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The Labor Supply Effects of Disability Insurance: Evidence from Automatic Conversion Using Administrative Data

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Abstract

We analyze a natural experiment generated by the interaction of the Social Security DI and OA programs at Full Retirement Age, when DI beneficiaries are automatically converted from the DI program to the OA retired worker program. At conversion benefit payments continue unchanged, however the DI program's high implicit marginal tax rate on earnings is abruptly relaxed. We use administrative Social Security data for the universe of primary worker DI beneficiaries from the 1934-1942 birth cohorts observed in panel over the period of 1995-2008. Our estimates imply that the DI program depresses labor supply among even the oldest DI beneficiaries. In the context of the literature to date that has sought to establish an upper bound on the earnings losses caused by the presence of the DI program by using quasi-experimental variation occurring at the program entry margin, our use of quasi-experimental variation arising from the program exit margin, when individuals are already in their mid-60s and the dominant trend in labor force participation in the population at large is downward, suggests that our estimates are most appropriately viewed as a lower bound estimate of the residual work capacity of all beneficiaries.

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Extensive research effort has been devoted to understanding the labor supply effects of social insurance programs, especially in light of the historical decline in male labor force participation. In particular, the Social Security Disability Insurance (DI) program has attracted the attention of policymakers and researchers alike, as it has grown dramatically since inception, and features a particularly strong work disincentive: an implicit 100,000 percent marginal tax rate on the first $1 of earnings above a threshold representing Substantial Gainful Activity (SGA), set at $1,000/month in 2010. Indeed, the decline in male labor force participation has been attributed at least in part to DI (Bound and Waidmann 1992; 2002; Autor and Duggan, 2003). Over the last two decades, the DI caseload has shifted from one characterized by individuals with circulatory, neoplasms and infectious diseases to one dominated by individuals with mental and musculoskeletal impairments.[1] This compositional shift has renewed interest in the work disincentives associated with the DI program and has increased the possibility that some form of work might be possible for some DI recipients.

Nevertheless, the causal effect of DI on labor supply is difficult to estimate since all U.S. workers face the same benefit schedule. As a result, observed variation in benefits is due mainly to past earnings, which may be correlated with unobserved health status or tastes for work. Lacking either exogenous variation in program generosity or a means of controlling for unobserved heterogeneity, only a small group of studies have succeeded in obtaining credible estimates of the effect of DI on labor supply (e.g., Bound 1989, Bound and Waidmann 1992; Gruber and Kubik 1997; Gruber 2000; Autor and Duggan 2003; Chen and van der Klaauw 2008; Maestas and Yin 2008; French and Song,

[1] See *Trends in the Social Security and Supplemental Security Income Disability Programs* (released by the Social Security Administration in 2006), pp. 44.

2010; and Maestas, Mullen and Strand 2010), and even these have come to different conclusions about the magnitude of the work disincentive effects of DI.

Maestas and Yin (2008) proposed a new source of identification that rests on a little-studied interaction between DI and the Social Security retirement program, and a recent policy change that changed the nature of the program interaction. Specifically, DI benefits are payable to eligible individuals until they reach their Full Retirement Age (FRA), at which point DI benefits automatically convert to retired worker benefits under the Social Security Old-Age (OA) program. While the terms governing the benefit amount change, the benefit amount itself remains unchanged. Thus, since they are no longer subject to the strict DI work rules, the implicit tax on earnings is abruptly relaxed at exactly the FRA. Moreover, the extent to which the implicit tax is relaxed has varied over time owing to the year 2000 elimination of the Social Security earnings test after the FRA. Prior to 2000, DI participants attaining full retirement age faced a reduction in the implicit marginal tax rate from approximately 100,000 percent to 33 percent (on an even higher exempt amount), the implicit tax rate imposed by the OA earnings test at the FRA. In 2000, the earnings test at the full retirement age was eliminated, and thus DI participants reaching their FRA in 2000 or later experienced complete elimination of the implicit tax at full retirement age. If the work disincentive is binding on DI participants, then we would expect to observe an increase in labor supply at the FRA.

Using a panel of DI beneficiaries in the Health and Retirement Study, Maestas and Yin (2008) found a 1.6 percentage point increase in labor force participation after conversion to the OA program at the FRA, on a base employment rate of 4.5 percent at ages 63-64. In sharp contrast, employment in the general population declines by 9.3

percentage points, on a base of 45 percent at ages 63-64. Using a difference-in-difference estimator adjusted for differentially time-varying covariates such as health status and health insurance coverage, the implied disincentive effect of the DI program is a 10.4 percentage point reduction in labor force participation. In addition to an extensive margin effect, Maestas and Yin (2008) also found significant disincentive effects on intensive margin measures, namely hours worked, weeks worked, and annual earnings.

In this paper, we analyze the natural experiment generated by the DI-OA program interaction at FRA in administrative Social Security data for the universe of primary worker DI beneficiaries from the 1934-1942 birth cohorts observed in panel over the period of 1995-2008. Using a regression discontinuity research design, we find evidence of a significant disincentive effect on both extensive and intensive margin measures of labor supply. The effect is strongest among individuals with recent labor force activity and among those who enter the program at younger ages. We find evidence of increased work activity after conversion among individuals in all of the major impairment categories, including those who qualified for the program on the basis of a musculoskeletal or mental impairment.

Institutional Background

The Social Security Disability Insurance Program defines disability as the inability to engage in any Substantial Gainful Activity (SGA) because of a medically determinable physical or mental impairment that is expected to result in death, or that has lasted or is expected to last for a continuous period of not less than 12 months. Individuals with qualifying disabilities are eligible for DI benefits if they are fully insured

and have recent work activity.[2] In order to be fully insured, an individual must have accumulated at least one calendar quarter of work[3] in covered employment for every year elapsing since age 22, up to a maximum of 40 quarters.[4] The recency requirement requires that at least half of those quarters be earned within the last 10 years. The threshold defining SGA is $1,000 per month in 2010 and increases annually with the cost of living. The SGA threshold is higher for blind beneficiaries ($1,640 per month in 2010).

DI applications are reviewed in five sequential steps. During the application process, an applicant may not work above the SGA threshold during a five-month waiting period beginning with the first calendar month following the date of disability onset. Applicants whose disability is determined to either meet codified criteria (known as the Listing of Impairments) or whose assessed residual functional capacities are such that they are unable to perform any job in the national economy given their age, skills, and work experience, are awarded benefits.

Once benefits commence, the beneficiary begins his or her Trial Work Period (TWP). The TWP allows the recipient to test his ability to work for at least nine months. During the TWP, full DI benefits are paid regardless of how high the recipient's earnings are. The TWP continues indefinitely until the recipient accumulates nine months of earnings above a threshold, which is lower than the SGA threshold (currently $720), during a rolling five-year period. These nine months may be nonconsecutive. At the end of the TWP (i.e., once nine months of work above the threshold have been accumulated)

[2] Blind workers need only be fully insured; the recency requirement does not apply.
[3] The amount of earnings required for a quarter of coverage in 2010 is $1,120; the amount increases annually with the national average wage index.
[4] Those who become disabled before age 24 need a minimum of six quarters earned during the past three years.

plus a three month Grace Period, benefits are suspended whenever earnings are above the SGA threshold. For the next 36 consecutive months, the individual is in an Extended Period of Eligibility (EPE) during which, as long as the individual continues to have a disabling impairment he or she can restart benefits whenever earnings fall below the SGA threshold without a new application, disability determination, or waiting period. At the end of the EPE, benefits are terminated if earnings are above the SGA threshold. After the 36th month of the EPE, if the individual is earning below the SGA threshold and receiving benefits, benefits continue. If not, benefits are terminated. If benefits are terminated because of earnings above the SGA threshold (as opposed to medical improvement) and earnings fall below the SGA threshold at any point within five years of when benefits stopped, then, under Expedited Reinstatement, benefits can be started again without a waiting period.

DI beneficiaries receive Medicare coverage automatically once they have been enrolled in DI for two years from the disability onset date. Once the TWP ends, disabled individuals continue to receive Medicare Hospital Insurance (Part A), Supplemental Medical Insurance (Part B), and Prescription Drug coverage (Part D) for at least 93 consecutive months. Premiums are not paid for Part A.

When a DI beneficiary reaches his FRA, he is notified that he has been automatically converted from the DI program to the OA retirement program. He continues to receive a monthly benefit of the same amount—except now it is labeled a retirement benefit rather than a disability benefit, and the DI program rules governing work no longer apply. Instead, the OA program rules now apply. Before 2000, the Social Security Retirement Earnings Test (RET) applied a marginal tax rate of 33 percent on

earnings above a disregard amount between the FRA and age 70. In 2000, the RET in this age range was removed, and therefore the marginal tax rate on earnings currently drops to zero at the FRA. If the individual had already satisfied the two-year waiting period for Medicare coverage or reached his 65th birthday (for cohorts with FRAs greater than 65), Medicare benefits continue as before; if not, they begin coincident with conversion.

Figure 1 illustrates how the individual budget constraint changes when the individual reaches his or her FRA and is automatically converted from the DI program to the OA program. The top panel shows the individual budget constraint for a DI beneficiary who has completed his or her Trial Work Period.[5] The budget constraint has two linear segments of equal slope and a discontinuity at point H_{SGA}. Point H_{SGA} is the number of hours of work at which earnings would equal the SGA threshold, given an individual wage rate of w. If hours of work are lower than H_{SGA}, the individual's income consists of earnings plus the full DI benefit. If hours of work exceed H_{SGA}, the individual's income consists only of earnings—the DI benefit is suspended. The indifference curve map shows how the individual, who in the absence of the DI program might choose to work hours equal to $H_0 > H_{SGA}$, could increase utility by reducing hours to H_{SGA} and participating in the DI program (i.e., move from the dotted blue indifference curve to the solid blue curve).[6]

Once the individual is converted to the OA program, the discontinuity at H_{SGA} is no longer present, as shown in the bottom panel of Figure 1. For any amount of work, he

[5] Since during the TWP the individual can earn any amount without penalty, the budget constraint during the TWP is linear, similar to the post-conversion budget constraint.

[6] Each individual has a "break-even" level of hours at which, given the shape of his indifference curves, he or she is indifferent between program participation and nonparticipation. As long as H_0 is less than the break-even level, the individual will be better off reducing hours to H_{SGA} to in order to qualify for DI.

or she retains the full OA benefit, which equals the DI benefit.[7] With no incentive to constrain hours to H_{SGA}, the individual can now increase utility even further (to the pink indifference curve) by increasing hours of work to point H_1. Hours at point H_1 are less than at the counterfactual point H_0 due to the income effect arising from benefit receipt.

Figure 1 illustrates how labor supply may change along the intensive (hours) margin. Changes at the extensive margin (labor force participation) are also possible, but only among individuals with relatively flat indifference curves. Such individuals are indifferent over a wide range of combinations of income and leisure, and thus are more susceptible to utility-improving inducements for program participation.

One implication of the theoretical framework presented in Figure 1 is that any labor supply responses at conversion are most likely to occur along the intensive margin, by beneficiaries with pre-conversion earnings near the SGA threshold. Another implication is that since individuals who would work fewer hours in the absence of the program (i.e., those with counterfactual earnings closer to the SGA threshold) are more susceptible to the DI work disincentives—in the sense that they have the most to gain from program participation—these same individuals should be more likely to respond to the relaxation of the work disincentives at conversion compared to those with higher counterfactual earnings.

Data and Summary Statistics

We use administrative Social Security data for the universe of DI primary worker beneficiaries in the 1934-1942 birth cohorts for the period 1995-2008, as identified in the

[7] This is true since the year 2000, when the Social Security Retirement Earnings Test (RET) for ages above the FRA was eliminated. Prior to 2000, the post-conversion budget constraint was piece-wise linear with a kink at the RET disregard amount. The slope of the budget constraint in the hours region above the kink was flatter on account of the 33 percent marginal tax rate on earnings imposed by the RET.

Disability Beneficiaries and Dependents (DBAD) extract of the Master Beneficiary Record (MBR) File. We linked the DBAD data to the 831 Disability File and the Master Earnings File (MEF). From the 831 File we obtain education level. The linkage to the MEF enables measurement of labor supply on the basis of covered wages recorded on the W-2 form in a calendar year. W-2 wage data are not top coded during the period we analyze. Our full analysis file contains 19,193,050 person-year observations.

While earnings are recorded in the administrative data as an annual total for a calendar year, DI beneficiaries reach their FRA at different points during the year, depending on their year and month of birth. This complicates interpretation of changes in labor supply outcomes in calendar years before and after conversion. Table 1 shows the FRA for each birth cohort in our analysis file, the beginning and end dates of the cohort's conversion period, and the percent of the cohort that converts out of DI in the calendar years they turn 65 and 66. Cohorts born before 1938 have an FRA of exactly 65. While cohort members convert in different months throughout the year depending on their birthdays, the entire cohort converts in the same calendar year. Annual earnings in the conversion year—the calendar year the cohort turns 65—are a combination of pre- and post-conversion earnings, according to the distribution of birthdays across months, and the calendar year in which the cohort turns 66 is the first full post-conversion calendar year—that is, everyone in the cohort has attained FRA and earnings are entirely post-FRA earnings.

On the other hand, cohorts born between 1938 and 1942 have an FRA ranging from 65 and 2 months to 65 and 10 months. As a result, the conversion period occurs in parts of two calendar years. For example, Table 1 shows how approximately 83 percent

of the 1938 cohort converts in the year the cohort turns 65 (2005) while 17 percent converts in the year the cohort turns 66 (2006).[8] The share of the cohort converting in the calendar year the cohort turns 66 increases with cohort birth age, such that only 17 percent of the 1942 cohort converts in the calendar year the cohort turns 65 (2007) and fully 83 percent convert in the calendar year the cohort turns 66 (2008). As a result, for these cohorts, cohort earnings in the year the cohort attains 66 reflect a combination of pre- and post-conversion earnings, and the calendar year in which these cohorts turn 67 is the first full post-conversion calendar year. In a sample with all cohorts pooled, earnings in the calendar year the cohort turns 65 are mostly pre-conversion earnings, earnings at age 66 are roughly half pre-conversion and half post-conversion earnings, and earnings at age 67 are entirely post-conversion earnings. In the analyses that follow, it is important to remember that "earnings at age *a*" are in fact "annual earnings in the calendar year the cohort attains age *a*."

Figure 2 shows the number of DI Beneficiaries in each birth cohort beginning in the calendar year the cohort turns age 60. Between age 60 and the cohort's FRA, the number of beneficiaries is increasing, reflecting program inflows in excess of program outflows. The number of beneficiaries peaks at the cohort's FRA then decreases thereafter reflecting the fact that people can only exit the population through death but not enter (there are no further DI program inflows once the entire cohort has been converted to the OA program). As the FRA shifts forward with each new birth cohort, the peak gradually shifts from age 64 to 65 as one would expect.

The next figures present summary statistics for our data extract of DI beneficiaries. Figure 3 shows the age profile in the mean monthly Primary Insurance

[8] The percents are approximations assuming a uniform distribution of birthdays over birth months.

Amount (PIA) in real 2008 dollars for each birth cohort. The PIA forms the monthly DI benefit amount and because it is a piece-wise linear function of past earnings it is also a summary measure of pre-program labor supply. Within each cohort, the average PIA rises slightly with age as individuals with greater lifetime labor supply flow into the program and flattens after conversion. Quite noticeably, across cohorts the average PIA has increased monotonically with every successive birth cohort at nearly every age, indicating that later cohorts have greater pre-program earnings than earlier cohorts.

Figure 4 shows a corresponding shift in the educational composition of the DI beneficiary population between 1995 and 2008. DI beneficiaries have become more educated, with a greater fraction of the caseload possessing 12 or more years of education. At the same time, the caseload has become heavily dominated by individuals with musculoskeletal impairments, as shown in Figure 5. Over the same period the caseload has become older, in step with the aging of the large Baby Boom cohort (not shown), and a growing share of beneficiaries have entered the program under the vocational criteria (which become less stringent after age 55) compared to the Listing of Impairments (not shown).

Of particular interest are the age profiles of labor supply among DI beneficiaries, unadjusted for covariates. Figure 6 shows the age profile of labor force participation for each birth cohort as the DI population passes through their FRA and converts to the OA program. In this instance, participation is defined as annual earnings above the annualized SGA threshold.[9] Not surprisingly given the DI work rules, in all cohorts labor

[9] The nominal monthly SGA threshold was $500 between 1995 and June 1999, it rose to $700 in July 1999, and beginning in 2001 the threshold has risen annually in line with the national average wage index. The annualized threshold in 2008 was $11,280. We apply the relevant threshold in each calendar year.

force participation at age 60 is low, ranging from around 3 to 5 percent.[10] Participation declines further as the cohort approaches FRA and flattens as the cohort crosses the FRA threshold. In a few birth cohorts, it increases slightly between ages 66 and 67.

In contrast to the extensive margin, the intensive margin shows a more pronounced response pattern as the cohorts cross the FRA threshold. Figure 7 shows mean annual earnings conditional upon positive earnings by age for the same cohorts. In nearly all birth cohorts, there is a pronounced increase in earnings in the calendar years the cohort turns 66 and 67, and the increase is sustained through age 70. Surprisingly, earnings prior to conversion are *higher* among earlier cohorts.[11] Figure 8 illustrates how responsiveness on the intensive margin varies for individuals with different types of medical impairments. In every one of the largest six impairment groups,[12] the intensity of labor supply rises significantly at ages 66 and 67. The increase in annual earnings is largest for individuals with musculoskeletal impairments, rising about 31 percent from about $6,400 at age 65 to $8,400 at age 67. The second largest increase occurs for individuals who qualified for DI on the basis of an injury; this raises the possibility that some individuals retain benefits after they have experienced some degree of recovery from their injury.

[10] Note that some of these individuals could be in their Trial Work Period, during which time earnings are unrestricted.

[11] In fact, earnings seem *too high* in the 1934-1936 cohorts. For example, the 1935 cohort attained age 61 in 1995, when the annualized nominal SGA threshold was $6,000 or $8,476 in real 2008 dollars. One potential explanation is that if an unusually large number of individuals with high pre-program earnings (and perhaps a high likelihood of utilizing their TWP) entered the program in that year, earnings could disproportionately reflect pre-program or TWP earnings. This is not entirely implausible given the recession in the early 1990's. It is well-known that poor economic conditions cause increased DI participation among displaced, disabled workers (Black, Kermit and Sanders, 2002; Autor and Duggan, 2003).

[12] The largest six impairment groups in the period 1995-2008 were: Musculoskeletal, Circulatory, Mental Disorders, Nervous+Sense, Repiratory, and Injuries.

Research Design

To estimate the change in labor supply as DI beneficiaries reach their FRA and convert to the OA program, we fit a series of regression discontinuity models using OLS estimators. As shown in Equation (1), we regress labor supply outcome y_{ica} for individual i in birth cohort c at age $a=60…70$ on a set of age dummies D_a, cohort dummies D_c, and a set of individual covariates x_{ica}:

$$y_{ica} = \sum_{a=60}^{70} D_a \beta_a + \sum_{c=1934}^{1942} D_c \delta_c + x_{ica}\alpha + \varepsilon_{ica} \quad (1)$$

The coefficients of interest are β_{66} and β_{67}, which measure the post-conversion labor supply response relative to a pre-conversion reference age, set to age 64 in the models that follow. The vector of covariates x_{ica} includes controls for sex, education level, impairment category, age at entitlement (to control for program tenure), and PIA (the monthly benefit amount and also a summary of pre-program labor supply).

The identifying assumption in this research design is that other factors affecting labor supply trend smoothly as individuals cross the FRA threshold. As noted above, Medicare coverage continues uninterrupted as most DI beneficiaries convert to OA. However, a small group of late entrants (those entering DI at age 63 or later) will newly acquire Medicare coverage coincident with conversion. To the extent Medicare coverage does not evolve smoothly through the FRA threshold, we note that the income effect associated with gaining coverage should lead these individuals to *reduce* their labor supply, therefore biasing down the estimated labor supply response. We address this concern by estimating Equation (1) separately for early and late DI entrants, where early entrants are defined as those who enter the program before 59 and late entrants are those who enter at ages 59 or older. As an additional test of the research design, we estimate

models contrasting individuals born in January versus December to show how the labor supply response is deferred by one year for those born nearly one year later.

Finally, since according to our theoretical framework in Figure 1, any labor supply response is likely to be concentrated among those with recent work activity, we estimate Equation (1) separately for the full population and a subset of individuals with recent work activity, defined as having positive earnings in the prior calendar year (i.e., at *a-1*).

Results

Table 2 shows estimates of Equation (1) for the labor supply outcome of annual earnings (not conditioned on participation) for all cohorts pooled. Equation (1) is estimated separately for four groups: 1) All DI beneficiaries who entered DI before age 59 ("All Beneficiaries, Early Entrants"); 2) All DI beneficiaries who entered DI at age 59 or older ("All Beneficiaries, Late Entrants"); 3) DI beneficiaries with recent work activity who entered DI before age 59 ("Recent Work Activity, Early Entrants"); and 4) DI beneficiaries with recent work activity who entered at age 59 or older ("Recent Work Activity, Late Entrants"). The coefficients of interest are the coefficients on the age dummies, where age 64 is the reference age category. In the models estimated for all beneficiaries, the pattern of age coefficients indicates a steady decline in earnings with age, for both early and late entrants. In contrast, among the beneficiaries with recent work activity, the pattern of age coefficients a steady decline in earnings with age only until age 66, after which, earnings rise sharply. These patterns are most easily grasped by examining the age coefficients graphically. Figure 9 has two panels, one for all beneficiaries and one for those with recent work activity, where each panel shows the

implied earnings levels for the early and late entrants (based on the coefficients from each of the models in Table 2). Implied earnings levels aid interpretation and are computed by adding mean earnings at age 64 in each sample to each age coefficient. Among those with recent work activity, an abrupt reversal of the downward trend in earnings occurs between ages 66 and 67, when the entire sample has converted to OA. The increase in earnings is apparent for both early and late entrants, and interestingly, is largest for early entrants. The fact that a labor supply response is evident—and even largest—for those who have been on DI longer suggests that the labor supply response is not due to regression to the mean, perhaps driven by a biological recovery effect.

In addition to the age coefficients, Table 2 also presents the coefficients for the other covariates in the model. Of note is the negative coefficient on the male indicator, which implies the counterintuitive result that earnings are lower for male DI beneficiaries compared to female beneficiaries. This coefficient arises because the model controls for PIA; holding PIA (i.e., lifetime earnings) constant, male DI beneficiaries have lower earnings than women. When we drop PIA from the models, the male coefficient reverts to its usual positive sign. Also of note is the pattern of increasing negative coefficients on the cohort dummies (the reference cohort is 1934); these imply higher earnings among earlier cohorts compared to later cohorts as was evident in Figure 7.

Results for the extensive margin alone are presented in graphic form only, and shown in Figure 10. Figure 10 has four panels, one for each of the four subgroups. In each panel we present results for three alternative measures of labor force participation: 1) Earnings > 0.50*[Annualized SGA]; 2) Earnings > 1.00*[Annualized SGA] and 3) Earnings > 1.50*[Annualized SGA]. As with the earnings regressions, labor force

participation under all three measures trends gradually downward with age among all beneficiaries. But among those with recent work activity, labor force participation initially trends downward then abruptly increases between ages 66 and 67, once all cohorts have converted to OA. The effect is evident for both recent and late entrants, and is strongest among early entrants. For example, among early entrants, the fraction earning at least 50 percent of the SGA threshold falls from about 42 percent to 25 percent between ages 64 and 66, then climbs back to nearly 40 percent by age 67. The fraction earning above the SGA threshold falls from about 24 percent at age 64 to 15 percent at 66, then climbs to 25 percent at age 67.

We next test for heterogeneous effects among those with recent work activity, beginning with impairment type. Figure 11 shows the implied earnings levels derived from the age coefficients of Equation (1) estimated separately by impairment type. Earnings decline for all groups, quite precipitously between ages 64 and 66, then rise abruptly between age 66 and 67 among both early and late entrants. Among early entrants, the percent increase in earnings is largest among those nervous system or sensory impairments, followed by circulatory impairments, respiratory impairments, mental disorders, musculoskeletal impairments and injuries. Among late entrants, the percent increase in earnings after conversion to OA is largest for those with musculoskeletal impairments. The pronounced pre-period drop in the two years before conversion is curious, and could suggest anticipatory behavior. Still, it is not clear if in the absence of impending conversion earnings would have continued to decline—as they do in aggregate for all beneficiaries combined—or if they would have remained at approximately their age 64 levels.

Earlier we noted that one implication of Figure 1 is that DI beneficiaries with lower counterfactual earnings should be more responsive to relaxation of the DI work disincentives at conversion. Although counterfactual earnings are not observed, the individual's Primary Insurance Amount can be thought of as an approximation since it is a function of past earnings, including earnings during the period prior to attaining insured status. Figure 12 shows the results of Equation (1) estimated separately for early and late entrants with recent work activity by high (above median) and low (below median) PIAs. Earnings rise more in absolute value for beneficiaries with high PIAs, but the effect in percent terms is similar or even larger (early entrants) for those with low PIAs since they have lower pre-period earnings.

Finally, Figure 13 presents a robustness check where we contrast the behavior around conversion for individuals born in January versus December. Individuals born in January of a given calendar year convert nearly a year later than those born in December, and therefore we would expect a similar labor supply response pattern but delayed by one year for those born in December. Indeed, the pre-conversion drop in earnings is noticeably delayed by one year. Among the early entrants, the abrupt increase occurs more rapidly for those born in December and the two birth month groups peak in the same year. However, among the late entrants the peak occurs one year later.

Conclusion

In this paper, we analyze a natural experiment generated by the interaction of the Social Security DI and OA programs at Full Retirement Age. When DI beneficiaries reach their FRA, they are automatically converted from the DI program to the OA retired worker program. Their benefit payments continue unchanged, however they are no

longer subject to the strict DI program rules limiting work activity. Consequently, the extraordinarily high implicit marginal tax rate on earnings is abruptly relaxed on the day individuals reach their FRA. We use administrative Social Security data for the universe of primary worker DI beneficiaries from the 1934-1942 birth cohorts observed in panel over the period of 1995-2008. Our analysis file contains 19.1 million person-year observations.

Using a regression discontinuity research design, we find evidence of a significant disincentive effect on both extensive and intensive margin measures of labor supply, primarily among individuals with recent work activity who comprise approximately 12 percent of all DI beneficiaries. The fact that the effect is larger among individuals who enter the program at younger ages (before age 59) than at older ages suggests that it is not the result of regression to the mean, perhaps driven by biological recovery. We find evidence of increased work activity after conversion among individuals in all of the major impairment categories, including those who qualified for the program on the basis of a musculoskeletal or mental impairment. The stronger effects at conversion among those with recent work activity are rationalized in a standard economic framework that predicts effects along the intensive margin of behavior, particularly among individuals whose labor supply was constrained by the program rules.

Our estimates imply that the DI program depresses labor supply among even the oldest DI beneficiaries. To place our estimates in the context of the literature to date that has sought to establish an upper bound on the earnings losses caused by the presence of the DI program by using quasi-experimental variation occurring at the program entry margin, our use of quasi-experimental variation arising from the program *exit* margin,

when individuals are already in their mid-60s and the dominant trend in labor force participation in the population at large is downward, suggests that our estimates are most appropriately viewed as a *lower* bound estimate of the residual work capacity of all beneficiaries.

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Figure 1. Individual Budget Constraint Before and After Conversion

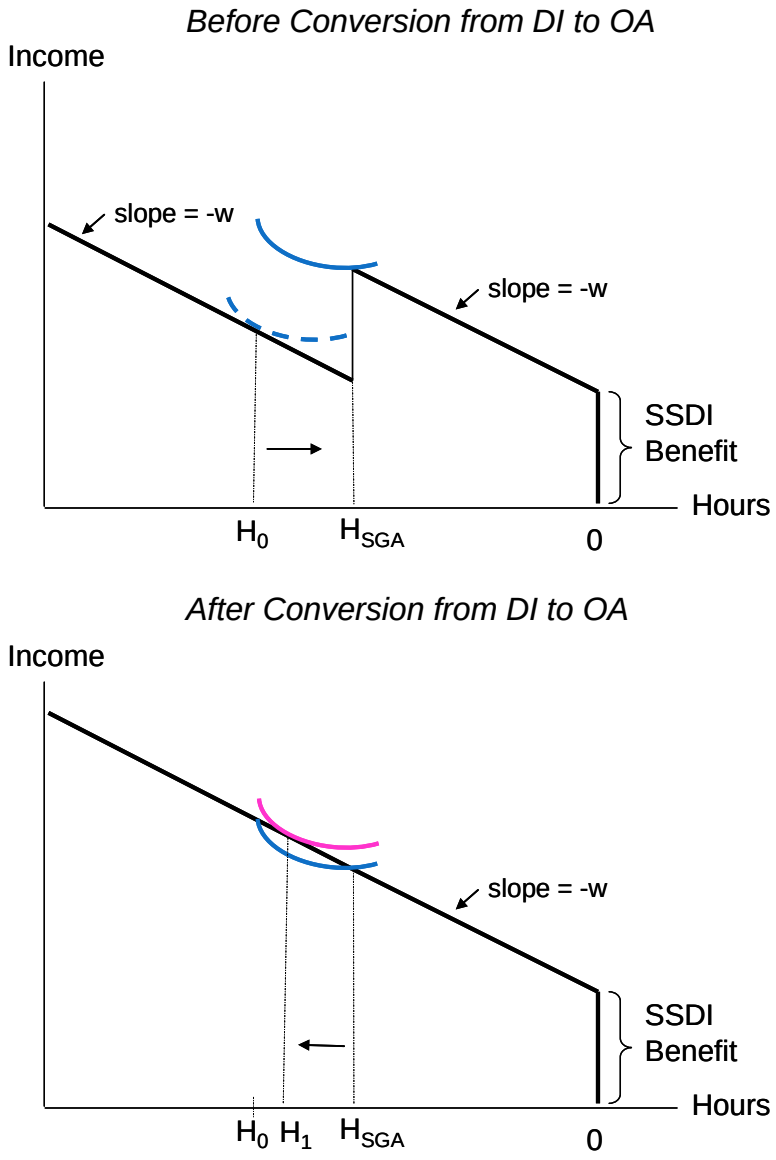


Figure 2. Number of SSDI Beneficiaries in Birth Cohort by Age

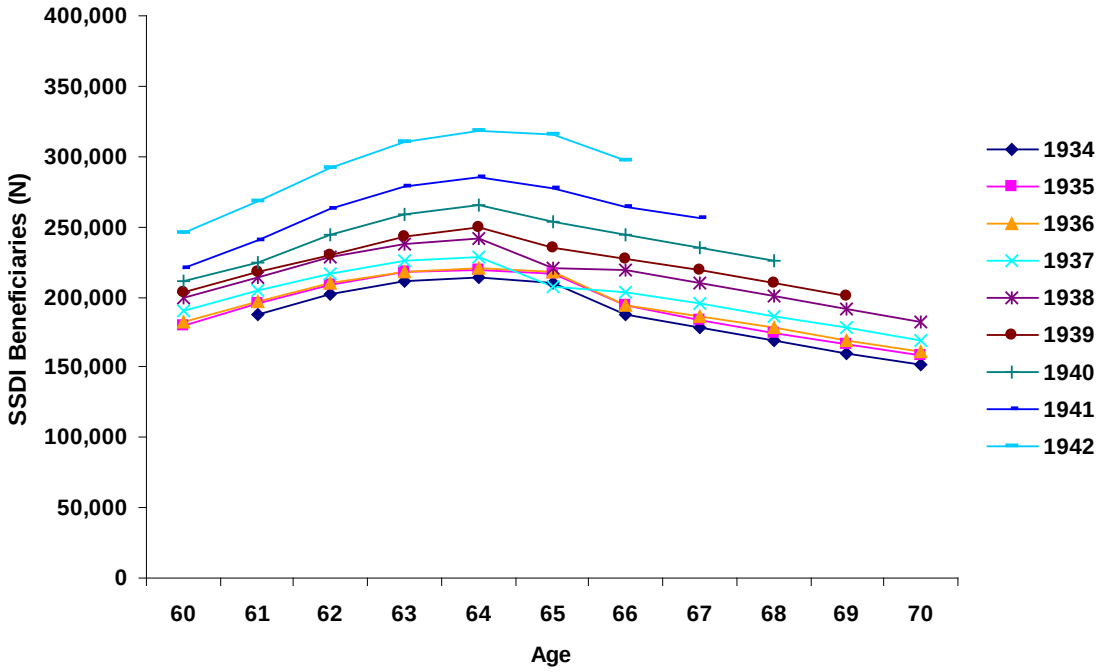


Figure 3. Mean PIA of SSDI Beneficiaries by Birth Cohort and Age

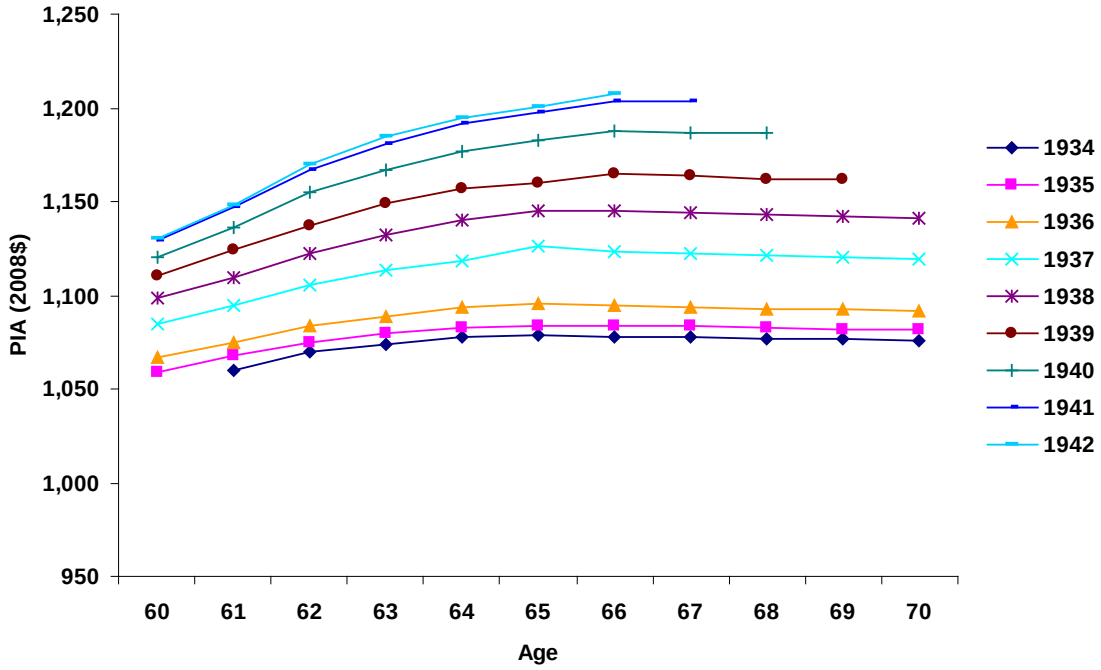


Figure 4. Education Composition of SSDI Caseload 1995-2008

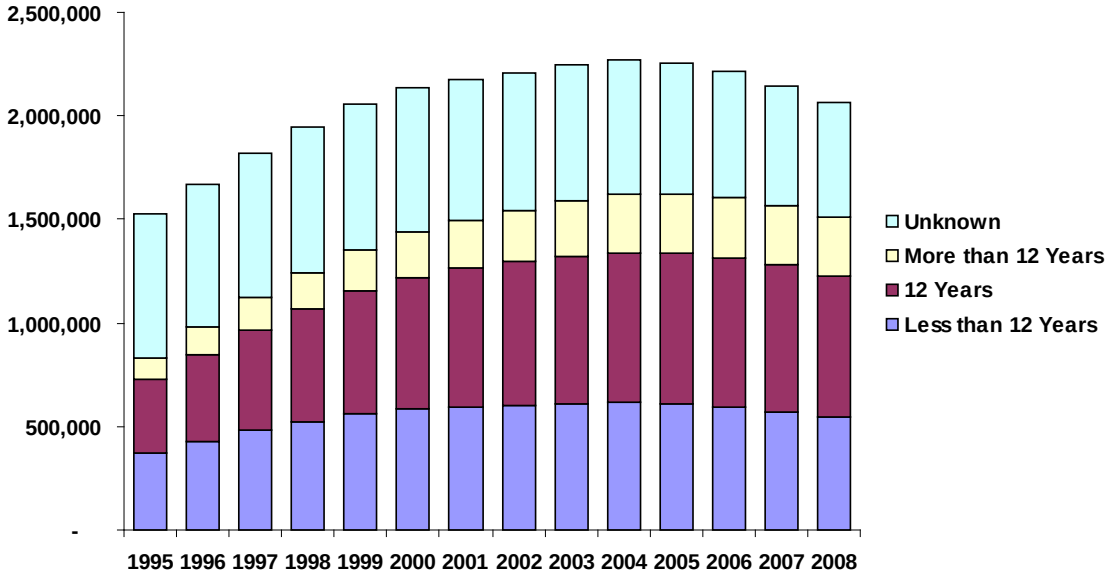


Figure 5. SSDI Caseload by Diagnostic Group

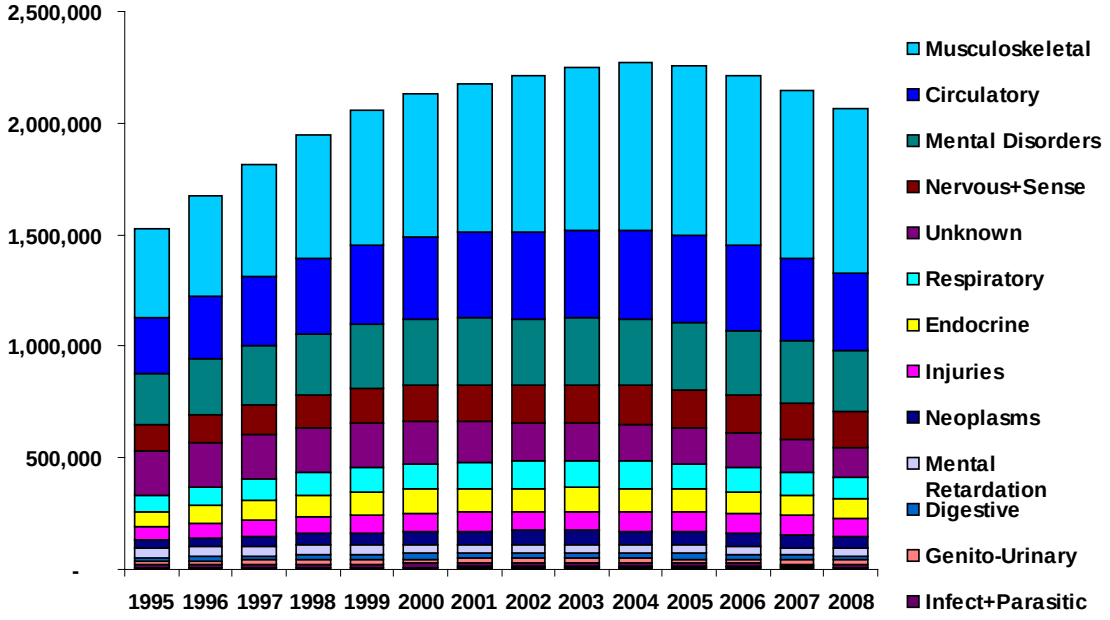


Figure 6. Fraction of SSDI Beneficiaries with Annual Earnings >SGA

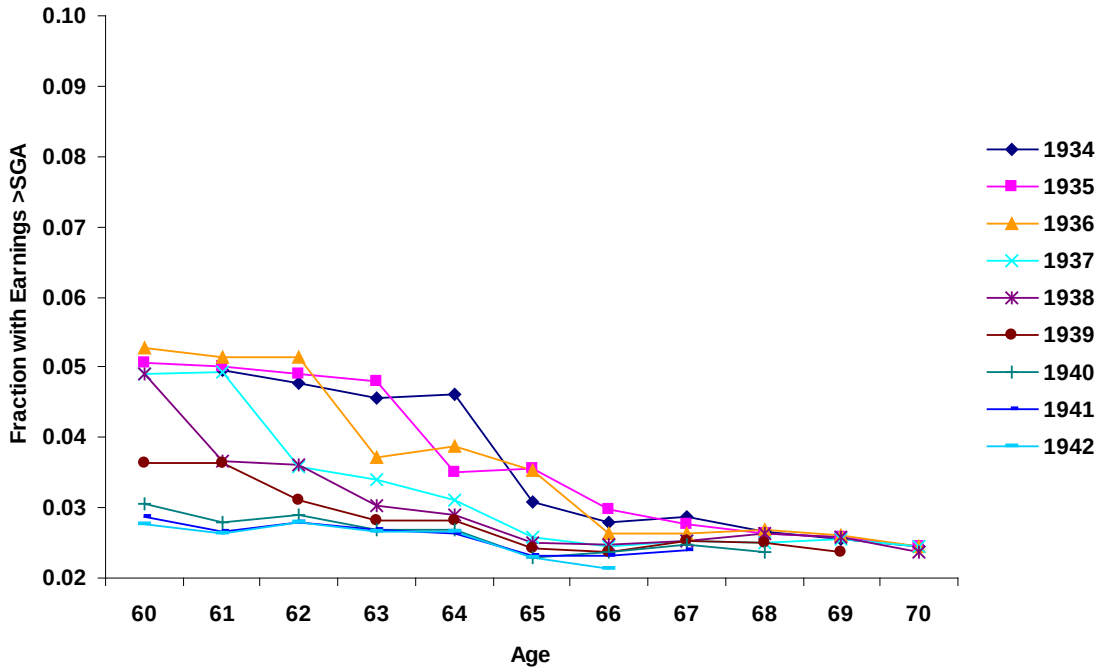


Figure 7. Mean Annual Earnings of SSDI Beneficiaries if Earnings >0 by Birth Cohort

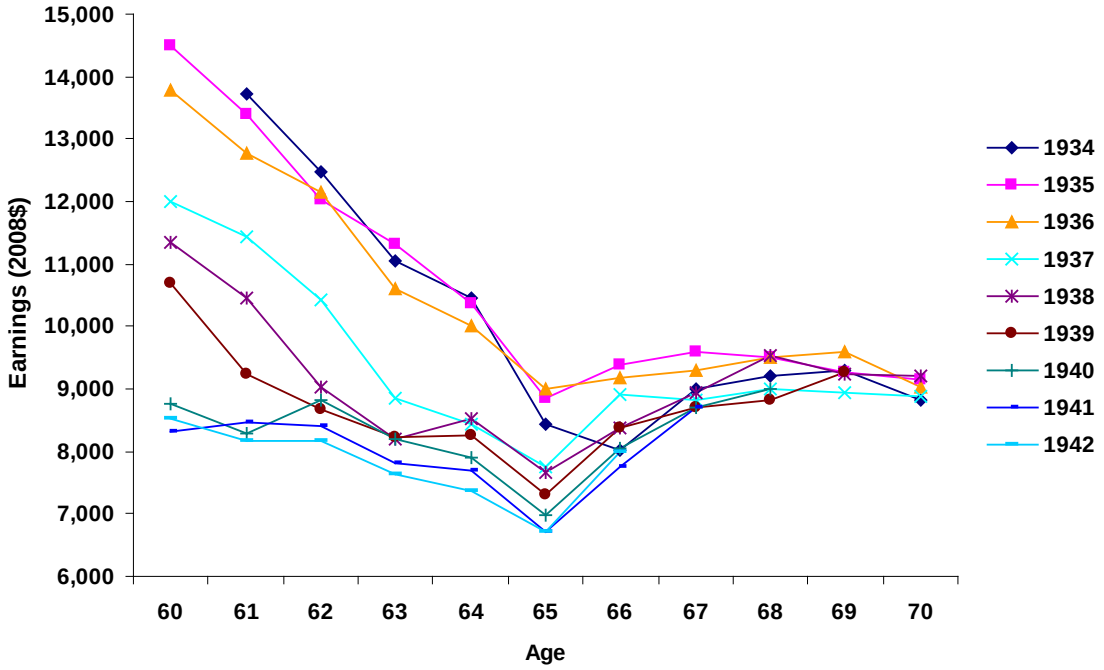


Figure 8. Mean Annual Earnings of SSDI Beneficiaries if Earnings >0 by Impairment Type

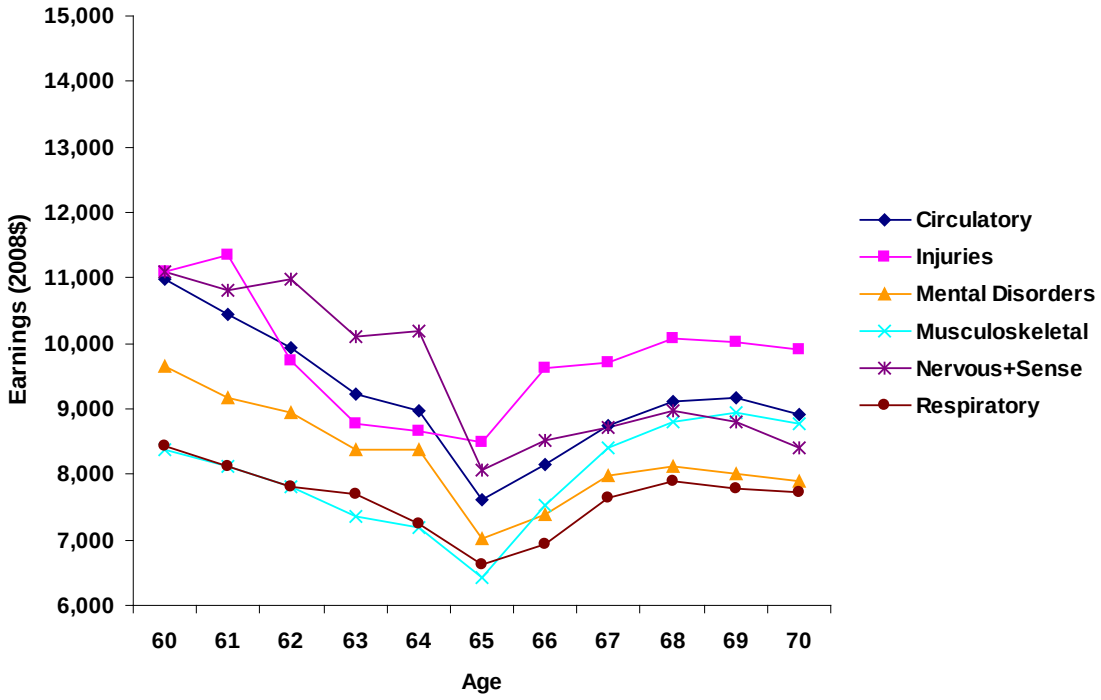
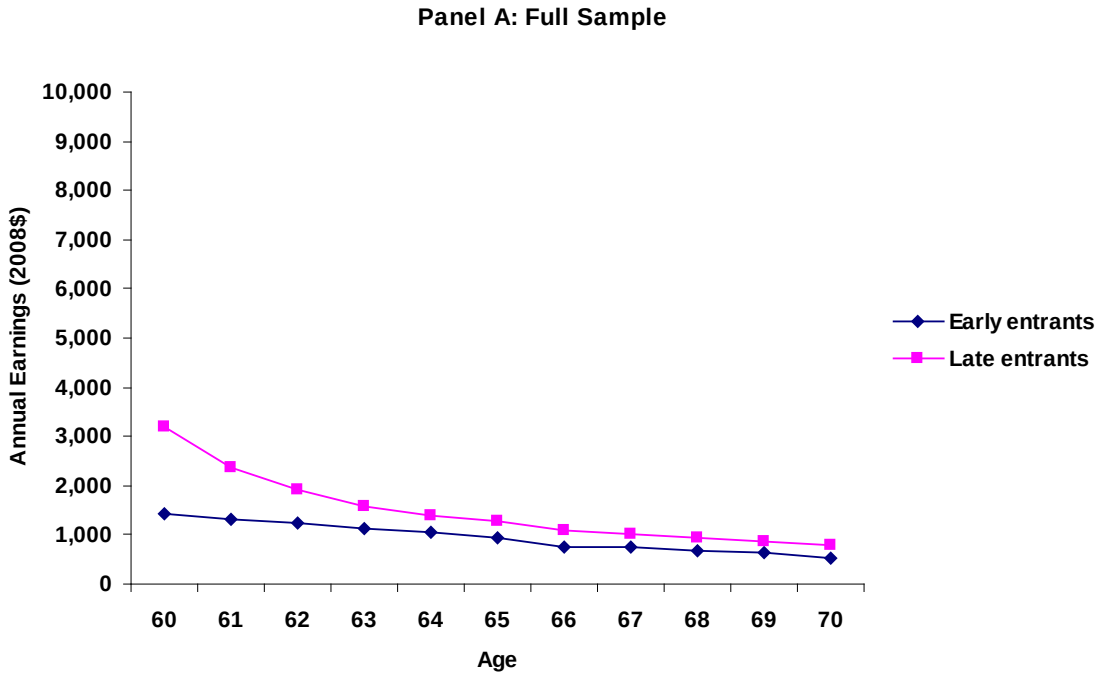


Figure 9. Regression Estimates of Annual Earnings by Age



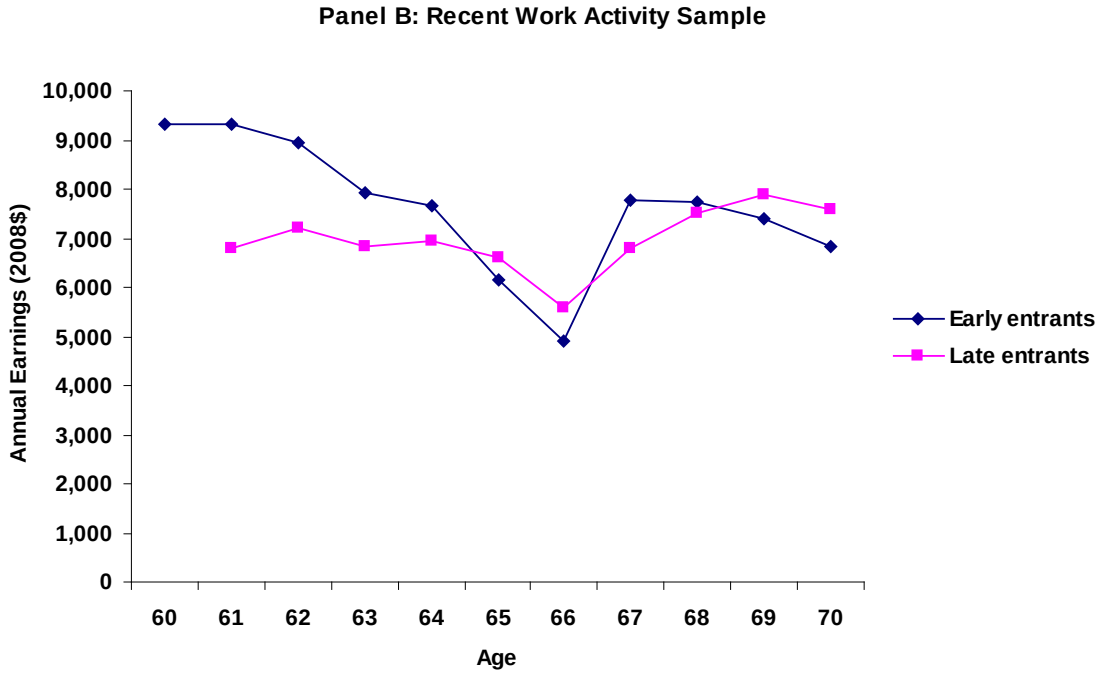
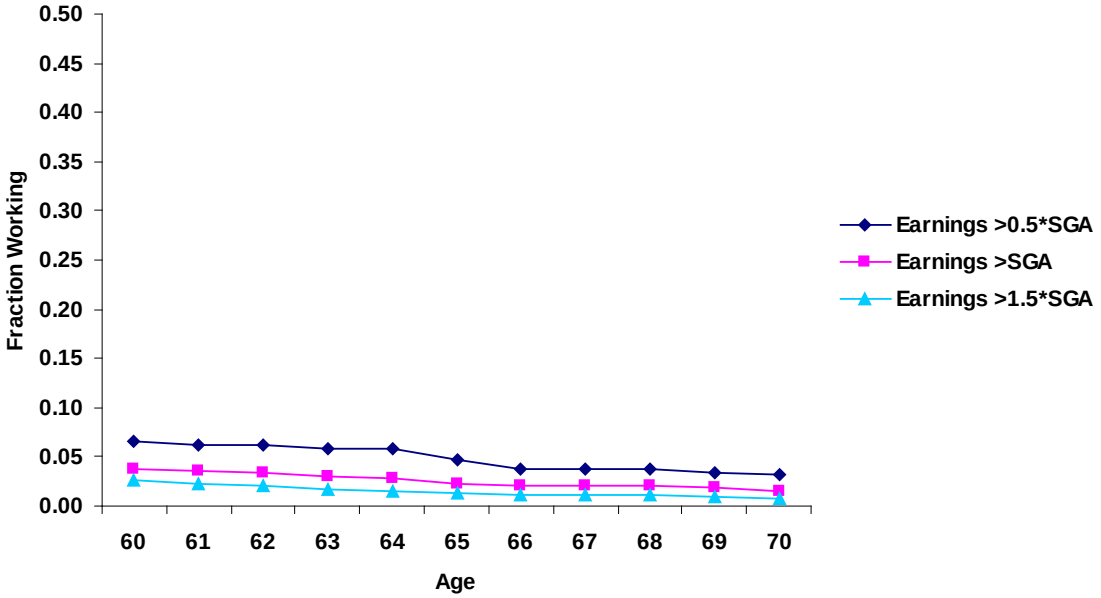


Figure 10. Regression Adjusted Labor Force Participation by Age *(continued on next page)*

Panel A: Early Entrants from Full Sample



Panel B: Late Entrants from Full Sample

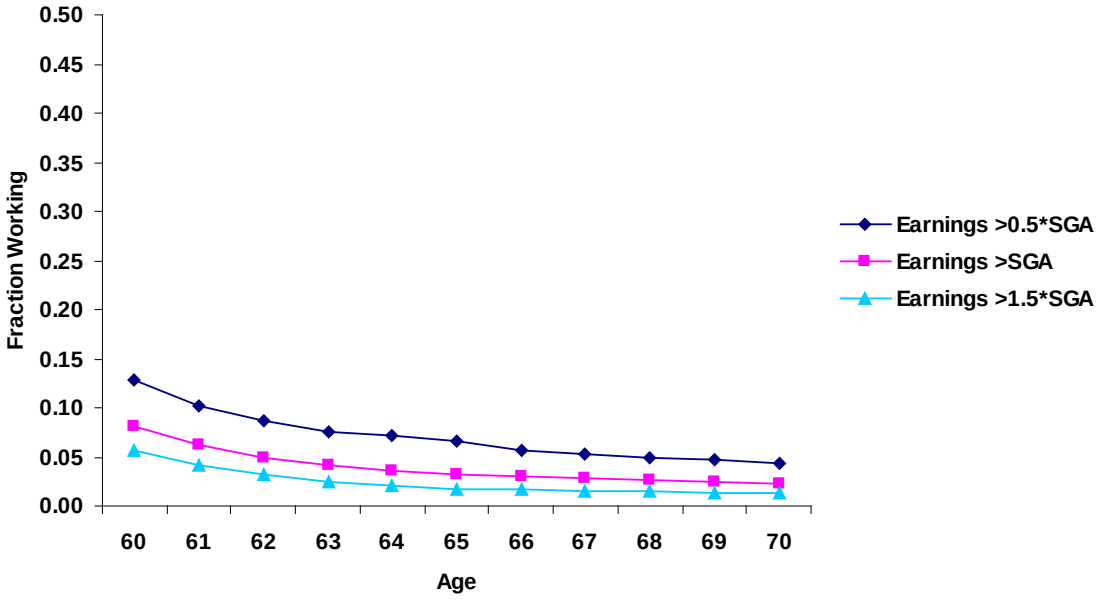
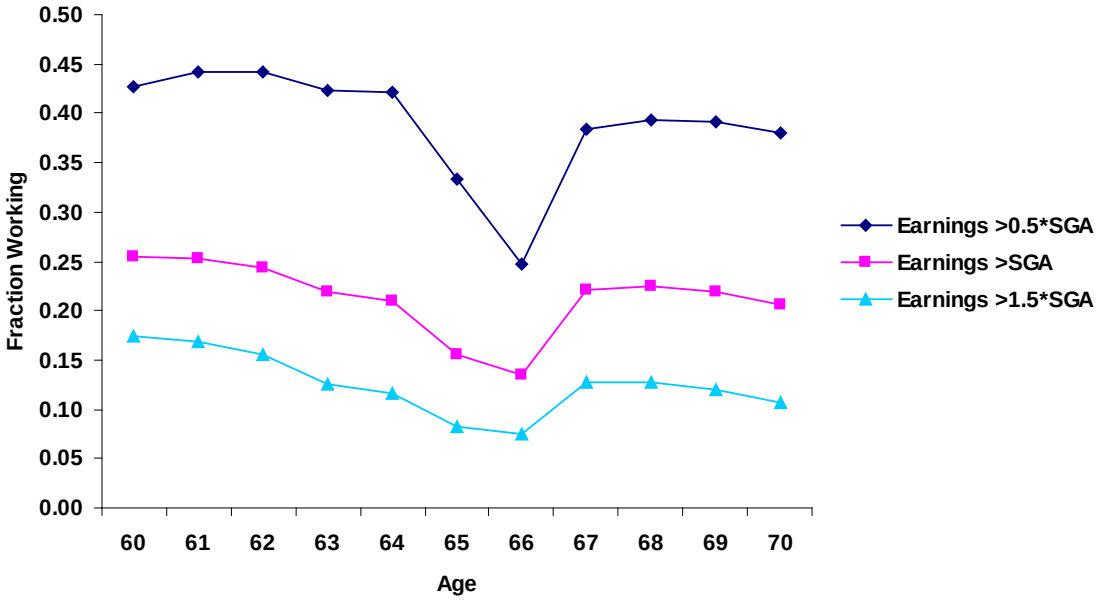


Figure 10. Regression Adjusted Labor Force Participation by Age *(continued from previous page)*

Panel C: Early Entrants from Recent Work Activity Sample



Panel D: Late Entrants from Recent Work Activity Sample

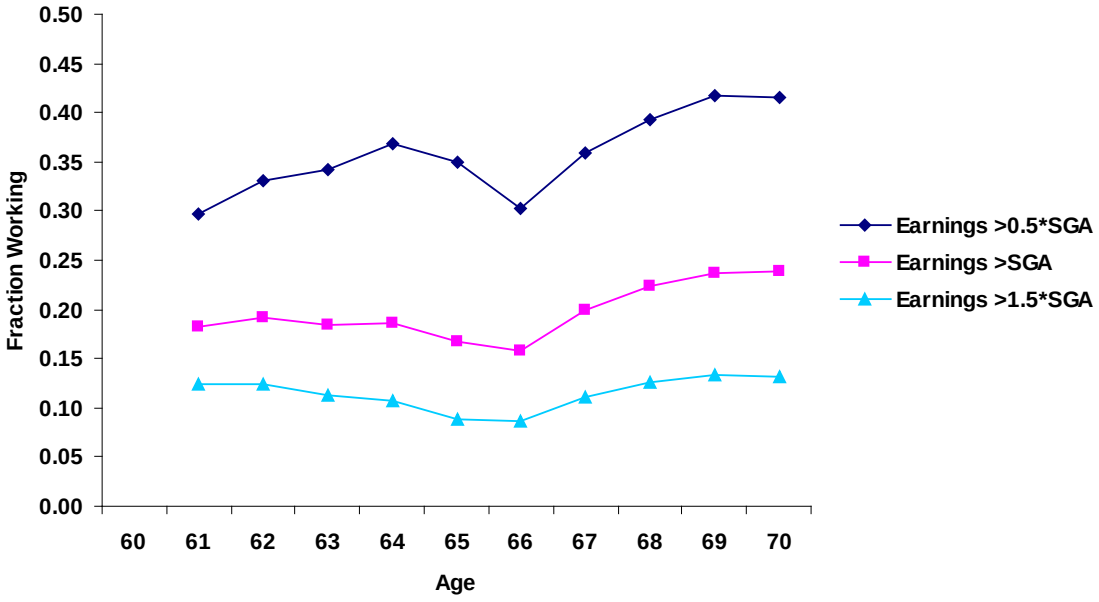


Figure 11. Regression Estimates of Annual Earnings by Age by Impairment Type, Recent Work Activity Sample

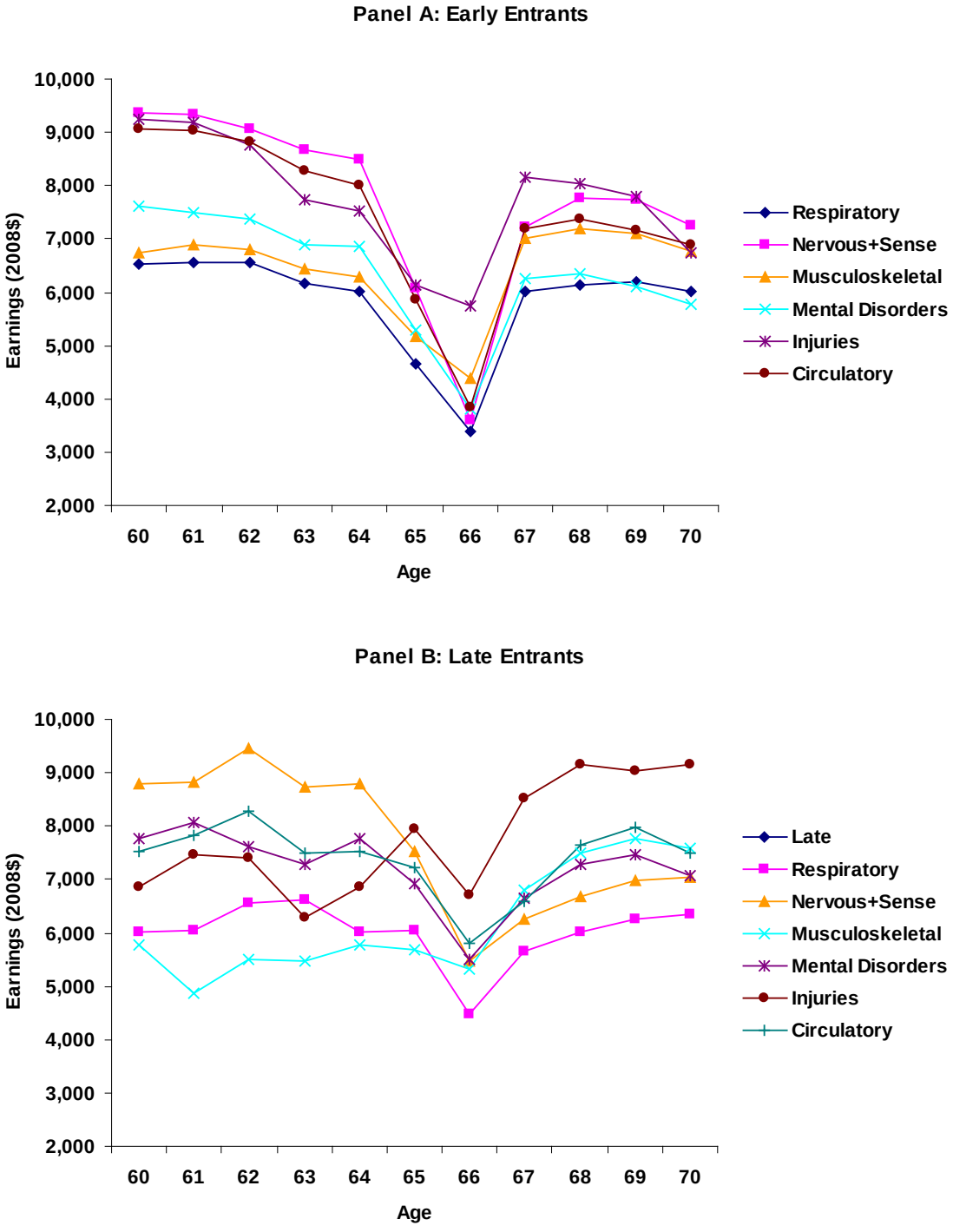


Figure 12. Regression Estimates of Earnings by Age and PIA for Early and Late Entrants in Recent Work Activity Sample

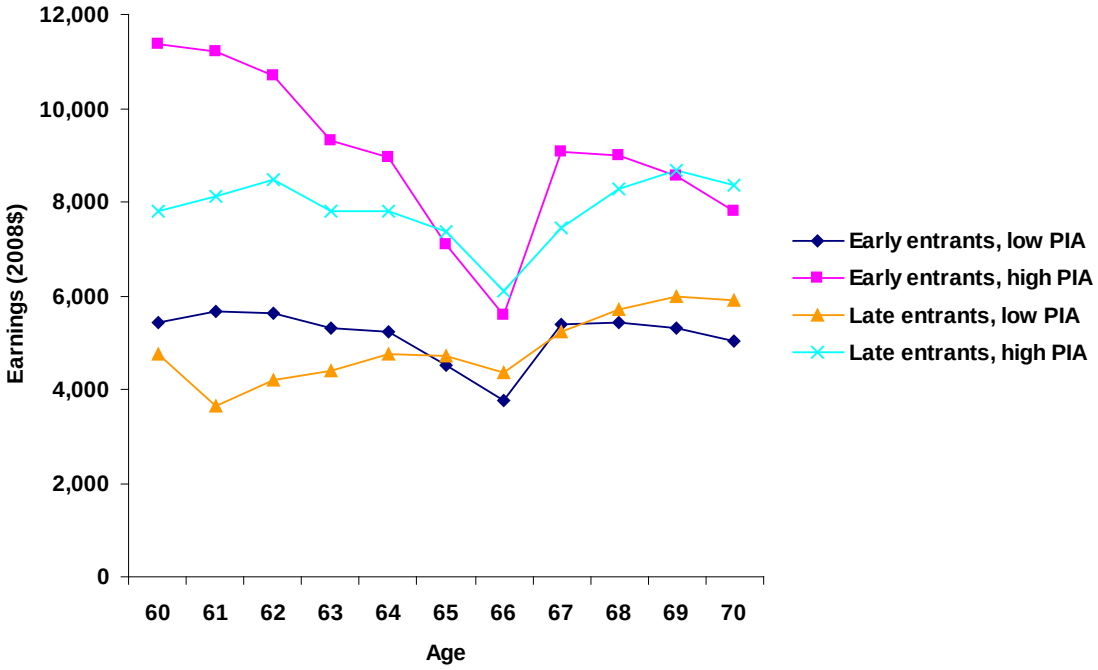


Figure 13. Regression Estimates of Annual Earnings by Age for Sample of January Conversions, Recent Work Activity Sample

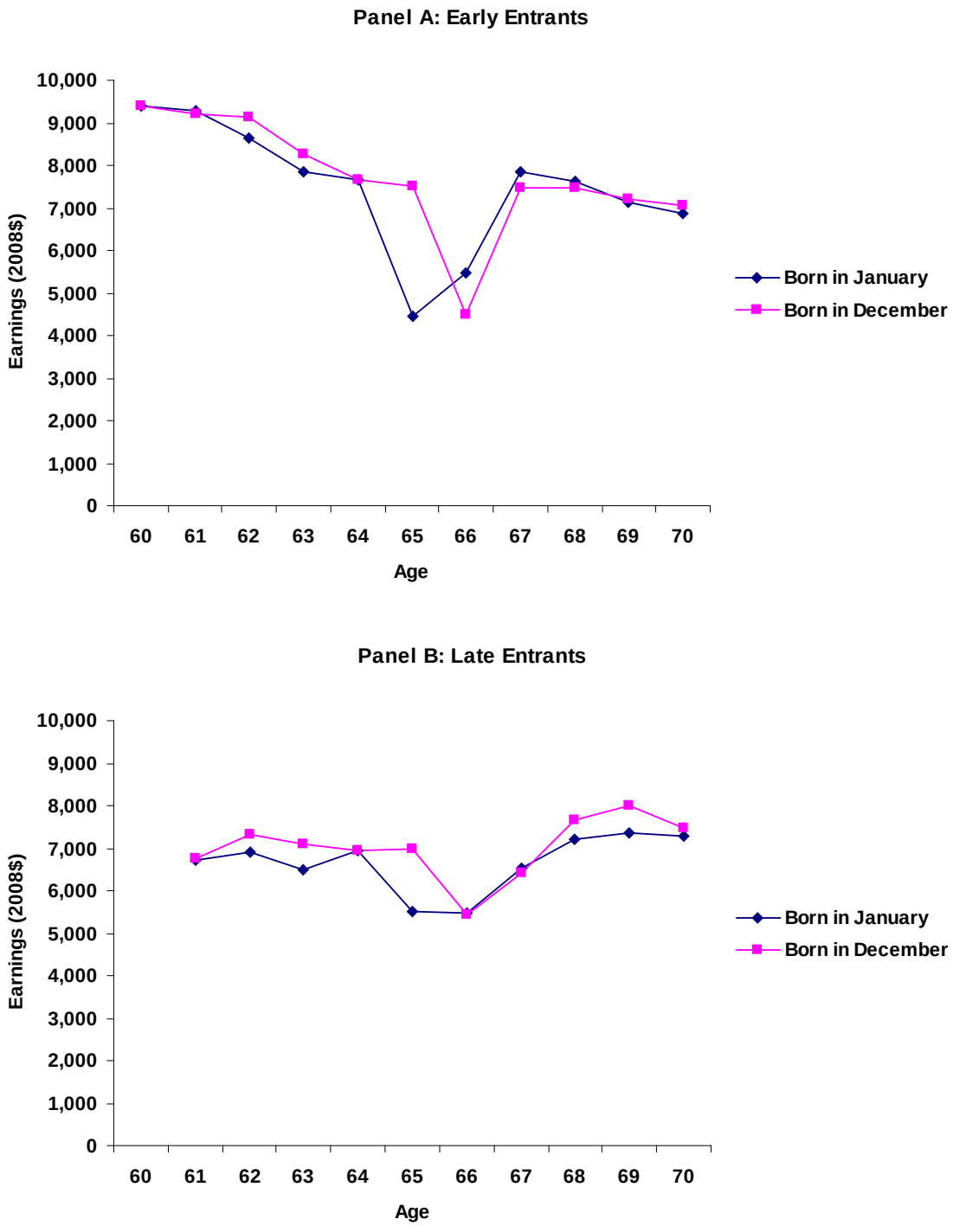


Table 1. Conversion Period by Birth Cohort

Birth Cohort	Full Retirement Age	Conversion Period	Age Attained in Calendar Year of Conversion (% of Cohort)
1934	65	Jan-99—Dec-99	65 (100%)
1935	65	Jan-00—Dec-00	65 (100%)
1936	65	Jan-01—Dec-01	65 (100%)
1937	65	Jan-02—Dec-02	65 (100%)
1938	65 and 2 months	Mar-03—Feb-04	65 (83%), 66 (17%)
1939	65 and 4 months	May-04—Apr-05	65 (67%), 66 (33%)
1940	65 and 6 months	Jul-05—Jun-06	65 (50%), 66 (50%)
1941	65 and 8 months	Sep-06—Aug-07	65 (33%), 66 (67%)
1942	65 and 10 months	Nov-07—Oct-08	65 (17%), 66 (83%)

Table 2. Regression Model of Annual Earnings of DI Beneficiaries Before and After Conversion to OA

	All Beneficiaries				Beneficiaries with Recent Work Activity			
	Early Entrants		Late Entrants		Early Entrants		Late Entrants	
Variable	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error
Intercept	-397.4	62.4	-14,179.0	275.4	3,893.0	400.1	-6,956.5	1,457.1
Age at entitlement	-8.3	0.3	225.2	4.0	-79.2	2.6	132.0	21.6
Men	-859.5	4.9	-634.2	12.7	-1,884.1	34.8	-617.2	69.7
Age 60	355.3	8.4	1,806.7	34.7	1,676.9	57.3	0.0	0.0
Age 61	260.8	8.2	964.8	25.3	1,657.7	57.0	-128.3	150.2
Age 62	195.7	8.3	513.0	22.0	1,303.6	56.3	285.0	119.0
Age 63	53.4	8.3	156.8	20.4	283.1	56.6	-117.9	106.9
Age 65	-125.8	8.6	-113.5	19.7	-1,486.8	58.7	-324.6	100.8
Age 66	-298.6	8.7	-307.0	19.9	-2,736.5	59.8	-1,344.0	99.9
Age 67	-312.1	9.3	-397.7	21.1	137.1	69.5	-134.1	109.8
Age 68	-363.9	10.0	-469.5	22.6	70.3	75.6	586.4	121.5
Age 69	-434.5	10.8	-529.0	24.4	-273.1	83.1	933.2	135.4
Age 70	-523.1	11.9	-634.2	26.8	-838.9	93.2	662.2	151.6
Circulatory	-363.7	58.8	-406.1	125.5	-1,060.4	367.8	-283.3	628.3
Congenital	-390.2	88.0	-696.8	238.9	-1,241.6	596.0	-1,405.2	1,285.5
Digestive	-172.7	61.8	70.9	133.9	-22.6	389.4	1,334.8	673.0
Endocrn+Nutrit	-536.9	59.3	-646.9	127.3	-1,682.1	373.2	-1,355.1	641.5
Genito-Urinary	-119.4	63.2	-351.0	132.2	-451.8	396.2	-311.3	665.1
Infect+Parasitic	-212.8	63.2	-309.8	141.3	-484.3	399.0	30.3	709.1
Injuries	-264.1	59.4	-150.2	127.8	-107.3	373.0	525.1	640.6
Mental Disorders	-379.2	58.8	-343.6	126.3	-1,353.5	368.0	-445.6	632.6
Mental Retardation	51.7	60.1	25.5	147.6	-444.2	379.6	342.2	767.7
Musculoskeletal	-445.6	58.7	-453.3	125.4	-1,199.3	367.0	-803.1	627.3
Neoplasms	251.6	60.4	352.6	127.2	1,066.9	377.0	1,334.5	636.3
Nervous+Sense	-285.2	59.1	-351.1	126.4	-683.8	369.4	-187.4	633.4
Other diag. group	-209.0	87.7	-162.1	182.7	-56.2	565.9	566.9	910.1
Respiratory	-586.7	59.4	-684.5	126.4	-1,979.9	373.5	-1,057.5	634.7
Skin	-413.6	72.5	-562.5	177.5	-1,023.2	480.9	-923.1	935.5
Unknown diag. group	691.1	59.0	-248.4	128.6	4,609.1	369.1	-45.6	645.6

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	All Beneficiaries				Beneficiaries with Recent Work Activity			
	Early Entrants		Late Entrants		Early Entrants		Late Entrants	
Variable	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error	Estimate	Std. Error
Birth cohort 1935	56.2	8.9	45.1	21.2	357.7	67.5	338.1	114.6
Birth cohort 1936	25.5	8.9	-39.8	21.4	379.7	65.5	-39.5	115.1
Birth cohort 1937	-221.0	8.8	-219.2	21.4	-1,298.8	65.5	-911.3	115.1
Birth cohort 1938	-311.0	8.7	-302.6	21.1	-2,013.2	65.2	-1,062.2	113.8
Birth cohort 1939	-389.7	8.9	-479.7	21.5	-2,484.8	66.1	-1,657.5	116.2
Birth cohort 1940	-532.5	9.0	-587.8	21.9	-3,376.8	67.0	-2,016.9	118.2
Birth cohort 1941	-592.6	9.1	-724.6	22.3	-3,663.3	67.4	-2,490.9	120.3
Birth cohort 1942	-635.9	9.2	-775.3	22.8	-3,905.1	67.4	-2,630.3	123.2
High school	107.4	5.6	142.5	12.6	40.0	41.3	41.6	72.4
Beyond high school	1,065.5	8.0	1,341.1	16.2	3,468.7	51.1	3,592.6	84.7
Unknown schooling	170.9	5.7	391.1	16.3	658.3	44.3	1,347.2	94.6
PIA amount	2.5	0.0	2.2	0.0	8.2	0.0	5.0	0.1
Number of Observations	12,924,783		6,268,267		1,483,822		801,740	

Notes:
OLS specification for dependent variable annual earnings in 2008$.
Age reference group: 64.
Diagnosis reference group: blood.
Birth cohort reference group: 1934.
Education reference group: less than high school.