a beneficiary is estimated to spend on the program, we use figures derived from administrative data and published by SSA (Zayatz 2005). These figures show the average duration on the program by age and years on the program for the period 1996-2000. Based on these values, we first obtain the average years spent on the program by our two age-groups by using the number of beneficiaries in the respective cells of age and year on the program in 2000 as weights.

We then use the number of average years on the program to calculate the maximum potential employment years a worker would have worked in the absence of DI. To do so, we multiply the average years on the program by the employment rate of rejected applicants for the respective age-group we obtained in Table 1. If the employment rate of rejected applicants can be used as an upper bound on the employment rate of beneficiaries, then the resulting number can be interpreted as the *maximum potential program effect* on total employment years lost.

These results are shown for the stock of applicants in 2000 in the first two columns of Appendix Table G1. The third column shows the average employment effect for all age groups, where we have used the age distribution in 2000 as weights. Column 4 shows what we obtain if we keep the age-distribution constant at the level of 1980. A comparison between these two columns shows the effect that changes in the age-structure alone can have on the total maximum number of potential employment years lost. To show the potential magnitudes involved, the remaining columns multiply the average effect on employment for the different age-distributions by the total stock of DI beneficiaries in 2000.

The remaining rows of the Appendix Table G1 show a similar exercise for additional outcomes. Row 2 shows the result for years of employment with minimal earnings (see the discussion in Table 1). Rows 3 and 4 show the maximal potential program effects for the average and median of life-time positive annual earnings. To obtain estimates for the maximum potential program effect on earnings, we use our estimates of maximum potential employment in the absence of the program and multiply them by the average earnings level of rejected applicants by age-group obtained in Table 1. We discount future earnings streams with an interest rate of three percent.

The final two rows show the same results for the present discounted value of outstanding average annual DI benefits for the stock of beneficiaries in 2000. We again obtain the average outstanding years by age-group on the program by weighting age- and duration-specific estimates from Zayatz (2005) by corresponding counts for 2000, and discount future benefit streams by an interest rate of three percent. The final row adds to this calculation the PDV of average annual

Medicare benefits. To obtain average annual Medicare benefits we divided total Medicare expenditures on the disabled by the number of disabled individuals receiving Medicare.[8] The annual value of Medicare benefits is taken from 2004 CMS Statistics, Tables 3 and 29. The ratio of Medicare expenses for older to younger DI beneficiaries comes from Riley, Lubitz, and Zhang (2003). We again use a three percent discount rate and allowed for a 1.4% annual growth rate in Medicare benefits, since this is the excess growth rate in Medicare costs above increases in the CPI projected by CBO (2010).

Appendix Table G3 shows the same analysis for new beneficiaries in 1997. Since the age-distribution of the stock of beneficiaries evolves more slowly, changes in the age distribution of new beneficiaries have bigger impacts on the maximum potential program effect and the total outstanding program liabilities for new beneficiaries. Appendix Tables G2 (stock in 2000) and G4 (new beneficiaries in 1997) show the corresponding results for women.

Web Appendix H: Controlling for Changes in Observable Characteristics using Matching

The basic comparisons of our paper in Table 1, Figure 2, and Figure 3 do not control for differences in the characteristics of applicants. Yet, differences in the distribution of applicant characteristics may affect the conclusion drawn in our main analysis. For example, the analysis shows that old and young applicants differ in pre-application characteristics that may potentially confound our comparisons of employment potential across groups. Similarly, within age-groups the characteristics of allowed and denied applicants differs, possibly affecting the interpretation of employment for denied applicants as an upper bound for the employment of new beneficiaries. Finally, within groups of denied and allowed applicants characteristics may change over time, making it difficult to compare the evolution of counterfactual employment rates.

To address the potential role of differences and changes in applicant characteristics, we employ four strategies. First, we employ nearest neighbor matching to match allowed and rejected applicants to non-applicants based on observable characteristics. Second, we use the same propensity scores to reweight the observations of allowed and rejected applicants to reflect the distribution of observable characteristics of non-applicants. Third, we estimate distributed lag regression models that include group-specific year effects and thus effectively use the evolution of employment and earnings of workers with similar characteristics as a control group. Finally, to ascertain that our comparisons are not affected by different distributions of characteristics, we also

[8] For a similar calculation, see Autor and Duggan (2006).

replicated our comparisons of allowed and rejected applicants within earnings, industry and impairment groups.

Our findings from these four approaches are summarized below. None of the results indicate that differences and changes in observable characteristics affect our main conclusions. As emphasized in the main text, this clearly does not imply that there exist no differences or changes in unobservable characteristics that could alter some of our findings or magnitudes. This is especially a concern with changes over time, since allowance rates have fluctuated significantly over the period we study – suggesting among others that older rejected workers may be increasingly drawn from a selected sample. However, at the least our findings suggest that trends in unobservable characteristics in, say, health and earnings potential must be to a certain degree offsetting to produce our relatively stable findings.

Matching. In the text we discuss the findings of our matching analysis (Figure 5). Our matching procedure is straightforward and follows a relatively standard approach in the literature.[9] We first estimate a probit regression of either being allowed or being denied as the outcome (where non-applicants have a value of zero). The main explanatory variables are age, average earnings, and industry prior to application. In a second step, we use a STATA routine to obtain the nearest neighbor among non-applicants separately for each allowed and rejected applicant (and separately for each of our year-groups).[10] We then used the identified control groups to estimate the effect of the event of application (successful in the case of allowed and unsuccessful in the case of denied) on employment and earnings before and after the year of application.

The results of the matching analysis are shown in Figure 5 and summarized in the text. The findings for employment indicate very stable employment patterns before or after application for both older and younger allowed and rejected disability applicants (Panel A and C). The findings for earnings indicate that the average earnings of rejected and allowed younger applicants are again very stable over time. For older applicants our findings indicate that, at best, average earnings of *both* rejected and allowed individuals after the year of application have fallen over time – leaving the difference in earnings essentially unchanged. This finding does not appear in our regression analysis that includes separate year effects for earnings-industry classes; it also does not appear in the descriptive evidence in Figure 3. Thus, we suspect it may be a product of the matching procedure rather than a true shift. Our results are robust to different specifications of the probit regression that

[9] For a recent application in a conceptually similar setting see Couch and Placzek (2009).
[10] This routine was written by Sascha Becker and Andrea Ichino (Becker and Ichino 2002).

determine the propensity score, and are robust to limiting our comparison to observations with common support.

Reweighting. The propensity scores resulting from the matching analysis can also be used to reweight the samples of allowed and rejected applicants such that the distribution of observable characteristics matches that of non-applicants. We implemented such a weighting procedure separately for each baseline year, and reproduced our main estimates of the dynamic effect of a successful or unsuccessful application on employment and earnings. Conceptually, the properties of estimates of such a weighting approach are similar to those of estimates obtained from a matching analysis.

For our purposes, the weighting approach allows us to implicitly control for trends in observable characteristics among allowed or denied applicants. Since the weighted samples of allowed and rejected applicants reflect the distribution of observable characteristics of non-applicants, this eliminates the influence of trends in observable characteristics among these groups in a comparison over time. Of course, the influence of changes in the characteristics of non-applicants remains, but it is less of a concern in so far as they change more gradually over time.

The results from our weighting analysis are summarized in Appendix Figure 1A. Panels A and C show the employment trajectories of allowed and rejected applicants by age-groups for our basic weighting procedure. Here, the underlying distribution of characteristics of allowed and rejected applicants reflect characteristics of non-applicants in the respective year group. Not surprisingly, the results are very similar to the corresponding findings in Figure 5 of the paper. The stability of these findings suggests that trends in observable characteristics should not have a strong effect on our results. To control for such trends explicitly, Panels B and D show the same figures, but where the results for 1992-1997 are obtained from a sample that has been reweighted such that the distribution of characteristics reflects the distribution of non-applicants in the base-year group 1982-1987. These figures thus directly hold constant any changes in observable characteristics. As suspected, the results are robust and indicate that the employment rate of allowed and denied applicants is stable over time.

Regression Analysis. Appendix Figure I shows coefficients from a distributed lag regression model of the impact of application on employment and earnings before and after the actual application date in the spirit of Jacobson, Lalonde, and Sullivan (1993) and Krueger and Kruse (2003). The model is described in detail in Web Appendix I. The results confirm the findings of our matching analysis – controlling for observable characteristics does not change the main conclusions

of the paper regarding the employment rate of older and younger rejected DI applicants and its stability over time.

Web Appendix I: Controlling for Changes in Observable Characteristics using Regression

Let y_{it} stand for either annual employment (a dummy for positive earnings in a given year) or annual earnings (in $1000 deflated by the CPI at 2000 prices). Then we estimate the following distributed lag model

$$y_{it} = \alpha + \theta_t + \gamma X_{it} + \delta ALD_i + \beta DEN_i + \sum_{k\geq -8}^{\leq 10} \delta^k D_{it}^k ALD_i + \sum_{k\geq -8}^{\leq 10} \beta^k D_{it}^k DEN_i + u_{it}$$

where *i* indexes individuals and *t* indexes calendar years; X_{it} captures individual characteristics; the dummies D_{it}^k indicate the k[th] year before or after application to disability; and ALD_i and DEN_i are dummies for whether an individual *i* is an allowed or rejected disability applicant.[1] The parameter δ^k (β^k) measures the *change* in employment or earnings of allowed (rejected) applicants in the k[th] year before and after application to DI relative to the baseline and *relative* to the change over time for non-applicants (captured by unrestricted year dummies θ_t). In addition, all of our models include a fourth-order polynomial in both current age and average annual earnings during the baseline period.

The models were estimated separately by gender and by broad age groups. To address the concern that remaining heterogeneity among rejected applicants, new beneficiaries, and non-applicants may affect our comparison, we extended the basic model in several ways. First, we included effects for the two-digit industry of the baseline job, effects for the employer of the baseline job, and effects for earnings class to make sure that the comparison is not affected by differences in the economic background of allowed and rejected workers. Second, we replaced the single time trend by interactions of year-dummies with two-digit baseline industry, earnings class, and earnings class-industry groups. Doing so ensures that the comparison of the *evolution* of earnings and employment of allowed and rejected workers is made with workers in similar industry or earnings cells. The estimates of δ^k and β^k for that final specification for older and younger men are shown in Appendix Figure I. As in Figure 3, estimates for the application years 1987-1992 and for 1997-2002 are very similar and are omitted to make the figure readable.

To summarize the regression results shown in the figures and to display standard errors, we follow Jacobson et al. (1993) and Krueger and Kruse (1995) and impose a parsimonious but flexible

functional form on the evolution of employment and earnings before and after application. That parameterization also gives us a convenient way to assess differences in the comparison between allowed and rejected workers across groups (e.g., by industry or education), and to test for the significance of those differences.

Specifically, we split the pattern into a dip prior to application, a drop during application, and a recovery following application. Thereby, the 'dip' is captured by a variable that is a linear trend -5 to -2 years prior to application and zero elsewhere; the 'drop' is captured by a dummy variable that is equal to one starting two years after application and zero before; the 'recovery' is captured by a variable that is linear starting three years after application and zero elsewhere. To obtain an estimate of the difference in allowed and rejected workers with respect to non-applicants, instead of a main effect we also include a dummy for the base period. If *k* indexes the years before and after application, we have

$$base^k = 1 \; if \; k < -6, \quad = 0 \; else$$

$$dip^k = -(k+6) \; if \; -5 \le k \le -2, \quad = 0 \; else$$

$$drop^k = 1 \; if \; k \ge 2, \quad = 0 \; else$$

$$rec^k = k - 2 \; if \; k \ge 2, \quad = 0 \; else$$

Our basic model can then be rewritten as

$$y_{it} = \alpha + \theta_t + \gamma X_{it} + \delta^0 base_{it}^k ALD_i + \delta^1 dip_{it}^k ALD_i + \delta^1 drop_{it}^k ALD_i + \delta^1 rec_{it}^k ALD_i + \beta^0 base_{it}^k DEN_i + \beta^1 dip_{it}^k DEN_i + \beta^1 drop_{it}^k DEN_i + \beta^1 rec_{it}^k DEN_i + u_{it} \quad (2)$$

We are particularly interested in the difference in the patterns of base, dip, drop, or recovery for allowed and rejected workers, over time, and across subsamples of the population. Those differences are captured by the two quadruplets of parameters $\left(\delta^0, \delta^1, \delta^2, \delta^3\right)$ and $\left(\beta^0, \beta^1, \beta^2, \beta^3\right)$.

Appendix Table I displays the parameter estimates and corresponding standard errors for the sample of older and younger men. To help assess the impact of the regression controls, we first estimated the effects without covariates (see our longer working paper). The estimated baseline differences relative to non-applicants clearly show the need to control for pre-application differences in employment and earnings among applicant groups and non-applicants. Once this is done, overall the numbers in the table confirm the results obtained from Appendix Figure I based on estimates of annual dummies before and after application. We conclude that the results from the descriptive

section are robust to including a control group of non-applicants and narrowing the comparison among groups of applicants with similar pre-application earnings and industry affiliation. However, we also find that ignoring age-related trends in earnings would risk misstating some of the pattern, especially for younger workers.

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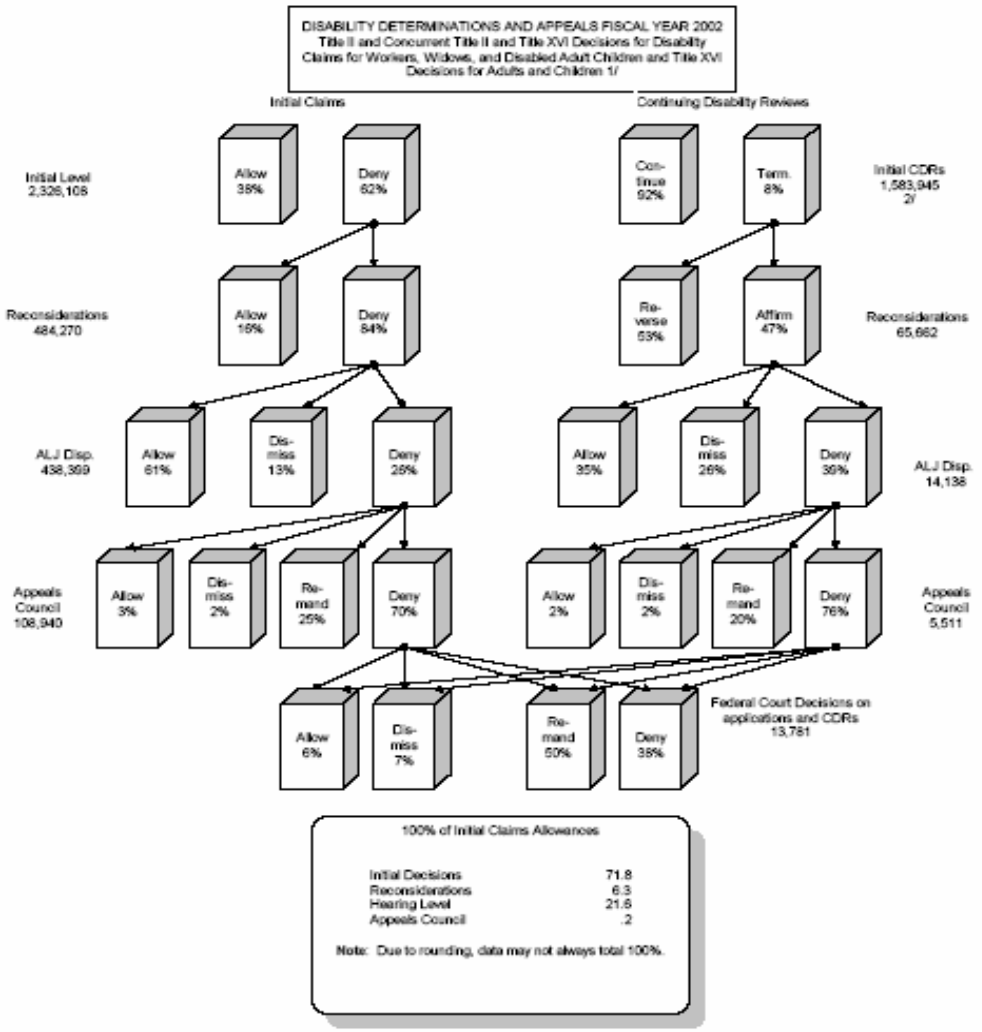
Appendix Table B: Annual Allowance Rates Based on Different Data Sources and Sample Restrictions

	Decisions at DDS Level							Decisions at All Levels					
		Based on 831 File						Based on 831 File					
Application Year	SSA Official Numbers, All Applicants	All First Time Applicants in 831 File	Annual Sample (Age 30-54)	Annual Sample (Age 30-64)	Different Application Cohorts (Age 30-64 Prior to Base Year) 1982	1987	1992	All First Time Applicants in 831 File	Annual Sample (Age 30-54)	Annual Sample (Age 30-64)	Different Application Cohorts (Age 30-64 Prior to Base Year) 1982	1987	1992
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1982	0.33	0.356	0.282	0.371	0.372			0.574	0.559	0.598	0.599		
1983	0.42	0.403	0.348	0.421	0.426			0.612	0.608	0.641	0.647		
1984	0.395	0.432	0.356	0.450	0.455			0.643	0.640	0.673	0.678		
1985	0.39	0.457	0.386	0.464	0.469			0.654	0.644	0.682	0.688		
1986	0.38	0.421	0.36	0.437	0.445			0.643	0.660	0.684	0.688		
1987	0.379	0.407	0.341	0.412	0.427	0.412		0.646	0.632	0.664	0.683	0.665	
1988	0.408	0.434	0.368	0.442	0.460	0.445		0.674	0.666	0.691	0.713	0.695	
1989	0.437	0.436	0.36	0.448	0.469	0.455		0.683	0.669	0.707	0.729	0.714	
1990	0.442	0.458	0.386	0.466	0.488	0.473		0.698	0.685	0.719	0.744	0.730	
1991	0.447	0.463	0.396	0.474	0.508	0.485		0.707	0.690	0.730	0.765	0.742	
1992	0.481	0.452	0.389	0.467	0.508	0.482	0.468	0.687	0.676	0.715	0.761	0.737	0.716
1993	0.447	0.409	0.354	0.428	0.475	0.452	0.430	0.660	0.651	0.691	0.747	0.723	0.694
1994	0.438	0.39	0.334	0.407	0.462	0.436	0.415	0.655	0.647	0.685	0.741	0.716	0.692
1995	0.482		0.331	0.418	0.491	0.454	0.428		0.638	0.687	0.756	0.725	0.699
1996	0.488		0.348	0.423	0.490	0.461	0.437		0.669	0.704	0.771	0.747	0.722
1997	0.498		0.36	0.443	0.522	0.482	0.459		0.676	0.713	0.784	0.753	0.732
1998	0.52		0.373	0.464	0.543	0.504	0.480		0.689	0.732	0.797	0.770	0.749
1999	0.517		0.387	0.472	0.556	0.521	0.494		0.695	0.735	0.800	0.778	0.758

Notes: Tabulations in column 1 from SSA. All other columns are based on the 831 file used in the paper. The 831 file does not include information on 'technical denials' or on decisions made at the hearings level. Thus, to infer final benefit receipt in columns 8 to 13, we use the Master Beneficiary Record as explained in the paper. The 'raw' tabulations from the 831 file in colums 2 and 8 do not impose any age or other restrictions. For the annual sample (columns 3-4 and 9-10) the age-restriction refers to each year. Other restrictions are imposed as discussed in the text. For the cohort samples (columns 5-7 and 11-13), the restriction refers to the year prior to the respective cohort range. Thus, allowance rates for the cohort samples increase over time because of aging of the cohort.

Appendix Figure B: Information on Stages of Disability Adjudication Process

CHART 1-2—DISABILITY DETERMINATIONS AND APPEALS, FISCAL YEAR 2002



1/ Includes all Title II and Title XVI disability determinations. The data relate to workloads processed (but not necessarily received) in fiscal year 2002, i.e., the cases processed at each adjudicative level may include cases received at one or more of the lower adjudicative levels prior to FY 2002. A revised process was introduced 10/1/99 in 10 States, under which initial denials could be appealed directly to OHA without a reconsideration.

2/ Includes non-State CDR mailer continuations. Also includes 24,389 CDRs where there was "no decision." The continuance and termination rates are computed without the "no decision" cases.

Source: Office of Disability Programs, February 2003

Appendix Table C1: Annual Allowance Rates by Age-Group Based on Annual Tabulations from 831 File, Men

Application Year	Decisions at All Levels			Decisions at DDS Level			Decision At Higher Level		
	All Ages (30-64)	Age 30-44	Age 45-64	All Ages (30-64)	Age 30-44	Age 45-64	All Ages (30-64)	Age 30-44	Age 45-64
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1982	0.641	0.477	0.711	0.402	0.227	0.477	0.239	0.250	0.234
1983	0.684	0.557	0.738	0.454	0.324	0.509	0.230	0.233	0.229
1984	0.713	0.584	0.766	0.482	0.325	0.547	0.231	0.259	0.219
1985	0.719	0.583	0.778	0.494	0.344	0.561	0.224	0.239	0.218
1986	0.721	0.595	0.784	0.460	0.323	0.529	0.261	0.272	0.255
1987	0.698	0.587	0.765	0.444	0.347	0.502	0.255	0.240	0.263
1988	0.728	0.612	0.796	0.464	0.345	0.534	0.264	0.266	0.262
1989	0.726	0.596	0.805	0.470	0.337	0.552	0.255	0.259	0.253
1990	0.745	0.638	0.818	0.490	0.380	0.563	0.256	0.257	0.254
1991	0.755	0.633	0.836	0.500	0.370	0.587	0.255	0.263	0.249
1992	0.735	0.610	0.827	0.494	0.362	0.593	0.240	0.248	0.234
1993	0.711	0.578	0.814	0.455	0.327	0.554	0.256	0.251	0.260
1994	0.702	0.573	0.795	0.435	0.299	0.532	0.267	0.273	0.263
1995	0.704	0.557	0.802	0.451	0.298	0.553	0.253	0.259	0.249
1996	0.722	0.583	0.809	0.444	0.309	0.529	0.278	0.274	0.280
1997	0.743	0.600	0.821	0.479	0.300	0.577	0.264	0.300	0.244
1998	0.757	0.607	0.833	0.492	0.321	0.580	0.264	0.285	0.254
1999	0.751	0.604	0.828	0.518	0.347	0.608	0.233	0.257	0.220

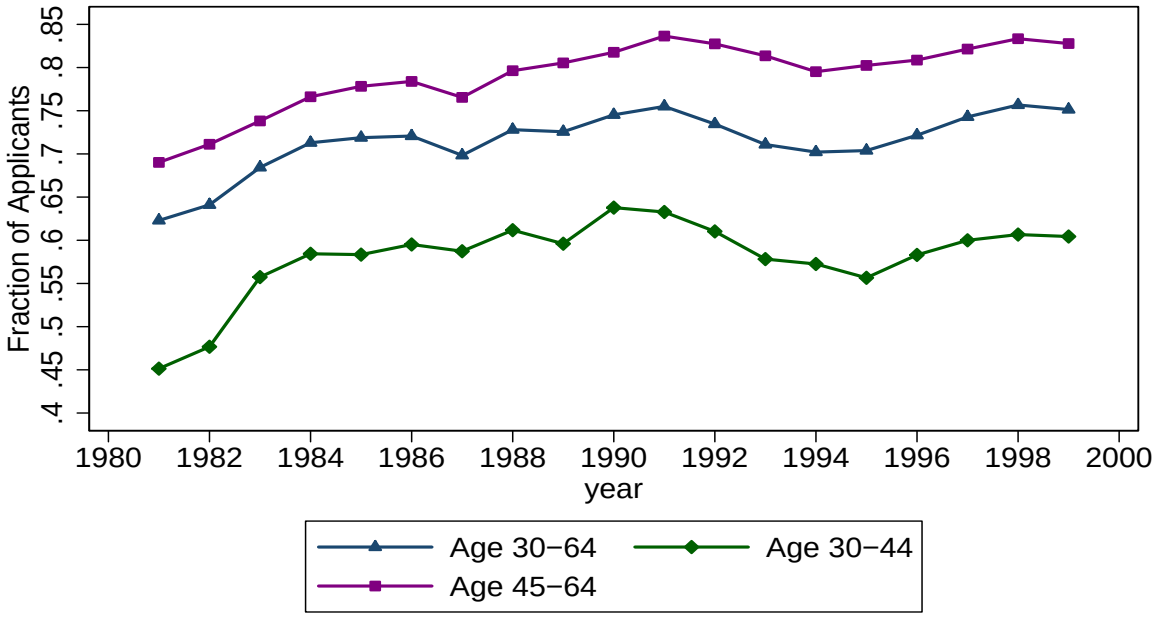
Notes: All entries are based on first-time applicants from the 831 file used in the paper. The 831 file does not include information on 'technical denials' or on decisions made at the hearings level. Thus, to infer final benefit receipt in columns 1 to 3 and 7 to 9, we use the Master Beneficiary Record as explained in the paper. As in our main text (and in contrast to Appendix Table B) we impose a minimal stability restriction that workers work at least 1 year in the four years prior to application. Other restrictions are imposed as discussed in the text.

Appendix Table C2: Annual Allowance Rates by Age-Group Based on Annual Tabulations from 831 File, Women

Application Year	Decisions at All Levels			Decisions at DDS Level			Decision At Higher Level		
	All Ages (30-64)	Age 30-44	Age 45-64	All Ages (30-64)	Age 30-44	Age 45-64	All Ages (30-64)	Age 30-44	Age 45-64
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1982	0.574	0.502	0.606	0.327	0.230	0.371	0.247	0.272	0.235
1983	0.614	0.518	0.652	0.382	0.289	0.419	0.232	0.228	0.233
1984	0.665	0.592	0.696	0.421	0.317	0.463	0.244	0.274	0.232
1985	0.673	0.605	0.704	0.429	0.362	0.460	0.244	0.243	0.245
1986	0.697	0.634	0.724	0.424	0.349	0.458	0.272	0.284	0.267
1987	0.682	0.575	0.732	0.391	0.288	0.440	0.290	0.288	0.292
1988	0.692	0.616	0.730	0.428	0.351	0.466	0.264	0.265	0.264
1989	0.726	0.654	0.765	0.427	0.328	0.480	0.299	0.326	0.285
1990	0.731	0.647	0.780	0.447	0.357	0.501	0.284	0.290	0.280
1991	0.738	0.657	0.789	0.454	0.368	0.509	0.284	0.289	0.280
1992	0.732	0.634	0.794	0.448	0.361	0.504	0.283	0.273	0.290
1993	0.705	0.604	0.771	0.408	0.324	0.463	0.297	0.280	0.307
1994	0.706	0.599	0.776	0.385	0.276	0.457	0.320	0.323	0.319
1995	0.700	0.587	0.776	0.392	0.273	0.471	0.308	0.314	0.305
1996	0.721	0.616	0.785	0.411	0.300	0.479	0.310	0.316	0.306
1997	0.721	0.592	0.796	0.421	0.301	0.491	0.300	0.291	0.305
1998	0.728	0.640	0.779	0.439	0.350	0.490	0.289	0.291	0.288
1999	0.747	0.653	0.797	0.433	0.334	0.487	0.313	0.319	0.311

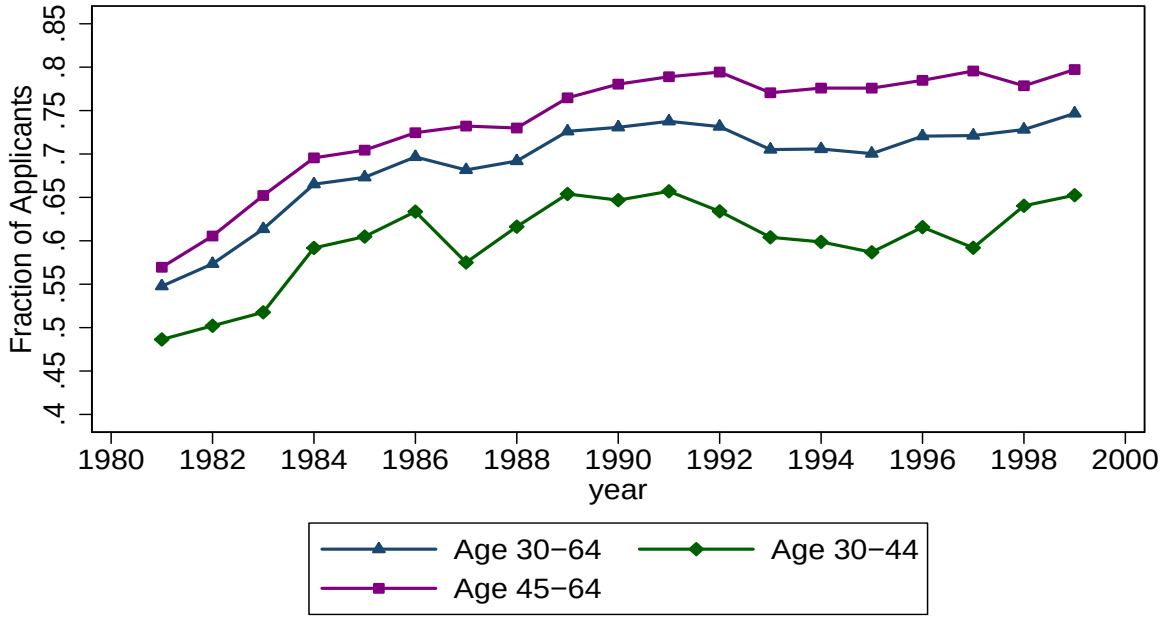
Notes: All entries are based on first-time applicants from the 831 file used in the paper. The 831 file does not include information on 'technical denials' or on decisions made at the hearings level. Thus, to infer final benefit receipt in columns 1 to 3 and 7 to 9, we use the Master Beneficiary Record as explained in the paper. As in our main text (and in contrast to Appendix Table B) we impose a minimal stability restriction that workers work at least 1 year in the four years prior to application. Other restrictions are imposed as discussed in the text.

Appendix Figure C1: Fraction of Allowed Male Applicants



Source: 1% Files of Social Security administrative data (see text).
Notes: Labels refer to rejected applicants, DDS Level Allowed Beneficiaries, and Hearings Level Allowed Beneficaries (see text).

Appendix Figure C2: Fraction of Allowed Female Applicants



Source: 1% Files of Social Security administrative data (see text).
Notes: Labels refer to rejected applicants, DDS Level Allowed Beneficiaries, and Hearings Level Allowed Beneficaries (see text).

Appendix Table D: Health Conditions, Employment, and Earnings of Disability Insurance Applicants by Characteristics and Age Groups (Men)

Application Year or Application Status Before/After Application	Fraction at Application by Application Year				Fraction Positive Annual Earnings (Mean over Application Years 1981-1999)				Fraction Deceased 10 Yrs Post Application (Mean over Application Years 1981-1999)	
	All New Beneficiaries	Rejected Applicants	All New Beneficiaries	Rejected Applicants	All New Beneficiaries		Rejected Applicants		All New Beneficiaries	Rejected Applicants
	1987		1997		Pre	Post	Pre	Post	Post	Post
	Panel A: Male Workers Age 45-64 at First Application									
Primary Health Condition at Application										
Musculoskeletal System	26.1	36.4	31.5	41.4	***91.7***	***14.6***	***82.6***	***34.5***	6.9	5.2
Circulatory System	31.2	31.1	25.7	23.8	***91.1***	***12.1***	***82.5***	***28.9***	17.7	11.8
Mental Disorders/Nervous System	8.1	8.0	11.7	13.2	***90.5***	***14.9***	***81.4***	***33.1***	12.5	8.8
Respiratory System	9.3	7.6	7.2	4.9	***90.8***	***8.3***	***77.6***	***18.6***	24.8	14.2
Neoplasms	18.1	5.2	17.0	5.6	***90.9***	***3.4***	***82.3***	***26.9***	8.6	12.8
Infectious Diseases	1.6	1.4	1.2	1.3	***91.4***	***8.2***	***80.7***	***31.4***	11.8	11.3
Injuries	5.6	10.3	5.7	9.8	***89.9***	***12.7***	***83.2***	***40.5***	10.2	6.2
Industry of Employment Prior to Application										
Manufacturing	61.3	54.7	53.7	46.5	***95.5***	***14.0***	***90.5***	***35.0***	14.2	9.6
Services	38.7	45.3	46.3	53.5	***92.0***	***11.8***	***84.0***	***30.5***	13.4	10.3
Average Earnings Prior to Application										
High (Above Median)	60.2	46.3	62.1	47.4	***96.4***	***13.5***	***92.6***	***35.7***	12.8	8.3
Low (Below Median)	39.8	53.8	37.9	52.6	***82.0***	***8.5***	***70.2***	***25.7***	14.4	11.2
	Panel B: Male Workers Age 30-44 at First Application									
Primary Health Condition at Application										
Musculoskeletal System	27.1	44.1	31.6	48.8	***90.9***	***21.0***	***87.0***	***60.7***	3.4	2.2
Circulatory System	14.5	9.5	12.5	8.7	***91.1***	***17.6***	***84.3***	***52.0***	12.8	6.0
Mental Disorders/Nervous System	23.3	20.1	26.1	19.0	***89.4***	***23.6***	***82.6***	***54.4***	7.2	4.5
Respiratory System	3.1	3.1	2.6	2.9	***90.1***	***15.0***	***83.0***	***43.2***	14.6	5.4
Neoplasms	10.6	1.5	11.1	1.7	***90.8***	***8.0***	***84.7***	***59.4***	8.6	4.5
Infectious Diseases	11.7	2.1	6.2	2.7	***90.3***	***11.0***	***82.7***	***41.6***	16.3	9.0
Injuries	9.7	19.6	9.9	16.2	***89.7***	***24.9***	***87.2***	***64.9***	5.5	2.4
Industry of Employment Prior to Application										
Manufacturing	32.0	31.0	28.9	27.1	***94.0***	***22.4***	***90.7***	***63.5***	8.3	3.5
Services	25.9	24.4	29.8	30.7	***91.0***	***21.3***	***85.9***	***57.0***	8.9	4.4
Average Earnings Prior to Application										
High (Above Median)	41.7	29.2	42.3	27.7	***96.1***	***21.9***	***94.2***	***67.8***	8.1	3.0
Low (Below Median)	58.3	70.8	57.7	72.3	***85.8***	***18.4***	***80.2***	***53.1***	9.1	4.2

Notes: Earnings are in 2000 dollars adjusted by the CPI. Applications refer to initial application to receive benefits from Social Security Disability Insurance (DI). "Rejected applicants" are those applicants who are rejected at the DDS phases 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 phases or at the hearings level).

Source: 1% Files of Social Security administrative data (see text).

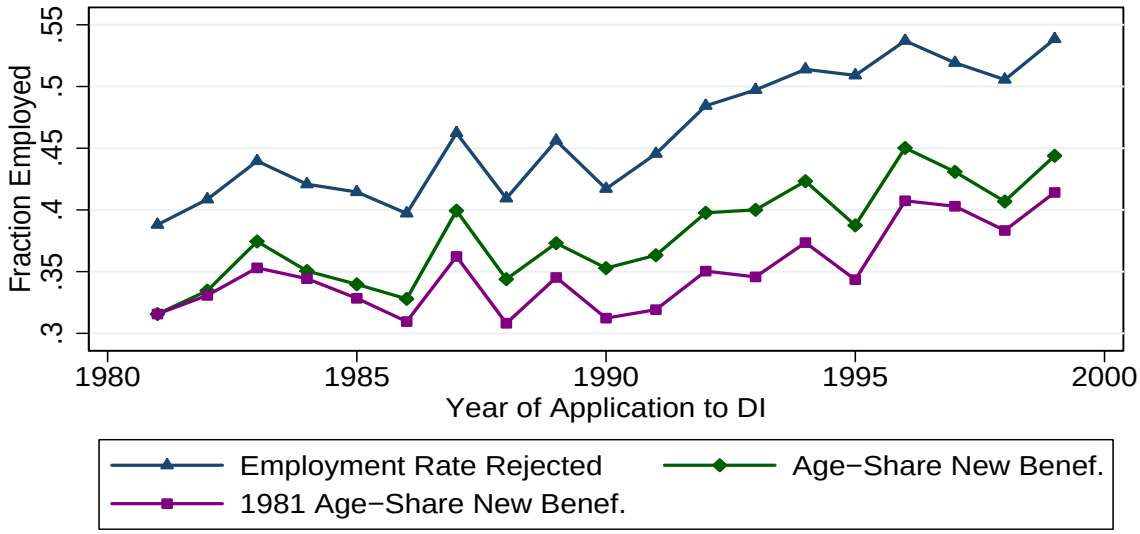
Appendix Table F: Predicted Employment of New Beneficiaries Based on Employment of Rejected Applicants at Population Characteristics of New Beneficiaries and At Constant Population Characteristics Over Time, Men Alternative Age Groups

	Male Workers Age 45-64 at Application				Male Workers Age 30-44 at Application			
Year of Application	**1982**	**1987**	**1992**	**1997**	**1982**	**1987**	**1992**	**1997**
(1) Employment, Rejected Applicants	**40.4**	**48.1**	**44.8**	**52.6**	**59.8**	**70.9**	**59.7**	**69.6**
(2) Predicted Employment, Reweighted by Age-Shares	38.9	46.9	42.2	51.1	59.8	70.8	59.4	69.2
(3) ***Predicted Employment, Constant Age-Shares***	*38.9*	*46.8*	*41.3*	*50.0*	*59.8*	*70.8*	*59.5*	*69.9*
(4) Predicted Employment Rejected Beneficiary, Reweighted by Age-Impairment-Shares	--	48.5	41.4	52.0	--	73.9	53.5	61.0
(5) ***Predicted Employment, Constant Age-Impairment Shares***	--	*48.6*	*40.0*	*50.5*	--	*73.8*	*60.5*	*62.7*
(6) Predicted Employment Allowed, Reweighted by Age-Earnings-Shares	44.6	48.9	45.1	54.9	61.8	71.6	61.4	71.8
(7) ***Predicted Employment, Constant Age-Earnings Shares***	*44.6*	*49.4*	*44.4*	*53.0*	*61.8*	*72.4*	*62.8*	*72.6*
(8) Predicted Employment, Reweighted by Age-Earnings-Impairment Shares	--	38.1	38.2	48.3	--	58.1	43.8	53.2
(9) ***Predicted Employment, Constant Age-Earnings-Impairment Shares***	--	*38.4*	*38.5*	*47.0*	--	*58.5*	*46.5*	*53.8*

Notes: Employment in the first row is employment in the second year after application of rejected applicants to DI. The following rows reweight employment of different groups of rejected applicants by the share of the corresponding group among new beneficiaries. The groups are five age-groups in rows 2 and 3; five age groups interacted with 14 impairment groups in rows 4 and 5; five age groups interacted with 4 earnings groups in rows 6 and 7; and five age groups interacted with 4 earnings groups and 14 impairment groups in rows 8 and 9. These weighted averages are recalculated holding the value of the shares constant at their 1982 level in rows 3, 5, 7, and 9 (shown in italics). Shares of new beneficiaries refer to shares of new beneficiaries allowed at the DDS level.

Source: 1% Files of Social Security administrative data (see text).

Appendix Figure F: Predicted Employment of New Male DI Beneficiaries, Prediction Based on Employment of Rejected Applicants, Age 30−64



Source: 1% Files of Social Security administrative data (see text).
Notes: Line labeled 'Age−share of new beneficiaries' reweights age−specific employment of rejected applicants by current age−share of new DDS−level allowed beneficiaries. Line labeled '1981 age−share of new beneficiaries' reweights age−specific employment of rejected applicants by 1981 age−share of new DDS−level allowed beneficiaries.

Appendix Table G1: Present Discounted Values of Benefits, Potential Employment, and Earnings by Age Groups and Actual and Reweighted Totals for the Stock of Male SSDI Beneficiaries in 2000

	Projected Average by Age Group in 2000		Average for Age All Ages 30-64, Actual and Reweighted			Total Amount (Billions for PDV, Millions for Employment)			
	30-44	45-64	Age Distribution in 2000 (Actual)	Age Distribution in 1980 (Reweighted)	Stock of Beneficiaries in 2000	Age Distribution in 2000 (Actual)	Age Distribution in 1980 (Reweighted)	Change Relative to 1980 (Billions for PDV, Millions for Employment)	Percent Change Due to Age Structure Relative to Level in 2000
Average Years on SSDI Program	14.6	3.9	6.5	5.7	2,786,411	18.1	15.8	2.3	12.6
Number of Potential Years of Employment	10.1	2.1	4.0	3.4	2,786,411	11.2	9.4	1.7	15.5
No. of Potential Years of Employment With Minimum Earnings	8.4	1.7	3.3	2.8	2,786,411	9.1	7.7	1.4	15.6
PDV of Average of Potential Positive Annual Earnings	61,075	13,513	24,903	21,250	2,786,411	69.4	59.2	10.2	14.7
PDV of Median of Potential Positive Annual Earnings	57,891	17,690	27,317	24,229	2,786,411	76.1	67.5	8.6	11.3
Present Discounted Value (PDV) of Average Annual SSDI Benefits	181,042	59,492	88,599	79,264	2,786,411	246.9	220.9	26.0	10.5
PDV of Annual Benefits Including Medicare Benefits	254,936	81,700	123,184	109,880	2,786,411	343.2	306.2	37.1	10.8

Notes: The stock, age distribution, and average monthly benefit of DI beneficiaries in 2000 are taken from Table 5.D of 2009 Annual Statistical Supplement to Social Security Bulletin. Average years on DI come from Zayatz (2005). PDV calculations are based on average number of years on DI, and potential employment and earnings are based on our calculations for rejected disability applicants shown in Table 1. The annual value of Medicare benefits is taken from 2004 CMS Statistics, Tables 3 and 29. The ratio of Medicare expenses for older to younger DI beneficiaries comes from Riley, Lubitz, and Zhang (2003). We assume a real interest rate of 3% for discounting future monetary values to the present. The dollar values are in 2000 prices.

Appendix Table G2: Present Discounted Values of Benefits, Potential Employment, and Earnings by Age Groups and Actual and Reweighted Totals for the Stock of Female SSDI Beneficiaries in 2000

	Projected Average by Age Group in 2000		Average for Age All Ages 30-64, Actual and Reweighted			Total Amount (Billions for PDV, Millions for Employment)			
	30-44	45-64	Age Distribution in 2000 (Actual)	Age Distribution in 1980 (Reweighted)	Stock of Beneficiaries in 2000	Age Distribution in 2000 (Actual)	Age Distribution in 1980 (Reweighted)	Change Relative to 1980 (Billions for PDV, Millions for Employment)	Percent Change Due to Age Structure Relative to Level in 2000
Average Years on SSDI Program	15.9	4.8	7.4	6.4	2,185,923	16.2	13.9	2.3	14.2
Number of Potential Years of Employment	10.6	2.6	4.5	3.8	2,185,923	9.9	8.2	1.6	16.7
No. of Potential Years of Employment With Minimum Earnings	8.0	2.1	3.5	2.9	2,185,923	7.7	6.4	1.2	15.9
PDV of Average of Potential Positive Annual Earnings	39,524	10,219	17,087	14,319	2,185,923	37.4	31.3	6.1	16.2
PDV of Median of Potential Positive Annual Earnings	36,222	11,087	16,980	14,604	2,185,923	37.1	31.9	5.2	14.0
Present Discounted Value (PDV) of Average Annual SSDI Benefits	148,809	54,272	76,445	67,498	2,185,923	167.1	147.5	19.6	11.7
PDV of Annual Benefits Including Medicare Benefits	228,206	80,859	115,415	101,472	2,185,923	252.3	221.8	30.5	12.1

Notes: The stock, age distribution, and average monthly benefit of DI beneficiaries in 2000 are taken from Table 5.D of 2009 Annual Statistical Supplement to Social Security Bulletin. Average years on DI come from Zayatz (2005). PDV calculations are based on average number of years on DI, and potential employment and earnings are based on our calculations for rejected disability applicants shown in Table 1. The annual value of Medicare benefits is taken from 2004 CMS Statistics, Tables 3 and 29. The ratio of Medicare expenses for older to younger DI beneficiaries comes from Riley, Lubitz, and Zhang (2003). We assume a real interest rate of 3% for discounting future monetary values to the present. The dollar values are in 2000 prices.

Appendix Table G3: Present Discounted Values of Benefits, Potential Employment, and Earnings by Age Groups and Actual and Reweighted Totals for Male New SSDI Beneficiaries in 1997

	Projected Average by Age Group in 1997		Average for Age All Ages 30-64, Actual and Reweighted			Total Amount (Billions for PDV, Millions for Employment)			
	30-44	45-64	Age Distribution in 1997 (Actual)	Age Distribution in 1982 (Reweighted)	New Beneficiaries in 1997	Age Distribution in 1997 (Actual)	Age Distribution in 1982 (Reweighted)	Change Relative to 1982 (Billions for PDV, Millions for Employment)	Percent Change Due to Age Structure Relative to Level in 1997
Average Years on SSDI Program	15.3	7.1	10.0	9.2	199,772	1.01	0.92	0.17	8.7
Number of Potential Years of Employment	10.7	3.8	6.2	5.5	199,772	0.63	0.55	0.15	11.9
No. of Potential Years of Employment With Minimum Earnings	8.8	3.1	5.1	4.5	199,772	0.51	0.45	0.12	12.1
PDV of Average of Potential Positive Annual Earnings	63,538	23,550	37,729	33,440	199,772	3.81	3.37	0.43	11.4
PDV of Median of Potential Positive Annual Earnings	60,226	30,829	41,252	38,099	199,772	4.16	3.84	0.32	7.6
Present Discounted Value (PDV) of Average Annual SSDI Benefits	188,342	103,680	133,700	124,618	199,772	13.49	12.57	0.92	6.8
PDV of Annual Benefits Including Medicare Benefits	257,806	135,041	178,570	165,402	199,772	18.02	16.69	1.33	7.4

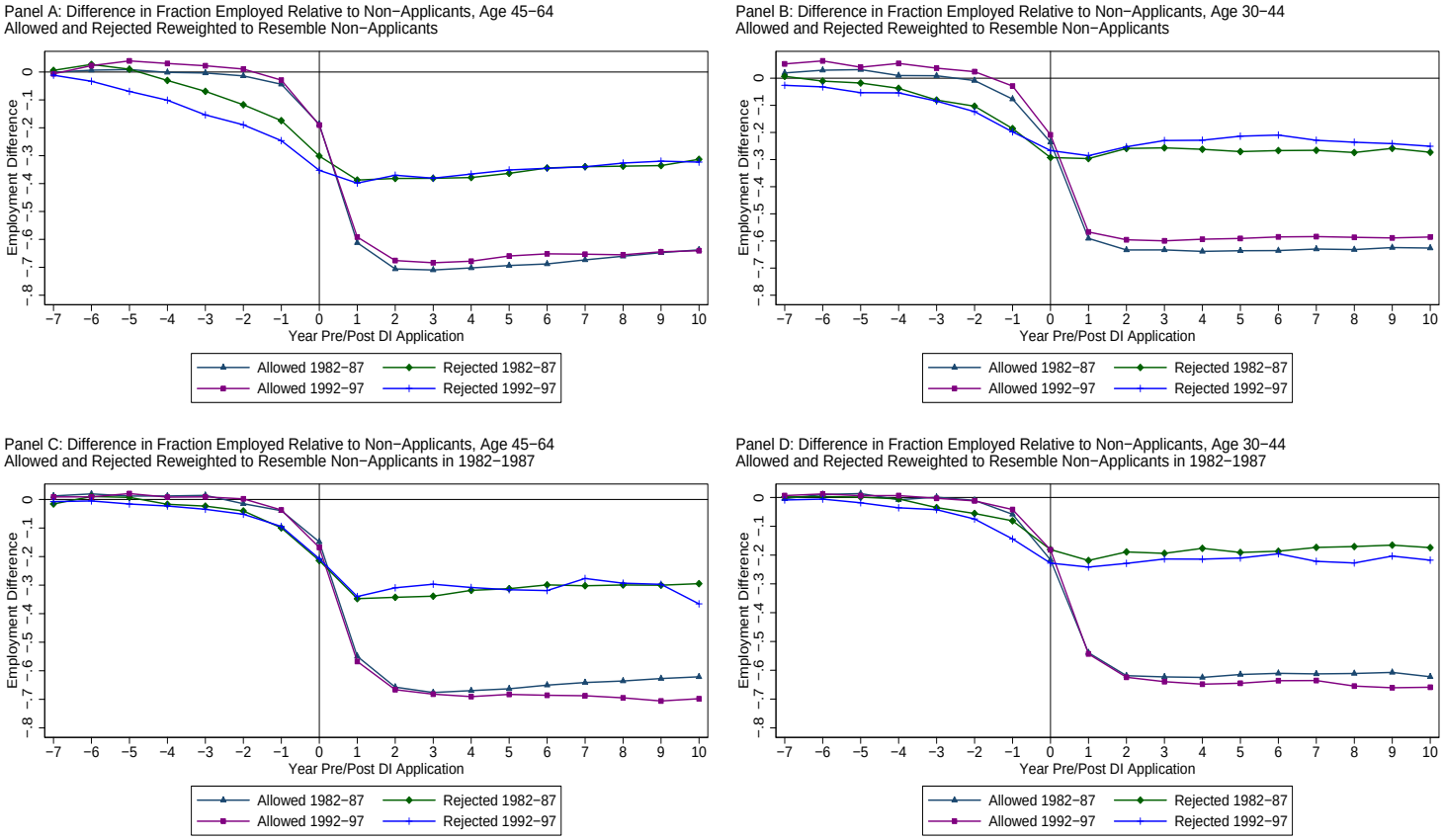
Notes: The stock, age distribution, and average monthly benefit of DI beneficiaries in 1997 are taken from Table 5.D of 2009 Annual Statistical Supplement to Social Security Bulletin. Average years on DI come from Zayatz (2005). PDV calculations are based on average number of years on DI, and potential employment and earnings are based on our calculations for rejected disability applicants shown in Table 1. The annual value of Medicare benefits is taken from 2004 CMS Statistics, Tables 3 and 29. The ratio of Medicare expenses for older to younger DI beneficiaries comes from Riley, Lubitz, and Zhang (2003). We assume a real interest rate of 3% for discounting future monetary values to the present. The dollar values are in 1997 prices. We use 1982 and 1997 to be consistent with Table 1 in the main body of the paper.

Appendix Table G4: Present Discounted Values of Benefits, Potential Employment, and Earnings by Age Groups and Actual and Reweighted Totals for Female New SSDI Beneficiaries in 1997

	Projected Average by Age Group in 1997		Average for Age All Ages 30-64, Actual and Reweighted			Total Amount (Billions for PDV, Millions for Employment)			
	30-44	45-64	Age Distribution in 1997 (Actual)	Age Distribution in 1982 (Reweighted)	New Beneficiaries in 1997	Age Distribution in 1997 (Actual)	Age Distribution in 1982 (Reweighted)	Change Relative to 1982 (Billions for PDV, Millions for Employment)	Percent Change Due to Age Structure Relative to Level in 1997
Average Years on SSDI Program	17.8	8.3	11.7	11.2	194,314	1.2	1.1	0.1	4.5
Number of Potential Years of Employment	11.8	4.5	7.2	6.8	194,314	0.7	0.7	0.1	5.6
No. of Potential Years of Employment With Minimum Earnings	9.0	3.6	5.6	5.3	194,314	0.5	0.5	0.1	5.3
PDV of Average of Potential Positive Annual Earnings	42,965	16,804	26,356	24,904	194,314	2.6	2.4	0.1	5.5
PDV of Median of Potential Positive Annual Earnings	39,375	18,231	25,951	24,778	194,314	2.5	2.4	0.1	4.5
Present Discounted Value (PDV) of Average Annual SSDI Benefits	161,763	89,241	115,720	111,695	194,314	11.4	11.0	0.4	3.5
PDV of Annual Benefits Including Medicare Benefits	241,821	125,927	168,242	161,810	194,314	16.5	15.9	0.6	3.8

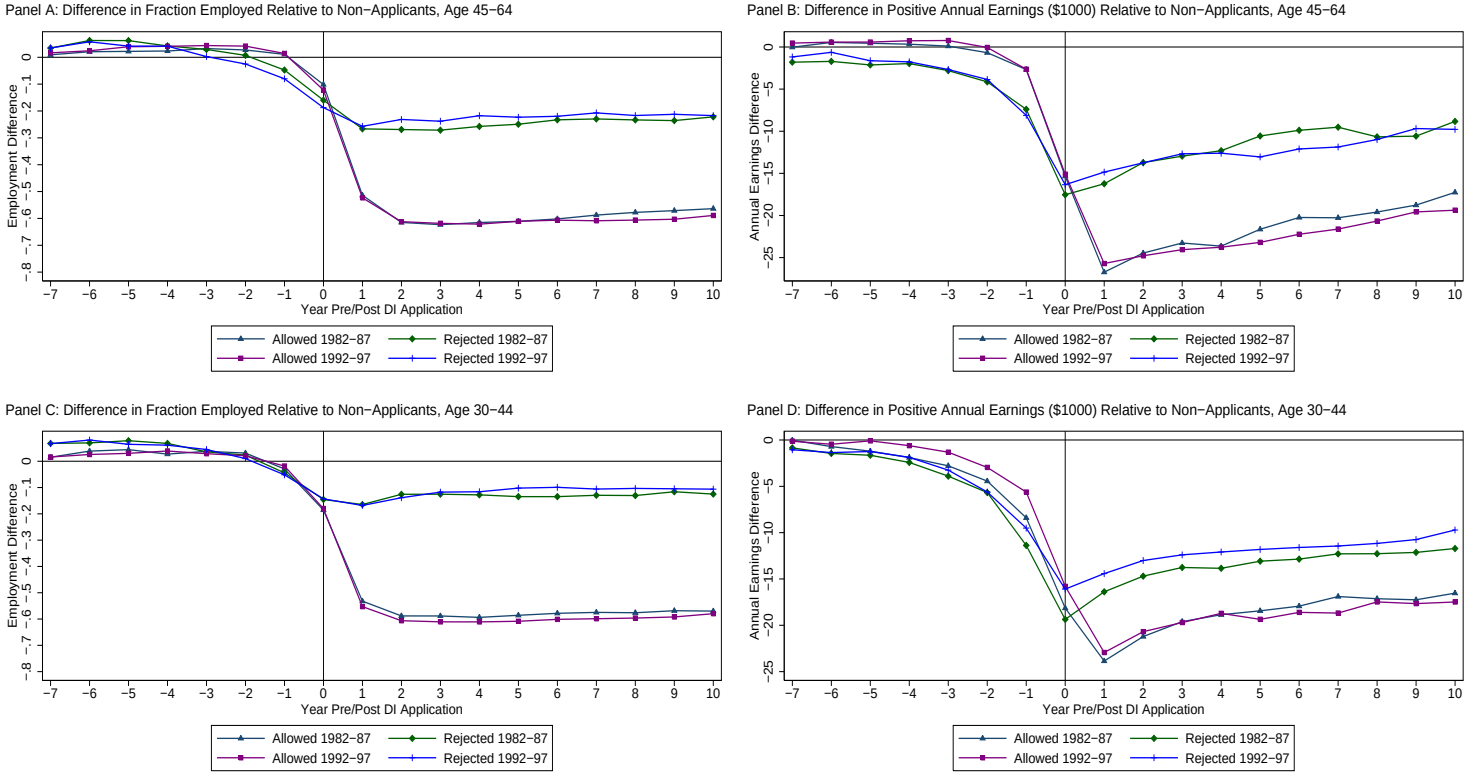
Notes: The stock, age distribution, and average monthly benefit of DI beneficiaries in 1997 are taken from Table 5.D of 2009 Annual Statistical Supplement to Social Security Bulletin. Average years on DI come from Zayatz (2005). PDV calculations are based on average number of years on DI, and potential employment and earnings are based on our calculations for rejected disability applicants shown in Table 1. The annual value of Medicare benefits is taken from 2004 CMS Statistics, Tables 3 and 29. The ratio of Medicare expenses for older to younger DI beneficiaries comes from Riley, Lubitz, and Zhang (2003). We assume a real interest rate of 3% for discounting future monetary values to the present. The dollar values are in 1997 prices. We use 1982 and 1997 to be consistent with Table 1 in the main body of the paper.

Appendix Figure H: Difference in Employment Between Allowed or Rejected and Non−Applicants Before and After DI Application, Men, Reweighted



Source: 1% Files of Social Security administrative data (see text).
Notes: Allowed refers to DDS Level Allowed Beneficiaries, Rejected refers to finally rejected applicants (see text). Reweighted to balance distribution of age at application, earnings prior to application, and industry prior to application(see text for details).

Appendix Figure I: Difference in Employment and Earnings Between Allowed or Rejected and Non−Applicants Before and After DI Application, Men Regression Specification including Group−Specific Trends



Source: 1% Files of Social Security administrative data (see text).
Notes: Allowed refers to DDS Level Allowed Beneficiaries, Rejected refers to finally rejected applicants (see text). Regression specification includes a quartic in age, a quartic in baseline average annual earnings, and year dummies interacted with ten dummies for earnings class prior to application and twelve industry dummies (see text for details).

Appendix Table I: Employment and Earnings Differences Before and After Application to SSDI Relative to Non-Applicants, Effects for Initially Allowed Beneficiaries and Rejected Applicants, Alternative Age Groups

Age Group	Men Age 45-64						Men Age 30-44					
Application Years	1982-1987		1987-1992		1992-1997		1982-1987		1987-1992		1992-1997	
Application Status	Rejected Applicants	DDS-level Allowed Beneficiary	Rejected Applicants	DDS-level Allowed Beneficiary	Rejected Applicants	DDS-level Allowed Beneficiary	Rejected Applicants	DDS-level Allowed Beneficiary	Rejected Applicants	DDS-level Allowed Beneficiary	Rejected Applicants	DDS-level Allowed Beneficiary
A. Employment												
Baseline Difference vs. Non-Applicants	**0.089**	0.043	**0.061**	0.041	**0.090**	0.056	**0.055**	0.050	**0.061**	0.052	**0.068**	0.049
	(0.033)	(0.024)	**(0.026)**	(0.015)	**(0.022)**	(0.014)	**(0.007)**	(0.007)	**(0.007)**	(0.005)	**(0.005)**	(0.005)
Dip Before Application	**0.013**	0.025	**0.019**	0.028	**0.003**	0.025	**0.016**	0.028	**0.016**	0.024	**0.017**	0.025
	(0.009)	(0.007)	**(0.007)**	(0.005)	**(0.006)**	(0.004)	**(0.002)**	(0.002)	**(0.002)**	(0.002)	**(0.002)**	(0.002)
Drop at Application	**-0.162**	-0.633	**-0.212**	-0.565	**-0.227**	-0.616	**-0.098**	-0.526	**-0.131**	-0.567	**-0.097**	-0.549
	(0.037)	(0.026)	**(0.032)**	(0.022)	**(0.025)**	(0.019)	**(0.008)**	(0.011)	**(0.007)**	(0.010)	**(0.007)**	(0.009)
Recovery After Application	**0.005**	0.005	**-0.005**	-0.005	**-0.001**	-0.008	**-0.004**	-0.001	**0.000**	-0.004	**-0.002**	-0.002
	(0.008)	(0.005)	**(0.006)**	(0.004)	**(0.005)**	(0.004)	**(0.001)**	(0.002)	**(0.001)**	(0.002)	**(0.001)**	(0.002)
B. Annual Earnings ($1000)												
Baseline Difference vs. Non-Applicants	**-0.952**	2.404	**0.199**	-0.169	**-0.019**	-0.299	**0.230**	0.565	**0.018**	-0.068	**0.065**	0.139
	(1.196)	(1.304)	**(0.821)**	(0.558)	**(0.589)**	(0.552)	**(0.230)**	(0.244)	**(0.141)**	(0.152)	**(0.133)**	(0.185)
Dip Before Application	**0.036**	-0.310	**-0.747**	-0.367	**-1.007**	-0.283	**-0.552**	-0.306	**-0.982**	-0.569	**-0.536**	-0.136
	(0.283)	(0.355)	**(0.220)**	(0.243)	**(0.199)**	(0.174)	**(0.074)**	(0.076)	**(0.074)**	(0.080)	**(0.056)**	(0.062)
Drop at Application	**-12.202**	-28.826	**-11.834**	-24.380	**-17.050**	-29.292	**-12.675**	-23.310	**-13.549**	-23.187	**-12.380**	-22.626
	(1.638)	(1.915)	**(1.035)**	(1.383)	**(1.530)**	(1.784)	**(0.561)**	(0.851)	**(0.534)**	(0.901)	**(0.604)**	(0.995)
Recovery After Application	**0.484**	0.643	**-0.306**	-0.010	**-0.146**	-0.391	**-0.226**	-0.237	**-0.267**	-0.672	**-0.159**	-0.539
	(0.336)	(0.351)	**(0.203)**	(0.262)	**(0.289)**	(0.351)	**(0.105)**	(0.156)	**(0.099)**	(0.167)	**(0.117)**	(0.212)

Notes: Authors' calculations from 1% Files of Social Security administrative data (see text). The sample consists of non-applicants, finally rejected applicants, and applicants who were awarded benefits during the DDS stages (see text). For definitions of baseline, dip, drop, and recovery see equation (2) in the text. The full model includes a quartic in age, and a quartic in average earnings in the four years prior to the base year; in addition, the model includes year effects interacted with ten dummies for earnings class prior to application and twelve industry dummies. Standard errors clustered at the year-earnings class-industry level are in parentheses.