

# Spousal Labor Supply Responses to Government Programs: Evidence from the Disability Insurance Program

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## Abstract

Disability is a permanent unexpected shock to labor supply, which, according to the theory of the added worker effect, should induce a large spousal labor supply response. The Disability Insurance (DI) program is designed to mitigate the income lost due to disability. To the extent that it does this, it can crowd out the spousal labor supply response predicted by the added worker effect theory. Using a unique data set that matches administrative data combining workers' earnings histories and disability insurance applications, this study finds that DI receipt crowds out spousal labor force participation by 6 percent and the effect lasts up to 5 years after the husband's disability determination. Crowd-out effects of between \$1,200 to \$2,000 dollars are also found for earnings up to 5 years after determination. Since there may be substantial heterogeneity in husbands' underlying health status that could affect wives' labor supply adjustment, additional estimates are provided for a sample of wives with healthier husbands. These estimates represent upper bounds on the crowd-out effects of DI. For this sample, DI crowds out wives' labor force participation by 8 to 11 percent and earnings by \$2,400, and the effects are significant up to 5 years after determination.

Keywords: Disability Insurance; Crowd Out; Spousal Labor

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# 1. Introduction

At the time of the enactment of the Social Security Disability Insurance program (DI) in 1956 only about 21 percent of women worked, and men were the primary and perhaps only earners in the family.<sup>1</sup> Over the last 50 years, however, women's labor force participation has nearly tripled. Women now play an increased role in insuring their households against financial risk due to shocks from spousal disability and unemployment. There have, however, been very few studies that have examined how women adjust their labor supply to their husband's disability, and disability insurance receipt.

The first objective of this study is then to explore the temporal labor supply pattern of the wives of disabled men to understand how it evolves in the years leading up to, during, and after their husband's application for disability insurance. Understanding the extent to which disabled workers are insured by the labor supply of their wives provides some context for policy makers to understand what the profile of disabled worker households looks like prior and subsequent to application. To my knowledge, there is no other study that has looked at the wives of the disability insurance applicants with such extensive pre- or post-employment data.

The second objective of this paper is to measure whether and the extent to which husbands' disability insurance receipt affects their wives' labor supply. DI may affect the well-being of the entire household, because it provides both a direct transfer to the beneficiary and, as well, alters the marginal cost of work for the beneficiary's wife. DI benefits replace approximately 57 percent of pre-application earnings for the median income DI beneficiary (SSA 2006). Since benefits are progressive, this replacement rate may be much higher for lower income beneficiaries. Therefore, DI benefits may have the potential to crowd out spousal labor supply responses. Existing studies on the crowd-out effects of the DI program are mixed. Work by Coile (2004) finds that DI receipt by a spouse crowds out wife's labor supply by 296 hours in the year of the health shock, while work by Bound et al (2006) finds no effect. One other study on a related program, Unemployment Insurance (UI), finds that if the UI program did not exist, wives' total hours of work would increase by 30 percent during their husbands' unemployment spells (Cullen and Gruber, 2000).

To estimate the crowd-out effect of DI on wife's labor supply and to understand the temporal pattern of labor supply for these women, a unique longitudinal data set that matches Social Security Administrative earnings records, disability award records, and beneficiary records with information on married couples from the SIPP was assembled. In addition to the demographic variables such as age, race and education,

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<sup>1</sup> This statistic is for white women as reported in Goldin (1990), table 2.1.

the resulting dataset provides a rich source of information on the wife's earnings history, her husband's health status at the time of the disability award, and the result of his application to the DI program. The administrative earnings records extend the reach of the SIPP by covering substantial periods of time both before and after the application to the DI program.

The wives of DI applicants are an interesting group to study because these women have husbands who have self-identified as having a disability so severe that they cannot work and are seeking disability insurance. If their husbands' claims to having a permanent work preventing disability are valid, albeit a point that is resoundingly argued in the literature on the work disincentive effects of the DI program, which we will turn back to later, then the wives are similar in all respects, except one group has husbands that receive DI and the other does not. This database is then well suited to studying the impact of participation in the DI program on wives' subsequent labor supply.

To understand how a program like DI affects the labor supply of wives, this study provides a comparison of the labor supply trajectories of the wives of rejected DI applicants and DI beneficiaries. The main idea is that because both groups of women have disabled husbands, both groups will have a similar labor supply response to their husbands becoming disabled. The average treatment effect (ATE), which I refer to as the "crowd-out effect" of the DI program, can then be found using a comparison group approach. The term "crowd-out effect" is used because it is assumed that these wives have already responded to their husbands' disability, the so called Added Worker Effect, so that the effect of the DI program will then "crowd out" this added worker effect.

In estimating the crowd-out effect there are several issues that I consider in the specification of the longitudinal regression models. First, it may take time for wives to readjust their labor supply after the DI award decision is made. Allowing for this kind of flexibility in estimating treatment effect turns out to be important and our estimates show that the crowd-out effects on wives' labor supply span multiple years, with significant effects showing up as long as 5 years after the DI decision.

Second, since studies have shown that there may be substantial differences in the residual work capacity of workers who are rejected from the DI program, in further analysis it is important to estimate models that allow for unobserved heterogeneity that may be correlated with program receipt. Since we have longitudinal data, we can account for person specific fixed effects and we find that DI receipt crowds out wives' labor force participation by 6 percent and earnings by \$1,200 in the year following the DI decision.

Finally, the database also contains potentially useful information on the severity of husband's health condition at the time of disability determination. Further specifications segmented by husband's health status show much larger crowd-out effects for the wives of "healthier" applicants.

The remainder of the paper is laid out in six sections. Section 2 provides a review of the background literature related to studying crowd-out effects and an overview of the DI program in the US. This is followed by Section 3, which summarizes the data and presents descriptive statistics. Section 4 presents the empirical strategy used to estimate crowd-out effects and Section 5 presents the results. Section 6 discusses and extends the results to other findings in the research literature and Section 7 concludes.

## **2. Background**

### **2.1 Literature Review**

The focus of the existing literature on the Social Security Disability Insurance program has been on measuring the work disincentives of the program on men. One common finding among these studies is that the labor force participation rates of older rejected applicants is low, and for those who return to work their earnings are lower than before their application (see most recently, von Wachter et al, 2011). The most commonly cited explanations provided for this behavior are the decreased labor force attachment of these workers, and unfavorable labor market conditions for rejected disability applicants.<sup>2</sup> A third hypothesis, and the one that is explored more carefully here, is the increased role of wives in insuring their households against financial risk with their labor supply. The idea is that increased labor force participation of women increases the ability of wives to "insure" their husbands thus accounting for his lower labor supply post-application.

There are two strands of literature that are related to the question of how programs such as DI affect spousal labor supply. The first is the extensive body of literature on spousal labor supply response to poor health.<sup>3</sup> There are several competing hypotheses in this literature on the effect of husbands' health on wives' labor supply. The first theory suggests that the onset of a husband's poor health may decrease household income. This decrease in household income may change the marginal disutility of work for the wife, prompting a labor supply response. In this context, negative shocks to lifetime income (due to unemployment or poor health) may cause the wife to increase her labor supply, assuming of course that leisure is a normal good. This spillover effect has been widely studied in the unemployment literature and

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<sup>2</sup> See Chen et al (2008) for an outline of why rejected applicants may not return to work.

<sup>3</sup> Siegel (2006) provides an excellent review of this work.

has been coined the “added-worker effect” or AWE by Lundberg (1985). The same theoretical prediction also results if wives are forward looking and there is an expectation that they will outlive their disabled partner. In this case, a spousal health shock can affect the marginal utility of leisure outside of the standard neoclassical framework. Though the mechanism is different than in the neoclassical model, the theoretical prediction of the model is identical: there is a strong incentive for the wife to increase labor supply to provide adequately for future needs. These future needs could include increases in health costs (including health insurance) to cover her husband’s disability condition. Recent studies in this literature using the Health and Retirement Study have found that changes in husband’s disability status has a positive effect on wives’ labor force participation. Charles (1999) studied changes in health measured by a disability index and found that a change in husband’s disability status increased wife’s labor force participation by between 1 to 8 percent. Siegel (2006) finds that estimates of labor supply effects are sensitive to the measure of health status used. Most relevant perhaps to this study is her finding of a positive spousal labor supply effect for husbands who are severely disabled (have many functional limitations). Earlier evidence from the 1970’s suggests similar positive results (Berger and Fleisher, 1983). One notable exception is the work by Coile (2004) who finds no AWE for wives two years after their husband’s severe health shock (i.e., health status is measured as an acute event or onset of a chronic disease), but as will be explained later, finds a substantial AWE for the wives of DI applicants.

There are reasons, however, why this added worker effect may be dampened or non-existent. A husband with a deteriorated health status may also affect his wife’s valuation of her non-market time. For example, increases in time spent in care giving in the home, or, changes in her preferences for joint leisure with her husband could change the amount of time she chooses to spend in the labor market. Or, if the household has access to other program income such as DI, receipt of these benefits by the husband could spillover and affect his wife’s labor supply.

As explained earlier, a simple family life-cycle model, where utility is increasing in combined spousal income and a home produced good such as health would predict that negative shocks to lifetime income (due to unemployment or poor health), will cause the spouse to increase his or her labor supply, assuming that leisure is a normal good. However, the existence of government programs may crowd out the financial impact of unemployment on households and dampens the added worker effect. To examine this hypothesis empirically Cullen *et al* (2000) focus on the unemployment insurance (UI) program. Their estimation approach compares the differential labor supply of wives of high versus low earning husbands and exploits cross state variation in the generosity of unemployment insurance benefits. They use the level of UI benefits for which the husband is potentially eligible as an instrument for actual benefit receipt to account for the endogeneity of benefit receipt and its correlation with past work (and potentially taste

for work). They find that the wives of UI recipients would work 30 percent more if their husbands did not receive benefits. Albeit using older data and different methods, Berger and Fleisher find a similar effect that wives' labor supply response to husbands' poor health is attenuated by transfer payments. If transfer payments are available, wives decrease their labor supply (Berger and Fleisher, 1983).<sup>4</sup>

Beyond the two strands of literature discussed above, there are other studies that examine the inter-relatedness of couples' labor supply. As mentioned earlier, an alternative to the AWE is the hypothesis that couples share preferences for joint leisure. Studies that have found a joint leisure preference have focused primarily on older couples and have not examined the interaction between retirement and the reason for retirement (Blau (1998), Gustman (2000) and Hurd (1990)). When Johnson and Favreault (2001) distinguish between the retirement of healthy couples and couples where one spouse retires in response to health problems, they find that spouses are less likely to leave the labor force in response to their partner leaving due to health problems. This result is strengthened if the sick spouse is not yet eligible for Social Security retirement benefits. Johnson and Favreault's findings are suggestive that there may be an AWE among couples when one spouse retires "involuntarily" because of health reasons.

Taken together, the literature provides empirical support for an AWE of husband's health on wife's labor supply, but this may be crowded out by husband's receipt of DI. Preliminary evidence on the effect of DI on wife's labor supply comes from Coile (2004) and Bound, Burkhauser, and Nichols (2003) and is mixed. Coile (2004), in her study on the effect of husbands' health shocks on wives, finds a strong crowd-out effect on hours for the wives of DI beneficiaries two years after the health shock. Bound *et al* (2003) track the household income sources of DI applicants before and after they apply for DI and find no effect of DI (non) receipt on spousal earnings. Compared to earnings 36 to 38 months before application, the earnings of spouses are either flat or decline up to 3 years after application. They find the same earnings pattern for the wives of both rejected applicants and beneficiaries.

## **2.2 The DI program and the household**

The DI program was initially designed to provide benefits to workers who were permanently disabled and had made contributions to Social Security for many years. This program, called the Social Security Disability Insurance (DI) program, initially represented the only program that provided benefits to the disabled. In the decades since its establishment, the program has expanded to include those younger than 50 and the definition was liberalized to allow those without permanent disability to qualify. The program was also expanded to include dependent spouses and children. Eligibility for the SSDI program was and still is based on having worked in covered employment as well as evidence of a work limiting illness. The

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<sup>4</sup> Transfer payments from the DI program were not considered explicitly in Berger and Fleisher's analysis.

second main component of the current DI program, called the Supplemental Security Income (SSI) program was introduced in 1972. We do not consider the wives of DI applicants that apply only to the SSI program so the rules and benefits of this program are not discussed here.

DI applicants have to go through the disability determination process. This screening process is made up of five stages designed to identify the easiest cases to assess first (either the most severe or the most able bodied) while leaving the judgement of harder cases (marginal applicants) to later stages. Figure A1 shows a flowchart of the five-stage determination process. Of particular relevance to this analysis is the final stage in this process — Stage 5. At this point, the marginal applicants are assessed on the basis of educational and vocational factors in addition to medical criteria. The sample of wives of Stage 5 applicants will be discussed in greater detail later on.

### **2.3 The Structure of the DI Program and Spousal Benefits**

In addition to the individual DI benefit provided to disabled workers, more than 1.7 million individuals received benefits as dependent family members of disabled workers in 2005. Approximately 95 percent of these dependents were the children of disabled workers. The rest consisted of spouses of disabled workers who were taking care of children under the age of 16. Spouses and children of disabled workers can receive benefits of up to 50 percent of the disabled workers' Primary Insurance Amount (PIA). Monthly benefits to spouses and children, however, are limited to a family maximum, which is 85 percent of the Average Indexed Monthly Earnings or 150 percent of the Primary Insurance Amount (PIA).<sup>5</sup> On average, a worker receives \$938 per month. The average monthly spouse benefit is \$247.20 for wives.

Spouses also face an earnings ceiling for DI spousal benefits. If they earn more than \$12,000 (in 2005) per year, there is a 50 percent tax on earnings for every dollar above this amount.<sup>6</sup> Perhaps because of this earnings cap and the relatively low benefit for spouses, the number of DI spouse beneficiaries is small and has not grown at the same pace as worker beneficiaries. In 2005, there were approximately 86,029 wives receiving DI benefits under their spouse's record. Aggregate data on the number of spousal beneficiaries in the SSDI program suggests that the number of spouses receiving SSDI benefits has actually decreased over time.<sup>7</sup> This conforms to the trend of more women entering the labor force over this time period and therefore being ineligible for spousal benefits.

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<sup>5</sup> See Social Security (2006), 2.A8–2.A19 for the formulas used to estimate the PIA

<sup>6</sup> For every two dollars above this amount, their benefits are reduced by one dollar. While the disabled worker's benefits do not change because of spousal earnings, the family benefit, which provides for children and the spouse, can change as a result of spousal earnings.

<sup>7</sup> Unless otherwise noted, all statistics reported in section 2.3 are from the 2006 Annual Statistical Supplement of the Social Security Bulletin.

### 3. Data

The data used in this study consists of various panels of the Survey of Income and Program Participation (SIPP) exact matched to administrative records from the Social Security Administration. The resulting longitudinal dataset includes the earnings histories for a sample of married women whose husbands applied to the disability insurance program between 1980 and 2008. The long earnings histories allow a more complete analysis of the effect of husband's disability and disability award on wife's labor supply at both the intensive, to the extent that this is measured by earnings, and the extensive margin.

There are a number of advantages to using the restricted Social Security earnings histories merged with the SIPP. First, using the SIPP alone results in sampling issues because SIPP panels are in general rather short. As a result, a SIPP panel would only have useful pre-application employment data for a subset of people who applied late within the panel, but then their post-decision labor market outcomes would only be observed for a few months — if at all. This would be somewhat pronounced for the earlier SIPP panels, which were particularly short (around 2 years in length). The addition of the administrative earnings histories provides employment histories, which allows a comparison of pre- and post-award labor force participation across a longer and more comparable time horizon. The additional benefit of using the administrative earnings data (as opposed to only SIPP earnings data) is that the sample sizes that result from the merge are now larger and earnings histories are much longer.

Second, the SIPP alone does not contain detailed DI award information. The merge with the SSA restricted 831 File provides a detailed history of DI applications and awards at the state level. The key items used from the 831 File are the date of award decision, the age of the husband when the DI application was filed, the stage in the disability determination process where the application decision was made, and the type of impairment on file and the actual DI decision. The sample from the 831 File is right censored with regard to the award decision for adjudications that were referred above the state level. To overcome this bias, the award outcomes from the 831 File were updated with DI beneficiary information from the SSA Master Beneficiary record.<sup>8</sup> While this updating may mitigate the bias, there is still some bias because there will always be a subset of applicants who are going to re-apply to the program at some time in the future.

There are some drawbacks to using this merged dataset. The information from the SIPP still has to be used in order to ensure that the couple is married at the time we observe the longitudinal earnings data. We use retrospective marital history information from the SIPP topical module to ensure that the couple is

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<sup>8</sup> The SSA Master Beneficiary record contains benefit/payment information for all beneficiaries to the DI program.

married throughout the time period for which we have SSA administrative data on their earnings. This limits the size of the sample post-award because the post-award earnings observations have to fall within the SIPP panel to ensure that the couple is still married post-award, but given the empirical evidence on the effect of wage shocks on marital disruption, this ensures that our sample of married women remains married through the periods that we observe their labor supply.

Another potential drawback is that, to the extent that people work in covered employment, the SSA administrative data is perhaps not subject to the recall bias issues that occur in the SIPP. If people, however, do not work in covered employment, then their earnings are not counted and accurately reflected in the administrative data. Moreover, while the labor force participation and earnings data obtained from the administrative earnings records extends the reach of the SIPP, it is important to note that we are still somewhat limited in the number of control variables that can be used in this analysis. Other time varying variables such as health insurance coverage, type of job, and age and number of children within the household (though in the SIPP) can no longer be used, because they are not available to match chronologically (for all time periods) with the earnings records for the full sample.<sup>9</sup>

To construct the data set, the 1990-1993, 1996, 2001 and 2004 panels of the SIPP were merged with the restricted Social Security records described earlier. The resulting dataset contains detailed DI award information, labor force participation, and earnings histories for a sample of married women whose husbands applied to the DI program between 1980 and 2008. Wives whose husbands applied to the Supplemental Security Insurance program were not included in the sample. The women selected for the study were between the ages of 29 to 59 at the time of their husbands' DI award decision.<sup>10</sup> The earnings histories used were for women between the ages of 20 to 60 years of age. There are earnings histories for some women for as far back as 10 years prior to their DI application and award.

The combination of these data sources created a unique longitudinal dataset that can be used to study pre- and post-award spousal employment more accurately than relying on information from the SIPP alone. The data structure used for this analysis follows that of von Wachter et al (2011), where the unit of observation is the individual and the panel variable is time that has elapsed (measured in years) since the husband received his final DI award decision. The panel constructed is unbalanced and consists of women with information from as early as ten years before the husband's DI award decision and up to 8 years after, as shown in Figure 1. There were 39,519 women in the main sample. As Figure 1 shows, labor

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<sup>9</sup> A detailed description of how the data were assembled will be available in a data appendix available from the author. See Czajka et al (2007) for a detailed analysis of any biases that may result from exact matching the SIPP to SSA administrative records.

<sup>10</sup> The married male applicants were between the ages of 30 to 65 at the time of application to the DI program.

force participation trajectory is U-shaped with the minimum occurring around the time of the award decision. There is a small dip (approximately 4 percent) in the labor force participation of women in the year of the husband's DI award decision. The earnings trajectory, also displayed on Figure 1, does not show a pronounced dip, but the monotonic increase seen in the trajectory pre-decision is not apparent after the DI award decision. These graphs display unconditional means. The analysis below will take into account age, education and other characteristics that affect the earnings and labor force participation of women to decompose how DI award affects wives' labor supply.

<Figure 1 here>

The mean characteristics of the married women used in the main analysis are described in column 2 of Table 1. At the time of the DI award decision the women were on average about 49 years old. The sample was older with approximately 85 percent of married women coming from cohorts born before 1956. The sample was approximately 23 percent nonwhite and the level of education was low with approximately 32 percent of the sample having more than a high school education. Approximately 64 percent of these women were working in the year that their husbands received their disability determination and these women earned on average \$21,031.<sup>11</sup> The changes in wife's pre- and post-employment will be explored in greater depth in the next section. Not surprisingly, since the mean statistics reported are for the year of the husband's application to DI, husbands' earnings were low at \$6,801. On average, the length of time between first filing and final award decision was almost 1 year.<sup>12</sup>

<Table 1 here>

## 4. Methods

The empirical strategy used in this analysis relies on a fixed effects approach that measures the changes in the wages of DI beneficiaries over time relative to the wives of rejected DI applicants. This approach extends Bound's (1989) analysis, but instead uses the wives of rejected disability applicants as the counterfactual. The assumption is that the wives of rejected DI applicants provide a good potential comparison group and their wage growth can capture the evolution of wages that would have occurred had the wives of beneficiaries not received any spousal benefits. Later on, I will comment on the validity of this assumption and provide estimates for a more homogeneous sample of marginal applicants where I argue this assumption is most likely to hold.

<sup>11</sup> The Bureau of Labor Statistics reports that in 2010, 57.4 percent of married women worked (BLS, 2011). The labor force participation rate reported here is much higher than this because our sample has less education, is more likely to be black and is older than the national sample upon which the BLS statistic is based.

<sup>12</sup> The time between filing was constructed as in von Wachter et al (2011) and takes into account reconsideration decisions at or below the state level.

The fixed effects estimation method used fully utilizes the observable characteristics of wives and their labor supply histories and follows Jacobson et al (2003), Bound et al (20 and more recently von Wachter et al (2011). In this model,

$$y_{it} = \alpha_i + \theta t + \gamma X_{it} + \sum_{k \geq -9}^{\leq 10} \delta^k D_{it}^k + u_{it}, \quad (1)$$

where  $y_{it}$  denotes the labor supply outcome of worker  $i$  at time  $t$ ,  $\alpha_i$  is an individual level fixed effect to control for time invariant unobserved heterogeneity,  $X_{it}$  is a vector of individual covariates,  $D_{it}^k$  is an indicator for the  $k^{\text{th}}$  year before or after the wife's husband received DI benefits. The  $\theta_t$ 's represent a calendar year time trend to account for wage growth across calendar time and the parameter  $\delta^k$  can then be interpreted as the effect on wife's labor supply of her husband's DI award  $k$  years before/after its occurrence. The parameter  $\delta^k$  is measured relative to the change over time for rejected applicants and relative to the baseline period, which in this case is 10 years before the husband's DI award decision.

The vector of controls  $X_{it}$  includes husband's earnings and interactions between wife's education and age and the interaction terms squared.

The data are set up to study how labor supply evolves around an event (the DI award date).<sup>13</sup> Since the data actually covers a period from 1980-2008, this method assumes that, for example, a wife whose husband received DI in 2008 and a wife whose husband received DI in 1995 will have similar responses one year after, two years after, etc., the event. As well, year fixed effects were included in the model to capture business cycle effects. In addition, since younger female age cohorts may have markedly different labor force attachment, the subsequent analysis is also presented by age cohort.

Nevertheless, the database does span 28 calendar years. The decision to use such a long lag and lead time was largely based on the desire to understand how the wages of wives evolve over time. It is also likely that during this time there may have been changes in the composition of the applicant pool. Recent research has suggested that more recent DI applicant cohorts may be younger than previous cohorts and may be presenting with less disabling conditions (van Wachter et al, 2011). In our sensitivity analysis, we, therefore, present estimates that are based on subsamples by wife's age cohort and husband's underlying health status. Arguably, husband's health status may be accounted for by the individual fixed-

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<sup>13</sup> A decision was made to use award decision date as opposed to application decision date. Additional empirical estimates using application data (not presented in this paper) prove this to be a moot point, since the results of using application date were not significantly different – they were just moved up by 1 year.

effect term but there is also a rich set of variables that could be potentially useful in modeling the severity of the husband's medical condition. The dataset assembled includes information on husband's impairment as listed on his disability application and the stage in the application process where the disability determination was made. Since the disability determination is set up to award benefits to the most severely disabled or most obviously not disabled (easiest to determine) at early stages, the stage in the DI process where the award determination is made may be a potentially useful way to control for severity of illness. The subsequent analysis, therefore, presents fixed effects estimates for subsamples by these measures of health status.<sup>14</sup>

#### **4.1 Identification and the evolution of wages**

The fixed effects estimates are likely to be biased if the control group is different in observed and unobserved characteristic. In order to assess the appropriateness of using wives of rejected applicants as a comparison group, the mean characteristics of the wives are compared by group in columns (2) and 3 of Table 1. Inspection of the t-values for the difference in means reported in this table shows that the mean characteristics of wives are similar in all demographic characteristics, except for age. As we would expect, wives with rejected spouses are younger than their accepted counterparts. Table 1 also contains the earnings information for the disabled husbands in the year they were awarded DI benefits. The husbands who are awarded DI earn more than those who are rejected.

In the year of the award decision, there is no significant difference between the labor supply of the wives of rejected versus beneficiary husbands. This holds for both earnings and labor force participation. The lack of a labor supply effect could be because there may be a lag between the award decision and when we observe a labor supply effect. To explore these conjectures further, the earnings histories available in the data are used to track women 8 years before to 8 years after their husbands receive their DI disability award notification. The mean annual earnings and labor force participation trajectories for the wives of disability applicants are shown in Figure 2 by treatment status, where treatment is husband's receipt of DI. This unconditional picture shows that the earnings of both groups are very similar pre-application and that they both follow the common time trend assumption needed for identification. Starting at about 8 years before the husbands' award decision, the earnings trajectories for both groups of wives appears to be similar, though the wives of beneficiaries have higher earnings. As older workers tend to earn more, and beneficiary wives are older, this finding is consistent with what we would expect. About 1 year

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<sup>14</sup> Since the individual fixed effects are viewed as nuisance parameters, the within transformed data was used to estimate the parameters. The fixed effects estimator was implemented using the *xtreg* command in STATA SE Version 11.

before the husband's DI decision the earnings of wives of both groups begin to dip. This descriptive picture suggests that both groups of women may be decreasing their labor supply in response to their husband's health status. For this sample of women, the difference in mean earnings across the groups for all time periods are not statistically significant. A visual inspection and a test of the statistical difference in means, reported in the Appendix, also confirms no divergent trends in the labor supply of the two groups of women pre-award.<sup>15</sup>

<Figure 2 here>

## 5. Results

### 5.1 Main Results

This section provides fixed effects estimates using the empirical approach and identification strategy described earlier. The baseline conditional fixed effects estimates are summarized in column 1 and 2 of Table 2. These estimates show that the crowd-out effect of DI on labor force participation of wives is approximately 6 percent starting about 1 year after the DI award decision. The effect persists up to 5 years after the decision and grows to approximately 8.4 percent. There is no crowd-out effect on earnings. In fact, the measured effect on earnings suggests that one year after the DI award, the wives of beneficiaries earn \$1,644 dollars per year starting 2 years after the DI decision, and their earnings increase to approximately \$2,479 in year 5. There are no significant differences in the pre-award labor supply of the two groups. These fixed effects findings together with those of samples discussed below are also summarized in Figure 3. In order for the reader to evaluate the statistical significance of the estimates in each period, the regression results are displayed in the Technical Appendix, Tables A2 and A3.

<Table 2 and Figure 3 here>

### 5.2 Sensitivity Analysis

#### *Age Cohorts*

There may be generational differences in wives' labor supply and attachment to the labor market. To account for this source of heterogeneity, the sample was separated into cohorts by birth year. Women are assumed to be in an older cohort if they were born before 1946 and in a young cohort if they were born

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<sup>15</sup> See Table A1 in the Technical Appendix for a summary of the mean earnings and labor force participation estimates for this baseline sample.

between 1976 to 1946. Figure 4 presents the unconditional labor supply trajectories by beneficiary status of the husband. The top graph shows that the labor force participation of younger wife cohorts is higher, both for treated and untreated wives. The trajectories for older wife cohorts show the pattern predicted by theory, whereby for pre-award decisions the trajectories for both the treated and untreated wives are similar, and then post-award the trajectories diverge, with the wives of rejected applicants having higher labor supply. A statistical test however shows that these differences are not significant.<sup>16</sup> Fixed effects estimates for the older cohort are presented in Table 2, column 4. Even after including controls and individual level fixed effects there is no effect of husband's DI receipt on wives' labor force participation. Similar results exist for the wives of younger cohorts, with one exception. The fixed effects estimates presented in Table 2, column 3 for the younger wife cohorts show that at one year post-award decision, there is a significant effect where DI crowds out participation by 8.8 percent. These participation effects do not persist past the year after the decision.

<Figure 4 here>

The lower panel of Figure 4 shows that younger wife cohorts have higher average earnings. The pattern and significance of the unconditional means for older cohorts is exactly as described for labor force participation. For younger cohorts, however, there are significant differences in the unconditional means both before and after the husband's DI decision.<sup>17</sup> The fixed effects estimates presented in Table 2, column 3 present a different pattern than the unconditional means. When we account for individual level fixed effects and observed heterogeneity, there is no significant difference between treated and untreated women before the DI award decision. During the year in which, and up to 2 years after their husband's decision, the wives of beneficiaries earn \$1,600 to \$1,800 less than those whose husbands were rejected. If a more conventional 5 percent significance level is used, the crowd-out effects are only significant in the year after the DI award decision.

### *Severity of Illness*

Even among people with the same health condition, there may be substantial heterogeneity in the severity of their illness and disability. While the assembled database does include the health condition of the husband as reported to the Disability Determination Service, it also includes another potentially useful measure of health condition severity – the stage at which the applicant was determined to be disabled (or not). There is one particular stage of the disability determination process that is interesting for both

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<sup>16</sup> The statistical difference in mean labor force participation are reported in Table A1 in the appendix and they confirm that there are no divergent trends in the labor force participation trajectories between wives of rejected applicants and beneficiaries within the older cohort sample.

<sup>17</sup> See Appendix 1, Table 1.

estimation and policy purposes. About 40 percent of disability applicants are determined at Stage 5, the final stage of the determination process.

One way to control for severity of illness is to look at women whose husbands were assessed at Stage 5 of the disability process. About 40 percent of applicants to DI reach this final stage. This group is interesting because these are the marginal or most difficult to assess of all applicants to the DI program. To reach this stage, it means that their health condition was not severe enough to have been awarded benefits in Stage 2, or healthy enough to have been rejected in Stage 3 or 4.<sup>18</sup> At stage 5, these applicants are now being assessed based on their age, education and other vocational factors to see if they can carry out any kind of work in the economy. Arguably, because they have gone through the DI screening process and have gotten to this stage, all the men in this sample have illnesses of equal severity.

The unconditional earnings and participation trajectories for this homogeneous subsample are shown in Figure 5. The figure shows that the participation rates of wives of the rejected are higher than the rates of wives of beneficiaries throughout most of the period under study. Earnings show a similar pattern up until around the time of the award decision. After the award decision, the earnings trajectory for wives of beneficiaries is much higher.

<Figure 5 here>

The conditional fixed effects estimates for this subsample of wives are reported in Table 2, column 5 and show very different results. The estimated crowd-out effects of DI receipt were between 8 to 11 percent for labor force participation. There was also a significant crowd-out effect for earnings. DI benefit receipt crowded out earnings by approximately \$2,400. In both cases, the labor supply effects persisted up to 5 years after the DI award decision.

These results are mirrored in the estimates for a subsample of women whose husbands have musculoskeletal disease. The severity of this disease is hard to assess and the number of DI applicants who list this medical impairment has increased substantially over the past 30 years. Currently, approximately 28.2 percent of DI beneficiaries are listed as having this impairment (SSA, 2010). Table 3 presents estimates for samples of women whose husbands have this impairment.<sup>19</sup> For musculoskeletal disease, the crowd-out effects are significant for all women. These crowd-out effects range from 8.5 percent to 14.2 percent for labor force participation for the baseline sample. When the sample is separated by age cohort, the crowd-out effects are large and significant for younger cohorts only. For this

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<sup>18</sup> See Figure A1 for a detailed flow chart of the stages of the DI program.

<sup>19</sup> Though not presented here, alternative specifications for other significant impairments showed no significant crowd-out effects.

young sample, DI benefit receipt crowds out wife's labor force participation by as much as 21 percent in the year after the DI award.

For earnings, we see the same pattern as described earlier. Beneficiary wives earn more than the wives of rejected DI applicants and their earnings post-award are greater.

## 6. Discussion

In evaluating these findings, it is useful to recall that the wife's labor force participation decision depends on whether she is more efficient at home or in the market. A wife's time spent in the labor market will then depend on her ability to maintain their income, costs of entry (or increased labor supply) into the market and the substitutability of the spouse's time spent producing her partner's health. The results presented above can be used to inform these predictions from this theoretical model.

For the baseline sample of women, husband's DI receipt decreased labor force participation by 6 percent in the year after the DI decision and these effects did linger over time. Significant crowd-out effects were estimated up to 5 years after the DI decision. There is only one other study that estimates the crowd-out effect of labor force participation, the work of Cullen *et al* (2000). The estimates reported here were much smaller than those reported by Cullen *et al* who reported crowd out estimates for the UI program of 30 percent. At first, it may seem somewhat surprising that crowd-out effects of a program like UI (which has healthier beneficiaries) should be larger. But as suggested earlier, a wife's time spent in the labor market also depends on the substitutability of her time spent producing her husband's health. It may be the case that women with sicker husbands spend more time care-giving. The question of care-giving is not explicitly considered in this paper. If it is assumed that the more severely ill that someone's husband is, the less "substitutable" is their time at home, then the earlier estimates presented by health status can also be used to address time substitutability. The effects reported for groups with husbands with a homogenous health condition, which is arguably "healthier" than the baseline sample, are large and persistent post-award compared to baseline estimates. These findings lend some support to the notion that women with healthier husbands may have more "substitutable" time than those with sicker husbands.

The same consistent pattern that I found for participation was also observed for earnings. DI program receipt decreased wives' earnings. The only other study to compare these findings with is that of Bound *et al* (2003) who found no effect of DI receipt on spousal earnings. Possible reasons for this difference in estimates could be that Bound's estimates were not decomposed by sex. Perhaps there is heterogeneity among the labor supply responses of wives versus husbands to DI award receipt. In addition, Bound's estimates were based on self-reported earnings in months 37 to 39 after application taken from the SIPP.

Contrast that with the data used in this study which is annual earnings from administrative sources that span a longer time period.

It is also important to consider how this study reconciles with recent findings on the labor supply behavior of men. As noted, women whose husbands are rejected from the DI program do work more than the wives of beneficiaries and this effect is driven predominantly by the behavior of younger cohorts. This is somewhat contrary to what we would infer from reading the recent literature. Von Wachter *et al* (2011) report that older men (age 45-64) do not return to their pre-disability labor force participation rates, but younger men do. Moreover, the earnings of younger men, in particular those in more recent time periods (1992-2002), do rebound to pre-disability levels. These findings would suggest that the crowd-out effect of DI should be concentrated among older wives. This is not what I find. The crowd-out effects on labor force participation are largely concentrated among younger women.

In Von Wachter *et al*'s research (see the appendix to published paper) there is an increase in the number of DI beneficiaries with non-terminal impairments such as musculoskeletal disease or mental illness. And, the rejected male applicants with these conditions are more likely to work. The estimates reported earlier for the older cohort of wives of men with musculoskeletal disease show higher crowd-out effects on earnings. While the wives of younger cohorts of men with the same disease show higher crowd-out effects on labor force participation. The pattern seen here is only somewhat consistent with the patterns documented for males in von Wachter *et al* (2011).

## 7. Conclusions

This paper presents estimates of the effect of the DI program on wives' labor supply. A sample of married women whose husbands applied to the DI program is tracked over a time span that is both before, during and after the DI award decision. Since previous research suggested that there is an AWE of husband's health on wife's labor supply, the effect of DI on wife's labor supply is best interpreted as a crowd-out effect. The findings presented in the paper show that the DI program does have a small significant crowd-out effect on wives' labor force participation of approximately 6 percent, and on wives' earnings by between \$1,500 to \$2,000. These effects are significant and persist up to 5 years post-DI award.

By studying a homogenous group of wives with healthier husbands, we have attempted to isolate the effect of DI receipt on wives' labor supply. These estimates are therefore larger and could be interpreted as an upper bound on the crowd-out effect of DI. The labor supply response for this sample was large at approximately 11 percent for labor force participation, and about \$2,500 for earnings, persisting up to 5 years post-determination. A similar type of analysis by medical impairment found even higher crowd-out

effects. Future studies on the effect of disability and disability insurance on wives' labor supply should explore other methods of understanding how substitutable a wife's time is between market work and time spent producing her husband's health.

While this study explores the heterogeneity of the treatment effects with respect to age cohort, husband's health status, and husband's impairment, there are other aspects of wife's labor supply that should be studied for this population. In particular, understanding more clearly how the potential costs of (re)entry affect labor supply adjustment for this group of women would also be of interest. Educational attainment can be used to understand the role of costs of (re)entry if it is assumed that women with higher education have lower cost of (re)entry into the labor market. Though not presented in the paper, when education was interacted with treatment status, these specifications did not lead to significant heterogeneous crowd-out effects. Future research in this area should, however, continue to explore this question by controlling for work experience and type of work.

Understanding and quantifying the effects of the disability insurance program and health shocks on the labor supply of married couples is important because it provides information on how a husband's early retirement due to disability will affect his wife. Since wives tend to be younger than their husbands and are likely to outlive them, reduced resources due to the husbands' early retirement and disability will then ultimately be more of a long term burden to the wives. By providing empirical evidence on wives' labor supply response when their spouses become ill and retire early, the result from this study assists in predicting the future retirement patterns and experiences of women.

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Figure 1: Average Annual Employment and Earnings for Wives of DI Applicants

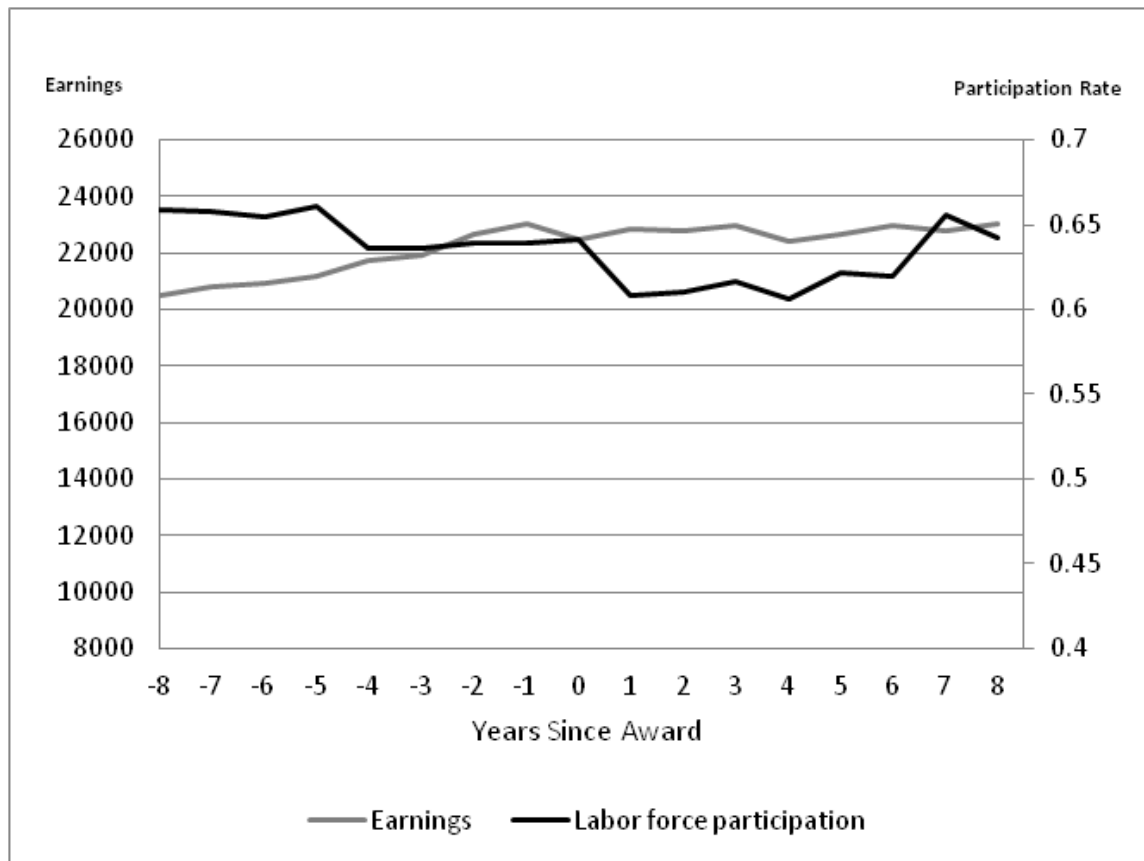


Figure 2: Average Annual Employment and Earnings for Wives of DI Applicants by Award Status

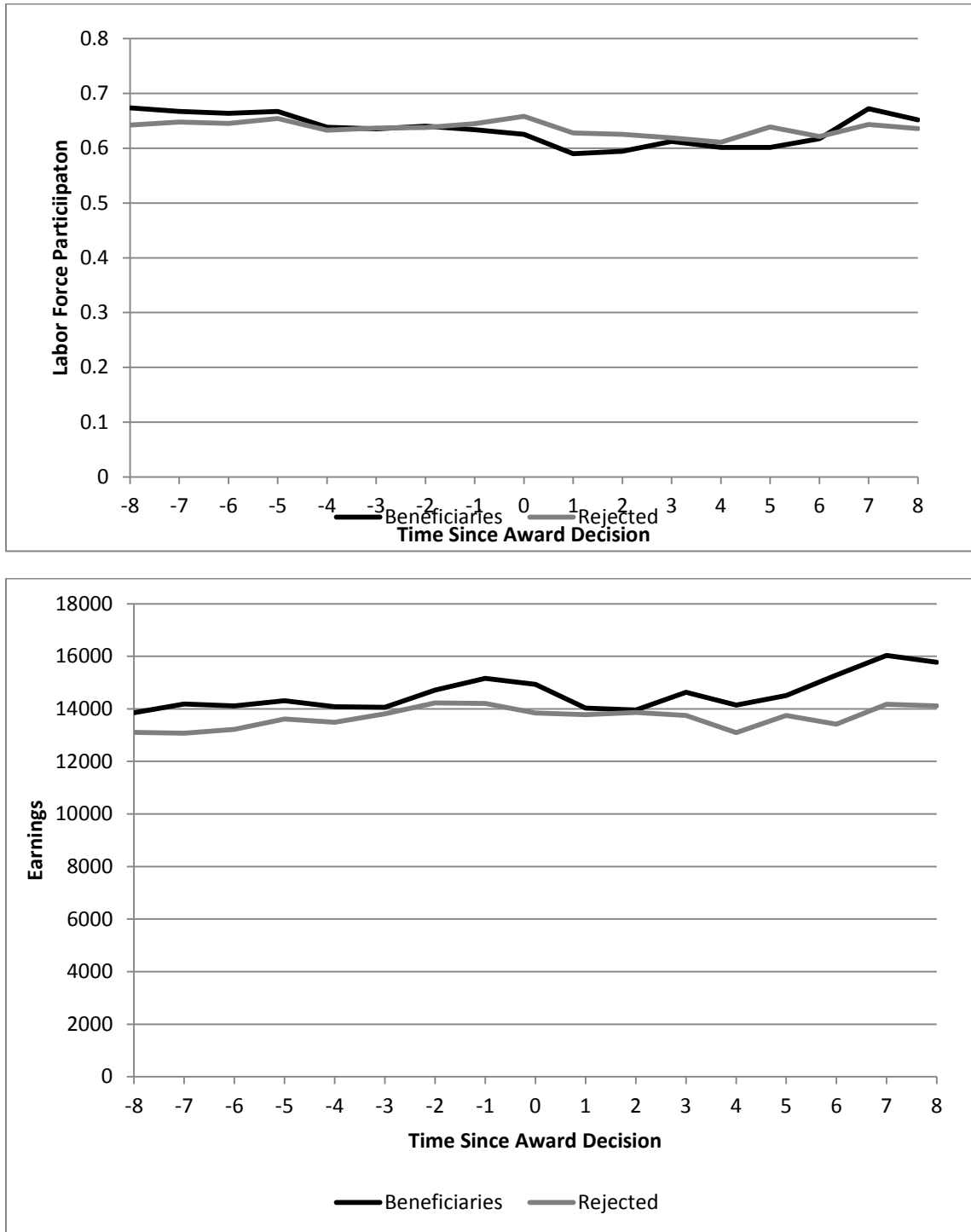


Figure 3. Fixed Effects Estimates Of The Crowd-out Effect Of DI On Wives' Labor Supply

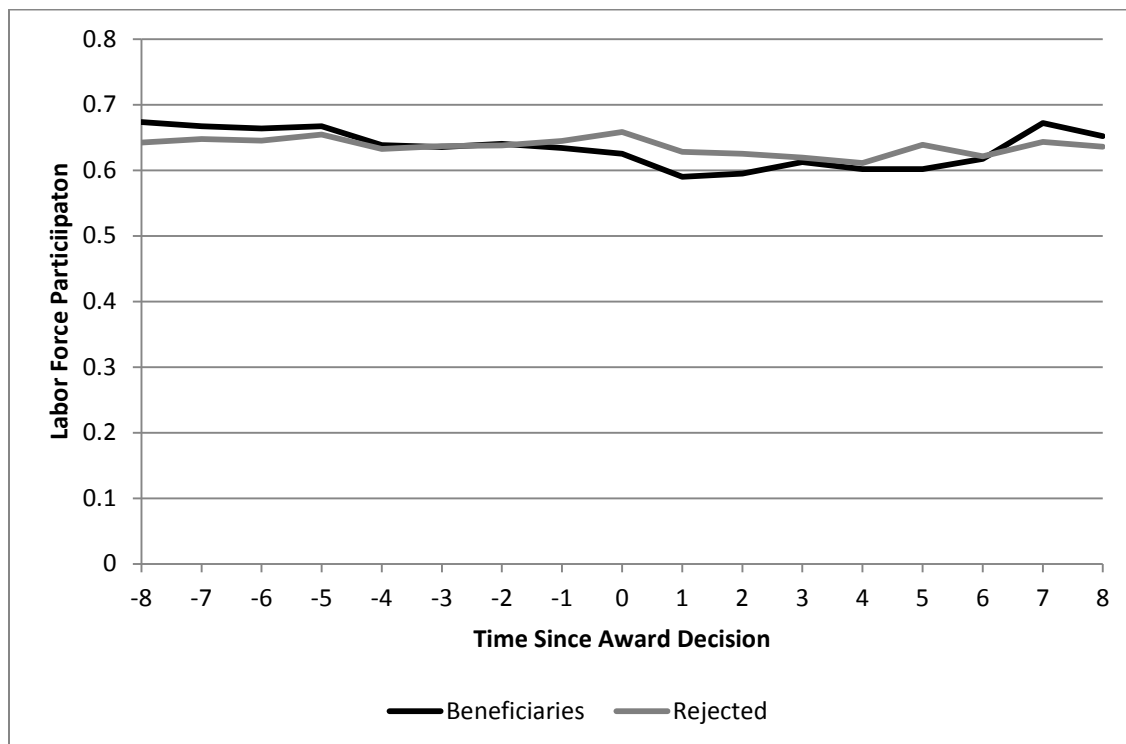
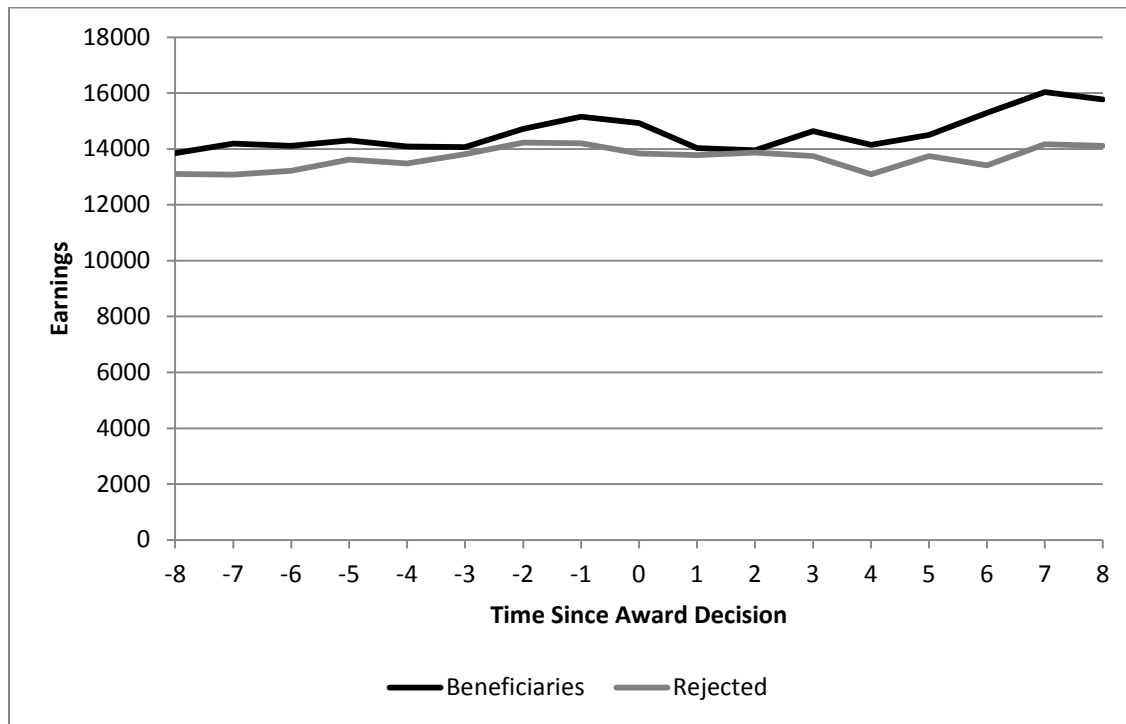


Figure 3. Fixed Effects Estimates Of The Crowd-out Effect Of DI On Wives' Labor Supply

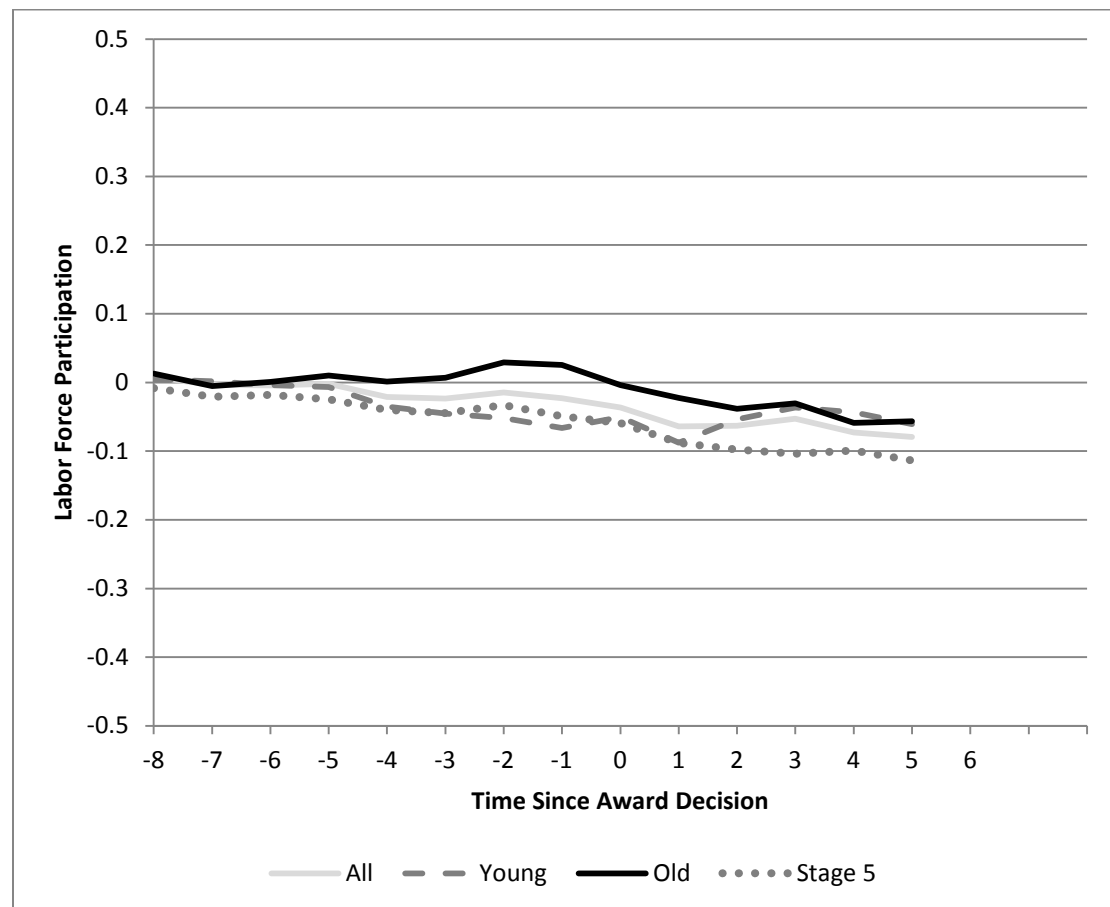
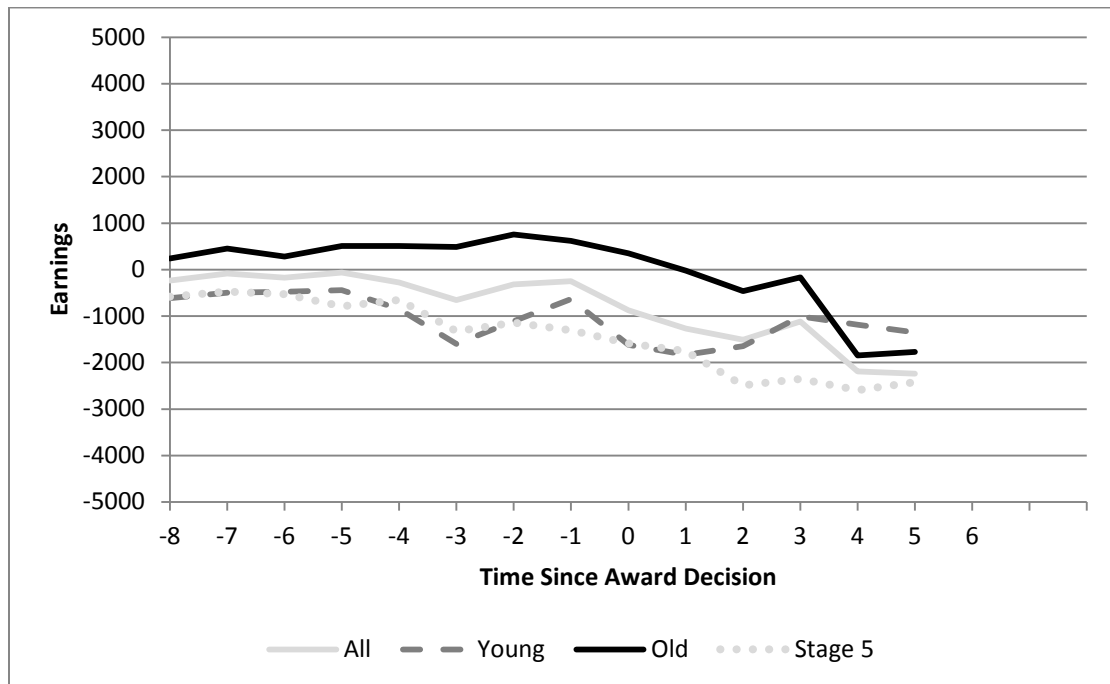


Figure 4: Average Annual Employment And Earnings Of Wives Of DI Applicants By Cohort

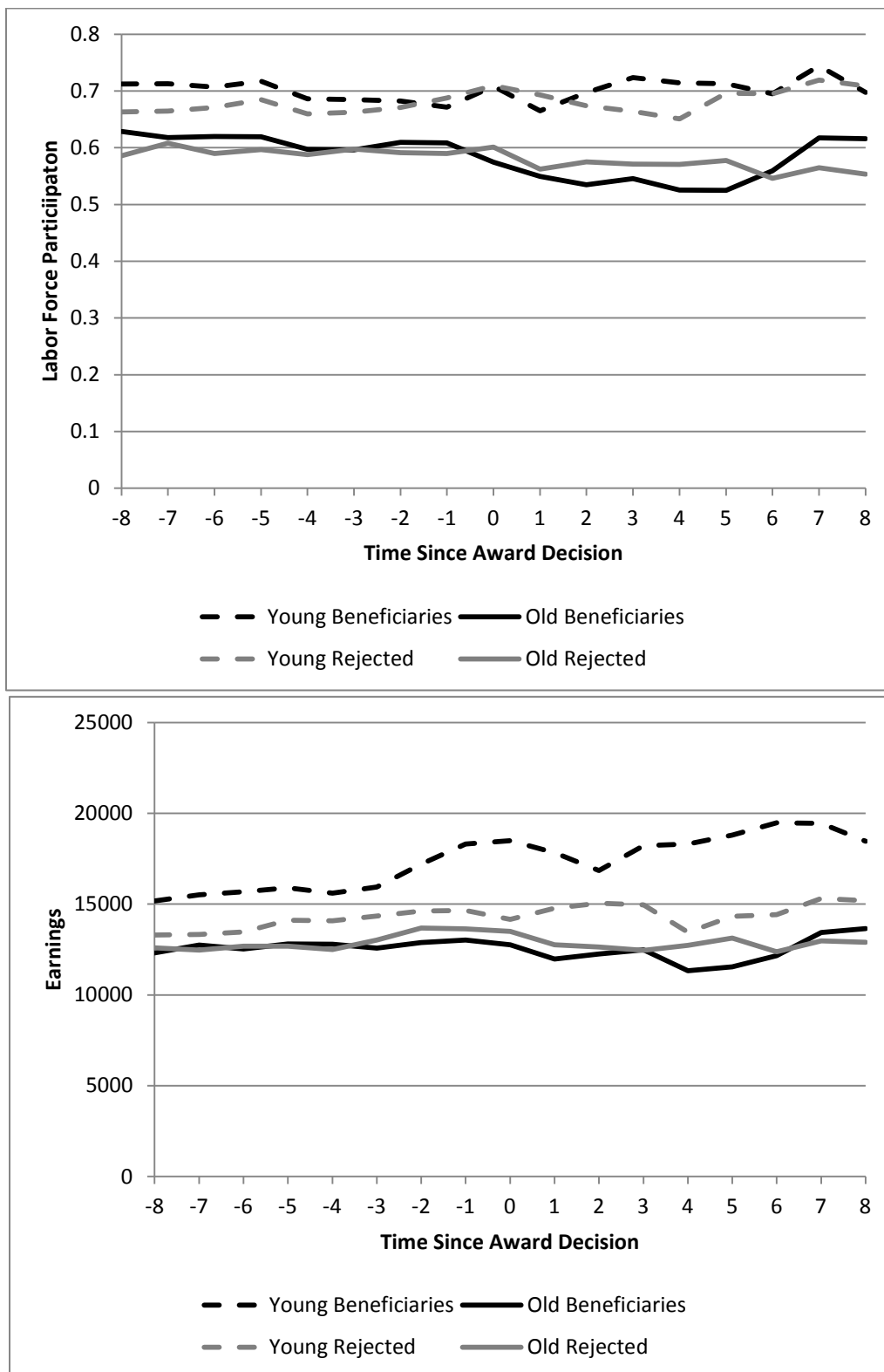


Figure 5: Average Annual Employment And Earnings For Wives Of Healthier DI Applicants

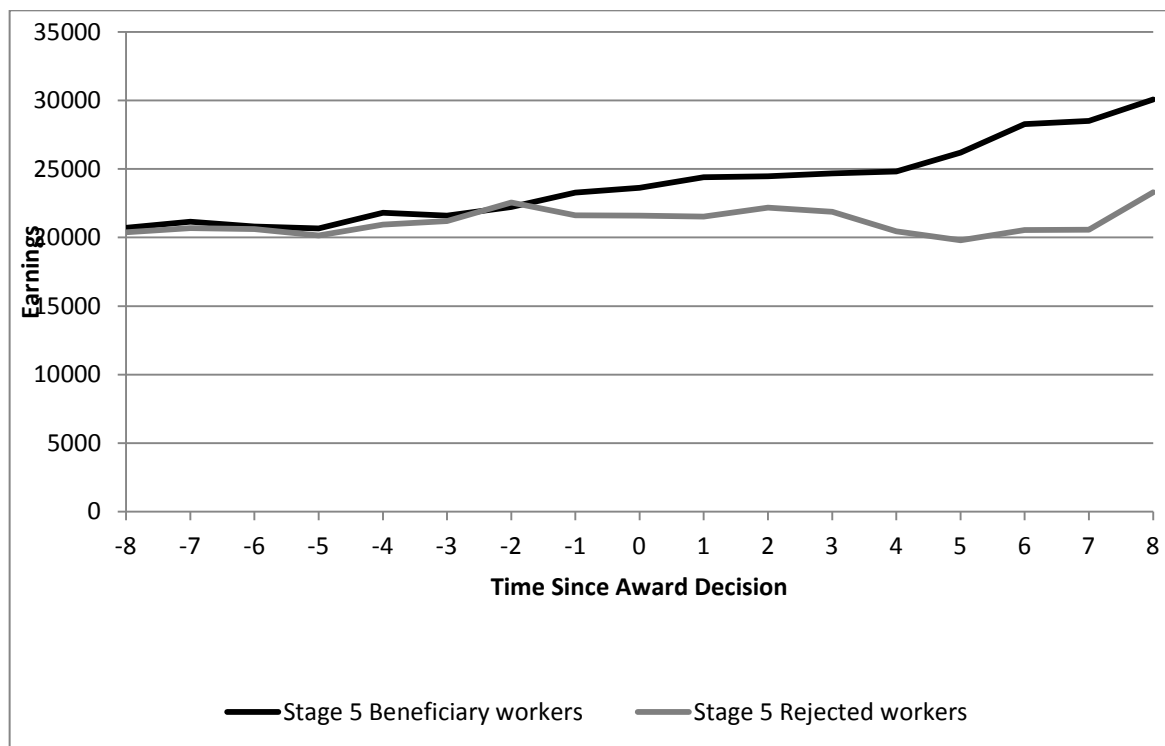
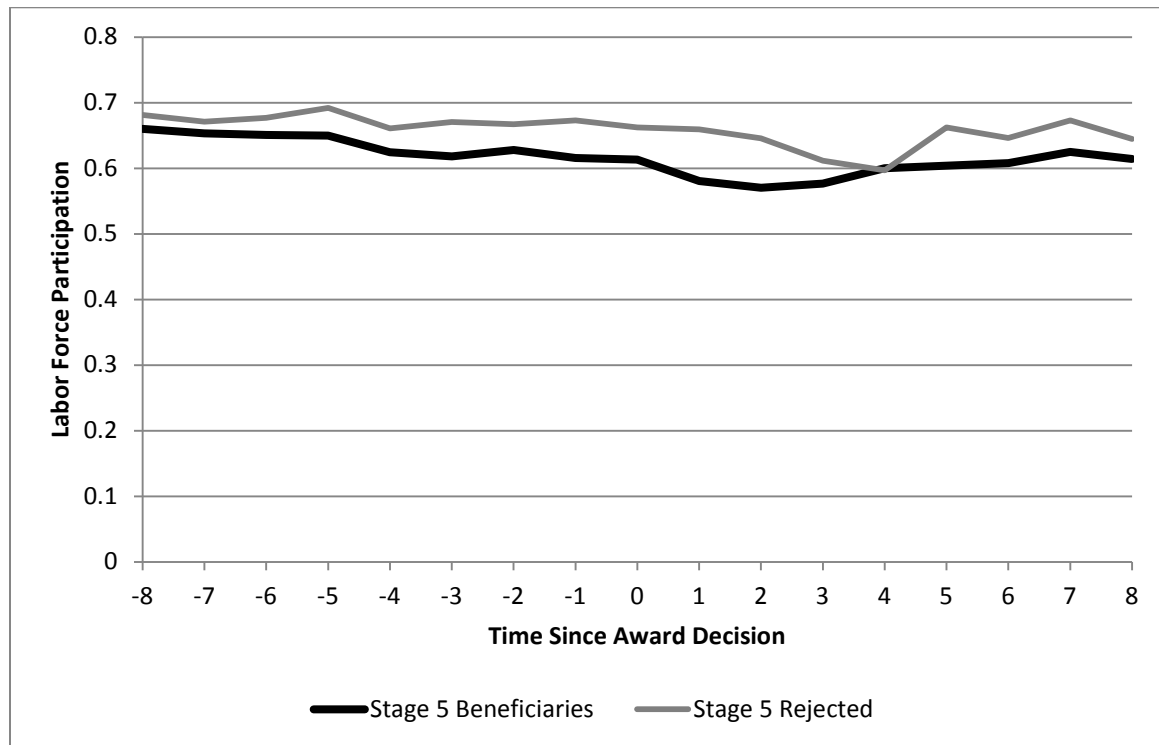


Table 1: Sample Means For Wives At The Time Of Their Husband's Award Decision

	<b>Sample Mean</b>	<b>Husband Rejected</b>	<b>Husband Accepted</b>	<b>t-value<sup>1</sup></b>
Age	49	47	51	11.14
Race (Percent Non White)	23.14	22.98	23.29	0.17
Percent with more than a high school diploma	32.38	34.15	33.3	0.87
Earnings (including non participants)	14,407	13,841	14,930	1.32
Labor force participation	64.10	65.81	62.52	1.61
Husbands' earnings	6,801	5,616	7,894	3.98
Sample Size in year of decision	2,195	1,053	1,142	

<sup>1</sup> These are un-weighted means calculated in the year of the husband's DI award decision. The t-value reported is for the difference in the means for the wives of rejected versus accepted husbands. Earnings are in 2004 dollars adjusted by the CPI and include non-workers. Labor Force Participation is defined as working at least one quarter in the year.

Table 2: Fixed Effects Estimates for Selected Samples of Wives of Disability Applicants

A. Earnings					
	All	All	Young	Old	Husband Evaluated at Stage 5
	(1)	(2)	(3)	(4)	(5)
2 years before	-428.29 (511.53)	-321.204 (511.76)	-1112.71 (726.88)	756.66 (736.09)	-1141.87 (702.46)
1 year before	-362.54 (567.36)	-246.73 (563.02)	-637.40 (861.89)	618.93 (773.41)	-1307.18+ (773.78)
Year of decision	-960.35 (602.23)	-875.46 (594.18)	-1619.37+ (857.47)	350.37 (846.26)	-1589.7+ (900.11)
1 year after	-1371.8+ (760.62)	-1265.35+ (751.47)	-1830.42* (915.71)	-24.66 (1107.18)	-1750.96 (1313.35)
2 years after	-1643.71* (713.31)	-1506.73* (705.74)	-1648.64+ (947.24)	-459.26 (1026.95)	-2490.3* (1065.35)
3 years after	-1309.5 (823.66)	-1114.83 (822.04)	-1006.63 (1032.26)	-169.59 (1198.78)	-2351.86* (1177.7)
4 years after	-2392.31** (826.3)	-2190.48** (815.33)	-1184.70 (1104.00)	-1848.94 (1183.25)	-2596.19* (1263.12)
5 years after	-2478.81** (915.64)	-2235.78* (902.52)	-1353.87 (1251.74)	-1772.76 (1293.09)	-2420.49+ (1431.37)
B. Labor Force Participation					
	All	All	Young	Old	Husband Evaluated at Stage 5
2 years before	-0.0197 (0.0189)	-0.0146 (0.0190)	-0.0520+ (0.0268)	0.0291 (0.0273)	-0.0329 (0.0283)
1 year before	-0.0273 (0.0203)	-0.0232 (0.0204)	-0.0664* (0.0289)	0.0253 (0.0293)	-0.0492 (0.0303)
Year of decision	-0.0376+ (0.0215)	-0.0363+ (0.0215)	-0.0504+ (0.0301)	-0.0039 (0.0311)	-0.0590+ (0.0318)
1 year after	-0.0643** (0.0234)	-0.0638** (0.0235)	-0.0876** (0.0339)	-0.0225 (0.0336)	-0.0881* (0.0347)
2 years after	-0.0647* (0.0252)	-0.0630* (0.0252)	-0.0537 (0.0350)	-0.0382 (0.0367)	-0.0978* (0.0386)
3 years after	-0.0560* (0.0273)	-0.0529+ (0.0274)	-0.0364 (0.0376)	-0.0305 (0.0399)	-0.1039* (0.0417)
4 years after	-0.0768** (0.0292)	-0.0727* (0.0292)	-0.0437 (0.0402)	-0.0590 (0.0424)	-0.0990* (0.0449)
5 years after	-0.0841** (0.0312)	-0.0793* (0.0313)	-0.0607 (0.0436)	-0.0567 (0.0449)	-0.1138* (0.0490)
N	39517	39517	21231	18286	16953

Note: This table reports results for a fixed effect model for 4 different subsamples. The estimates reported are estimates of  $\delta^k$  the effect of DI receipt on wife's earnings  $k$  years before or after the award decision as defined in Equation 1 in the text. Standard errors in parentheses are clustered at the individual level. Estimates in columns 2-5 include controls for a linear time trend, husband's earnings and interacted age and education dummies. The estimates are relative to a base period 9-10 years before the award decision. Significance levels + =10%, \* =5%, and \*\* =1%.

Table 3: Estimates For Wives Of DI Applicants With Musculoskeletal Impairments

	All Musculo.	Old Cohort Musculo.	Young Cohort Musculo.
A. Earnings			
2 years before	-1653.89+ (896.88)	-1940.43+ (1136.23)	-180.86 (1457.34)
1 year before	-1881.26* (953.37)	-1985.16+ (1183.08)	-579.54 (1614.76)
Year of decision	-2479.48* (1070.36)	-2775.45* (1349.94)	-400.3 (1838.76)
1 year after	-3709.77** (1162.22)	-4096.09** (1457.70)	-1031.89 (2001.49)
2 year after	-4069.65** (1292.93)	-4415.35** (1697.20)	-1398.48 (1932.78)
3 year after	-3983.21** (1402.23)	-5105.84** (1805.2)	390.95 (2132.42)
4 year after	-3666.25* (1580.94)	-5427.13** (2076.71)	843.29 (2231.02)
5-10 years after	-4538.06* (2036.55)	-6810.73* (2776.64)	-264.37 (2705.74)
B. Labor Force Participation			
2 years before	-0.065+ (0.035)	0.018 (0.048)	-0.1224* (0.0546)
1 year before	-0.085* (0.038)	0.006 (0.053)	-0.1506* (0.0590)
Year of decision	-0.099* (0.039)	-0.009 (0.054)	-0.1472* (0.0570)
1 year after	-0.139** (0.043)	-0.036 (0.058)	-0.205** (0.0681)
2 year after	-0.142** (0.048)	-0.074 (0.068)	-0.1131+ (0.0663)
3 year after	-0.097+ (0.050)	-0.005 (0.074)	-0.1169+ (0.0629)
4 year after	-0.075 (0.054)	-0.004 (0.080)	-0.0639 (0.0680)
5-10 years after	-0.087 (0.057)	0.017 (0.089)	-0.1205+ (0.0707)
N	13537	5506	8031

Note: This table reports results for a fixed effect model for 3 different subsamples. The estimates reported are estimates of  $\delta^k$  the effect of DI receipt on wife's earnings  $k$  years before or after the award decision as defined in Equation 1 in the text. Standard errors in parentheses are clustered at the individual level. Estimates in columns 3-6 include controls for a linear time trend, husband's earnings and interacted age and education dummies. The estimates are relative to a base period 9-10 years before the award decision. Significance levels + =10%, \* =5%, and \*\* =1%.

## Technical Appendix

Table A1: Differences In Mean Earnings And Labor Force Participation For Selected Samples Of Wives<sup>1</sup>

	<i>k=-2</i>	<i>k=0</i>	<i>k=1</i>	<i>k=2</i>	<i>k=5</i>
Earnings					
All wives	487 (736)	1089 (820)	254 (950)	89 (845)	760 (1054)
Stage 5	-1102 (1106)	191 (1261)	-38 (1493)	-358 (1344)	2704 (1934)
Young Cohort	2587 (1166)	4338 (1387)	3058 (1716)	1792 (1336)	4472 (1739)
Old Cohort	-807 (961)	-730 (1083)	-791 (1170)	-378 (1111)	-1595 (1334)
Stage 5 young cohort	2152 (1753)	5673 (2006)	4498 (2304)	4584 (2437)	11081 (3549)
Labor Force Participation					
All wives	0 (2)	-3.3 (2)	-3.8 (2.1)	-3.1 (2.3)	-3.7 (3)
Stage 5	-4 (2.9)	-4.9 (4.2)	-7.9 (3.3)	-7.5 (3.7)	-5.8 (5.1)
Young Cohort	1.1 (2.7)	-0.1 (2.9)	-2.8 (3.2)	2.3 (3.4)	1.7 (4.2)
Old Cohort	1.8 (2.8)	-2.7 (2.9)	-1.3 (2.9)	-4.0 (3.2)	-5.3 (4.2)
Stage 5 young cohort	-1.7 (4.1)	1.8 (4.6)	-1.6 (5)	2.7 (5.4)	9.25 (6.6)

<sup>1</sup> Earnings are in 2004 dollars adjusted by the CPI. Earnings include nonworkers. Standard errors in parentheses are clustered at the individual level.

Table A2. Fixed Effects Estimates Of The Crowd-Out Effect Of DI On Wife's Labor Supply

	All	All	Young	Old	Stage 5
k=-8	0.0072 (0.0114)	0.0079 (0.0115)	0.0046 (0.0156)	0.0128 (0.0169)	-0.0081 (0.0165)
k=-7	-0.0045 (0.0131)	-0.0034 (0.0131)	0.0015 (0.0177)	-0.0055 (0.0195)	-0.0207 (0.0193)
k=-6	-0.0060 (0.0139)	-0.0042 (0.0140)	-0.0041 (0.0186)	0.0010 (0.0211)	-0.0182 (0.0208)
k=-5	-0.0044 (0.0154)	-0.0019 (0.0154)	-0.0068 (0.0208)	0.0100 (0.0229)	-0.0247 (0.0230)
k=-4	-0.0245 (0.0167)	-0.0209 (0.0168)	-0.0350 (0.0229)	0.0011 (0.0245)	-0.0401 (0.0249)
k=-3	-0.0275 (0.0177)	-0.0233 (0.0179)	-0.0454+ (0.0251)	0.0069 (0.0257)	-0.0445+ (0.0266)
k=-2	-0.0197 (0.0189)	-0.0146 (0.0190)	-0.0520+ (0.0268)	0.0291 (0.0273)	-0.0329 (0.0283)
k=-1	-0.0273 (0.0203)	-0.0232 (0.0204)	-0.0664* (0.0289)	0.0253 (0.0293)	-0.0492 (0.0303)
k=0	-0.0376+ (0.0215)	-0.0363+ (0.0215)	-0.0504+ (0.0301)	-0.0039 (0.0311)	-0.0590+ (0.0318)
k=1	-0.0643** (0.0234)	-0.0638** (0.0235)	-0.0876** (0.0339)	-0.0225 (0.0336)	-0.0881* (0.0347)
k=2	-0.0647* (0.0252)	-0.0630* (0.0252)	-0.0537 (0.0350)	-0.0382 (0.0367)	-0.0978* (0.0386)
k=3	-0.0560* (0.0273)	-0.0529+ (0.0274)	-0.0364 (0.0376)	-0.0305 (0.0399)	-0.1039* (0.0417)
k=4	-0.0768** (0.0292)	-0.0727* (0.0292)	-0.0437 (0.0402)	-0.0590 (0.0424)	-0.0990* (0.0449)
k=5	-0.0841** (0.0312)	-0.0793* (0.0313)	-0.0607 (0.0436)	-0.0567 (0.0449)	-0.1138* (0.0490)
k=6	-0.0785* (0.0334)	-0.0737* (0.0335)	-0.0956* (0.0463)	-0.0220 (0.0482)	-0.1370* (0.0552)
ser_yr	0.0042** (0.0014)	0.0034* (0.0016)	0.0086** (0.0021)	-0.0027 (0.0023)	0.0046+ (0.0024)
d_totearn		-4.74* (2.1)	-6.9* (2.72)	-3.2 (3.31)	-0.098 (3.15)
xml		0.0331** (0.0103)	0.0410** (0.0130)	0.0626* (0.0277)	0.0323+ (0.0169)
xml2		-0.0004** (0.0001)	-0.0005** (0.0001)	-0.0006* (0.0003)	-0.0004* (0.0002)
_cons	-7.6759** (2.7590)	-6.4411* (3.1303)	-16.8318** (4.2055)	5.5678 (4.5968)	-8.6701+ (4.7473)
N	39517	39517	21231	18286	16953

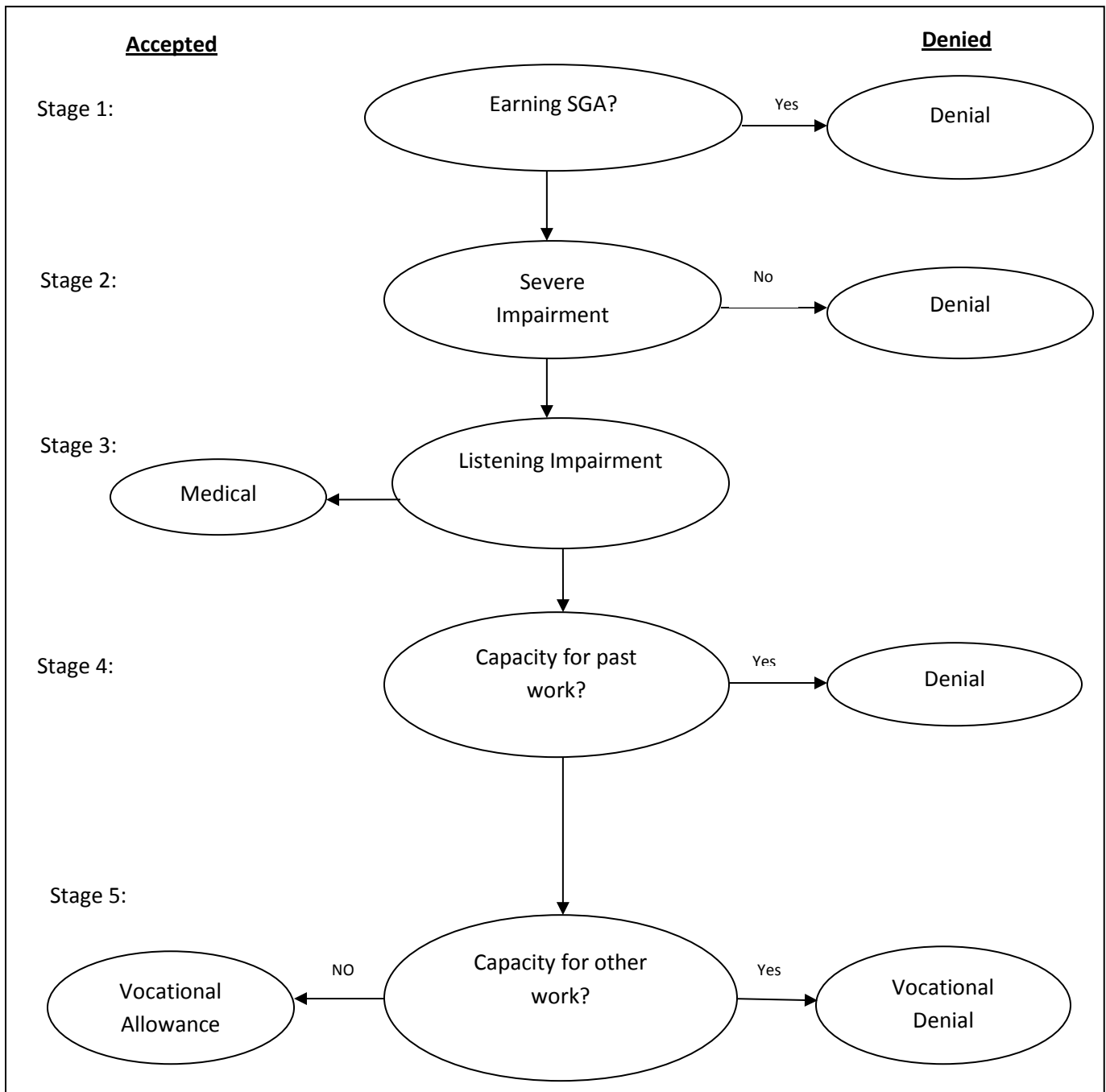
Note: This table reports fixed effect estimates of  $\delta$  in different time periods  $k$ . Standard errors in parentheses are clustered at the individual level. Estimates in columns 3-7 include controls for a linear time trend, husband's earnings and interacted age and education dummies. The parameter value on d\_totearn should be multiplied by  $10^{-7}$ . The estimates are relative to a base period of 9-10 years before the DI award decision. Significance levels + =10%, \* =5%, and \*\* =1%.

Table A3. Fixed Effects Estimates Of The Crowd-Out Effect Of DI On Wife's Earnings

	All	All	Young	Old	Stage 5
k=-8	-202.56 (263.86)	-234.83 (266.36)	-616.82+ (332.28)	236.31 (432.46)	-581.75+ (340.65)
k=-7	-49 (343.26)	-82.13 (346.88)	-499.53 (423.86)	454.68 (567.02)	-473.6 (429.44)
k=-6	-165.74 (341.54)	-171.91 (344.37)	-474.68 (473.72)	283.09 (503.62)	-527.94 (471.73)
k=-5	-71.65 (399.68)	-61.60 (402.95)	-439.71 (523.54)	510.09 (622.77)	-786.63 (532.14)
k=-4	-323.17 (427.21)	-278.53 (430.55)	-848.73 (569)	510.87 (652.57)	-648.95 (585.6)
k=-3	-719.71 (474.73)	-653.2 (475.79)	-1598.86* (676.44)	490.17 (686.58)	-1328.67* (655.52)
k=-2	-428.29 (511.53)	-321.20 (511.76)	-1112.71 (726.88)	756.66 (736.09)	-1141.87 (702.46)
k=-1	-362.54 (567.36)	-246.73 (563.02)	-637.40 (861.89)	618.93 (773.41)	-1307.18+ (773.78)
k=0	-960.35 (602.23)	-875.46 (594.18)	-1619.37+ (857.47)	350.37 (846.27)	-1589.7+ (900.11)
k=1	-1371.8+ (760.62)	-1265.35+ (751.47)	-1830.42* (915.71)	-24.66 (1107.18)	-1750.96 (1313.35)
k=2	-1643.71* (713.31)	-1506.73* (705.74)	-1648.64+ (947.24)	-459.26 (1026.95)	-2490.3* (1065.35)
k=3	-1309.5 (823.66)	-1114.83 (822.04)	-1006.63 (1032.27)	-169.59 (1198.78)	-2351.86* (1177.7)
k=4	-2392.31** (826.3)	-2190.48** (815.33)	-1184.70 (1104)	-1848.94 (1183.25)	-2596.19* (1263.12)
k=5	-2478.81** (915.64)	-2235.78* (902.52)	-1353.87 (1251.74)	-1772.76 (1293.09)	-2420.49+ (1431.37)
k=6	-2260.13* (986.77)	-1971.63* (972.37)	-1423.84 (1329.07)	-1313.59 (1399.41)	-1752.1 (1456.62)
ser_yr	406.88** (37.48)	256.11** (36.79)	413.24** (48.54)	78.7970 (53.1810)	310.98** (55.62)
d_totearn		-0.010 (0.0069)	-0.018* (0.01)	-0.0018 (0.0114)	-0.007 (0.009)
xml		1692.53** (358.14)	1413.45** (461.34)	3100.31** (1092.36)	1478.06** (528.27)
xml2		-14.58** (3.92)	-13.33* (5.48)	-26.7* (10.9066)	-12.31* (5.79)
_cons	-796359.2** (74546.24)	-511855.9** (72774.21)	-823062.9** (96308.56)	-168529.91 (105147.71)	-619855.01** (109146.74)
N	39517	39517	21231	18286	16953

Note: This table reports fixed effect estimates of  $\delta$  in different time periods  $k$ . Standard errors in parentheses are clustered at the individual level. Estimates in columns 3-7 include controls for a linear time trend, husband's earnings and interacted age and education dummies. The estimates are relative to a base period of 9-10 years before the DI award decision. Significance levels + =10%, \* =5%, and \*\* =1%.

Figure A1: The Five Stages Of The Disability Determination Process.



Source: Lahiri et al (1995)