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ABSTRACT

We provide a detailed analysis of the incidence, duration and determinants of claims made on private Long Term Disability (LTD) policies using a database of approximately 10,000 policies and 1 million workers from a major LTD insurer. We document that LTD claims rates are much lower than claims rates on the public analogue to LTD, the Social Security Disability Insurance program, yet LTD policies have a much higher return-to-work rate among initial claimants. Nevertheless, our analysis indicates that the impact of moral hazard on LTD claims is substantial. Using within firm, over time variation in plan parameters, we find that a higher replacement rate and a shorter waiting time to benefits receipt—also known as the Elimination Period or EP—significantly increase the likelihood that workers claim LTD. About sixty percent of the effect of a longer EP is due to censoring of shorter claims, while the remainder is due to deterrence: workers facing a longer EP are less likely to claim benefits for impairments that would lead to a only a brief period of LTD receipt. This deterrence effect is equally large among high and low-income workers, suggesting that moral hazard rather than liquidity underlies the behavioral response. Consistent with this interpretation, the response of LTD claims to plan parameters is driven primarily by the behavior of the healthiest disabled, those who would return to work after receiving LTD.

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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 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.[1] Recent data from the Current Population Survey 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. These rates are similar for men and women and they increase steadily with age. For example, adults between the ages of 55 and 64 are four times as likely as adults ages 25 to 34 to be out of the labor force as a result of a disability.[2]

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 million recipients of SSDI and SSI between the ages of 25 and 64 receiving total cash benefits of $150 billion in 2010, as well as an approximately equal amount of health insurance benefits through the Medicare and Medicaid programs. Yet these federal programs provide incomplete insurance because their acceptance rates are low (about one-half) and their replacement of pre-disability earnings is only partial: average after-tax replacement rates are approximately 50 percent, with lower replacement rates for higher income workers. The Social Security claims administration process is slow and litigious. Although first round disability determinations are usually rendered within six months of application, almost half of all awards are made on appeal, which adds one to three years to the determination process. Applicants do not receive cash or medical benefits until their claim is awarded but they must remain out of the labor force for the duration of the application since substantial labor force participation would lead to summary denial of a disability award.

Due to the many limitations of the public disability programs—particularly for workers with high earnings as well as those who wish to remain employed despite work limitations—many private

[1] U.S. Social Security Administration (2011)

[2] Results from authors' tabulations of the March Current Population Survey.

employers in the U.S. offer long term disability insurance (LTD). Approximately one-third of civilian workers are eligible for coverage through private LTD provided by their employers that supplement the public programs. Take-up rates for this coverage are close to 100 percent. These 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 claims and a higher rate of returning to work after claiming.[3]

Despite the importance of this private disability option, we know little about the characteristics and impact of such plans. This paper begins to address this deficiency by analyzing for the first time in the economics literature a detailed database of private LTD policies and claims. 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 claims data from a large component of their business that contains seven years of data (2000 through 2006). Our database includes data on employment, earnings, and LTD claims 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 claiming rates in our sample are much lower than claiming rates for SSDI and yet there is a much higher return-to-work rate among new LTD recipients than among those receiving benefits from the SSDI and/or SSI programs.

We next use these data to provide insight into the critical question of the moral hazard impacts of disability insurance. We match individual LTD claims records to data on potential benefit generosity

[3] 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 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 claimants to exit the labor force and enter the SSDI program.

under the relevant LTD plans, and exploit variation both across and within firms in the LTD policy replacement rate, maximum monthly benefit, and elimination period or EP (the amount of time that must elapse before benefits can commence). This setting allows us to estimate how plan parameters affect claims rates, claims durations and the composition of claims to provide an overall picture of how responsive LTD claims are to incentives and to explore some of the economic mechanisms behind these behavioral responses. While likely not perfectly predictive of behavioral responses to *public* disability insurance programs (due to the differing characteristics of LTD enrollees), these results offer some insights into the probable magnitude of such responses.

We find that a higher policy replacement rate significantly increases the likelihood that a person claims LTD benefits. This effect is driven by variation in the maximum monthly benefit, as workers whose benefits are capped (and therefore face a lower effective replacement rate) are substantially less likely to claim LTD benefits than otherwise similar workers whose benefits are not capped by their policies. Our estimate of the elasticity of LTD claiming with respect to the replacement rate is sizable, equal to approximately 0.6. We also find that plans with higher replacement rates have lower exit rates from receipt of benfits, but the relationship is not statistically significant. In addition, the impact of a higher replacement rate on the frequency of LTD claims is driven primarily by increases in the claims rate of the healthiest claimants, those who return to work after receiving LTD. This result is consistent with the theoretical predictions in Autor and Duggan (2003) and empirical evidence in von Wachter et al. (2010) that the health of the marginal disability insurance claimant is greater than the health of the average claimant.

Our most striking results concern the impact of the elimination period (EP) on the frequency, composition and duration of LTD claims. A longer EP may affect both claims rates and claims durations through two channels. A first is censoring of shorter claims. For example, claims for impairments that last between 90 and 179 days will not be observed in plans with an 180 day EP but will be observed on plans with a 90 day EP. The second channel is deterrence: workers on plans with a longer EP may decline to claim 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 claiming unattractive relative to continuing to work.

Our analysis finds an economically large and statistically robust effect of the EP on the frequency of claims. 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 a near doubling of the LTD claims rate. 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 claims. We estimate that the marginal claimants deterred by a longer EP are those who are most likely to complete their disability spell within our five-year sample window and return to the workforce. By contrast, the incidence of LTD claims which ultimately lead to an SSDI award—generally the most severe disabilities—is unaffected by the length of the EP. This is consistent with the expectation that deterrence should primarily affect claims for less severe disabilities; for acute disabilities where labor force withdrawal is non-elective, deterrence should not (and does not appear to) play a role. Complementing this result, we find a striking *positive* relationship between the elimination period and the duration of LTD claims paid: plans with longer EPs have claims of substantially greater duration. We also show that the deterrence effect of the elimination period does not simply reflect liquidity constraints—the effect is present for both higher and lower-income workers—and thus appears most consistent with "forward-looking" moral hazard behavior.

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 our results for the incidence of claims, while Section 4 focuses on the interesting implications of the elimination period results, and Section 5 examines the duration of claims. We conclude in Section 6 with the implications of our findings for both LTD and DI policy.

1. 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, as an individual would still incur housing, food, and related costs in the event

of disability as well as substantial increases in healthcare costs. Since disability substantially reduces labor income without reducing living costs, consumption declines by an average of more than 20 percent following the onset of disability (Meyer and Mok, 2008).

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).[4] 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.[5] 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.

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 (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 substantially 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

[4] The vast majority (93 percent) of employer-provided LTD policies have a flat replacement schedule (unless the worker reaches the maximum monthly benefit) as opposed to a progressive schedule like the SSDI program.

[5] LTD plans can also 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. 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 et al, 2011; French and Song, 2011).

insurance (38 percent) but more common than comparable vision coverage (22 percent). Employers pay the full premium for the vast majority (90 percent) of the 40 million civilian workers with LTD coverage.

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.

Characteristics of LTD Policies

There is also substantial cross-employer variation in the generosity of LTD policies. This variation is most apparent in the maximum monthly LTD benefit. As shown in Table 2, among those LTD policies with a maximum monthly benefit, the 90th percentile monthly maximum is $15,000 versus a 10th percentile of $3,000 per month.[6] Notably, this 10th percentile benefit *exceeds* the maximum benefit possible from today's SSDI program, underscoring that potential private LTD

[6] Approximately one-fifth (22 percent) of those surveyed in this BLS survey do not report a maximum monthly benefit. A firm with few high-wage workers might not need to have a maximum monthly benefit given that benefits would effectively be capped at 60 to 67 percent of earnings for the highest-paid worker.

benefits are substantially higher than potential SSDI benefits for many workers, especially those with high incomes.

The lower panel of Table 2 highlights the variation in replacement rates across LTD policies, which, although less pronounced than for maximum benefits, is nevertheless significant. Approximately two-thirds (60 percent) of workers face a policy replacement rate of 60 percent, and an additional 17 percent are in policies with replacement rates of 61 to 67 percent. Just 2 percent of policies have a replacement rate of more than 67 percent while approximately one-in-five (20 percent) are below 60 percent. Further examination of the BLS data (not tabulated) reveals that the average replacement rate is almost identical across demographic groups. For example, the average replacement rate is 59 percent for both full-time and part-time workers and is also 59 percent for workers in the first, second, third, and fourth quintiles of the earnings distribution.[7]

Comparison with SSDI

There are several key contrasts between private LTD insurance and its public sector counterpart, the Social Security Disability Insurance program.[8] SSDI is one of the nation's largest social insurance programs, with cash expenditures of $128 billion in 2010 and an additional $80 billion in Medicare expenditures. SSDI provides disability compensation to those with previous labor force attachment who are no longer able to engage in "substantial gainful activity." After a waiting period (functionally equivalent to the elimination period in private LTD) of five months since disability onset, individuals may apply to a local Social Security Administration (SSA) field office for SSDI benefits. If approved, the individual receives a monthly Social Security disabled worker benefit until reaching the full retirement age. SSDI recipients also qualify for health insurance coverage through Medicare two years after the onset of the disability.[9] If an SSDI applicant is denied, he or she can

[7] The BLS data unfortunately do not have comparable information on the elimination period.

[8] We compare LTD to SSDI rather than SSI because SSDI, like LTD, is an insurance program that workers become eligible for through employment. By contrast, SSI is an entitlement that does not depend on employment history and primarily serves those with limited labor force experience.

[9] After reaching full retirement age, the SSDI beneficiary transitions onto standard Social Security retirement. The beneficiary's cash and Medicare benefits remain unchanged at the transition.

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, 2010).

SSDI is a public insurance program that workers buy into directly through their payroll taxes. To become insured by SSDI, a worker generally needs to have engaged in substantial gainful employment in covered employment for five of the prior ten years, though the entitlement period is shorter for younger workers. A worker with median earnings (approximately $32,000 in 2009) pays an effective premium of approximately to $600 for SSDI coverage.[10] Notably, annual premiums for LTD coverage—which average approximately $250—are substantially lower than the effective premiums that workers pay for SSDI coverage.[11] Moreover, the true disparity is likely even larger because workers with LTD coverage tend to have above average incomes, meaning that their effective SSDI premiums 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 claims in our sample—their LTD benefits are reduced by the SSDI award one-for-one (thus, leaving the claimant's benefit unaffected but reducing the LTD insurer's cost). In addition, SSDI recipients become entitled to Medicare health insurance benefits two years after the onset of disability.[12] LTD plans, by contrast, do not pay healthcare costs.

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

[10] The SSDI portion of Social Security's 12.4 percent payroll tax rate is 1.8 percent, which would imply $576 in annual SSDI taxes for this worker. The SSDI program is currently running a large deficit, however, with SSDI benefits 31 percent greater than tax revenues received. Multiplying $576 by 1.31 yields $755, a number that is much closer to an actuarially fair premium (though private LTD policies are likely somewhat higher than actuarially fair, reflecting the insurer's load).

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

[12] Although the SSDI award entitles the beneficiry to Medicare, Medicare premiums are paid through a separate payroll tax.

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 average 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 lower incomes of $1500 per month or less can receive a higher benefit from SSDI than from private LTD coverage. 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 $106,800 in earnings (at present), the monthly SSDI benefit caps out at this income level ($2,570 monthly in 2012) and hence the SSDI replacement rate declines at higher salaries. It is therefore not surprising that high-income workers are much more likely to receive 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 Current Population Survey (CPS) in 2009 and 2010.[13] The age distributions of the two populations are similar, but those receiving LTD have significantly higher education and higher family incomes than those receiving SSDI.

While there is little previous academic research on LTD, there is a large literature on SSDI (see Autor and Duggan 2006 for an overview). The general consensus of this literature is that applications to SSDI and labor force decisions are sensitive to both program parameters (benefit generosity and

[13] While the CPS has not asked respondents about LTD coverage since 1993, the March CPS Annual Demographic Supplement queries respondents on their LTD benefits receipt.

medical eligibility criteria) and outside opportunities (economic conditions and potential earnings). Gruber (2010) finds, however, 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 claims, 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 claimants. We begin to address this knowledge gap here.

2. Construction of the Analytic Sample

Our analysis exploits a unique administrative database containing LTD policies and claims 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.[14] 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.

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. Because our initial focus is on claims incidence rather than claims durations, we drop observations for an individual after his/her first quarter of benefit receipt (100,136 observations), though we conduct a

[14] 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, do not report detailed data age and salary data for each insured worker to the insurer but instead report a count of insured workers. Because the insurer obtains detailed data on only the workers at these firms who file claims, these data are unsuitable for our analysis.

separate duration analysis in the final empirical section. We next drop observations that are missing wage data. Given that we control for wages using the preceding two quarters of earnings, this leads us to drop all employees in the first two quarters that a firm appears in the data and new employees for their first two quarters of coverage. This reduces our sample size from 21.81 million person-quarters to 15.62 million person-quarters.

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.

We make four further restrictions in constructing the final analytic sample. First, we drop those firm-division-class combinations with fewer than 25 enrollees at any point during the sample period since, for very small firms, there is likely to be a greater vulnerability to endogenous changes in plan parameters. This criterion reduces our sample size to 8.91 million observations.

We next drop observations for those firm-division-class combinations that provide their employees with a choice between multiple plans at any point during our sample period. We do this because workers will likely sort across policies in response to their own perceived probability of claiming. This reduces our sample size to 8.30 million observations. We restrict attention to non-elderly adults between the ages of 18 and 64. And, finally, we drop individuals in the top 1 percent or bottom 1 percent of the year-specific earnings distribution, thereby excluding workers with annual earnings of less than 12 thousand dollars or more than approximately 240 thousand dollars in the typical year. This leaves us with a final sample of 7.99 million person-quarter observations representing 9,721 unique firm-division-class combinations and 1.02 million unique workers.

Summary statistics for the sample (Table 3) show that the average worker in our sample is 41.6 years old, 52.9 percent are males, and the mean monthly salary is $4,014. More than half (53.5 percent) of workers are in services, with the next most common industries being manufacturing (15.2

percent), finance, insurance, and real estate (10.2 percent), and wholesale trade (8.9 percent).[15] The sample is geographically dispersed, with all fifty states represented and the two most common states being California and New York (not tabulated).

One particularly noteworthy fact revealed by the table is that the incidence of LTD claims is quite low at 0.091 percent per quarter—that is, less than 1 tenth of 1 percentage point.[16] This is 34 percent lower than the average SSDI award rate of approximately 0.14 percent per quarter for insured workers.[17] 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. For example, while the quarterly exit rate from SSDI (excluding deaths and conversions to retired worker benefits) is just 0.2 percent, while for those receiving LTD benefits in our sample it is almost 10 percent.[18]

The most common medical conditions with which individuals 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 claimants. Perhaps the most striking difference between the distribution of diagnoses in our sample and the corresponding distribution for SSDI lies in the category of mental disorders, which account for about 25 percent of SSDI awards (SSA, 2010) during this period versus just 7.0 percent of private LTD claims. 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.

[15] Although LTD coverage rates are comparable in service and manufacturing sectors (Table 1), services is a numerically larger sector.

[16] All claims data reported here refer to successful LTD claims. We do not analyze rejected claims.

[17] 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).

[18] The LTD exit rate measured in our data is likely to include a small number of deaths, though we cannot distinguish these from other causes of exit. If one includes deaths in the SSDI exit count, the SSDI quarterly exit rate increases from 0.2 to 0.9 percent, which is still an order of magnitude smaller than for LTD.

An examination of our data reveals that the incidence of LTD claims varies substantially with worker characteristics. For example, workers in the top five percent of the year-specific salary distribution have a claiming probability of just 0.04 percent per quarter whereas those in the bottom 5 percent have a claiming probability that is three times as high at 0.13 percent per quarter. Age is also a strong predictor of LTD claims, with those in their early sixties almost five times as likely to claim LTD benefits as are 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 claim LTD benefits, with probabilities of 0.10 percent and 0.08 percent, respectively. Excluding maternity claims, however, eliminates this gender difference. Given the substantial differences in claims rates by age, sex and salary, we control for demographic characteristics, when exploring the effect of plan parameters on claiming probabilities and other outcomes of interest.

Table 4 provides information on the policy parameters of the LTD plans in our sample, weighting by plan enrollment.[19] Consistent with the representative data summarized in Table 2, the most common 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.

The final panel of Table 4 provides comparable data for the maximum monthly benefit in LTD plans. The sample from this insurer is similar to the national data on this dimension as well, though our sample contains relatively fewer plans with maximum monthly benefits exceeding $5,000. [20] A likely reason is that our sample is limited to "list billed" firms, which tend to be somewhat smaller than the average firm purchasing LTD coverage. 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 95th percentile maximum benefit is $12,500 versus a 5th percentile of just $3,000.

[19] More precisely, we weight by the number of worker-quarter observations available for each plan. Thus, these statistics correspond to the plan attributes faced by the average worker in our sample.

[20] The median maximum monthly benefit in our private LTD sample is $6,000 versus $7,000 in the national data.

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 sample whose potential LTD benefit is capped at the maximum level provided by their LTD plan is 4.0 percent, and this is substantially higher for workers with high incomes. 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 LTD claims rates.

Empirical Strategy

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

$$(1) \qquad \Pr\left(CLAIM_{ijq}\right) = f\left(\alpha + \beta EP_{jg} + \eta RR_{ijg} + \mu X X_{ijq} + \theta_j + \delta_q\right)$$

In this equation, *i* indexes individual workers, *j* indexes their firm-division-class category, and *q* indexes year-by-quarter interactions. *CLAIM* is an indicator variable equal to one if worker *i* makes a claim in year-quarter pair *q*. The variable *EP* measures the elimination period (in days), and *RR* is the replacement rate for worker *i*. Notice that unlike *EP*, which varies only at the firm-division-class level, the replacement rate measure varies at the individual level because workers who are capped by the monthly benefit limit face an effective replacement rate that is below the nominal policy replacement rate.[21] We will also consider specifications where we include an indicator for whether the individual's potential LTD benefit is capped at the maximum monthly benefit. 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

[21] To avoid the concern that the individual-specific replacement rate may be endogenous to a worker's health, we calculate the replacement rate using workers' average earnings during months six through twelve *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.

position in the sample's annual earnings distribution.[22] We also include in all specifications a set of firm-division-class fixed effects. We use a linear probability model for our main estimates of (1).

There are a number of potential limitations with specification (1). First, 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. To explore whether our results are sensitive to the linearity assumption, we have estimated a companion set of models with probit specifications using the subset of policies that contribute a large number of observations to the data set. These models, available from the authors, yield very similar results to those below.

A second concern is that while we have millions of observations, the variation that we analyze in our key policy variables exists only at the firm-division-class-quarter (FDC) level. We therefore cluster our standard errors by FDC.

A final concern 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 claims rates is identified by the interactions between policy parameters and worker earnings.

It remains possible, of course, that even changes in plan parameters are affected by worker preferences and demographics; for example, a firm that has an aging work force may choose to lower

[22] 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.

its benefits to reduce the incidence or cost of claims. While our detailed demographic and income variables should control for such changes, to the extent that there are unobserved changes in claiming propensity that are correlated with changes in plan parameters, it could bias our estimates. To address this concern, some specifications also include FDC by quarter interactions, which allow us to fully control for any changes in FDC characteristics that may be associated with changing plan parameters. With these interactions included, however, we cannot identify the effect of the elimination period on outcomes (since it only varies at the FDC by quarter level). But we can still identify benefit effects by using variation in the effective replacement rate across workers within a given FDC by quarter.[23]

3. The Impact of Plan Parameters on Claims Incidence

The upper panel of Table 5 presents initial estimates of equation (1), which models the relationship between plan parameters and LTD claims. To facilitate interpretation of the point estimates, the elimination period coefficient shows the effect per 1,000 days of EP while the replacement rate measure is divided by 1,000 (so that the mean replacement rate is 0.00061). Column (1) of the table finds a highly significant negative coefficient on the elimination period term. The point estimate of -0.011 (se 0.0027) implies that an increment of 90 days to an LTD's policy elimination period lowers the LTD claims rate by 0.10 percentage points, which slightly exceeds the average baseline rate. This finding suggests that claiming behavior is quite responsive to the 'deductible' that workers face when making claims—a point that we analyze in detail below.

The column (1) estimate also finds a marginally significant impact of the replacement rate on LTD claims. A 10 percentage point rise in the replacement rate is estimated to increase the claims rate by 0.007 percentage points, or about 8 percent of the sample mean. This implies an elasticity of claims with respect to the replacement rate of 0.47 at the sample mean replacement rate and claiming

[23] Consider, for example, two hypothetical workers at firm A with monthly incomes of $4,000 and $10,000 ($48,000 and $120,000 per year), respectively, and compare them with two workers at firm B with identical incomes. Suppose that both employers have LTD policies with a replacement rate of 60 percent but that the maximum monthly benefit for firm A is just $3,000 versus $10,000 for firm B. In this example, both of the workers with lower wages would have a replacement rate of 60 percent. In contrast, the high-income worker at firm A would have a replacement rate of just 30 percent while his counterpart at firm B would have a replacement rate of 60 percent.

rate (60.5 percent and 0.09 percent respectively). This elasticity is somewhat larger than that found by the literature on disability insurance (Gruber, 2000).

In the second column, we add an indicator for whether the worker would be capped by the maximum monthly benefit if she were to make an LTD claim. For capped workers, the effective replacement rate is lower than the nominal rate stipulated by the policy. The replacement rate retains its positive sign in this specification—that is, higher replacement rates induce more claims—but it is substantially smaller in magnitude than in the prior column and is statistically insignificant. Conversely, 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 make an LTD claim. The point estimate implies that if a worker is capped, she is 0.014 percentage points less likely to make an LTD claim, which is approximately a 15.9 percent reduction in the base claims rate. 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 claiming with respect to the replacement rate of 0.55, which is slightly larger than in the first column.

The variation that identifies this point estimate deserves discussion. Because the model includes detailed wage category controls, the coefficient on the capped variable is not simply identified by comparisons across workers with different earnings.[24] Nor is it driven by a comparison of workers with the same earnings in firms with different replacement rates, since our FDC indicators absorb this source of variation. The estimated effect is instead identified by the interaction between a worker's wage and her FDC-specific benefit cap. The significantly negative coefficient on the benefits cap variable indicates that the difference in the claims rate of high-income workers versus low-income workers is relatively lower at firms with lower monthly maximum benefit caps, presumably reflecting the fact that the disparity in the replacement rate of high-income workers versus low-income workers is relatively lower at these firms.

[24] As above, this specification controls for FDC-specific claim rates by the inclusion of FDC fixed effects, and it flexibly controls for the relationship between income and claims rates using 20 salary indicator variables.

To test the robustness of the initial estimates, we add to the model a series of wage category-specific splines, which are linear wage terms that vary freely across categories (column 3). These splines account for the fact that as a worker's wage increases within each of the twenty salary bins, she becomes less likely to claim (because of the negative relationship between claiming and income) but also more likely to be constrained by the benefits cap. Inclusion of this richer set of wage controls does not appreciably impact our estimates. In column 4, we drop the actual replacement rate from the specification given its small magnitude and statistical insignificance. This has virtually no impact on the estimated effect of the elimination period or the benefits cap variable. It does, however, increase the precision of the capped indicator, which is significant at the 5 percent level in this specification.

The final specification in the first panel of Table 5 additionally includes FDC by quarter interactions, which purge all cross-sectional and over-time variation in policy parameters between and within firms and thus identify the model solely from interactions between workers' wage levels and policy parameters (specifically, the interaction between the policy replacement rate, the worker's wage, and the benefits cap). Notably, the coefficient on the capped measure remains virtually unchanged in this specification.[25] The point estimate implies that capped workers are 16 percent less likely to claim benefits, yielding an implied elasticity of claiming of 0.6, which is about twice that of the impact of DI benefits estimated by Gruber (2000). The similarity of the estimate in column 5 to earlier columns suggests that the relationship between plan parameters and LTD claims is not primarily driven by the endogenous sorting of workers with low claims propensity to less generous plans (or vice versa). We therefore interpret these results as capturing the behavioral responses of LTD claimants to the replacement rates they face. Lengthening the period of time that workers must wait to obtain LTD benefits significantly reduces workers' propensity to claim, while raising the benefits for which they are eligible through higher maximum monthly benefits encourages claiming.

[25] The main effect of the policy replacement rate is absorbed by the FDC dummies.

How severely disabled are the marginal claimants?

Given the evidence that LTD claims are elastic to policy parameters, a key question that we explore next is how severe the health conditions are that constitute the marginal LTD claims induced or deterred by variation in policy generosity. In general, we would expect marginal claims to comprise cases where claimants have some discretion about whether or not to continue working versus claiming benefits, implying that these disabilities will be relatively non-severe. Conversely, the most severe disabilities are likely to require labor force exit and so will be relatively unaffected by financial incentives.

To test these hypotheses, we use the longer-term outcomes of LTD claimants as a measure of the 'revealed' severity of impairments. We divide the sample of claimants 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.[26] 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 claimants for at least one year after their initial LTD claim. We may not however see the ultimate resolution of some claims, particularly those that are most recent. Undoubtedly, some of these claimants will return to work and others will receive SSDI.[27]

Table 6 reports the results from specifications that are analogous to the last two columns of Table 5, where in this case the dependent variables are dummies for claims that fall into each of three categories: a claim leading to return to work (the "most healthy" claimants); a claim leading to SSDI (the "least healthy" claimants); a claim leading to neither return to work nor SSDI. Note that these

[26] Like all LTD policies of which we are aware, this insurer offsets LTD benefits dollar-for-dollar against SSDI benefits. Thus, receipt of SSDI does not affect the replacement rate of LTD beneficiaries, though it may extend the duration of their benefits.

[27] Of 7,267 LTD awards in our sample, 29.4 percent are observed to lead to an SSDI award. Among LTD claimants awarded SSDI, 96.1 percent do *not* return to work. Among LTD claimants 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.

three categorical outcomes (approximately) sum to the total claims rate, so this set of models decomposes the effect of policy parameters on claims into these three constituent components. [28]

We find that there is a significant effect of the elimination period on the most healthy and intermediate groups, but that there is no effect on the least healthy, those who ultimately move to SSDI. Note that the coefficients in columns 1 and 3 are quite close in magnitude and their sum is approximately equal to the coefficient in column 2 of Table 5 (where the outcome is any LTD claim). Thus, about half of the deterrence effect of a longer EP results from a reduction in claims that would have returned to work and the other half from claims that neither return to work nor garner an SSDI award (in our sample window). None of the effect is due to the deterrence of claims that would have resulted in an SSDI award. Reinforcing this pattern of results, we find that the bulk of the effect of the binding benefits cap on the claims rate is driven by its effect on the least severe category—that is, claimants who ultimately return to work. Our results therefore support the hypothesis that the healthiest potential LTD recipients are the most responsive to plan parameters. This is consistent with the logic of the simple model in Autor and Duggan (2003), which implies that marginal disability benefits claimants are likely to be those with greatest work capacity.[29]

4. Why Does a Longer EP Deter Claims? Censoring, Forward-Looking Moral Hazard and Liquidity Constraints

While it is self-evident why a lower replacement rate will reduce workers' propensity to claim LTD benefits, the robust negative effect of a longer elimination period on LTD claims deserves further scrutiny. This negative effect may reflect either a mechanical or behavioral response to plan parameters: mechanically, a longer EP will censor LTD claims that would be resolved during the elimination period (e.g., a disability of 120 day duration will not result in an LTD claim for a

[28] There is a small amount of slippage because 83 of the 7,267 claims are coded as both "return-to-work" and "claim SSDI." This occurs when a claimant receives SSDI and also returns to work at his/her employer. We do not observe whether the SSDI award was made before or after the claimant returned to work. It is likely that some of the claims coded as "claim PDI, no RTW and no SSDI" will garner an SSDI award outside of our sample window.

[29] Consistent with this hypothesis, von Wachter et al. (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.

policyholder facing a 180 day EP); behaviorally, a longer EP may deter claims that would require the claimant to accept an extended period of earnings loss followed by only a brief period of benefits receipt. These different channels have distinct welfare implications. If the negative effect of a longer EP on LTD claims is purely mechanical, this would imply that a longer EP reduces insurance without correcting any behavioral distortions such as moral hazard. If the effect reflects a behavioral response, however, this would suggest that either a longer EP reduces moral hazard or that it causes liquidity constraints to become more binding. We consider these possibilities here.

A simple means to isolate the deterrence from the censoring component of the EP-claims relationship is to eliminate the claims 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 allows us to assess what of the initial EP-claims 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 4), we focus on the 90/180 distinction. We drop claims 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 paid claims. As an additional conservative step to excise any mechanical effect that the EP may have on claims rates, we also disregard maternity-related claims, which for obvious reasons are substantially (three times) more prevalent on 90 than 180-day EP claims (see Appendix Table 2).

The censoring-adjusted estimates, which are found in Panel B of Table 5, can be summarized simply: after eliminating the pure censoring effect from the comparison, plans with a higher EP still have substantially lower claims 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 claims rate differential between shorter and longer EP plans is due to censoring with the rest due to deterrence.

Censoring also has noticeable effects on the response to benefits generosity. While the censoring adjustment has only a minimal effect on the coefficient on the overall replacement rate variable in column (1), the coefficient on the binding maximum benefit variable in columns (4) and (5) is

reduced by about one-third relative to the corresponding specifications in the upper panel (i.e. where shorter claims and maternity-related claims are included). This is again consistent with the notion that it is the workers with the least severe disabilities who drive the observed responsiveness of PDI claims to benefit parameters; those claimants with the shortest spells appear to be those with a higher elasticity of claiming with respect to benefit levels.

There are two potential explanations for the behavioral response of LTD claimants to longer waiting time to benefits eligibility. The first 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. [30] In this case, the worker's choice is distorted by the fact that a third party subsidizes some courses of action but not others. If forward-looking moral hazard is operative, this implies excessive use of LTD benefits relative to a world with first-best incentives.

A second mechanism that is consistent with the same behaviors but has distinct 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 claims 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

[30] Cabral (2011) studies a related phenomenon: patients' strategic delay of treatment to maximize their insurer's share of treatment costs. Such behavior is relevant for policies where the patient's marginal out of pocket treatment costs vary over the year (e.g., if there is an initial annual out-of-pocket deductible or a cap on benefits paid within a year). For the policies we study, there is little incentive for strategic retiming because claimants' out-of-pocket costs depend almost entirely on salary (through foregone income) and do not change discreetly over time.

the degree that it deters claims, 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 income plays in deterrence. If liquidity constraints are the primary reason that plans with a longer EP experience fewer claims, this deterrence effect should be greatest for lower-income workers, i.e., those for whom cash flow concerns will be most constraining. If forward-looking moral hazard is the main explanation, however, we would not expect the deterrence effect of a longer EP to depend substantially on claimants' income.

We offer a simple test of these competing explanations in Table 7 by re-estimating the models in columns (4) and (5) of Table 5 for the relationship between plan parameters and LTD claims separately for workers whose monthly incomes are above and below the sample median. These estimates find that the deterrence effect of a higher EP is sizable and robustly significant for both above-median and below-median workers. While in absolute terms, it is larger for below-median earners (compare the coefficient of -0.014 in column (3) to the coefficient of -0.008 in column (5)), it is also the case that quarterly claims rates are substantially higher for workers for below versus above-median workers: 0.11 percent versus 0.07 percent, respectively. Dividing the point estimates through by the base claims rates, we find that the elasticity of claims with respect to the EP is quite comparable for low-income and high-income workers. When we perform this same analysis on the censoring-adjusted sample in Panel B of Table 7, we reach a similar conclusion. Indeed, the point estimates in the lower panel suggest that the deterrence elasticity is somewhat higher for high-income workers than for low-income workers, which is strongly at odds with a liquidity constraints interpretation of the deterrence results in Table 5.

On net, we find a substantial effect of plan parameters on the incidence of claims—not surprisingly, more generous policies receive more claims. 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 claims rate is due to claims deterrence rather than simple censoring. This deterrence effect appears to reflect moral hazard rather than the operation of binding liquidity constraints. These behavioral relationships also have important implications for claims durations, as we show next.

5. Impacts of LTD Parameters on Claims Durations

A key difference between private LTD and SSDI noted above is the higher rate of exit from LTD receipt. While the quarterly exit rate from SSDI is just 0.2 percent (0.9 percent if deaths are included), the exit rate from our sample is more than an order of magnitude higher at 12.7 percent. Though some of this disparity likely reflects differences in the underlying health of LTD and SSDI enrollees (i.e. there are no maternity claims in SSDI) as well as differences in their attachment to the labor market, it is plausible that some is also attributable to differences in the incentives created by the two programs.

In this final set of analyses, we focus on the exit rate from claims status for individuals in our sample who claimed LTD benefits 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 claims exits analogous to equation (1) above. [31] 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.[32]

Our analysis sample for these specifications, summarized in Appendix Table 2, 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.[33] The mean LTD spell in our sample lasts 6.2 quarters and the

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

[32] 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 claimant with a 90-day EP received benefits whereas the quarter 2 indicator would "turn on" in the first quarter that an LTD claimant with a 180-day EP received benefits (and the quarter 1 indicator would never "turn on" for this claimant).

[33] The average duration is somewhat higher at 6.2 quarters because many of our claims 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 claims in 2007 and thus do not consider exit decisions after 2007Q1 though our results are very similar if we include them.

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 firm-division-class combinations accounted for by these claimants (thus an average of just 2.1 claimants among employers with one or more claimants).

We focus first on the two variables that jointly determine worker replacement rates: the direct replacement rate measure and the binding cap measure. The replacement rate may affect the probability that an LTD spell completes through two countervailing channels. On the one hand, one would expect more generous LTD policies to have lower exit rates from receipt of benefits. However, to the extent that healthier enrollees are more likely to claim LTD when benefits are more generous, one might expect them to have higher exit rates once enrolled. This latter effect seems plausible given our earlier findings that a less binding maximum induces a healthier set of workers to claim LTD benefits.

Our results in Table 8 reflect these offsetting effects. The coefficient on the replacement rate is negative, suggesting that higher replacement rates are associated with lower exit rates, but in most cases it is statistically insignificant. The estimates for the binding benefit cap are mixed and never statistically significant. Taken together, our results are inconclusive regarding the importance of incentive versus compositional effects of replacement rates on exit rates

This ambiguity does not carry over to the expected effect of the elimination period on claims durations. Given the finding above that a longer EP deters a substantial share of claims net of its mechanical censoring effect, and presuming that primarily shorter claims are deterred, a longer EP will shift the composition of LTD claims towards those with longer duration.

There are two reasons to expect that the claims deterred by a longer EP are those that would have relatively short durations were they not deterred. First, shorter claims are more likely to stem from non-severe impairments for which labor force withdrawal is elective. Longer claims, by contrast, are more likely to be brought on by severe impairments for which labor force exit is non-elective and hence deterrence is not relevant. Second, the incentive effect of the EP has greater 'leverage' for shorter versus longer claims. 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 plan has a 90 day EP, she will receive 21

quarters of LTD payments whereas if her plan has a 180 day EP, she will receive 20 quarters of benefits. Hence, a 90 day increment to the EP reduces her LTD benefit by only 5 percent. Now consider a worker who expects to be out of the labor force for four quarters due to a disability. For this worker, a 180 day EP reduces her LTD benefits by 33 percent (one of three quarters) relative to a 90 day EP.

The estimates in Table 8 provide strong confirmation of this prediction. Across all specifications, we find that the exit rate from LTD beneficiary status is substantially lower for claimants from plans with longer elimination periods. The point estimate of -0.149 in the first column of Table 8 (panel A), for example, suggests that a 90-day increase in the elimination period generates a quarterly exit rate that is 1.3 percentage points lower than baseline. This represents about 10 percent of the average quarterly exit rate of 12.7 percentage points. Adding nine diagnosis dummies to the estimates (columns 4 through 6) 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 8 using the censoring-adjusted sample that excludes claims of under 2 quarters from plans with a 90 day EP as well as all maternity claims. The estimates in this specification are very similar to those in the first panel, suggesting that censoring is not driving these results.[34]

Figure 2 provides a clear view into the operation of the deterrence effect by plotting the distribution of disability durations for claims from plans with relatively brief (≤100 days) versus relatively long (>100 days) EPs using the censoring-adjusted sample. In this figure, spell durations denote *quarters since disability onset*—thus, an impairment lasting 200 days would be coded as having duration of three quarters regardless of the plan's elimination period. If the only effect of a longer EP were to censor disability spells that conclude prior to the end of the EP, we would expect the conditional distribution of spell lengths to be comparable between 90 and 180 days plans for spells lasting beyond 180 days. This is not the case. The entire distribution of claims durations

[34] Note that 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 on LTD were not included in these specifications. As it stands, the effect of these shorter claims is almost entirely absorbed by the indicator variables coding (a) one quarter on LTD benefits and (b) maternity care as primary diagnosis.

appears substantially right-shifted for plans with a 180 versus 90-day elimination periods. There is substantial "missing mass" in the frequency of LTD claims for impairments lasting only 3 quarters for plans with a 180 day EP and, conversely, there appears to excess mass for claims of 5 quarters and longer.[35] Clearly, a longer EP deters a significant number of workers from claiming disability benefits for short-term impairments.

6. 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 income loss that exceeds the savings of most workers. Absent disability insurance, it seems likely that the consumption of disabled workers would fall significantly more than is observed for individuals who enter SSDI (Meyer and Mok, 2008). 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 LTD claims, containing variation across and within firms in benefit parameters, we document substantial behavioral responses to LTD insurance generosity. Individuals are much less likely to claim benefits if the period of time they have to wait to claim is longer and if the replacement rate provided by their LTD policy is lower. These responses are largest for LTD claims that appear to be most discretionary, and for claimants who are ultimately most likely to return to work. These results are consistent with the hypothesis advanced in Autor and Duggan (2003) that marginal disability claimants are the healthiest claimants.

[35] Given the relatively small number of claims, the pattern of excess mass at higher durations is unsurprisingly not entirely monotone.

Notably, the length of the policy elimination period also has a first order effect on the composition of claimants; workers who claim 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 claims from individuals with less severe disabilities. An important question that follows is whether the deterrence effect of the EP on shorter claims ultimately causes would-be claimants 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. They do however suggest that it is worthy of careful study.

There are two important caveats to drawing strong policy conclusions from our findings. The first is that our estimates may not exclusively represent pure moral hazard effect, as there may be income effects of program generosity on claiming behavior. For example, if disability raises the disutility of remaining employed, then more generous LTD benefits may result in a larger reduction in labor supply simply by increasing the utility of leisure. This income effect on labor supply is simply a transfer from insurers to insured and has no efficiency cost; indeed, if individuals are liquidity constrained, there could be a welfare improvement from such transfers. In the case of the elimination period, however, our analysis suggests that liquidity constraints are not the primary channel affecting claiming behavior since the deterrence elasticity is comparable for high and low-income workers. But it is possible that liquidity is nevertheless relevant for a subset of the workers in the LTD-insured population.

A second 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. Future work could usefully document the benefits associated with this consumption smoothing in order to more fully evaluate the optimal level of program generosity.

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Figure 1. Comparison of Private LTD and SSDI Benefits

Figure 2. Distribution of LTD Payment Benefit Spells by Duration since Disability Onset

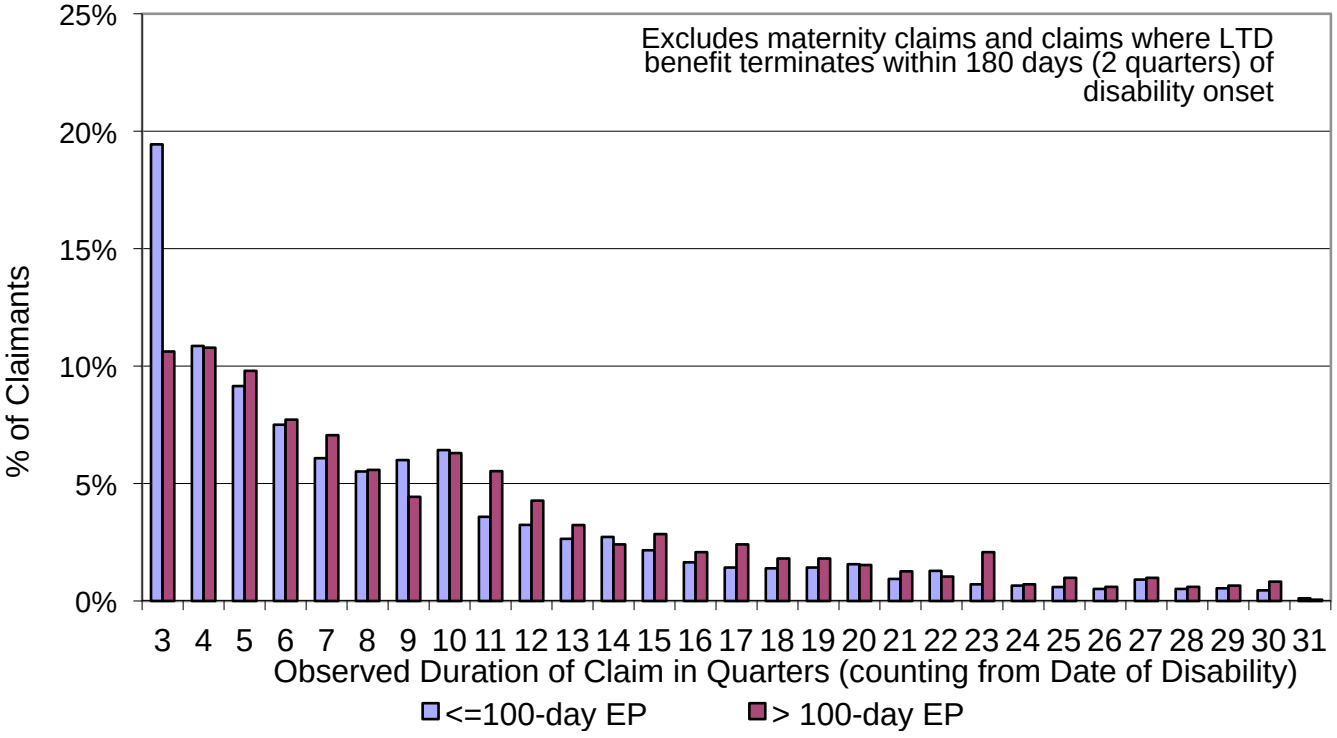

Table 1: Percent of Workers with Access to Employer Provided LTD Coverage, Overall and by Subgroup: Bureau of Labor Statistics Data

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: Distribution of Maximum Benefit Amounts and Replacement Rates in Employer-Provided LTD Policies: Bureau of Labor Statistics Data

A. Maximum Monthly Benefit Payment

Maximum Reported	No Max Reported	Percentiles 10th	25th	50th	75th	90th
79%	21%	$3,000	$5,000	$7,500	$10,000	$15,000

B. Distribution of replacement rates

Mean	Median	<60%	60%	61-66%	67%	>67%
59.2%	60.0%	20%	60%	10%	7%	2%

Table provides information on the maximum monthly benefit and replacement rate of employer-provided LTD plans among civilian workers (private and state and local government) in March 2010. Data were obtained from Tables 30 and 31 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 3: Summary Statistics for LTD Analysis Sample

	Mean	Std Dev
Enrollee Characteristics (n=7,992,005)		
LTD Claims per Quarter	0.091%	0.030%
Age	41.6	10.5
Age 18-24	3.5%	18.4%
Age 25-29	11.4%	31.8%
Age 30-34	14.4%	35.1%
Age 35-39	15.0%	35.7%
Age 40-44	15.6%	36.2%
Age 45-49	14.6%	35.3%
Age 50-54	12.2%	32.7%
Age 55-59	8.8%	28.4%
Age 60-64	4.6%	20.9%
Female	47.1%	49.9%
Monthly Salary	$4,014	$2,691
Industry of Employer (n=7,992,005)		
Services	53.5%	49.9%
Manufacturing	15.2%	35.9%
Finance, Insurance, Real Estate	10.2%	30.3%
Wholesale Trade	8.9%	28.4%
Missing Industry	1.5%	12.0%
All Other	10.9%	31.1%
LTD Claim Diagnosis (n=7,267)		
Accidents	16.3%	36.9%
Cancer	15.9%	36.5%
Sickness / Fatigue	13.8%	34.5%
Back / Musculoskeletal	12.5%	33.1%
Heart / Circulatory	11.4%	31.8%
Maternity	9.0%	28.6%
Mental	7.0%	25.6%
Arthritis / Respiratory	6.9%	25.3%
All Other	7.3%	25.9%
LTD Plan Parameters (n=7,992,005)		
Elimination Period	122.6	48.3
Replacement Rate	0.605	0.033
Maximum Monthly Benefit	$6,746	$3,207
Benefit Cap Binding	4.01%	19.62%

Table contains summary statistics for the analysis sample with 7.99 million observations described in Section 2 of the paper. The LTD Claim Diagnosis panel refers to just the 7,267 LTD claims among workers in this sample. The unit of observation for all of the other variables is the person-quarter and there are 1.02 million unique workers contained in this sample. Salary represents the worker's average monthly salary in the six preceding months.

Table 4: Replacement Rate, Elimination Period, and Max Monthly Benefit Distributions

Replacement Rate		Elimination Period		Maximum Monthly Benefit	
	% of Obs		% of Obs		% of Obs
				<$3,000	4.0%
40.0%	0.2%	30	0.3%	$3,000	4.8%
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%
63.0%	0.1%	120	0.4%	> $5,000 to <$6,000	0.3%
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%
70.0%	0.6%	360	0.8%	$10,000	17.2%
All other	0.0%			>$10,000	6.1%
Total	100.0%	Total	100.0%	Total	100.0%

Table summarizes the distribution of the replacement rate, elimination period, and maximum monthly benefit in the LTD plans among enrollees in the 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 availble for each plan.

Table 5: The Impact of Policy Parameters on LTD Claiming: Ages 18-64 in the One Plan Sample

	(1)	(2)	(3)	(4)	(5)
			A. All Claims		
Elimination Period (/ 1,000)	-.0109***	-.0109***	-.0109***	-.0109***	
	(.0027)	(.0027)	(.0027)	(.0027)	
Actual Replacement Rate (/ 1,000)	.706*	.176	.049		
	(.379)	(.496)	(.506)		
Benefit Cap Binding		-1.45E-4*	-1.49-4*	-1.54E-4**	-1.46E-4**
		(8.05E-5)	(8.10E-5)	(6.27E-5)	(6.38E-5)
# Observations	7,992,005	7,992,005	7,992,005	7,992,005	7,992,005
	B. Dropping Maternity Claims and Claims with <= 180 days between Disability Onset and Close Date				
Elimination Period (/ 1,000)	-.0045***	-.0045***	-.0045***	-.0045***	
	(.0012)	(.0012)	(.0012)	(.0012)	
Actual Replacement Rate (/ 1,000)	.685**	.520	.405		
	(.300)	(.396)	(.406)		
Benefit Cap Binding		-4.49E-5	-4.49E-5	-9.05E-5*	-9.45E-5*
		(7.01E-5)	(7.07E-5)	(5.46E-5)	(5.56E-5)
# Observations	7,990,082	7,990,082	7,990,082	7,990,082	7,990,082
Salary Bin Linear Terms	No	No	Yes	Yes	Yes
FDC x Quarter Effects	No	No	No	No	Yes

Table presents linear probability models where the outcome variable is equal to one if worker has an LTD claim this quarter and is otherwise zero. Models in Panel B exclude claims for maternity related reasons and claims with fewer than 180 days between date-of-disability and claim close date. 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 0.0909 percent.

Table 6: The Impact of LTD Parameters on Benefit Claiming: Differentiating by SSDI and Return-to-Work Status

	Claim PDI and RTW		Claim PDI, no RTW and no SSDI		Claim PDI and receive SSDI	
	(1)	(2)	(3)	(4)	(5)	(6)
Elimination Period (/ 1,000)	-.0059***		-.0048***		-.0006	
	(.0020)		(.0012)		(.0009)	
Benefit Cap Binding	-7.88E-5**	-7.41E-5**	-2.11E-5	-2.59E-5	-5.37E-5*	-4.63E-5
	(3.75E-5)	(3.69E-5)	(3.71E-5)	(3.75E-5)	(3.04E-5)	(3.07E-5)
# Observations	7,992,005	7,992,005	7,992,005	7,992,005	7,992,005	7,992,005
FDC x Quarter Effects	No	Yes	No	Yes	No	Yes
Mean of Dependent Variable	3.60E-4		2.92E-4		2.68E-4	

Table presents linear probability models for the following indicator variables: worker claims LTD and returns to work (columns 1 and 2); worker claims LTD and neither returns to work nor enrolls in SSDI (columns 3 and 4); and worker claims LTD and subsuquently obtains SSDI (columns 5 and 6). 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. Even-numbered columns also include firm-division-class-quarter interactions. Standard errors are clustered by firm-division-class.

Table 7: The Impact of Policy Parameters on LTD Claiming: High vs. Low Income Individuals

	All		Low Income		High Income	
	(1)	(2)	(3)	(4)	(5)	(6)
			A. All Claims			
Elimination Period (/ 1,000)	-.0109***		-.0137***		-.0081***	
	(.0027)		(.0050)		(.0019)	
Benefit Cap Binding	-1.54E-4**	-1.46E-4**	-2.28E-4	-1.54E-4	-1.68E-4**	-1.83E-4***
	(6.27E-5)	(6.38E-5)	(3.29E-4)	(3.56E-4)	(6.79E-5)	(6.89E-5)
# Observations	7,992,005	7,992,005	3,996,000	3,996,000	3,996,005	3,996,005
Average Claiming Probability	0.091	0.091	0.114	0.114	0.068	0.068
FDC x Quarter Effects	No	Yes	No	Yes	No	Yes
	B. Dropping Maternity Claims and Claims with <= 180 days between Disability Onset and Close Date					
Elimination Period (/ 1,000)	-.0045***		-.0034*		-.0053***	
	(.0012)		(.0020)		(.0016)	
Benefit Cap Binding	-9.05E-5*	-9.45E-5*	-5.21E-5	2.15E-5	-1.05E-4*	-1.29E-4*
	(5.46E-5)	(5.56E-5)	(2.77E-4)	(2.92E-4)	(6.08E-5)	(6.25E-5)
# Observations	7,990,082	7,990,082	3,994,696	3,994,696	3,995,386	3,995,386
Average Claiming Probability	.067	.067	.084	.084	.050	.050
FDC x Quarter Effects	No	Yes	No	Yes	No	Yes

Variables and specifications are identical to specifications (4) and (5) in Table 5. Sample is subdivided into worker-quarter observations in which salary is below (columns 3 and 4) or above (columns 5 and 6) the year-specific median of all salary observations in the full sample.

Table 8: Duration Analyses: Quarterly Probability of Exiting LTD Recipient Status

	(1)	(2)	(3)	(4)	(5)	(6)
			A. All Claims			
Elimination Period (/ 1,000)	-.149***	-.150***	-.149***	-.180***	-.180***	-.180***
	(0.046)	(.046)	(.046)	(.046)	(.046)	(.046)
Actual Replacement Rate (/1000)	-43.8		-61.3	-30.5		-70.9
	(43.3)		(53.6)	(43.4)		(51.3)
Benefit Cap Binding		.003	-.008		-.006	-.019
		(.013)	(.014)		(.015)	(.017)
# Observations	39,117	39,117	39,117	39,117	39,117	39,117
Diagnosis Controls	No	No	No	Yes	Yes	Yes
	B. Dropping Maternity Claims and Claims <= 180 days between Disability Onset and Close Date					
Elimination Period (/ 1,000)	-.166***	-.166***	-.166***	-.182***	-.183***	-.182***
	(.036)	(.036)	(.036)	(.037)	(.037)	(.037)
Actual Replacement Rate (/1000)	-62.5*		-60.9	-62.1		-72.4*
	(35.2)		(41.2)	(38.0)		(43.3)
Benefit Cap Binding		.012	.001		.008	-.005
		(.011)	(.011)		(.012)	(.012)
# Observations	36,968	36,968	36,968	36,968	36,968	36,968
Diagnosis Controls	No	No	No	Yes	Yes	Yes

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 if claimant exits LTD in the subsequent quarter and is 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; and twenty salary bin indicators, each corresponding to 5 percentiles of the year-specific salary distribution. Columns 4 through 6 include nine indicator variables for diagnosis categories. Standard errors are clustered by firm-division-class. The mean of the dependent variable is 0.127.

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 PDI Claimants by EP Length

	≤100days	>100 days
	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 Duration of LTD Receipt	5.6	7.8
Median Duration of LTD Receipt	3	6
	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%
	LTD Claim Diagnosis (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).