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Firm-Level Early Intervention Incentives: Which Recent Employers of Disability Program Entrants Would Pay More?

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ABSTRACT

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Key Findings and Policy Implications

We used linked Social Security (SS) administrative data to analyze SS Disability Insurance (DI) program reform proposals that would hold firms partially responsible for a portion of the DI benefits paid to their recent employees. One proposal would require employers to carry short-term disability insurance; the second proposal would apply an experience rating to the DI portion of the Federal Insurance Contributions Act premium. Our analysis creates baseline firm-level benefit liability measures, simulates firm liabilities under the proposals, and compares the simulated liabilities to the baseline measures.

We found that the proposals would place a relatively large burden on low-wage firms with fewer than 500 workers.

The policy implications of the findings are:

- Firms with high potential liabilities face competing incentives to accommodate and retain or reduce hiring and retaining workers at high risk for medical problems.
- Although these proposals would likely reduce DI expenditures, they might have less desirable unintended consequences.

I. INTRODUCTION

The United States' disability support system caseload has been growing for several decades. For instance, from 1980 to 2013, the Social Security Disability Insurance (DI) program—the nation's primary income insurance program for disabled working-age adults—expanded from 2.9 to 8.9 million beneficiaries. Although a majority of the growth is explained by changes in the size and age-sex composition of the labor force, a large share is due to other factors (Stapleton and Wittenburg 2011). As caseloads are growing, total federal expenditures for this population are also rapidly expanding. At the beginning of the Great Recession (fiscal year 2008), total federal outlays for working-age adults with disabilities was $357 billion, a 31 percent increase from just six years prior, after adjustment for inflation, and accounted for 12 percent of all federal outlays in that year (Livermore et al. 2011). The DI Trust Fund—from which all DI benefits are paid—is projected to be depleted by 2016 (Social Security Administration 2014). The projected gap between the Trust Fund's 75-year expenditures and revenues is equal to 0.33 percent of SS wages—equivalent to $19 billion for 2014. Hence, the program's financing challenge could presumably be solved by imposing an additional 0.33 percentage points in payroll taxes paid by current and future employers and workers spread proportionately on all SS wages.

Concerns about these trends have led to numerous ideas for reforming the U.S. disability support system. Some proposals suggest fundamental reforms that would significantly alter the program's benefits, funding source, or the gateway to benefits. Many experts have recommended the adoption of early intervention strategies to reduce labor force exit due to disability and entry into DI. These strategies assume that (1) the best time to intervene is before workers are separated from their employer, and (2) to be successful, the policy reforms must increase the willingness of employers and their employees to support disability prevention and continuation of work after disability onset. The goal of this study is to inform the discussion of one employer-based early intervention approach—the partial internalization to employers of the costs of DI benefits paid to their recent employees, including simulation analysis of two prominent reform proposals. Currently, the costs of DI benefits are external to decisions made by employers and their employees in that an employer or worker decision that affects the costs of future benefits does not affect their benefit contributions.[1] Partial internalization of these costs would presumably reduce exit from the labor force and entry into DI.

We focus our analysis on two proposals designed to lower DI program entry by making employers—and by extension their employees—liable for a substantial share of the federal costs associated with a former employee's entry into the DI program. One proposal would mandate all employers to purchase short-term private disability insurance (STDI) policies that would be required to pay the first 24 months of DI benefits for many types of workers with disabilities (Autor and Duggan 2010); insurance premiums would reflect employer experience. The other proposal would assign an experience rate to the share of payroll taxes allocated to the DI Trust

[1] The term *external* in this context refers to the connection between benefits paid and employer/worker costs. Although employers and their employees do pay for DI benefits—via payroll taxes allocated to the DI Trust Fund—their Trust Fund contributions do not vary based on the amount of benefits paid from the DI Trust Fund to the employers' former workers. For all employers and employees, contributions to the DI Trust Fund are a fixed proportion of wages subject to the Federal Insurance Contributions Act (FICA) tax.

Fund (Burkhauser and Daly 2011), again internalizing the cost of at least some share of DI benefits. To examine these proposals, we performed analyses using annual wage records from 2001 to 2005 for all firms linked to SSDI applicant and beneficiary data. We conduct simulations of the proposals that are designed to be true to their intent, although we had to make numerous assumptions to accommodate data limitations and complete details that were not specified in the proposals themselves.

Our findings pertain to the incentives that would be created by such policies in the absence of behavioral change. We are not able to address the extent to which such policies would produce the behavioral changes and outcomes intended, nor how behavioral responses would change incentives at the margin. We are, however, able to provide information that is indicative of some of the other consequences of such policies, and therefore relevant to consideration of their strengths and limitations.

To create a benchmark for assessing the reform proposals, we developed a measure of the DI benefit liabilities that a firm would accrue in a year if it were held liable for a share of the benefits of its current-year workers should the latter enter DI in the near future. The measure, which we call the benefit-liability-to-wage ratio (BLWR), is the firm's DI liability relative to the firms' current year Social Security (SS) wages—that is, wages subject to the FICA payroll tax. BLWR measures future DI Trust Fund liabilities attributed to these employees relative to the current-year contribution of these same employees' wages to the base for the 1.8 percent DI payroll tax that is the source of revenue for the DI Trust Fund.[2]

The analysis of BLWR focuses on the variability of the statistic across firms and its relationship to firm characteristics. BLWR in firms with fewer than 50 employees—hereafter "small firms"—varies erratically due to high variation in allowed application rates across such firms and unobserved idiosyncratic factors that cause high variation in mean wages. Nearly 93 percent of all firms were in this category in 2005, and they accounted for 16 percent of all benefit liabilities. The findings indicate difficult small-firm issues for any policy that internalizes the DI liabilities to employers. Variation in BLWR is much less erratic among firms with 50 or more workers, yet a small number of such firms has substantial BLWR values—in some cases larger than the FICA DI tax rate—often by a substantial margin. Variation in BLWR across firms is higher than variation in applicant rates due to variation in applicant allowance rates and progressivity of DI wage-replacement rates.

Policies that successfully internalize the DI costs captured in BLWR to employers will disproportionately increase the cost of employing low-wage workers. High BLWR firms usually have very low mean annual wages, implying substantial employment of low-skilled, part-time, or temporary workers. The bulk of allowed DI applicants, however, are from firms with fairly low BLWR. Workers in these firms have much higher mean annual wages, but the wages of their allowed applicants are not much higher than those of workers from high-BLWR firms.

To analyze incentives under an STDI mandate similar to that proposed by Autor and Duggan (2010), we assessed how STDI premiums relative to SS wages (the premium-to-wage

[2] The DI payroll tax is a component of the 15.3 percent payroll tax for Medicare and Social Security, half paid by the employer and half by the employee.

ratio, PWR) would vary across firms in the absence of behavioral change and compared that variation to variation in BLWR. PWR differs from BLWR for two reasons. First, PWR is based on the firm's expected-loss-to-wage ratio (ELWR). To simulate ELWR, which presumably would be determined by insurers under a national program, we used a cell-based prediction model, with cells defined by prior-year BLWR and current-year workforce characteristics. Second, ELWR is multiplied by an administrative cost factor to obtain PWR, which varies by firm size—again reflecting expectations about the behavior of insurers in a competitive market. We find that the distribution of PWR closely approximates the distribution of BLWR for larger firms, where administrative costs are low and experience is presumably quite stable from year to year, but deviates substantially from BLWR from smaller firms where administrative costs and presumably year-to-year variation in BLWR are higher.

We developed disability experience rates (DERs) to analyze the Burkhauser and Daly (2011) experience-rated payroll tax proposal. Our formula for DER mirrors a formula that eighteen states use to assign experience rates to employer UI contributions. Relative to BLWR, the distribution of NDER is more favorable to relatively small firms than to larger firms, presumably because it smooths year-to-year variation in firm experience.

We used data from three sources to support our analyses: Internal Revenue Service annual wage records for workers as captured in the Master Earnings File (MEF) of the Social Security Administration (SSA); information on individual DI applicants and their application outcomes from SSA's 831 Disability File (831 File); and information on age, mortality, and sex from SSA's Number Identification file (Numident). We matched applicants to firms and then aggregated across Employer Identification Numbers (EIN) to produce firm-level statistics. The statistics reported here are based on 100 percent of the MEF wage records from 2000 through 2005 and all DI applicants from 2000 through 2007—ending just at the onset of the Great Recession.[3]

We provide additional background in the next section, discuss details on the data and methods in Section III, and present our findings in Section IV. The paper concludes with a discussion of the implications.

[3] Reflecting the privacy restrictions that apply to the MEF data, author Jae Song conducted all analyses for this project.

II. SUMMARY OF TWO PROPOSALS

There are several proposals to substantively reform the DI program. Two of these proposals—Autor and Duggan (2010) and Burkhauser and Daly (2011)—propose different ways of internalizing for employers and employees part of the cost of an employee's entry into DI. Because these proposals are central to our study, we describe each in some detail below.

A. Mandatory STDI

In a 2010 publication, David Autor and Mark Duggan proposed requiring all employers to have STDI for their employees. The STDI could be purchased at competitive prices from private insurers, or employers could self-insure. Employees could be required to pay as much as 40 percent of their individual STDI premium. Ninety days after the onset of a medically documented disability that inhibits "normal job functions," a worker covered by the employer's STDI policy would become eligible for benefits. The STDI benefits would provide claimants with up to 24 months of supports including partial wage replacement (about 60 percent) as well as vocational rehabilitation and workplace accommodation supports intended to help the individual remain in the workforce. The STDI insurer would have a financial incentive to help claimants make an expedient return to work because it would reduce the insurer's losses. If the STDI claimant is still unable to perform normal job functions 21 months after disability onset, he or she may apply for DI and other disability benefits. However, if it is apparent at disability onset that the worker's prospects of returning to work are very limited, then the worker would be able to apply for disability benefits earlier under the Compassionate Allowance provision. STDI benefits would terminate either 27 months after disability onset or if a Compassionate Allowance disability benefit award is made.

The STDI premium paid by each employer with 50 or more full-time equivalent (FTE) workers would be subject to an experience rating based on the employer's past loss experience. Employers with relatively large STDI losses in the past, from the insurer's perspective, would pay relatively high STDI premiums. The opposite is also true. Because the STDI premiums would receive an experience rating, employers would have an incentive to minimize the number of their workers who apply for STDI. To achieve this goal, employers might diligently work to prevent disability onset (for example, by encouraging workers to maintain their health and fitness and avoid unsafe behaviors) and help them continue to work after the onset of a disabling condition (for example, by providing workplace accommodations or changing job responsibilities). As some critics fear, employers might also avoid hiring workers with disabilities. STDI premiums for firms with fewer than 50 FTE workers would be determined by the average STDI claimant rate of firms in that industry, as well as by each firm's average employee age.

B. Experience-rated payroll tax

In their 2011 book, Richard Burkhauser and Mary Daly proposed internalizing the cost of disability benefit claims. However, instead of requiring the purchase of STDI, Burkhauser and Daly suggested calculating an experience rate for the share of FICA taxes ("payroll taxes") allocated to the DI Trust Fund. Currently, 1.8 percent of the 12.4 percent SS payroll tax is

allocated to the DI Trust Fund.[4] This percentage does not vary by employer. Burkhauser and Daly suggested either (1) assigning an experience rating to the 1.8 percent directly, with some employers paying more than that percentage and others paying less based on the employers' past DI claims experience, or (2) rewarding payroll tax discounts to firms that purchase STDI and work with DI gatekeepers to manage cases, coupled with charging additional payroll tax to firms that do not take such measures to reduce DI entry.

C. Evidence of effectiveness

Although Autor and Duggan (2010) and Burkhauser and Daly (2011) cite examples that suggest their proposals could be effective, both acknowledge there is little direct evidence of the proposals' potential impacts. Both sets of authors appeal to international efforts, especially Dutch disability policy reforms, which have internalized benefit costs to employers in various ways and been followed by substantial declines in new claimants. In addition, Burkhauser and Daly (2011) point to evidence of the effectiveness of employer experience rating for UI and workers' compensation premiums; these programs provide precedents for experience rating the DI payroll tax. However, all of these authors acknowledge that studies, pilot tests, and demonstrations should be conducted before any of their proposals are adopted domestically.

[4] Half of the tax is paid by the employer and half by the employee.

III. DATA AND METHODS

We construct several firm-level statistics for firms with at least 50 workers: a benchmark measure of DI benefit liabilities generated in a year by each firm's workers (BLWR); statistics that reflect the essence of the mandatory STDI proposal from Autor and Duggan (2010), ELWR and PWR; and experience-rate statistics that reflect the essence of the proposal from Burkhauser and Daly (2011), DER and NDER. We also produced descriptive statistics of the workforces of firms by firm BLWR category. In what follows we first describe the data, then turn to the construction of the five variables.

A. Data

The data in this study are 100% samples from three SSA administrative files: the MEF, the 831 File, and Numident.[5] The MEF contains detailed individual-level information on all FICA-taxable earnings processed since 1977. SSA uses MEF earnings information to determine (1) whether a claimant for DI or retirement benefits has a sufficient work history to qualify and (2) the individual's primary insurance amount (PIA)—the monthly benefit amount for those claiming on their own earnings history, exclusive of dependent benefits.[6] The 831 File contains a record for every worker who has applied for DI benefits since 1988. Numident contains the name, SS number (SSN), sex, and date and place of birth and death for every SSN ever issued. We used MEF records from 2000 through 2005 and the 831 File records for those who first claimed DI benefits in 2000 through 2007. To illustrate the size of the annual files, for 2005 we used more than 167 million wage records, which contained 682,000 EINs, from the MEF. In the same year, SSA granted benefit awards to 821,000 disabled workers.[7] These restricted-access data files are subject to strict privacy and disclosure requirements. Consequently, only cleared SSA employees are permitted to access the MEF records; the restrictions on the 831 File data are nearly as stringent.

We used records from these administrative data sources to create an analysis file that links firms, employees, applications, and wages together. Each MEF wage record includes an EIN and the worker's SSN. We used the EIN to identify the wage records of each firm's employees in each year and to subsequently match firm-level records across years. We used the SSN of DI applicants to match application information from the 831 File to wage information from past employers and to match demographic information from Numident.

The information contained in the MEF is not sufficient to fully analyze or implement any approach to early intervention that relies on partially internalizing the costs of DI benefits to employers. Some wage records are for special administrative purposes, including third-party payments of taxable private disability or pension benefits. We identified and removed such

[5] See Olsen and Hudson (2009) for more details on the MEF.

[6] We observe SS wages in the MEF as well as total wages. *SS wages* refer to those wages subject to the FICA tax, for which there is an annual maximum; *total wages* are those subject to the Medicare tax, for which there is no maximum.

[7] SSA (2006, Table 45).

records using procedures developed by SSA for administrative purposes. EINs can change from one year to the next, reflecting changes in corporate ownership and other administrative reasons, as well as start-up and liquidation. To a limited extent, we have been able to identify EIN changes that occurred for administrative reasons based on large numbers of workers from a single EIN in one year shifting to a different single EIN the next year. Industry is a standard predictor of expected losses in the private market but is not available in the MEF. Hence, as explained later in this report, our model for expected losses relies on mean wages and number of employees, rather than industry, to construct risk categories. Similarly, for purposes of risk rating, the insurance industry usually measures firm size by FTE employment, but the MEF does not include the hours-worked information needed to develop a measure of FTE employment. Therefore, we make do with counting the number of workers who received wages from each EIN.

The 831 File and Numident have fewer limitations for our purposes. Using the 831 File, we were able to identify any person who had applied for DI benefits for the first time.[8] For those granted a DI allowance any time subsequent to application, we are also able to determine the month in which their first DI benefit was due, their PIA, and the primary impairment that was the basis of their allowance. Each person's date of birth, death (if applicable), and sex are retrieved from Numident. The one limitation encountered is that the 831 File does not include the actual DI benefit due, including any benefits for auxiliary beneficiaries. The PIA, which captures a DI recipient's monthly benefit amount, is the most important component of the benefit, but it ignores benefits paid to auxiliary beneficiaries, that is, qualified dependents. In 2005, mean family benefits due to disabled workers were 23 percent higher than mean PIA due to auxiliary beneficiaries.[9] Using the PIA rather than the family benefit due affects relative values of our estimates for benefit liabilities across firms to the extent that the relative size of auxiliary benefits varies across firms.

B. Methods

In this section, we describe how we constructed the key statistics for the analysis. We start by defining BLWR: stating two assumptions that are instrumental to its definition and then describing how it is constructed. Next, we present the ELWR model and describe our approach to marking up ELWR for administrative costs to obtain PWR. We then present the experience-rate methodology used to construct the DER and how we converted to normalized DER (NDER) to facilitate comparisons with the other statistics. Finally, we describe the statistics on firm workforce characteristics.

Benefit-liability to wage ratio (BLWR). The definition of BLWR depends on assumptions made about (1) the number of years of benefits paid to new beneficiaries that are assigned to past employers; and (2) how long employers are held liable for DI benefits after separation from employment. We assume that recent past employers would be held liable for 24 months' worth of the DI benefits to the former worker, exclusive of dependent benefits. The use of 24 months is consistent with Autor and Duggan's (2010) proposal, but it is low relative to the years of benefit

[8] We looked back only 10 years before the sample period to verify the application was the first for each person.

[9] Based on Table 29 in SSA (2006).

liability that can accrue to employers from workers' compensation claims. The number of months can be scaled up or down to increase the liability that accrues to employers. To avoid gaming opportunities, separation from employment would not immediately absolve the employer of any DI benefit liability. At the same time, it would be impractical and serve little purpose to hold the employer liable indefinitely following separation from employment. Roughly commensurate with the 24 months of liability for DI benefits that we assume would accrue to employers, we assume that the employer's liability for workers on the employer's payroll in the current calendar year continues through the end of the second calendar year that follows the current year. Under this assumption, the employer's liability typically continues for allowances to former workers that occur in the 30 months after the last month of employment. Using calendar years to define this period, rather than months or quarters, is practical: we used calendar-year earnings data reported in the MEF to support the analysis.

We defined applicants who were recent employees of a firm as those who received wages from the firm in year *Y* and applied for DI in *Y, Y+1,* or *Y+2*. The year application rate for each employer is defined as the number of applicants who received wages from the employer in *Y* and applied for DI benefits in *Y, Y+1,* or *Y+2*. The allowed application rate is defined analogously, but the numerator includes only those applicants with DI benefits due in *Y, Y+1,* or *Y+2*.

As previously indicated, BLWR is a measure of the labor cost liability (as a share of SS wages) that an employer would accrue in one year if employers were held liable for the first 24 months of benefits paid to current-year employees who enter DI in the current year or in the two subsequent years. Many DI entrants have multiple employers in the years leading up to DI entry (the current year or the previous two years). We specify that the share of the benefit liability accruing to each employer in each calendar year in the three-year pre-entry period is the wages paid by the employer to the beneficiary in that year as a share of all wages paid to the claimant by all employers in the pre-entry period. Thus, the share of liability the employer accrues in a single calendar year reflects only the wages paid to the beneficiary in the same year. Any wages paid by the employer to the beneficiary in the other two years add to the employer's liability but are accrued in the other years. If a worker receives wages from only one employer over the three-year period, 100 percent of the liability is assigned to that employer. BLWR for a firm in each year is defined as the sum of liabilities accrued for all employees in that year divided by the sum of all SS wages paid in the same year to the same employees. At the employer level, it is directly comparable to the DI portion of the payroll tax (1.8 percent of SS wages, including both the employer and employee share).

The computation of BLWR involves several steps. Let *i* denote workers, *j* denote firms, and *Y* denote year. Also, let $J_{i,Y}$ be the set of firms that paid worker *i* in year *Y*, $I_{j,Y}$ be the set of workers paid by firm *j* in year *Y*, Y^*_i be the year of benefit allowance for person *i,* and $A_{j,Y}$ be the set of workers at firm *j* in year *Y* who apply for DI benefits in year *Y, Y+1,* or *Y+2* and who are first due benefits within that period. We defined the benefit liability (*bl*) accrued by firm *j* in year *Y* as

$$(1)\quad bl_{j,Y} = 24 \sum_{i \in A_{j,Y}} p_{i,Y} \left(\frac{w_{ij,Y}}{\sum_{y=Y_i^*-2}^{Y_i^*} \sum_{l \in J_{i,y}} w_{il,y}} \right),$$

where $w_{ij,Y}$ is the SS wages earned by worker *i* for working at firm *j* in year *Y* indexed in year *Y* dollars and $p_{i,y}$ is the PIA for *i* indexed in year *Y* dollars. Each employer's benefit liability accrued in year *Y* is a share of 24 months' worth of DI benefits (the PIA multiplied by 24) due to all former workers who within two to three years of year *Y* apply for DI benefits and are eventually allowed. The share that constitutes the employer's liability accrued in year *Y* is the wage paid by the employer to the worker in *Y* divided by all wages paid to the worker in year Y^*_i, Y^*_i *-1*, and Y^*_i *-2*. BLWR for a given employer in *Y* is that employer's benefit liability in *Y* divided by all wages the employer pays to all workers in that year:

$$(2)\quad blwr_{j,Y} = \frac{bl_{j,Y}}{\sum_{i \in I_{j,Y}} w_{ij,Y}}.$$

Expected-liability-to-wage ratio (ELWR) and premium-to-wage ratio (PWR). Our model for calculating ELWR for STDI follows the approach described by Autor and Duggan (2010) to the extent feasible with our data. They described experience-rated STDI premium calculations that would vary by firm size and, for small firms, by industry. Specifically, firms with 50 or more FTE workers would pay premiums based on their own history, whereas smaller firms would pay experience-rated premiums based on their industry's average disability claims experience as well as the average age of the firm's workers. The MEF data do not enable us to develop a model exactly to these specifications because (1) the number of FTE workers for each employer cannot be determined, and (2) MEF data do not contain employer industry information.

However, we were able to specify a model that follows the same overall approach Autor and Duggan (2010) used for firms with 50 or more workers during the calendar year. Using a cell-based model, we divided employers in *Y* into cells on the basis of four categorical variables:

- number of workers (that is, number paid SS wages during the year), with four categories: 50 to 99, 100 to 499, 500 to 999, and more than 1,000;
- BLWR in *Y-1*, with six categories: fewer than 50 workers in the previous year (including those with no workers); three categories for BLWR in the first, second, and third quartiles of firms with 50 or more workers in the previous year; BLWR between the 75th and 90th percentile in the previous year; and BLWR in the top decile in the previous year;
- mean SS wages, with six categories defined by lowest decile, remainder of lowest quartile, second quartile, third quartile, fourth quartile except highest decile, highest decile; and
- mean age, with four categories defined by the four quartiles for the current year.

For each firm in the sample, ELWR is defined to be the mean of BLWR for all firms in the same cell. We created the 576 (4 x 6 x 6 x 4) cells for firms with 50 or more workers in 2005

using data for 2005 (*Y*) and 2004 (*Y-1*). Reflecting the large number of firms in the data, none of these cells was empty.[10] We treated the number of workers, mean age, and mean wage in *Y* to be known at the time premiums are determined. Therefore, we have assumed that insurers would be able to accurately predict these numbers for *Y* from information employers would be required to provide. Because workers come and go, an STDI insurer could potentially adjust a firm's risk rating and premium on a monthly basis, in which case the insurer's information on these risk adjustment variables would always be nearly current even if the employer's workforce changes rapidly.

PWR is defined as ELWR multiplied by an administrative cost factor that depends on firm size. The administrative cost factor is the inverse of the insurer's *expected loss ratio*—expected losses expressed as a share of the premium amount. In the absence of better information, we based our loss-ratio estimates on estimates for long-term private disability insurance (LTDI). Based on information provided by industry actuaries, the LTDI mean loss ratio is about 77 percent.[11] However, loss ratios vary by firm size, from as low as 60 percent for the smallest firms to as high as 90 percent for the largest. If anything, we expect actual loss ratios for STDI to be higher than those for LTDI, given a firm's size, because the administrative work associated with claims is not likely to be much lower for STDI than for LTDI (most administrative work occurs in the first two years after an LTDI claim is filed) and the losses associated with STDI benefits paid would typically be lower than those for LTDI, because STDI benefits would be paid for no more than two years. Similar to the LTDI industry, we would still expect STDI loss ratios to vary by firm size because of economies of scale.

To account for the effect of administrative costs on premiums, we assumed that the median premium will range from 167 percent of the ELWR of firms with 50 to 99 workers (1.67 = 1/.60) to 111 percent of the ELWR for firms with 1,000 or more workers (1.11 = 1/.90), with interpolated values of 1.483 for firms with 100 to 499 workers and 1.297 for firms with 500 to 999 workers, respectively. That is, we multiplied the firm's ELWR by the administrative cost ratio for its size class to estimate a premium-to-wage ratio (PWR). Per the above discussion, it seems likely that, given ELWR, actual premiums would be somewhat higher than the values reported.

Disability experience rates (DER) and normalized DER (NDER). Implementing the Burkhauser and Daly (2011) proposal requires calculating an experience rating for DI payroll taxes. To do this, we selected an experience rating scheme currently being used to calculate UI payments by 18 states (U.S. Department of Labor 2013), following the published rules used by Texas. We chose this method over three other methods used by the remaining states because of the progressive nature of DI benefits. Because the objective of experience rating is to provide accurate price signals to employers about how their behavior affects federal expenditures, it is important to use an experience-rating methodology that reflects the progressive nature of DI. The method adopted reflects the progressive nature of DI benefits because it uses benefits due the worker (but not dependents) in its calculation. The other three UI formulas rely on the

[10] There were fewer than 10 firms in 75 cells, including 13 cells with just one firm.

[11] This value assumes that future benefits are discounted using rates on U.S. Treasury securities.

proportionality of UI benefits to produce rates that only require wage and claimant information, not benefit information.

Let $B_{j,Y-3}$ be the set of all applicants who were allowed benefits in Y-3, Y-2, or Y-1 and whose most recent earnings within one year of DI application came from firm *j*. We defined a firm's DER as

$$(3) \quad der_{j,Y} = \frac{36 \sum_{i \in B_{j,Y-3}} p_{i,Y}}{\sum_{y=Y-3}^{Y-1} \sum_{i \in I_{j,y}} w_{ij,y}}.$$

The numerator for DER in *Y* for employer *j* is the sum of 36 months of PIA over all recent employees (1) for whom employer *j* was their last employer, (2) who applied for benefits less than one year after separation from employer *j*, and (3) who were allowed benefits in Y-3, Y-2, or Y-1. The denominator is the sum of all SS wages paid by the employer in the previous three years. Starting with the fourth year after the employer last paid wages to the worker, the employer is no longer liable for the employee's benefits.

Whereas BLWR and ELWR are each expressed as a percentage of a firm's current year SS wages (the base for the payroll tax), DER is a percentage of a firm's SS wages paid over the last three years. To make the DER series comparable to BLWR and ELWR, we normalized DER by multiplying DER by the ratio of the median of BLWR to the median of DER. This assures that total of liabilities assigned to firms under DER in any year are comparable in magnitude to total liabilities under BLWR. The normalized value is the normalized DER (NDER). Hence, by definition, the medians of BLWR and NDER over all firms are the same.

An important difference between the application of the UI formula for DI benefits from its typical UI benefit application is that, for the latter, benefits are almost always of short duration; except when extended during a major economic downturn, UI benefits rarely last for longer than six months. In contrast, many DI entrants receive benefits for longer than 36 months—the maximum period of employer liability in this formula. We assumed an experience-rated system would put a time limit on the period over which an employer continues to be held liable for the benefits of past employees, though the period might not necessarily be 36 months.

Workforce characteristics. We also produced statistics on the workforce characteristics of employers by BLWR category, including characteristics of applicants and allowed applicants from the employer's workforce. Workforce characteristics include: number of employees during the year (the number of MEF records with positive wages for the EIN); mean (annual) wages, mean age, and percentage male for all employees as well as for applicants and allowed applicants; the five-year mortality rate for applicants and allowed applicants; percentage of applicants and allowed applicants in each of five education categories; and the percentage of allowed applicants in each of 17 primary impairment categories. We do not show standard errors for statistics because they are population values.

IV. RESULTS

In this section we first present summary statistics for benefit liability accrued and SS wages by firm size for all firms in 2005, including those with fewer than 50 workers; all subsequent results are for firms with 50 or more workers. Next, we compare firm-level distributions for applicants per worker, allowed applicants per worker, and BLWR, then go on to consider how BLWR varies with firm size, mean wages, and observable employee characteristics. We then present descriptive statistics for the estimated ELWR model. Finally, we present the distributions of ELWR, PWR, and NDER and compare them to the distribution of BLWR, by firm size.

A. Statistics for all firms

Of the 6.4 million firms reporting payroll in 2005, only 465,000—7.2 percent of all firms—reported paying 50 or more unique workers in that year, but they accounted for 84 percent of the DI benefit liability accrued (as we have defined it), 78 percent of SS wages, and 80 percent of paid workers (Table 1). The nearly six million firms with fewer than 50 workers on payroll accounted for just 16 percent of the benefit liabilities accrued.

We expected the total liability accrued for DI worker benefits in one year (the sum of the numerator of BLWR across all firms) to be roughly comparable to the total for own benefits paid to new beneficiaries in one year. Our calculated $11.6 billion in total liability accrued in 2005 is comparable to published statistics on annual benefits paid to new DI worker beneficiaries for 2005 through 2008. For instance, SSA (2013) reported awards to 798,675 DI workers in 2006. Based on their mean PIA, the total for 12 months' worth of these workers' own benefits is $10.2 billion, about 12 percent less than the liability accrued by employers in 2005, according to our calculations.[12] One important reason for the difference is that the number of awards was growing during this period, and a substantial number of awards corresponding to liabilities accrued in 2005 were made retroactively in the years after 2006.

Total benefit liabilities accrued were equal to 0.23 percent of SS wages paid by all firms in that year. Reflecting the fact that these liabilities reflect only a small share of all DI benefits these workers will be paid, this value is a small share (12.7 percent) of the DI portion of the FICA rate—a rate intended to fund 100 percent of these workers DI benefits. For the smallest firms, this share was lower—0.17 percent; otherwise, there is little variation in this ratio by firm size, with values ranging from 0.24 to 0.26 percent.

The benefit liabilities for substantial numbers of firms with 50 or fewer workers were extraordinarily high relative to their SS wages in 2005 (Table 2). For these firms, the 90th percentile of BLWR is 50 percent of SS wages, and the 99th percentile is 472 percent of wages. Such very large values can occur because total wages in the year are very low; an extreme case is a single worker who receives low wages over a very short period then enters DI. It is for this reason the remainder of the analysis focuses on larger employers. However, even among the

[12] The number of awards is reported in Table 39 of SSA (2013) and the mean PIA is reported in Table 43.

Table 1. Benefit liability accrued in 2005, by firm size

Number of employees	Number of firms (thousands)	Percentage of firms	Benefit liability accrued (millions)	Percentage of benefit liability accrued	SS wages (billions)	Percentage of SS wages	Benefit liability as percentage of SS wages	Workers on payroll (thousands)	Percentage of workers
Fewer than 50	5,959	92.8	1,850	15.9	1,024	20.8	0.17	45,828	20.4
50 to 99	234	3.6	706	6.1	291	5.9	0.24	16,092	7.2
100 to 499	188	2.9	1,960	16.8	751	15.3	0.26	37,473	16.7
500 to 999	22	0.3	887	7.6	337	6.9	0.26	15,489	6.9
1,000 or more	21	0.3	6,240	53.6	2,515	51.1	0.25	109,731	48.9
50 or more	465	7.2	9,793	84.1	3,894	79.2	0.25	178,783	79.6
All firms	6,424	100.0	11,643	100.0	4,918	100.0	0.23	224,612	100.0

.

Table 2. BLWR distribution, by firm size in 2005

Percentile	Fewer than 50	50 to 99	100 to 499	500 to 999	1,000 or more	All firms	50 or more
1st	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5th	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10th	0.000	0.000	0.000	0.000	0.001	0.000	0.000
25th	0.000	0.000	0.002	0.001	0.001	0.000	0.001
50th	0.053	0.014	0.006	0.003	0.003	0.009	0.005
75th	0.170	0.028	0.012	0.006	0.005	0.048	0.014
90th	0.506	0.053	0.023	0.012	0.009	0.194	0.029
95th	1.047	0.077	0.033	0.017	0.014	0.440	0.044
99th	4.721	0.166	0.072	0.041	0.035	2.213	0.104
Percentage of firms	92.8	3.6	2.9	0.3	0.3	100.0	7.2

latter we find some employers with large values for BLWR, especially for those with 50 to 99 employees. For instance, the 99th percentile for the employers of this size is 16.6 percent of payroll—more than nine times the DI portion of FICA. The top percentiles decline with firm size; for instance, the 99th percentile declines to 3.5 percent of payroll for firms with 1,000 or more workers—not nearly as large, but still almost twice the DI portion of FICA.

B. Firms with 50 or more workers

The distributions of the application rate, the allowed applicant rate, and BLWR across firms with 50 or more workers are all skewed toward the upper percentiles, and BLWR is substantially more skewed relative to the median than either the application rate or the allowed application rate. Table 3 presents several percentiles for each distribution as well as the value of each percentile relative to the corresponding median. Based on the latter, the application rate has the least dispersion, reflecting that at least one worker from almost all firms of this size in 2005 applied for benefits in 2005, 2006, or 2007—1 in 1,000 workers at the 1st percentile, 8 in 1,000 at the median, and 36 in 1,000 at the 99th percentile. The positive skew of the application rate distribution is reflected in that the 99th percentile is equal to 4.7 times the median. The distribution of allowed applicants has a larger positive skew relative to the median, reflecting that none or very few of the applicants from many firms were allowed; the 99th percentile for allowed applicants—30 in 1,000 workers—is 6.7 times the median of 5 in 1,000. BLWR is skewed further relative to its median, reflecting a combination of relatively low mean wages paid by firms with high BLWR (confirmed later) and the progressivity of DI; given the allowed applicant rate, the lower the mean wages, the higher the BLWR. The 99th percentile for BLWR—10.5 percent of SS wages—is 19.4 times its median, 0.5 percent.

Table 3. Distributions of applicant rates, allowed applicant rates, and benefit-liability-to-wage ratio for firms with 50+ workers

	Applicant rate		Allowed applicant rate		BLWR	
Percentile	Value	Relative to median	Value	Relative to median	Value	Relative to median
1st	0.001	0.1	0.000	0.0	0.000	0.0
5th	0.002	0.2	0.000	0.0	0.000	0.0
10th	0.003	0.3	0.000	0.0	0.000	0.0
25th	0.004	0.5	0.001	0.3	0.001	0.2
50th	0.008	1.0	0.005	1.0	0.005	1.0
75th	0.013	1.7	0.010	2.2	0.014	2.6
90th	0.018	2.4	0.016	3.5	0.029	5.3
95th	0.021	2.7	0.019	4.1	0.044	8.2
99th	0.036	4.7	0.030	6.7	0.104	19.1

Note: Statistics are for 2005; values are rates. All values are in percentages. Applicants are employees in 2005 who applied for SSDI in 2005, 2006, or 2007. Allowed applicants are those who became eligible for benefits in 2005, 2006, or 2007, in some cases retroactively. The denominator for both applicant and allowed applicant rates is the number of workers in 2005. BLWR is the SSDI benefit liability accrued by the employer (as defined in the text) in 2005 divided by Social Security wages paid by the employer in the same year.

The annual distribution of BLWR was very stable during the five-year period we examined (Table 4). The 5th and 10th percentiles are both zero in all years, and the 25th percentile rounds to 0.1 percent in every year. The percentiles at the upper end of the distribution display the greatest range—from 0.175 (2001) to 0.186 (2005) at the 95th percentile—but there is no clear trend. Because there is no systematic variation in the distribution across years, in the remainder of this paper we focus on the most recent year only, 2005.

Table 4. BLWR distributions for firms with 50+ workers, 2001 to 2005

Percentile	2001	2002	2003	2004	2005
1st	0.000	0.000	0.000	0.000	0.000
5th	0.000	0.000	0.000	0.000	0.000
10th	0.000	0.000	0.000	0.000	0.000
25th	0.001	0.001	0.001	0.001	0.001
50th	0.005	0.006	0.006	0.006	0.005
75th	0.014	0.014	0.014	0.014	0.014
90th	0.029	0.030	0.030	0.030	0.029
95th	0.045	0.046	0.046	0.046	0.044
99th	0.104	0.109	0.110	0.107	0.104

Note: Statistics are for 2005. All values are in percentages.

C. Workforce characteristics by BLWR category

To examine the relationship between observable characteristics of the workforce and BLWR of firms with 50 or more workers, we first divided these firms into quartiles based on BLWR and split the top quartile into the highest 10 percent and the remaining 15 percent. Descriptive statistics for the workforce in these groups appear in Tables 5 through 8.

Among firms with 50 or more workers, most workers are employed by firms that have low BLWR (third column of Table 5), reflecting the previously described variation in the distribution of BLWR by firm size. More than 73 percent of workers were employed by firms with BLWR no higher than 0.5 percent of the firm's SS wages (two lowest BLWR quartiles), and 93 percent were employed by firms with BLWR no higher than 1.4 percent of SS wages (lowest three quartiles). Reflecting the relatively small values for the mean number of workers in firms in the top BLWR quartile, less than 7 percent of workers are employed by firms in this quartile; just 2.5 percent are employed by firms in the top BLWR decile.

Table 5. Descriptive statistics for firms with 50+ workers, by BLWR category

BLWR category	Percentage of firms	Mean workers	Percentage of workers	Application rate	Allowance rate	Percentage of allowed applicants
Total	**100.0**	**901**	**100.0**	**0.004**	**0.693**	**100.0**
0.000 < BLWR ≤ 0.001	25.0	771	21.4	0.002	0.305	4.9
0.001 < BLWR ≤ 0.005	25.0	1,875	52.0	0.004	0.738	45.9
0.005 < BLWR ≤ 0.014	25.0	718	19.9	0.006	0.725	30.6
0.014 < BLWR ≤ 0.029	15.0	253	4.2	0.010	0.779	10.8
0.029 < BLWR	10.0	224	2.5	0.012	0.786	7.8

Note: Statistics are for 2005. Applicants are workers in 2005 who applied for SSDI in 2005, 2006, or 2007, and the denominator for the applicant rate is the number of workers in 2005. The allowance rate is the percentage of those applicants who eventually became eligible for SSDI benefits in the same period, in some cases retroactively.

A consequence of the high concentration of workers in low BLWR firms is that more than half of allowed applicants had been employed by firms in the lowest two quartiles, despite their relatively low BLWR values (last column of Table 5). Firms in the top BLWR quartile accounted for less than 19 percent of allowed applicants, despite their relatively high BLWR values.

The allowance rate (allowances as a percentage of applicants) is much lower for applicants from firms in the lowest BLWR quartile than in firms in the other BLWR groups: 30.5 percent versus values above 70 percent for all other groups. The low allowance rate provides a proximate explanation for why these firms are in the lowest BLWR quartile group but does not suggest an underlying cause. Similarly, the 79 percent allowance rate for firms in the top BLWR decile helps explain why these firms are in that decile, but only in a proximate sense.

Workers' mean annual wages (including those above the SS taxable limit) decline substantially with BLWR category (Table 6). This confirms that the low wages paid by high BLWR combined with the progressivity of DI contribute substantially to their high BLWR values. Mean wages in firms in the highest BLWR categories are so low that they suggest workforces consisting primarily of temporary, seasonal, or part-time workers.

Table 6. Employee mean annual wages, mean age, and percentage male for firms with 50+ workers, by BLWR category

BLWR category	Percentage of firms	Mean annual wages ($)	Mean age			Percentage male		
			Workers	App.	Allow.	Workers	App.	Allow.
Total	**100.0**	**25,956**	**37.7**	**46.0**	**48.6**	**50.5**	**49.5**	**50.3**
0.000< BLWR ≤ 0.001	25.0	36,900	37.1	42.2	47.6	51.8	48.6	44.1
0.001< BLWR ≤ 0.005	25.0	28,330	38.3	47.1	49.1	49.6	48.1	49.0
0.005< BLWR ≤ 0.014	25.0	14,242	37.1	45.8	48.3	50.0	48.9	50.2
0.014< BLWR ≤ 0.029	15.0	9,226	36.5	46.0	48.0	52.5	53.3	54.2
0.029< BLWR	10.0	4,177	38.6	46.2	47.8	58.2	57.8	56.8

Note: Statistics are for 2005. Applicants are workers in 2005 who applied for SSDI in 2005, 2006, or 2007, and the denominator for the applicant rate is the number of workers in 2005. Wages above SSA limit not excluded.

Instructions: See Table 5.

Allow. = allowed applicants; App. = applicants.

Table 7. Mortality rates and education levels of applicants and allowed applicants for firms with 50 workers, by BLWR category

BLWR category	Percentage of firms	Five-year mortality		Years of education for allowed applicants				
		Applied	Allowed	Missing	0–11	12	13–15	16 or more
Total	100.0	13.2	17.1	4.7	18.9	46.0	19.7	10.7
0.000 < BLWR ≤ 0.001	25.0	8.7	18.8	4.8	9.4	37.4	25.5	22.9
0.001 < BLWR ≤ 0.005	25.0	14.2	17.7	4.7	15.0	44.9	22.1	13.3
0.005 < BLWR ≤ 0.014	25.0	13.1	16.5	4.6	22.6	48.1	17.2	7.5
0.014 < BLWR ≤ 0.029	15.0	13.8	16.4	4.7	25.4	47.2	16.1	6.6
0.029 < BLWR	10.0	13.8	15.8	4.7	24.3	47.2	16.9	6.8

Note: Statistics are for 2005. Values for education are row percentages.

Table 8. Primary impairments among allowed applicants for firms with 50+ workers, by BLWR category

BLWR category	Percentage of firms	Blood	Circulatory	Congenital	Digestive	Endocrine/	Genitourinary	Infectious disease	Injury	Intellectual	Musculoskeletal	Neoplasm	Nervous/sensory	Psychiatric	Respiratory	Skin	Other	Missing
Total	**100.0**	**0.3**	**8.8**	**0.1**	**2.4**	**3.9**	**2.2**	**1.3**	**4.6**	**1.0**	**27.7**	**11.5**	**11.2**	**17.5**	**4.2**	**0.2**	**0.3**	**2.6**
0.000 < BLWR ≤ 0.001	25.0	0.4	6.1	0.1	2.8	2.9	2.2	1.6	4.6	0.5	23.6	14.4	13.9	20.8	3.0	0.2	0.4	2.5
0.001 < BLWR ≤ 0.005	25.0	0.4	8.4	0.1	2.6	3.5	2.2	1.4	4.5	0.8	28.7	12.5	11.7	16.6	3.9	0.2	0.3	2.4
0.005 < BLWR ≤ 0.014	25.0	0.3	9.4	0.1	2.3	4.4	2.2	1.3	4.6	1.2	27.9	10.5	10.7	17.3	4.6	0.2	0.3	2.8
0.014 < BLWR ≤ 0.029	15.0	0.3	9.6	0.1	2.2	4.5	2.2	1.2	4.9	1.5	26.5	10.2	10.3	18.5	4.6	0.2	0.2	2.9
0.029 < BLWR	10.0	0.2	9.7	0.1	1.8	4.5	2.4	1.4	4.8	1.6	26.0	9.2	9.6	20.2	4.7	0.3	0.2	3.2

Note: Statistics are for 2005. Includes firms with 50 or more workers only. Values for impairments are row percentages.

Workers' mean age and gender composition vary little across BLWR groups (Table 6). Not surprisingly, the mean age of applicants is substantially higher than the mean age of workers in each BLWR category. Although the mean age of applicants from the lowest BLWR quartile is lower than for those from the other groups, the mean age of allowed applicants varies little across the quartiles. The percentage of male workers is relatively high for employers in the top BLWR decile (58 percent) but varies little across the other groups. Among allowed applicants from firms in the lowest BLWR quartile, the percentage of male workers is low relative to the corresponding percentage for all workers (44 percent versus 52 percent); differences between these two percentages are much smaller for all of the other BLWR groups.

Mortality rates of applicants and allowed applicants decline substantially from the lowest BLWR group to the highest (Table 7). Five-year mortality for allowed applicants is highest for the lowest BLWR quartile (18.8 percent), lowest for the top BLWR decile (15.8 percent), and declines monotonically in between. Mortality rates for all applicants are somewhat lower, as to be expected, but follow the same declining pattern. This suggests that applicants and allowed applicants from low BLWR firms have medical conditions that are typically more severe than those of their counterparts in higher BLWR firms.

Education levels of allowed applicants also decline with BLWR category. For instance, although more than 86 percent of those from the firms in the lowest BLWR quartile have 12 or more years of education, less than 71 percent of those from firms in the highest decile do. Education levels for all applicants (not reported) are similar. Unfortunately, we do not have education data for all workers, so we cannot tell the extent to which these statistics reflect variation in education levels for all workers across the BLWR groups versus differences between the education levels of applicants from the group and other workers in the group's firms.

We found only modest variation in the distribution of primary impairments among allowed applicants across BLWR categories (Table 8). The most prevalent primary impairments, those in the musculoskeletal category, are reported relatively infrequently for allowed applicants from firms in the lowest BLWR categories when compared to those from firms in other categories; psychiatric, nervous/sensory, and neoplasms are reported relatively frequently. However, these differences across BLWR categories are not striking.

D. ELWR model statistics

Descriptive statistics from the ELWR model are listed in Table 9. As noted above, the cell-based model divides firms into 576 cells based on categorical variables for number of employees, prior-year BLWR, mean wages, and mean worker age; a firm's ELWR is the mean current-year value of BLWR in that firm's cell. We report the marginal distributions of ELWR for each of the four categorical variables in Table 9.

The most notable feature of the marginal distributions is the strong marginal relationship between the wage categories and ELWR. Mean ELWR for firms in the lowest wage decile—in which the mean wage is $2,648—is about 1.1 percent of wages, where mean ELWR for firms in the highest wage decile—in which the mean wage is $66,692—is about 0.1 percent of wages. Firms in the top BLWR quartile in the previous year, and especially those in the top decile, are also expected to have high values in the current year; mean ELWR for the firms in the top decile in the previous year is 1.6 percent of wages.

Table 9. Marginal distributions of ELWR

Category	Category information	Mean ELWR
All firms with 50 or more workers		
Number of workers	**Percentage of firms in category**	
50 to 99	50.2%	0.0040
100 to 499	40.4%	0.0042
500 to 999	4.8%	0.0046
1,000 or more	4.5%	0.0049
Prior-year BLWR	**Percentage of firms in category**	
Zero or no experience	68.2%	0.0033
Low 25%	8.0%	0.0046
Second 25%	8.2%	0.0032
Third 25%	8.1%	0.0051
Next 15%	4.7%	0.0070
High 10%	2.9%	0.0166
Mean SS wages	**Mean SS wage in category**	
Low 10%	$2,648	0.0108
Next 15%	$5,450	0.0060
Second 25%	$10,677	0.0045
Third 25%	$19,791	0.0031
Next 15%	$31,339	0.0022
High 10%	$66,692	0.0012
Mean worker age	**Mean age in category**	
Low 25%	29.3	0.0040
Second 25%	37.4	0.0038
Third 25%	41.4	0.0038
High 25%	46.2	0.0055

Note: Statistics are for 2005, for firms with 50 or more workers only. Derived from cell-based means; cells were defined by crossing the four categorical variables indicated in the table, to create a total of 4 x 6 x 6 x 4 = 576 cells. Quartiles for prior-year BLWR are for those with positive BLWR; those with zero experience or fewer than 50 workers in the prior year are in the first category. ELWR means reported are the marginal means for the four categorical variables.

E. Comparison of BLWR, ELWR, and DER

We compared the distributions of BLWR, ELWR, and DER in Table 10 for firms with 50 or more workers. We also reported NDER, which is designed to have the same denominator as BLWR and ELWR (SS wages paid by the employer in the current year). Also shown are the values of the percentiles for each measure relative to the measure's own median.

Table 10. Comparison of distributions for BLWR, ELWR, and DER

	BLWR		ELWR		DER		
Percentile	Value	Relative to median	Value	Relative to median	Value	NDER	Relative to median
1st	0.000	0.0	0.002	0.1	0.000	0.000	0.0
5th	0.000	0.0	0.003	0.3	0.000	0.000	0.0
10th	0.000	0.0	0.004	0.3	0.000	0.000	0.0
25th	0.001	0.2	0.007	0.6	0.000	0.000	0.0
50th	0.005	1.0	0.012	1.0	0.004	0.005	1.0
75th	0.014	2.6	0.018	1.6	0.015	0.018	3.3
90th	0.029	5.3	0.028	2.4	0.035	0.044	8.1
95th	0.044	8.2	0.051	4.4	0.058	0.072	13.2
99th	0.104	19.1	0.071	6.0	0.145	0.180	33.2

ELWR substantially reduces dispersion relative to BLWR. This is evident from the fact that the upper percentiles of the ELWR distribution are substantially smaller than the corresponding percentiles of the BLWR distribution, and the lower ELWR percentiles are somewhat larger than the corresponding BLWR percentiles. Large numbers of firms with zero or very low BLWR are assigned higher ELWR values, reflecting the experience of other firms in their cell. As a result, the median of ELWR is more than twice as large as the median of BLWR: 1.2 percent of payroll, versus 0.5 percent. The largest differences are at the upper ends of the two distributions. At the 99th percentile, ELWR is 7.1 percent of payroll, versus 10.4 percent for the 99th percentile of BLWR. The value of ELWR at this percentile is 6 times the median value, less than one-third of the value of BLWR at this percentile relative to its median.

Compared to the BLWR distribution, the distribution of NDER displays relatively greater dispersion relative to its median. The value of NDER at the 99th percentile is 33 times the median, whereas the corresponding ratio for BLWR is 19. The greater relative dispersion of NDER is at least partly explained by the fact that, following the UI model, the DI entrant's last employer is assigned 100 percent of the liability for the entrant's benefits during the relevant period, whereas for BLWR the liability for the same benefits is shared with all employers who paid wages to the DI entrant during a three-year period.

F. STDI premiums and comparison of distributions by firm size

In Table 11, we compared the distributions of BLWR, ELWR, PWR, and NDER by firm size. Recall that PWR is the simulated premium under a mandatory STDI system that uses the ELWR model to project expected losses. As discussed in the methods section, STDI premiums in a competitive market will equal the insurer's expectation of losses marked up for administrative costs. We have assumed that the markup for administrative costs reflects current markups in the LTDI market, which decrease with firm size.

PWR values for all firms with 50 to 99 workers are substantial, even for those with zero BLWR. For instance, although the 25th percentile of BLWR is 0.0, the 25th percentile of PWR is 2.0 percent of payroll. Thus, the mandatory STDI system we have simulated would impose a cost

Table 11. BLWR, ELWR, PWR, and NDER, by firm size

	50 to 99 workers				100 to 499 workers				500 to 999 workers				1,000 or more workers			
Percentile	BLWR	ELWR	PWR	NDER	BLWR	ELWR	PWR	NDER	BLWR	ELWR	PWR	NDER	BLWR	ELWR	PWR	NDER
1st	0.000	0.008	0.013	0.000	0.000	0.003	0.005	0.000	0.000	0.001	0.002	0.000	0.000	0.001	0.001	0.000
5th	0.000	0.009	0.015	0.000	0.000	0.004	0.005	0.000	0.000	0.001	0.002	0.000	0.000	0.001	0.001	0.000
10th	0.000	0.009	0.015	0.000	0.000	0.004	0.006	0.000	0.000	0.002	0.002	0.001	0.001	0.001	0.001	0.001
25th	0.000	0.012	0.020	0.000	0.002	0.005	0.008	0.001	0.001	0.003	0.003	0.002	0.001	0.002	0.002	0.003
50th	0.014	0.018	0.029	0.002	0.006	0.007	0.011	0.007	0.003	0.004	0.005	0.007	0.003	0.003	0.003	0.007
75th	0.028	0.028	0.047	0.017	0.012	0.011	0.017	0.019	0.006	0.006	0.007	0.019	0.005	0.004	0.005	0.017
90th	0.053	0.051	0.086	0.045	0.023	0.019	0.029	0.043	0.012	0.011	0.014	0.046	0.009	0.009	0.010	0.049
95th	0.077	0.051	0.086	0.073	0.033	0.022	0.033	0.068	0.017	0.013	0.017	0.079	0.014	0.013	0.014	0.093
99th	0.166	0.089	0.149	0.178	0.072	0.049	0.072	0.167	0.041	0.026	0.034	0.226	0.035	0.035	0.039	0.293

Note: Statistics are for 2005. BLWR values are from Table 2. PWR is ELWR multiplied by the assumed ratio of premiums to expected losses for firms in the size category (1.67 for 50 to 99 workers; 1.483 for 100 to 499 workers; 1.297 for 500 to 999 workers; and 1.110 for firms with 1,000 or more workers.

on some small firms having no allowed applicants that exceeds the DI portion of the payroll tax, 1.8 percent. This partly reflects the way that the ELWR model spreads risk across firms, and partly reflects the high administrative markup for small firms. At the other end of the PWR distribution for these firms, the 99th percentile is 14.9 percent of payroll, compared to 8.9 percent for ELWR and 16.6 percent for BLWR. Thus, although the ELWR model reduces the liability of firms in this group with very high BLWR, that reduction is mostly offset by the administrative costs.

The simulated premiums under mandatory STDI are much lower relative to SS wages for larger firms, partly because the ELWR percentiles for these firms are lower than for those with 50 to 99 workers, reflecting lower BLWR percentiles, and partly because the administrative markup is lower. For the largest firms (1,000 or more workers), the 5th PWR percentile is 0.1 percent of SS wages, and the 95th percentile is 1.4 percent. The latter value is smaller than the 5th percentile for firms with 50 to 99 workers (1.5 percent). That is, relative to SS wages, large firms at the upper tail of the liability distribution for large firms would pay premiums that are on par with those paid by small firms at the lower tail of the liability distribution for small firms.

The distributions of relative disability experience rates (NDER) are much less sensitive to firm size than the distributions of BLWR or PWR. This presumably reflects the use of three years of experience to determine their values. As a result, firms of all sizes with persistently low experience have low experience rates while those with persistently high experience have persistently high experience rates. For firms with more variable experience, NDER may differ substantially from BLWR in a given year, because of the latter's relative volatility.

V. CONCLUSION

A. Summary of findings

The first set of findings concern our benchmark BLWR measure, which is the portion of the DI liabilities accrued by a firm's workers in a year relative to SS wages. Using 2005 data, we find that the aggregate liability is equivalent to 0.23 percent of aggregate SS wages. Variation in BLWR is extremely high in firms with fewer than 50 employees. Although these small firms account for a substantial share of all liabilities (16 percent in 2005), we exclude them from the remainder of the analysis because this extreme variation likely reflects idiosyncratic features of small firms that we cannot observe in our data but would need to be accounted for in a more nuanced approach.

Among firms with 50 or more workers, variation in BLWR is less extreme, yet still substantial, and highly skewed. Most firms have very low values (the median is 0.5 percent of SS wages in 2005), but firms in the top quarter have values of at least 1.4 percent of SS wages. That is, in a single year the partial DI liabilities accrued for just the first 24 months of DI benefits of workers in these firms is only modestly lower than the DI payroll tax that is intended to finance 100 percent of all DI benefits (1.8 percent). The top 10 percent have values of at least 2.9 percent of SS wages, and the top 5 percent have values of at least 4.4 percent.

We also find that BLWR variation is substantially greater than can be attributed to variation in application rates alone. The additional variation is due to variation in allowance rates and the concentration of allowed applicants among low-wage workers and the progressivity of SSDI benefits. The importance of these effects is demonstrated, for example, by comparing the 95th percentiles of firm application rates, allowed application rates, and BLWR relative to their own medians. The difference between the values for the allowance rate and BLWR reflects the fact that mean wages at high BLWR firms are much lower than for other firms (less than $7,206 in the top BLWR quarter compared to $36,900 in the bottom quarter in 2005) in combination with the effect of the progressivity of DI benefits. The low mean wages for the top quarter of firms suggests that most of their employees are temporary, seasonal, or part-time.

Most firms with high BLWR are relatively small; the mean number of workers of those in the top quarter of the distribution in 2005 is under 250. Because they are relatively small, they account for a small share of all workers (6.7 percent) and, despite their high BLWR values, a relatively small share of allowed applicants 18.6 percent). Over half of allowed applicants are from firms with relatively low BLWR (51 percent from firms with BLWR below 0.5 percent of SS wages in 2005)—firms that are typically much larger and collectively employ 73.4 percent of all workers.

Allowed applicants in high BLWR firms have exceptionally low levels of education; in 2005, 72.4 percent had 12 or fewer years of schooling in 2005. Educational attainment among the allowed applicants in the next highest BLWR quarter is not much higher; 70.7 percent had 12 or fewer years of school in 2005.

Turning to the simulation results for mandated STDI premiums, we found that the distribution of premiums relative to SS wages (PWR) for large firms (1,000+) closely reflects the

distribution of BLWR. For substantially smaller firms (50 to 99 workers), however, premiums deviate substantially from BLWR because of high administrative costs and because variation in expected losses relative to SS wages (ELWR) is much lower than variation in BLWR. Hence, even if such firms have very low BLWR in some years, they would have to pay substantial premiums—premiums that could well be higher than those paid by large firms with higher BLWR. PWR distributions for intermediate size firms fall between these two extremes. We also found that, in the absence of behavioral change, the simulated STDI policy would reduce aggregate Trust Fund liabilities for benefits to these firms' former employees by 0.25 percent of their SS wages and increase aggregate labor costs for these firms by 0.31 percent of SS wages.

The simulation results for an experience-rated payroll tax indicate that the distributions of relative disability experience rates (NDER) are much less sensitive to firm size than the distributions of BLWR or PWR. Firms of all sizes with persistently low experience have low experience rates while those with persistently high experience have persistently high experience rates. For firms with more variable experience (the smaller the firm, the more likely), NDER may differ substantially from BLWR in a given year.

B. Discussion

The analysis is intended to inform policymaker discussions of how to address the pending exhaustion of the DI Trust Fund, projected to occur in 2016. Based on the projections of SSA's actuaries, (SSA, 2014), one way to do that would be to impose an additional burden of 0.33 percentage points in payroll taxes on current and future employers and workers, spread proportionately on all SS wages. Our analysis provides information about policies that change the burden of DI expenditures on employers (explicitly) and their workers (implicitly) in a manner intended to reflect the DI-entry experience of a firm's workers, rather than proportionately. The economic argument for partial internalization is that the behaviors of employers and their workers have external effects on DI costs. If so, then partial internalization of future DI expenditures for a firm's workers would presumably cause employers and their workers to behave in ways that would increase worker retention and reduce DI entry. Our findings pertain to the incentives that would be created by such policies in the absence of behavioral change.

Our results indicate that, in general, such policies will place a relatively large burden on the labor costs of many relatively small firms whose workers' DI benefits are high relative to their SS wages, and on the labor costs of many workers with relatively low skills. The latter group includes many workers in relatively small firms with high BLWR, but perhaps even more in larger firms that have more moderate values for BLWR. Conversely, low-BLWR firms with high mean wages and high-skill workers will experience relative reductions in labor costs. The latter finding suggests that one of the consequences of such policies is likely to be lower demand for low-skill workers—particularly for workers in occupations that are physically demanding or workers with characteristics that increase their risk of DI entry (obesity, smoking, relatively old, etc.). If so, such workers would experience a decline in their already low economic status. Further, those with significant medical conditions might choose to apply for DI benefits sooner than they otherwise would—the opposite of the intended effect. Other such workers may become more costly for society in other ways, such as through criminal activity, reliance on welfare benefits, and homelessness.

Our simulation of a mandatory STDI policy shows that successfully shifting the burden of the first 24 months of DI benefits onto employers with 50 or more workers would, in the absence of behavioral change, reduce the DI funding gap for these workers by 0.25 percent of their SS wages. Special provisions would be needed to extend the policy to firms of fewer than 50 workers, and successfully doing so would immediately reduce the DI funding gap by 0.23 percentage points of all SS wages, again in the absence of behavioral change. Because of administrative costs, the aggregate burden on labor costs would be higher unless employers are not able to reduce their new liabilities; the aggregate for firms with 50 or more workers would be 0.31 percent of their SS wages. STDI coverage might be particularly costly to relatively small firms, even those with relatively favorable DI-entry experience, because they would share in costs for other relatively small firms with higher DI-entry experience and because premiums would include high administrative costs relative to expected benefits. These small firms' premiums relative to SS wages might actually be higher than those of large farms with substantially higher DI-entry experience than their own. That anomaly could likely be mitigated if insurers considered several years of each firm's historical experience when predicting experience, rather than just the most recent year as in our simulation.

Unlike a mandatory STDI policy, DI experience rates similar to those proposed by Burkhauser and Daly (2011) would not necessarily have an impact on the DI funding gap in the absence of behavioral change. They could be designed to be revenue neutral in the absence of behavioral change, or even revenue decreasing, but then would have to rely on behavioral change to bring the DI Trust Fund into actuarial balance. They could also be designed to partially fill the funding gap in the absence of behavioral change, relying on behavioral change to fill the smaller remaining gap—similar to a mandatory STDI policy.

It seems very likely that firms would change their behavior under either of these policies. Ultimately, the attractiveness of these proposals depends on the unknown magnitude of such responses, including some which are not desirable. Behavioral responses seem especially likely for the small firms that have high DI-entry experience under current policy, because of the size of the impact on their overall labor costs. Some potential responses could include: efforts to prevent the onset or worsening of conditions that lead to DI entry, increased retention of workers after onset or worsening of a condition, increased prices, acquisition of private insurance coverage for the new liabilities if an attractively priced option exists, hiring fewer workers, and screening out job applicants perceived to be at risk for disability onset.

The behavioral responses of firms with relatively low DI-entry experience—typically large firms that employ a very large majority of all workers and a majority of future DI entrants—might be qualitatively similar, but the option of not changing their behavior will be more viable for these firms, for three reasons: (1) the liability represents a very small share of SS wages; (2) to be financially attractive, a response would need to be targeted at a small share of their workforce, those most likely to enter DI; and (3) some such firms have presumably already exploited opportunities for prevention and retention via the use of private disability insurers and management services. Also, if the relatively high mortality rates among allowed applicants from such firms signal relatively more severe, less remediable medical conditions, firm prevention and retention efforts may not be as fruitful at the margin.

Nonetheless, many large firms in the lower half of the DI-benefit risk distribution might be responsive. Their large workforces mean that their new liabilities would be large in absolute terms (even if small as a share of SS wages)—perhaps much larger than those of many smaller firms with higher DI-benefit risk. Their size may give them response opportunities that are not available to other employers. For instance, they may have more opportunities to modify or change the worker's job assignments or may find it economical to engage third-party providers. Therefore, if such low BLWR firms have efficient opportunities to reduce the cost of the increased liabilities, they seem likely to do so. For firms to be efficient, we expect their efforts to be narrowly directed at workers who have already experienced the onset of a significant medical condition, or are at very high risk for doing so, and not at the broader workforce; more broadly directed efforts will more likely result in losses for the firm.

Although the principle of internalizing an external cost of behavior is an appealing reason to consider these reforms, it is important to consider possible unintended consequences, such as greater wage inequality and reduced employment for low-skill workers. Such consequences could undermine the social value of partial internalization. Developers of policies that rely on partial internalization of DI benefits to employers should consider how to address such consequences in ways that do not conflict with the policy objective—encouraging employers to help their workers stay in the labor force after disability onset.

It is desirable to have a better understanding of the consequences of specific partial internalization policies before implementation. Although more might be learned from existing data, research on existing data has significant limitations. Pilot tests designed to address the most important knowledge gaps might be the best approach to overcoming the limitations of existing data.

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