# Moral Hazard and Claims Deterrence in Private Disability Insurance

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*Exploiting within-firm, over-time variation in plan parameters for nearly 10,000 Long Term Disability (LTD) policies held by U.S. employers, we present the first empirical analysis of the determinants of private LTD spells. We find that a shorter waiting period and a higher replacement rate increase the incidence of LTD spells. Sixty percent of the latter effect is due to the mechanical censoring of shorter spells, with the remainder due to the deterrence of spells that would have continued beyond the waiting period. Deterrence is driven primarily by a reduction in the incidence of shorter duration spells and less severe disabilities.*

One of the most significant threats to economic security facing working Americans is the risk of career-ending disability. The U.S. Social Security Administration (SSA) estimates that a 20-year-old U.S. worker has a three in ten chance of experiencing a disability that limits work for at least six months prior to reaching full retirement age (SSA 2011). Recent data from the Current

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Population Survey (CPS) indicate that 6.4 percent of adults between the ages of 25 and 64 are out of the labor force because of a disability. An additional 4.0 percent of adults in this age range report that a disability limits the kind or amount of work that they can perform.

The U.S. government provides public insurance against disabilities that preclude gainful employment through its Social Security Disability Insurance (SSDI) and Supplemental Security Income (SSI) programs. These are very large programs, with the 12.4 million recipients of SSDI and SSI between the ages of 25 and 64 receiving total cash benefits of $150 billion in 2011, as well as an approximately equal amount of health insurance benefits through the Medicare and Medicaid programs (SSA 2012). Yet these federal programs provide incomplete insurance: their award rates are low (approximately 55 percent); and their replacement of pre-disability earnings is only partial, with average after-tax replacement rates of 50 percent, and lower replacement rates for higher income workers.

Alongside publicly provided SSDI, many U.S. employers offer private long-term disability insurance (LTD) policies that supplement the coverage provided by SSDI. Approximately one-third of civilian workers are eligible for coverage through private LTD provided by their employers that supplement the public programs. Employer-provided LTD programs tend to have less stringent (although still quite rigorous) rules for qualification for benefits. They offer higher replacement rates than the public disability programs as well as much more intensive strategies for returning disabled workers to work. And, importantly, they appear to have better outcomes, both in terms of a lower incidence of disability accessions and a higher rate of returning to work after obtaining benefits.[1]

[1] Distinct from the federal disability programs, LTD policies provide rapid, in-work assistance to workers who develop work limitations, and these early interventions may reduce the rate at which

Despite the fact that one third of U.S. workers are covered by LTD policies, we know little about the characteristics and impacts of private disability insurance. This paper begins to address this deficiency by analyzing a detailed database of private LTD policies and payments. The data come from a major provider of private disability insurance coverage in the U.S. This firm provided to us a universe of wage records and LTD spell data from a large component of its business that contains seven years of data (2000 through 2006). These records enumerate employment, earnings, and LTD spells at the person-quarter level for workers in insured employment. After various sampling restrictions we have approximately eight million quarterly employment observations from nearly ten thousand unique employers in our analysis sample.

We first use these data, along with nationally representative data from the Bureau of Labor Statistics (BLS) on civilian workers' private long-term disability coverage, to document key facts about private LTD, most importantly that LTD accession rates in our sample are much lower than accession rates for SSDI, while return-to-work rates among new LTD recipients are much higher than among those receiving benefits from the SSDI and/or SSI programs.

We then analyze the critical question of the moral hazard impacts of disability insurance by matching individual LTD awards records to data on potential benefit generosity under the relevant LTD plans. We exploit variation both across and within firms in the LTD policy replacement rate, the maximum monthly benefit, and the elimination period (EP)— the amount of time that must elapse after disability onset before benefits can commence—to study how LTD accessions

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work limitations become career-ending disabilities. Recognizing this potential, Autor and Duggan (2010) propose piloting a variant of the public SSDI program where private LTD is offered as a "transition state" for disabled workers in the hope that in-work assistance provided by LTD policies may obviate the need for some beneficiaries to exit the labor force and enter the SSDI program.

and spell durations respond to policy parameters. A higher LTD earnings replacement rate significantly increases the likelihood that an insured worker obtains LTD benefits. This effect is driven by both cross-policy variation in nominal replacement rates, and within-policy, cross-worker variation in effective replacement rates stemming from the fact that high earnings are often capped at their policy's monthly maximum benefit—thus high earners face an effective replacement rate below the nominal level stipulated by their policies. Our estimates of the elasticity of LTD spell length with respect to the replacement rate range between 1 and 4, which are very sizeable relative to the previous literature.

Our most striking results concern the impact of the elimination period on the frequency, composition and duration of LTD spells. A longer EP may affect the incidence and duration of LTD spells through two channels. A first channel is censoring of shorter spells. This channel is mechanical, since shorter spells do not qualify for benefits under a longer EP. The second channel is deterrence: workers on plans with a longer EP may decline to seek benefits for impairments expected to have a modest duration—for example, those exceeding the EP by only one quarter—because the obligatory loss in earnings during the EP may make obtaining LTD benefits unattractive relative to continuing to work.

Our analysis finds an economically large and statistically robust effect of the EP on the frequency of LTD accessions. A 90 day reduction in the elimination period, from 180 days (used by 34 percent of the firms in our sample) to 90 days (used by 63 percent of the firms in our sample), leads to an approximate doubling of the incidence of LTD accessions. About sixty percent of this effect is due to censoring, while the remaining forty percent is due to deterrence. This deterrence channel in turn affects the composition and duration of realized LTD spells, with the marginal LTD awards deterred by a longer EP being those which were most likely to result in a near term return to work.

Complementing this result, we find a striking *positive* relationship between the elimination period and the duration of LTD realized spells: plans with longer EPs have LTD spells of substantially longer durations. This result reflects the fact that a longer EP deters a significant number of workers from obtaining LTD benefits for short-term but not longer-term impairments. We further find that the deterrence effect is equally present among high, middle and low-income workers within our sample, suggesting that liquidity constraints may not be the primary reason why a longer elimination period deters LTD accessions. We interpret this evidence as being most consistent with what Aron-Dine et al. (2012) call "forward looking" moral hazard: when responding to the incentives generated by insurance plan parameters, workers account for the expected durations of their disability spells. Because longer waiting periods differentially reduce workers' effective replacement rates for shorter spells, these spells are most likely to be deterred.

The paper proceeds as follows. Section 1 provides background on private LTD in the U.S. and its interaction with publicly financed disability insurance (DI). Section 2 describes our data and empirical strategy. Sections 3 presents results for the incidence of LTD awards, while Section 4 focuses on the interesting implications of the elimination period results. Section 5 examines the duration of LTD spells, and Section 6 concludes by considering implications of our findings for both LTD and DI policy.

## I. Employer-Provided Long-term Disability Coverage

Private employer-provided LTD coverage insures workers against the risk of long-term disability. In certain respects, the financial risk of long-term disability is even greater than the financial risk of death to a worker's surviving dependents, as a worker who suffers a career-ending disability would lose earnings capacity while still incurring housing, food, and related costs, as well as substantial

increases in healthcare costs. Consistent with these observations, Meyer and Mok (2013) find that individual consumption declines by more than 20 percent following the onset of disability.

The typical LTD policy can be described with three parameters. The elimination period represents the number of days that must elapse between the onset of disability and the first day of benefit payment. The replacement rate is the ratio of LTD benefits to the worker's average earnings prior to the disability (though the period over which earnings are calculated can vary across policies). Finally, the maximum monthly benefit places a cap on a policy's allowed benefit payments per month, which causes workers with higher earnings to face an effective replacement rate that is below their policy's nominal replacement rate. All else equal, plans with shorter elimination periods, higher replacement rates and higher maximum monthly benefits are more generous.[2] In contrast, all workers insured for disability through the public SSDI program face an identical elimination period (5 months), benefits formula, and maximum monthly benefit—though the SSDI schedule is more progressive than the flat-then-cap schedule of most LTD plans.

[2] LTD plans typically only consider whether a person can work at her current job during the first two years of the LTD spell (as opposed to at any job in the national economy) and thus on this metric are more lenient than SSDI. Additionally, LTD plans can differ with respect to their medical eligibility criteria, primarily in terms of their treatment of so-called subjective and non-verifiable disorders, which may include mental health disorders and soft tissue pain. In our data, there are approximately 20 different definitions of disability used by the insurer, with the top two accounting for 83 percent of firms and the next two account for an additional 12 percent of firms (with numbers five and six accounting for another four percent). In a companion set of specifications available from the authors, we add to our main models indicator variables for each disability definition. Our key estimates are virtually unchanged by inclusion of these additional controls. Notably, even within the SSDI program, which has nominally uniform eligibility criteria nationwide, there is substantial variation across disability examiners and administrative law judges in their interpretation of the program's eligibility criteria (Maestas, Mullen, and Strand, 2013; French and Song, 2013).

Many firms that offer LTD coverage also offer short-term disability (STD) coverage. STD benefits are paid if a worker is out of work due to illness or disability for a period that exceeds the number of sick days available to her. A firm offering both STD and LTD might pay benefits initially through STD and then subsequently through LTD to the same worker. And of course, the generosity of benefits between the two plans need not be the same.

According to the U.S. Department of Labor (DOL) (2010), the 33 percent coverage rate among civilian workers in employer-provided LTD policies is lower than for employer-provided health insurance (56 percent), life insurance (60 percent), or retiree benefits (57 percent) but higher than for employer-provided long-term care insurance (16 percent) or retiree health benefits (26 percent). Employer-provided LTD coverage is also somewhat less common than employer-provided dental insurance (38 percent) but more common than vision coverage (22 percent). Employers pay the full premium for the vast majority (90 percent) of the 40 million civilian workers with LTD coverage.

### *A. Characteristics of workers covered by employer-provided LTD*

Rates of employer-provided LTD coverage vary significantly with worker characteristics, as illustrated in Table 1 (sourced from U.S. DOL, 2010). For example, full-time workers are six times as likely as part-time workers (41 percent versus 7 percent) to be covered by an employer's LTD policy while those in "Management, Business, and Financial" occupations are twice as likely as those in production jobs to have LTD coverage. Interestingly, there is almost no difference between workers covered by a union (35 percent) and their counterparts without union coverage (33 percent). Workers in the top ten percent of the wage distribution are over fourteen times as likely as those in the bottom tenth to be covered (58 percent versus 4 percent), while workers in firms with 500 or more workers are more than twice as likely to be covered as those in firms with

fewer than 50 employees. Measured at the level of the census region, there is relatively little geographic variation in employer-provided LTD coverage, with the highest region (East North Central) at 37 percent and the lowest (Pacific) at 29 percent. This pattern is generally consistent with the findings from Levy (2004), who used individual-level data from a supplement to the Current Population Survey in 1993 to investigate the characteristics of those with employer-provided LTD coverage.

### *B. Comparison with SSDI*

There are several key contrasts between private LTD insurance and its public sector counterpart, the Social Security Disability Insurance (SSDI) program. SSDI is one of the nation's largest social insurance programs, with cash expenditures of $140 billion in 2012 and an additional $80 billion in Medicare expenditures (U.S. Centers for Medicare and Medicaid Services (CMS), 2012).[3] SSDI provides disability benefits to those with previous labor force attachment who are no longer able to engage in "substantial gainful activity." To apply for benefits, individuals file a disability claim with a local Social Security Administration (SSA) field office. If approved, the disabled worker receives a monthly Social Security benefit that is indexed to the Consumer Price Index and commences after a minimum of five months has elapsed since the onset of disability—thus, the SSDI five month waiting period is functionally equivalent to the elimination period in private LTD. SSDI benefits are paid by the Social Security Administration until

[3] SSDI expenditure data for 2012 are obtained at: http://www.ssa.gov/OACT/STATS/table4a2.html . Medicare expenditure data corresponds to the year 2011, the latest available from the Medicare and Medicaid Statistical Supplement. We inflate the $66.3 billion reported there by 20 percent because this number does not include spending on SSDI recipients in private Medicare Advantage plans. More than 25 percent of Medicare recipients were in these plans in 2011 though the share for SSDI recipients on Medicare was closer to 20 percent.

the worker reaches the full retirement age (currently 66), dies, or, in a small percentage of cases, is determined to have made a medical recovery. SSDI recipients also qualify for health insurance coverage through Medicare two years after the onset of the disability. If an SSDI applicant's claim is denied, she can appeal the case through both administrative and judicial channels. Among those applying for SSDI disabled worker benefits in 2006, approximately one-third (34 percent) were approved initially. Of those rejected, more than half (53 percent) appealed with the majority (64 percent) of those appealing awarded benefits at a subsequent stage. Thus 56 percent of SSDI applicants ultimately qualify for the program (SSA 2012a).

SSDI is a public insurance program that workers pay into directly through their payroll taxes. To become insured by SSDI, a worker generally needs to have engaged in covered employment for five of the prior ten years, though the entitlement period is shorter for the very youngest workers. A worker with median earnings (approximately $32,000 in 2009) pays an effective premium of approximately $600 annually for SSDI coverage.[4] Annual premiums for LTD coverage, which average approximately $250, are much lower.[5] Moreover, the effective difference is likely even larger because workers with LTD coverage tend to have above average incomes, meaning that their annual SSDI contributions are higher than for the median worker. However, it is important to recognize that LTD is an add-on rather than a replacement for SSDI. If an individual obtains an SSDI award while also receiving LTD—which occurs in 41 percent of the LTD spells in our sample—the beneficiary's LTD payments are reduced by the amount of the SSDI award, thus, leaving the worker's benefit unaffected while reducing the LTD insurer's cost.

[4] The SSDI portion of Social Security's 12.4 percent payroll tax rate is 1.8 percent.

[5] Author tabulations from U.S. Department of Labor (2010) data.

A second important contrast between LTD and SSDI plans is the earnings information used to calculate benefits. The cash benefit under an LTD policy is determined using only the worker's most recent earnings at her current employer. SSDI, in contrast, uses a worker's average indexed monthly earnings (AIME) during her working years when calculating her benefit. SSA then uses a progressive benefit formula to calculate the worker's Primary Insurance Amount (PIA), which is her monthly benefit in the first year of benefit receipt. This PIA is then adjusted for inflation in each subsequent year. Figure 1 compares potential SSDI benefits with potential benefits for the modal employer-provided LTD policy (60 percent replacement rate and maximum monthly benefit of $7,000). For simplicity, we abstract from the difference between recent monthly income and a worker's AIME by assuming that they are equal. As this figure shows, workers with relatively low incomes of $1,500 per month or less can receive a higher benefit from SSDI than from a private LTD plan. However, for incomes above this amount, the LTD benefit is larger, with this gap growing with income. For example, a worker with income of $30,000 per year has a replacement rate of 52 percent with SSDI versus 60 percent with employer-provided LTD. The corresponding difference for a worker with income of $100,000 per year is 25 percent versus 60 percent. Because Social Security taxes are paid on only the first $113,700 in earnings (as of 2013), the monthly SSDI benefit caps out near the PIA corresponding to this income level (about $2,650 monthly in 2012) and hence the SSDI replacement rate steadily declines at higher salaries. Moreover, because high income workers tend to be high skill workers, SSA's screening criteria are relatively more likely to determine that a given impairment does not preclude a high income worker from engaging in substantial gainful employment. It is therefore not surprising that high-income workers are more likely to obtain private LTD coverage.

Appendix Table 1 compares the characteristics of disabled workers receiving LTD benefits (both long-term and short-term) and those receiving SSDI, using data from the March CPS in 2009 and 2010. The age distributions of the two populations are similar, but those receiving LTD have significantly higher education and family incomes than those receiving SSDI.

While there is little previous academic research on LTD, there is a large literature on SSDI (Autor and Duggan 2006). The general consensus of this literature is that applications to SSDI and labor force decisions are sensitive to program parameters (benefit generosity and medical eligibility criteria) and to outside opportunities (economic conditions and potential earnings). Gruber (2010) finds that the elasticity of labor supply with respect to SSDI benefits appears lower than for other social insurance programs such as Unemployment Insurance or Workers Compensation. This lower elasticity is logical given that workers who take-up SSDI benefits must exit the labor force on a long term (typically permanent) basis, whereas these other benefits programs provide immediate access to short-term income replacement.

Given that more than 40 million workers in the U.S. are covered by employer-provided LTD policies, and that these policies may potentially affect labor supply and SSDI accessions, the absence of economic analysis of LTD is a noteworthy omission in the literature—most likely explained by the absence of public use data on LTD policies, insured, and beneficiaries. We begin to address this knowledge gap here.

## II. Data and Empirical Approach

Our analysis exploits a unique administrative database containing LTD policies and LTD spells for a major provider of private disability insurance in the U.S. This dataset includes the universe of LTD policies offered by this insurer over the 2000 through 2006 period to firms that are "list billed"—that is, billed

separately for each employee, rather than receiving one aggregate bill for all employees. List-billed firms tend to be somewhat smaller firms than average among the set of firms covered by the insurer.[6] Our data are quarterly; since many of the key independent variables will depend on lagged earnings (as described below), our final sample period is 2000:Q3 to 2006:Q4. Our analysis does not use individual identifiers in the data other than to link records over time.

*A. Sample selection*

We begin with a sample of 21.91 million person-quarters of private LTD enrollment or benefit receipt during this 6.5-year period in list-billed LTD plans and that have non-missing data. We then impose a series of restrictions on the sample, including most importantly removing individuals who do not have wage information for the preceding two quarters of earnings (an important control), leaving us with a sample of 15.3 million persons that we refer to as our full sample. There are 42,844 unique firms represented in this sample and 55,802 unique combinations of firm, division, and class, which represent the unit at which group private LTD policies are typically purchased from this insurer. Within a particular firm, there may be multiple divisions if there are two or more facilities in different locations. Similarly, within a firm-division, there may be different classes if, for example, there are both full-time workers and part-time workers who are covered by different policies. Workers are uniquely identified within a firm, but the data do not enable us to follow workers who switch firms.

[6] Our baseline sample of list-billed enrollees accounts for less than one-fifth of the insurer's enrollees. Non list-billed firms, which are typically large firms, report a count of insured workers to the LTD insurer rather than reporting detailed age and salary data for each insured worker. For non list-billed policies, the insurer obtains detailed data only on workers who file claims, making these policies unsuitable for our analysis.

We make three further restrictions in constructing the primary analytic sample: we drop those firm-division-class (FDC) combinations with fewer than 25 enrollees at any point during the sample period (to avoid endogenous benefits changes); we drop FDC combinations that offer employees choices among multiple plans; and we drop individuals in the top 1 percent or bottom 1 percent of the year-specific earnings distribution. This leaves us with a sample of 7.99 million person-quarter observations representing 9,721 unique FDC combinations and 1.02 million unique workers.

Table 2 provides summary statistics of worker characteristics and plan parameters, weighting by the number of worker-quarters available for each plan. The average worker in our primary analytic sample is 41.6 years old. The share of males is 52.9 percent, and the mean monthly salary is $4,014. More than half (54.3 percent) of workers are in services, with the next most common industries being manufacturing (13.0 percent). The sample is geographically dispersed, with all fifty states represented and the two most common states being California and New York (not tabulated).[7]

One particularly noteworthy fact revealed by the table is that the incidence of LTD awards is quite low at 0.091 percent per quarter in the primary analytic samples, which is 34 percent lower than the average SSDI award rate of approximately 0.14 percent per quarter for insured workers.[8] As we show in our duration analyses below, the difference in exit rates between SSDI and private LTD recipients is even greater than this entry rate difference. These contrasts

[7] Appendix Table 2 compares the characteristics of our sample to coverage rates of LTD in Bureau of Labor Statistics data.

[8] All data reported here refer to LTD claims that are awarded benefits. We do not analyze rejected claims. In 2003, which is the midpoint of our sample period, SSDI awards averaged 5.5 per 1,000 insured annually, or 1.4 per 1,000 insured quarterly (http://www.ssa.gov/OACT/STATS/table6c7.html, accessed 11/15/2011).

likely reflect differences in the beneficiary populations between privately and publicly insured workers and differences in incentives and screening under private versus public policies.

The most common medical conditions with which individuals in our primary sample qualify for LTD benefits are accidents (16.3 percent) and cancer (15.9 percent), with chronic fatigue, back problems, and heart and circulatory conditions each accounting for more than 10 percent of awards. Perhaps the most striking difference between the distribution of diagnoses in our sample and the corresponding distribution for SSDI lies in the categories of musculoskeletal and mental disorders. These two categories jointly accounted for more than 50 percent of all SSDI awards in 2010. (SSA 2012a), but they comprise less than 20% of LTD awards in our primary sample. One factor that may be partly responsible for this difference is that most LTD policies stipulate a fairly stringent standard for awarding benefits for so-called "subjective and non-verifiable disorders," a category that includes many mental disorders as well as soft-tissue pain. These plan features may make it relatively more difficult for workers with mental disorders in particular to access LTD benefits.

LTD receipt varies substantially with worker characteristics. For example, workers in the top five percent of the year-specific salary distribution have a LTD accession probability of just 0.04 percent per quarter whereas those in the bottom 5 percent have an accession probability that is three times as high at 0.13 percent per quarter. Age is also a strong predictor of LTD incidence, with those in their early sixties almost five times as likely to receive an LTD award as young adults (0.23 percent for those 60 to 64 versus 0.05 percent both for those 18 to 24 and for those 25 to 29). Women are also more likely than men to receive LTD awards, with probabilities of 0.10 percent and 0.08 percent, respectively. Excluding maternity-related LTD spells, however, eliminates this gender difference. Given the substantial differences in incidence by age, sex and salary, we control for

demographic characteristics when exploring the effect of plan parameters on LTD awards, durations, and exits.

As a sensitivity test, several subsequent analyses focus exclusively on the subset of firms that change their policy parameters—either the elimination period or replacement rate—during the sample window. Of the 9,724 FDCs in our primary analytic sample, 129 change their elimination period at least once during our study, 52 change their replacement rate, and 10 change both.[9] This changer sample of 250,143 person-quarter observations, summarized in the final column of Table 2, comprises only three percent of the primary sample. Both the mean elimination period and policy replacement rate are closely comparable between the changer and primary samples. A key outstanding difference between the samples is the incidence of LTD awards, which is approximately 30 percent higher in the changer than in the primary sample (0.120% versus 0.091%). Our data do not unfortunately inform the question of why some firms change policy parameters within our sample window.

Table 3 provides additional detailed information on the policy parameters of the LTD plans in our primary sample, weighting by plan enrollment as above. The modal replacement rate in our sample is 60 percent, which is in effect for 82.6 percent of person-quarters in our data; the next most common replacement rates are 66.7 percent (12.7 percent) and 50 percent (3.8 percent). The distribution of elimination periods is dominated by a small number of values, with 97.3 percent of the sample having either a 90-day or 180 day elimination period. As shown in panel C, the most common maximum monthly benefit levels are $5,000 (33.2 percent), $6,000 (18.0 percent) and $10,000 (17.2 percent). The 95$^{th}$ percentile

[9] The most common changes in the elimination period are from: 90 to 180 days (47.4%); 180 to 90 days (35.3%); and 60 to 90 days (5.3%). Ten other combinations account for the remaining 12.0%. Four FDCs change their elimination period more than once. The most common replacement rate changes are from: 66.67 to 60.0 (44.2%); 60.0 to 66.67 percent (15.4%); and 60.0 to 50.0 (11.5%).

maximum benefit is $12,500 versus a 5th percentile of just $3,000. Panel D shows that LTD accession rates are generally higher on plans with lower replacement rates and lower benefit caps (though, logically, are lower on plans with a longer elimination period), which is consistent with the fact that higher earnings workers typically have both fuller insurance and better health. Our identification strategy abstracts from this cross-sectional correlation between worker demographics and plan parameters by focusing on within-plan changes in policy parameters.

Notably, due to the substantial variation in benefits caps, workers on different policies earning the same incomes and facing the same nominal LTD replacement rates may nevertheless face different effective replacements due to cross-policy differences in the monthly benefits cap. The fraction of person-quarters in our primary sample whose potential LTD benefit is capped at the maximum level provided by their LTD plan is 4.0 percent (Table 2, panel C), and this fraction is substantially higher for workers with high earnings. The average effective replacement rate among those who are capped is 43.0 percent versus 60.5 percent for those who are uncapped. We make use of this variation in effective replacement rates stemming from binding monthly benefits caps when analyzing the impact of replacement schedules on the incidence of LTD spells.

*B. Econometric approach*

Our basic empirical approach to estimating the relationship between LTD spells and policy parameters is to fit models of the following form:

$$(1) \qquad \Pr\left(LTD_{ijq}\right) = f\left(\alpha + \beta_1 EP_{jg} + \beta_2 RR_{jg} + \beta_3 CAP_{ijg} + \mu X_{ijq} + \theta_j + \delta_q\right)$$

In this equation, *i* indexes individual workers, *j* indexes their FDC category, and *q* indexes year-by-quarter interactions. *LTD* is an indicator variable equal to one if worker *i* commences an *LTD* disability spell in year-quarter pair *q*, where *q* corresponds to the onset date of the disability, with benefits commencing after

completion of the elimination period. The three LTD policy parameters of interest, the elimination period, replacement rate, and binding benefits cap indicator, are captured by the variables *EP*, *RR* and *CAP*. Unlike *EP* and *RR*, which vary only at the FDC-quarter level, the *CAP* indicator varies at the individual-quarter level: workers who are capped by the monthly benefit limit face an effective replacement rate that is below the nominal policy replacement rate *RR*.[10] Consequently, within a FDC, workers at different wage levels may face different effective LTD replacement rates since the cap will bind for high but not low wage workers. The vector *X* contains a set of demographic controls, including indicators for gender, age and, critically, monthly earnings, which is likely to be highly correlated with the incidence of disability. In our initial specifications, we control for earnings with twenty salary bin indicators that capture each person's position in the sample's annual earnings distribution.[11] All specifications include a set of FDC fixed effects $\theta_j$ and year-by-quarter dummies $\delta_q$. We estimate (1) using a linear probability model (LPM).

There are a number of potential limitations with specification (1). A first concern is that while we have millions of observations, the variation that we analyze in our key policy variables exists only at the FDC-quarter (FDCQ) level. We consequently cluster our standard errors by FDC in all specifications to account for this error structure. A further implication of the fact that we include

[10] Because individual-specific replacement rates may be endogenous to worker health, we use policy replacement rates as explanatory variables and we determine the *CAP* variable for each worker using average earnings two quarters *prior* to the current observation. See Bound (1989) and Parsons (1991) for discussion of the drawback of the contemporaneous replacement rate as a measure of potential benefits.

[11] We include eight indicator variables for ages 25 through 64 in five year brackets as well as one indicator for the 18 through 24 age group. The monthly earnings indicators code earnings in twenty, five-percentile bands, where the earnings percentiles are calculated separately in each year. Individuals in the top one percent and bottom one percent of the earnings distribution in each year are excluded from the sample, and hence the top and bottom earnings categories each contain four percent of the sample.

FDC fixed effects in all regression models is that the source variation that identifies the coefficients on the elimination period and replacement rate variables stems from within-firm *changes* in these policy parameters. To ensure that our main results are not skewed by the inclusion of the large fraction of firms that do not change policy parameters during our sample window, we re-estimate all of our main models using only the set of FDCs changers summarized in the third column of Table 2.

A second concern for identification is that the policy parameters that workers face may be endogenous to their tastes or other correlates of claiming behavior. For example, firms whose employees are more likely to claim LTD benefits may have systematically higher or lower replacement rates. We attempt to address this concern in our main specification by including both FDC fixed effects (to capture the preferences of covered workers) and detailed wage category controls. In these specifications, the effect of policy parameters is identified by over-time changes in these parameters within a firm. Similarly, the effect of actual replacement rates on LTD awards is identified by the interactions between policy parameters and worker earnings.

A final concern for estimation is that the dependent variable is dichotomous and, moreover, is equal to zero for the vast majority of observations (99.9 percent), which suggests that a linear probability model may not provide the appropriate specification. We face the problem, however, that many LTD policies contribute a relatively small number of observations, which suggests that we are likely to face an incidental parameters problem in estimating equation (1) via maximum likelihood. This leads us to prefer the LPM.

A notable difference between estimating specification (1) using a LPM versus a non-linear maximum likelihood model such as logit or probit, however, is that the non-linear model will drop all FDC observations for which there are no LTD accessions observed during our sample—even if these FDCs change their policy

parameters—since these zero outcomes are perfectly predicted by the relevant FDC fixed effects. Viewed through the lens of the non-linear model, these FDCs provide no usable variation for identifying the coefficients of interest $\beta_1, \beta_2,$ and $\beta_3,$ because the absence of LTD accessions is consistent with the possibility that the relevant FDC fixed effect is unboundedly negative. In the LPM, of course, the absence of LTD accessions for a given FDC is viewed as informative about the coefficients of interest: if plan parameters change but LTD accessions do not, this implies that the elasticity of accessions with respect to the relevant parameters is small or zero.[12]

While there is no consensus solution to this estimation problem, we apply a straightforward approach that recognizes both econometric paradigms. We estimate our primary linear probability models using only the subset of FDCs that have non-zero LTD accessions in our sample, thus limiting the analysis to the observations that would be retained by the maximum likelihood model. Alongside these estimates, we additionally report a "scaled" point estimate for these models that is formed as a weighted average of the LPM coefficient estimated from the restricted sample and an "implied" point estimate of zero for the set of FDCs that are dropped due to the absence of LTD accessions. So, for example, if we estimate that $\hat{\beta}_1 = 1.0$ using the restricted sample, and if 25 percent of observations were dropped by the FDC restriction, we additionally report a scaled estimate of $\hat{\beta}_1^s = \hat{\beta}_1 \times 0.75$.[13]

[12] See Angrist (2001) and Hahn (2001) for thoughtful discussion.

[13] This scaled estimate is likely to be a lower bound given that the "true" effect is unlikely to be zero at these FDCs with zero claims. As it turns out, our main results are not substantively affected by these manipulations for a logical reason: by construction, the scaled point estimates are smaller in absolute magnitude than the point estimates from the LPM; also by construction, the LTD accession rates are smaller in the primary sample than in the restricted sample. The net effect of these two forces is that the implied elasticities of LTD accessions with respect to policy parameters—that is, the proportional change in accessions for a proportional change in policy generosity—is roughly comparable between the main estimates and the scaled estimates.

## III. The Impact of Plan Parameters on LTD Incidence

### *A. LTD accessions*

Table 4 presents initial estimates of equation (1), which models the relationship between plan parameters and LTD spells. To facilitate interpretation of the point estimates, the dependent variable, and the *EP* and *RR* measures have each been rescaled. The dependent variable takes on two values: 100 if an LTD spell commences in the corresponding year and quarter and zero otherwise, so the coefficient estimates correspond to marginal increases in probability expressed in percentage points. The *EP* coefficient estimates the effect of a 100 day change in the *EP* on the probability in percentage points of an LTD spell commencing. The *RR* coefficient estimates the effect of a 10 percentage point change on the probability in percentage points of an LTD spell commencing. Finally, the *CAP* coefficient estimates the effect of the benefit cap binding on the probability in percentage points of an LTD spell commencing.

Column (1) of the table finds a highly significant negative coefficient on the elimination period term. The point estimate of -0.161 (se 0.036) implies that an increment of 30 days to an LTD's policy elimination period lowers the LTD accession rate by 0.048 percentage points, which is approximately a twenty-five percent decline relative to the base rate of 0.153 percentage points. This result indicates that LTD accessions are quite responsive to the 'deductible' workers will face if they instigate an LTD spell—a point that we analyze in detail below.

The column (1) estimate also finds a significant impact of the replacement rate on LTD awards. A 10 percentage point rise in the replacement rate is estimated to increase the award rate by 0.10 percentage points, or about sixty-five percent of the sample mean. This implies an elasticity of LTD spells with respect to the replacement rate of 4.0 at the sample mean replacement and incidence rates (60.5 percent and 0.153 percent respectively). This elasticity is considerably larger than

that found by the literature on disability insurance (Gruber 2000), though the confidence interval surrounding this estimate does not rule out substantially smaller (or larger) effects.

In the second column, we add an indicator for whether the worker would be capped by the maximum monthly benefit—thus receiving an effective replacement below the policy's nominal replacement rate—if she were to receive an LTD award. The coefficient on the capped indicator is negative and significant; workers whose effective replacement rate is curtailed by the monthly benefit cap are less likely to obtain LTD benefits. The point estimate implies that if a worker is capped, she is 0.033 percentage points (se 0.011) less likely to commence an LTD spell, which is approximately a 40 percent reduction in the base LTD rate for the higher income workers subject to benefit caps.[14] Using the fact that capped workers on average face a replacement rate that is 29 percent below the nominal replacement rates offered by their policies (43.0 percent versus 60.5 percent), we estimate an elasticity of LTD spells with respect to the replacement rate of 1.4, which is smaller than the elasticity implied by the direct policy replacement rate measure, but remains much higher than in the previous literature on SSDI.

Because the model includes detailed wage category controls, the coefficient on the capped variable is not identified by comparisons across workers with different earnings. The inclusion of FDC fixed effects further implies that identification is not coming from comparisons among workers who have

[14] The baseline accession rate is much lower for higher income workers. In the sample from panel A of Table 4, it is 0.201 among workers in the percentiles 11 through 20 of the year-specific earnings distribution as compared to only 0.084 percent among workers at the 81st to 90th percentiles. While most capped workers are above the 90th percentile, we use the 0.084 percent figure for comparison to avoid endogenous effects on claiming arising from the binding cap.

comparable salaries but work in firms with different replacement rates. Instead, identification comes from the interaction between workers' wages and their FDC-specific benefit caps: the significant negative coefficient on the benefits cap variable therefore indicates that LTD accessions are relatively less frequent among high relative to low-wage workers at firms with lower (more binding) monthly maximum benefit caps.

Column 3 of the table probes the robustness of these results by adding to the model a set of wage category-specific splines, which are linear wage terms that vary freely across categories. These additional controls account for the fact that as a worker's wage increases within each of the twenty salary bins, the prevalence of LTD spells typically declines (a function of higher income) while the likelihood rises that the benefits cap binds. Inclusion of this richer set of wage controls does not appreciably impact our estimates. In further robustness tests, we have estimated models that include a dummy indicating whether workers have access to short-term disability insurance, and have also added a full set of FDC by quarter dummy variables to the model, so that the identifying variation stems from the interaction between the policy replacement rate, the worker's wage, and the benefits cap. These additional covariates do not substantively change the results.

Recognizing that the main variation that identifies the coefficients on the *EP* and *RR* variables stems from changes in policy parameters within FDC groups, we re-estimate in panel B the primary models using exclusively the subsample of policy changers summarized in the final column of Table 2. Simple mean comparisons suggest that changes in policy parameters noticeably affect LTD accession rates. Among those FDCs that lower their EP (most often from 180 to 90), the average accession rate increases from 0.90 per 1,000 before the change to 2.01 per 1,000 after the change. Among the FDCs that increase their EP (most often from 90 to 180), the average award rate declines from 1.58 per 1,000 before

the change to 0.76 per 1,000 after the change.[15] As shown in panel B, the point estimates for the *EP* and *RR* variables estimated using the changer sample are almost indistinguishable from their counterparts estimated using the full sample in panel A. Our results are also quite similar when we estimate a companion set of specifications (not tabulated) for the changer sample in which we additionally include 171 separate FDC-specific linear time trends. These many specification tests testify to the robustness of the main results.

Because these models are estimated on the subset of FDCs that have non-zero LTD accessions during the sample window, one may be concerned that the point estimates will not accurately reflect—more precisely, will overstate—the causal effect of policy parameters on LTD accessions in the full sample that includes FDCs where no accessions were observed. Following our discussion above, we present scaled coefficients in the bottom rows of each panel that adjust the main point estimates towards zero in proportion to the fraction of the sample dropped under the positive-accessions restriction. In practice, this entails reducing the absolute value of the coefficients by approximately 40 percent, which is one minus the fraction of the sample retained under the positive-accession restriction. Notably, the LTD accession rate in the full sample is almost exactly 40 percent lower than in the restricted sample (0.091 percent versus 0.153 percent). Accordingly, this rescaling does not substantively affect the implied elasticities of LTD accessions with respect to policy parameters.

### *B. How severely disabled are the marginal LTD recipients?*

Given the evidence that the incidence of LTD spells is elastic to policy parameters, a key question that we explore next is how severe the health

[15] These comparisons do not condition the sample on having positive LTD accessions either before or after the policy change.

conditions are that constitute the marginal LTD accessions induced or deterred by variation in policy generosity. In general, we would expect marginal LTD awards to comprise cases where workers have some discretion about whether or not to continue working versus seeking LTD benefits, implying that these impairments may be relatively less severe.

To test these hypotheses, we use the longer-term outcomes of LTD recipients as a measure of the 'revealed' severity of impairments. We divide the sample of LTD recipients into three groups: those who return to work (at the original employer) following receipt of LTD benefits; those who ultimately receive SSDI in addition to LTD, and are therefore unlikely to return to work; and those who remain as LTD recipients for the duration of our sample but do not receive SSDI. While we do not directly observe the health of LTD recipients, we infer that those who return to work are most healthy, those who receive SSDI are least healthy, and those who remain on LTD but do not receive SSDI comprise an intermediate case. We are able to observe outcomes for the individuals in our sample through December of 2007 and thus can follow all LTD beneficiaries for at least one year after their LTD spell commences. We may not however see the ultimate resolution of some spells, particularly those that are most recent. Undoubtedly, some of these beneficiaries will return to work and others will receive SSDI.[16]

Table 5 reports the results from specifications analogous to the third column of Table 4, which includes FDC dummies and salary bin-specific linear splines. In this case the dependent variables in columns 2 through 4 are dummies for LTD spells that fall into each of three categories: a spell leading to return to work (the

[16] Of 7,267 LTD awards in our sample, 29.4 percent are observed to lead to an SSDI award. Among LTD beneficiaries awarded SSDI, 96.1 percent do *not* return to work. Among LTD beneficiaries who do not receive SSDI by the end of our sample period, the return-to-work rate is 54.5 percent. Of course, the actual return-to-work rate among non-SSDI awardees may be higher, as some in this group may ultimately be awarded SSDI or return to work.

"most healthy" recipient); a spell leading to SSDI (the "least healthy" recipients); and a spell leading to neither return to work nor SSDI. Note that these three outcomes roughly sum to the total accession rate, so this set of models decomposes the effect of policy parameters on accessions into these three constituent components. As a benchmark, we also replicate in the first column of the table the main specification for LTD accessions from Table 4.

We find a significant effect of the elimination period on LTD accessions on the healthiest and intermediate groups, but no effect on LTD accessions among the least healthy, those who ultimately move to SSDI. Noting that the coefficients in columns 2 and 3 are quite close in magnitude and their sum is approximately equal to the coefficient in column 1 (where the outcome is any LTD accession), we infer that about half of the deterrence effect of a longer EP results from a reduction in LTD spells that would have returned to work and the other half from spells that would neither return to work nor garner an SSDI award (in our sample window). By contrast, essentially none of the deterrence effects accrues through reduced LTD accessions that would have resulted in an SSDI award. These findings, which are confirmed in the lower panel of the table using only the changer subsample, are consistent with the logic of the simple model proposed in Autor and Duggan (2003), which implies that marginal disability benefits enrollees are likely to be those with greatest work capacity.[17]

The estimates for the policy replacement rate and binding benefits cap measure offer a different pattern of results, however. The column 3 estimates indicate that a higher replacement rate significantly increases the rate of LTD accessions that ultimately lead to an SSDI award—the most severe category—and

[17] Consistent with this hypothesis, von Wachter, Song, and Manchester (2010) find that rejected SSDI applicants who are relatively young or whose primary diagnosis is a mental health or musculoskeletal disorder have substantially higher return to work rates than average rejected applicants.

that this effect explains about 60 percent of the relationship between the *RR* measure and the overall accession rate. While the replacement rate is also estimated to positively affect accessions in the other two categories—LTD spells that lead to return to work and LTD spells that lead to neither to return to work nor an SSDI award—these effects are not statistically significant. Reinforcing these conclusions, we find that a lower benefits cap—corresponding to a lower effective replacement rate for high income workers—deters LTD spells that lead to return to work and LTD spells that lead to an SSDI award. Estimates using the changer sample in Panel B are qualitatively similar.

Why is it that a longer elimination period appears to deter the least severe LTD spells—those that do not lead to an SSDI award—while a lower replacement rate appears to deter LTD spells that span the gamut of severity, including those that lead to an SSDI award? One potential explanation is that these different policy parameters affect the attractiveness of LTD benefits at different time horizons. A shorter elimination period increases the incentive to seek LTD benefits in the near term because beneficiaries are required to forego fewer days of paid employment before benefits can commence. Once benefits are awarded, however, the length of the EP has no effect on the value of continuing the LTD spell relative to returning to work. By contrast, a higher replacement rate makes it both more attractive for an insured worker to seek LTD benefits and to remain out of work once benefits are awarded. It is therefore possible that the EP and the replacement rate generate somewhat different behavioral response among LTD insured workers because they differentially affect the economic value of commencing a spell versus continuing a spell.

## IV. Why Does a Longer EP Deter LTD Spells? Censoring, Forward-Looking Moral Hazard and Liquidity Constraints

While it is clear why a lower replacement rate will tend to reduce workers' propensity to seek LTD benefits, the robust negative effect of a longer elimination period on LTD accessions is likely to reflect a more complex combination of causal effects: mechanically, a longer EP will censor LTD spells that would be resolved during the elimination period (e.g., a disability of 120 day duration will not result in an LTD award for a policyholder facing a 180 day EP); behaviorally, a longer EP may deter accessions that would require the beneficiary to accept an extended period of earnings loss followed by only a brief period of benefits receipt. These two causal channels—censoring and deterrence—have distinct welfare implications. If the negative effect of a longer EP on LTD spells is purely mechanical—reflecting exclusively censoring of shorter spells—this would imply that a longer EP reduces insurance without correcting any behavioral distortions such as moral hazard. If the effect instead reflects a behavioral response, this would suggest that a longer EP deters LTD awards by reducing moral hazard or by making liquidity constraints more binding. We explore these possibilities next, although we underscore that our data provide only a modicum of direct evidence on the liquidity channel.

A simple means to isolate the deterrence from the censoring component of the EP-award relationship is to eliminate the spells that *would have been* censored on a longer EP plan relative to a shorter EP plan—thus, in effect, imposing comparable censoring on shorter EP plans to what is mandated by longer EP plans. This approach allows us to assess how much of the initial EP-award relationship remains net of censoring. This remaining component is the deterrent effect of a longer EP.

Since more than 97 percent of the observations in our data are from plans with either a 90 or 180 day EP (Table 3), we focus on the 90/180 distinction. We drop spells where date of onset of disability and the PDI benefits close date are fewer than 181 days apart. For policies with an elimination period of fewer than 180 days, this eliminates nearly one-third of awards. As an additional conservative step to excise any mechanical effect that the EP may have on LTD spells, we also disregard maternity-related awards, which logically are several times more prevalent among LTD awards made on 90 versus 180 day EP plans (see Appendix Table 3).

Table 6 summarizes the censoring-adjusted estimates. After eliminating the pure censoring effect from the comparison, plans with a higher EP still have substantially lower award rates. Across all columns, we find that the coefficient on the EP variable is approximately 40 percent as large as in the companion specification above (panel A) that does not make the censoring adjustment. By implication, about 60 percent of the LTD accession differential between shorter and longer EP plans is due to censoring with the rest due to deterrence. The censoring adjustment has only a minimal effect on the coefficient on the overall replacement rate variable, while it modestly reduces (by about a third) the coefficient on the binding maximum benefit variable relative to the corresponding specifications in the upper panels (i.e. where shorter spells and maternity-related awards are included).

There are multiple mechanisms that may explain the behavioral response of LTD insured workers to longer waiting times for benefits eligibility. One mechanism is what Aron-Dine et al. (2012) refer to as "forward-looking moral hazard." Considering the expected duration of an impairment, insured workers choose between two courses of action: temporarily discontinuing work to treat their health conditions, thereby forfeiting earnings during the elimination period prior to receiving LTD benefits for whatever treatment period is remaining; or

alternatively, remaining on the job during the course of the impairment despite any heightened disutility of work, thereby foregoing LTD benefits but also avoiding income loss during the EP. Logically, all else equal, a longer EP makes discontinuing work less attractive relative to remaining on the job.

A second mechanism that is consistent with the same behaviors but has different efficiency implications is the operation of binding liquidity constraints: if some insured individuals who would prefer to discontinue work while treating their health conditions lack adequate savings to meet expenses during the EP, then a longer EP will deter LTD accessions by causing these liquidity constraints to bind for a larger set of workers (see Chetty 2008 for discussion). Unlike forward-looking moral hazard, this behavioral distortion operates through the income rather than the substitution effect. To the degree that it deters LTD accessions, it implies that LTD use is inefficiently low relative to a world with first-best incentives.

An empirical implication that distinguishes these mechanisms is the role that financial assets and income plays in deterrence. If liquidity constraints are the primary reason that plans with a longer EP experience fewer LTD awards, this deterrence effect should be greatest for workers for whom cash flow concerns are most constraining. It is difficult to assess the liquidity constraints that individuals face, however, absent detailed information on their assets, incomes, and expenditure commitments (such as loans and recurring bills). Unfortunately, our data set offers information on only one of these financial variables: monthly earnings. If workers with relatively low earnings are also relatively likely to have limited assets and face expenditure commitments that comprise a relatively large share of income, then we can use our measure of monthly income as an imperfect proxy for liquidity constraints. Appendix Table 4 implements this (imperfect) test of liquidity constraints and finds little evidence consistent with a liquidity constraint interpretation. In percentage terms, the impact of both the elimination

period and the replacement rate on LTD accessions are in all cases somewhat larger for higher income workers.

On net, we find a substantial effect of plan parameters on the incidence of LTD accessions. Not surprisingly, more generous policies have a higher incidence of awards. In the case of the elimination period in particular, we are further able to establish that almost half of the effect of a longer waiting period on the incidence of LTD spells is due to deterrence rather than simple censoring. This deterrence effect appears most consistent with the operation of moral hazard, though we have limited power to exclude binding liquidity constraints as an alternative explanation. These behavioral relationships also have important implications for spell durations, as we show next.

## V. Impacts of LTD Parameters on Spell Durations

A key difference between private Long-term Disability insurance and publicly provided Social Security Disability Insurance lies in the probability that a disability spell ends in medical recovery. While the quarterly exit rate from SSDI is only about 2.0 percent (with most of this accounted for by deaths or conversions to retired worker benefits), the exit rate from the LTD spells in our sample is more than six times as large at 12.7 percent. Some of this disparity surely reflects differences in the underlying health of LTD and SSDI enrollees (i.e. maternity is not a covered condition under SSDI) as well as differences in the labor market attachment of the two populations. It is plausible, however, that part of the difference is attributable to the different incentives created by the two programs. While our data do not permit us to assess why exit rates differ between LTD and SSDI spells, we can explore how variation in policy parameters across LTD policies affects the probability of exit from LTD receipt.

In the final set of analyses, we focus on the exit rate from LTD receipt status for individuals in our sample who commenced an LTD spell at some point during

our study period. For each LTD spell, we define an indicator for each quarter of LTD receipt. This variable is equal to one if the beneficiary leaves LTD in the quarter and is equal to zero otherwise. We estimate an OLS model for LTD exits analogous to equation (1) above.[18] In addition to controlling for plan parameters, demographics, income, and year by quarter dummies, we also introduce 27 indicator variables corresponding to the number of quarters that the individual has been receiving LTD benefits. These variables control flexibly for the relationship between duration and exit rates that has been found for other programs such as welfare and unemployment insurance.[19]

Our analysis sample for these specifications, summarized in Appendix Table 3, includes 7,267 unique LTD spells and 39,117 quarterly observations, and thus the average number of quarterly observations for each person is 5.4.[20] The mean LTD spell in our sample lasts 6.2 quarters and the median spell lasts 4 quarters, though it is important to emphasize that many of these spells are censored (i.e., are ongoing at the end of our window of observation). There are 3,497 unique FDC combinations accounted for by these LTD spells (thus an average of just 2.1 awards among employers with any awards).

[18] As with the analysis of awards, an individual exits the sample after her LTD beneficiary status changes, which in this case means that the LTD spell concludes.

[19] We code disabilty spell duration starting from the quarter of disability onset (minus one) rather than from the quarter in which LTD benefits commence so that the duration of disability is not mechanically influenced by the length of the EP. Thus the quarter 1 indicator would "turn on" in the first quarter that an LTD beneficiary with a 90-day EP received benefits whereas the quarter 2 indicator would "turn on" in the first quarter that an LTD beneficiary with a 180-day EP received benefits (and the quarter 1 indicator would never "turn on" for this beneficiary).

[20] The average duration is somewhat higher at 6.2 quarters because many of our spells continue through the end of 2007. The final quarter that we include in this duration analysis sample is 2006Q4 (with exit equal to 0 if the person received benefits in 2007Q1). We do not have new LTD spells commencing in 2007 and thus do not consider exit decisions after 2007Q1, though our results are very similar if we include them.

We focus first on the two variables that jointly determine worker replacement rates: the policy replacement rate measure and the binding cap measure. The replacement rate may affect the probability that an LTD spell completes through two countervailing channels. Holding health constant, LTD beneficiaries receiving a higher replacement rate would be expected to have lower exit rates from receipt of benefits. Indeed, the Table 6 results suggest that higher replacement rates and less binding benefits caps increase the incidence of LTD spells that lead to long term SSDI benefits receipt rather than a return to work. However, to the extent that healthier enrollees are also induced to apply for and receive LTD when benefits are more generous, one might expect them to have higher exit rates once enrolled. Due to these countervailing effects, we have no firm prediction for how the replacement rate should affect LTD exits.

This ambiguity does not carry over to the expected effect of the elimination period on exits, however. Table 4 shows that a longer EP substantially deters LTD accessions net of its mechanical censoring effect. If a longer EP differentially deters shorter spells, it will shift the composition of LTD spells towards those with longer durations. Why might shorter spells be differentially deterred? A central reason is that the simple mathematics of deductibles imply that a longer EP differentially reduces the overall replacement rate a worker receives during her LTD spell for shorter relative to longer spells. To see this point, consider a worker who expects to be out of the labor force for 22 quarters due to a disability. If the worker's LTD plan has a 90 day EP, she will receive 21 quarters of LTD payments. Assuming a nominal policy replacement rate of 60 percent, her total share of foregone wage income replaced by LTD will be 57 percent ($0.6\times 21/22 = 0.57$). If instead her LTD plan has an EP of 180 days, she will receive 20 quarters of benefits and an effective replacement rate of 55 percent ($0.6\times 20/22 = 0.55$), which is only two percentage points below the effective replacement rate on the 90 day EP plan. Now consider a worker who expects to be

out of the labor force for only four quarters due to a disability. With a 90 day EP, this worker's spell replacement rate would be 45 percent ($0.6\times 3/4 = 0.45$). With a 180 day EP, her spell replacement rate would fall to only 30 percent ($0.6\times 2/4 = 0.30$), which is 15 percentage points (33 percent) lower. Hence, because a longer EP has a greater proportional impact on workers' overall spell replacement rates in shorter relative to longer spells, we expect longer EPs to differentially deter shorter spells.

The results in Table 7 are consistent with this set of predictions. The coefficient on the replacement rate measure is weakly positive for LTD exits, indicating that a higher replacement rate predicts a higher LTD exit rate. In most cases, however, this relationship is statistically insignificant. The estimates for the binding benefit cap are also of mixed sign and never statistically significant. These results accord with hypothesis that the incentive and compositional effects induced by a higher replacement rate have countervailing effects on exits, leaving the net effect ambiguous and potentially small.

By contrast, the Table 7 estimates provide strong confirmation of the prediction that a longer EP shifts the distribution of realized LTD spells towards spells with longer durations. Across all specifications, we find that the exit rate from LTD beneficiary status is substantially lower for spells that originate on plans with a longer elimination period. The point estimate of -1.45 in the first column of Table 7 (panel A), for example, suggests that a 90-day increase in the elimination period generates a quarterly exit rate that is 1.5 percentage points below baseline. This represents slightly more than 10 percent of the average quarterly exit rate of 12.7 percentage points. Adding nine diagnosis dummies to the estimates (columns 3 and 4) slightly increases the magnitude of these point estimates.

To ensure that these results on LTD exit are indeed driven by deterrence rather than censoring, we re-estimate the models in the lower panel of Table 7

using the censoring-adjusted sample that excludes spells of under 2 quarters from plans with a 90 day EP as well as all maternity-related spells. The estimates in this specification are closely comparable to those in the first panel, indicating that censoring is not driving these results.[21]

To provide more granular insight into the operation of the deterrence effect, Figure 2 plots the empirical hazard of LTD accessions according to their ultimate durations. The two series in this figure correspond to LTD spells initiated from two distinct sets of plans: those with 90 day EPs and those with 180 day EPs, jointly covering over 97 percent of our sample. These empirical hazards are equal to the observed probability that a covered worker in our sample commences an LTD spell during a calendar quarter that lasts for a specified number of subsequent months.[22] Spells length are measured from the date of onset but they are only observed in the data if the worker applies for and is awarded LTD benefits, and if the disability persists beyond the EP. Hence, the shortest LTD spell observed in Figure 2 is three months for plans with a 90 day EP and six months for plans with a 180 day EP.

Figure 2 reveals that a longer EP lengthens the average duration of LTD receipt by shifting the composition of spells. If the primary effect of a 180 relative to a 90 day EP were to mechanically eliminate (censor) disability spells that lasted either more than 90 but fewer than 180 days, the empirical hazard of spells of length 180 days or longer should be comparable for both sets of plans. This is not

[21] There would be much larger discrepancies in the estimated relationship between the EP and the exit rate in these two panels if indicators for the numbers of quarters since the onset of disability were not included in these specifications. As it stands, the effect of these shorter spells is almost entirely absorbed by the indicator variables coding (a) one quarter on LTD benefits and (b) maternity care as primary diagnosis.

[22] We exclude from the figure the very small number of spells observed to last longer than 48 months in our sample. Spell durations in the figure are rounded down to the nearest 30 day interval.

what we find. Not only are spells of four and five months (mechanically) absent from plans with a 180 day EP, spells of length six to nine months (180 to 270 days) are also substantially less likely to occur on plans with a 180 versus 90 day EP. For spells of ten months (300 days) or greater, however, the empirical hazard for both types of plans lie roughly on top of one another.[23] This pattern confirms that exit rates from LTD spells are on average lower on plans with longer EPs not because longer spells occur more frequently on these plans but because shorter spells occur *less* frequently. Thus, a longer EP deters a significant number of workers from accessing disability benefits for short-term but not long-term impairments. This pattern is also noteworthy because it appears inconsistent with the operation of binding liquidity constraints: while a longer EP will differentially deter LTD spells among liquidity-constrained workers, we see no reason to expect that a longer EP would differentially deter shorter but not longer LTD spells among liquidity-constrained workers.[24] We infer that the deterrence effect of the elimination period appears most consistent with forward-looking moral hazard.

## VI. Conclusions and Implications

The possibility of long-term disability is one of the most significant income risks facing U.S. workers, and can lead to financial losses that exceed the savings of most workers. Absent disability insurance, it seems likely that the consumption

[23] Notably, plans with a 90 day EP appear to have an excess mass of spells lasting 28 months, while plans with a 180 day EP appear to have an excess mass of spells lasting 31 months. It is likely that these spikes, corresponding to the 25th month of disability payments, stem from LTD policy provisions that impose more stringent eligibility criteria following two years of benefits receipt. For example, some policies disallow payments for "subjective and non-verifiable disorders" after two years, while others stipulate that the worker's disability must preclude employment in *any* occupation after two years, rather than (simply) the worker's original occupation.

[24] Unless of course longer duration spells were entirely involuntary, in which case they would be inelastic to policy parameters. But our Table 5 estimates for the effect of the replacement rate on LTD spells leading to SSDI awards suggests that this is not the case.

of disabled workers would fall significantly more than is observed for individuals who enter SSDI (Meyer and Mok 2013). At the same time, disability is in many cases difficult to medically verify, and the benefits for disabled workers can be high relative to their previous income. This leads to a potential moral hazard problem that offsets some of the welfare gains generated by the consumption-smoothing benefits of disability insurance.

These moral hazard problems have been explored in the context of public disability insurance, but the estimation of their impacts has been limited by the lack of exogenous individual variation in SSDI benefits in the U.S. In this paper, we have explored a different and largely unstudied source of disability insurance: private disability insurance provided by employers. Using a new data set on private long-term disability spells, containing variation across and within firms in benefit parameters, we document substantial behavioral responses to LTD insurance generosity. Individuals are much less likely to obtain LTD benefits if the period of time they have to wait to access benefits is longer and if the replacement rate provided by their LTD policy is lower. These responses are largest for LTD spells that appear to be most discretionary, and for those that are ultimately most likely to return to work. These results are consistent with the hypothesis advanced in Autor and Duggan (2003) that marginal disability enrollees are healthier than average enrollees.

Notably, the length of the policy elimination period also has a first order effect on the composition of spells; workers who obtain LTD benefits after a longer wait period are substantially less likely to exit beneficiary status than those who enter after a shorter elimination period. This suggests that a longer elimination period likely discourages LTD accession among individuals with less severe disabilities. An important question that follows is whether the deterrence effect of the EP on shorter spells ultimately causes would-be beneficiaries to suffer longer-term adverse health consequences that would have been averted had they obtained

treatment earlier. Our data do not, unfortunately, provide the detail or power to answer this question.

An important caveat is that our analysis does not allow us to quantify the psychic benefits that disability insurance provides to insured workers and their families, or the total social welfare gains that may accrue from defraying the financial risks of work-limiting disability. Gruber (2000) and Bound et al. (2004) discuss the tradeoff between the consumption smoothing benefits and moral hazard costs of SSDI, and Meyer and Mok (2013) assess what set of behavioral and preference parameters would be consistent with the current SSDI program providing optimal insurance. Alongside these studies, future work could usefully document the welfare gains associated with the consumption smoothing benefits of disability insurance policies in order to more fully evaluate the optimal level of program generosity.

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Figure 1. Comparison of Benefits Schedules of
Private LTD and SSDI Disability Policies by Monthly Income Level
(using LTD replacement rate of 60 percent)

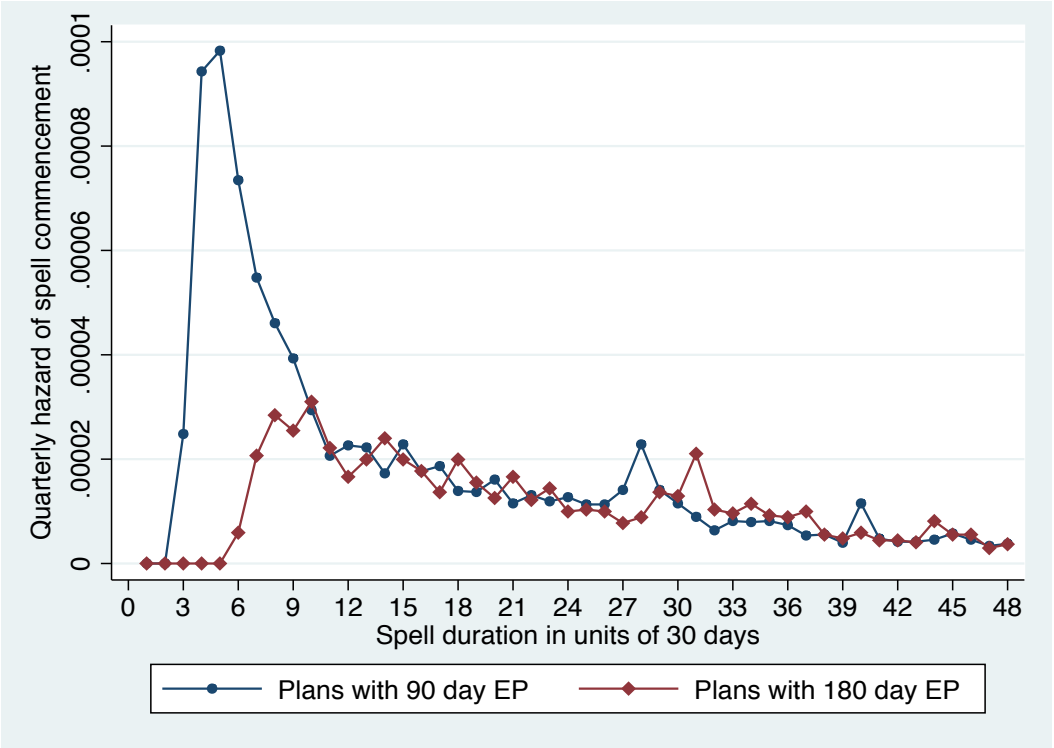


Figure 2. Empirical Hazard of Disability Spell Accession by Realized Duration on Plans with 90 and 180 Day Elimination Periods (spells exceeding 48 months excluded)

Table 1: Percent of Workers with Access to Employer Provided LTD Coverage, Overall and by Subgroup: Bureau of Labor Statistics Data

| | | | |
|---|---|---|---|
| All workers | 33% | All workers | 33% |
| *Worker characteristics* | | *Establishment characteristics* | |
| Management, professional, and related | 52% | Goods-producing industries | 34% |
| Service | 15% | Service-producing industries | 33% |
| Sales and office | 33% | | |
| Natural resources, construction, and maintenance | 26% | 1-49 workers | 19% |
| Production, transportation, and material moving | 28% | 50-99 workers | 30% |
| | | 100-499 workers | 36% |
| Full-time | 41% | 500+ workers | 51% |
| Part-time | 7% | | |
| Union | 35% | *Geographic areas* | |
| Nonunion | 33% | New England | 35% |
| | | Middle Atlantic | 30% |
| Wage percentiles: | | East North Central | 37% |
| Lowest 10 percent | 4% | West North Central | 36% |
| Lowest 25 percent | 9% | South Atlantic | 35% |
| Second 25 percent | 30% | East South Central | 33% |
| Third 25 percent | 42% | West South Central | 31% |
| Highest 25 percent | 55% | Mountain | 34% |
| Highest 10 percent | 58% | Pacific | 29% |

Table provides information on the share of civilian workers (private and state and local government) offered employer-provided long-term disability insurance coverage in March 2010. Average takeup rate is 96 percent so for most groups enrollment is approximately equal to this access rate. Data were obtained from Table 17 of U.S. Department of Labor's National Compensation Survey, Employee Benefits in the U.S., March 2010 publication at: http://www.bls.gov/ncs/ebs/benefits/2010/ebbl0046.pdf.

Table 2: Summary Statistics for LTD Sample:
Full Sample, Main Analytic Sample, and Subsample of Firms Changing Policy Parameters

| | 1. Full Sample | 2. Analytic Sample | 3. Changer Sample |
|---|---|---|---|
| | | A. Enrollee Characteristics | |
| Person-Quarters | 15,315,296 | 7,992,005 | 250,143 |
| Policies | 55,802 | 9,721 | 171 |
| Monthly Salary | $4,728 | $4,014 | $4,351 |
| | ($41,320) | ($2,691) | ($2,833) |
| Female | 45.2% | 47.1% | 48.1% |
| Age | 42.1 | 41.6 | 41.5 |
| | (10.5) | (10.5) | (10.4) |
| Age 18-24 | 3.3% | 3.5% | 2.8% |
| Age 25-34 | 24.1% | 25.8% | 26.9% |
| Age 35-44 | 30.6% | 30.5% | 30.7% |
| Age 45-54 | 28.0% | 26.7% | 26.2% |
| Age 55-64 | 14.2% | 13.4% | 13.4% |
| | | B. Industry | |
| Ag, Mining, Construct, Transport | 6.2% | 5.9% | 2.1% |
| Manufacturing | 13.0% | 15.2% | 20.4% |
| Wholesale + Retail Trade | 12.0% | 11.1% | 6.4% |
| Finance, Insurance, Real Estate | 11.4% | 10.2% | 11.5% |
| Services | 54.3% | 53.5% | 57.0% |
| Public Sector | 2.0% | 2.7% | 0.2% |
| Missing | 1.1% | 1.5% | 2.2% |
| | | C. Plan Parameters | |
| Elimination Period | 118.5 | 122.6 | 123.7 |
| | (45.6) | (48.3) | (50.9) |
| Replacement Rate | 60.2% | 60.5% | 61.1% |
| | (3.88) | (3.34) | (3.96) |
| Maximum Monthly Benefit | $6,490 | $6,746 | $7,146 |
| | (3,082) | (3,207) | (3,364) |
| Benefit Cap Binding | 6.49% | 3.95% | 6.14% |
| | | D. LTD Awards | |
| Quarterly Award Rate | 0.087% | 0.091% | 0.120% |
| Awards | 13,394 | 7,267 | 300 |
| Accidents | 15.9% | 16.2% | 19.0% |
| Cancer | 17.2% | 15.8% | 16.7% |
| Sickness / Fatigue | 13.7% | 13.9% | 13.3% |
| Back / Musculoskeletal | 11.9% | 12.5% | 11.0% |
| Heart / Circulatory | 11.6% | 11.4% | 10.7% |
| Maternity | 8.5% | 9.0% | 10.7% |
| Mental | 6.8% | 7.0% | 6.7% |
| Arthritis / Respiratory | 6.8% | 6.9% | 4.7% |
| All Other | 7.6% | 7.2% | 7.3% |

Numbers in parenthese are standard deviations. The three samples summarized are: (1) the full sample of person-quarter observations with non-missing wage data for individuals ages 18-64; (2) the primary sample, which additionally excludes individuals in the top 1 percent and bottom 1 percent of the year-specific earning distribution and those in firm-division-class combinations (FDCs) with fewer than 25 workers or with multiple plan choices; and (3) the subset of FDCs from the primary sample that change either the elimination period or replacement rate during the sample window. The unit of observation is the person-quarter in panels A through C, and is the LTD award in panel D. Monthly salary in panel A

Table 3: Replacement Rate, Elimination Period, and Max Monthly Benefits in Primary Analytic Sample

| A. Replacement Rate | | B. Elimination Period | | C. Maximum Monthly Benefit | | D. Quarterly Accession Rates by Selected Plan | |
|---|---|---|---|---|---|---|---|
| | % of Obs | | % of Obs | | % of Obs | | Rate |
| | | | | <$3,000 | 4.0% | RR 60% | 0.092% |
| 40.0% | 0.2% | 30 | 0.3% | $3,000 | 4.8% | RR 66.7% | 0.081% |
| 50.0% | 3.8% | 60 | 1.0% | >$3,000 to <$5,000 | 3.6% | | |
| 60.0% | 82.6% | 90 | 63.3% | $5,000 | 33.3% | EP 90 Days | 0.098% |
| 63.0% | 0.1% | 120 | 0.4% | > $5,000 to <$6,000 | 0.3% | EP 180 Days | 0.066% |
| 65.0% | 0.1% | 150 | 0.2% | $6,000 | 18.0% | | |
| 66.7% | 12.7% | 180 | 34.0% | >$6,000 to <$10,000 | 12.7% | Max <$5,000 | 0.123% |
| 70.0% | 0.6% | 360 | 0.8% | $10,000 | 17.2% | Max = $5,000 | 0.100% |
| All other | 0.0% | | | >$10,000 | 6.1% | Max >$5,000 | 0.078% |
| Total | 100.0% | Total | 100.0% | Total | 100.0% | Mean | 0.091% |

Table summarizes the distribution of the replacement rate, elimination period, and maximum monthly benefit in the LTD plans among enrollees in the primary analysis sample. Maximum monthly benefit is in nominal dollars, elimination period is in days, and replacement rate is the ratio of potential monthly benefits to average monthly earnings (for workers not capped by the maximum monthly benefit). Statistics are weighted by the number of worker-quarter observations available for each plan.

Table 4. The Impact of Policy Parameters on LTD Claiming
Dependent Variable: 100 x *1*[Worker Commences LTD Spell in Year and Quarter]

| | (1) | | (2) | | (3) | | (1) | | (2) | | (3) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A. FDCs with 1+ Claims | | | | | | B. Changer & 1+ Claims Sample | | | | | |
| EP Days/100 | -0.1612 | *** | -0.1614 | *** | -0.1615 | *** | -0.1644 | *** | -0.1647 | *** | -0.1649 | *** |
| | (0.0357) | | (0.0357) | | (0.0357) | | (0.0352) | | (0.0352) | | (0.0356) | |
| RR (%) /10 | 0.1000 | ** | 0.0970 | ** | 0.0969 | ** | 0.0938 | ** | 0.0904 | ** | 0.0875 | ** |
| | (0.0400) | | (0.0400) | | (0.0400) | | (0.0396) | | (0.0408) | | (0.0417) | |
| RR Capped | | | -0.0333 | *** | -0.0320 | *** | | | -0.0325 | | -0.0310 | |
| | | | (0.0114) | | (0.0117) | | | | (0.0492) | | (0.0503) | |
| N | 4,740,278 | | 4,740,278 | | 4,740,278 | | 182,225 | | 182,225 | | 182,225 | |
| EP scaled | -0.0956 | | -0.0957 | | -0.0958 | | -0.1198 | | -0.1200 | | -0.1201 | |
| RR scaled | 0.0593 | | 0.0575 | | 0.0575 | | 0.0683 | | 0.0658 | | 0.0638 | |
| Capped scaled | | | -0.0197 | | -0.0190 | | | | -0.0237 | | -0.0226 | |
| Salary Bin Linear Terms? | N | | N | | Y | | N | | N | | Y | |

Table presents linear probability models where the outcome variable is equal to one-hundred if worker has an LTD claim this quarter and is otherwise zero. Models include only FDCs with one or more claims. Models in Panel B are only estimated on the subsample of firm-division-class plans in which there is a change in policy EP or RR parameters during the sample period. All models include indicators for all firm-division-class combinations and year-by-quarter combinations; nine age bin indicators for ages 18-24 and each five year age group from 25-29 through 60-64; and twenty salary bin indicators, each corresponding to 5 percentiles of the year-specific salary distribution. Standard errors are clustered by firm-division-class. The mean of the dependent variable is 0.153 in Panel A and 0.165 percent in Panel B. Scaled estimates reported at the bottom of each panel are calculated by multiplying the point estimates by the fraction of the relevant sample included in each specification (after dropping FDCs where no accessions were observed during the sample window). * $p \leq 0.10$, ** $p \leq 0.05$, *** $p \leq 0.01$.

Table 5. The Impact of LTD Parameters on Benefit Claiming: Differentiating by SSDI and Return-to-Work Status

| | 100 x *1*[Any Accession] | | 100 x *1*[PDI + Return to Work] | | 100 x *1*[PDI + No RTW or SSDI] | | 100 x *1*[PDI + SSDI] | |
|---|---|---|---|---|---|---|---|---|
| | (1) | | (2) | | (3) | | (4) | |
| | | | A. FDCs with 1+ Claims | | | | | |
| EP Days/100 | -0.1615 | *** | -0.0896 | *** | -0.0687 | *** | -0.0087 | |
| | (0.0357) | | (0.0278) | | (0.0144) | | (0.0131) | |
| RR (%) /10 | 0.0969 | ** | 0.0118 | | 0.0247 | | 0.0600 | * |
| | (0.0400) | | (0.0314) | | (0.0197) | | (0.0307) | |
| RR Capped | -0.0320 | *** | -0.0147 | ** | -0.0047 | | -0.0125 | ** |
| | (0.0117) | | (0.0070) | | (0.0069) | | (0.0058) | |
| N | 4,740,278 | | 4,740,278 | | 4,740,278 | | 4,740,278 | |
| | | | B. Changer and FDCs with 1+ Claims Sample | | | | | |
| EP Days/100 | -0.1649 | *** | -0.0919 | *** | -0.0724 | *** | -0.0064 | |
| | (0.0356) | | (0.0278) | | (0.0138) | | (0.0137) | |
| RR (%) /10 | 0.0875 | ** | 0.0112 | | 0.0195 | | 0.0553 | |
| | (0.0417) | | (0.0309) | | (0.0221) | | (0.0349) | |
| RR Capped | -0.0310 | | -0.0224 | | 0.0337 | | -0.0412 | * |
| | (0.0503) | | (0.0314) | | (0.0340) | | (0.0237) | |
| N | 182,225 | | 182,225 | | 182,225 | | 182,225 | |

Table presents linear probability models for the following indicator variables: worker receives LTD (column 1); worker receives LTD and returns to work (column 2); worker receives LTD and neither returns to work nor enrolls in SSDI (column 3); and worker receives LTD and subsequently obtains SSDI (column 4). All models include indicators for all firm-division-class combinations and year-by-quarter combinations; nine age bin indicators for ages 18-24 and each five year age group from 25-29 through 60-64; twenty salary bin indicators, each corresponding to 5 percentiles of the year-specific salary distribution; and twenty salary bin specific linear salary terms. Standard errors are clustered by firm-division-class. * $p \leq 0.10$, ** $p \leq 0.05$, *** $p \leq 0.01$.

Table 6. The Impact of Policy Parameters on LTD Claiming: Dropping Maternity-Related LTD Awards and Spells with <180 Day Duration
Dependent Variable: 100 x *1*[Worker Commences LTD Spell in Year and Quarter]

| | (1) | | (2) | | (3) | | (1) | | (2) | | (3) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A. FDCs with 1+ Claims: Censor Adjusted | | | | | | B. Changer & 1+: Censor Adjusted | | | | | |
| EP Days/100 | -0.0652 | *** | -0.0654 | *** | -0.0656 | *** | -0.0667 | *** | -0.0670 | *** | -0.0668 | *** |
| | (0.0168) | | (0.0168) | | (0.0168) | | (0.0173) | | (0.0174) | | (0.0175) | |
| RR (%) /10 | 0.1093 | *** | 0.1070 | *** | 0.1072 | *** | 0.1020 | *** | 0.0988 | ** | 0.0970 | ** |
| | (0.0381) | | (0.0381) | | (0.0382) | | (0.0393) | | (0.0400) | | (0.0408) | |
| RR Capped | | | -0.0234 | ** | -0.0214 | * | | | -0.0291 | | -0.0242 | |
| | | | (0.0111) | | (0.0113) | | | | (0.0476) | | (0.0490) | |
| N | 4,286,348 | | 4,286,348 | | 4,286,348 | | 176,393 | | 176,393 | | 176,393 | |
| EP scaled | -0.0387 | | -0.0388 | | -0.0389 | | -0.0486 | | -0.0488 | | -0.0487 | |
| RR scaled | 0.0648 | | 0.0634 | | 0.0636 | | 0.0743 | | 0.0720 | | 0.0707 | |
| Capped scaled | | | -0.0139 | | -0.0127 | | | | -0.0212 | | -0.0177 | |
| Salary Bin Linear Terms? | N | | N | | Y | | N | | N | | Y | |

Table presents linear probability models where the outcome variable is equal to one-hundred if worker has an LTD claim this quarter and is otherwise zero. Models exclude awards for maternity related reasons and awards with fewer than 180 days between date-of-disability and claim close date, and are restricted to only FDCs with one or more claims meeting these criteria. Panel B estimates include only the subsample of firm-division-class plans in which there is a change in policy EP or RR parameters during the sample period. All models include indicators for all firm-division-class combinations and year-by-quarter combinations; nine age bin indicators for ages 18-24 and each five year age group from 25-29 through 60-64; and twenty salary bin indicators, each corresponding to 5 percentiles of the year-specific salary distribution. Standard errors are clustered by firm-division-class. The mean of the dependent variable is 0.125 in Panel A, and 0.122 in Panel B. Scaled estimates reported at the bottom of each panel are calculated by multiplying the point estimates by the fraction of the relevant sample included in each specification (after dropping FDCs where no accessions were observed during the sample window). * $p \leq 0.10$, ** $p \leq 0.05$, *** $p \leq 0.01$.

Table 7. The Impact of Policy Parameters on the Probability of an LTD Spell Ending
Dependent Variable: 100 x *1*[Worker Ends LTD Spell in Subsequent Quarter]

| | (1) | | (2) | | (3) | | (4) | |
|---|---|---|---|---|---|---|---|---|
| | | | | A. Full Sample | | | | |
| EP Days/100 | -1.453 | *** | -1.453 | *** | -1.764 | *** | -1.766 | *** |
| | (0.457) | | (0.457) | | (0.459) | | (0.458) | |
| RR (%) /10 | 0.250 | | 0.253 | | 0.134 | | 0.129 | |
| | (0.641) | | (0.642) | | (0.592) | | (0.592) | |
| RR Capped | | | 0.286 | | | | -0.619 | |
| | | | (1.283) | | | | (1.546) | |
| N | 39,117 | | 39,117 | | 39,117 | | 39,117 | |
| | | | | B. Dropping Maternity Claims and Disabilities <180 Days | | | | |
| EP Days/100 | -1.678 | *** | -1.676 | *** | -1.842 | *** | -1.840 | *** |
| | (0.357) | | (0.357) | | (0.370) | | (0.370) | |
| RR (%) /10 | -0.004 | | 0.004 | | -0.142 | | -0.137 | |
| | (0.466) | | (0.466) | | (0.482) | | (0.482) | |
| RR Capped | | | 1.187 | | | | 0.828 | |
| | | | (1.096) | | | | (1.225) | |
| N | 36,968 | | 36,968 | | 36,968 | | 36,968 | |
| Diagnosis Controls | N | | N | | Y | | Y | |

Table presents linear probability models for exits from LTD receipt in which the outcome variable, measured at the person-quarter level, is equal to one hundred if claimant exits LTD in the subsequent quarter and zero otherwise. Panel A includes all 7,267 claimants in the original analysis sample of 7,992,005 insured workers. Panel B excludes maternity claims and claims with fewer than 180 days between date of disability and close date. All models include indicators for all year-by-quarter combinations; indicators for the number of quarters of elapsed disability duration; nine age bin indicators for ages 18-24 and each five year age group from 25-29 through 60-64; twenty salary bin indicators, each corresponding to 5 percentiles of the year-specific salary distribution; and twenty salary bin specific linear salary terms. Columns 3 and 4 include nine indicator variables for diagnosis categories. Standard errors are clustered by firm-division-class. The mean of the dependent variable is 12.70. * $p \leq 0.10$, ** $p \leq 0.05$, *** $p \leq 0.01$.

Appendix Table 1. Characteristics of Private LTD and SSDI Recipients

| | LTD | SSDI | Full Population |
|---|---|---|---|
| Male | 52.3% | 49.6% | 49.3% |
| Black | 15.2% | 19.0% | 12.9% |
| Hispanic | 11.1% | 8.5% | 15.1% |
| Less than High School | 13.4% | 23.4% | 12.4% |
| High School Grad | 34.7% | 40.5% | 30.0% |
| Some College | 34.6% | 25.4% | 29.6% |
| College Grad | 17.3% | 10.2% | 28.0% |
| Family Income < FPL | 4.9% | 22.1% | 12.3% |
| Family Income < 2*FPL | 26.9% | 55.6% | 28.4% |
| Average Age | 51.1 | 50.1 | 40.5 |
| Aged 18-24 | 1.0% | 3.4% | 15.3% |
| Aged 25-29 | 2.8% | 3.8% | 11.1% |
| Aged 30-34 | 4.8% | 3.5% | 10.3% |
| Aged 35-39 | 7.2% | 6.0% | 10.6% |
| Aged 40-44 | 8.9% | 8.3% | 10.9% |
| Aged 45-49 | 10.7% | 13.3% | 11.9% |
| Aged 50-54 | 19.3% | 16.7% | 11.5% |
| Aged 55-59 | 22.0% | 21.1% | 10.0% |
| Aged 60-64 | 23.3% | 23.5% | 8.5% |
| Married | 55.1% | 41.7% | 54.8% |
| Divorced or Separated | 26.8% | 25.3% | 12.9% |
| Total Obs | 490 | 5083 | 166773 |

Source: March 2009 and March 2010 supplements to the Current Population Survey. Data summarize non-elderly adults from each survey, weighting 2009 and 2010 responses by the number of observations in each year. Individuals are coded as receiving LTD if they report receiving disability income from a company or union policy or from a disability or accident policy. Individuals are coded as receiving SSDI if they report receiving Social Security due to a disability.

Appendix Table 2. Characteristics of All LTD Enrollees vs. Sample

| | All LTD | Sample |
|---|---|---|
| *Geographic areas* | | |
| New England | 5% | 11% |
| Middle Atlantic | 12% | 17% |
| East North Central | 18% | 18% |
| West North Central | 8% | 6% |
| South Atlantic | 20% | 18% |
| East South Central | 6% | 6% |
| West South Central | 10% | 7% |
| Mountain | 7% | 3% |
| Pacific | 14% | 15% |
| Firm Size | | |
| 1-99 workers | 23% | 53% |
| 100-499 workers | 13% | 43% |
| 500+ workers | 64% | 4% |
| Wage Percentiles | | |
| Lowest 25 percent | 3% | 3% |
| Second 25 percent | 23% | 29% |
| Third 25 percent | 32% | 33% |
| Highest 25 percent | 42% | 35% |

Table compares workers in our LTD sample with all workers covered by LTD through an employer. Sources for the all LTD column include DOL (2010) along with data from the March 2004 CPS (for geography and wages) and from the Census Bureau (for employer size in 2003) available at the following website: http://www.sba.gov/advocacy/849/12162.

Appendix Table 3. Characteristics of PDI Claimants by EP Length

| | ≤100days | >100 days |
|---|---|---|
| | A. Plan Attributes | |
| Elimination Period | 87.8 | 181.9 |
| Replacement Rate | 59.8% | 59.8% |
| Monthly Salary | 3266 | 3282 |
| Benefit Cap Binding | 2.8% | 3.5% |
| Quarterly Claims Rate | 0.104% | 0.068% |
| Mean Quarters LTD Receipt | 5.6 | 7.8 |
| Median Quarters LTD Receipt | 3 | 6 |
| | B. Claimant Demographics | |
| Female | 60.0% | 48.7% |
| Age 18-24 | 2.3% | 0.6% |
| Age 25-29 | 7.1% | 3.2% |
| Age 30-34 | 10.6% | 5.4% |
| Age 35-39 | 10.3% | 8.8% |
| Age 40-44 | 12.6% | 11.4% |
| Age 45-49 | 15.2% | 16.8% |
| Age 50-54 | 15.7% | 18.6% |
| Age 55-59 | 15.5% | 20.1% |
| Age 60-64 | 10.7% | 15.1% |
| | C. LTD Claim Diagnosis<br>*Stats excluding maternity claims in parentheses* | |
| Accident | 16.7% (18.8%) | 15.0% (15.4%) |
| Fatigue | 13.8% (15.6%) | 14.1% (14.5%) |
| Heart / Circulatory | 10.3% (11.6%) | 14.4% (14.8%) |
| Mental | 7.1% (8.0%) | 6.9% (7.1%) |
| Cancer | 14.9% (16.8%) | 18.4% (18.9%) |
| Arthritis / Respiratory | 6.7% (7.6%) | 7.4% (7.6%) |
| Back | 11.9% (13.4%) | 14.2% (14.6%) |
| All Other | 7.3% (8.2%) | 7.0% (7.2%) |
| Maternity | 11.3% | 2.6% |
| # Observations | 5,351 | 1,916 |

Table contains summary statistics for the 7,267 LTD claims in our LTD sample. Claims are divided into those originating on plans with elimination periods of ≤100 days (left-hand panel) or >100 days (right-hand panel).

Appendix Table 4. The Impact of Policy Parameters on LTD Claiming:
Impacts by Worker Income Tercile
Dependent Variable: 100 x *1*[Worker Commences LTD Spell in Year and Quarter]

| | A. Point Estimates | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| EP x 1st Tercile | -0.1819 *** | -0.0717 *** | -0.2157 *** | -0.0545 ** |
| | (0.0367) | (0.0177) | (0.0681) | (0.0247) |
| EP x 2nd Tercile | -0.1520 *** | -0.0595 *** | -0.1228 *** | -0.0623 * |
| | (0.0350) | (0.0178) | (0.0367) | (0.0321) |
| EP x 3rd Tercile | -0.1446 *** | -0.0624 *** | -0.1378 *** | -0.0832 *** |
| | (0.0344) | (0.0175) | (0.0288) | (0.0254) |
| RR x 1st Tercile | 0.1062 *** | 0.1053 *** | 0.1056 ** | 0.0919 ** |
| | (0.0403) | (0.0384) | (0.0480) | (0.0445) |
| RR x 2nd Tercile | 0.1004 ** | 0.1072 *** | 0.0831 * | 0.0941 ** |
| | (0.0402) | (0.0383) | (0.0424) | (0.0411) |
| RR x 3rd Tercile | 0.0983 ** | 0.1121 *** | 0.0899 ** | 0.1049 ** |
| | (0.0402) | (0.0383) | (0.0430) | (0.0411) |
| Pr(EP1=EP2=EP3) | 0.001 | 0.464 | 0.390 | 0.665 |
| Pr(RR1=RR2=RR3) | 0.466 | 0.394 | 0.704 | 0.821 |
| Sample | Main | Main | Changer | Changer |
| Drop maternity, spells <180 days | No | Yes | No | Yes |

| | B. 1000 x Mean Accession rates | | | |
|---|---|---|---|---|
| | Main | Censored | Changer | Changer/Censored |
| 1st Tercile (lowest) | 0.197% | 0.154% | 0.224% | 0.143% |
| 2nd Tercile | 0.152% | 0.125% | 0.154% | 0.126% |
| 3rd Tercile (highest) | 0.105% | 0.091% | 0.129% | 0.104% |
| | C. Estimated % Effect of 30 Day Rise in EP | | | |
| 1st Tercile (lowest) | -28% | -14% | -29% | -11% |
| 2nd Tercile | -30% | -14% | -24% | -15% |
| 3rd Tercile (highest) | -41% | -21% | -32% | -24% |
| | D. Estimated % Effect of 1 Pct Point Rise in Replace Rate | | | |
| 1st Tercile (lowest) | 5.4% | 6.9% | 4.7% | 6.4% |
| 2nd Tercile | 6.6% | 8.6% | 5.4% | 7.5% |
| 3rd Tercile (highest) | 9.6% | 11.8% | 6.4% | 9.1% |
| N | 4,740,278 | 4,286,348 | 182,225 | 176,393 |

Table presents linear probability models where the outcome variable is equal to one-hundred if worker has an LTD claim this quarter and is otherwise zero. Models include only FDCs with one or more claims. Changer sample includes only the subsample of FDCs in which there is a change in policy EP or RR parameters during the sample period. Even numbered columns exclude awards for maternity related reasons and awards with fewer than 180 days between date-of-disability and claim close date and are further restricted to FDCS with at least one observed award meeting these criteria. All models include indicators for all firm-division-class combinations and year-by-quarter combinations; nine age bin indicators for ages 18-24 and each five year age group from 25-29 through 60-64; twenty salary bin indicators, each corresponding to 5 percentiles of the year-specific salary distribution; and twenty salary bin specific linear salary terms. Standard errors are clustered by firm-division-class. * $p \leq 0.10$, ** $p \leq 0.05$, *** $p \leq 0.01$.